Study of the directional spectrum of ocean waves using array, buoy and radar measurements

A. A. Fernandes

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in

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Statement

As required under the University ordinance 0.19.8.(vi), I state that this thesis entitled *Study of the directional spectrum of ocean waves using array, buoy and radar measurements* is my original contribution and it has not been submitted on any previous occasion.

The literature related to the problem investigated has been cited. Due acknowledgements have been made wherever facilities and suggestions have been availed of.

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Certificate

This is to certify that the thesis entitled *Study of the directional spectrum of ocean waves using array, buoy and radar measurements*, submitted by A. A. Fernandes to Goa University for the degree of Doctor of Philosophy, is based on his original studies carried out under my supervision. The thesis or any part thereof has not been previously submitted for any other degree or diploma in any university or institution.

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- Palaeoclimate
- Computer programming in FORTRAN

Software developed

- Short-term wave statistics from wave by wave analysis and spectral analysis
- Directional spectrum of ocean waves from arrays using the method of Esteva and Borgman
- Directional spectrum of ocean waves from an orbital following buoy using the digital band pass filter method
- Directional spectrum of ocean waves from SAR imagery
- Spectral, cross spectral and rotary spectral analysis
- Digital low pass, high pass and band pass filtering in time domain as well as frequency domain
- Factor analysis or empirical orthogonal function analysis
- Multiple regression analysis
- Statistical prediction of palaeoclimate

Select List of Publications other than ocean waves

- *Nautical and physical oceanographic observations off the drilling rig Chancellors Ville in the Mahanadi Basin.* Project Leaders: Ehrlich Desa, **A. A. Fernandes** and P. V. Sathe. NIO Technical Report No. 05/80, December 1980.
- **A. A. Fernandes** and R. Mahadevan. *Factor analysis of multivariate data.* NIO Technical Report No. 2/82, October 1982.

- **A. A. Fernandes** and R. Mahadevan. *Storm surges along the East Coast of India.* NIO Technical Report No. 4/83, June 1983.
- **A. A. Fernandes,** Y. S. Prahlad, and D. Sengupta. Scattering of Rossby and Poincare waves off rough lateral boundaries. *Dynamics of Atmospheres and Oceans*, 26:41–64, 1989.
- **A. A. Fernandes,** V. Kesava Das, and N. Bahulayan. Harmonic tidal analysis at a few stations using the least squares method. *Mahasagar*, 24(1):1–12, 1991.
- **A. A. Fernandes,** P. Chandramohan and B. U. Nayak. Observed currents off Bombay High during winter. *Mahasagar*, 26(2):95–104, 1993.
- **A. A. Fernandes** and Shyam M. Gupta. *Statistical prediction of Late Miocene climate.* NIO Technical Report No. NIO/TR-5/94, May 1994.
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- **A. A. Fernandes** and Shailesh Pednekar. *Intercomparison between Aanderaa and Potok current meters deployed during Phase II of PMN EIA programme.* NIO Technical Report No. NIO/TR-1/97, September 1997.

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Dr. R. Mahadevan was my *guru*, who taught me all about factor analysis and storm surges, without leaving anything back. More than that Dr. Mahadevan instilled in me the confidence for tackling challenging problems.

When I started working on waves, wave spectrum, wave directional spectrum, etc., in 1979, my coinvestigator was Mr. Albert Gouveia alongwith whom I developed several computer programs. Mr. P. V. Sathe on several occasions offered sound advice for implementing challenging refinements to the thesis.

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Synopsis

A brief review of the available methods of measurement and analysis of the wave (1–30 s period) directional spectrum is given in Chapter 1. The review also includes the directional spectrum of surf beat (30 s – 5 minutes period).

Chapter 2, contents of which are summarized below, discusses my original contribution in the determination of the directional spectrum of ocean waves from array measurements.

Wave direction has for the first time been consistently, accurately and unambiguously evaluated from array measurements using phase/time/path difference (PTPD) methods of Esteva [1977] in case of polygonal arrays and Borgman [1974] in case of linear arrays. A description of these methods is given. Cross spectrum analysis, which is employed in these methods, is briefly described. Time series measurements of water surface elevation at a 15-gauge polygonal array, in $\approx 8m$ water depth, operational at the Coastal Engineering Research Center's (CERC) Field Research Facility at Duck, North Carolina, USA, have been used. Two modifications have been made in the methodology. One modification is that instead of the *apparent* phase in the range $(-\pi,\pi)$ the *true* phase in the range $(-\infty,\infty)$, has been used; the other modification being that estimates of wave direction are registered only if the relevant gauges are coherent at 0.01 significance level.

It is shown that PTPD methods, which were not successfully used heretofore, are adept in describing the propagation of waves generated by distant storms (swell), locally generated waves (sea), infragravity waves (surf beat) locally generated by energetic incident swell, and surf beat of remote origin occurring when low swell energies are present. PTPD methods fail in case of multimodal directional spreads, which can be easily spotted from the large value of the standard deviation of redundant estimates of wave direction. Specifically it was found that at Duck: (i) the directions of swell and surf beat, when energetic swell is present, conform to the schematic diagram of surf beat generation given by Herbers et al. [1995] (ii) surf beat of remote origin occurs when the significant wave height, H_{mo} falls below 0.41 m (iii) the surf beat of remote origin is not normally incident at the shore contrary to Herbers et al. [1995]. In fact it was found that the surf beat of remote origin is incident at angles in excess of 45^o with respect to the shore normal, and

(iv) the surf beat of remote origin is largely trans-oceanic in origin.

PTPD methods assume that in a spectral frequency band, the waves can approach from a single direction, the wave direction may be different for different spectral bands and are simple, expedient and provide redundant estimates of wave direction. Two gauges are sufficient for determining wave direction using the method of Borgman [1974] while 3 non-collinear gauges are required in case of the method of Esteva [1977].

In the wind wave regime (0.04 - 0.32 Hz), estimates of wave direction as a function of frequency using Esteva's method with the two modifications described above, are consistent with the results of frequency-direction spectra obtained by the CERC using the sophisticated Iterative Maximum Likelihood Estimation (IMLE) method described by Pawka [1983], which assumes that at a given frequency band waves can approach simultaneously from all directions.

Wave direction estimates using the method of Borgman [1974] suffer from an ambiguity within a mirror symmetry as the method is applied to linear arrays. In contrast wave direction estimates using the method of Esteva [1977] are unambiguous as the method is applied to polygonal arrays.

There are two reasons why PTPD methods for determining wave direction from array measurements have not become popular; the first being the insufficient documentation of Borgman [1974] in case of linear arrays; and the second being the failure of Esteva [1977] in determining wave direction correctly over the design range 25–7 s of her 5-gauge polygonal array at Pt. Mugu, California. Esteva was able to determine correctly the direction of the observed swell of 16 s but failed to do so in case of the observed swell of 8 s. Fernandes et al. [1988] provided the necessary documentation in case of linear arrays, and repeating the computer simulations of Esteva for her polygonal array were successful in consistently, accurately and unambiguously determining the direction of both 16 s as well as 8 s swell. Their success was due to their adroit use of the criterion of Barber and Doyle [1956], which stipulates that for ensuring correct directions, the distances between the gauges 12 and 13 in the semi-ordered gauge triad 123, should both be less than half a wave length for the particular frequency band. Thus Fernandes et al. [1988] established that the method of Esteva for determing wave direction unambigously from polygonal arrays works in case of computer simulated data. **The principal object of the present study is to establish that the method Esteva works in case of measured data also.**

Chapter 3, contents of which are discussed below discusses my work in the determination of the wave directional spectrum using an orbital following buoy.

Software has been developed for the determination of wave direction from time series measurements of heave, pitch and roll of an orbital following buoy. The method of digital band pass filtering described by Edward C. Brainard II of Endeco Inc., USA was used. A derivation of the basic formula used is presented. The software developed by me, viz. BUOY-D-P.FOR, and the software provided by ENDECO, viz. 1156DBP.EXE, were both run for observed as well as computer simulated data. In the case of observed data, wave directions obtained with BUOY-D-P agreed within $\pm 5^o$ with the single available visual estimate of swell direction and within $\pm 50^o$ with directions obtained with 1156DBP. In the case of computer simulated data, BUOY-D-P was able to recover wave directions accurately for both mono-chromatic and multi-chromatic wave trains. 1156DBP was equally successful, except that if the simulated wave direction was θ, the computed direction was found to be $\pi + \theta$. This offset has been explained.

Chapter 4, contents of which are described below discusses my work in the determination of the wave directional spectrum using Synthetic Aperture Radar (SAR), which is the modern method for measuring waves.

Gaussian smoothed SAR image spectra have been evaluated from 512X512 pixel sub-scenes of image mode ERS-1 SAR scenes off Goa, Visakhapatnam, Paradeep and Portugal. The two recently acquired scenes off Portugal showed the signature of swell of wavelength $\approx 200m$ and internal waves of wavelength $> 400m$. Only internal waves of wavelength $> 400m$ were seen in the scene off Goa observed on 11 March 1992. The scenes off Visakhapatnam and Paradeep did not show any wave like features, the latter appearing to be of "white noise" nature.

There exists a 180^o ambiguity in wave direction observed from radar imageries. Based on the method of Atanassov et al. [1985], a computer program has been developed for removal of the 180^o ambiguity by using two images of the same area separated by a time interval which is small compared to the period of the dominant waves. The computer program has been successfully tested with computer simulated images. A brief review of the method of Atanassov is given.

The major conclusions of the thesis, summarized in Chapter 5, are:

1. PTPDM of Esteva [1977] and Borgman [1974] have for the first time been successfully used to determine wave directional spectrum from *measured* data. The software for the same has been indigenously developed.

2. Software has indigenously been developed for the determination of the wave directional spectrum from time series measurements of heave, pitch and roll of an orbital following buoy using the digital band pass filter method. The software has been validated with computer simulated data. Some modifications are needed to deal with measured (field) data.

3. Software developed for removal of the 180^o ambiguity in wave direction from computer simulated images should be useful to remove the said ambiguity from actual satellite imagery if at least two looks of the multi-look data is available.

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Chapter 1

INTRODUCTION

Ocean waves (1–30 s period) are generated by wind, the restoring force being gravity. Growth of waves depends on the fetch and duration of the wind. Waves smaller than 1 s period are known as ripples for which the restoring force is surface tension. Kinsman [1965] is an excellent book on ocean waves.

Generally waves are measured for a period of 20 minutes, every three hours. The analysis of the 20 minute record yields short term statistics, viz., significant wave height, zero crosssing period, etc.. An analysis of significant wave height, zero crosssing period, etc., over a period of 1–5 years yields long term wave statistics, viz., highest significant wave height that will occur once in 50 or 100 years known as return period.

The directional spectrum means the distribution of wave energy density as a function of frequency and direction. A cross-section of the directional spectrum surface for a given frequency, which is a curve depicting the wave energy density as a function of direction is also referred to as the directional spectrum. Essentially the directional spectrum is a representation of the 2-dimensional wave number spectrum obtained using the dispersion relation for surface waves. The directional spectrum gives a more complete description of the waves occuring at a particular place and time than other representations such as significant wave height and the predominant wave height and direction.

The earliest and the most enduring application of the directional spectrum was in the field of wave forecasting and hindcasting by Pierson et al. [1955], the WAM model of Hasselmann et al. [1988] being its present day analogue. In another case Komar and Inman [1970] have used directional spectra for the study of littoral transport. Directional spectra have been used by for studying the diffraction of wind waves. Directional spectra are also useful for the design and analysis of moorings, offshore towers and piles. For the analysis of vibration and three dimensional analysis of structures with torsional loads, directional spectrum is an input function. Directional spectra are necessary for the study of growth and decay of waves and to acertain the frequency and directional spread of energy density by processes like resonant interactions. Occurrence of "freak" waves which have been responsible for the destruction of breakwaters in Iceland, Norway and France is thought to be linked with the wave directional spectrum of ocean waves [Bruun, 1985].

Panicker [1974] listing as many as 91 references gives an extensive review of the methods of measurement and analysis of the wave directional spectrum.

The three main methods for measuring the wave directional spectrum are through (i) arrays (ii) buoys and (iii) radar.

Arrays and buoys directly measure the wave directional spectrum, while radar measures it through remote sensing using radio or microwaves. In array type of measurement just one parameter, viz., wave elevation is measured at several points in a linear or polygonal array. In buoy type of measurements several different parameters are measured at essentially the same point. As we shall see later two types of buoys are available, viz., slope following buoys and orbital following buoys. In radar type of measurements, the backscatter from Bragg resonant surface waves is measured. It was Crombie [1955] who identified Bragg scattering as the mechanism for imaging "sea-clutter" (ocean waves) from radar echo from sea at High Frequency (dekameter waves).

The wave directional spectrum can also be measured using optical methods including stereophotogrammetry which has been done in the Stereo Wave Observation Project reported by Cote et al. [1960] and Chase et al. [1957], who used two simultaneously taken photographs of the sea surface.

Uberoi [1964] used an optical analogue method to determine the wave directional spectra of 2-dimensional functions from single photographs. Stilwell and Pilon [1974] using the concept of continuous skylight luminance function obtained wave directional spectra from single photographs of the sea surface using optical 2-dimensional Fourier Transform technique, utilizing auxiliary data of altitude and azimuth, the method being a generalization of the sun glitter method of Cox and Munk [1954] and Cox [1958], which provided statistics of surface slopes but could not determine the wave directional spectrum.

Panicker [1974] briefly describes the following mathematical techniques available for determining the wave directional spectra from cross-spectra between the measured quantities: (i) Direct Fourier Transform method, which is useful when large number of cross-spectra are available as in the case of the Stereo Wave Observation Project (ii) Parametrized Estimation method, which assumes a parametrized representation of the wave directional spectrum and uses an inverse relationship to evaluate the defining parameters from the cross-spectra. This technique has been used to estimate the directional spectrum when only a limited number of cross-spectra are available as in the case of arrays and buoys (iii) Amplitude and phase detection techniques (iv) Discrete wave train analysis which may be used when energy is concentrated in a finite number of directions, and (v) Data adaptive Techniques, which include Maximum Likelihood Estimation method (MLE) and Maximum Entropy Method. These data adaptive methods specially the MLE method and its refinement the Iterative Maximum Likelihood Estimation (IMLE) method yield high resolution wave directional spectra and are being extensively being used in case of buoys and arrays.

It has been found, as elaborated in Chapter 2, from array, buoy as well as radar measurements that the wave directional spectrum has a unimodal distribution, so that the computation of the "mean" wave direction as a function of frequency is both meaningful as well as useful and is routinely performed in case of commercially available wave directional buoys marketed by ENDECO, WAVEC and NEREIDES.

Chapter 2 discusses about arrays giving the design of some important arrays reported in literature alongwith a review of the techniques of analysis used to determine the wave directional spectrum from array measurements. The highlight of this thesis is that for the first time, wave direction has been successfully evaluated as a function of frequency from actual array measurements over a wide range of frequencies including locally generated waves (sea), waves generated by distant storms (swell), and infra gravity waves (surf beat) – using what we have called as Phase/time/path difference methods, which are essentially amplitude and phase detection techniques, a description of which is given in case of linear as well as polygonal arrays. A description of cross-spectrum analysis, which forms the basis of all techniques for determining the wave directional spectrum from arrays and buoys, is also given.

Chapter 3 gives a brief review of some important buoys reported in literature and the techniques of analysis of the wave directional spectrum for both slope following buoys as well as orbital following buoys. A salient part of this thesis is that I have indegeneously developed the software for determining the wave direction as a function of frequency from an ENDECO orbital following buoy using the ENDECO Digital Band Pass Filter method and applied it to actual field measurements.

Chapter 4 essentially discusses the problem of determining the wave directional spectrum from Synthetic Aperture Radar imagery. Wave directional spectrum has been determined from actual SAR scenes observed off Goa, Visakhapatnam, Paradeep and Portugal. A method for removal of the 180^o ambiguity in determination of wave direction from radar imagery which I have successfully implemented is described. Some information about radar, radiowaves, microwaves etc., is also given.

Chapter 5 lists the conclusions of the work carried out and reported in this thesis on the determination of wave directional spectrum using arrays, buoys and radar.

Tables in Appendix A and Appendix B give the wave directional estimates of measured data at Duck, North Carolina, USA, using phase/time/path difference methods in case of linear and polygonal arrays respectively – these tables constitute the principal results of this thesis.

Chapter 2

ARRAYS

In case of arrays the wave directional spectrum is estimated from the simultaneous time series measurements of wave elevation at a number of gauges placed either in linear or polygonal arrays.

Two examples of linear arrays are given in Figure 2.1. The first example shown in Figure 2.1 is the 6-gauge linear array of Hasselmann et al. [1973] comprising of two 4-gauge sub-arrays each having a spacing of ratio D, 4D and 6D, the sub-array having $D = 7m$, being tuned for the wavelength band 10m-150m, and the sub-array having $D = 28m$ being tuned for the wavelength band 40m-600m. The second example shown in Figure 2.1 is the 4-gauge linear array of Pawka [1974] having a spacing of D, 3D and 4D, with $D = 30.5m$. A make-shift polygonal array comprising of 10 alongshore gauges and five intersecting cross shore gauge located at $8m$, at the Coastal Engineering Research Center's (CERC) Field Research Facility at Duck, North Carolina, USA, is shown in Figure 2.2. Measured data at this $8m$ array at Duck was procured for the purpose of the present study. An excellently designed 25-gauge polygonal array, which has been used by Elgar et al. [1992], Elgar et al. [1994] and Herbers et al. [1995], also located at Duck, but at $13m$ depth is shown in Figure 2.3. The five gauge polygonal array of Esteva [1976] and Esteva [1977], which has been discussed elaborately in this thesis is shown in Figure 2.4. The 14-gauge polygonal array in the form of a cross used by Donelan et al. [1985] for studying wave directionality in case of waves of period less than $4s$ is shown in Figure 2.5.

The gauges comprising an array may be surface piercing capacitance gauges or bottom mounted pressure gauges. Arrays are generally located in shallow water depths of around 7–13m. At larger depths it is not feasible to install capacitance gauges unless they are pile driven or mounted on spar buoys. Also at larger depths, the wave signal at the bottom mounted pressure gauges is attenuated as a function of wave period (frequency), the attenuation being greater for smaller periods, so that the shorter waves may not be sensed at all. At depths shallower than 7m wave breaking takes place so that linear wave theory, on which all the techniques for determining the wave directional

Figure 2.1 Examples of Linear arrays — (a) 6-gauge array of Hasselmann et al. [1973] and (b) the 4-gauge array of Pawka [1974]

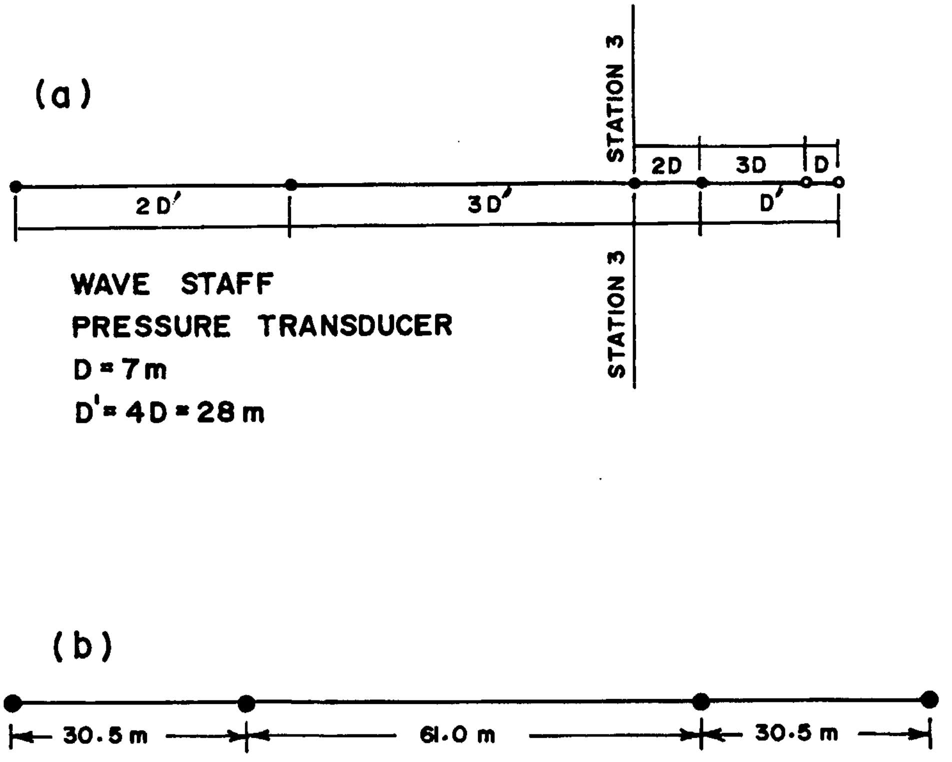


Figure 2.2 15-gauge polygonal array at at the CERC's Field Research Facility at Duck, North Carolina, USA, located at 8*m* depth. The 10 longshore gauges are operational since March 1987. The 5 cross-shore gauges were added in 1990. This is the array, the measurements at which are analysed and discussed in this thesis

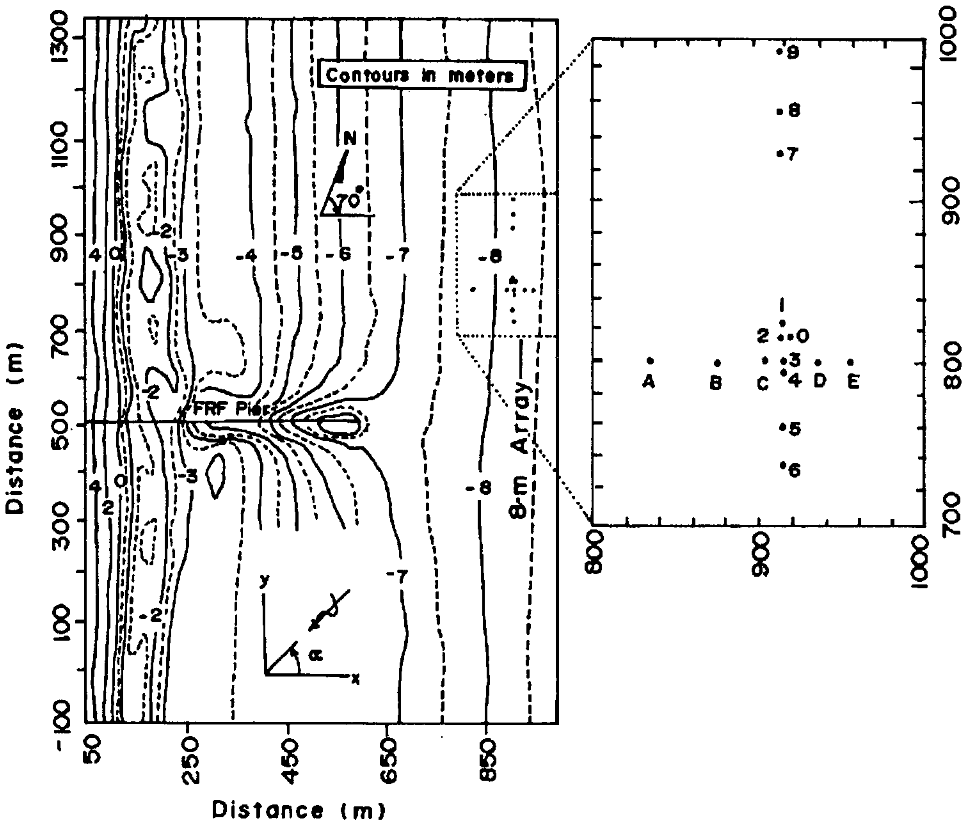


Figure 2.3 25-gauge polygonal array at at the CERC's Field Research Facility at Duck, North Carolina, USA, located at $13m$ depth. This is a very excellently designed array, which has been used by the group composed of Guza, Herbers, Steve Elgar to study wave directionality, principally of surf beat

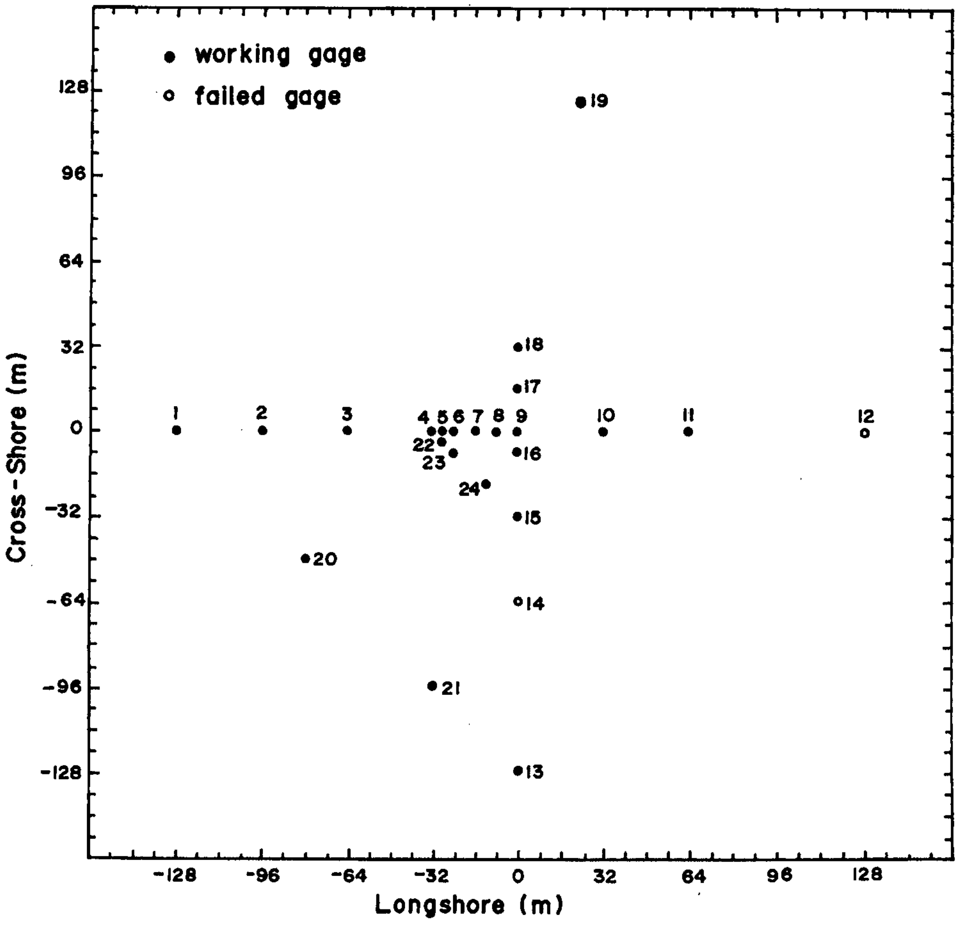


Figure 2.4 The 5-gauge array of Esteva [1977] located at Pt. Mugu California at 9.14m depth, where swell of 8s and 16s was observed. Esteva was successful in correctly determining the direction of the 16s swell, but failed in determining correctly the direction of 8s swell, in case of both measured as well as computer simulated data, although the array was designed for the range 7 − 25s by L. E. Borgman

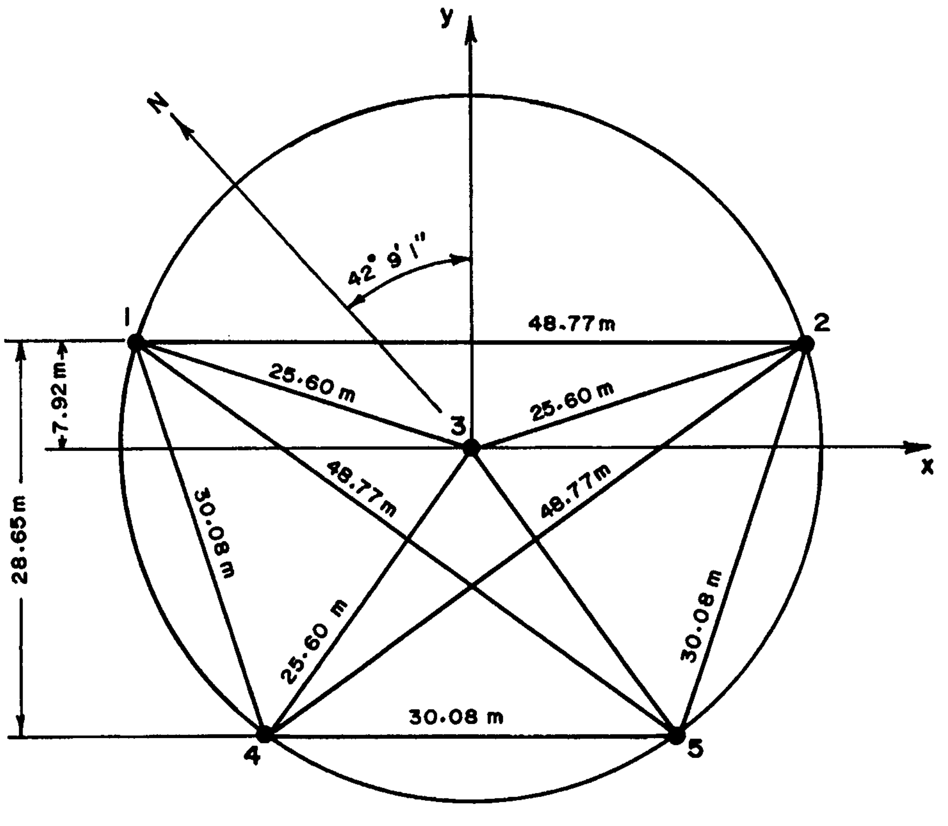
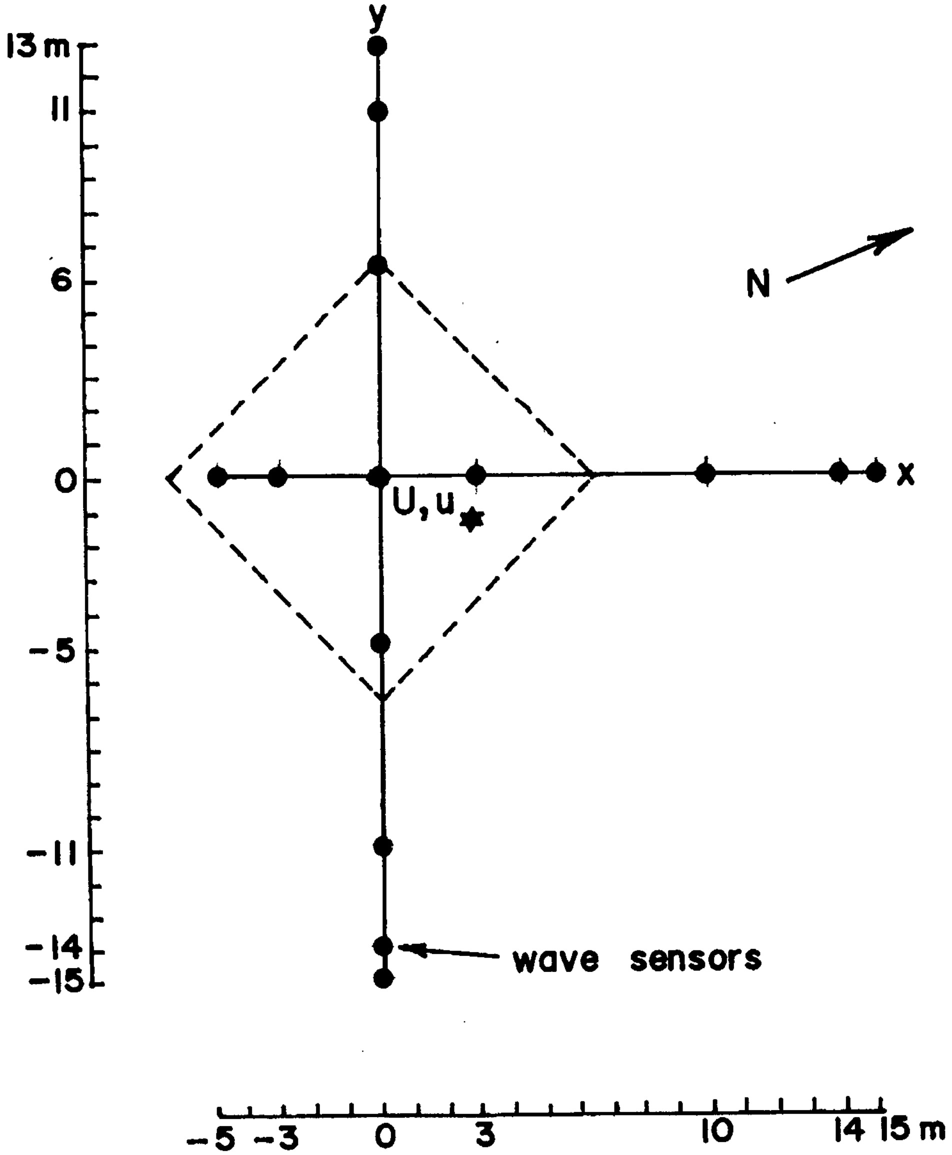


Figure 2.5 The 14-gauge array of Donelan et al. [1985] used to study wave directionality for waves of period less than 4*s* in Lake Ontario at 10*m* depth



spectrum are based, no longer holds.

Linear arays are unable to distinguish between waves arriving at the array at the same angle but from opposite sides, i.e., linear arrays suffer from an ambiguity within a mirror symmetry. Linear arrays can resolve directions well only when waves approach nearly normal to the array. On the other hand polygonal arrays can determine wave direction unambiguously. The major drawback of arrays is that they cannot be installed in deep water. Precision in the determination of the coordinates of the gauges, i.e., the knowledge of its exact location, which is a prerequisite for accurate determination of wave direction, is difficult as the gauges are underwater.

There are two approaches for the determination of wave direction from array measurements. In the first approach pioneered by Barber [1963], at each spectral frequency band energy is evaluated as a function of direction, wherefrom the mean wave direction is determined from the location of the energy peak. This approach allows for the possibility of waves approaching from more than one direction at each frequency and is the traditional approach. Refinements of this approach are the Maximum Likelihood Estimation Method of Regier [1975], Regier and Davis [1977] and Davis and Regier [1977]; and the Iterative Maximum Likelihood Estimation method of Pawka [1982] and Pawka [1983]. Other refinements to the method of Barber [1963] are the variational method of Long and Hasselmann [1979] and the modified Barber method of Donelan et al. [1985]. Almost all the literature on the directional spectrum deals with this approach, which is used for both array as well as buoy measurements.

The traditional approach in dealing with wave direction assumes that the sea surface is composed of a large number of sinusoidal waves of varying frequency and direction, as is exemplified by Pierson et al. [1955] who proposed the frequency direction spectrum:

$$E(f,\alpha) = \rho(f)\ (2\pi)^{-1}\ g(\alpha), \text{ where}$$

$$g(\alpha) = \begin{cases} \cos^2\alpha, & \text{if } -\pi/2 < \alpha < \pi/2 \\ 0 & \text{otherwise} \end{cases}$$

Such unimodal bell-shaped directional spreading function with the peak of the bell generally in the direction of the wind has been observed by Longuet-Higgins et al. [1963] from the measurements of a floating buoy; by Tyler et al. [1974] from synthetic radar observations of radio scatter; and by Donelan et al. [1985] from the measurement of wave elevation at a multi-element array. Since the directional spreading function has been found to be unimodal, the computation of the "mean" wave direction as a function of frequency is both meaningful and useful and is routinely performed in case of commercially available wave directional buoys fabricated by ENDECO, WAVEC and NEREIDES.

In the other approach "mean" wave direction is computed as a function of frequency directly using phase/time/path difference (PTPD) concepts. Fernandes et al. [1988] have aptly named the methods based on PTPD concepts as PTPD methods. The mathematical model on which PTPD methods are based make two assumptions, viz., (i) that the sea surface is the result of a small number of narrow banded wave trains consisting of long-crested waves travelling in well defined directions, and (ii) that only one wave train is present with a particular period. These assumptions may be restated in terms of spectral analysis, as saying that in a particular frequency band the waves can approach from a single direction – the direction may be different for different frequency bands. As evidence in support of this approach and the underlying assumptions, Esteva [1977] cited photographs of the sea surface, radar images of the sea, "redundancy", "expediency" and the work of Thompson [1974], Fujinawa [1974] and Fujinawa [1975].

There are two reasons why PTPD methods for determining wave direction from array measurements have not become popular, the first being the insufficient documentation of Borgman [1974] in case of linear arrays; and the second being the failure of Esteva [1976] and Esteva [1977] in determining wave direction correctly over the design range 25–7 sec of her 5-gauge polygonal array at Pt. Mugu, California.

In the method of Borgman just 2 gauges are sufficient for determining wave direction, i.e. the analysis is done in units of gauge pairs with the different gauge pairs possible in the linear array giving redundant estimates of wave direction. By the method of Borgman, as we shall see in Chapter 2.4, wave direction is estimated as a function of frequency, from the distance between the gauges and the phase difference, ϕ_{12} between the two gauges, which is computed as a function of frequency by cross spectrum analysis.

In the method of Esteva just 3 non-collinear gauges are sufficient for determining wave direction, i.e the analysis is done in units of 3 gauges, i.e., gauge triads, with the different gauge triads possible in the polygonal array giving redundant estimates of wave direction. By the method of Esteva, as we shall see in Chapter 2.5, wave direction is estimated as a function of frequency, from the coordinates of the three non-collinear gauges, ijk, say, and the phase differences, ϕ_{ij} and ϕ_{ik} between the gauges ij and ik, which are computed as a function of frequency by cross spectrum analysis.

At the Pt. Mugu site of Esteva's 5-gauge polygonal array, designed by Leon E. Borgman, swell of 16s and 8s was observed. Since Esteva's array had five gauges, ${}^5C_3 = 10$ different combinations of gauge triads are possible giving 10 independent estimates of wave direction. Esteva, using "consistency" within these 10 redundant estimates of wave direction as a criterion for accuracy, reported success in determining the direction of swell of 16s and failure in case of swell of 8s; and on the basis of computer simulation studies concluded that (i) gauge triads which are nearly equilateral have greater direction discernability (this idea was first propounded by Barber [1963]).

(ii) the analysis gives correct directions only for waves coming from certain directions. (iii) that at the Pt. Mugu site, directional information provided by the array adds little to the information that could be obtained from wave refraction studies, and thus seems hardly cost-effective.

Fernandes et al. [1986] and Fernandes et al. [1988] provided the necessary documentation in case of linear arrays and repeating the computer simulations of Esteva for her polygonal array, were successful in consistently, accurately and unambiguously determining the direction of both 16s swell as well as 8s swell. Their success was due to their adroit use of the criterion of Barber and Doyle [1956] which stipulates, that for ensuring correct directions, the distances between the gauges used for determining phase/time/path difference through cross spectrum analyses, should be less than half a wavelength for the particular wave period (spectral frequency band) for which wave direction is determined; and demonstrated that all the above three conclusions of Esteva were erroneous.

Thus Fernandes et al. [1988] established that the method of Esteva for determining wave direction from polygonal arrays works in case of computer simulated data. The present study is principally aimed at establishing that the method of Esteva works in case of measured data also, and presents detailed documentation of work carried out towards determination of wave direction from linear and polygonal arrays using the PTPD methods of Borgman and Esteva respectively in case of measured data.

It may be interesting to first give additional details about the results of Esteva [1977] and then discuss the reason behind her failure to determine wave direction correctly for the observed swell of 8*s*.

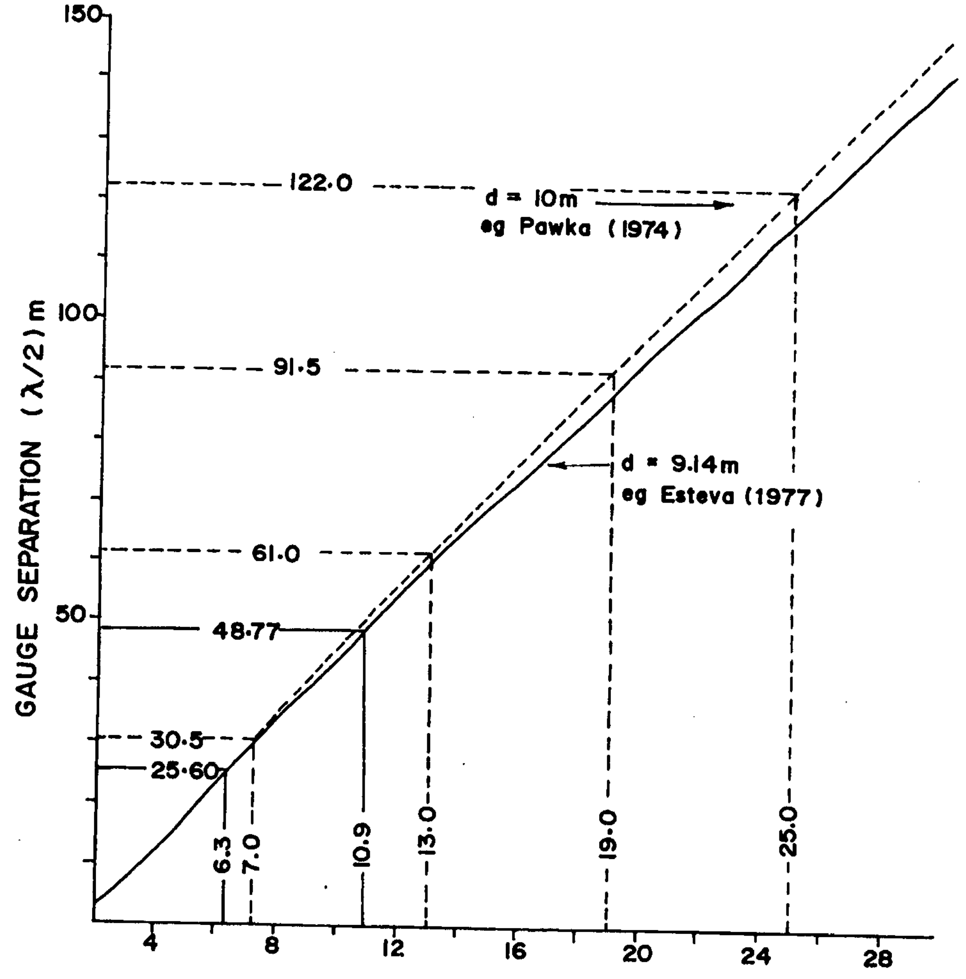
From measured data at the 5-gauge array at Pt. Mugu, California, Esteva [1977] obtained ten redundant estimates of wave direction for each frequency band 0.01 Hz wide between approximately 30 and 3*s*. These redundant estimates of wave direction displayed discrepancies of the order of 20^o for those bands with central periods above 10*s* and of 180^o for those with shorter central periods. It had been expected that the array would yield direction to better than 20^o for periods between 25 and 7*s*.

In order to isolate problems associated with the calculations from measured data, Esteva simulated the propagation of narrow-banded wave trains across the array in a computer, and from high resolution spectra (1/1024 Hz), recovered the assigned directions within 1^o for 16*s* waves when the frequencies of the spectral components in the wave train differed by 0.003 Hz or more, and the directions were spread within a 5^o arc. The recovery of the assigned directions in case of 8*s* waves was a total failure, which Esteva reported as "meaningless".

For determining wave direction as a function of frequency using the PTPD methods of Borgman and Esteva in case of linear and polygonal arrays respectively, as mentioned above, knowledge of the phase difference between the gauges is required. Phase differences computed from cross spectrum analysis, are generally reported in the range $(-\pi, \pi)$ to allow for both phase lags and phase leads. This rendition of the phase difference in the interval $(-\pi, \pi)$ generally does not faithfully represent the physical situation, so that the wave directions computed from phase differences in this rendition may be erroneous. Let me elaborate. The key assumption in the above rendition of phase difference is that the angles θ and $\pm 2n\pi + \theta$, are equivalent, where n is an integer and θ is any arbitrary angle, here measuring phase difference. Consider, for example a sinusoidal long-crested wave of period T seconds approaching two gauges located at points A and B. A phase difference of 30^o may be defined to mean that a wave crest will arrive at B, $T/12$ seconds *after* it crosses A. By this definition a phase difference of -330^o signifies that the wave crest arrives at B, $(11T/12$ seconds *before* it crosses A. Thus the phase differences 30^o and -330^o, are equivalent by the above assumption as $30 = 360 - 330$, but represent two distinct, entirely different situations physically. Thus if the phase difference in the actual physical situation, i.e., the *true* phase difference is -330^o, cross spectrum analysis will erroneously report the phase difference as 30^o. It therefore stands to reason that that the phase difference (at a particular central period) determined by cross spectrum analysis in the range $(-\pi, \pi)$, which may be termed as the *apparent* phase difference, will faithfully represent the physical situation only if we are able to restrict the phase difference in the physical situation, i.e., the *true* phase difference also to the range $(-\pi, \pi)$. This is obviously ensured by restricting the distance D between the points A and B to to less than half a wavelength, i.e., $D < \lambda/2$, which is the criterion of Barber and Doyle [1956]. Whenever the criterion of Barber and Doyle [1956] is violated, i.e., the distance between the gauges is greater than half a wavelength, the phase difference between the gauges in the physical situation, i.e., the *true* phase difference will lie beyond the range $(-\pi, \pi)$ if the wave direction is along or close to the line joining the gauges. **Thus it may be concluded that the wave directions determined from *apparent* phase differences in the range $(-\pi, \pi)$, will definitely be correct if and only if the criterion of Barber and Doyle [1956] holds.**

Esteva's 5-gauge array is shown in Figure 2.4. It may be seen that the distances between the gauges is limited to three values only, viz., 25.60, 30.08 and 48.77m; and that the nearly equilateral gauge triads (triangles), viz., 134, 345 and 235, which Esteva surmised had greater direction discernability have 30.08m as the maximum distance between the gauges. From Figure 2.6, which depicts the relation between the wave period and the wavelength (actually half the wavelength!), it may be noted that when the largest arm in the triangle formed by a gauge triad is 30.08m, the criterion of Barber and Doyle [1956] is satisfied for all periods above 7.1s. Therefore wave directions in case of swell of 8s as well as 16s, both of which are above 7.1s, will be computed correctly from the *apparent* phase differences in case of the gauge triads 314, 345 and 325, which only incidentally happen to be nearly equilateral triangles. Fernandes et al. [1988], in their successful attempt in recovering the assigned direction of both 8s as well as 16s swell, have classified the above three gauge triads as belonging to the class "ALWAYS", indicating that the computed wave direction using these three gauge triads will *always* be correct for swell of both 8*s* as well as 16*s*.

Figure 2.6 Criterion for true phase to lie within $(-\pi,\pi)$ -- $D \leq \lambda/2$



As mentioned above, from measured data, Esteva [1977] reported consistency within the 10 redundant estimates of wave direction as a function of frequency for wave periods above 10*s*. This result may be explained with the help of Figure 2.6, which shows that for the maximum distance between Esteva's gauges, viz., 48.77*m*, the criterion of Barber and Doyle [1956] is satisfied for all wave periods above 10.9*s*, which is spectrally very close to the value 10*s* reported by Esteva. This argument explains the reason behind Esteva's success in case of 16*s* swell and her failure in case of 8*s* swell both arising from the use of the *apparent* phase differences.

Fernandes et al. [1988] grouped Esteva's 10 redundant combinations of gauge triads or triangles into the following three distinct classes for the purpose of determining wave direction at a specified spectral frequency: (i) Class "ALWAYS" , composed of gauge triads all of whose gauge separations are within half a wavelength at the specified frequency, thereby *always* giving correct directions; (ii) Classs "IF" , composed of those gauge triads that contain a single gauge separation, i.e., one arm of the triangle, which exceeds half the wavelength at the specified frequency, thereby giving correct directions *if* we do not use that particular arm in the computation of phase differences. This can easily be done; (iii) Class "NEVER" , composed of those gauge triads that contain at least two arms of the triangle that exceed half a wavelength. In this case computed wave directions can be correct by chance only!

Since as seen above, for a gauge triad belonging to class "IF", the choice of gauge pairs used for determining phase differences is crucial to the analysis, we use the following convention: A gauge triad is considered as a semi-ordered sequence of gauges ijk for which we compute the phase differences ϕ_{ij}, ϕ_{ik}, where the order of the first gauge i, which is the pivot is important; and the triads ijk and ikj are equivalent.

In case of 16*s* swell, all the 10 gauge triads of Esteva, viz., (123, 124, 125, 134, 135, 145, 234, 235, 245, 345), fall into the class "ALWAYS", as a consequence of which all these gauge triads ought to, and as reported by Esteva [1977] do yield correct directions.

In case of swell of swell of 8*s*; the following three gauge triads belong to the "ALWAYS", (134, 235, 345), and therefore *always* yield correct directions; the following five gauge triads of Esteva belong to the class "IF", (123, 135, 145, 234, 245), and will yield correct directions only *if* the following semi-ordered gauge triads are used, (312, 315, 415, 324, 524), indicating that Esteva's ordering of all the five gauge triads in this class happened to be wrongly chosen, so that the computed wave directions will not be correct; the following two gauge triads belong to the class "NEVER", (124, 125), and will yield incorrect wave directions. Therefore out of total 10 gauge triads of Esteva, in case of 7 gauge triads comprising of the classes "IF" and "NEVER" her computations just could not yield the correct directions — whence her failure.

The above strategy can be used in case of measured data also, but it is wasteful, as it treats perfectly good signal at the the higher frequencies as noise and discards it. The two innovations that have been adopted in this thesis for determining wave direction as a function of frequency using the PTPD methods of Esteva [1977] and Borgman [1974], from actual measurements, in case of "swell", "sea" and "surf beat", are (i) the use of *true* phase differences instead of the *apparent* phase differences (ii) and the use of the concept of "coherence" between the gauges. These two innovations are used to unravel the signal at the higher frequencies, so that no "signal" is lost.

The above two methods incorporating the two innovations are referred herein as the 'modified Borgman method' and the 'modified Esteva method'.

2.1 DATA

The measured wave data used in this study comes from a 15-gauge polygonal array of bottom mounted pressure gauges operational at the Coastal Engineering Research Center's (CERC), Field Research Facility (FRF) at Duck, North Carolina, USA. The array comprises of 10 alongshore gauges (operational since March 1987) and 5 intersecting cross-shore gauges (added in 1990) placed at $\approx$ 8 m depth ($7.44 - -8.13m$, see Figure 2.2). The gauges are placed $\approx 0.5m$ above the sea bed.

Code names and FRF identification numbers (the latter in braces) for the 15 gauges are as follows: 1(111); 2(121); 3(131); 4(141); 5(151); 6(161); 7)171); 8(181); 9(191); 0(101); A(211); B(221); C(231); D(241) and E(251). Gauge coordinates, mean water depth at the gauge location, the height of the pressure sensor above the bottom, and the distances between the different gauges are given in Table 2.1.

Long and Oltman-Shay [1991], who discuss the directional characteristics of the waves at the FRF at Duck using the then 10-gauge linear array, present detailed information about the pressure sensors used, data collection procedure, coastline characteristics, wind and wave climate etc.. The coastline in the vicinity of the FRF is nearly straight and the depth contours are nearly parallel. The coastline is oriented such that the seaward shore normal makes an angle of 70^o with true North. According to Leffler et al. [1989] wind and wave climate at FRF can be classified into four basic types. The first is low wind situations, characterised by low frequency swell arriving from the east to the south east and the most common wave generating winds are *Northeasters*.

Table 2.1 Distance between the gauges (in metres) comprising the 8*m* polygonal array at Duck, Nort Carolina, USA. x,y are the co-ordinates of the gauges in metres; d is the mean depth at the gauge in metres; and b is the height of the gauge above the bottom in metres

Gauge	1	2	3	4	5	6	7	8	9	0	A	B	C	D	E	x	y	d	b
1	.00	9.61	25.20	30.40	64.80	90.30	105.00	130.40	164.50	10.74	83.71	47.12	32.56	32.56	47.22	914.50	825.70	7.90	.40
2	9.61	.00	15.62	20.80	55.20	80.70	114.60	140.00	174.10	5.00	80.94	42.28	26.14	26.14	43.27	914.10	816.10	7.90	.40
3	25.20	15.62	.00	5.22	39.61	65.10	130.20	155.60	189.70	16.06	80.20	39.90	20.10	20.10	39.60	914.90	800.50	7.90	.34
4	30.40	20.80	5.22	.00	34.40	59.90	135.40	160.80	194.90	21.20	79.96	39.78	21.12	21.12	40.35	914.50	795.30	7.90	.43
5	64.80	55.20	39.61	34.40	.00	25.50	169.80	195.20	229.30	55.34	88.59	55.23	44.74	44.74	56.71	914.00	760.90	7.90	.50
6	90.30	80.70	65.10	59.90	25.50	.00	195.30	220.70	254.80	80.75	102.69	75.56	68.25	68.25	76.65	914.20	735.40	7.90	.48
7	105.00	114.60	130.20	135.40	169.80	195.30	.00	25.40	59.51	114.80	152.69	136.48	131.93	131.93	136.17	914.30	930.70	7.90	.24
8	130.40	140.00	155.60	160.80	195.20	220.70	25.40	.00	34.11	140.18	174.87	160.97	157.07	157.07	160.61	914.30	956.10	7.90	.40
9	164.50	174.10	189.70	194.90	229.30	254.80	59.51	34.11	.00	174.24	206.17	194.40	190.83	190.83	193.63	915.20	990.20	7.90	.40
0	10.74	5.00	16.06	21.20	55.34	80.75	114.80	140.18	174.24	.00	85.83	46.91	22.27	22.27	38.60	919.10	816.00	7.91	.48
A	83.71	80.94	80.20	79.96	88.59	102.69	152.69	174.87	206.17	85.83	.00	40.30	100.30	100.30	119.80	834.70	800.40	7.44	.46
B	47.12	42.28	39.90	39.78	55.23	75.56	136.48	160.97	194.40	46.91	40.30	.00	60.00	60.00	79.50	875.00	800.00	7.65	.49
C	26.83	18.06	10.40	11.41	41.02	66.12	130.27	155.61	189.70	21.08	69.80	29.51	30.50	30.50	50.00	904.50	800.80	7.82	.27
D	32.56	26.14	20.10	21.12	44.74	68.25	131.93	157.07	190.83	22.27	100.30	60.00	.00	.00	19.50	935.00	800.40	8.00	.34
E	47.22	43.27	39.60	40.35	56.71	76.65	136.17	160.61	193.63	38.60	119.80	79.50	19.50	19.50	.00	954.50	800.60	8.13	.52

The data used consisted of 47 three hourly records of time series of wave elevation measured at the 15 wave gauges during 1-6 February, 1994. Simultaneous time series, of wind speed and direction measured at the pier end, and of barometric pressure were also available. At each gauge the time series consisted of 5 X 4096 points sampled at $2Hz$, i.e., $0.5s$ sampling interval and was ≈ 2.84 hours long. Starting times of the records were 01, 04, 07, 10, 13, 16, 19, and 22 hours of each day. The record at 10 hours on 1 February was not available. The data was kindly supplied by Dr. Charles E. Long of the CERC on two $150Mb$ cartridge tapes. Earlier Dr. Long had supplied 2 day's data (2-3 February, 1994) on a 1/2" magnetic tape along with plots of frequency-direction spectra for the same using the Iterative Maximum Likelihood Estimation (IMLE) method of Pawka [1983] in case of both the full 15-gauge array as well the 10-gauge linear part of the array. Fernandes et al. [1995] have presented a preliminary analysis of part of the data on the 1/2" magnetic tape spanning 27 hours, using the phase/time/path difference methods of Esteva [1977] and Borgman [1974] in case of polygonal and linear arrays respectively. An analysis of the full six day data is briefly given in Fernandes et al. [1996]. A more elaborate analysis of the full six day data is given in Fernandes et al. [2000].

Sources of error in the determination of wave direction are: (A) Error in the measurement of the location of the gauges, which at Duck is within $\pm 0.15m$, (B) Coarseness of the time series sampling interval – this is significant at very high frequencies, and (C) Non uniform depth at the gauges in the array and the presence of astronomical tide – at Duck, omitting gauge A, which we have not used , the depth changes by $< 0.5m$ over the array and the tidal range ($\approx 1.0m$) is small, so that the assumption of a constant depth of $8m$ at the gauges, that we have made, should not introduce too much error. The errors are diminished substantially, essentially due to the long record length and the large number of gauges, available at Duck, which permit a great deal of "averaging" to be carried out. Experiments with computer simulated wave trains, show that the error in estimation of wave direction at Duck from a single determination is much less than $\pm 3^o$ even in presence of random noise.

2.2 CROSS-SPECTRUM ANALYSIS

Cross-spectrum analysis means the computation of two parameters, viz. phase and coherence between two time series, as a function of frequency (phase spectrum and coherence spectrum).

The phase function gives the average phase difference (lead/lag) between the two series. The coherence is a measure of the consistency or stability of the relative phase difference between the two series, and like the regression coefficient is defined in the range (0,1). A coherence of zero indicates that the phase difference has a large variance (see Halpern [1973]), so that the average phase difference does not make any physical sense.

The following operations are performed in the computing scheme used. In step (i) ensembles are defined. Steps (ii)-(v) are performed for each ensemble. In steps (vi)-(viii) the essential results of the cross-spectrum analyses are computed.

(i) Divide the two time series into M ensembles, each ensemble having N points, where N may be chosen for convenience to be a power of 2, i.e. $N = 2^a$, where a is a positive integer. The total number of points in each series is clearly, NM. Let ${x_k}^m$, ${y_k}^m$, $k = 0, 1, ...N-1$; $1 \leq m \leq M$, represent the m th ensemble of the time series of surface elevation simultaneously measured at two gauges. Let the sampling interval be h, so that each ensemble is of duration $Nh = T$ (say).

Table 2.2 Characteristics of five different windows used in cross spectrum analysis. † s is the inverse of the factor by which spectral densities have to be scaled up to compensate for energy loss due to windowing. ‡ W is the half power frequency band width, and T is the record length

Window	Coefficients				
	α	β	γ	$s^\dagger$	$W^\ddagger$
Rectangular	1.00	0.00	0.00	1.0000	0.88/T
Hanning	0.50	0.50	0.00	0.3750	1.44/T
Hamming	0.54	0.46	0.00	0.3974	1.33/T
Blackman	0.42	0.50	0.08	0.3030	1.64/T
Cosine Taper	0.50	0.50	0.00	0.8750	1.03/T

(ii) Apply a window in time domain to the two time series so as to redefine them as follows:

${x_k}^m = {x_k}^m \cdot b_k$

${y_k}^m = {y_k}^m \cdot b_k$, where.

$$b_k = \alpha + \beta \cos[\frac{2\pi}{N}(k - \frac{N}{2})] + \gamma \cos[\frac{4\pi}{N}(k - \frac{N}{2})] \tag{2.1}$$

and α, β, γ are coefficients which depend on the particular window that is being used. Table 2.2 constructed after LeBlanc et al. [1975] gives the coefficients α, β, γ for five different windows, viz. Rectangular or Box-car, Hanning, Hamming, Blackman and Cosine Taper. In case of Cosine Taper, below given is the window in time domain in analytic form as it is somewhat different from the general type given in (2.1).

$$w(t) = \begin{cases} \frac{1}{2}(1 - \cos\frac{10\pi t}{T}) & \text{for } \frac{2T}{5} < |t| \leq \frac{T}{2} \\ 1.0 & \text{for } 0 < |t| \leq \frac{2T}{5} \\ 0 & \text{for } |t| > \frac{T}{2} \end{cases}$$

(iii) Define a complex time series ${z_k}^m$ as follows:

${z_k}^m = {x_k}^m + i{y_k}^m$

(iv) Compute the Fourier Transform ${Z_k}^m$of${z_k}^m$ as follows:

$$ {Z_k}^m = \sum_{n=0}^{N-1} {z_n}^m \exp\left(\frac{-2\pi ikn}{N}\right), \text{ where } i = \sqrt{-1} $$

(v) Compute the Fourier Transforms ${X_k}^m$ of ${x_k}^m$ and ${Y_k}^m$ of ${y_k}^m$ as follows ([Bendat and Piersol, 1971]):

$$ {X_k}^m = \left\{ {Z_k}^m + [{Z_{N-k}}^m]^* \right\} / 2 $$

$$ {Y_k}^m = \left\{ {Z_k}^m - [{Z_{N-k}}^m]^* \right\} / (2i) $$

where the asterisk indicates the complex conjugate.

(vi) Compute the mean power spectral densities (energy), $\tilde{G}_x, \tilde{G}_y$ of the two series corresponding to the frequencies f_k

$$ f_k = k/(Nh), k = 0, 1, \ldots, N/2 \tag{2.2} $$

$$ \tilde{G}_x(f_k) = \frac{2h}{Ns} p_k^2 \sum_{m=1}^{M} |X_k^m|^2 / M \tag{2.3} $$

$$ \tilde{G}_y(f_k) = \frac{2h}{Ns} \hat{p}_k^2 \sum_{m=1}^{M} |Y_k^m|^2 / M \tag{2.4} $$

where s is the inverse of the factor by which the spectral densities are scaled to compensate for energy loss due to windowing, and depends on the window used (see Table 2.2); $p_k, \hat{p}_k$ are wave attenuation correction factors, which are functions of frequency (wave number), water depth at the gauge location, and height of the pressure sensor above the bottom. If the water depth and the height of the gauge above the bottom are the same for the two gauges, then $p_k = \hat{p}_k$. The spectral densities have units of L^2T. Sometimes for convenience spectral densities are given in units of amplitude squared, i.e. L^2 as follows, for example in the case of $\tilde{G}_x$

$$ \tilde{G}_x(f_k) = \frac{4}{N^2 s} p_k^2 \sum_{m=1}^{M} |Y_k^m|^2 / M \tag{2.5} $$

From (2.2) we see that spectral densities are available at frequency intervals of 1/T, (T=Nh), from zero frequency to the high frequency limit 1/(2h), which is called the Nyquist frequency. The half-power band-width frequency resolution is given by W/T, where W which is given in Table 2.2 depends on the window used. The number of degrees of freedom is 2*M.

(vii) Following Thompson [1979], the coherence squared, $c^2(f_k)$ for all frequencies defined by (2.2). is computed as follows:

$$c^2(f_k) = \frac{\left|\sum_{m=1}^{M} [X_k^m]^* \cdot Y_k^m\right|^2}{\sum_{m=1}^{M} [X_k^m]^2 \cdot \sum_{m=1}^{M} [Y_k^m]^2} \tag{2.6}$$

Sometimes instead of $c^2(f_k)$ its square root, viz., $c(f_k)$ called coherence is used. Table 2.3 gives the threshold values of c^2 and c which are significant at 0.05 and 0.01 significance level. The thresholds are computed using the following formula

$$c^2 = 1 - \psi^{1/(M-1)} \tag{2.7}$$

where $\psi = 0.05$ or 0.01 and M is the total number of ensembles in each time series. For 80 ensembles the threshold value of coherence squared at 0.01 significance level is 0.057, indicating that if the observed coherence squared is larger than 0.057, then in just one case out of 100 the two time series are likely to be not coherent.

(viii) Let $\sum_{m=1}^{M} [X_k^m]^* \; Y_k^m = a_k + i\, b_k$

The real part a_k and the imaginary part b_k are known as the co-incident spectrum/co-spectrum and quadrature/ quad-spectrum respectively. The phase spectrum $\phi(f_k)$ for all frequencies defined by (2.2) is then uniquely defined in the interval $(-\pi,\ \pi)$ by taking into consideration the signs in the numerator and denominator in the formula given below

$$\phi(f_k) = \arctan(-b_k/a_k) = \phi \text{ (say)} \tag{2.8}$$

The phase spectrum defined in this fashion gives the phase lead of the time series x over the time series y. Assume that the two time series are coherent at frequency f_k. We emphasize that (2.8) determines the apparent phase difference ϕ in the interval $(-\pi,\ \pi)$. Owing to the circular nature of the angular scale the true phase difference in the actual physical situation is just one of the infinite number of possible phase differences $\phi + 2j\pi$, where j is an integer that has to be determined.

One strategy is to ensure that $j = 0$, so that the phase ϕ computed by (2.8) is a true representation of the actual physical situation, i.e. is the true phase. This can be done by insisting that

Table 2.3 Threshold values of coherence and coherence squared, which are significant at 0.05 and 0.01 significance level, for different number of ensembles M

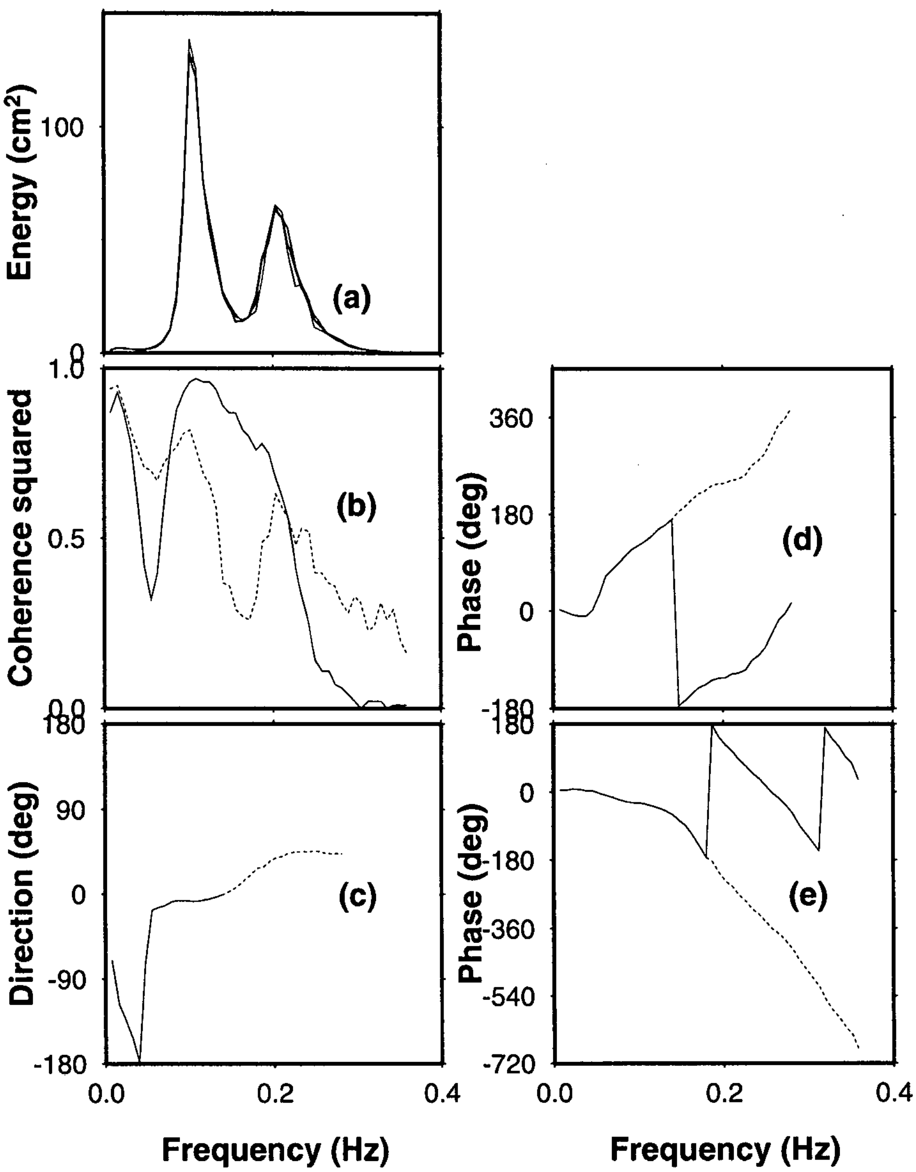
No.	M	Coherence		Coherence squared	
		(0.05)	(0.01)	(0.05)	(0.01)
1	3	.881	.949	.776	.900
2	4	.795	.886	.632	.785
3	5	.726	.827	.527	.684
4	6	.671	.776	.451	.602
5	7	.627	.732	.393	.536
6	8	.590	.694	.348	.482
7	9	.559	.662	.312	.438
8	10	.532	.633	.283	.401
9	11	.509	.607	.259	.369
10	12	.488	.585	.238	.342
11	13	.470	.565	.221	.319
12	14	.454	.546	.206	.298
13	15	.439	.529	.193	.280
14	16	.425	.514	.181	.264
15	17	.413	.500	.171	.250
16	18	.402	.487	.162	.237
17	19	.392	.475	.153	.226
18	20	.382	.464	.146	.215
19	25	.343	.418	.117	.175
20	30	.313	.383	.098	.147
21	35	.290	.356	.084	.127
22	40	.272	.334	.074	.111
23	45	.257	.315	.066	.099
24	50	.244	.300	.059	.090
25	55	.232	.286	.054	.082
26	60	.223	.274	.050	.075
27	65	.214	.263	.046	.069
28	70	.206	.254	.042	.065
29	75	.199	.246	.040	.060
30	80	.193	.238	.037	.057

the distance between the gauges is less than half a wavelength so that the phase difference in the actual situation is restricted to the interval $(-\pi,\ \pi)$. Fernandes et al. [1986] and Fernandes et al. [1988] used this strategy in their successful attempt at determining wave direction from computer simulated time series of wave elevation at gauges arranged in both linear and polygonal arrays. This strategy may be used in case of measured data also, but it is wasteful, as it treats perfectly good signal at the higher frequencies as noise and discards it. An inspection of cross-spectra from measured data suggests an alternative strategy to determine the true phase $\phi + 2j\pi$ from the apparent phase ϕ. Generally when the distance between the gauges is $\approx 30m$, the gauges are coherent for all frequencies less than about 0.25 Hz and the phase spectrum in the above frequency range is a continuous function of frequency evolving from zero phase at zero frequency, except for a few jumps (generally a maximum of two jumps) across the $(-\pi,\ \pi)$ pseudo-discontinuity arising due to the circular nature of the angular scale. Such phase spectra have either positive jumps or negative jumps as shown in Figure 2.7, from which it is clear that the true phase at a particular frequency, f_k is obtained from the apparent phase ϕ by adding $+2j\pi$, where the integer j indicates the last jump number prior to be frequency f_k . At frequency zero Hz, as there is no prior jump, the jump number is reckoned as zero. For negative jumps j is negative and for positive jumps j is positive. For example for all frequencies between the first and second positive jumps, the jump number j = +1. Similarly for all frequencies between the second and third negative jump the jump number j = -2 Figure 2.7 shows both the apparent phase ϕ as well as the true phase $\phi + 2j\pi$. The true phase spectra are terminated at the high frequency end of the spectrum at the frequency where the gauges are statistically no longer coherent, i.e. the coherence squared falls below the threshold given by (2.7). Thus the true phase is determined from the apparent phase by taking into consideration the jump number. **We may summarize by saying that, subject to the gauges being statistically coherent as discussed above, the *true* phase is determined from the *apparent* phase by adding $+/-2\pi$ for every positive/negative jump respectively. By using the *true* phase we ensure that wave directions *will* be correct and we also increase the high frequency limit at which the waves can be correctly determined.**

2.3 ATTENUATION CORRECTION

When wave elevation is measured with a bottom mounted pressure gauge, the observed waves are attenuated in height. The attenuation increases with increasing frequency. To compensate for attenuation, wave amplitudes have to be scaled by a factor $p(\kappa)$ derived using Linear Wave Theory (see Shore Protection Manual, Vol 1):

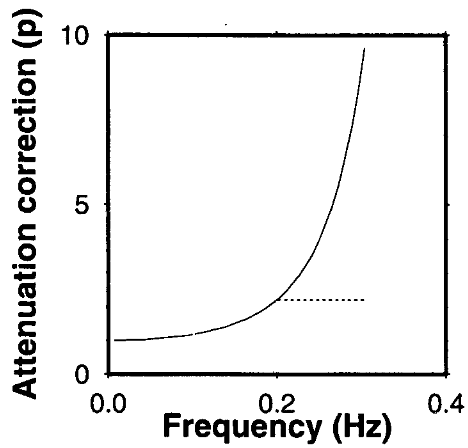
Figure 2.7 Examples of positive and negative jumps: Wave directional spectrum using the method of Esteva [1977] for the gauge triad CB1 on 2 February 1994 at 04 hours. Note that the estimates of wave direction are available even when the criterion $|D \sin\alpha| < \lambda/2$, is not valid



$$p(\kappa) = \frac{\cosh(\kappa d)}{\cosh(\kappa b)} \tag{2.9}$$

where κ is the wave number, d is the water depth at the location of the gauge, and b is the height of the gauge above the bottom. The attenuation correction as a function of frequency is shown in Figure 2.8. To avoid amplification of noise at higher frequencies, the attenuation correction for frequencies above 0.2 Hz (say) may be reckoned as equal the attenuation correction for 0.2 Hz. (It may be mentioned that since we perform only ensemble averaging [frequency averaging is not done!], our wave direction estimates are independent of attenuation correction.)

Figure 2.8 Attenuation correction from linear wave theory (solid line) for gauge 0 at the $8m$ array at Duck, North Carolina, USA. For frequencies above $0.2Hz$, we have assumed the same attenuation correction as for $0.2Hz$ (dashed line)



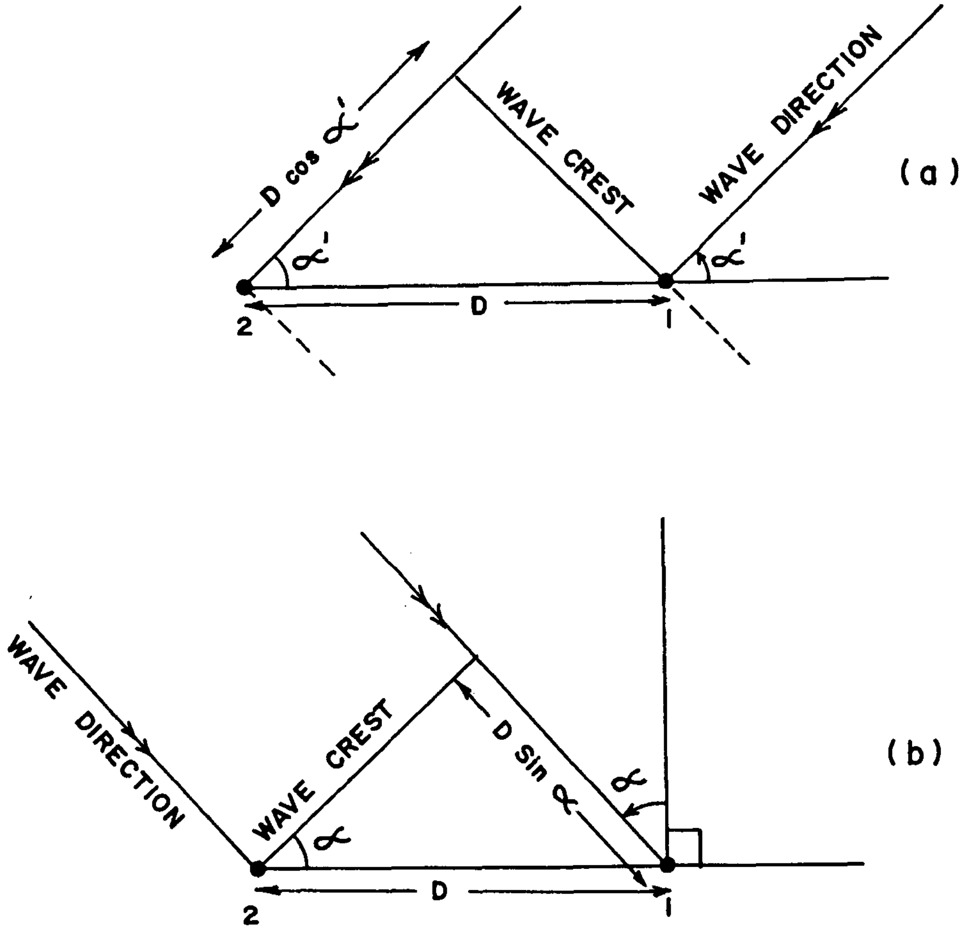
2.4 BORGMAN'S METHOD FOR LINEAR ARRAYS

Consider a sinusoidal long crested wave of frequency f (wave period T, $T = 1/f$) approaching gauges 12, separated by distance D, at an angle α' measured with respect to the line joining the gauges (see Figure 2.9).

By convention wave direction is the direction *from* which waves approach. Equating two definitions of path difference we obtain (see [Borgman, 1974]):

$$D \cos \alpha' = C\tau \tag{2.10}$$

Figure 2.9 The method of Borgman [1974] for determining wave direction as a function of frequency in case of linear 2-gauge arrays



where the wave celerity C is a function of f alone; the time difference τ between the arrival of a wave crest at the two gauges is related to the corresponding phase difference ϕ as follows:

$$\tau = \phi T/(2\pi) \tag{2.11}$$

The phase difference ϕ between the arrival of a wave crest at the two guages is computed as a function of frequency by cross-spectrum analysis using (2.8).

To evaluate the celerity C, the wave number κ, corresponding to the frequency f is first determined from the following dispersion relationship by the method of iteration:

$$(2\pi f)^2 = \kappa g \tanh(\kappa d) \tag{2.12}$$

where d is the mean water depth at the gauge sites. The wavelength λ ($\lambda = 2\pi/\kappa$) can then be determined and the celerity, C ($= \lambda/T = \lambda f$) evaluated.

In (2.10) the only unknown is α'. Thus wave direction as a function of frequency is easily computed in the interval (0, π). As in the case of the 15-gauge array at Duck, North Carolina (see Figure 2.2), with the linear part of the array being parallel to the shore, wave direction α is sometimes measured with respect to the seaward normal to the the shore. This can be done by simply adding $-\pi/2$ to the wave direction α' computed by (2.10). Sometimes the axis for measuring wave direction does not coincide with the line passing through the two gauges for which a suitable correction, δ computed from the coordinates of the gauges has to be applied.

Thus $\alpha = \alpha' - \pi/2 + \delta$ gives the wave direction, with respect to the normal to the shore, as function of frequency, computed from the *apparent* phase differences.

This is called as PASS = 0 of the analysis, which is exactly equivalent to the analysis of Borgman [1974]. In this case if the criterion, $|D\cos\alpha'| < \lambda/2$, is violated, the computed directions will be incorrect, as the true phase is not restricted to the interval $(-\pi, \pi)$. In measured data, the smallest frequency at which the above criterion is violated is immediately recognised from the phase spectrum by the first jump across the ($-\pi$, π) pseudo discontinuity. (In case of computer simulated data instead of the above criterion, because there is no gradual evolution of phase difference with increasing frequency, the more stringent criterion of $D < \lambda/2$ must neccessarily be used).

Therefore in what is called PASS = 1 of the analysis, wave directions α are given a value of 9999.99 for all frequencies above f_a , where f_a is the smallest frequency at which either the first jump across the ($-\pi$, π) discontinuity occurs or the coherence falls below the threshold given by (2.7). Thus PASS = 1 is superior to the analysis of Borgman [1974] in that in PASS=1 incorrect wave directions are flagged with the value 9999.99 as the wave direction.

In PASS = 2 of the analysis, for frequencies above the first phase jump across the $(-\pi, \pi)$ discontinuity, the true phase is determined from the apparent phase computed by (2.8) by taking into consideration the jump number as explained in the section on cross spectrum analysis, and directions are computed from the true phase difference. In PASS = 2, directions are given a value of 9999.99 for all frequencies above f_b, $f_b \geq f_a$, where f_b is the smallest frequency at which the coherence falls below the threshold given by (2.7) and f_a is the same as defined above. Thus PASS = 2 of our analysis, which is superior to both PASS = 0 (the Borgman analysis!), and PASS = 1, makes full use of the **signal** in the measured data. PASS = 2 is also superior to the analysis of Munk et al. [1963], who directly compute the wave direction α, without the intermediate computation of α'.

In PASS = 0 as well as PASS = 1, the apparent phase is used in (2.11), whereas in PASS = 2, the true phase is used. PASS=2 is herein referred as the 'Modified Borgman Method'.

The true phase is determined from the apparent phase by taking into consideration the jump number discussed in Chapter 2.2. The jumps occur when the path difference between the arrival of a wave crest at the two gauges satisfies the relationship

$$D \cos\alpha' = D \sin\alpha = (2n+1)\,\lambda/2$$

where D is the distance between the gauges, the wave direction is given by α' or α, λ is the wavelength, n is any integer (positive, zero or negative) and the jump number j is given by

$$j = \begin{cases} n+1 & \text{for } n \geq 0 \\ n & \text{for } n < 0 \end{cases}$$

Thus two gauges are sufficient to determine wave direction as a function of frequency. If more 2-gauge combinations (i.e. gauge pairs) are available redundant estimates of wave direction are possible. We have made 10 redundant estimates of wave direction for each of the 47 data files of measured data at North Carolina. The following 10 gauge pairs: 43, 21, 32, 42, 65, 78, 89, 31, 01 and 54; satisfying $D < \lambda/2$ for wave periods above $9s$, were chosen with the help of a figure similar to Figure 2.6. Two gauge pairs with small gauge separation, viz, 43 and 21 satisfied the same criterion for periods above $3.5s$.

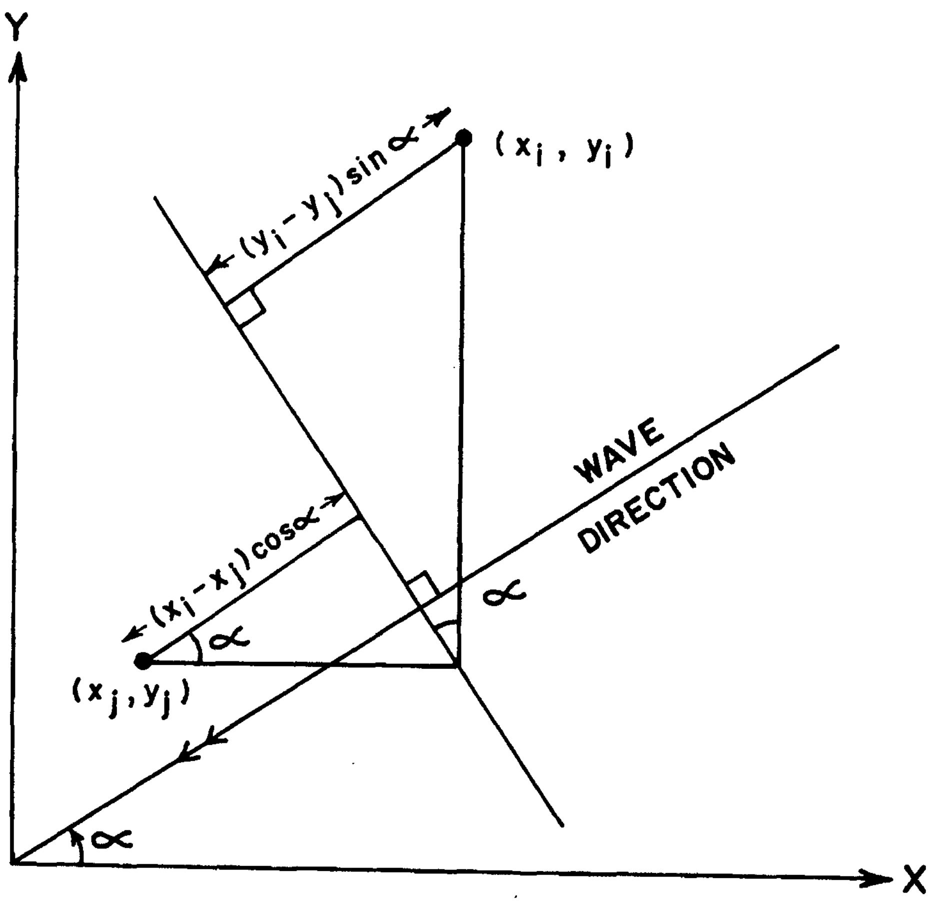
Linear (2-gauge) arrays are unable to distinguish between waves arriving at the gauges at the same angle but from opposite sides, i.e. at angles α' and $-\alpha'$, or in terms of α, at angles α and $\pi - \alpha$, as the phase difference for either case is the same. However, oftentimes it may be possible to assume that waves come from just one side, viz., the seaward side, e.g. swell at a long coastline, so that linear array can be used to advantage.

2.5 ESTEVA'S METHOD FOR POLYGONAL ARRAYS

More often than not it is wrong to assume that waves come from just one side as has to be done in case of linear arrays. In such cases polygonal arrays are used to unambiguously determine wave direction.

Let (x_i, y_i) and (x_j, y_j) be the coordinates of two gauges. Let α be the wave direction (see Figure 2.10) measured anti-clockwise positive with respect to the x-axis, By convention wave direction is the direction *from* which waves are approaching.

Figure 2.10 Method of Esteva [1977] for determining wave direction as a function of frequency from polygonal 3-gauge arrays



For length λ, the phase difference is 2π. Therefore for length $(x_i - x_j)\cos\alpha + (y_i - y_j)\sin\alpha$, the corresponding phase difference is

$$\begin{aligned}\phi_{ij} &= (2\pi/\lambda)\,[(x_i - x_j)\,\cos\alpha + (y_i - y_j)\,\sin\alpha] \\ &= \kappa\,[(x_i - x_j)\,\cos\alpha + (y_i - y_j)\,\sin\alpha]\end{aligned}$$

In particular,

$$\phi_{12} = \kappa\,[(x_1 - x_2)\,\cos\alpha + (y_1 - y_2)\,\sin\alpha] \tag{2.13}$$

$$\phi_{13} = \kappa\,[(x_1 - x_3)\,\cos\alpha + (y_1 - y_3)\,\sin\alpha] \tag{2.14}$$

From (2.13) and (2.14) it is clear that

$$\begin{aligned}\sin\alpha &= [(x_1 - x_2)\,\phi_{13} + (x_1 - x_3)\,\phi_{12}]/P \\ \cos\alpha &= [(y_1 - y_3)\,\phi_{12} - (y_1 - y_2)\,\phi_{13}]/P\end{aligned}$$

where, $P = \kappa\,[(x_1 - x_2)(y_1 - y_3) - (x_1 - x_3)(y_1 - y_2)]$, does not vanish for nonlinear arrays.

Then α is uniquely determined in the range $(-\pi,\ \pi)$ from the following equation by considering the signs of the numerator and the denominator:

$$\alpha = \arctan \frac{[(x_1 - x_2)\,\phi_{13} + (x_1 - x_3)\,\phi_{12}]Sgn\ P}{[(y_1 - y_3)\,\phi_{12} - (y_1 - y_2)\,\phi_{13}]Sgn\ P} \tag{2.15}$$

where $Sgn\ P = 1$, for $P > 0$ and $Sgn\ P = -1$, for $P < 0$

ϕ_{12} and ϕ_{13} can be determined as a function of frequency from the cross-spectrum between gauges 12 and 13 respectively by using (2.8). Thus from (2.15) wave direction is determined as a function of frequency. This is called as PASS = 0 of the analysis, which is equivalent to the analysis of Esteva [1977]. In this case wave directions will be incorrect for all frequencies above $f_a = \min\ (f_{12},\ f_{13})$, where f_{ij} are the smallest frequency at which either the phase ϕ_{ij} jumps across the $(-\pi,\ \pi)$ pseudo-discontinuity or the coherence squared c_{ij}^2 falls below the threshold given by (2.7).

Therefore in PASS = 1 of the analysis, directions for all frequencies above f_a are given the value of 9999.99, so that PASS = 1, is superior to PASS = 0, i.e., the analysis of Esteva [1977].

In PASS = 2 of the analysis, the *true* phases are determined from the *apparent* phases ϕ_{12} and ϕ_{13} computed by using (2.8) by taking into consideration the jump numbers as explained in the Chapter 2.2 and directions are computed from the true phase difference. In PASS = 2, wave directions are given a value of 9999.99 for all frequencies above f_b, $f_b \geq f_a$, where f_b, is the smallest frequency at which the coherence squared for either gauges 12 or 13 falls below the threshold given by (2.7).

It may be emphasized that in PASS = 0 as well as PASS = 1, the *apparent* phases ϕ_{12} and ϕ_{13} computed from (2.8) are used in (2.15), whereas in PASS = 2, the *true* phase is used. PASS=2 is referred herein as the 'Modified Esteva method'.

Thus three non collinear gauges are sufficient to determine wave direction unambiguously as a function of direction. If more 3-gauge combinations (i.e. gauge triads) are available, redundant estimates of wave direction are possible. We have made 15 redundant estimates of wave direction as a function of frequency for each of the 47 measured data files at North Carolina. The following 15 gauge triads: 012, 34C, DO3, D24, C1D, 4C5, DOE, CB1, CB2, CB0, DO4, DOC, 02D, 41D and C24; satisfying $D < \lambda/2$ for wave periods above 9s were chosen. Two gauge triads with small gauge separations D, viz, 012 and 34C satisfied the same criterion for periods above 3.7s.

2.6 RESULTS AND DISCUSSION

Software in FORTRAN Language, constructed on the "black-box" principle, has been developed to determine wave direction from measurements of surface elevation at the 15-gauge array at North Carolina, USA using the phase/time/path difference methods (PTPDM) of (Esteva [1976], Esteva [1977]) and Borgman [1974] in case of polygonal (3-gauge) and linear (2-gauge) arrays respectively. Before applying the software to the measured data, the software was applied to computer simulated wave fields at the 15-gauge array and was found to consistently yield directions correctly in case of both linear as well as polygonal arrays.

A sinusoidal wave can be simulated on a computer using the formula

$$\eta(t) = A\,\cos[2\pi ft + \delta + \kappa(x\cos\alpha + y\sin\alpha)]$$

where η is the wave elevation as a function of time t at a gauge having coordinates $(x,\ y)$; f is the frequency of the wave; A is its amplitude; κ is the wave number; α is the wave direction measured as in Figure 2.11 and δ is an arbitrary phase at the origin.

The computer simulation of the wave fields was done by combining three sinusoidal waves with frequencies 3/1024 Hz apart, each sinusoid being assigned a specific direction, nearly equal amplitude, each frequency 0.134/1024 (= 0.00012) Hz removed from the closest spectral frequency, and having arbitrary phase at the origin in lines with Fernandes et al. [1988]. For representing ocean waves more realistically random noise within the interval $\pm 1.5cm$ was added. The simulated time series at the 15-gauge array had 1024 points sampled at $1Hz$, i.e. $1s$.

Figure 2.11 Simulation of wave trains in case of arrays

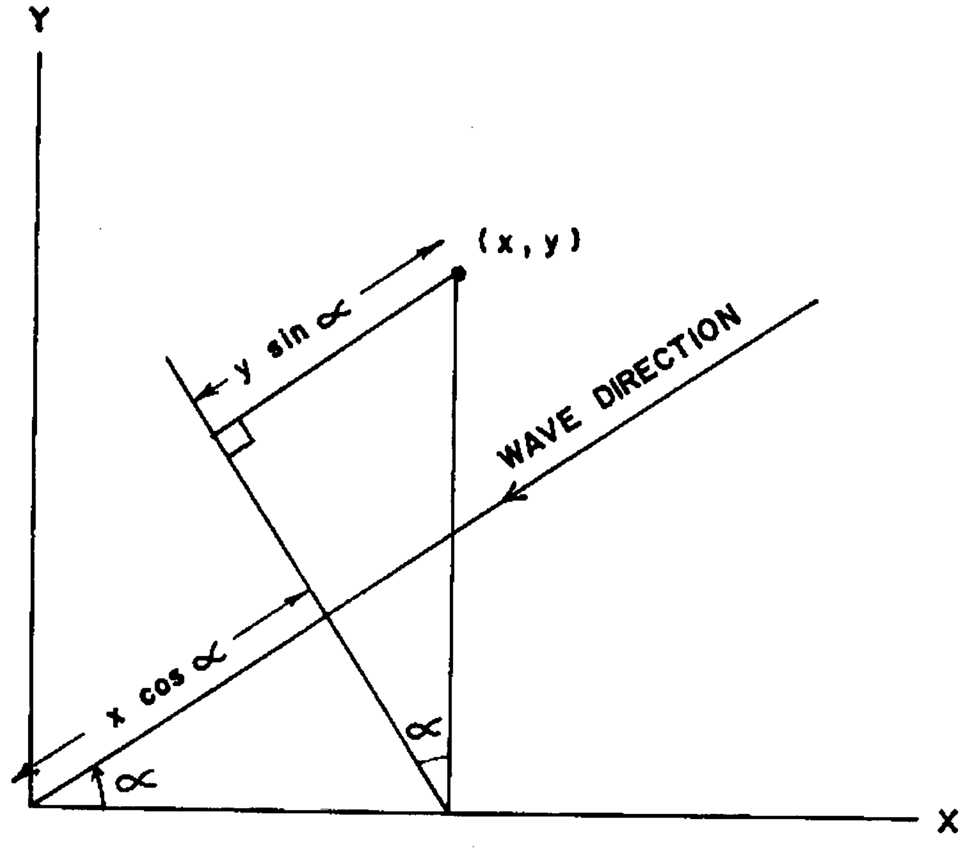


Table 2.4 presents the characteristics of one such computer simulated wave field. This wave field may be briefly described as swell of $\approx 10s$, with the three swell components having wave directions of $5^o, -5^o$ and -10^o.

Table 2.4 Characteristics of a computer simulated wave field at the 15-gauge polygonal array at $8m$ depth at the Coastal Engineering Research Center's (CERC) Field Research facility at Duck, North Carolina, USA. † Indicates approximate wave period. ‡ indicates initial phase at the origin

Closest spectral		Simulated wave train			
Line (k)	Period (s)	Amplitude (cm)	Period† (s)	Phase‡ (deg)	Direction (deg)
102	10.14	11.43	10.125	15	5
105	9.85	15.24	9.833	25	-5
108	9.57	11.43	9.558	20	-10

We shall be presenting an array of tables giving the wave directional spectrum in case of polygonal and linear arrays, with measured as well as computer simulated wave fields. An annotation of the specifications of the analyses performed as indicated at the top of this array of tables is given in Table 2.5.

In the spectrum and cross-spectrum analyses of the computer simulated data we used one ensemble of 1024 points sampled at $1Hz$, i.e. $1s$. Hanning window was used. Spectral densities are given in units of cm^2. Spectral densities have been scaled up by a factor of 1/0.375 to compensate for loss of energy due to windowing.

Table 2.6 gives the wave directional spectrum (PASS = 0) for the computer simulated swell of $\approx 10s$ using gauge pair 89. We note that the wave directions are correctly computed for the swell of $\approx 10s$ as the swell frequencies satisfy the criterion of Barber and Doyle [1956], $D < \lambda/2$, for the gauge pair 89.

Table 2.5 Annotations of specifications in tables giving the analysis of the 15-gauge array at Duck, North Carolina, USA, using the methods of Borgman [1974] and Esteva [1977] in case of linear and polygonal arrays respectively

PAIR	- For linear arrays the analysis is done in units of gauge pairs
TRIAD	- For polygonal arrays the analysis is done in units of gauge triads
PART	= 0 , Time series is computer simulated = 6 , Time series has a total of 5 X 4096 points
PASS	= 0 , Apparent phase used for determining wave direction = 1 , Apparent phase used; incorrect wave directions flagged as 9999.99 wave directions are assumed incorrect when either coherence falls below 0.057 or phase jump across -180/+180 degrees occurs =2 , True phase used; incorrect wave directions flagged as 9999.99 waveve directions are assumed incorrect when coherence falls below 0.057
Hmo	- Significant wave height for (gauge pair 12/ gauge triad 123) computed as four times the zero th moment
NP	- Number of ensembles
SAMIN	- Sampling interval in seconds
NDF	- Number of degrees of freedom, is twice the number of ensembles
UNITS	= 1 , spectral densities in cm**2 = 2 , spectral densities in cm**2/Hz
WINDOW	= 1 , Rectangular window used = 2 , Hanning window used = 3 , Hamming window used = 4 , Blackman window used = 5 , Cosine Taper window used
ICOR	= 0 , Attenuation correction not performed = 1 , Attenuation correction performed
CUT	- Attenuation correction for frequencies above cut(-off) value are the same as for the cut(-off) value
TH, TL	- Spectral densities between periods (TH, TL) used to determine the significant wave height
DIST	- Distance between gauges 12 in case of gauge pair 12; distances between gauges 12 and 13 in case of gauge triad 123
PER	- Central period for frequency band
G1, G2	- Spectral densities for gauge pair 12
G1, G2, G3	- Spectral densities for gauge triad 123
LAM	- Wavelength corresponding to central period
PH1, COH1	- Phase and coherence respectively for gauges 12 in case of gauge pair 12; Phase and coherence respcctively for gauges 12 in case of gauge triad 123
PH2, COH2	- Phase and coherence respectively for gauges 13 in case of gauge triad 123
FREQ	- Central frequency for frequency band
DIR	- Wave direction measured with respect to the seaward normal, northwards positive
QH1,QH2	- "TRUE" Phase differences, i.e., PASS=2, while PH1,PH2 are "APPARENT" phase differences, i.e., PASS=0

Table 2.6 PAIR=89 PART=0 PASS=0 00/00/00 00:00 HRS Hmo=[.63; .63] NP=1024 SAMIN=1.0 NDF= 2 UNITS=1 WINDOW=2 ICOR=0 CUT= .20 TH=21.40 TL= 1.99 FORMAT=(8f7.2) FACTOR=1.0 DIST= 34.11

NO	PER	G1	G2	LAM	PH1	COH1	FREQ	DIR
90	11.51	.005	.005	97.80	-4.76	1.00	.0869	.66
91	11.38	.002	.002	96.59	-50.25	1.00	.0879	21.77
92	11.25	.003	.001	95.41	-57.05	1.00	.0889	24.80
93	11.13	.001	.004	94.37	-26.57	1.00	.0898	10.27
94	11.01	.004	.003	93.23	48.31	1.00	.0908	-23.03
95	10.89	.002	.001	92.12	103.79	1.00	.0918	-52.65
96	10.78	.009	.000	91.03	-64.85	1.00	.0928	27.22
97	10.67	.007	.001	89.97	-53.01	1.00	.0938	21.34
98	10.56	.000	.002	89.03	-72.27	1.00	.0947	30.08
99	10.45	.004	.001	88.00	.01	1.00	.0957	-1.52
100	10.34	.041	.022	87.00	3.56	1.00	.0967	-2.96
101	10.24	13.638	14.161	86.01	-18.41	1.00	.0977	5.90
102	10.14	85.534	86.062	85.14	-16.78	1.00	.0986	5.17
103	10.04	29.449	30.463	84.19	-17.03	1.00	.0996	5.19
104	9.94	27.749	26.949	83.26	8.79	1.00	.1006	-4.93
105	9.85	149.959	150.404	82.34	9.23	1.00	.1016	-5.06
106	9.75	56.766	57.151	81.54	9.22	1.00	.1025	-5.02
107	9.66	12.748	12.192	80.65	22.88	1.00	.1035	-10.15
108	9.57	85.925	85.796	79.79	22.30	1.00	.1045	-9.84
109	9.48	31.069	31.381	78.93	22.48	1.00	.1055	-9.82
110	9.39	.069	.081	78.18	22.23	1.00	.1064	-9.65
111	9.31	.004	.002	77.36	34.57	1.00	.1074	-14.09
112	9.23	.000	.008	76.55	-137.37	1.00	.1084	57.39
113	9.14	.004	.003	75.76	-125.51	1.00	.1094	49.23
114	9.06	.001	.002	74.97	-118.35	1.00	.1104	44.75
115	8.98	.001	.002	74.28	-152.47	1.00	.1113	65.75
116	8.90	.000	.001	73.53	-116.74	1.00	.1123	42.83
117	8.83	.001	.009	72.78	174.31	1.00	.1133	999.99
118	8.75	.002	.009	72.05	123.44	1.00	.1143	-47.92
119	8.68	.001	.003	71.40	148.91	1.00	.1152	-61.49
120	8.61	.000	.001	70.69	128.99	1.00	.1162	-49.46

Table 2.7 TRIAD=41d PART=0 PASS=0 00/00/00 00:00 HRS Hmo= [.63; .63; .63] NP=1024 SAMIN=1.0 NDF= 2 UNITS=1 WINDOW=2 ICOR=0 CUT= .20 TH=21.40 TL= 1.99 FORMAT=(8f7.2) FACTOR=1.0 DIST= [30.40; 21.12]

NO	PER	G1	G2	G3	PH1	PH2	COH1	COH2	FREQ	DIR
90	11.51	.006	.000	.000	96.86	101.79	1.00	1.00	.0869	-142.64
91	11.38	.007	.003	.000	-136.58	144.90	1.00	1.00	.0879	151.24
92	11.25	.008	.003	.004	-152.47	70.47	1.00	1.00	.0889	133.05
93	11.13	.006	.000	.001	-171.09	48.06	1.00	1.00	.0898	123.64
94	11.01	.001	.001	.004	140.16	-136.38	1.00	1.00	.0908	-30.59
95	10.89	.003	.002	.008	146.77	-108.98	1.00	1.00	.0918	-36.53
96	10.78	.008	.000	.011	141.99	-124.88	1.00	1.00	.0928	-32.78
97	10.67	.004	.003	.009	-96.38	-146.89	1.00	1.00	.0938	26.44
98	10.56	.004	.004	.001	137.20	62.65	1.00	1.00	.0947	-113.19
99	10.45	.009	.004	.008	-79.71	-170.87	1.00	1.00	.0957	18.84
100	10.34	.012	.022	.019	17.88	-39.19	1.00	1.00	.0967	-15.95
101	10.24	14.505	13.896	13.860	-10.99	-88.77	1.00	1.00	.0977	4.87
102	10.14	86.561	85.888	84.562	-11.00	-88.51	1.00	1.00	.0986	4.89
103	10.04	31.877	30.430	31.122	-11.12	-88.77	1.00	1.00	.0996	4.93
104	9.94	26.258	26.258	26.004	11.14	-87.58	1.00	1.00	.1006	-4.80
105	9.85	153.305	150.548	151.954	11.93	-87.22	1.00	1.00	.1016	-5.15
106	9.75	54.679	55.365	55.028	11.91	-86.69	1.00	1.00	.1025	-5.17
107	9.66	14.509	14.897	15.509	22.69	-87.74	1.00	1.00	.1035	-9.49
108	9.57	83.083	85.606	84.569	22.92	-87.88	1.00	1.00	.1045	-9.56
109	9.48	31.621	31.081	31.611	22.09	-88.23	1.00	1.00	.1055	-9.20
110	9.39	.077	.023	.102	7.58	-93.54	1.00	1.00	.1064	-3.09
111	9.31	.023	.028	.002	32.26	87.79	1.00	1.00	.1074	-165.21
112	9.23	.010	.001	.009	99.58	123.85	1.00	1.00	.1084	-147.92
113	9.14	.002	.001	.001	-162.17	8.37	1.00	1.00	.1094	108.02
114	9.06	.002	.001	.002	18.89	109.17	1.00	1.00	.1104	-173.15
115	8.98	.005	.001	.001	-85.61	151.49	1.00	1.00	.1113	160.81
116	8.90	.005	.001	.002	113.41	-174.66	1.00	1.00	.1123	-21.55
117	8.83	.008	.003	.007	83.19	-172.01	1.00	1.00	.1133	-16.79
118	8.75	.003	.004	.007	102.16	-157.19	1.00	1.00	.1143	-21.56
119	8.68	.000	.001	.006	119.64	-161.94	1.00	1.00	.1152	-23.91
120	8.61	.001	.003	.001	-74.62	-143.26	1.00	1.00	.1162	21.05

Table 2.8 PAIR=78 PART=6 PASS=0 05/02/94 16:00 HRS Hmo=[.27; .27] NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT= .20 TH=21.40 TL= 1.99 FORMAT=(8f5.1) FACTOR=1.0 DIST= 25.40

NO	PER	G1	G2	LAM	PH1	COH1	FREQ	DIR
2	128.00	.858	.899	1135.28	3.03	.98	.0078	-22.10
3	64.00	1.525	1.562	567.11	4.08	.99	.0156	-14.66
4	42.67	1.172	1.194	377.46	6.03	.98	.0234	-14.41
5	32.00	.428	.410	281.54	7.96	.94	.0313	-14.19
6	25.60	.265	.256	224.71	11.34	.83	.0391	-16.18
7	21.33	.434	.470	186.66	12.91	.84	.0469	-15.28
8	18.29	.816	.874	159.35	10.26	.82	.0547	-10.30
9	16.00	1.494	1.733	138.76	11.37	.82	.0625	-9.94
10	14.22	2.877	3.338	122.67	13.05	.87	.0703	-10.08
11	12.80	3.561	3.593	109.71	16.20	.85	.0781	-11.21
12	11.64	4.078	4.261	99.03	27.50	.79	.0859	-17.33
13	10.67	6.144	6.738	89.97	40.73	.79	.0938	-23.63
14	9.85	10.932	12.024	82.34	51.51	.83	.1016	-27.64
15	9.14	12.413	14.208	75.76	57.24	.84	.1094	-28.31
16	8.53	9.356	10.021	69.99	59.36	.82	.1172	-27.02
17	8.00	6.108	5.937	64.90	64.66	.81	.1250	-27.32
18	7.53	4.485	4.167	60.37	73.18	.75	.1328	-28.89
19	7.11	5.119	4.522	56.30	85.99	.77	.1406	-31.97
20	6.74	5.166	4.881	52.62	93.53	.77	.1484	-32.56
21	6.40	3.708	3.719	49.23	103.22	.72	.1563	-33.76
22	6.10	2.607	2.583	46.17	113.85	.61	.1641	-35.09
23	5.82	1.694	1.811	43.37	128.09	.59	.1719	-37.41
24	5.57	1.248	1.233	40.78	130.29	.52	.1797	-35.52
25	5.33	1.194	1.188	38.38	123.96	.55	.1875	-31.35
26	5.12	1.198	1.208	36.15	127.10	.58	.1953	-30.17
27	4.92	1.042	1.157	34.08	138.82	.55	.2031	-31.16
28	4.74	.880	.912	32.15	143.46	.54	.2109	-30.29
29	4.57	.649	.677	30.33	148.02	.42	.2188	-29.40
30	4.41	.607	.622	28.64	161.80	.40	.2266	-30.45
31	4.27	.541	.562	27.06	171.37	.34	.2344	-30.48
32	4.13	.370	.366	25.59	-160.42	.14	.2422	26.67
33	4.00	.225	.238	24.21	-144.37	.11	.2500	22.47
34	3.88	.169	.166	22.92	-119.14	.09	.2578	17.37
35	3.76	.121	.128	21.71	-97.74	.07	.2656	13.42
36	3.66	.092	.086	20.57	-72.94	.08	.2734	9.45
37	3.56	.077	.061	19.50	-20.75	.07	.2813	2.54
38	3.46	.067	.048	18.52	31.67	.08	.2891	-3.68
39	3.37	.050	.037	17.60	73.74	.15	.2969	-8.16
40	3.28	.032	.025	16.73	85.15	.08	.3047	-8.97
41	3.20	.024	.017	15.93	115.46	.04	.3125	-11.60
42	3.12	.018	.013	15.18	97.08	.11	.3203	-9.27
43	3.05	.014	.011	14.48	87.56	.09	.3281	-7.97
44	2.98	.011	.009	13.82	141.26	.00	.3359	-12.33
45	2.91	.009	.009	13.20	-109.73	.00	.3438	9.11
46	2.84	.007	.007	12.62	-8.24	.00	.3516	.65
47	2.78	.008	.006	12.08	-91.93	.01	.3594	6.98

Table 2.9 PAIR=78 PART=6 PASS=1 05/02/94 16:00 HRS Hmo=[.27; .27] NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT= .20 TH=21.40 TL= 1.99 FORMAT=(8f5.1) FACTOR=1.0 DIST= 25.40

NO	PER	G1	G2	LAM	PH1	COH1	FREQ	DIR
2	128.00	.858	.899	1135.28	3.03	.98	.0078	-22.10
3	64.00	1.525	1.562	567.11	4.08	.99	.0156	-14.66
4	42.67	1.172	1.194	377.46	6.03	.98	.0234	-14.41
5	32.00	.428	.410	281.54	7.96	.94	.0313	-14.19
6	25.60	.265	.256	224.71	11.34	.83	.0391	-16.18
7	21.33	.434	.470	186.66	12.91	.84	.0469	-15.28
8	18.29	.816	.874	159.35	10.26	.82	.0547	-10.30
9	16.00	1.494	1.733	138.76	11.37	.82	.0625	-9.94
10	14.22	2.877	3.338	122.67	13.05	.87	.0703	-10.08
11	12.80	3.561	3.593	109.71	16.20	.85	.0781	-11.21
12	11.64	4.078	4.261	99.03	27.50	.79	.0859	-17.33
13	10.67	6.144	6.738	89.97	40.73	.79	.0938	-23.63
14	9.85	10.932	12.024	82.34	51.51	.83	.1016	-27.64
15	9.14	12.413	14.208	75.76	57.24	.84	.1094	-28.31
16	8.53	9.356	10.021	69.99	59.36	.82	.1172	-27.02
17	8.00	6.108	5.937	64.90	64.66	.81	.1250	-27.32
18	7.53	4.485	4.167	60.37	73.18	.75	.1328	-28.89
19	7.11	5.119	4.522	56.30	85.99	.77	.1406	-31.97
20	6.74	5.166	4.881	52.62	93.53	.77	.1484	-32.56
21	6.40	3.708	3.719	49.23	103.22	.72	.1563	-33.76
22	6.10	2.607	2.583	46.17	113.85	.61	.1641	-35.09
23	5.82	1.694	1.811	43.37	128.09	.59	.1719	-37.41
24	5.57	1.248	1.233	40.78	130.29	.52	.1797	-35.52
25	5.33	1.194	1.188	38.38	123.96	.55	.1875	-31.35
26	5.12	1.198	1.208	36.15	127.10	.58	.1953	-30.17
27	4.92	1.042	1.157	34.08	138.82	.55	.2031	-31.16
28	4.74	.880	.912	32.15	143.46	.54	.2109	-30.29
29	4.57	.649	.677	30.33	148.02	.42	.2188	-29.40
30	4.41	.607	.622	28.64	161.80	.40	.2266	-30.45
31	4.27	.541	.562	27.06	171.37	.34	.2344	-30.48
32	4.13	.370	.366	25.59	-160.42	.14	.2422	9999.99
33	4.00	.225	.238	24.21	-144.37	.11	.2500	9999.99
34	3.88	.169	.166	22.92	-119.14	.09	.2578	9999.99
35	3.76	.121	.128	21.71	-97.74	.07	.2656	9999.99
36	3.66	.092	.086	20.57	-72.94	.08	.2734	9999.99
37	3.56	.077	.061	19.50	-20.75	.07	.2813	9999.99
38	3.46	.067	.048	18.52	31.67	.08	.2891	9999.99
39	3.37	.050	.037	17.60	73.74	.15	.2969	9999.99
40	3.28	.032	.025	16.73	85.15	.08	.3047	9999.99
41	3.20	.024	.017	15.93	115.46	.04	.3125	9999.99
42	3.12	.018	.013	15.18	97.08	.11	.3203	9999.99
43	3.05	.014	.011	14.48	87.56	.09	.3281	9999.99
44	2.98	.011	.009	13.82	141.26	.00	.3359	9999.99
45	2.91	.009	.009	13.20	-109.73	.00	.3438	9999.99
46	2.84	.007	.007	12.62	-8.24	.00	.3516	9999.99
47	2.78	.008	.006	12.08	-91.93	.01	.3594	9999.99

Table 2.10 PAIR=78 PART=6 PASS=2 05/02/94 16:00 HRS Hmo=[.27; .27] NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT= .20 TH=21.40 TL= 1.99 FORMAT=(8f5.1) FACTOR=1.0 DIST= 25.40

NO	PER	G1	G2	LAM	PH1	COH1	FREQ	DIR	QH1
2	128.00	.858	.899	1135.28	3.03	.98	.0078	-22.10	3.03
3	64.00	1.525	1.562	567.11	4.08	.99	.0156	-14.66	4.08
4	42.67	1.172	1.194	377.46	6.03	.98	.0234	-14.41	6.03
5	32.00	.428	.410	281.54	7.96	.94	.0313	-14.19	7.96
6	25.60	.265	.256	224.71	11.34	.83	.0391	-16.18	11.34
7	21.33	.434	.470	186.66	12.91	.84	.0469	-15.28	12.91
8	18.29	.816	.874	159.35	10.26	.82	.0547	-10.30	10.26
9	16.00	1.494	1.733	138.76	11.37	.82	.0625	-9.94	11.37
10	14.22	2.877	3.338	122.67	13.05	.87	.0703	-10.08	13.05
11	12.80	3.561	3.593	109.71	16.20	.85	.0781	-11.21	16.20
12	11.64	4.078	4.261	99.03	27.50	.79	.0859	-17.33	27.50
13	10.67	6.144	6.738	89.97	40.73	.79	.0938	-23.63	40.73
14	9.85	10.932	12.024	82.34	51.51	.83	.1016	-27.64	51.51
15	9.14	12.413	14.208	75.76	57.24	.84	.1094	-28.31	57.24
16	8.53	9.356	10.021	69.99	59.36	.82	.1172	-27.02	59.36
17	8.00	6.108	5.937	64.90	64.66	.81	.1250	-27.32	64.66
18	7.53	4.485	4.167	60.37	73.18	.75	.1328	-28.89	73.18
19	7.11	5.119	4.522	56.30	85.99	.77	.1406	-31.97	85.99
20	6.74	5.166	4.881	52.62	93.53	.77	.1484	-32.56	93.53
21	6.40	3.708	3.719	49.23	103.22	.72	.1563	-33.76	103.22
22	6.10	2.607	2.583	46.17	113.85	.61	.1641	-35.09	113.85
23	5.82	1.694	1.811	43.37	128.09	.59	.1719	-37.41	128.09
24	5.57	1.248	1.233	40.78	130.29	.52	.1797	-35.52	130.29
25	5.33	1.194	1.188	38.38	123.96	.55	.1875	-31.35	123.96
26	5.12	1.198	1.208	36.15	127.10	.58	.1953	-30.17	127.10
27	4.92	1.042	1.157	34.08	138.82	.55	.2031	-31.16	138.82
28	4.74	.880	.912	32.15	143.46	.54	.2109	-30.29	143.46
29	4.57	.649	.677	30.33	148.02	.42	.2188	-29.40	148.02
30	4.41	.607	.622	28.64	161.80	.40	.2266	-30.45	161.80
31	4.27	.541	.562	27.06	171.37	.34	.2344	-30.48	171.37
32	4.13	.370	.366	25.59	-160.42	.14	.2422	-33.95	199.58
33	4.00	.225	.238	24.21	-144.37	.11	.2500	-34.81	215.63
34	3.88	.169	.166	22.92	-119.14	.09	.2578	-37.13	240.86
35	3.76	.121	.128	21.71	-97.74	.07	.2656	-38.50	262.26
36	3.66	.092	.086	20.57	-72.94	.08	.2734	-40.23	287.06
37	3.56	.077	.061	19.50	-20.75	.07	.2813	-46.36	339.25
38	3.46	.067	.048	18.52	31.67	.08	.2891	-52.48	391.67
39	3.37	.050	.037	17.60	73.74	.15	.2969	-56.58	433.74
40	3.28	.032	.025	16.73	85.15	.08	.3047	-54.55	445.15
41	3.20	.024	.017	15.93	115.46	.04	.3125	9999.99	9999.99
42	3.12	.018	.013	15.18	97.08	.11	.3203	9999.99	9999.99
43	3.05	.014	.011	14.48	87.56	.09	.3281	9999.99	9999.99
44	2.98	.011	.009	13.82	141.26	.00	.3359	9999.99	9999.99
45	2.91	.009	.009	13.20	-109.73	.00	.3438	9999.99	9999.99
46	2.84	.007	.007	12.62	-8.24	.00	.3516	9999.99	9999.99
47	2.78	.008	.006	12.08	-91.93	.01	.3594	9999.99	9999.99

Table 2.11 TRIAD=cb1 PART=6 PASS=0 02/02/94 04:00 HRS Hmo= [.91; .94; .93] NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT= .20 TH=21.40 TL= 1.99 FORMAT=(8f5.1) FACTOR=1.0 DIST= [29.51; 26.83]

NO	PER	G1	G2	G3	PH1	PH2	COH1	COH2	FREQ	DIR
2	128.00	1.285	1.325	1.265	2.89	6.04	.87	.94	.0078	-69.65
3	64.00	2.292	2.324	2.309	-2.52	4.76	.93	.95	.0156	-117.09
4	42.67	2.132	2.089	2.115	-6.54	8.03	.87	.89	.0234	-132.37
5	32.00	1.759	1.714	1.786	-9.37	7.29	.78	.82	.0313	-151.92
6	25.60	1.413	1.543	1.599	-8.76	3.27	.61	.76	.0391	-177.64
7	21.33	1.425	1.579	1.394	1.21	3.41	.42	.71	.0469	-73.75
8	18.29	2.115	2.300	1.958	31.76	-2.95	.32	.70	.0547	-16.30
9	16.00	2.892	3.340	2.806	65.10	-8.56	.40	.67	.0625	-13.87
10	14.22	5.609	5.271	5.006	77.01	-12.71	.59	.72	.0703	-11.70
11	12.80	10.747	9.985	10.577	89.75	-20.43	.77	.75	.0781	-7.57
12	11.64	21.637	22.459	24.857	103.99	-25.84	.88	.77	.0859	-6.17
13	10.67	63.337	69.610	68.941	115.12	-27.69	.93	.81	.0938	-6.70
14	9.85	132.793	137.724	130.672	123.07	-28.48	.96	.82	.1016	-7.32
15	9.14	125.338	125.599	121.938	129.63	-31.02	.97	.76	.1094	-6.79
16	8.53	75.187	76.562	76.946	140.27	-36.13	.96	.69	.1172	-5.55
17	8.00	59.947	59.899	54.932	151.71	-42.06	.96	.66	.1250	-4.22
18	7.53	45.024	45.330	40.605	159.25	-48.46	.94	.59	.1328	-2.38
19	7.11	25.779	27.402	26.831	170.35	-58.62	.89	.37	.1406	.35
20	6.74	19.805	21.732	21.499	-175.25	-73.53	.87	.36	.1484	138.44
21	6.40	16.130	17.320	13.784	-165.83	-87.97	.87	.29	.1563	134.63
22	6.10	14.575	13.789	14.135	-153.23	-113.90	.82	.27	.1641	128.61
23	5.82	15.898	16.228	15.818	-142.28	-139.92	.80	.26	.1719	123.36
24	5.57	18.271	21.753	24.924	-136.22	-172.83	.76	.33	.1797	118.65
25	5.33	32.301	39.037	41.908	-127.68	176.05	.78	.49	.1875	-127.80
26	5.12	52.163	53.161	48.809	-124.14	146.72	.75	.51	.1953	-133.93
27	4.92	65.249	65.657	63.615	-122.78	123.37	.68	.63	.2031	-140.82
28	4.74	59.645	62.494	59.989	-115.99	109.14	.62	.59	.2109	-143.67
29	4.57	44.391	48.438	55.116	-115.11	87.31	.56	.56	.2188	-153.00
30	4.41	29.389	36.380	37.912	-108.63	69.97	.41	.48	.2266	-159.74
31	4.27	29.948	28.834	30.406	-90.55	50.53	.33	.53	.2344	-165.20
32	4.13	21.060	23.070	23.313	-81.14	35.64	.24	.52	.2422	-173.13
33	4.00	11.375	16.799	14.583	-67.60	16.58	.14	.40	.2500	173.61
34	3.88	9.946	12.302	11.366	-42.65	-1.71	.11	.40	.2578	155.84
35	3.76	8.298	8.568	8.528	-15.78	-16.14	.11	.37	.2656	122.63
36	3.66	6.339	6.551	7.080	-3.99	-33.75	.07	.36	.2734	96.96
37	3.56	4.692	4.754	5.624	16.26	-54.40	.06	.31	.2813	75.93
38	3.46	3.307	3.238	3.618	52.75	-85.90	.04	.28	.2891	58.19
39	3.37	2.448	2.292	2.723	65.28	-107.56	.02	.33	.2969	58.58
40	3.28	1.709	1.636	1.892	21.42	-130.60	.00	.31	.3047	83.28
41	3.20	1.229	1.352	1.412	-162.27	-156.29	.02	.23	.3125	123.75
42	3.12	.983	.964	1.181	-143.70	170.26	.02	.24	.3203	-133.83
43	3.05	.740	.637	.806	-51.37	141.08	.02	.31	.3281	-107.73
44	2.98	.514	.631	.533	-21.09	122.80	.00	.26	.3359	-97.13
45	2.91	.379	.498	.347	47.82	95.87	.01	.29	.3438	-69.03
46	2.84	.275	.281	.245	18.17	74.96	.01	.20	.3516	-77.91
47	2.78	.172	.183	.186	34.84	32.95	.01	.16	.3594	-55.90

Table 2.12 TRIAD=CB1 PART=6 PASS=1 02/02/94 04:00 HRS Hmo= [.91; .94; .93] NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT= .20 TH=21.40 TL= 1.99 FORMAT=(16f5.1) FACTOR=1.0 DIST= [29.51; 26.83]

NO	PER	G1	G2	G3	PH1	PH2	COH1	COH2	FREQ	DIR
2	128.00	1.285	1.325	1.265	2.89	6.04	.87	.94	.0078	-69.65
3	64.00	2.292	2.324	2.309	-2.52	4.76	.93	.95	.0156	-117.09
4	42.67	2.132	2.089	2.115	-6.54	8.03	.87	.89	.0234	-132.37
5	32.00	1.759	1.714	1.786	-9.37	7.29	.78	.82	.0313	-151.92
6	25.60	1.413	1.543	1.599	-8.76	3.27	.61	.76	.0391	-177.64
7	21.33	1.425	1.579	1.394	1.21	3.41	.42	.71	.0469	-73.75
8	18.29	2.115	2.300	1.959	31.76	-2.95	.32	.70	.0547	-16.30
9	16.00	2.892	3.340	2.806	65.10	-8.56	.40	.67	.0625	-13.87
10	14.22	5.609	5.271	5.006	77.01	-12.71	.59	.72	.0703	-11.70
11	12.80	10.747	9.985	10.577	89.75	-20.43	.77	.75	.0781	-7.57
12	11.64	21.637	22.459	24.857	103.99	-25.84	.88	.77	.0859	-6.17
13	10.67	63.338	69.610	68.941	115.12	-27.69	.93	.81	.0938	-6.70
14	9.85	132.794	137.725	130.672	123.07	-28.48	.96	.82	.1016	-7.32
15	9.14	125.339	125.600	121.939	129.63	-31.02	.97	.76	.1094	-6.79
16	8.53	75.187	76.563	76.946	140.27	-36.13	.96	.69	.1172	-5.55
17	8.00	59.947	59.900	54.932	151.71	-42.06	.96	.66	.1250	-4.22
18	7.53	45.024	45.331	40.605	159.25	-48.46	.94	.59	.1328	-2.38
19	7.11	25.779	27.402	26.832	170.35	-58.62	.89	.37	.1406	.35
20	6.74	19.805	21.732	21.499	-175.25	-73.53	.87	.36	.1484	9999.99
21	6.40	16.130	17.320	13.784	-165.83	-87.97	.87	.29	.1563	9999.99
22	6.10	14.575	13.789	14.135	-153.23	-113.90	.82	.27	.1641	9999.99
23	5.82	15.898	16.228	15.818	-142.28	-139.92	.80	.26	.1719	9999.99
24	5.57	18.271	21.753	24.924	-136.22	-172.83	.76	.33	.1797	9999.99
25	5.33	32.301	39.037	41.908	-127.68	176.05	.78	.49	.1875	9999.99
26	5.12	52.164	53.161	48.809	-124.14	146.72	.75	.51	.1953	9999.99
27	4.92	65.249	65.657	63.615	-122.78	123.37	.68	.63	.2031	9999.99
28	4.74	59.646	62.494	59.989	-115.99	109.14	.62	.59	.2109	9999.99
29	4.57	44.391	48.438	55.117	-115.11	87.31	.56	.56	.2188	9999.99
30	4.41	29.389	36.381	37.912	-108.63	69.97	.41	.48	.2266	9999.99
31	4.27	29.948	28.834	30.406	-90.55	50.53	.33	.53	.2344	9999.99
32	4.13	21.060	23.070	23.313	-81.14	35.64	.24	.52	.2422	9999.99
33	4.00	11.375	16.800	14.583	-67.60	16.58	.14	.40	.2500	9999.99
34	3.88	9.946	12.302	11.366	-42.65	-1.71	.11	.40	.2578	9999.99
35	3.76	8.298	8.568	8.528	-15.78	-16.14	.11	.37	.2656	9999.99
36	3.66	6.339	6.552	7.080	-3.99	-33.75	.07	.36	.2734	9999.99
37	3.56	4.692	4.755	5.624	16.26	-54.40	.06	.31	.2813	9999.99
38	3.46	3.307	3.238	3.618	52.75	-85.90	.04	.28	.2891	9999.99
39	3.37	2.448	2.292	2.723	65.28	-107.56	.02	.33	.2969	9999.99
40	3.28	1.709	1.636	1.892	21.42	-130.60	.00	.31	.3047	9999.99
41	3.20	1.229	1.352	1.412	-162.27	-156.29	.02	.23	.3125	9999.99
42	3.12	.983	.964	1.181	-143.70	170.26	.02	.24	.3203	9999.99
43	3.05	.740	.637	.806	-51.37	141.08	.02	.31	.3281	9999.99
44	2.98	.514	.631	.533	-21.09	122.80	.00	.26	.3359	9999.99
45	2.91	.379	.498	.347	47.82	95.87	.01	.29	.3438	9999.99
46	2.84	.275	.281	.245	18.17	74.96	.01	.20	.3516	9999.99
47	2.78	.172	.183	.186	34.84	32.95	.01	.16	.3594	9999.99

Table 2.13 TRIAD=CB1 PART=6 PASS=2 02/02/94 04:00 HRS Hmo= [.91; .94; .93] NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT= .20 TH=21.40 TL= 1.99 FORMAT=(16f5.1) FACTOR=1.0 DIST= [29.51; 26.83]

NO	PER	G1	G2	G3	PH1	PH2	COH1	COH2	FREQ	DIR	QH1	QH2
2	128.00	1.285	1.325	1.265	2.89	6.04	.87	.94	.0078	-69.65	2.89	6.04
3	64.00	2.292	2.324	2.309	-2.52	4.76	.93	.95	.0156	-117.09	-2.52	4.76
4	42.67	2.132	2.089	2.115	-6.54	8.03	.87	.89	.0234	-132.37	-6.54	8.03
5	32.00	1.759	1.714	1.786	-9.37	7.29	.78	.82	.0313	-151.92	-9.37	7.29
6	25.60	1.413	1.543	1.599	-8.76	3.27	.61	.76	.0391	-177.64	-8.76	3.27
7	21.33	1.425	1.579	1.394	1.21	3.41	.42	.71	.0469	-73.75	1.21	3.41
8	18.29	2.115	2.300	1.959	31.76	-2.95	.32	.70	.0547	-16.30	31.76	-2.95
9	16.00	2.892	3.340	2.806	65.10	-8.56	.40	.67	.0625	-13.87	65.10	-8.56
10	14.22	5.609	5.271	5.006	77.01	-12.71	.59	.72	.0703	-11.70	77.01	-12.71
11	12.80	10.747	9.985	10.577	89.75	-20.43	.77	.75	.0781	-7.57	89.75	-20.43
12	11.64	21.637	22.459	24.857	103.99	-25.84	.88	.77	.0859	-6.17	103.99	-25.84
13	10.67	63.338	69.610	68.941	115.12	-27.69	.93	.81	.0938	-6.70	115.12	-27.69
14	9.85	132.794	137.725	130.672	123.07	-28.48	.96	.82	.1016	-7.32	123.07	-28.48
15	9.14	125.339	125.600	121.939	129.63	-31.02	.97	.76	.1094	-6.79	129.63	-31.02
16	8.53	75.187	76.563	76.946	140.27	-36.13	.96	.69	.1172	-5.55	140.27	-36.13
17	8.00	59.947	59.900	54.932	151.71	-42.06	.96	.66	.1250	-4.22	151.71	-42.06
18	7.53	45.024	45.331	40.605	159.25	-48.46	.94	.59	.1328	-2.38	159.25	-48.46
19	7.11	25.779	27.402	26.832	170.35	-58.62	.89	.37	.1406	.35	170.35	-58.62
20	6.74	19.805	21.732	21.499	-175.25	-73.53	.87	.36	.1484	4.05	184.75	-73.53
21	6.40	16.130	17.320	13.784	-165.83	-87.97	.87	.29	.1563	7.81	194.17	-87.97
22	6.10	14.575	13.789	14.135	-153.23	-113.90	.82	.27	.1641	14.33	206.77	-113.90
23	5.82	15.898	16.228	15.818	-142.28	-139.92	.80	.26	.1719	20.17	217.72	-139.92
24	5.57	18.271	21.753	24.924	-136.22	-172.83	.76	.33	.1797	27.76	223.78	-172.83
25	5.33	32.301	39.037	41.908	-127.68	176.05	.78	.49	.1875	28.83	232.32	-183.95
26	5.12	52.164	53.161	48.809	-124.14	146.72	.75	.51	.1953	34.60	235.86	-213.28
27	4.92	65.249	65.657	63.615	-122.78	123.37	.68	.63	.2031	38.87	237.22	-236.63
28	4.74	59.646	62.494	59.989	-115.99	109.14	.62	.59	.2109	40.17	244.01	-250.86
29	4.57	44.391	48.438	55.117	-115.11	87.31	.56	.56	.2188	43.58	244.89	-272.69
30	4.41	29.389	36.381	37.912	-108.63	69.97	.41	.48	.2266	45.07	251.37	-290.03
31	4.27	29.948	28.834	30.406	-90.55	50.53	.33	.53	.2344	44.88	269.45	-309.47
32	4.13	21.060	23.070	23.313	-81.14	35.64	.24	.52	.2422	45.41	278.86	-324.36
33	4.00	11.375	16.800	14.583	-67.60	16.58	.14	.40	.2500	45.81	292.40	-343.42
34	3.88	9.946	12.302	11.366	-42.65	-1.71	.11	.40	.2578	44.56	317.35	-361.71
35	3.76	8.298	8.568	8.528	-15.78	-16.14	.11	.37	.2656	42.78	344.22	-376.14
36	3.66	6.339	6.552	7.080	-3.99	-33.75	.07	.36	.2734	43.30	356.01	-393.75
37	3.56	4.692	4.755	5.624	16.26	-54.40	.06	.31	.2813	43.12	376.26	-414.40
38	3.46	3.307	3.238	3.618	52.75	-85.90	.04	.28	.2891	9999.99	9999.99	-445.90
39	3.37	2.448	2.292	2.723	65.28	-107.56	.02	.33	.2969	9999.99	9999.99	-467.56
40	3.28	1.709	1.636	1.892	21.42	-130.60	.00	.31	.3047	9999.99	9999.99	-490.60
41	3.20	1.229	1.352	1.412	-162.27	-156.29	.02	.23	.3125	9999.99	9999.99	-516.29
42	3.12	.983	.964	1.181	-143.70	170.26	.02	.24	.3203	9999.99	9999.99	-549.74
43	3.05	.740	.637	.806	-51.37	141.08	.02	.31	.3281	9999.99	9999.99	-578.92
44	2.98	.514	.631	.533	-21.09	122.80	.00	.26	.3359	9999.99	9999.99	-597.20
45	2.91	.379	.498	.347	47.82	95.87	.01	.29	.3438	9999.99	9999.99	-624.13
46	2.84	.275	.281	.245	18.17	74.96	.01	.20	.3516	9999.99	9999.99	-645.04
47	2.78	.172	.183	.186	34.84	32.95	.01	.16	.3594	9999.99	9999.99	-687.05

Table 2.14 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 06/02/94 01:00 HOURS Hmo= .29 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.676	-30.94	-29.91	-28.95	-29.17	-26.82	-27.07	-23.01	-29.16	-1.30	-25.79	-25.28	8.27
3	64.00	1.181	-25.24	-19.62	-12.00	-15.46	-15.85	-14.45	-15.30	-14.80	3.89	-15.12	-14.42	7.00
4	42.67	1.233	-19.52	-12.87	-7.37	-10.51	-11.13	-11.53	-12.86	-9.38	10.45	-11.35	-9.64	7.33
5	32.00	.571	-18.93	-12.39	-6.65	-9.97	-9.74	-8.96	-12.22	-8.99	11.83	-12.24	-8.86	7.56
6	25.60	.357	-18.83	-18.97	-11.42	-13.58	-9.48	-9.13	-13.32	-14.62	-.10	-14.67	-12.42	5.18
7	21.33	.445	-17.33	-13.56	-12.06	-13.38	-7.68	-12.53	-14.33	-13.06	-2.39	-11.21	-11.76	3.88
8	18.29	.703	-13.09	-12.85	-11.94	-12.37	-8.68	-11.13	-11.22	-12.93	-2.70	-11.50	-10.84	2.98
9	16.00	1.255	-11.79	-13.49	-10.68	-11.21	-8.27	-10.76	-10.54	-12.41	-5.79	-10.75	-10.57	2.05
10	14.22	2.185	-10.89	-11.92	-9.67	-10.26	-11.49	-9.44	-12.78	-11.17	-5.21	-12.95	-10.58	2.11
11	12.80	3.228	-10.64	-11.29	-9.75	-10.19	-14.65	-10.57	-16.74	-10.80	-4.84	-14.55	-11.40	3.13
12	11.64	3.424	-10.60	-10.96	-10.37	-10.71	-15.55	-13.58	-20.32	-10.98	-6.73	-15.34	-12.51	3.59
13	10.67	4.358	-16.16	-16.96	-16.57	-17.25	-20.44	-20.42	-26.40	-17.83	-11.62	-21.38	-18.50	3.73
14	9.85	6.947	-20.79	-24.33	-22.73	-22.91	-23.23	-25.07	-27.85	-24.64	-19.04	-25.95	-23.65	2.40
15	9.14	8.933	-23.65	-25.97	-24.85	-25.01	-26.34	-29.96	-29.80	-26.10	-21.41	-30.67	-26.38	2.82
16	8.53	8.211	-25.44	-24.66	-25.86	-26.75	-28.45	-30.30	-31.97	-26.84	-19.32	-32.37	-27.20	3.67
17	8.00	8.363	-23.99	-24.04	-25.77	-27.57	-31.80	-31.27	-35.19	-28.83	-18.40	-35.27	-28.21	5.09
18	7.53	8.821	-27.91	-29.77	-29.71	-31.19	-34.50	-35.35	-37.39	-33.47	-25.11	-38.87	-32.33	4.12
19	7.11	10.325	-31.91	-37.50	-35.44	-35.42	-37.03	-37.89	-40.30	-37.99	-34.42	-40.19	-36.81	2.45
20	6.74	9.534	-32.86	-39.55	-36.07	-35.79	-37.96	-38.50	-39.82	-38.49	-35.55	-40.80	-37.54	2.30
21	6.40	6.764	-34.28	-41.78	-37.11	-37.19	-39.50	-40.63	-41.15	-40.30	-37.42	-42.30	-39.16	2.43
22	6.10	4.623	-36.20	-38.72	-37.93	-39.25	-41.06	-41.02	-42.24	-40.52	-33.36	-44.46	-39.48	2.99
23	5.82	3.635	-33.88	-35.20	-37.02	-40.49	-41.78	-43.55	-42.48	-40.53	-28.32	-44.31	-38.76	4.81
24	5.57	2.649	-29.18	-35.48	-33.71	-38.42	-39.55	-46.42	-40.50	-39.97	-29.00	-40.15	-37.24	5.16
25	5.33	1.858	-28.85	-36.10	-34.69	-37.77	-38.33	-41.51	-39.26	-38.30	-30.87	-39.58	-36.53	3.80
26	5.12	1.729	-27.70	-35.46	-36.48	-38.16	-37.46	-38.34	-38.99	-36.82	-31.16	-39.96	-36.05	3.61
27	4.92	1.364	-25.66	-34.27	-37.86	-37.69	-35.72	-37.15	-39.09	-35.23	-29.88	-40.04	-35.26	4.19
28	4.74	.935	-28.90	-39.30	-39.95	-38.95	-34.51	-38.76	-41.29	-40.03	-35.94	-41.31	-37.90	3.63
29	4.57	.631	-30.51	-42.39	-41.32	-41.00	-37.46	-41.31	9999.99	-42.82	-38.40	-42.00	-39.69	3.66
30	4.41	.449	-29.23	-39.23	-42.33	-40.50	-38.08	-41.82	9999.99	-39.59	-35.33	-42.14	-38.70	3.95
31	4.27	.316	-27.53	-42.35	-42.42	-39.18	-36.47	-41.09	9999.99	-40.98	-40.03	-43.25	-39.26	4.57

Table 2.15 POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 01/02/94 01:00 HOURS Hmo=1.07 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	1.859	-109.46	-92.50	-99.80	-98.33	-100.18	-74.93	-103.11	-120.37	-122.61	-123.34	-96.94	-99.78	-105.23	-96.53	-92.93	-102.40	12.30
3	64.00	4.429	-119.10	-106.21	-119.94	-120.00	-117.92	-101.28	-120.34	-129.43	-134.05	-135.17	-119.35	-118.45	-120.11	-117.54	-104.93	-118.93	9.24
4	42.67	6.134	-129.20	-107.83	-129.23	-129.96	-128.95	-105.35	-129.39	-142.01	-150.41	-150.64	-129.05	-128.34	-129.53	-128.15	-106.25	-128.31	13.21
5	32.00	5.255	-137.09	-118.49	-137.18	-138.98	-138.76	-115.74	-137.09	-154.61	-164.18	-165.79	-137.22	-137.33	-136.78	-133.80	-115.99	-137.88	14.42
6	25.60	3.993	-132.38	-104.54	-137.19	-139.78	-133.67	-92.12	-136.86	-154.66	-167.09	-170.93	-137.39	-137.23	-136.73	-124.88	-99.68	-133.81	21.37
7	21.33	3.720	-84.39	-40.11	-57.09	-43.72	-61.42	-37.15	-69.77	-77.60	-74.94	-74.87	-45.67	-43.85	-84.88	-57.81	-49.54	-60.16	15.99
8	18.29	6.587	-12.78	-10.76	-7.57	-8.96	-13.31	-16.11	-9.87	-13.08	-15.33	-17.94	-6.39	4.09	-18.52	-11.89	-12.46	-11.40	5.35
9	16.00	17.082	-6.94	-6.28	-5.30	-6.39	-7.64	-13.30	-5.73	-6.70	-7.53	-7.76	-4.99	.26	-10.23	-6.65	-6.27	-6.76	2.75
10	14.22	28.523	-5.90	-5.06	-6.23	-6.41	-5.91	-9.95	-1.46	-5.96	-7.07	-8.53	-5.79	-2.26	-10.30	-5.62	-5.21	-6.11	2.28
11	12.80	26.181	-7.80	-6.55	-8.61	-8.61	-7.38	-10.78	-1.86	-7.76	-8.79	-10.83	-8.16	-5.08	-12.50	-7.39	-6.92	-7.94	2.42
12	11.64	41.125	-10.13	-6.88	-9.25	-8.95	-8.77	-11.13	-5.59	-8.57	-8.03	-8.61	-8.62	-6.46	-11.36	-9.05	-8.39	-8.65	1.51
13	10.67	100.914	-9.17	-6.56	-8.90	-8.42	-7.28	-10.44	-6.50	-6.93	-6.14	-6.31	-8.37	-6.73	-9.72	-8.18	-7.49	-7.81	1.29
14	9.85	170.327	-7.49	-6.14	-7.56	-7.08	-6.11	-10.35	-7.35	-5.31	-4.46	-4.07	-7.22	-6.33	-8.41	-6.83	-6.44	-6.74	1.49
15	9.14	190.153	-6.70	-5.45	-6.53	-6.05	-5.56	-9.08	-7.99	-4.49	-3.53	-2.73	-6.22	-5.76	-7.54	-6.03	-5.77	-5.96	1.56
16	8.53	153.843	-5.69	-5.50	-6.31	-6.20	-5.06	-9.00	-6.93	-3.94	-3.14	-2.07	-6.13	-5.28	-6.83	-5.76	-5.74	-5.57	1.58
17	8.00	96.541	-4.30	-4.70	-5.21	-5.38	-4.34	-8.83	-5.61	-3.09	-2.46	-1.07	-5.07	-4.32	-5.99	-5.11	-5.15	-4.71	1.67
18	7.53	69.287	3.44	1.61	1.99	1.51	4.35	-1.97	1.93	6.16	5.60	7.15	2.01	2.75	1.90	3.62	2.11	2.94	2.17
19	7.11	79.713	7.67	5.91	6.39	6.24	9.86	4.46	6.59	12.05	11.44	12.61	6.44	7.28	6.57	9.11	6.99	7.97	2.38
20	6.74	76.729	8.81	8.78	8.68	8.81	11.56	9.07	8.32	13.97	13.86	14.89	8.79	9.32	8.27	11.92	9.46	10.30	2.22
21	6.40	64.330	9.79	12.53	11.75	11.96	13.33	12.98	11.00	15.57	16.07	17.07	12.01	12.27	11.07	14.54	12.35	12.95	1.96
22	6.10	57.727	11.96	14.14	13.78	13.81	14.72	15.41	13.05	16.68	17.28	18.12	14.02	14.41	13.41	15.57	13.68	14.67	1.61
23	5.82	54.983	15.42	16.48	16.91	16.54	18.31	19.38	16.17	20.30	20.34	21.31	17.01	17.41	16.87	19.23	16.68	17.89	1.73
24	5.57	42.309	17.31	16.64	18.68	18.04	20.57	21.71	18.18	22.63	21.93	23.08	18.60	19.03	19.20	21.24	17.72	19.64	1.99
25	5.33	30.758	17.39	15.25	18.69	17.31	20.08	19.73	18.28	22.41	21.23	22.70	18.37	19.21	19.55	21.23	16.47	19.19	2.06
26	5.12	28.902	19.55	17.37	19.13	18.30	21.76	21.46	18.89	24.25	22.91	24.07	18.92	19.74	19.40	24.13	18.22	20.54	2.28
27	4.92	24.668	21.45	19.72	19.39	19.67	23.67	23.02	18.95	26.01	24.12	24.63	19.51	19.88	18.93	25.55	20.11	21.64	2.49
28	4.74	17.462	25.82	21.11	22.18	22.11	27.97	25.30	21.75	31.11	27.96	28.34	22.17	22.71	21.16	30.56	22.37	24.84	3.41
29	4.57	13.202	27.55	24.07	24.38	24.61	29.02	27.28	23.87	32.44	28.70	29.11	24.45	24.97	23.50	33.52	23.88	26.76	3.13
30	4.41	9.299	25.18	24.05	25.16	9999.99	29.51	27.37	24.64	32.88	27.08	27.91	24.99	25.70	25.11	37.95	23.33	27.20	3.83
31	4.27	6.144	23.65	24.30	29.48	9999.99	32.03	30.08	29.40	33.90	29.16	29.64	29.01	29.75	30.07	38.82	25.60	29.63	3.68

Table 2.7 gives the wave directional spectrum (PASS = 0) for the computer simulated swell of $\approx 10s$ using gauge triad 41D. We note that the wave directions are correctly computed for the swell of $\approx 10s$ as the swell frequencies satisfy the criterion of Barber and Doyle (1956) for the gauges 41 and 4D.

In the spectrum and cross-spectrum analyses of the measured data at North Carolina we used 80 ensembles of 256 points sampled at $2Hz$, i.e. $0.5s$ sampling interval, thus yielding 160 degrees of freedom. Blackman window was used. Spectral densities were scaled up by a factor of 1/0.303 to compensate for loss of energy due to windowing. Spectral densities were further scaled upto compensate for attenuation of wave amplitude. Attenuation correction for frequencies above $0.2Hz$ was assumed to be the same as for $0.2Hz$ to prevent amplification of noise at higher frequencies. A similar strategy was used by Fernandes et al. [1981] to correct for attenuation of waves measured with a shipborne wave recorder. For computation of significant wave height H , spectral densities corresponding to periods between 21.40 and 1.99 sec were summed up. Spectral densities are given in units of cm^2. To convert to m^2/Hz the spectral densities must be multiplied by (0.0064). Values of coherence squared above 0.057 are significant at 0.01 significance level.

Table 2.8 gives the observed wave directional spectra (PASS = 0) at North Carolina for gauge pair 78 at 16 hours on 5 February 1994. We note that the gauges 78 are coherent at 0.01 significance level (coherence squared ≥ 0.057) upto spectral line No. 40 corresponding to 0.3047 Hz frequency. We note that for gauges 78 there exists a positive jump across the $-180^o/+180^o$ pseudo discontinuity at spectral line number 32. Therefore the wave directions in this PASS=0 Table 2.8 are correct upto spectral line number 31. Above spectral line number 31 the wave directions are incorrect and are flagged as 9999.99 in Table 2.9, which is PASS=1 for the same record. In the PASS=2 Table 2.10 for the same record wave directions are flagged as 9999.99 for spectral lines above and including number 41. Thus PASS=2 extends the range of frequencies over which wave directions can be correctly estimated by PASS=1 analysis. For the same record Figure 2.12 shows the spectral densities, coherence squared, “apparent” and “true” phase differences and wave direction estimates (PASS=1 and PASS=2), as a function of frequency. Figure 2.13 gives an example of a negative jump in case of gauge pair 65 for the record on 2 February at 13 hours.

Table 2.11 gives the observed wave directional spectra (PASS = 0) at North Carolina for gauge triad CB1 at 04 hours on 2 February 1994. We note that the gauges CB are coherent at 0.01 significance level (coherence squared ≥ 0.057) upto spectral line No. 37 corresponding to 0.2813 Hz frequency. Gauges C1 are coherent at 0.01 significance level upto spectral line No. 52, which is beyond range of the above table. We note that for gauges CB there exists a positive jump across the $-180^o/+180^o$ pseudo discontinuity at spectral line number 20. For gauges C1 there exist negative jumps across the $-180^o/+180^o$ pseudo discontinuity at spectral line numbers 25 and 42. Thus the lowest spectral line at which either gauges CB or C1 are incoherent or a phase jump across the $-180^o/+180^o$ pseudo discontinuity occurs is spectral line number 20. Therefore the wave directions in this PASS=0 Table 2.11 are correct upto spectral line number 19. Above spectral line number 19 the wave directions are incorrect and are flagged as 9999.99 in Table 2.12, which is PASS=1 for the same record. The lowest spectral spectral line at which either gauges CB or C1 are incoherent is number 38. Therefore in the PASS=2 Table 2.13 for the same record wave directions are flagged as 9999.99 for spectral lines above and including number 38. Thus PASS=2 extends the range of frequencies over which wave directions can be correctly estimated by PASS=1 analysis. Figure 2.14 shows the spectral densities, coherence squared, "apparent" and "true" phase differences and wave direction estimates (PASS=1 and PASS=2), as a function of frequency. Figure 2.15 to Figure 2.18 are more examples of jumps in case of gauge triads.

As already mentioned in Chapter 2.4 10 redundant estimates of wave direction using the 'Modified Borgman method' (i.e. PASS=2 or "true" phase and "coherence") for each of the 47 records of *measured* data at Duck, North Carolina, USA during 1-6 February 1994, using the following 10 gauge pairs: 43, 21, 32, 42, 65, 78, 89, 31,01 and 54, were made. Table 2.14 presents the wave direction estimates PASS=2 for each of the 10 redundant gauge pairs for central wave periods $\geq 4.27s$ – for the record on 6 February 1994 at 01 hours. The vector mean wave direction as well as the standard deviation over the 10 redundant esimates of wave direction are also given. Similar tables for each of the 47 records are given in Appendix A.

As already mentioned in Chapter 2.5 15 redundant estimates of wave direction using the 'Modified Esteva method' (i.e. PASS=2 or "true" phase and "coherence") for each of the 47 records of *measured* data at Duck during 1-6 February 1994, using the following 15 gauge triads: 012, 34C, D03, D24, C1D, 4C5, D0E, CB1, CB2, CB0, D04, D0C, 02D, 41D and C24, were made. Table 2.15 presents the wave direction estimates PASS=2 for each of the 15 redundant gauge triads for central wave periods $\geq 4.27s$ – for the record on 1 February 1994 at 01 hours. The vector mean wave direction as well as the standard deviation over the 15 redundant esimates of wave direction are also given. Similar tables for each of the 47 records are given in Appendix B. For a gauge triad 123, estimates of wave direction are not available for frequencies $> f_o$, where f_o is the smallest frequency at which the coherence squared for either gauges 12 or 13 falls below the threshold of 0.057. Therefore the number of available redundant estimates of wave direction using Esteva's method is ≤ 15, and this number decreases with increasing frequency. Table 2.16 gives the number of redundant estimates actually available for the 47 records in case of spectral period 4.27 s. Table 2.16 shows that in case of 12 of the 47 records, all the 15 redundant estimates of wave direction were available at 4.27 s and that the number of available redundant estimates were ≥ 4. In case of all the 47 records, all the 15 redundant estimates were available for spectral periods $\geq 8.00s$ (not shown).

Table 2.16 Number of available redundant estimates of wave direction at 4.27 s, using Esteva's method. For spectral periods > 4.27 s, the number of available redundant estimates is larger than that indicated in this table

		February 1994					
No.	Hours	1	2	3	4	5	6
1	01	14	5	7	15	8	15
2	04	13	15	7	15	14	14
3	07	13	7	7	15	15	11
4	10	–	6	5	4	15	10
5	13	12	7	14	13	15	6
6	16	14	14	15	8	15	8
7	19	11	8	15	11	9	11
8	22	8	8	15	7	8	14

Figure 2.12 Wave direction estimation using gauge pair 78 on 5 February 1994 at 16 hours using the modified Borgman method (a) Spectral densities for gauges 78 (b) Coherence squared for gauges 78 (c) Wave direction estimates (PASS=1, solid; PASS=2, dashed) (d) Phase difference for gauges 78, *apparent* phase (solid) and *true* phase (dashed)

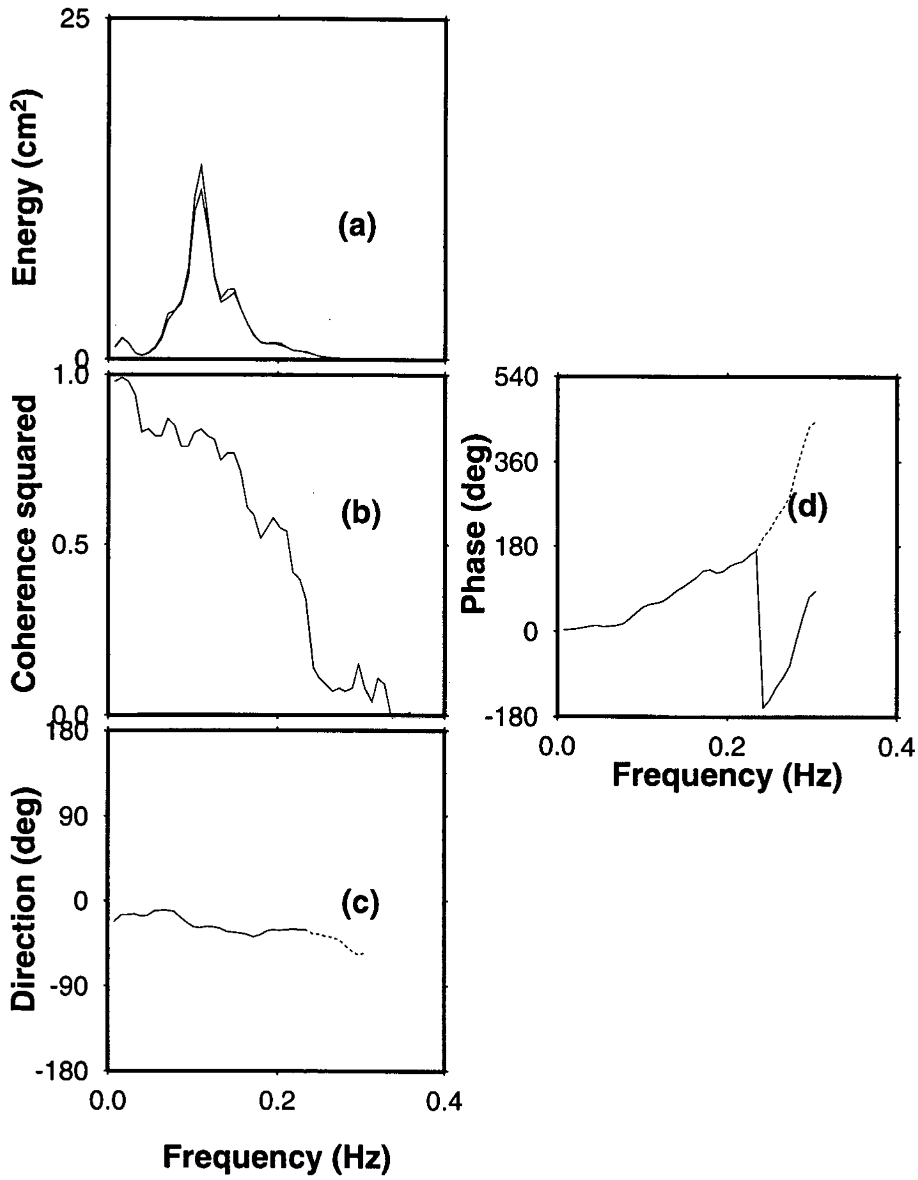


Figure 2.13 Wave direction estimation using gauge pair 65 on 2 February 1994 at 13 hours using the modified Borgman method (a) Spectral densities for gauges 65 (b) Coherence squared for gauges 65 (c) Wave direction estimates (PASS=1, solid; PASS=2, dashed) (d) Phase difference for gauges 65, *apparent* phase (solid) and *true* phase (dashed)

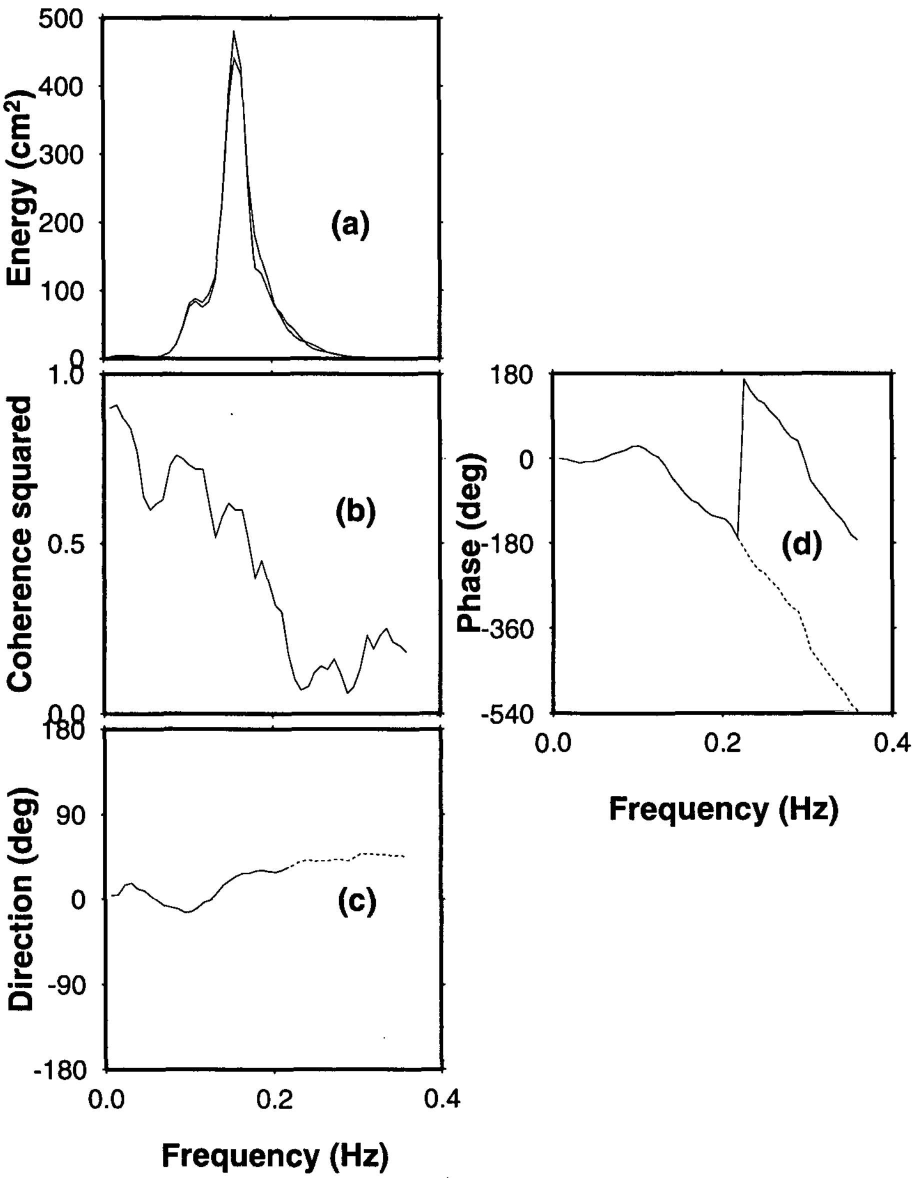


Figure 2.14 Wave direction estimation using gauge triad CB1 on 2 February 1994 at 04 hours using the method of Esteva [1977] as modified by us (a) Spectral densities for gauges CB1 (b) Coherence squared for gauges CB (solid) and gauges C1 (dashed) (c) Wave direction estimates (PASS=1, solid; PASS=2, dashed) (d) Phase difference for gauges CB, *apparent* phase (solid) and *true* phase (dashed), and (e) Phase difference for gauges C1, *apparent* phase (solid) and *true* phase (dashed)

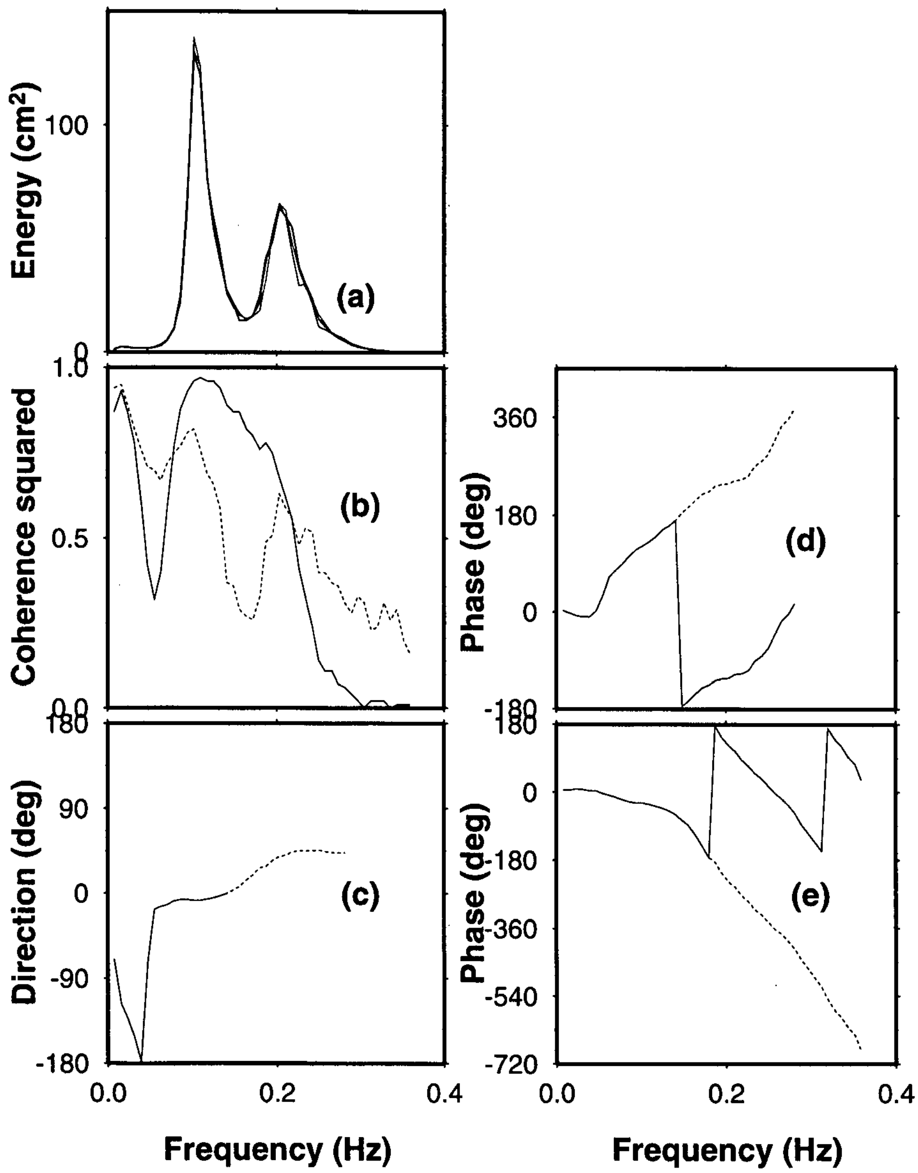


Figure 2.15 Wave direction estimation using gauge triad CB1 on 4 February at 10 hours using the method of Esteva [1977] as modified by us (a) Spectral densities for gauges CB1 (b) Coherence squared for gauges CB (solid) and gauges C1 (dashed) (c) Wave direction estimates (PASS=1, solid; PASS=2, dashed) (d) Phase difference for gauges CB, *apparent* phase (solid) and *true* phase (dashed), and (e) Phase difference for gauges C1, *apparent* phase (solid) and *true* phase (dashed)

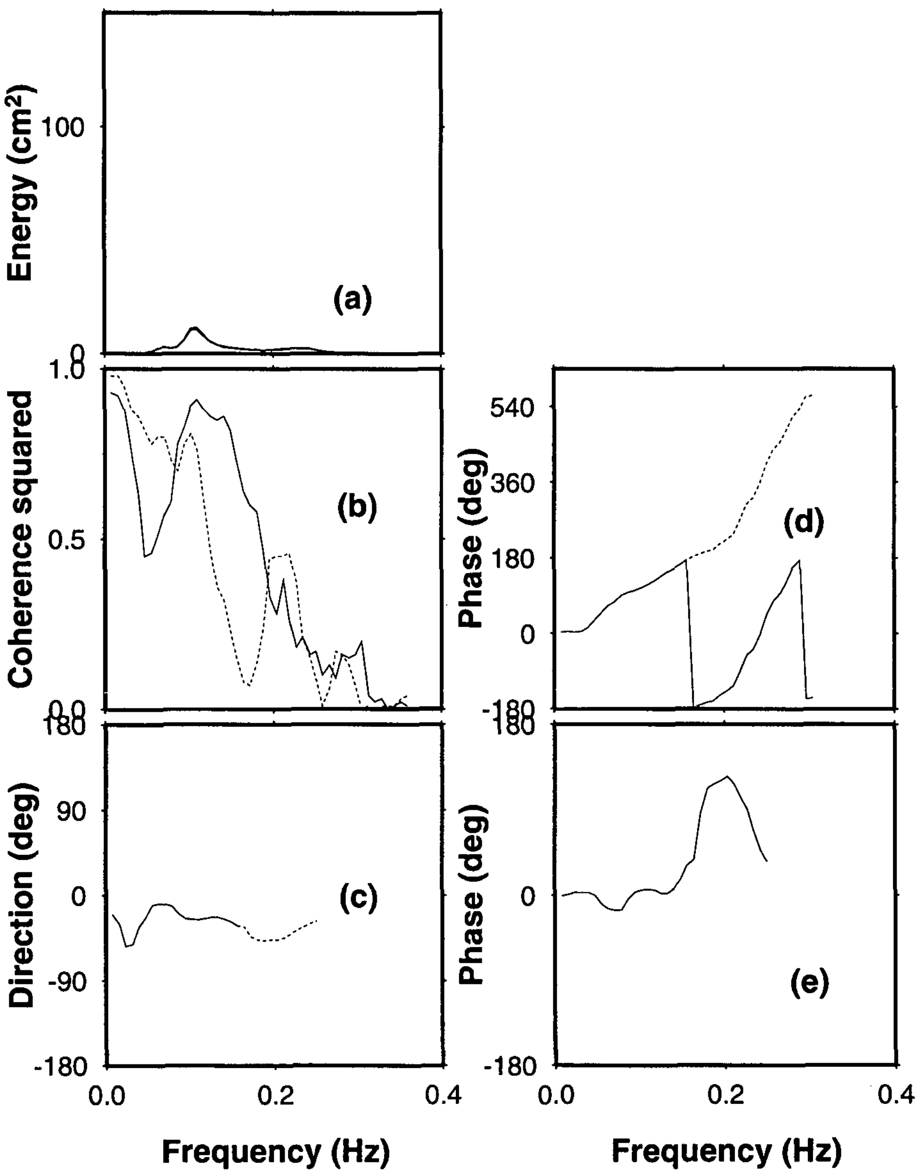


Figure 2.16 Wave direction estimation using gauge triad C1D on 2 February at 10 hours using the method of Esteva [1977] as modified by us (a) Spectral densities for gauges C1D (b) Coherence squared for gauges C1 (solid) and gauges CD (dashed) (c) Wave direction estimates (PASS=1, solid; PASS=2, dashed) (d) Phase difference for gauges C1, *apparent* phase (solid) and *true* phase (dashed), and (e) Phase difference for gauges CD, *apparent* phase (solid) and *true* phase (dashed)

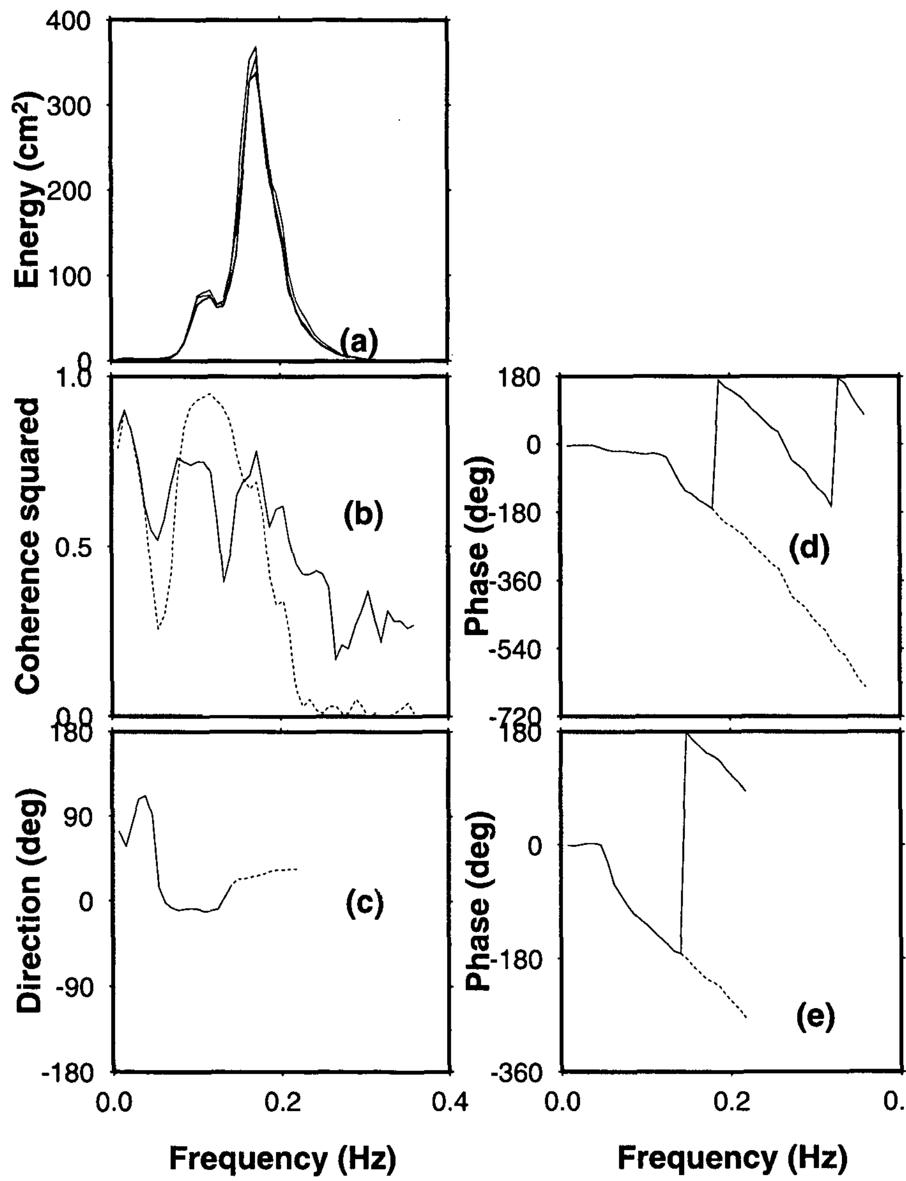


Figure 2.17 Wave direction estimation using gauge triad C1D on 1 February at 01 hours using the method of Esteva [1977] as modified by us (a) Spectral densities for gauges C1D (b) Coherence squared for gauges C1 (solid) and gauges CD (dashed) (c) Wave direction estimates (PASS=1, solid; PASS=2, dashed) (d) Phase difference for gauges C1, *apparent* phase (solid) and *true* phase (dashed), and (e) Phase difference for gauges CD, *apparent* phase (solid) and *true* phase (dashed)

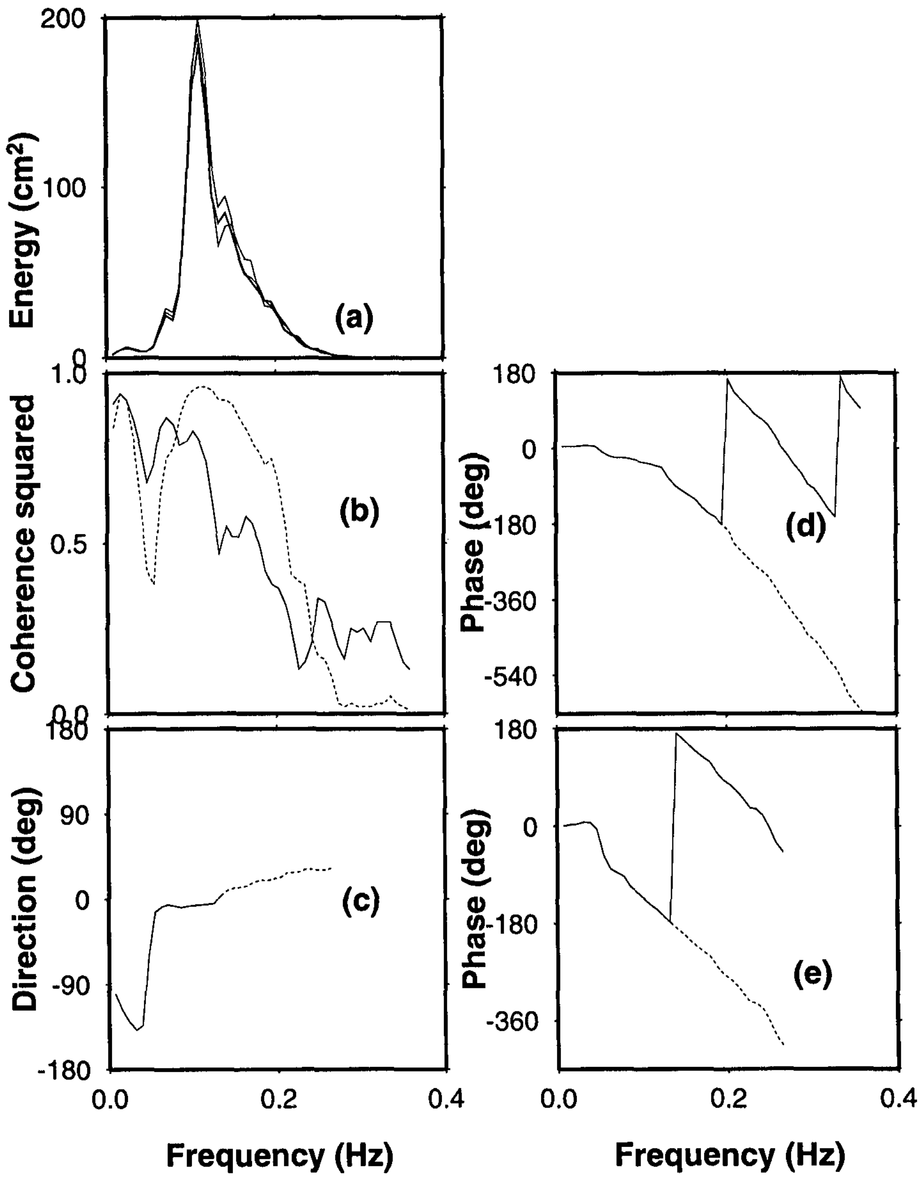


Figure 2.18 Wave direction estimation using gauge triad 012 on 5 February at 16 hours using the method of Esteva [1977] as modified by us (a) Spectral densities for gauges 012 (b) Coherence squared for gauges 01 (solid) and gauges 02 (dashed) (c) Wave direction estimates (PASS=1, solid; PASS=2, dashed) (d) Phase difference for gauges 01, *apparent* phase (solid) and *true* phase (dashed), and (e) Phase difference for gauges 02, *apparent* phase (solid) and *true* phase (dashed)

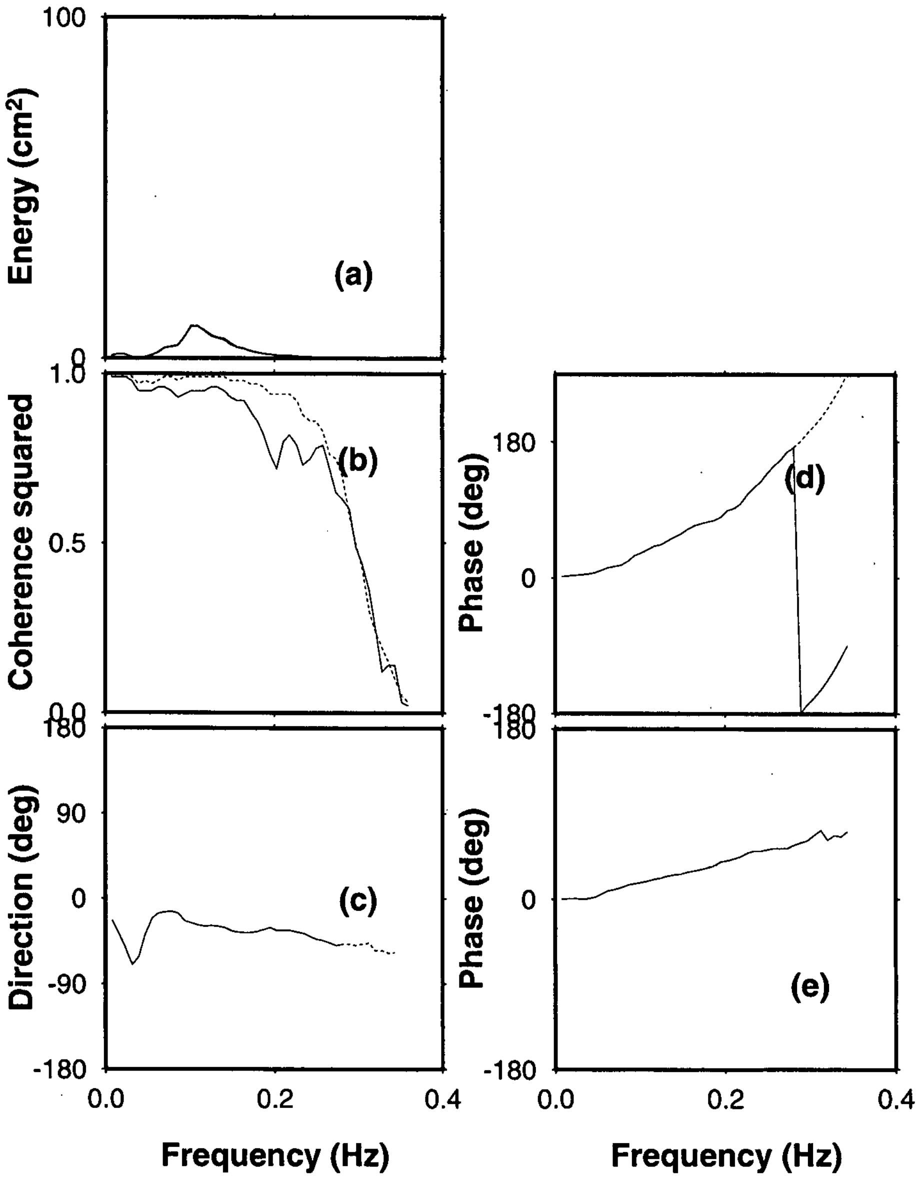


Figure 2.19 to Figure 2.24 show the spectral densities for gauge 0 on an uniform scale for the period 1-6 February 1994, one figure for each day. The wave spectra show three peaks, one centred at 64.00 or 42.67s (this peak which is due to surf beat is not perceptible in the figures); the second peak is centred at 9.85s (this peak is due to swell, i.e., waves generated by distant storms); and the third peak which is centred at 3.28s at 22 hours on 1 February and gradually shifts with increasing time to 6.40s at 13 hours on 2 February, is due to a growing sea, which subsequently decays. The trough between the peak due to surf beat and the peak due to swell generally occurs at spectral period 25.60 or 21.33s. The peaks due to surf beat, swell and sea occur at the same respective frequencies for all the 15 gauges in the array. The significant wave heights for each record measured using the 15 wave gauges (gauge A was not analyzed as it, unfortunately was not part of any of the 15 redundant gauge triads or 10 redundant gauge pairs!) differed by $\pm 0.01m$. On 1 February 1994, energetic swell of $\approx 10s$ period is present.

Figure 2.25 to Figure 2.30 based on tables in Appendix A and Appendix B gives the mean wave direction (PASS=2) as a function of frequency by considering a maximum of 15 gauge triads and a maximum of 10 gauge pairs, one figure for each day. It may be noted that the mean wave direction computed by using linear (Borgman's 2-gauge) arrays and polygonal (Esteva's 3-gauge) arrays are nearly identical for central wave periods $\leq 14.22s$, as by providence the waves for these wave periods are directed *towards* shore, even when the wind is directed away from the shore (as we shall shortly see), so that there is no ambiguity in the Borgman determination. We found from the analysis of all the 47 records, that the difference between the mean of 10 redundant estimates using Borgman's method and the 15 redundant estimates using Esteva's method, had a mean of 0.33^o and a standard deviation of 2.89^o for spectral periods between $14.22 - 4.27s$ $(47 * 22 = 1034$ points). On 1 February 1994, when energetic swell propagating up the coast, towards the shore is present, surf beat is locally generated and travels up the coast, away from the shore, so that surf beat directions reported by linear arrays are incorrect.

During 4-6 February 1994, when low wave conditions occur (significant wave height, $H_{mo} < 0.41m$), the surf beat propagates up the coast, towards shore, i.e., is of remote origin, so that surf beat directions estimated by linear arrays and polygonal arrays should be identical – Figure 2.28 to Figure 2.30 show that the direction estimates of surf beat using the 'Modified Borgman Method' are closer to the shore normal than the estimates obtained using the 'Modified Esteva Method' by about 25^o. However experiments with computer simulated wave trains with surf beat direction -75^o with respect to the shore normal showed that both the Esteva and Borgman determinations yielded correct and accurate surf beat directions. The large departure in case of the observed data is probably due to the fact that both the gauge triads as well as the gauge pairs with small gauge separations (distances) have been selected, i.e., the analysis scheme is tuned to study *wind* wave directionality. It is worth mentioning that initially, we analyzed only nine records, viz., the eight

Figure 2.19 Spectral density for gauge 0 on 1 February 1994 at 01, 04, 07, 10, 13, 16, 19 and 22 hours. Record for 10 hours was not available. The values in metres represent the significant wave height, H_{mo}

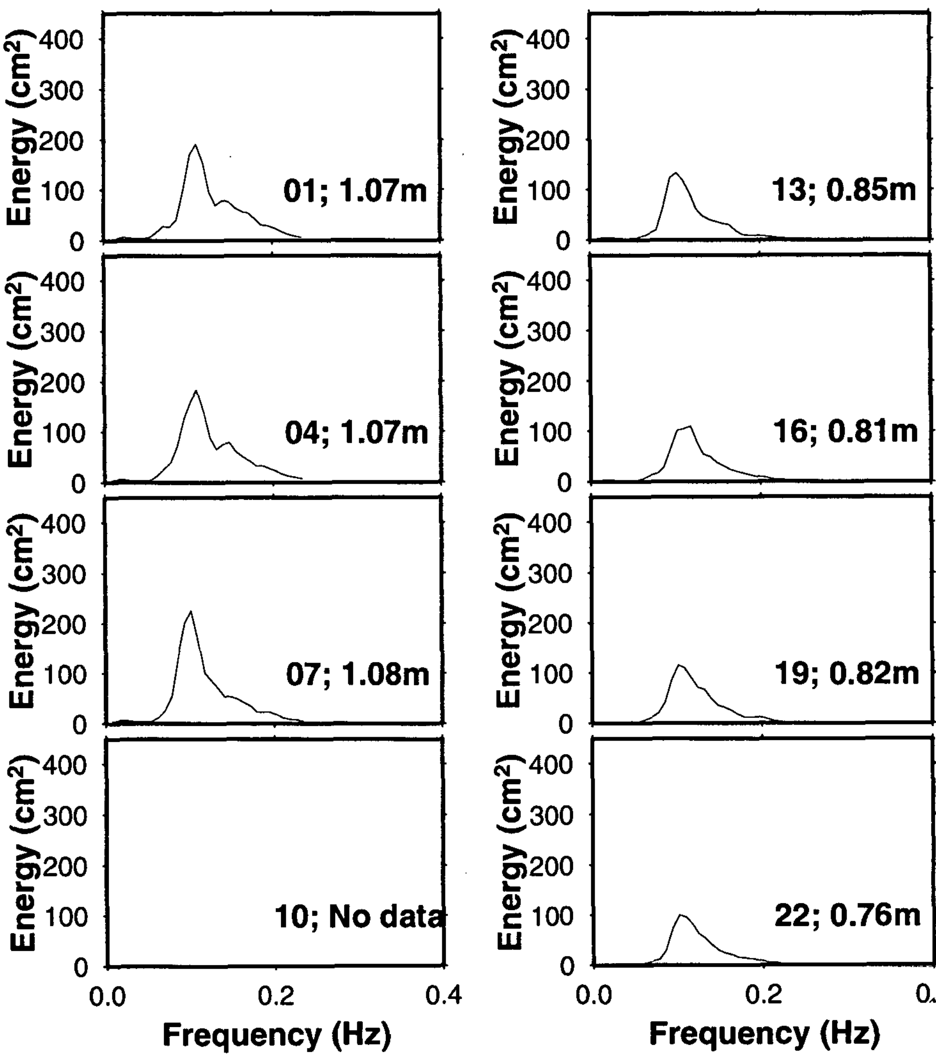


Figure 2.20 Spectral density for gauge 0 on 2 February 1994 at 01, 04, 07, 10, 13, 16, 19 and 22 hours. The values in metres represent the significant wave height, H_{mo}

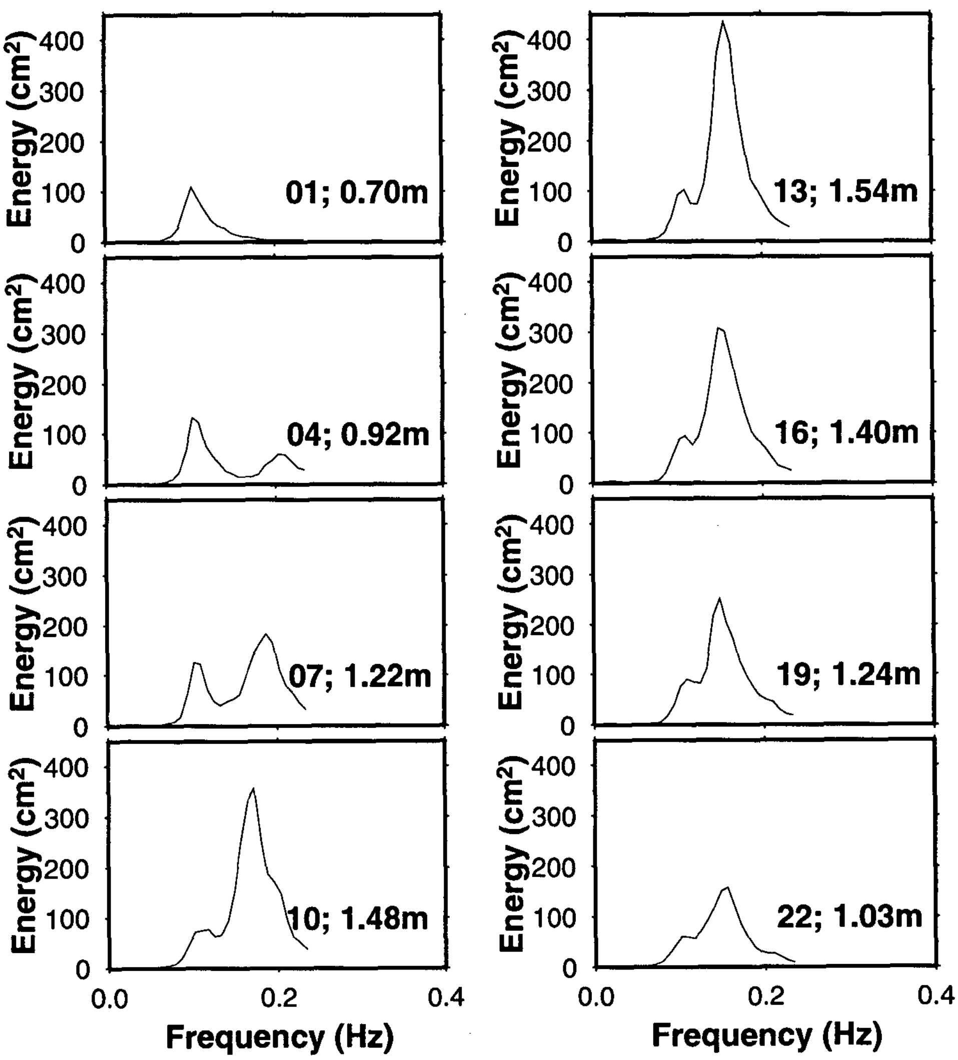


Figure 2.21 Spectral density for gauge 0 on 3 February 1994 at 01, 04, 07, 10, 13, 16, 19 and 22 hours. The values in metres represent the significant wave height, H_{mo}

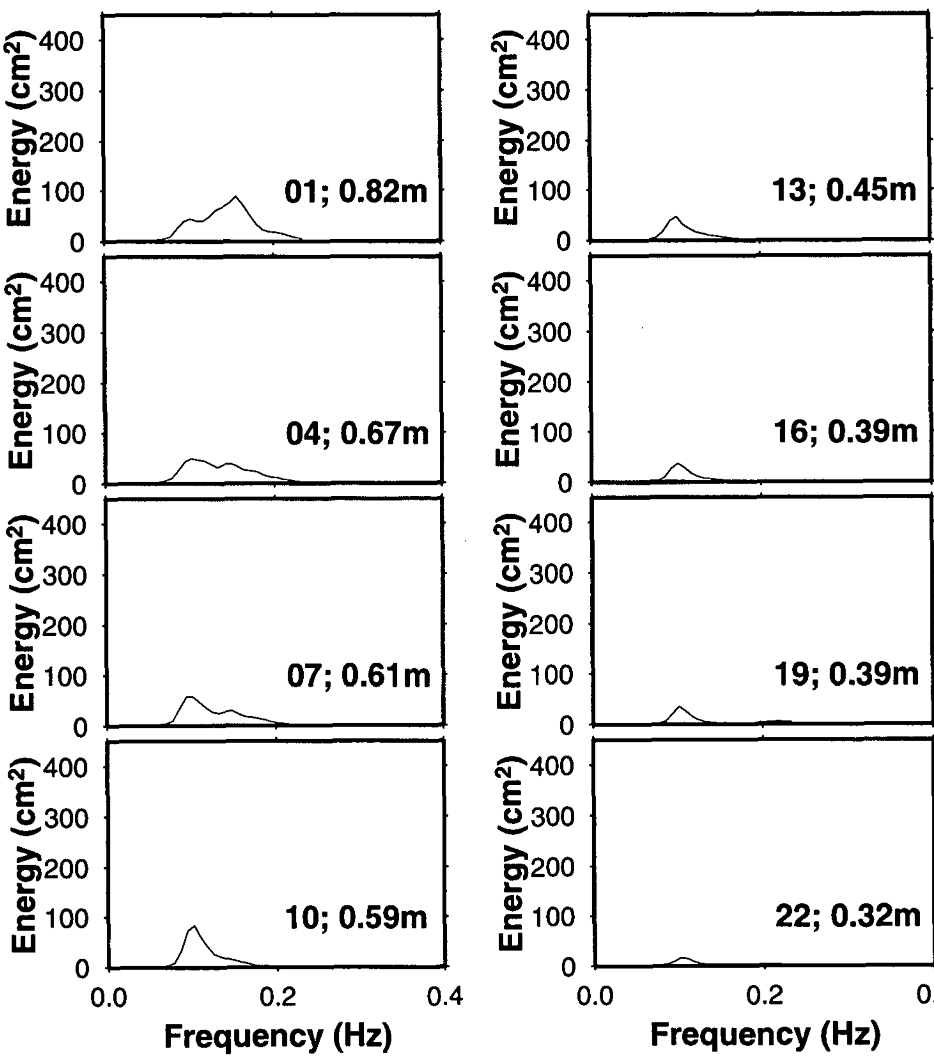


Figure 2.22 Spectral density for gauge 0 on 4 February 1994 at 01, 04, 07, 10, 13, 16, 19 and 22 hours. The values in metres represent the significant wave height, H_{mo}

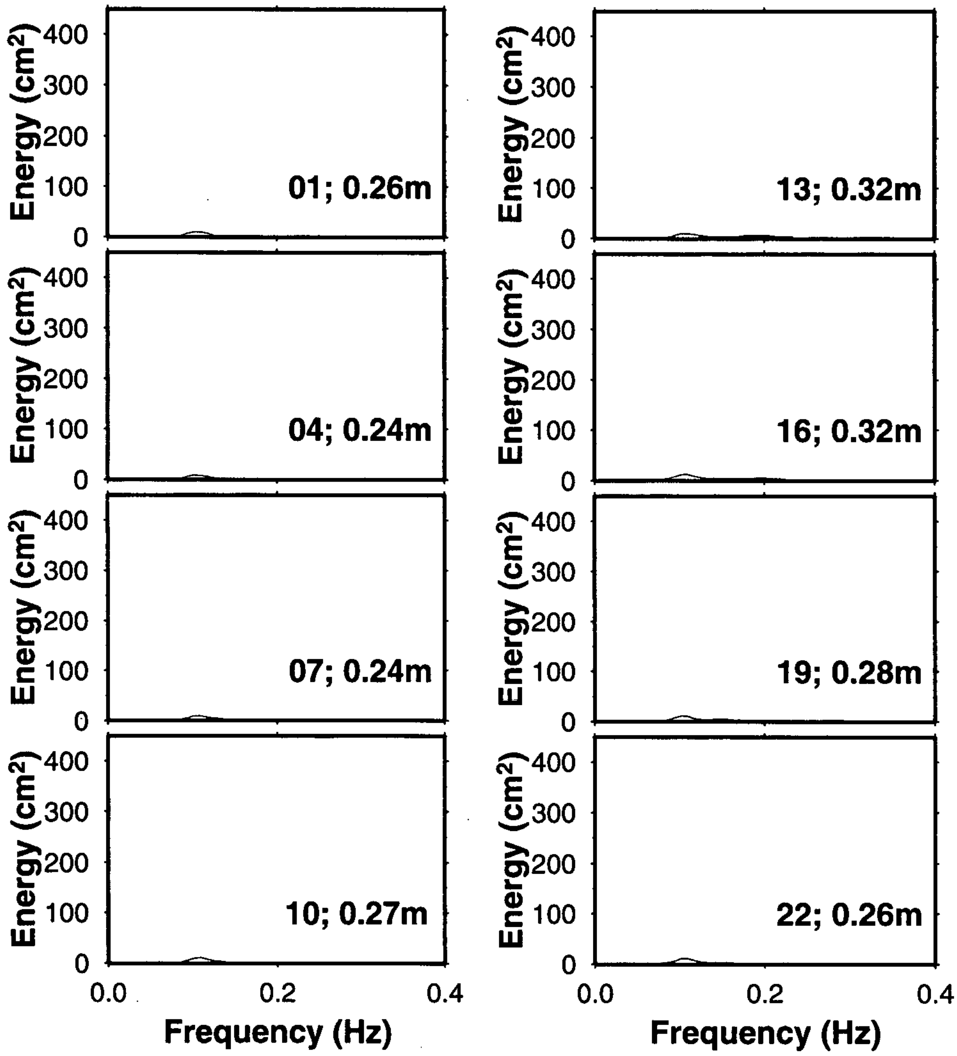


Figure 2.23 Spectral density for gauge 0 on 5 February 1994 at 01, 04, 07, 10, 13, 16, 19 and 22 hours. The values in metres represent the significant wave height, H_{mo}

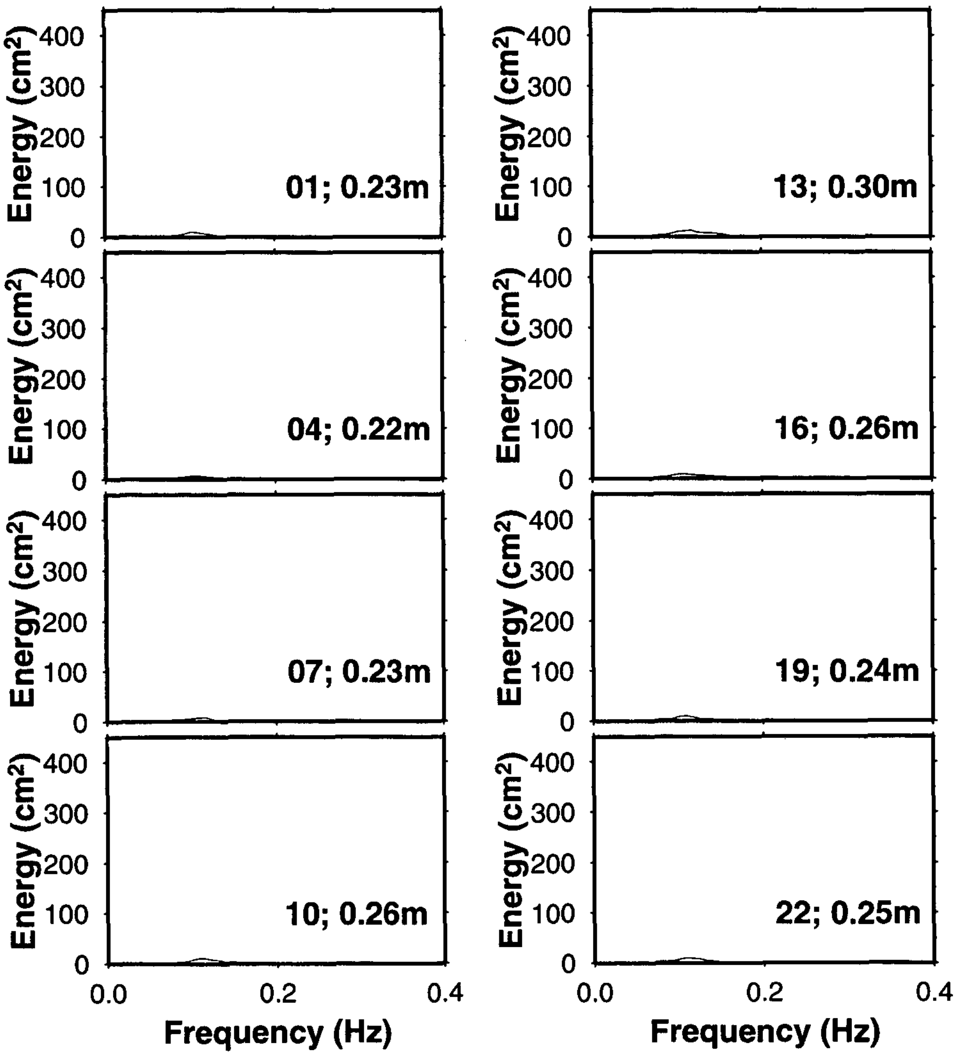


Figure 2.24 Spectral density for gauge 0 on 6 February 1994 at 01, 04, 07, 10, 13, 16, 19 and 22 hours. The values in metres represent the significant wave height, H_{mo}

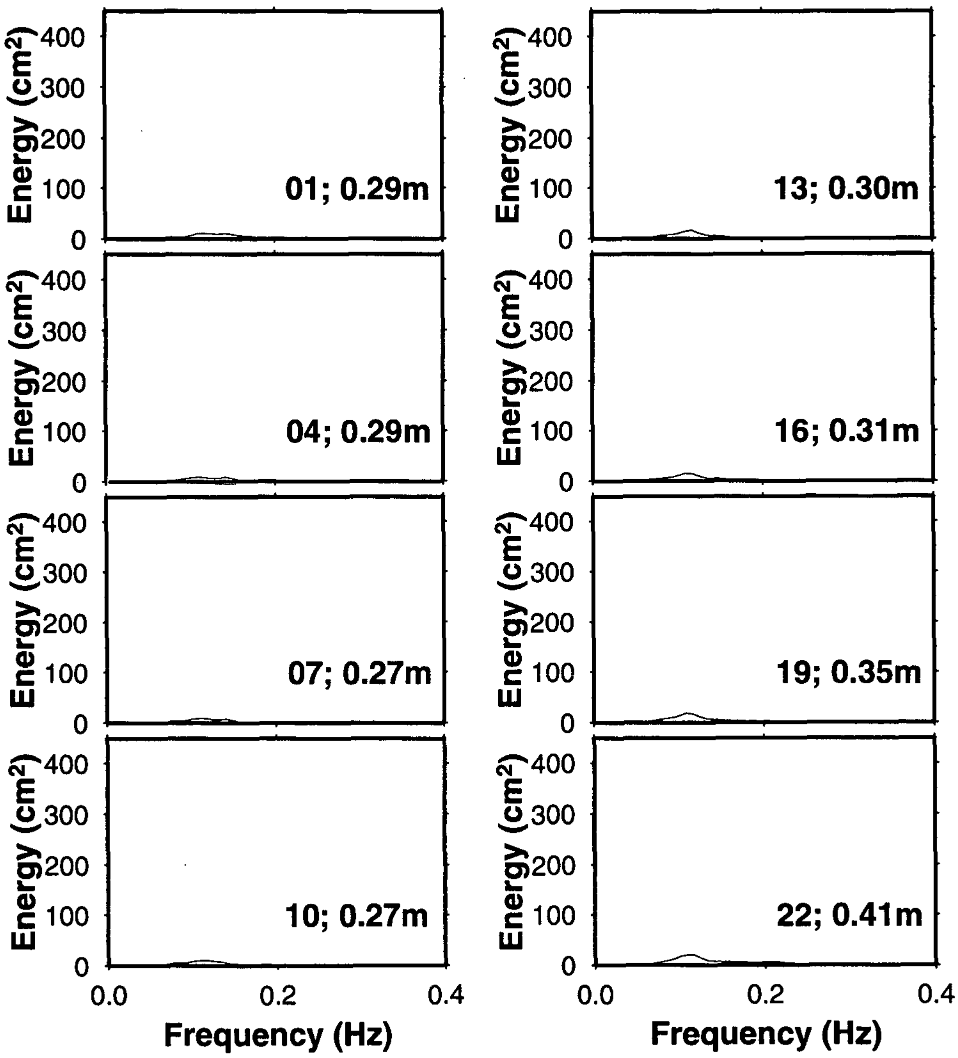


Figure 2.25 Mean of maximum 15 redundant gauge triad wave direction estimates (solid), and mean of maximum of 10 redundant gauge pair wave direction estimates (dashed); determined using *true* phase, i.e. PASS=2, on 1 February 1994

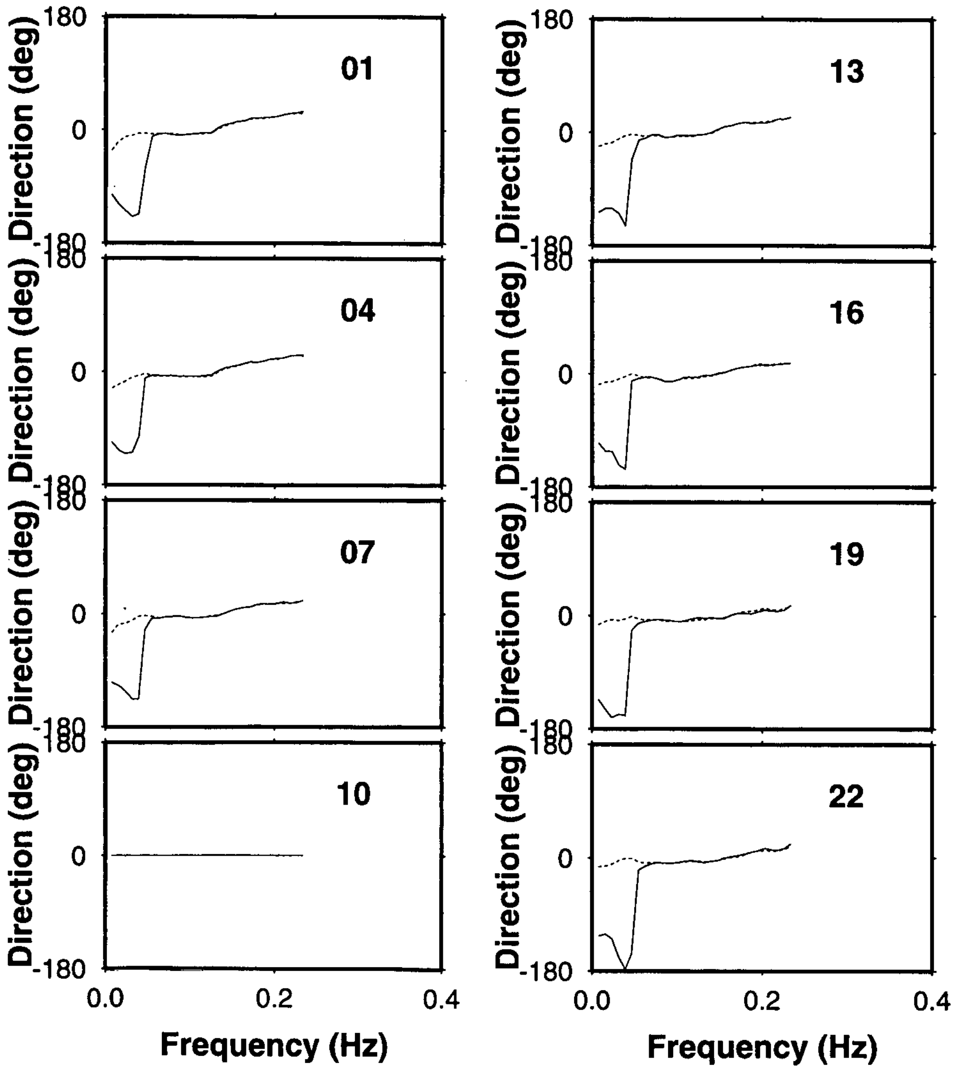


Figure 2.26 Mean of maximum 15 redundant gauge triad wave direction estimates (solid), and mean of maximum of 10 redundant gauge pair wave direction estimates (dashed); determined using *true* phase, i.e. PASS=2, on 2 February 1994

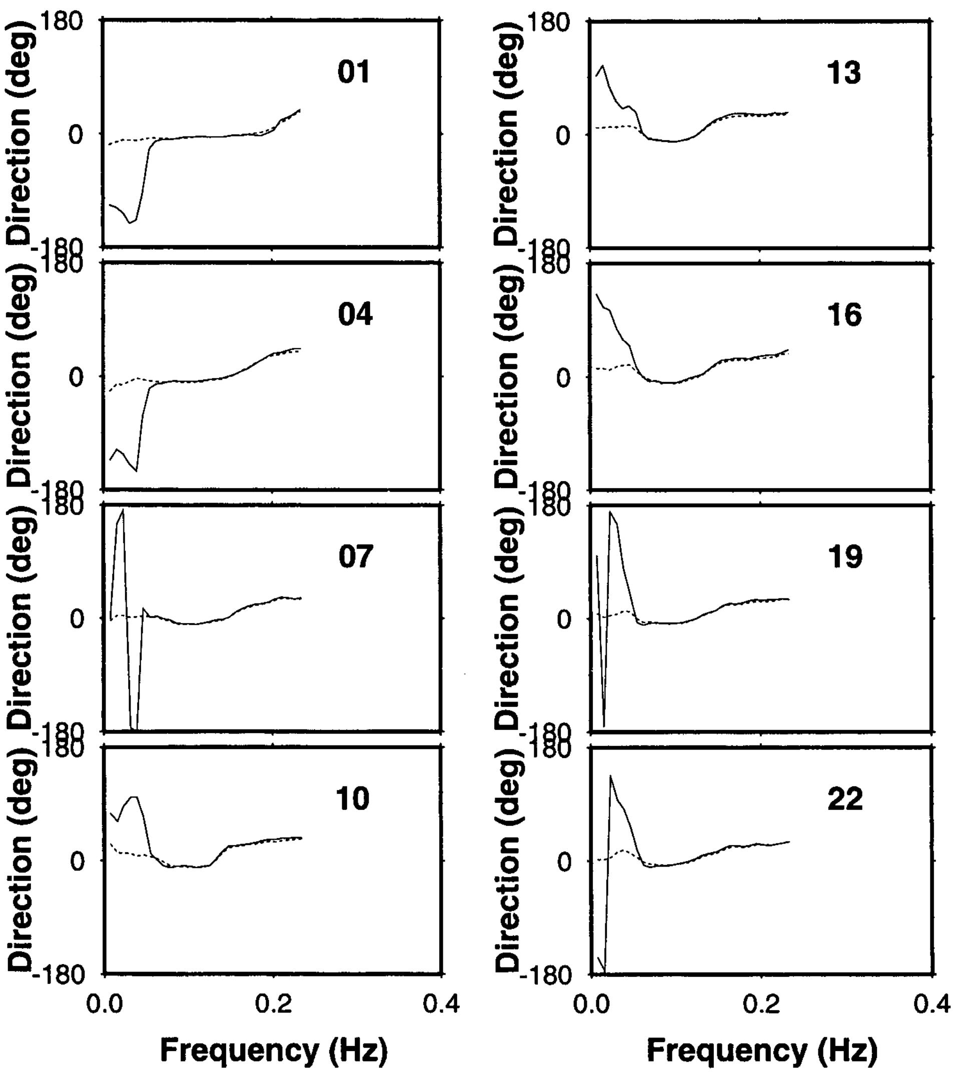


Figure 2.27 Mean of maximum 15 redundant gauge triad wave direction estimates (solid), and mean of maximum of 10 redundant gauge pair wave direction estimates (dashed); determined using *true* phase, i.e. PASS=2, on 3 February 1994

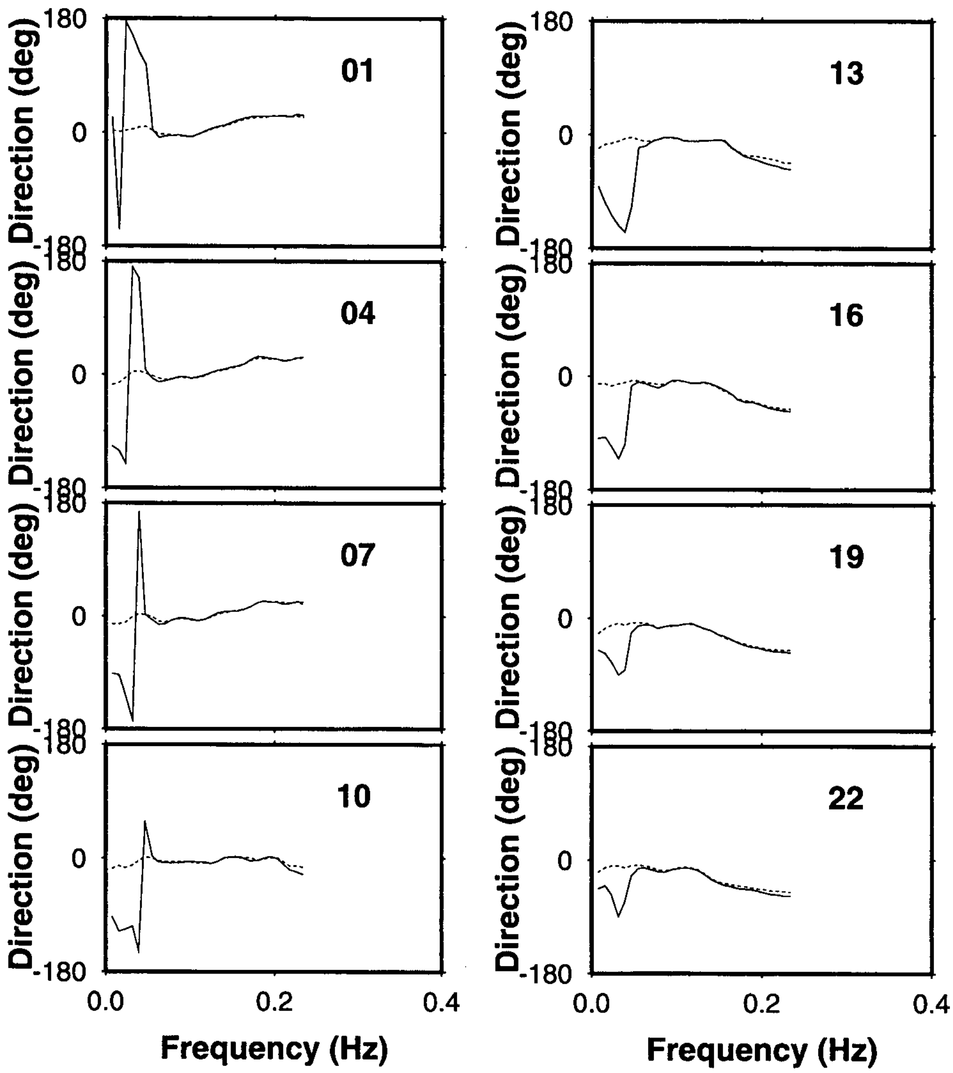


Figure 2.28 Mean of maximum 15 redundant gauge triad wave direction estimates (solid), and mean of maximum of 10 redundant gauge pair wave direction estimates (dashed); determined using *true* phase, i.e. PASS=2, on 4 February 1994

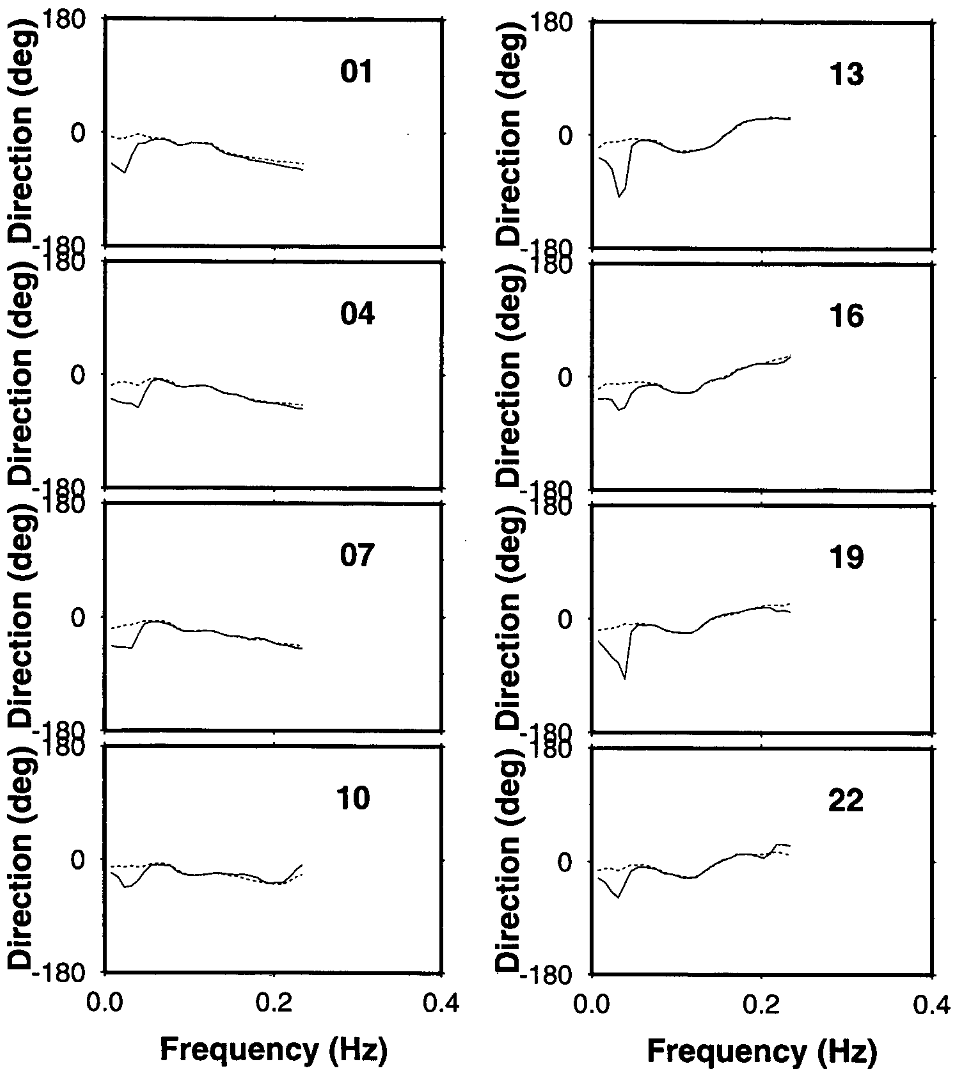


Figure 2.29 Mean of maximum 15 redundant gauge triad wave direction estimates (solid), and mean of maximum of 10 redundant gauge pair wave direction estimates (dashed); determined using *true* phase, i.e. PASS=2, on 5 February 1994

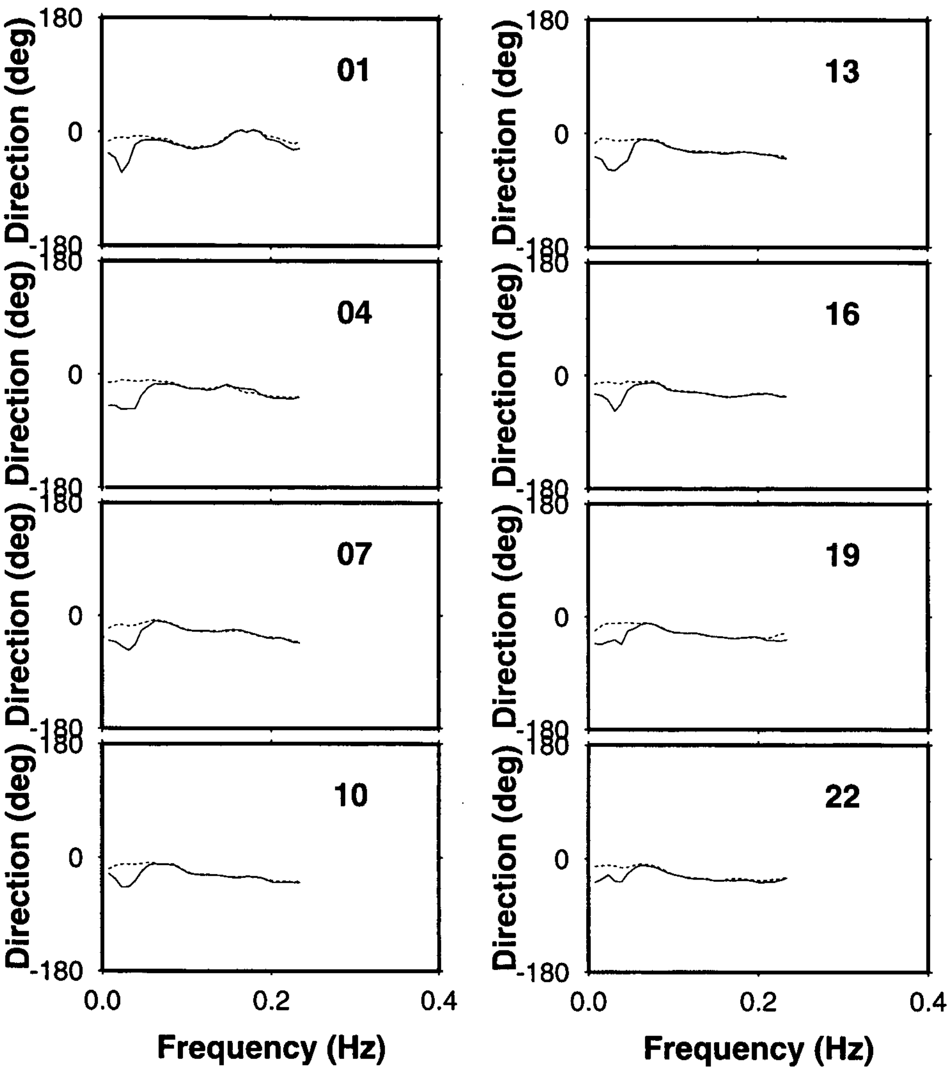
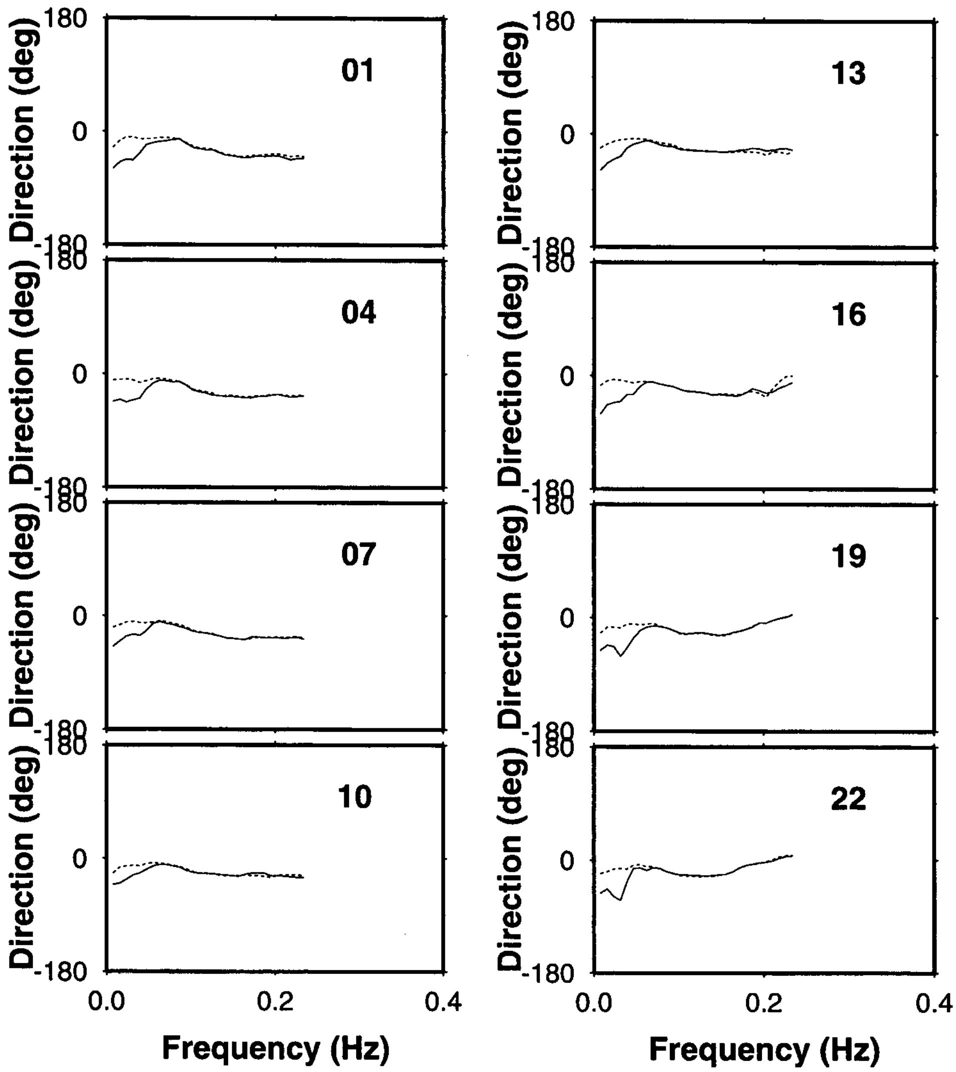


Figure 2.30 Mean of maximum 15 redundant gauge triad wave direction estimates (solid), and mean of maximum of 10 redundant gauge pair wave direction estimates (dashed); determined using *true* phase, i.e. PASS=2, on 6 February 1994



records on 2 February 1994 and one record on 3 February 1994 at 01 hours, during which we made a number of computer runs with gauge triads having large separations, with the intention of studying surf beat directionality, but unfortunately, these records included cases of wind wave generation directed down the coast, towards shore, which in turn generates surf propagating down the coast away from shore. We may recollect that the surf beat generated by the energetic swell, propagates up the coast, away from the shore, as a result of which, our simple model of one frequency, one direction was not satisfied, and therefore even the gauge triad analysis gave garbage results, in case of surf beat in presence of locally generated wind waves.

Figure 2.31 based on the tables in Appendix B shows the standard deviation of wave direction over a maximum of 15 redundant estimates of wave direction using the modified Esteva method (PASS=2) during 1-6 February 1994, while Figure 2.32 shows the mean of a maximum of 15 redundant estimates of wave direction. Both the figures include representations of the significant wave height as well as the vector mean wind speed and direction. From the energy contours in Figure 2.32, it is seen that the swell centred at spectral period 9.85s, which is present throughout the observation period, is dominant (energy $> 10^{2.0}\ cm^2$) from the beginning upto 2 February 04 hours, after which the sea gains dominance, reaching its peak at 13 hours on the same day (energy $> 10^{2.4}\ cm^2$). It is also seen that the sea decays completely by 3 February 22 hours, after which only very low swell (energy $\approx 10^{0.8}\ cm^2$) is present, the significant wave height being less than 0.41m. The energy values given above are for the particular spectral frequencies, i.e., they do not indicate the total energy (variance) for swell, surf beat and sea components, each of which spreads over several spectral frequencies. Figure 2.31 shows that during 1-6 February 1994, a maximum of 15 redundant estimates of wave direction has a standard deviation of $< 4^o$ in the range $14.22 - 6.40s$. During this time swell of $\approx 10s$ propagated towards shore, up the coast at an angle of $\approx 7^o$ with the seaward shore normal during the successive dominance of both swell and sea, with the angle increasing to and steadying at $\approx 23^o$ during the period of incidence of of very low swell on 4, 5 and 6 February. The above standard deviation is also $< 4^o$ for periods between $6.40 - 4.27s$ during 01-13 hours on 2 February, when waves are locally generated (note the energy contour ridge line is oriented in such a way that the frequency decreases with increasing time) by a *Northeaster* of $\approx 10m/s$, owing to which the wave direction in the period range $6.40 - 4.27s$ aligned itself with the wind direction, and the significant wave height increased from 0.70 to 1.54m. The low value of the standard deviation indicates that the directional spread in case of sea as well as as swell is unimodal and very narrow. In general the standard deviation $< 12^o$ in the range $21.33 - 4.27s$, so that our estimates are reliable. It is curious to note that during 3 and 5 February the wind is blowing *away* from shore, but the high frequency waves generated by this wind are all directed *towards* shore, almost at a right angle to the wind. When I brought this apparent anomaly of offshore winds generating onshore waves to the attention of Dr. C. E.

Long, in a personal communication he informed me, that he very frequently sees the phenomenon of wind from the southwest generating high frequency waves from the south east (our case!) and he sees high frequency waves from the northeast during much rarer occasions when the observed wind is from the northwest. An explanation for this anomaly may be that at Duck, the cross-shore component of the wind is fetch limited and the waves generated by the longshore component of the wind are refracted towards shore.

The standard deviation of 15 redundant estimates of wave direction $< 12^o$ even for surf beat when low wave conditions ($H_{mo} < 0.41m$) prevailed on 4, 5 and 6 February indicating that the directional spread is unimodal and narrow. This surf beat (the lowest three rows of wave vectors in Figure 2.32 representing 32.00, 42.67 and 64.00s) propagates up the coast towards shore at angles in excess of 45^o with the shore normal. It may be noted that this surf beat of remote origin does not get refractively straightened as it approaches the coast as much as the swell centred at $9.85s$, probably because the $150m$ depth contour makes an angle of $\approx 30^o$ with the shore normal. Based on a 24-gauge polygonal array at $13m$ depth at Duck installed by the Scripps Institution of Oceanography, using a variational method, Herbers et al. [1995] found that surf beat of remote, possibly trans-oceanic origin propagates at normal incidence towards the shore when very low swell energies (variance in the range $0.04 - 0.14Hz < 100\,cm^2$) are present. Our results therefore introduce an element of doubt whether the direction polarization parameter, on the basis of which Herbers et al. [1995] inferred normal incidence, is properly constructed. The standard deviation of a maximum of 15 redundant estimates of wave direction $< 16^o$ also in case of surf beat when energetic swell was propagating from the beginning upto 2 February 04 hours, the surf beat propagating up the coast away from the shore at an angle of about 45^o with the shore normal. The direction of surf beat generated by the energetic swell conforms to the schematic diagram of surf beat generation given by Herbers et al. [1995] (their Fig 2). During the period 2 February 07 hours to 3 February 04 hours, the period when locally generated wind waves are predominant, the standard deviation of a maximum of 15 redundant estimates of wave direction in case of surf beat is very large, indicating that our assumption of unimodal directional spread is incorrect so that our estimates of surf beat direction are not correct in this particular case. It may be speculated that since the swell and the sea both propagate towards shore, the upcoast and downcoast directions of the swell and the sea respectively give rise to a bimodal directional spread for this surf beat.

The histogram in Table 2.17 shows that 61 out of 72 estimates of direction of surf beat observed during 4-6 February 1994 indicate that the surf beat propagates towards the shore, up the coast at angles of $30 - 60^o$ with respect to the shore normal. Table 2.17 in conjunction with Figure 2.33, which depicts geodesic paths of the surf beat incident at Duck — show that the surf beat of remote origin is largely trans-oceanic in origin. Geodesic is the shortest distance on an eliptical earth is the geodesic, and this differs considerably from the great circle path when the range is close to

Figure 2.31 Frequency – time plot: (a) Significant wave height, H_{mo}, (b) Vector mean wind, and (c) Standard deviation of a maximum of 15 redundant estimates of wave direction during the period 1-6 February 1994, using the method of Esteva [1977] as modified by us

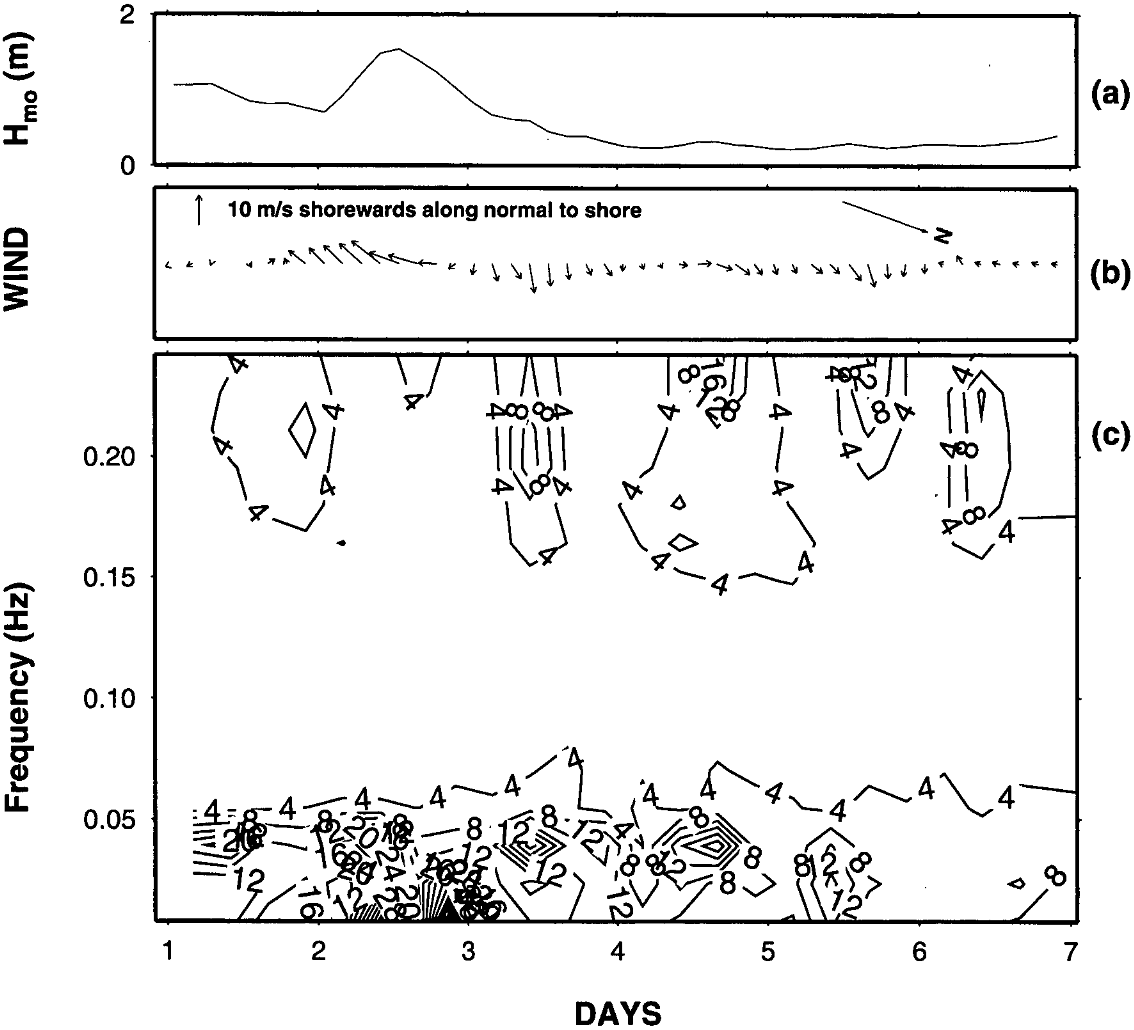
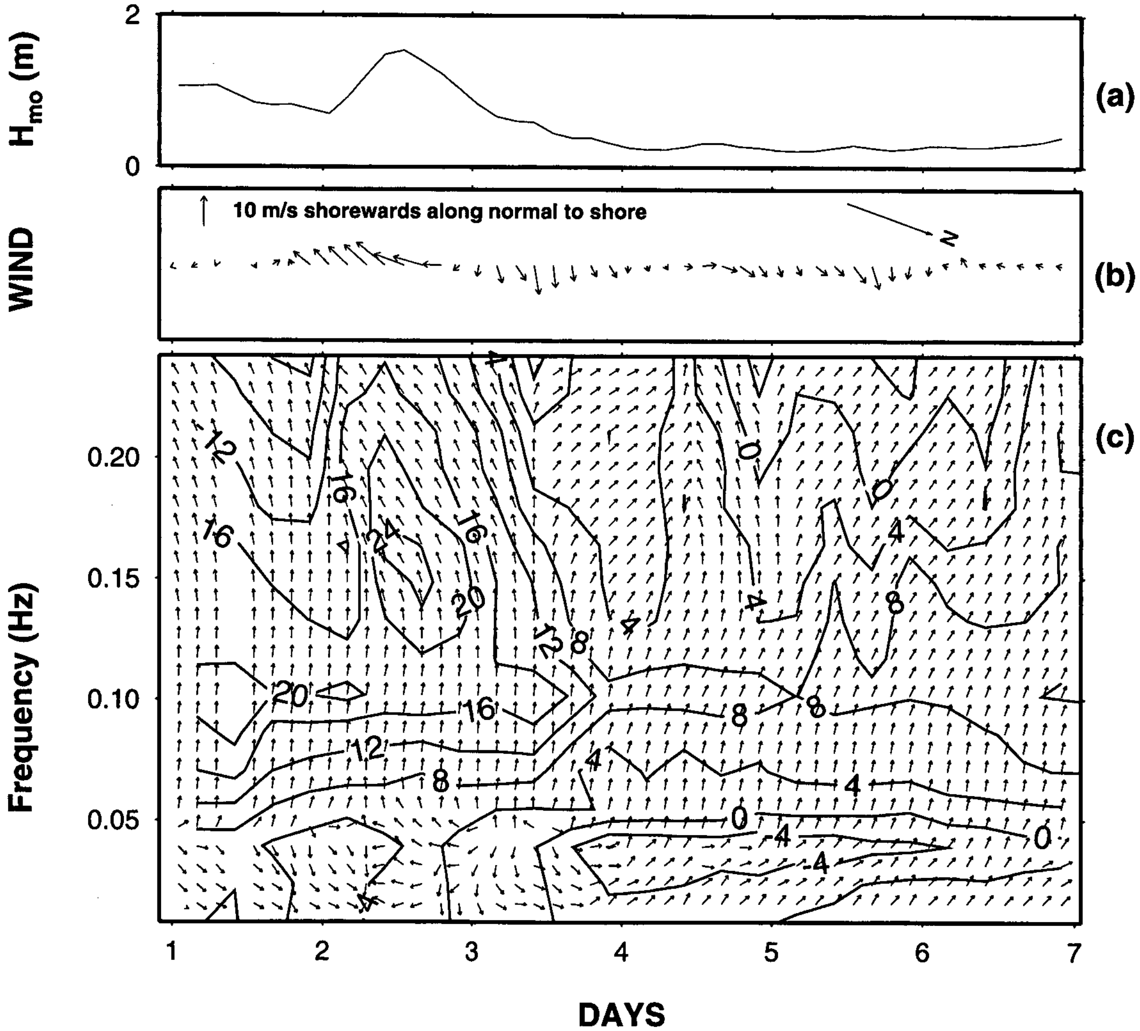


Figure 2.32 Frequency – time plot: (a) Significant wave height, H_{mo}, (b) Vector mean wind, and (c) Mean of a maximum of 15 redundant estimates of wave direction during the period 1-6 February 1994, using the method of Esteva [1977] as modified by us. Energy contours are in decibels ($10 * log_{10}$ Energy). Energy is measured in cm^2



antipodal. The fact that the $30-60^o$ geodesic represent the boundaries of a narrow window into the South Atlantic and the Indian Ocean to the West of Australia, suggest that the surf beat of remote origin does propagate along geodesics just like sound propagation in the deep ocean in the SOFAR (Sound frequency and ranging) channel. It may be worth mentioning that Munk and Forbes [1989] report that in 1960, 300 lbs of high explosives were detonated near the sound axis off Perth, on the West coast of Australia, and these were clearly recorded on axial hydrophones off Bermuda off the East coast of USA. In one case the surf beat of remote origin appears to have been generated as close as the West Indies.

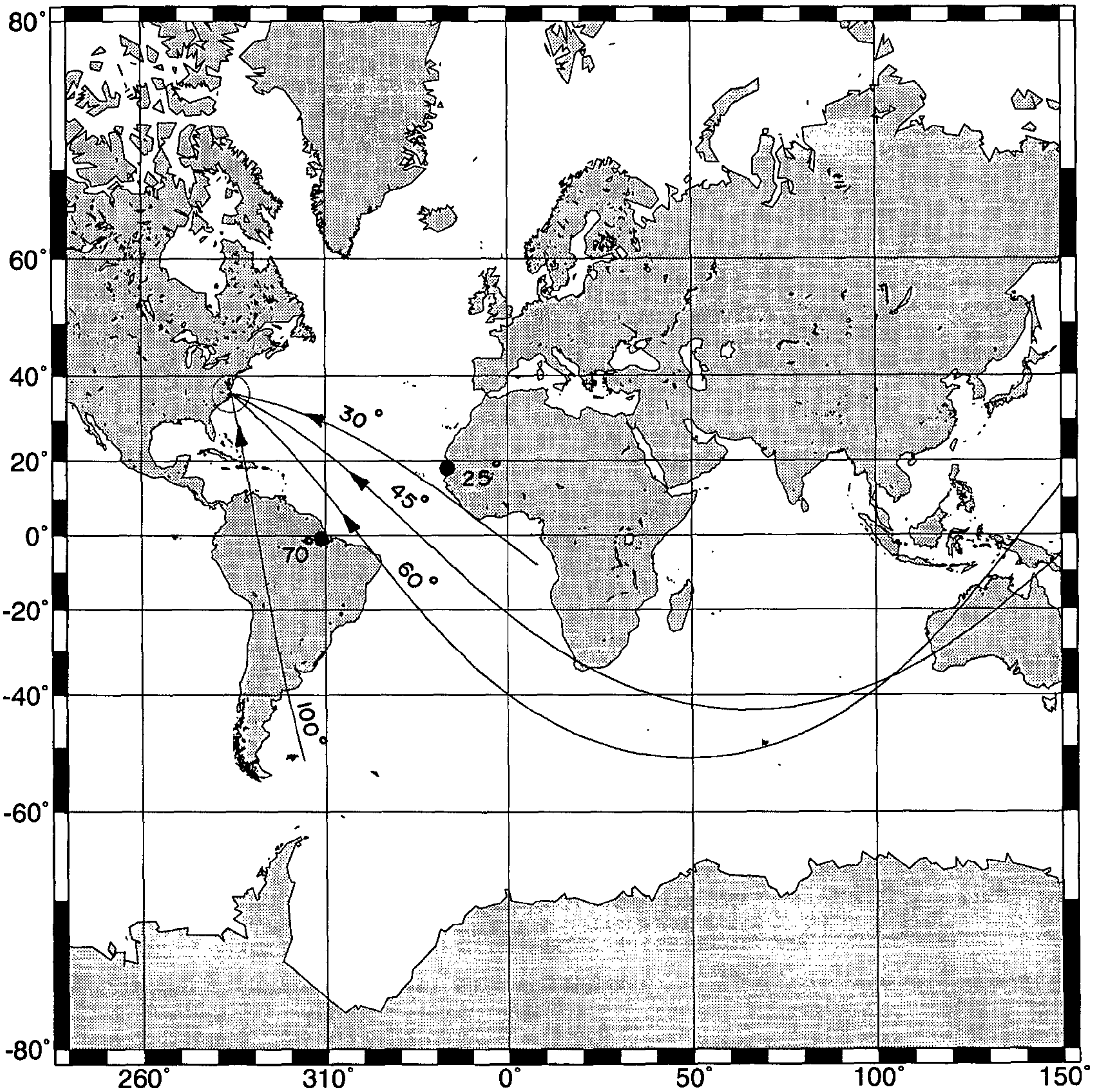
Table 2.17 Histogram of surf beat of remote origin (spectral periods 64.00, 42.67 and 32.00s) occuring during 4-6 february 1994 (8 observations per day) giving a total of 72 estimates of surf beat direction. Surf beat directions are up the coast, towards shore measured with respect to the seaward shore normal. The uniform negative sign of surf beat direction has been dropped for convenience

Range (degrees)	Frequency
25-30	4
30-35	7
35-40	9
40-45	14
45-50	19
50-55	4
55-60	8
60-65	3
65-70	3
.	.
.	.
95-100	1
25-100	72

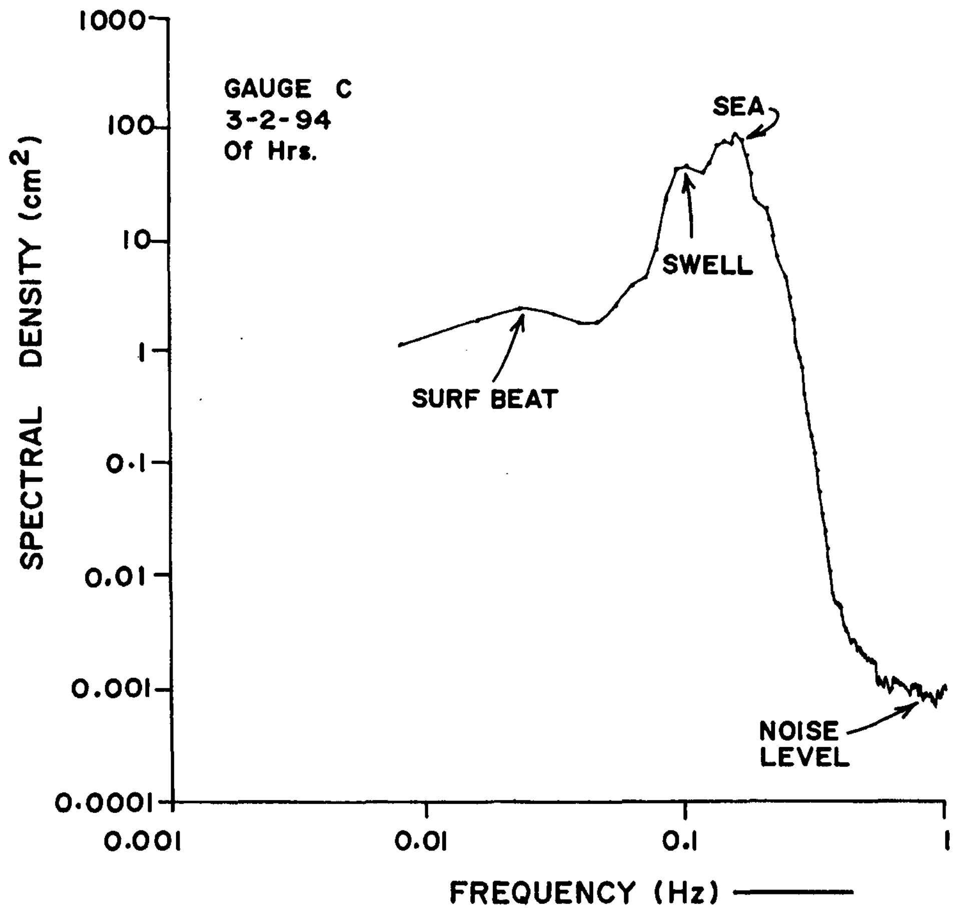
Figure 2.34 shows the energy spectrum for gauge C at 01 hours on 3 February 1994 with both axes in logarithmic scale. It is seen that on the forward face of the spectrum the energy falls faster than f^{-5} as the surface elevation is measured with a bottom mounted pressure gauge.

We shall now show that, in the wind wave regime (0.04-0.32 Hz), our estimates of wave direction as a function of frequency using Esteva's method as modified by us, are consistent with the results of frequency-direction spectra obtained by the Coastal Engineering Reseach Center (CERC) using the sophisticated Iterative Maximum Likelihood Estimation (IMLE) method described by Pawka [1983], which assumes that at a given frequency waves can approach from all

Figure 2.33 Great circle paths indicating origin of surf beat incident at Duck during 4-6 February 1994, when low wave conditions (significant wave height, $H_{mo} < 0.41m$) occur. The figure in conjunction with Table 2.17 suggests that the surf beat of remote origin is largely trans-oceanic in origin



scales


GAUGE C
3-2-94
Of Hrs.
SEA
SWELL
SURF BEAT
NOISE LEVEL
SPECTRAL DENSITY (cm²)
1000
100
10
1
0.1
0.01
0.001
0.0001
0.001
0.01
0.1
1
FREQUENCY (Hz)

directions. The frequency-direction spectrum for the record on 3 February 1994 at 22 hours (i.e., when locally generated waves have nearly decayed) using IMLE method for the full 15-gauge array is shown in Figure 2.35(a,b). Superimposed on the IMLE contour plot of energy shown in Figure 2.35(b) is a plot (the thick curve down the page!) of wave direction (mean of a maximum of 15 redundant estimates) as a function of frequency using Esteva's method as modified by us, which shows that the results of IMLE and Esteva's method are consistent with each other. In Figure 2.36, which is similar to Figure 2.35 and is for the record on 2 February 1994 at 13 hours (i.e., at the peak of wave generation) for the full array, we note that the curve showing Esteva's method surprisingly does not exactly follow the ridge on the IMLE contour plot at the high frequency end of the spectrum. Since the wave direction in Figure 2.36 varies within the range $(-90^o, +90^o)$ there will be no ambiguity in the IMLE analysis even if it is restricted to the linear part, i.e., the longshore part of the array – this is given in Figure 2.37, which shows that the curve depicting Esteva's method lies exactly along the ridge of the IMLE contour plot even at the high frequency end of the spectrum. Thus the results of Esteva's method as modified by us are consistent with that of the IMLE method. These methods were found to be consistent with each other not only for just the above two records, but also for all the 16 records on 2 and 3 February 1994 for which the CERC IMLE plots were available, and which as we have seen include instances of predominant swell, a developing sea and a decaying sea. Our estimates of wave direction using Esteva's method Figure 2.31 and Figure 2.32 are also consistent with the CERC IMLE derived bulk parameters, viz., peak period, peak direction, etc., given in Figure 2.38, which is reproduced from Long and Roughton [1995]. We note that our representation explains the singularities in the peak period and peak direction (bulk parameters) as given by the CERC publication. Also the unchanging direction of swell as shown by our representation appears to be realistic.

. . .

Figure 2.35 CERC computed frequency-direction spectrum on 3 February 1994 at 22 hours for full array using the IMLE method. In part (b) the thick curve down the page gives the wave direction (mean of 15 redundant estimates) computed using the Modified Esteva Method

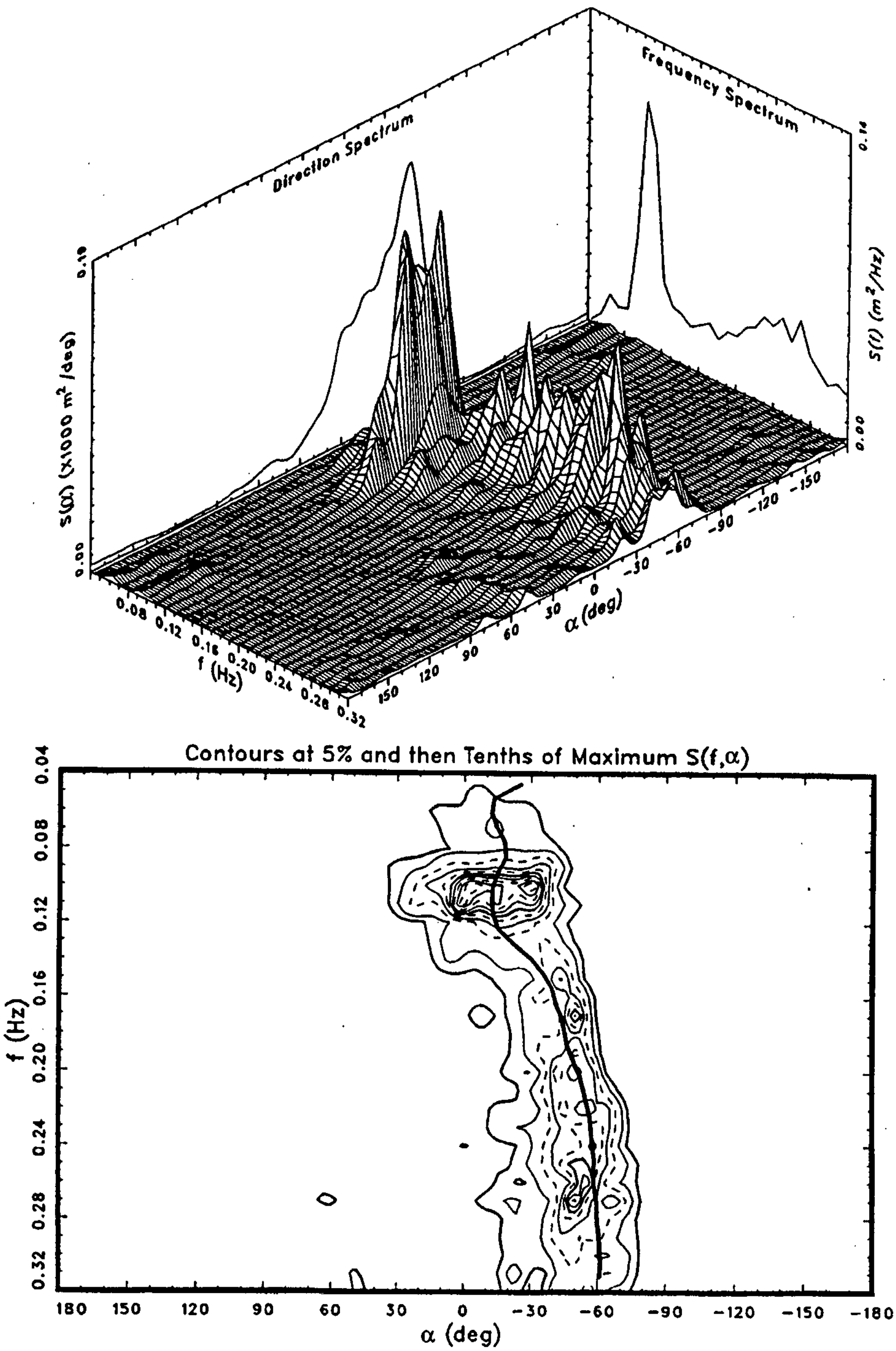


Figure 2.36 CERC computed frequency-direction spectrum on 2 February 1994 at 13 hours for full array using the IMLE method. In part (b) the thick curve down the page gives the wave direction (mean of 15 redundant estimates) computed using the Modified Esteva Method

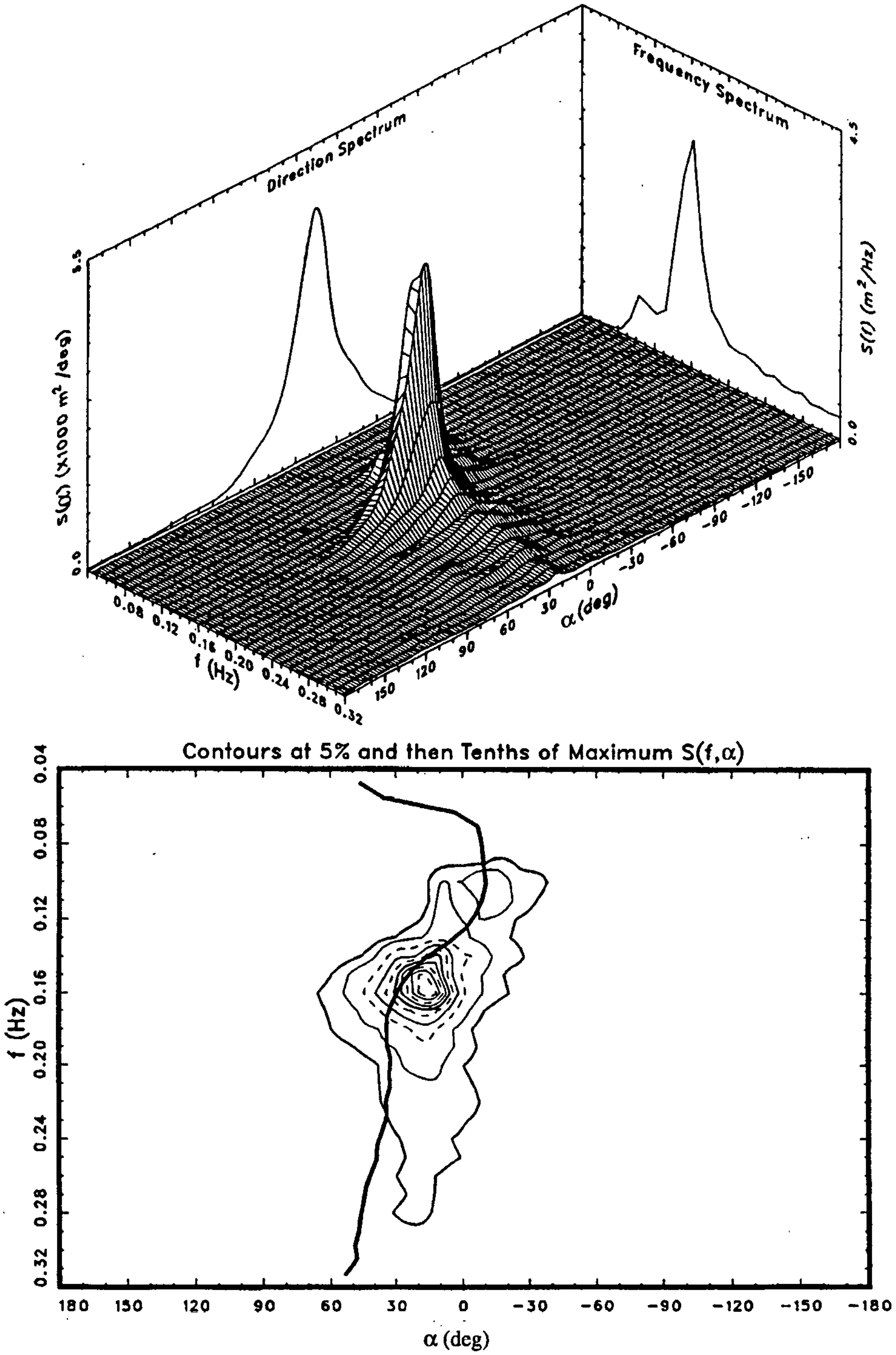


Figure 2.37 CERC computed frequency-direction spectrum on 2 February 1994 at 13 hours for linear part of the array using the IMLE method. In part (b) the thick curve down the page gives the wave direction (mean of 15 redundant estimates) computed using the Modified Esteva Method

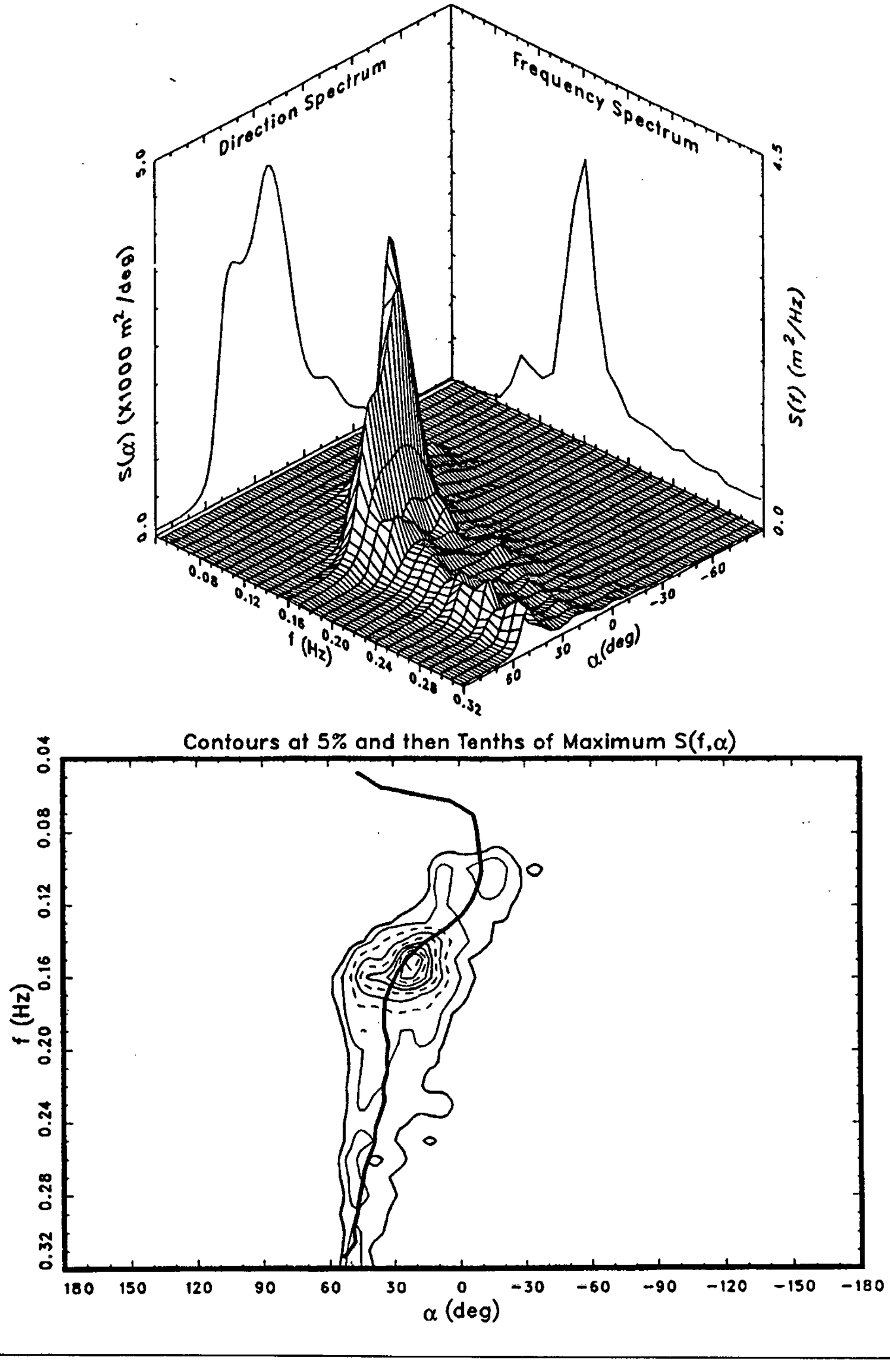
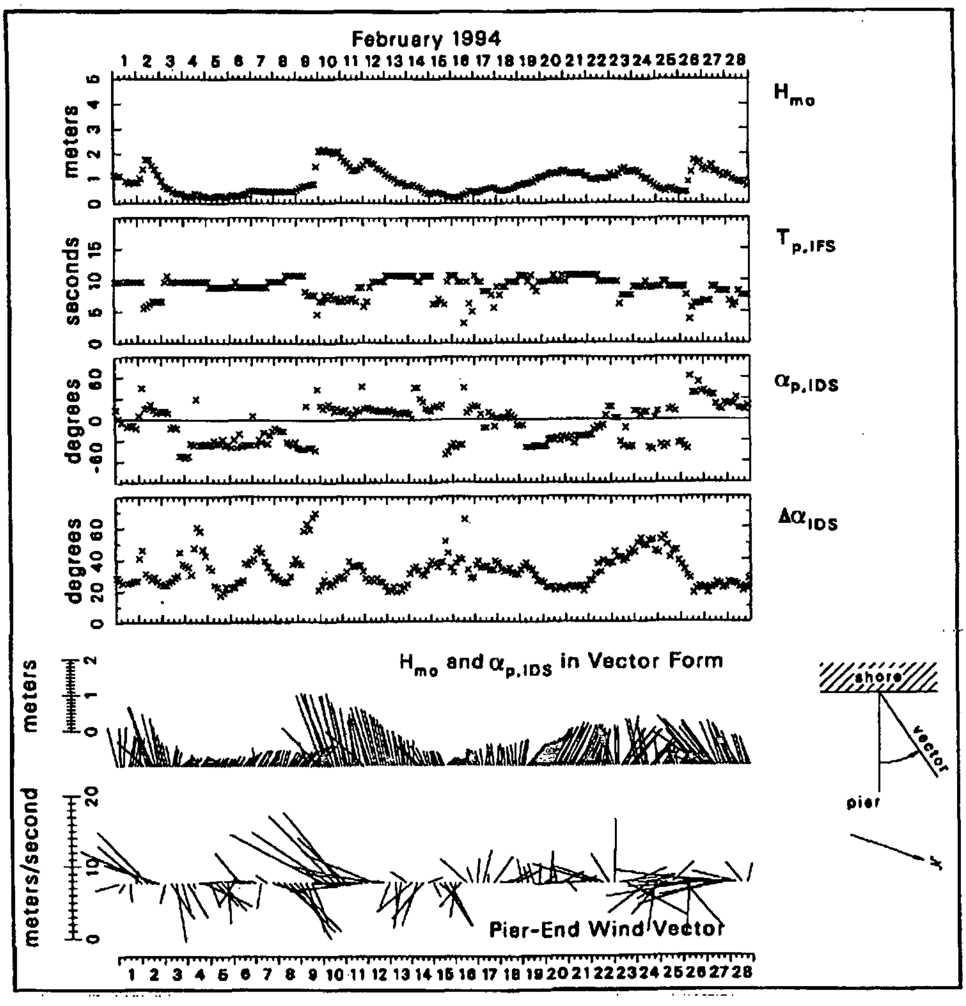


Figure 2.38 Bulk parameters derived by the CERC using IMLE method for the month of February 1994. For comparison with the results using Esteva's method as modified by us, the period of interest is 1-6 February 1994. H_{mo} is the significant wave height, $T_{p,IFS}$ is the peak period from the integrated frequency spectrum, $\alpha_{p,IDS}$ is the peak wave direction of the integrated direction spectrum, $\Delta\alpha_{IDS}$ is the directional spread parameter of the integrated direction spectrum. (Figure reproduced from Long and Roughton [1995])



Chapter 3

BUOYS

In case of buoy measurements, the wave directional spectrum is determined from the simultaneous time series measurements of wave elevation (obtained by double integration of the vertical acceleration, i.e., the heave signal), slopes of the wave surface in two mutually perpendicular directions (measured with inclinometers), and the compass orientation of the buoy. Such buoys are known as slope following buoys and were first used by Longuet-Higgins et al. [1963]. Buoys that measure the orbital velocity in two mutually perpendicular directions instead of the slope, known as orbital following buoys, are described by Middleton and LeBlanc [1982] and marketed by ENDECO.

The advantage of buoys over arrays is that buoys can be deployed both in deep water as well as shallow water. Also buoys can be very easily deployed, while a lot of logistic support, including diving and precise location of gauges, is required for installing and maintaining arrays.

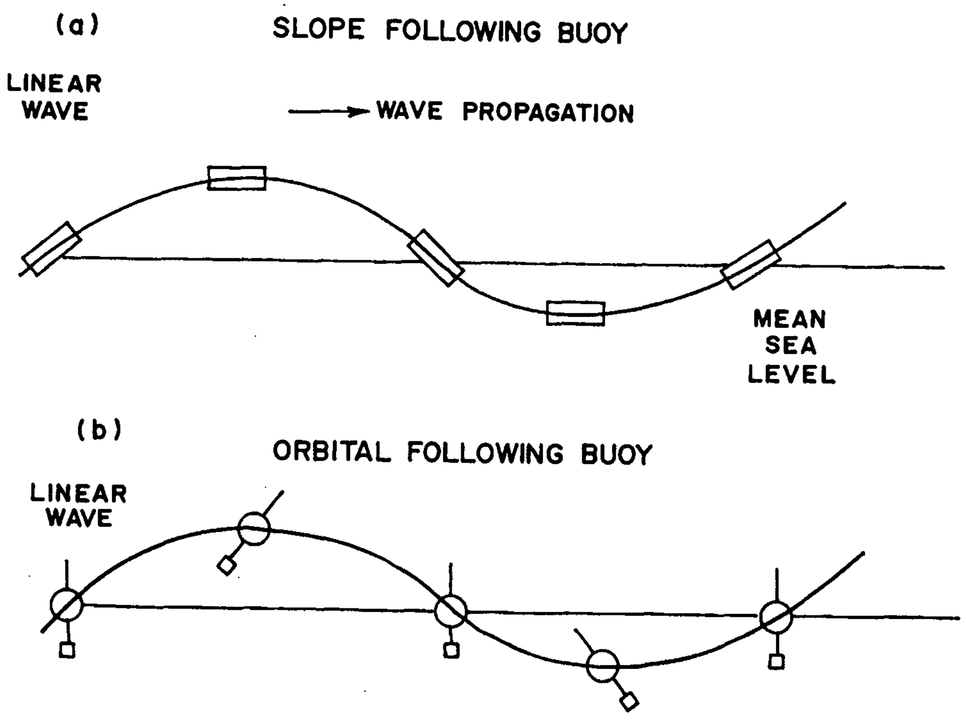
3.1 FREQUENCY DOMAIN FILTER METHOD FOR DETERMINING WAVE DIRECTION FROM AN ORBITAL FOLLOWING BUOY

Software has been developed in FORTRAN language using a personal computer for the determination of wave direction from time series measurements of heave, pitch and roll of an orbital following buoy. The method of digital band pass filtering described by Edward C. Brainard II of Endeco Inc. USA was used. A derivation of the basic formula used is presented. The software developed by us, viz. BUOY-D-P.FOR, and the software provided by ENDECO, viz. 1156DBP.EXE, were both run for observed as well as computed simulated data. This is a preliminary report on program development. In the case of observed data, wave directions obtained with BUOY-D-P agreed within $\pm 5^o$ with the single available visual estimate of swell direction and within $\pm 50^o$ with directions obtained with 1156DBP. In the case of computer simulated data, BUOY-D-P was able to recover wave directions accurately for both mono-chromatic and multi-chromatic wave trains. 1156DBP was equally successful, except that if the simulated wave direction was θ, the computed direction was found to be $\pi + \theta$. This offset has been explained.

3.1.1 Introduction

For the determination of wave direction, two types of wave following buoys are used, viz. slope following buoys and orbital following buoys. In the case of a slope following buoy, the tilt of the buoy in the direction of the wave follows a simple harmonic motion having the frequency of the wave and is 90^o out of phase with the wave motion (also with heave of the buoy) (Figure 3.1a). Maximum tilt (positive and negative) is experienced on the slope of the wave at mean sea level. The buoy is level as the wave crest and trough. A slope following buoy has an inherent defect owing to its flat bottom "discus" shaped design. It is liable to capsize unless its diameter is larger (above 12 m). This type of buoy is also liable to give erroneous wave directions in the presence of breaking waves.

Figure 3.1 Slope and orbital following buoy motions



In the case of orbital following buoy, its tilt in the direction of the wave again follows a simple harmonic motion having the frequency of the wave but is in phase with the wave motion (also with heave of the buoy), (Figure 3.1b). Maximum tilt (positive and negative) of the buoy occurs on the crest and trough of the wave. The buoy is level on the slope of the wave at mean sea level. This type of buoy is spherical in design, has a deeply suspended and rigidly attached ballast, behaves like an "inverted pendulum", is inherently stable and cannot capsize. Also, breaking waves cannot introduce errors in the computation of wave direction.

Slope following buoys detect the vertical acceleration and the wave slope in the north-south and east-west directions. Tilt following buoys detect the vertical acceleration and the tilt of the buoy in the north-south and east-west direction. In both types of buoys, therefore, three independent measurements are made.

Slope following buoys came into existence first, and orbital following buoys came much later. The first slope following buoy was that of Longuet-Higgins et al. [1963] while perhaps the first orbital following buoy was that of Middleton et al. [1978]. The methodology created for the determination of the directional spectrum from the motions of a slope following buoy is being applied for orbital following buoys with slight modifications.

3.1.2 Methodology

Consider a one-dimensional mono-chromatic wave

$$h(t) = (H/2)\cos(\kappa x - \sigma t) \tag{3.1}$$

where h is the wave elevation with respect to time; H, the wave height; $\kappa(=2\pi/L)$, the wave number; L, the wave length; $\sigma(=2\pi/T)$, the angular frequency; and T, the wave period.

Let $z = 0$ be the mean water line, the z-axis reckoned positive upwards, and d be the mean water depth. Then the horizontal component of orbital velocity, u, and the vertical component of fluid acceleration, a_z due to the wave motion are given by:

$$u = \frac{\pi H}{T}\frac{\cosh[\kappa(z+d)]}{\sinh(\kappa d)}\cos(\kappa x - \sigma t) \tag{3.2}$$

$$a_z = -\frac{g\pi H}{L}\frac{\sinh[\kappa(z+d)]}{\cosh(\kappa d)}\cos(\kappa x - \sigma t) \tag{3.3}$$

Ideally, an orbital following buoy simultaneously performs two motions heave and tilt. Due to flotation, the buoy faithfully heaves up and down with the wave, i.e. it acts as a wave rider. And due to the horizontal component of orbital velocity, the buoy tilts positively and negatively in the direction of the wave, the tilt being proportional to the horizontal component of the orbital velocity, u. The tilt of the buoy is in phase with the wave elevation because of the presence of $+\cos(kx-\sigma t)$ in (3.1) and (3.2).

As far as the tilt motion is concerned, the buoy acts as an inverted pendulum. This is achieved in practice by rigidly attaching to the buoy a deeply suspended ballast. The ballast acts as the fulcrum of the inverted pendulum, while the spherical buoy acts as the bob of the pendulum.

Due to the similarity between (3.1) and (3.3), the wave elevation is reckoned from the vertical acceleration of the buoy measured with an accelerometer. To determine the wave direction, besides the wave elevation, it is necessary to know the tilts of the buoy in the north-south and east-west directions. Two inclinometers measure the tilt in two mutually perpendicular directions with respect to the lubber's line on the buoy. These tilts, known as pitch and roll, are then converted into nort-south and east-west tilts with the help of a two-axis flux gate compass. In the ENDECO system, the accelerometer, the two inclinometers and the two-axis flux gate compass are housed in the ballast of the buoy, while the electronics and the battery power supply are located in the spherical buoy.

We shall now present a derivation of the formula for the determination of wave direction from time series measurements of wave elevation (heave), north-south tilt and east-west tilt of the buoy for a mono-chromatic wave. It is assumed that:

a) Let θ be the wave direction. The wave direction is the direction from which the wave front comes, and is reckoned clockwise positive with respect to the north axis.

b) Let $h(t) = H\cos(\frac{2\pi t}{T}+\delta)$

where h is the wave elevation as a function of time t; H, the amplitude of the wave; T, the period of the wave; and δ, the initial phase of the wave. Then the tilt of the buoy in the direction of wave is given by

$$\phi(t) = \frac{cH}{T}\cos(\frac{2\pi t}{T}+\delta)$$

where c is a constant. A positive tilt indicates that the buoy is tilted towards the direction in which the wave front is going, while a negative tilt indicates that the buoy is tilted towards the direction from which the wave front is coming.

Case (i)[$\phi(t) < 0$]: In Figure 3.2, θ is the wave direction; ϕ, the tilt of the buoy, and P(x,y,z) is a point on the axis of the buoy. X-axis is along east, Y-axis along north and Z-axis vertically upwards. 0 is the lower extremity of the buoy; it is the point about which the buoy is tilting, i.e., the fulcrum. Note that since $\phi < 0$, the buoy is tilted towards the direction from which the wave front is coming. Then the north-south tilt, η, and the east-west tilt, ε, of the buoy are given by:

$$(N-S):\ \tan\eta = \frac{r\sin|\phi|\cos\theta}{r\cos|\phi|} = \frac{y}{z}$$

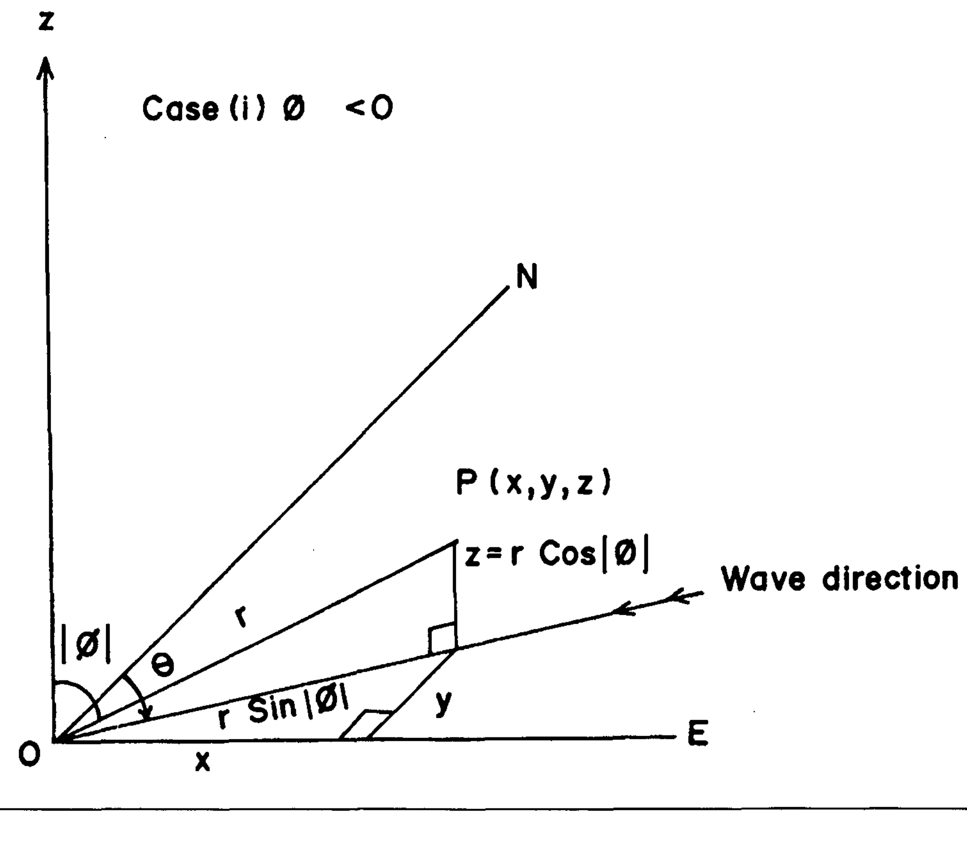
$$(E-W):\ \tan\varepsilon = \frac{r\sin|\phi|\sin\theta}{r\cos|\phi|} = \frac{x}{z}$$

And from the above two equations,

$$\theta = \arctan[\frac{\tan\varepsilon}{\tan\eta}] \tag{3.4}$$

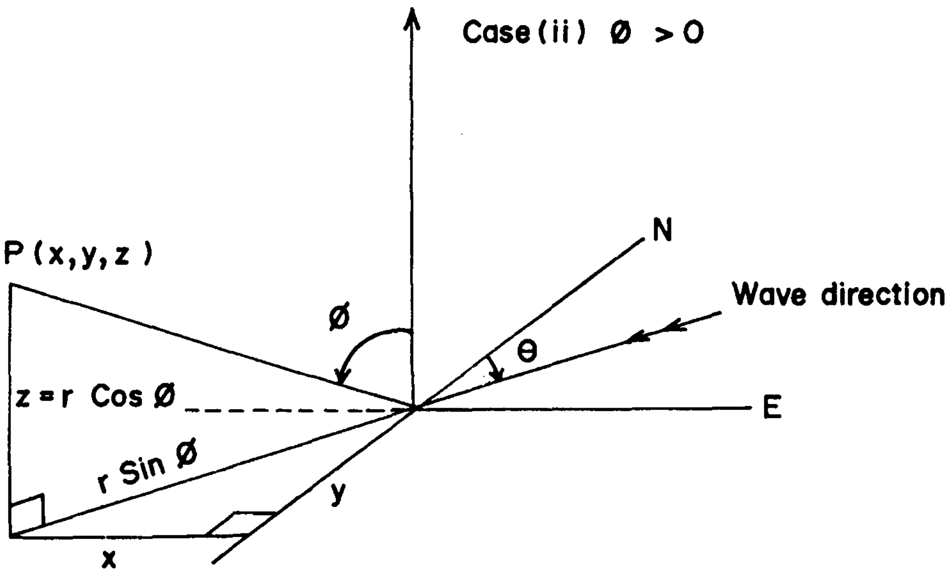
By taking into consideration the signs of the numerator and denominator, θ is uniquely determined in the range $(0, 2\pi)$. In FORTRAN programming language, this is conveniently achieved by invoking the double argument function ATAN2 (Y,X).

Figure 3.2 Buoy tilts for wave troughs



Case (ii) $[\phi(t) > 0]$: This case is treated in Figure 3.3. Note that since $\phi > 0$, the buoy is tilted towards the direction in which the wave front is going. In this case, the north-south tilt, η, and the east-west tilt, ε, are given by

Figure 3.3 Buoy tilts for wave crests



$$(N-S): \ \tan\eta = \frac{r\sin\phi\cos(\theta+\pi)}{r\cos(\phi)} = \frac{y}{z}$$

$$(E-W): \ \tan\varepsilon = \frac{r\sin\phi\sin(\theta+\pi)}{r\cos(\phi)} = \frac{x}{z}$$

And from the above two equations,

$$\theta = \arctan[\frac{-\tan\varepsilon}{-\tan\eta}] \tag{3.5}$$

By taking into consideration the signs of the numerator and denominator, θ is determined correctly and uniquely in the range $(0,2\pi)$. It may be noted that since θ is determined in the range $0,2\pi)$ and not $(-\pi/2,\pi/2)$, (3.4) and (3.5), though similar, are two quite distinct formulae. It is also to be noted that (3.5), which is valid for all $\phi > 0$, is particularly valid for wave crests.

Brainard [????] has given the following formula for wave crests:

$$\theta = \arctan(\varepsilon/\eta)$$

It may be noted that the above formula is an approximation of (3.5) that holds true for small values of η and ε, which generally is the case in practice. As we shall see later, the absence of the negative sign in the numerator and denominator is due to Brainard taking an inverted heave series as input for his computer program.

(3.4) and (3.5), are valid for monochromatic waves. The method of digital band-pass filtering assumes that these equations will be valid for high resolution spectral bands. Essentially, the method applies a band-pass filter to the heave, north-south tilt and east-west tilt series and uses (3.5) at each wave crest of the filtered series to determine the mean wave direction in the band.

Our software, viz. BUOY-D-P.FOR, runs in the manner indicated below: First, steps (1)-(3) are carried out. Then for each frequency band, steps (4)-(10) are performed. this is the main phase of the computations, as the mean wave direction and standard deviation of direction for each band are computed here. Lastly, in steps (11)-(13), the mean energy in each frequency band is computed and the essential results of the processing are printed.

1) Read heave, north-south tilt, and east-west tilt series, h,n,e respectively.

2) Perform FFT of h,n,e to obtain the Fourier transforms H,N,E respectively.

3) Save H,N,E in binary scratch files. Binary files are used for fast access.

4) *Read H,N,E.

5) *Band pass H,N,E, i.e. set the Fourier components outside the band to zero.

6) *Perform inverse FFT of H,N,E to obtain h,n,e.

7) *Determine the location of wave crests of h.

8) *Determine values of n and e corresponding to the wave crests.

9) *Determine the wave direction at each crest using (3.5).

10) *Determine the mean direction and standard deviation for the frequency band.

11) Use Blackman window on the original heave series.

12) Perform FFT of heave series.

13) Find mean energy in each band and scale the mean energy by a factor of 1/0.303 to compensate for loss of energy due to windowing.

3.1.3 Results and discussion

Our software, viz. BUOY-D-P.FOR, and the software provided by ENDECO, viz. 1156DBP.EXE, were both run for observed as well as computer simulated data. The observed data came from an ENDECO type 1156 directional wave-track buoy system deployed for eight days off Candolim, Goa (lat. 15^o 30'N; long. 73^o 44'E) in a mean water depth of 14 m. Low wave conditions prevailed during the entire period. The significant wave height was in the range 0.53-0.96 m and the zero crossing period was in the range 4.36-5.99 sec. There were two main spectral peaks, one generally around 11.11 sec and the other around 5.56 sec, the latter peak being the more dominant nearly all the time.

In Figure 3.4 are presented the mean directions at the peak frequency for two series of observed data: (i) 3 hourly records for one day from 1500 hrs on 5 March 1992, and (ii) 24 hourly records for 8 days from 12 hours on the same day. The figure shows that both the software show the same trends. The software 1156DBP shows more stable and perhaps more realistic wave directions. Directions computed by BUOY-D-P are within $\pm 50^o$ from those computed by 1156DBP.

At 1100 hrs on 10 March 1992, the swell direction was roughly estimated at 300^o by visual observation. The results from two software for the record at 1200 hrs on the same day are presented in Table 3.1. It is seen that at the peak frequency (0.19 Hz), BUOY-D-P shows a mean wave direction of 325^o, while 1156DBP shows the direction to be 302^o. Both computed directions are close to the visual estimate. The data in Table 3.1 also show that the mean direction is more or less the same for all frequency bands in the case of BUOY-D-P. In the case of 1156DBP, wave directions show more scatter, specially at the low frequency end of the spectrum. This feature was noticed for all other records also.

The results obtained with the two software in the case of computer simulated data are discussed below. The characteristics of one record of simulated data are discussed below. The characteristics

Figure 3.4 Mean wave direction at peak frequency for (a) 3 hourly records, and (b) 24 hourly records

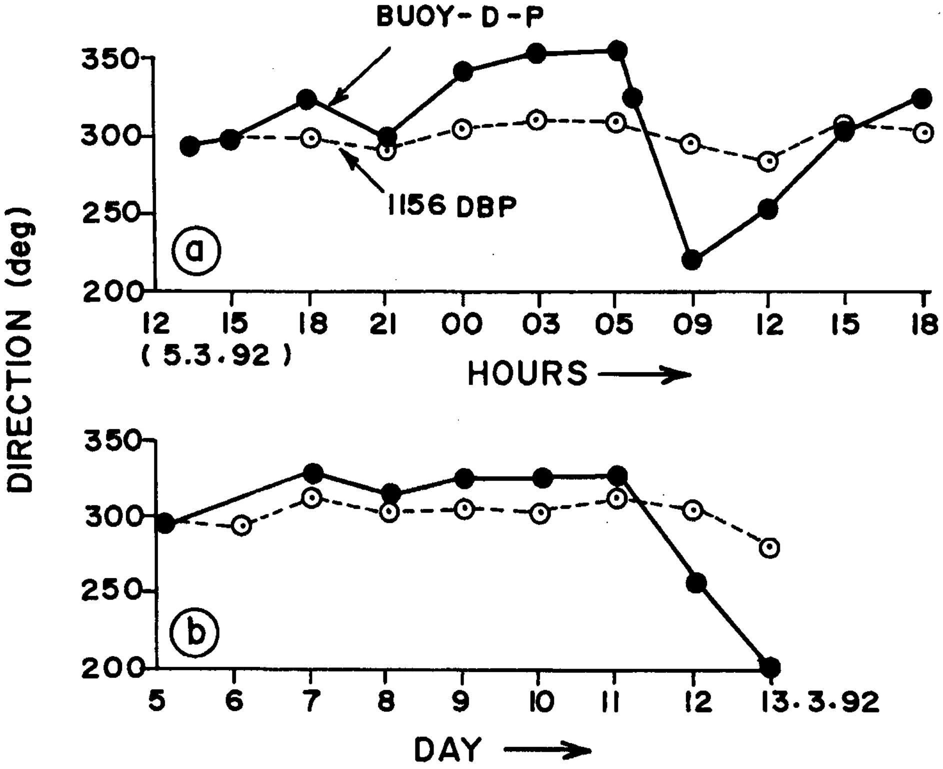


Table 3.1 Analysis of observed wave data using ENDECO wave directional orbital following buoy. Observation date, 10 March 1992; No. of points, 2048; sampling interval, 0.5 sec

Band No.	Centre Frequency (Hz)	Centre Period (sec)	Software BUOY-D-P Energy (m^2/Hz)	Software BUOY-D-P Dir (deg)	Software BUOY-D-P Std Dev (deg)	Software 1156DBP Energy (m^2/Hz)	Software 1156DBP Dir (deg)	Software 1156DBP Std Dev (deg)
1	0.03	33.33	0.06	325	003	0.10	350	012
2	0.04	25.00	0.08	321	002	0.11	001	008
3	0.05	20.00	0.03	325	002	0.03	262	007
4	0.06	16.67	0.01	324	001	0.02	252	009
5	0.07	14.29	0.06	324	002	0.05	320	005
6	0.08	12.50	0.05	323	002	0.09	242	009
7	0.09	11.11	0.09	324	001	0.07	273	006
8	0.10	10.00	0.05	324	001	0.03	267	008
9	0.11	9.09	0.02	325	001	0.01	249	005
10	0.12	8.33	0.01	324	002	0.01	194	008
11	0.13	7.69	0.01	324	001	0.01	278	004
12	0.14	7.14	0.02	325	001	0.02	309	005
13	0.15	6.67	0.02	324	001	0.02	311	002
14	0.16	6.25	0.13	323	001	0.10	308	002
15	0.17	5.88	0.07	324	001	0.14	307	001
16	0.18	5.56	0.14	325	001	0.16	303	001
17	0.19	5.26	0.19	325	002	0.14	302	001
18	0.20	5.00	0.15	326	001	0.09	302	001
19	0.21	4.76	0.06	324	003	0.07	308	001
20	0.22	4.55	0.04	323	002	0.07	310	001
21	0.23	4.35	0.05	324	002	0.04	305	002
22	0.24	4.17	0.07	324	002	0.10	300	001
23	0.25	4.00	0.09	323	002	0.10	308	001
24	0.26	3.85	0.02	324	003	0.04	302	001
25	0.27	3.70	0.07	324	002	0.07	308	001

of one record of simulated data which are similar to those of Fernandes et al. [1988] are given in Table 3.2. In this record, essentially two wave trains were simulated. One wave train represented swell of approximately 11 s coming from 000^o. The other represented swell of around 6 s coming from 120^o. It is seen from Table 3.3 that BUOY-D-P computes the direction of both swells accurately. In the case of 1156DBP, we see that the mean direction of both swells is correct if we add $\pm 180^o$ to the computed direction. Additional computer runs showed the same feature. While BUOY-D-P reproduced wave directions correctly, 1156DBP directions showed an offset of 180^o

We found that this offset in the 1156DBP output could be removed by just reversing the signs of the simulated heave series. The presence of the offset of 180^o and the fact that 1156DBP uses (3.4) instead of (3.5), indicate that the heave series in the ENDECO observed data are actually inverted about the zero line. Thus, the observed offset is solely due to differing assumptions concerning the heave series.

Table 3.2 Characteristics of computer simulated wave data

Wave Train No.	Heave amplitude (m)	Tilt amplitude (deg)	Period (sec)	Initial phase (deg)	Wave direction (deg)
	0.1143	1.07	10.64	85	000
1	0.1524	1.37	11.10	85	000
	0.1143	0.99	11.60	85	000
	0.1143	1.99	5.74	90	120
2	0.1524	2.59	5.88	90	120
	0.1143	1.90	6.01	90	120

Since in the case of simulated data there is an offset of 180^o between directions computed by BUOY-D-P and 1156DBP, we cannot but conclude that the apparent consistency in the results in the case of observed data is by chance only. Application of empirically obtained frequency dependent amplitude and phase corrections, as suggested by LeBlanc and Middleton [1982] and incorporated in 1156DBP, might show the offset in the case of observed data also.

When we ran 1156DBP with computer simulated data using either a mono-chromatic train, or a multi-chromatic wave train whose component sinusoids were all from just one uniform direction, we observed an artifact of a backward travelling wave located in the higher frequencies. With BUOY-D-P, such an artifact was not present. The artifact of a backward travelling wave was observed by LeBlanc and Middleton [1982].

For the record, we may mention that the paper of Brainard [????] is unpublished. A CD/ROM computer search through the Aquatic Sciences and Fisheries Abstracts (ASFA) database did not list this particular article, though it listed several articles by the same author, including some apparently earlier work and some apparently later work.

The work reported here on determination of the wave directional spectrum from an orbital following buoy using the digital band pass filter method has been published in Fernandes et al.

Table 3.3 Analysis of computer simulated wave data with characteristics given in Table 3.2. Number of points, 2048; sampling interval, 0.5 sec

Band No.	Centre Frequency (Hz)	Centre Period (sec)	Software BUOY-D-P Energy (m^2/Hz)	Software BUOY-D-P Dir (deg)	Software BUOY-D-P Std Dev (deg)	Software 1156DBP Energy (m^2/Hz)	Software 1156DBP Dir (deg)	Software 1156DBP Std Dev (deg)
1	0.03	33.33	0.00	053	084	0.00	233	001
2	0.04	25.00	0.00	043	059	0.00	219	001
3	0.05	20.00	0.00	033	050	0.00	203	001
4	0.06	16.67	0.00	024	031	0.00	194	001
5	0.07	14.29	0.00	016	013	0.01	187	001
6	0.08	12.50	0.10	005	003	0.05	182	001
7	0.09	11.11	3.41	001	002	2.33	180	000
8	0.10	10.00	0.18	354	002	0.05	180	001
9	0.11	9.09	0.00	342	006	0.00	197	003
10	0.12	8.33	0.00	334	036	0.00	289	005
11	0.13	7.69	0.00	349	072	0.00	317	003
12	0.14	7.14	0.00	131	020	0.00	318	003
13	0.15	6.67	0.00	128	003	0.00	315	003
14	0.16	6.25	0.09	122	001	0.05	310	006
15	0.17	5.88	3.30	120	000	2.26	307	010
16	0.18	5.56	0.21	119	001	0.11	199	009
17	0.19	5.26	0.00	115	002	0.01	148	006
18	0.20	5.00	0.00	112	006	0.01	133	003
19	0.21	4.76	0.00	110	007	0.00	125	001
20	0.22	4.55	0.00	108	011	0.00	117	001
21	0.23	4.35	0.00	106	012	0.00	115	000
22	0.24	4.17	0.00	105	013	0.00	114	000
23	0.25	4.00	0.00	103	018	0.00	109	000
24	0.26	3.85	0.00	102	010	0.00	109	000
25	0.27	3.70	0.00	102	009	0.00	107	000

[1994].

Chapter 4

SAR

Radar is an active microwave sensor that measures by remote sensing the backscatter from the sea surface and generates a 2-dimensional synoptic image of the wavy sea surface. When mounted on an aircraft or a satellite it is known as Side Looking Airborne Radar (SLAR) or Synthetic Aperture Radar (SAR) respectively. SAR can give a description of the waves over a large area, each image being as large as $100X100\ Km^2$ in case of SEASAT and ERS-1 and ERS-2 satellites. The above satellites are polar orbiting satellites which give global, repettitive, day and night and all weather coverage. SAR is the modern method for determining the wave directional spectrum.

Some fundamental information about radars, including synthetic aperture radar, is given in Chapter 4.1. A review of literature on SAR is given in Chapter 4.2.

Gaussian smoothed SAR image spectra have been evaluated from 512X512 pixel sub-scenes of image mode ERS-1 SAR scenes off Goa, Visakhapatnam, Paradeep and Portugal. The two recently acquired scenes off Portugal showed the signature of swell of wavelength $\approx 200m$ and internal waves of wavelength $> 400m$. Only internal waves of wavelength $> 400m$ were seen in the scene off Goa observed on 11 March 1992. The scenes off Visakhapatnam and Paradeep did not show any wave like features, the latter appearing to be of "white noise" nature. Chapter 4.3 describes our analysis of the above SAR image data.

There exists a 180^o ambiguity in wave direction observed from radar imageries. Based on the method of Atanassov et al. [1985], a computer program has been developed for removal of the 180^o ambiguity by using two images of the same area separated by a time interval which is small compared to the period of the dominant waves. The computer program has been successfully tested with computer simulated images. Chapter 4.4 describes our work on the problem of removal of the 180^o ambiguity.

The work reported here on the determination of Gaussian smoothed SAR image spectra from measured data off Paradip, Goa, Visakhapatnam and Portugal; and on the removal of the 180^o ambiguity in wave direction from radar imagery is presented in Fernandes et al. [1999] which has been communicated to “Photonirvachak”.

4.1 RADAR FUNDAMENTALS

Radar is an acronym for RAdio Detection And Ranging. Radars were developed during World War II for detecting enemy aircraft, specially at night. Radars use electromagnetic radiation (waves) in the microwave region of the spectrum to illuminate an object. All electromagnetic radiation travels at the same speed, the speed of light in free air, viz., $3X10^{10}\ cm\ s^{-1}$. Light is the visible part of the electromagnetic spectrum between the infrared and ultraviolet bands of the spectrum. The full electromagnetic spectrum which includes phenomena as diverse as X-rays, γ-rays, visible light, infrared heat rays, microwaves used in cooking as well as for terrestrial and satellite communication.

The velocity of light, c is given by

$$c = \nu\lambda$$

where ν is the frequency and λ is the wavelength. Since the speed of light is constant, we see that the frequency is inversely proportional to the wavelength.Thus wavelength or frequency is the distinguishing feature of electromagnetic radiation.

Regardless of its frequency, all electromagnetic radiation behaves alike. For most purposes it behaves like waves. Just like waves it can be refracted, diffracted or polarized, and it is shifted in frequency on reflection from a moving object (Doppler Effect). The only difference is the distance or scale over which the phenomena operate. If all dimensions are scaled by the wavelength of the radiation, then light cannot be distinguished from radio waves, and textbooks of optics can as claimed by Stewart [1985] be used to predict the propagation of radio signals.

As suggested above, electromagnetic radiation can be divided into two classes. The lowest frequencies are known as the radio bands. Radio bands are characterized by coherent sources of radiation, with modulation rates that are a significant fraction of the frequency, and is received by equipment that observes the phase of the radiation. Table 4.1 gives the modern nomenclature of the different radio bands. In contrast with the radio bands, the highest frequencies are the light beams. Light beams are characterized by either incoherent sources of radiation or by coherent sources of radiation with relatively low rates of modulation, and are received by equipment that detect the square of the amplitude of the signal, rather than its phase [Stewart, 1985].

Common modes of polarization used include VV (Vertical polarization at transmission and Vertical polarization at reception), HH (Horizontal polarization at transmission and Horizontal polarization at reception), and right-hand and left-hand circular polarization.

Table 4.1 Modern nomenclature of radio frequency bands. Extracted from Stewart [1985]

Band	Frequency range	Metric subdivision	Adjectival designation
2	30 to 300 Hz	Megametric waves	ELF Extremely low frequency
3	300 to 3000 Hz		VF Voice frequency
4	3 to 30 KHz	Myriametric waves	VLF Very low frequency
5	30 to 300 KHz	Kilometric waves	LF Low frequency
6	300 to 3000 KHz	Hectometric waves	MF Medium frequency
7	3 to 30 MHz	Dekametric waves	HF High frequency
8	30 to 300 MHz	Metric waves	VHF Very High frequency
9	300 to 3000 MHz	Decimetric waves	UHF Ultra high frequency
10	3 to 30 GHz	Centimetric waves	SHF Super high frequency
11	30 to 300 GHz	Millimetric waves	EHF Extremely high frequency
12	300 to 3000 GHz	Decimillimetric waves	- Far infrared

Table 4.2 World War II nomenclature of microwave bands. Extracted from Stewart [1985]

Band	Frequency range [Gigahertz]	Band	Frequency range [Gigahertz]
P	0.225-0.390	K	10.90-36.00
L	0.390-1.550	Q	36.0-46.0
S	1.55-5.20	V	46.0-56.0
C	3.90-6.20	W	56.0-100.0
X	5.20-10.90		

Common modes of modulation are amplitude modulation (AM) and frequency modulation (FM), both of which are used in radio broadcasts. In amplitude modulation, the power of the carrier wave is varied in accordance with the message being carried, while in frequency modulation, the carrier frequency is varied in response to the message being carried. FM is used in satellite communication because FM requires less power for long range transmission, and is also unaffected by the problem of picking up static associated with AM. In FM the amount of information that can be relayed is given by the bandwidth, i.e., the frequency range of the carrier. For example a TV Message relayed in the frequency range 54 to 58.2 MHz, has a bandwidth of 4.2 MHz. This bandwidth is spread out to as much as 36 MHz for quality satellite broadcasts. Voice channels in contrast require a bandwidth of only 3 to 4 KHz for quality sound reproduction.

Microwaves penetrate through clouds and to some extent rain also [Ulaby et al., 1981].

As mentioned by Baylin et al. [1993] higher frequency radio waves have the potential for relaying larger quantities of information, because as the frequency increases, any given bandwidth becomes a smaller fraction of the FM carrier wave frequency. Microwave transmissions to satellites or between earth based line of sight relay stations are not susceptible to noise from atmospheric disturbances as are lower frequency transmissions. Several times a year for a period of 2–3 days short wave radios fail due to sun spot activity which disturbs the required reflection of these relatively low frequency waves by the ionosphere. Below frequencies of about 30 MHz, a radio wave will be reflected back from the ionosphere. Since microwave frequencies are far above 30 MHz, they easily pass through the ionosphere shield, whence their usefulness in satellite communication and earth observation.

Table 4.2 gives the nomenclature of the different bands that make up the microwave part of radio frequency bands. Besides being used in all types of radars including Synthetic Aperture Radar mounted on satellites, microwaves are also used in transponders on communication satellites. In the sport of cricket, radars are used to measure the speed of the ball delivered by a fast or medium fast bowler. It is common to talk of X-, C-, L-Band radars or S-Band transponders. Subband designations designated by lower case letters are less frequently used except in case of K-Band. For example K_u-Band relays in communication satellites typically uplink from 13.7 to 14.2 GHz and downlink from 11.7 to 12.2 GHz.

The Synthetic Aperture Radar, on board ERS-1 satellite operates (images) at C-Band. S-Band links are used to control the ERS-1 satellite: downlink telemetry reception and uplink telecommand to be performed by European Space Agency (ESA) earth stations. And the data transmission from ERS-1 to the earth stations is done in X-Band. The radar altimeter on ERS-1 operates at K_u-Band.

4.1.1 Doppler Effect

A property of electromagnetic radiation (EMR), which is utilized in radars is the Doppler Effect. As given in Suits [1983], if a source of EMR having a fixed frequency, ν, either approaches or recedes from an observer, the observer will receive radiation from the source at a different frequency, ν', where ν' is greater than ν for approaching sources and is less than ν for receding sources. This alteration of EMR frequency caused by relative motion between source and observer is called *Doppler Effect* and is given by

$$\nu' = \frac{\nu(1-\beta^2)^{1/2}}{1-\beta\cos\theta}$$

where β is the ratio of the source velocity to the propagation velocity of EMR, and θ is the angle between the direction of motion of the source and the line connecting the source and the observer. When $\beta \ll 1$ as in the case of aircraft and satellites, the above equation becomes simply

$$\Delta\nu = \frac{\nu u}{c}\cos\theta = \frac{u\cos\theta}{\lambda}$$

where u is the relative velocity between source and receiver; c is the velocity of EMR, and λ is the wavelength of the EMR.

The total change in frequency from that emitted to that received back at the aircraft or satellite is twice as much as in a single Doppler shift and is given by

$$\Delta\nu = \frac{2u}{\lambda}\cos\theta \tag{4.1}$$

A derivation of (4.1) as given in Moore [1983] is reproduced below.

The cause of the Doppler shift is the change of the phase of the signal due to relative motion in addition to the normal change in phase due to transmission, i.e., propagation. The instantaneous phase shift of a signal returned to a radar, ϕ neglecting phase shifts in the reflection process, is given by

$$\phi = \omega_c t - \kappa_c(2R) = \omega_c t - 4\pi R/\lambda_c$$

where ω_c is the angular carrier frequency, κ_c is the carrier wavenumber and λ_c is the carrier wavelength.

If there is no relative motion, the angular frequency, ω, which is the rate of change of phase is given by

$$\omega = \frac{d\phi}{dt} = \omega_c$$

In presence of relative motion,

$$\omega = \omega_c - \frac{4\pi}{\lambda_c}\frac{dR}{dt} = \omega_c - \frac{4\pi u_R}{\lambda_c}$$

In terms of frequency f, and carrier frequency f_c, the above formula may be written as,

$$2\pi f = 2\pi f_c - \frac{4\pi u_R}{\lambda_c}$$

i.e.,

$$f = f_c - \frac{2u_R}{\lambda_c}$$

i.e., $f = f_c + f_D$, where the Doppler shift in frequency, f_D is given by (4.2),

$$f_D = -\frac{2u_R}{\lambda_c} \tag{4.2}$$

which is the same as (4.1). In the above derivation of (4.2), u_R is the relative velocity, or the rate of change of R. And the factor 2 in above equations is due to the round trip distance involved in radar. For Doppler Effect in one way transmission this factor is not present.

4.2 SAR REVIEW

The first Synthetic Aperture Radar (SAR) was flown aboard the short lived SEASAT, the first satellite dedicated to the study of the oceans. A review of SEASAT performance is given in the book edited by Allan [1983]. Allan's article therein reports that the SEASAT SAR imaged ocean waves, internal waves, slicks and streaks. Articles by D. W. S. Lodge and N. H. Kenyon therein reported that SEASAT SAR imaged large scale marine bedforms like sand banks and sand waves and was useful in identifying the direction of current flows and in indicating whether the flood or ebb current is dominant. One of SEASAT SAR mission's objectives was to detect sea and fresh water ice and to map snow cover.

Johannessen et al. [1994] report that ERS-1 SAR has imaged horizontal roll vortices in the atmosphere, atmospheric gravity waves, wind and current fronts, wind direction, rain cells, eddies, sea ice, internal waves, slicks and surface wind waves, specially swell. SAR is also useful for ship detection.

Ocean waves are weakly imaged and can be recognized from SAR imagery from their fine "finger print" like signature. In contrast with ocean waves, internal waves and bathymetric features are more strongly imaged.

The mechanism for imaging of long ocean waves/ internal waves by all types of radar including ship radar, Side Looking Airborne Radar (SLAR) or Real Aperture Radar (RAR) mounted on aeroplanes, and Synthetic Aperture Radar (SAR) mounted on satellites, is by modulation of the back-scatter from short Bragg resonant capillary-gravity waves by the long gravity waves/ internal waves. For Bragg scattering to be effective the radar incidence angle with respect to the vertical is generally between 20 and 70^o. At near zero degrees or nadir incidence, specular reflection dominates while at angles larger than 70^o, "shadowing" effect dominates.

The theory of imaging of longer ocean waves by all types of radar is discussed in terms of the 'Two-scale' model in which the sea surface is treated as a superposition of short Bragg scattering ripples superimposed on the longer gravity waves and was pioneered by Wright [1968], Valenzuela [1968], Keller and Wright [1975] and Alpers and Hasselmann [1978]; and is applied locally in a reference system lying in the tangent plane ('facet') of the long waves. Three processes contribute to ocean wave imaging by radar, the first two of which are common to both RAR and SAR, while the third is a feature solely of SAR: [i] the changes caused by the long wave slope, in the effective angle of incidence relative to the local facet normal (electromagnetic interactions or tilt modulation), [2] the modulation of the energy of the short Bragg scattering ripples through interactions between the ripple waves and the long gravity waves (hydrodynamic interactions or modulation), and [3] the temporal variation in facet position and the Bragg scattering coefficients of the facets during the finite integration time in which SAR sees the facet (motion effects or velocity bunching). A review of the theory of imaging of ocean waves by SAR is given in Hasselmann et al. [1985].

Alpers and Hennings [1984] give a theory of imaging of underwater bottom topography by real and synthetic aperture radar, while Alpers [1985] gives the theory of imaging of internal waves by radar.

Being an active microwave sensor SAR has an all-weather, day/night capability. High resolution in range (across track) direction is achieved by transmitting very short pulses to illuminate the sea surface. High resolution in azimuthal (along track) direction is achieved by using the forward motion of the satellite to synthesize an aperture of very great length.

A review of work done on measurement of ocean waves from space is given in Beal et al. [1991].

Determination of the wave directional spectrum from image mode SAR imagery off the coast of India has been previously reported by Kumar et al. [1996], Kumar et al. [1997] , Sarma [1997] and Kumar et al. [1999]. Mahadevan et al. [1990] are the pioneers in India in the field of ocean wave imaging by SAR.

4.3 SAR MEASUREMENTS

Digital ERS-1 image mode SAR scenes off Paradeep (observed on 31 May 1996), Goa (11 March 1992) and Visakhapatnam (2 December 1997), were purchased from the National Remote Sensing Agency (NRSA), Hyderabad with the intention of studying the spatial evolution of directional ocean wave spectra. The NRSA supplied the scenes off Goa and Paradeep, including header and trailer files on 1/2" Computer Compatible Tape (CCT). The scene off Visakhapatnam was supplied on CDROM. The image data was 8-bit and comprised of 6801 lines each of 6680 pixels. The line/pixel spacing is 15m as given in the header files.

Monaldo and Lyzenga [1986] give the methodology for evaluating the directional ocean wave spectra of 512X512 or 256X256 pixel sub-scenes drawn from the full imagery, according to which the following steps of computation have to be performed: (i) fractional modulation; (ii) 2-dimensional Fourier transform, which transforms the data from spatial domain to wave number domain; (iii) a fourth-order stationary response correction, to make allowance for azimuthal and range fall off in energy; (iv) Gaussian smoothing with a 15X15 kernel; (v) speckle noise removal; (vi) tilt and velocity bunching modulation transfer function (correction). The spectrum obtained on performing each of the steps (ii) through (v) is known as the SAR image spectrum. The spectrum obtained on completion of step (vi) is known as the wave directional spectrum, viz., wave height spectrum or wave slope spectrum depending on whether normalization with wave number is done or not. It has been found prudent by Beal [1981] to perform Gaussian smoothing with a 3X3 kernel prior to step (iii) above so as to obtain stable results when stationary response correction is performed.

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Figure 4.1 SAR full image off Paradeep on 31 May 1996

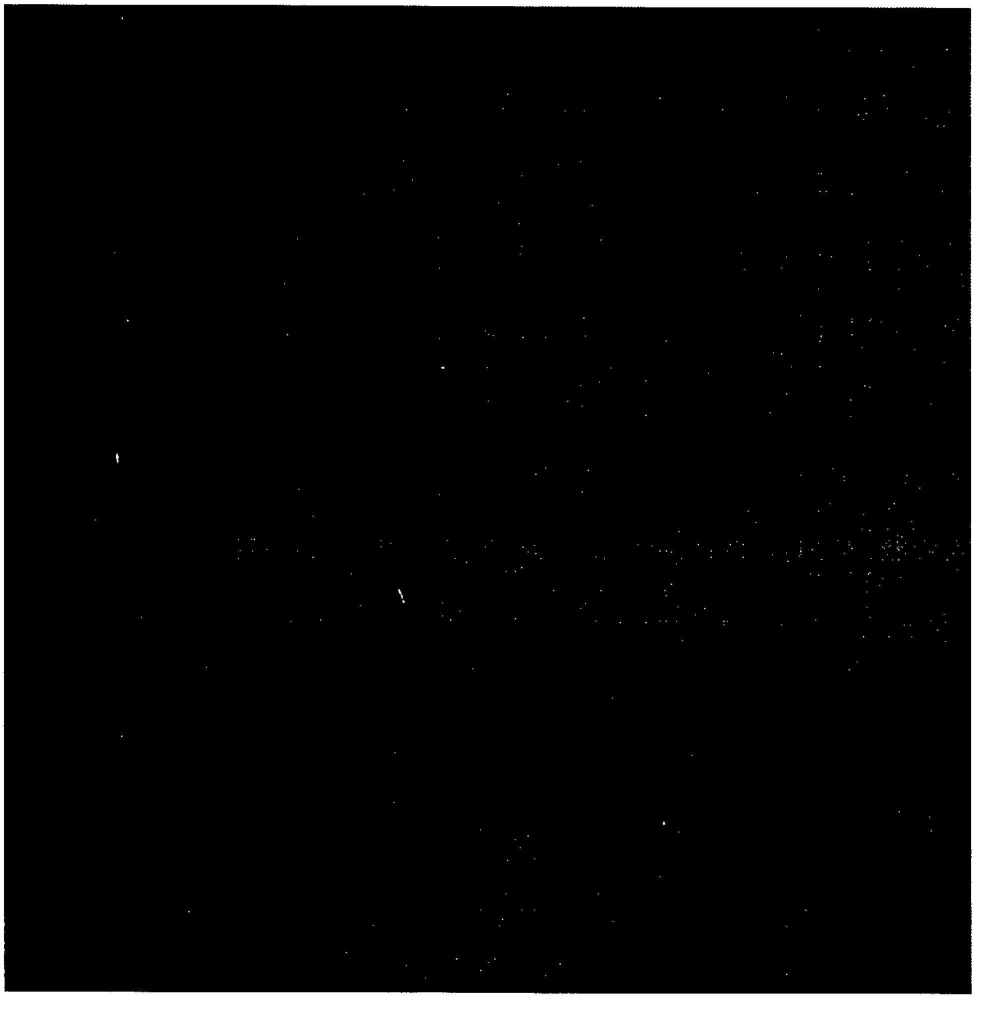


Figure 4.2 512X512 SAR sub-scene off Paradeep on 31 May 1996

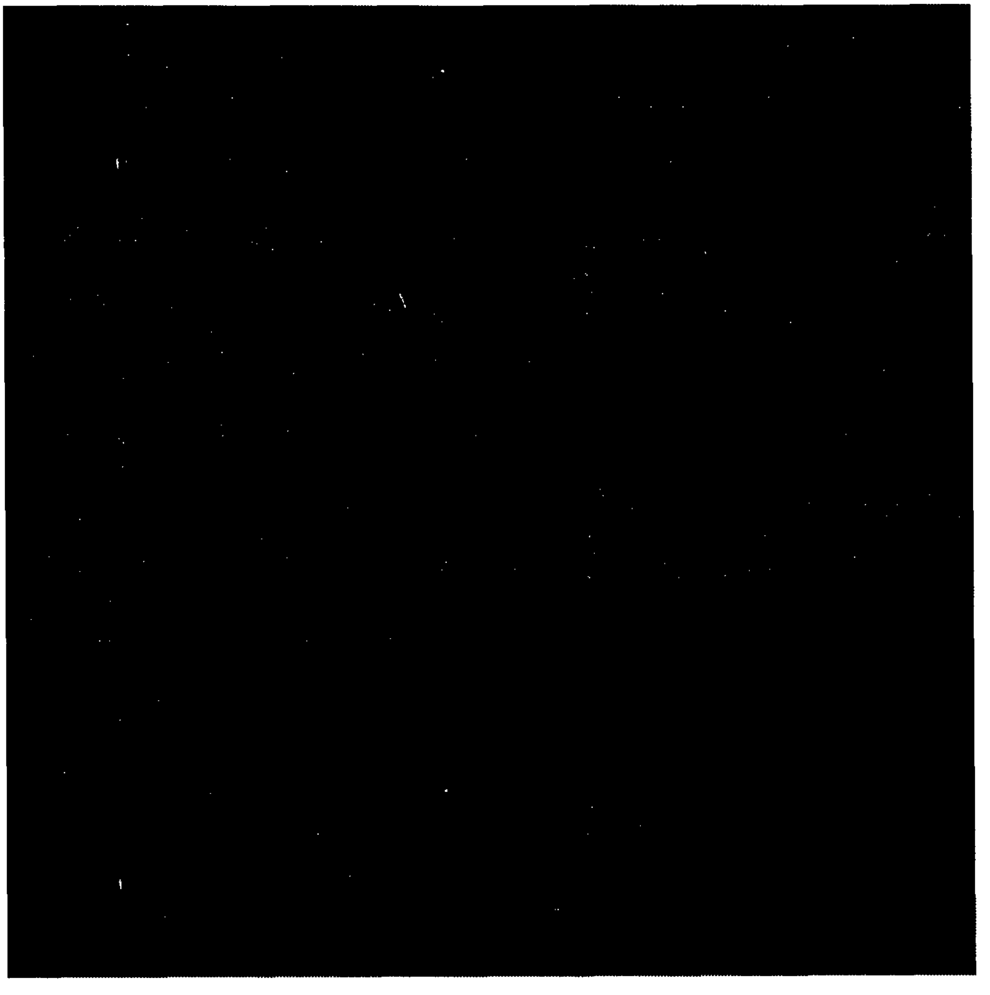


Figure 4.3 SAR image spectrum of512X512 SAR sub-scene off Paradeep on 31 May 1996. Circles denote wavelengths of 50, 100, 200, 300 and 400m

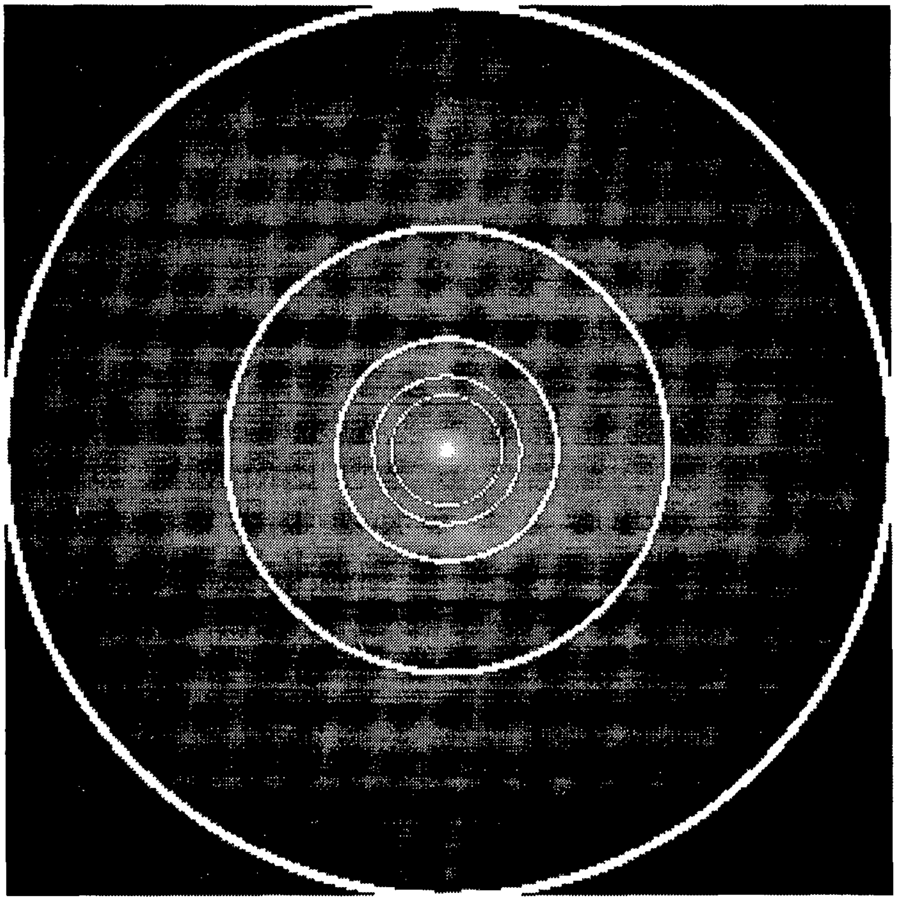


Figure 4.4 SAR full image off Goa on 11 March 1992

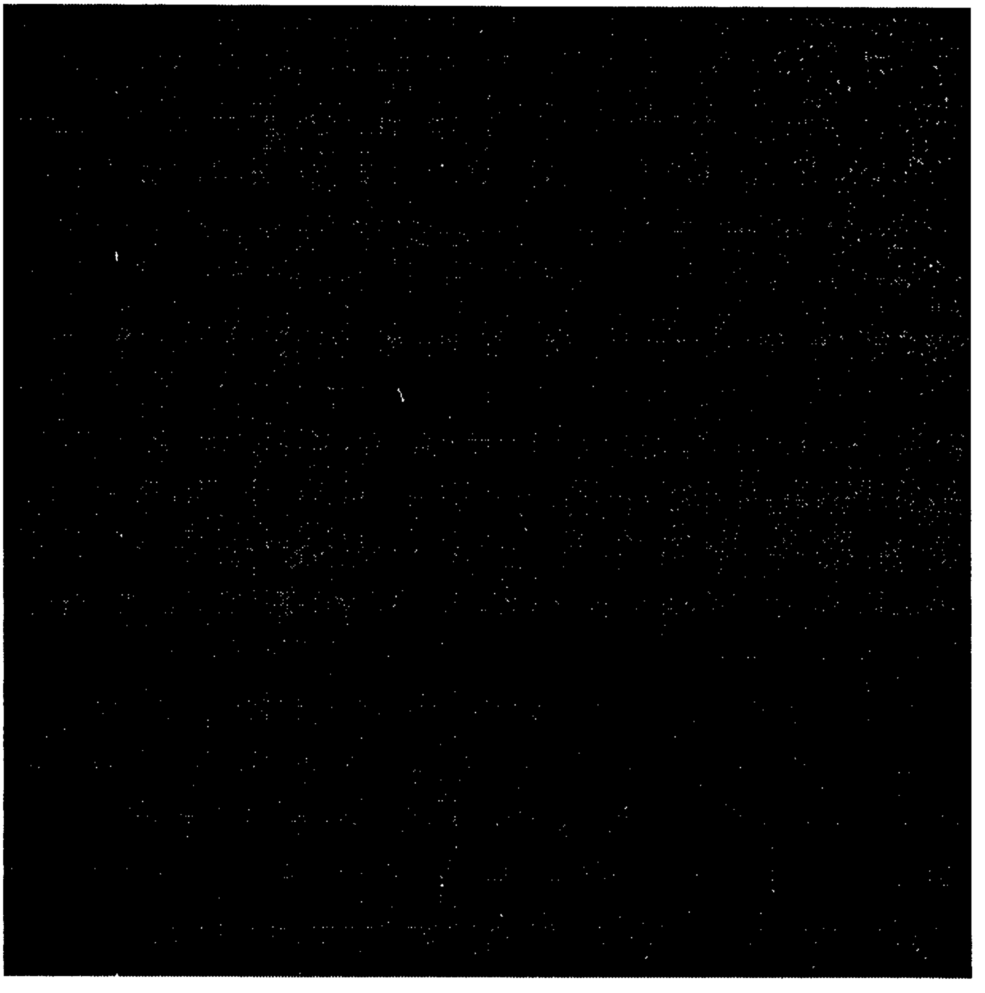


Figure 4.5 512X512 SAR sub-scene off Goa on 11 March 1992

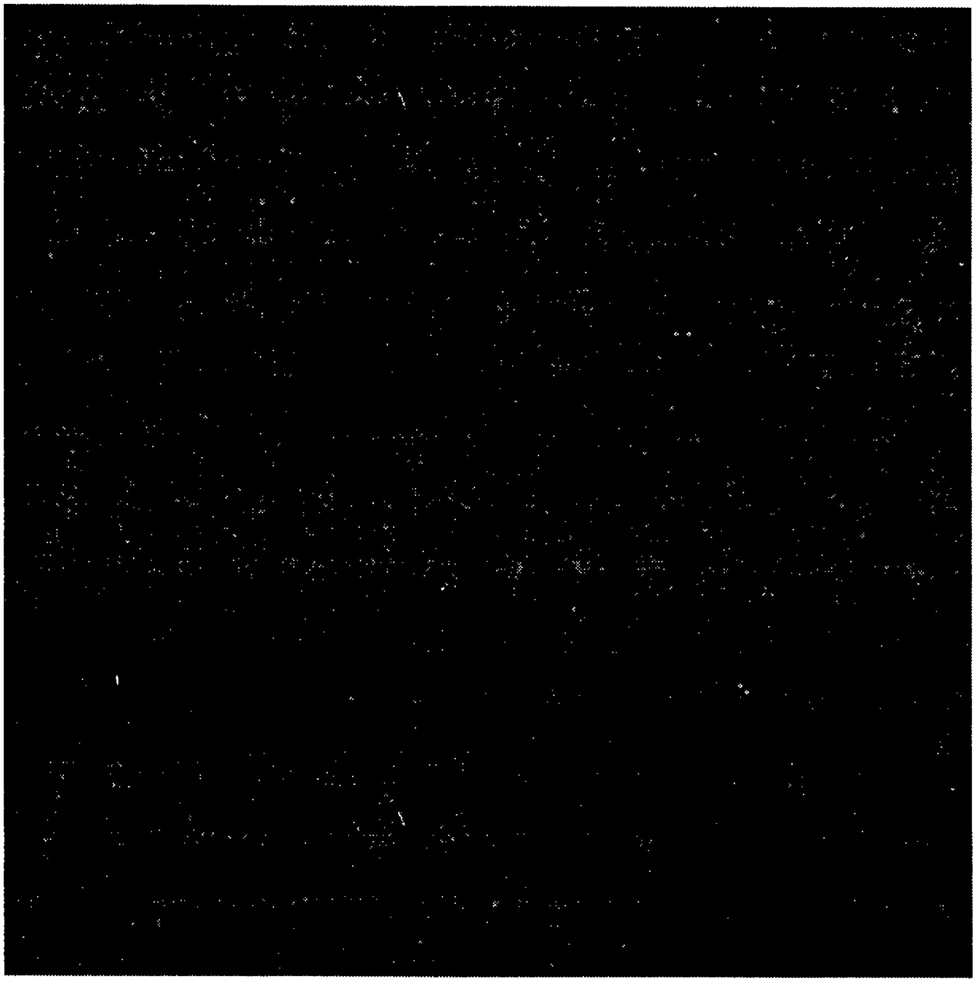


Figure 4.6 SAR image spectrum of512X512 SAR sub-scene off Goa on 11 March 1992. Circles denote wavelengths of 50, 100, 200, 300 and 400m

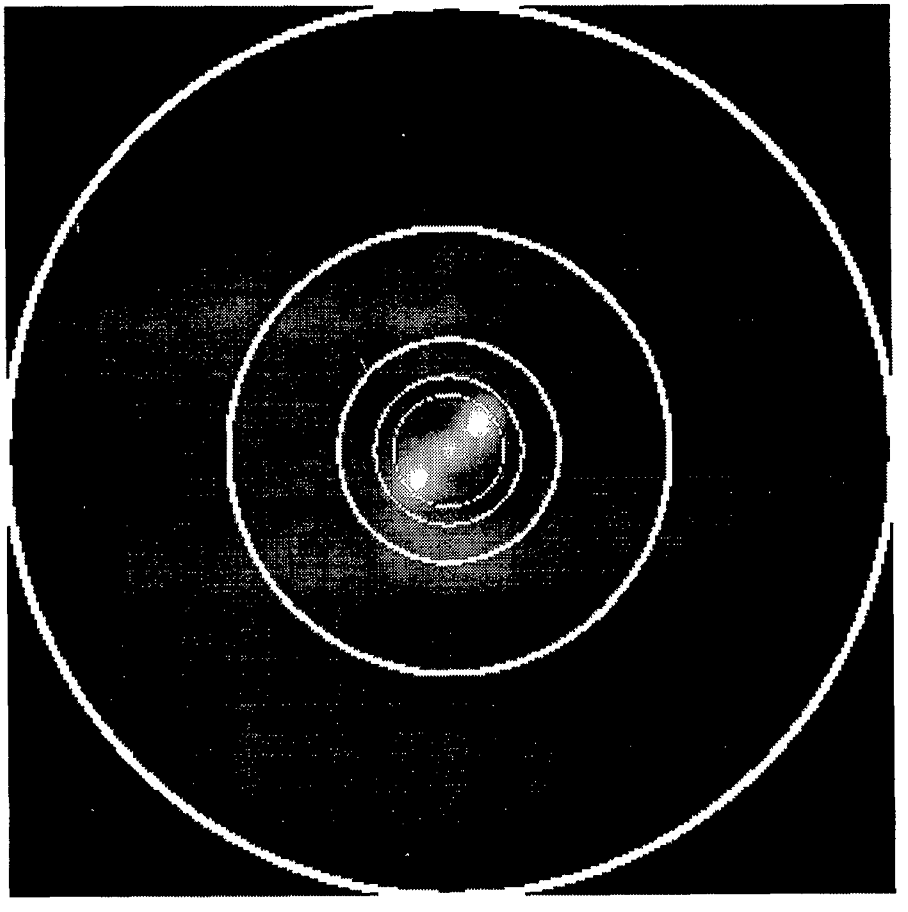


Figure 4.7 SAR full image off Visakhapatnam on 2 December 1997

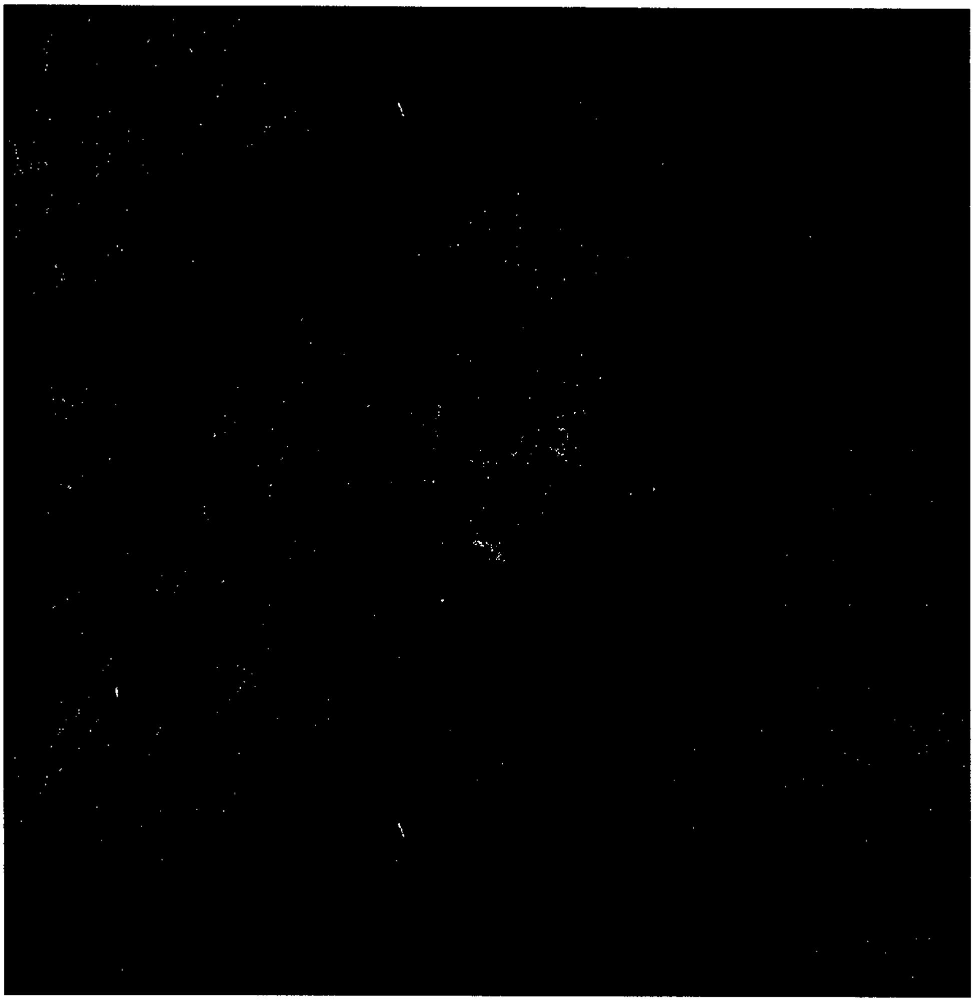


Figure 4.8 512X512 SAR sub-scene off Visakhapatnam on 2 December 1997

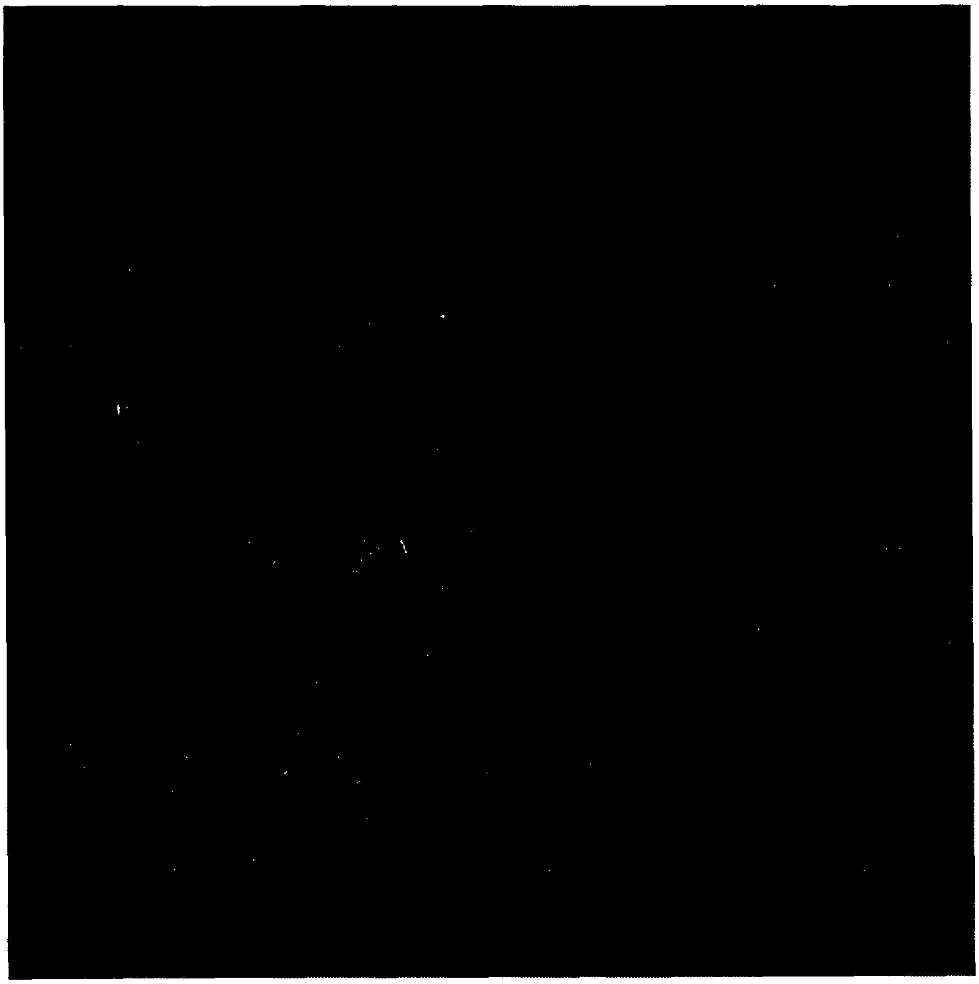


Figure 4.9 SAR image spectrum of512X512 SAR sub-scene off Visakhapatnam on 2 December 1997. Circles denote wavelengths of 50, 100, 200, 300 and 400m

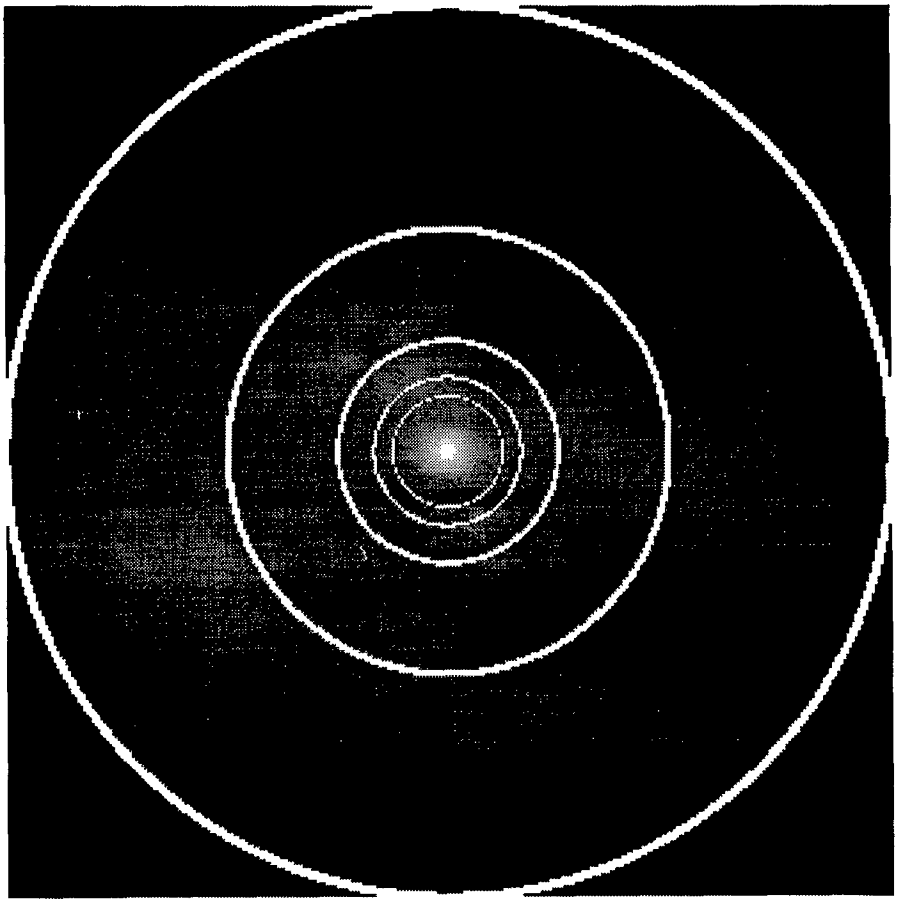


Figure 4.10 SAR full image off Portugal (p023-747)

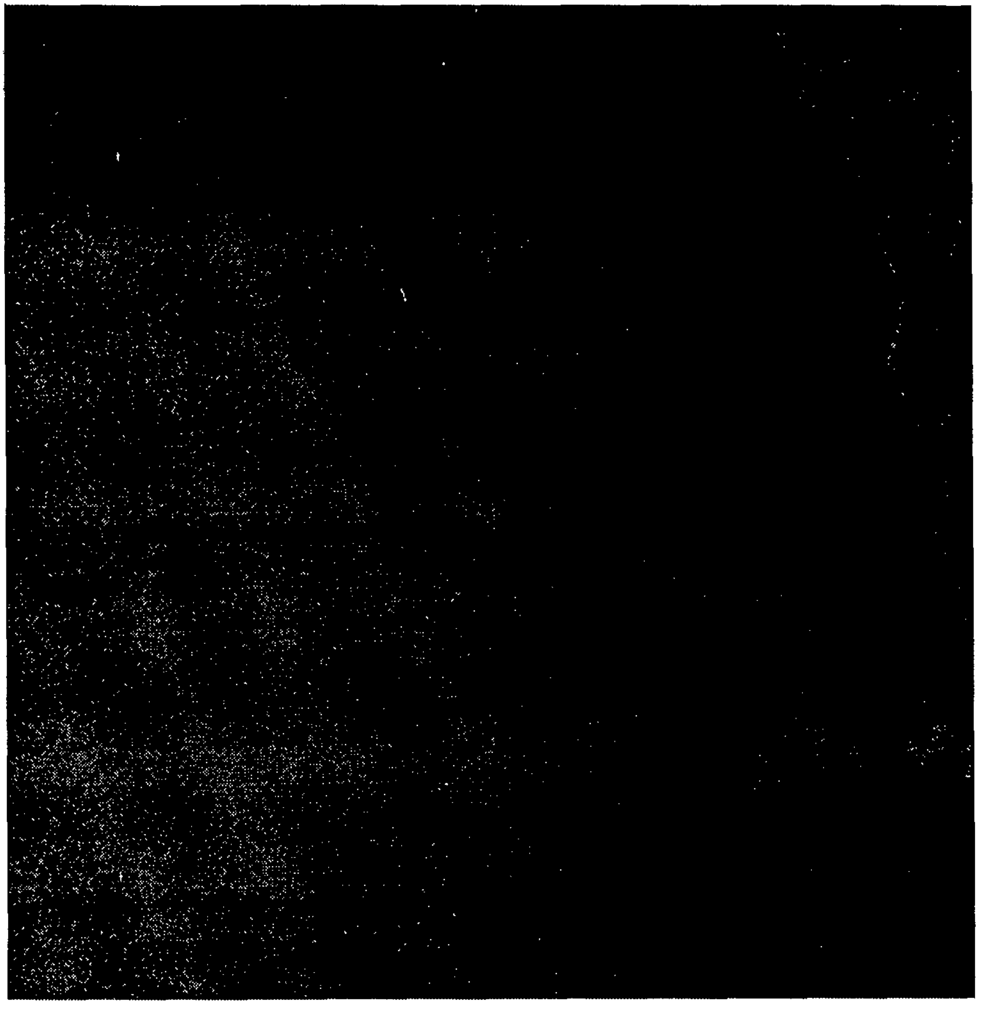


Figure 4.11 512X512 SAR sub-scene 'a' off Portugal (p023-747)

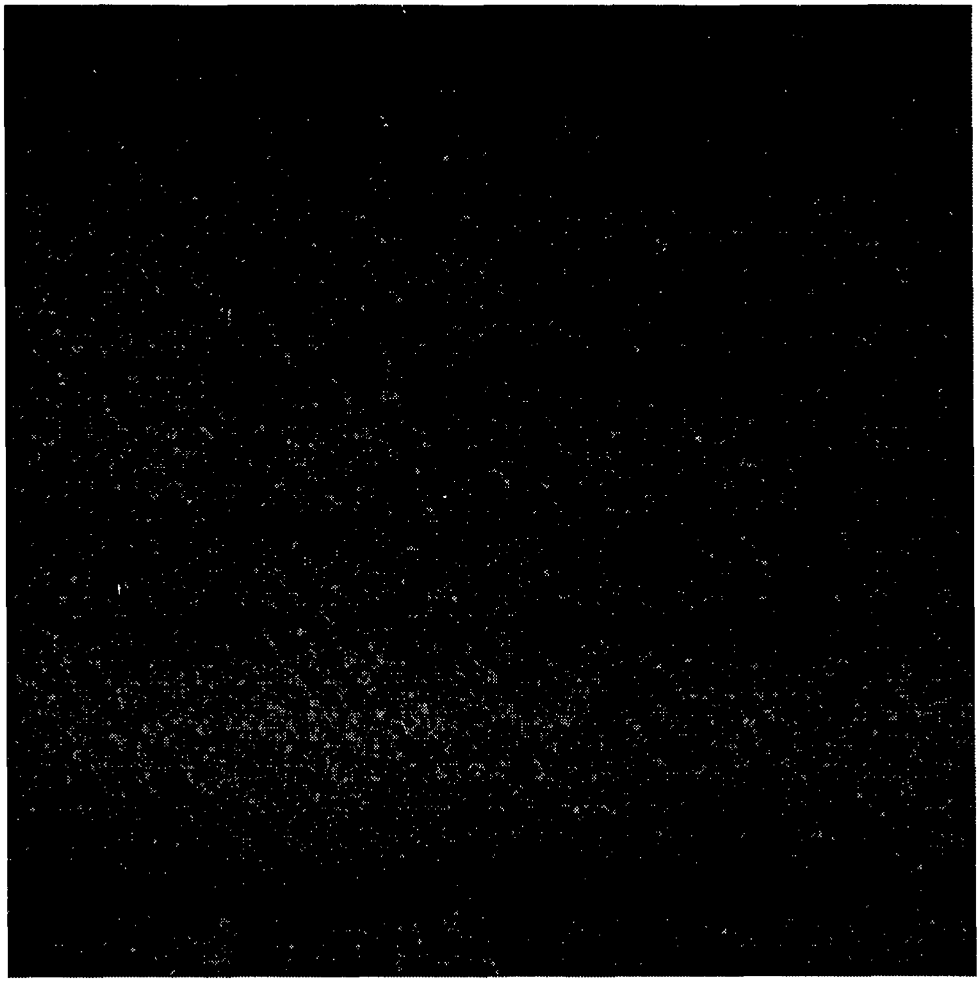


Figure 4.12 SAR image spectrum of 512X512 SAR sub-scene 'a' off Portugal (p023-747). Circles denote wavelengths of 50, 100, 200, 300 and 400m

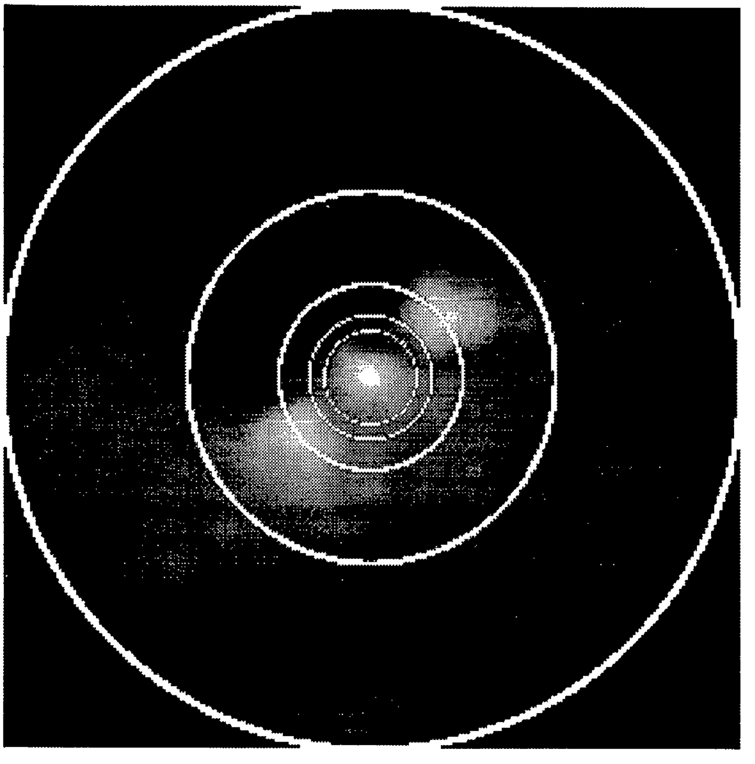


Figure 4.13 512X512 SAR sub-scene 'b' off Portugal (p023-747)

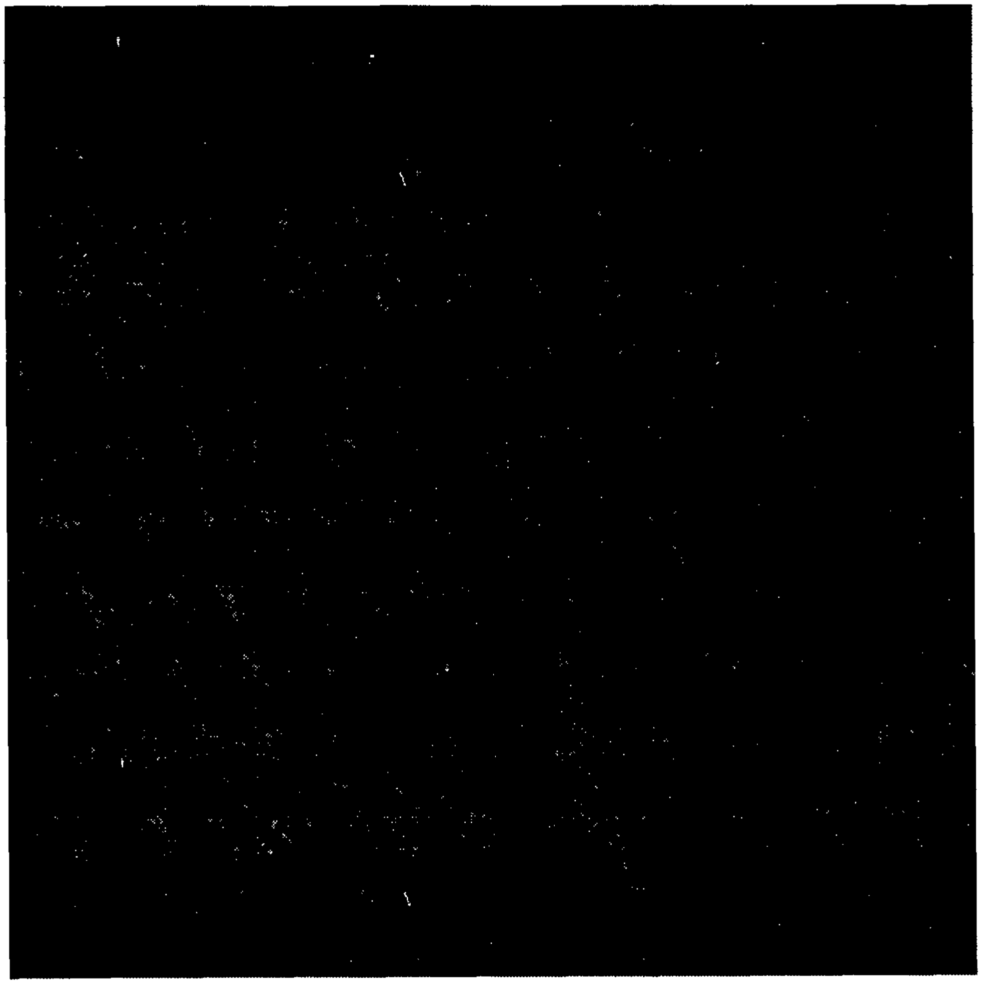


Figure 4.14 SAR image spectrum of 512X512 SAR sub-scene 'b' off Portugal (p023-747). Circles denote wavelengths of 50, 100, 200, 300 and 400m

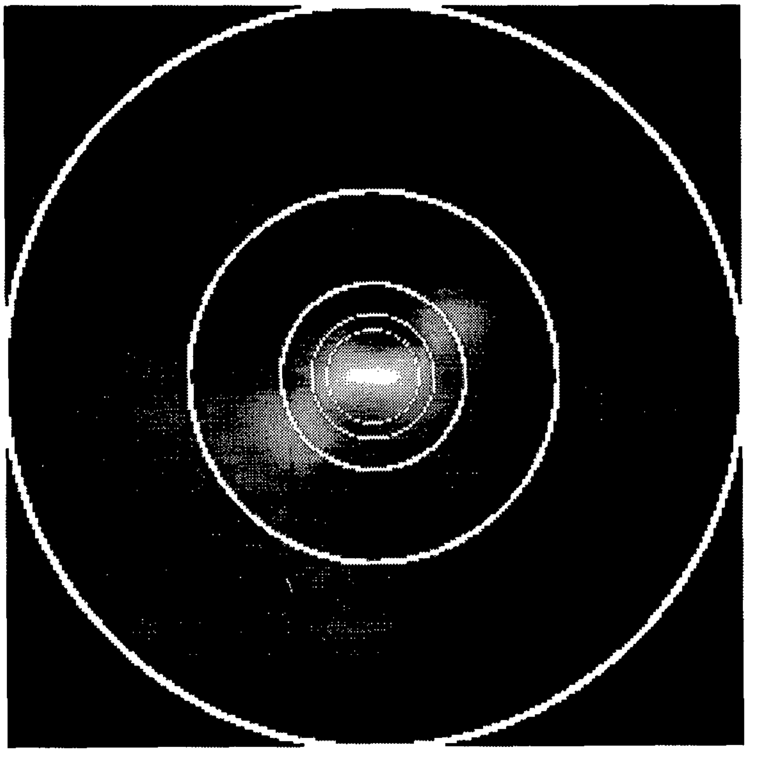


Figure 4.15 SAR full image off Portugal (p023-783)

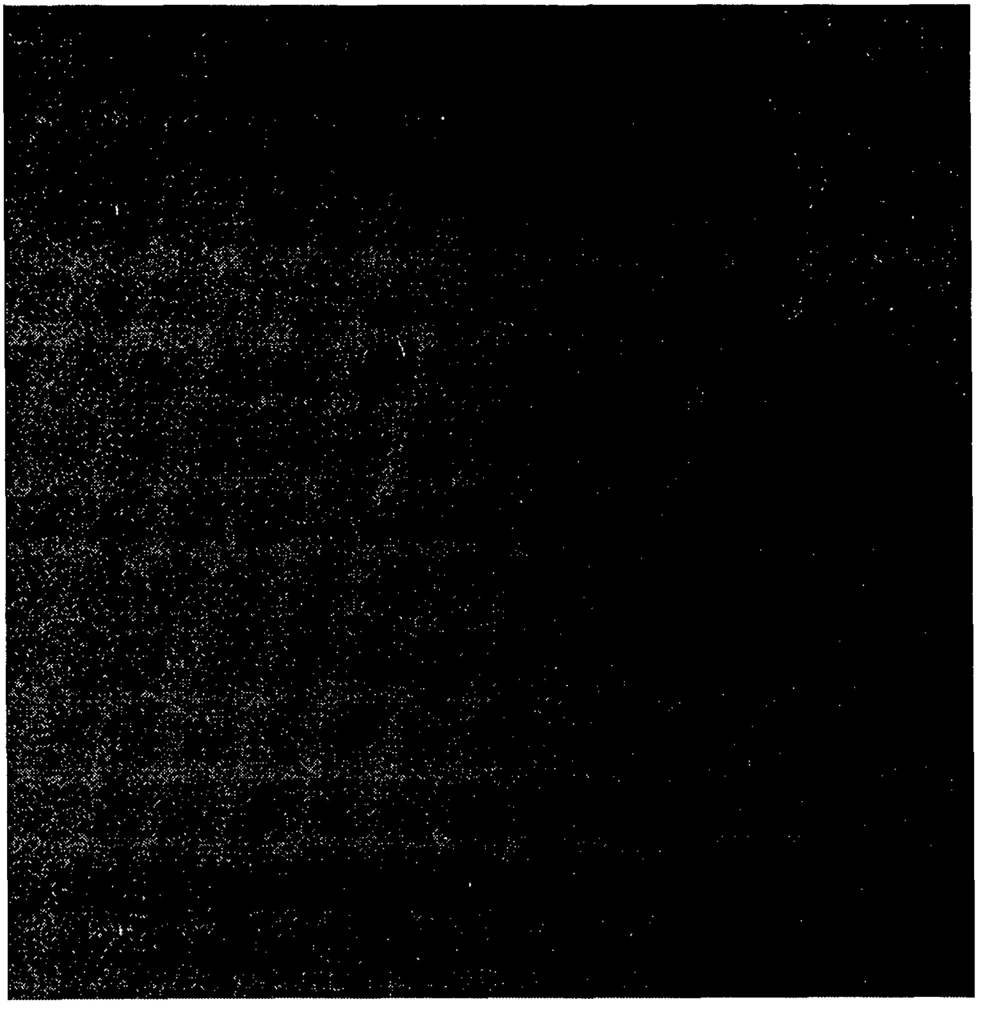


Figure 4.16 512X512 SAR sub-scene 'a' off Portugal (p023-783)

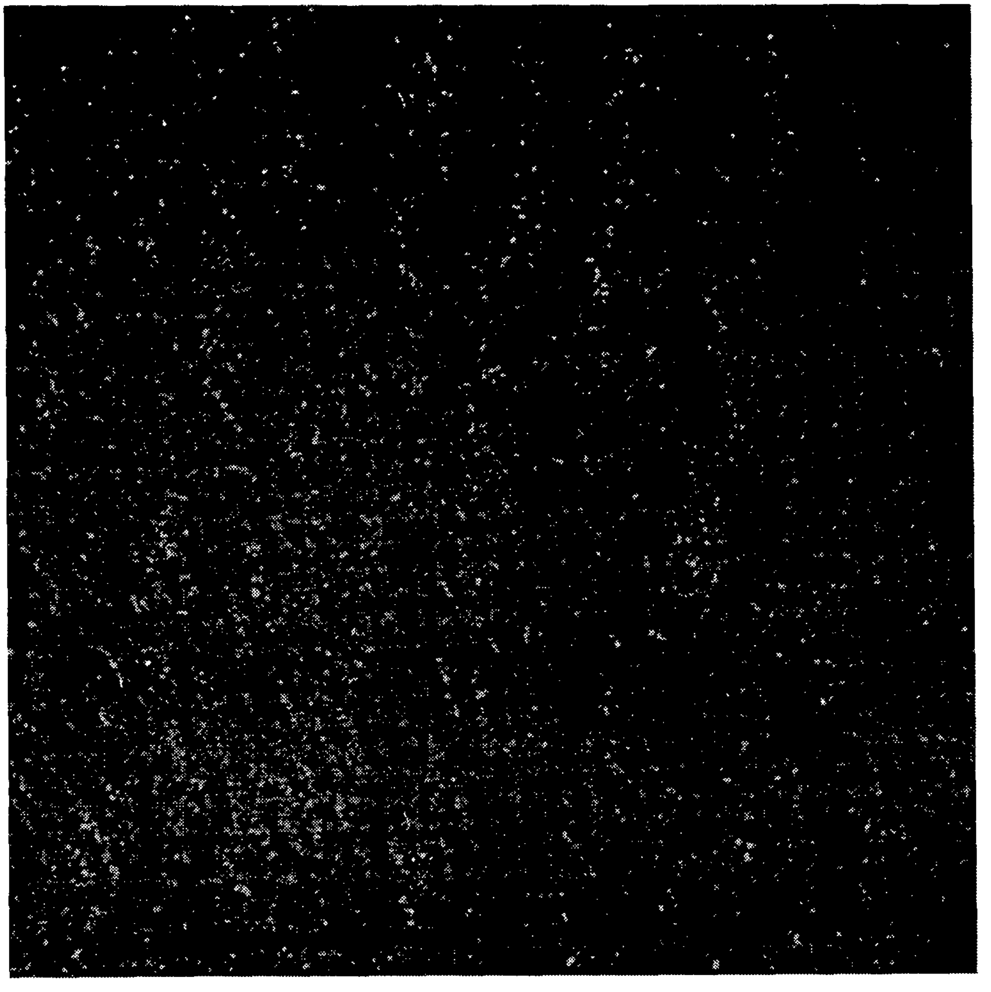


Figure 4.17 SAR image spectrum of 512X512 SAR sub-scene 'a' off Portugal (p023-783). Circles denote wavelengths of 50, 100, 200, 300 and 400m

Figure 4.18 512X512 SAR sub-scene 'b' off Portugal (p023-783)

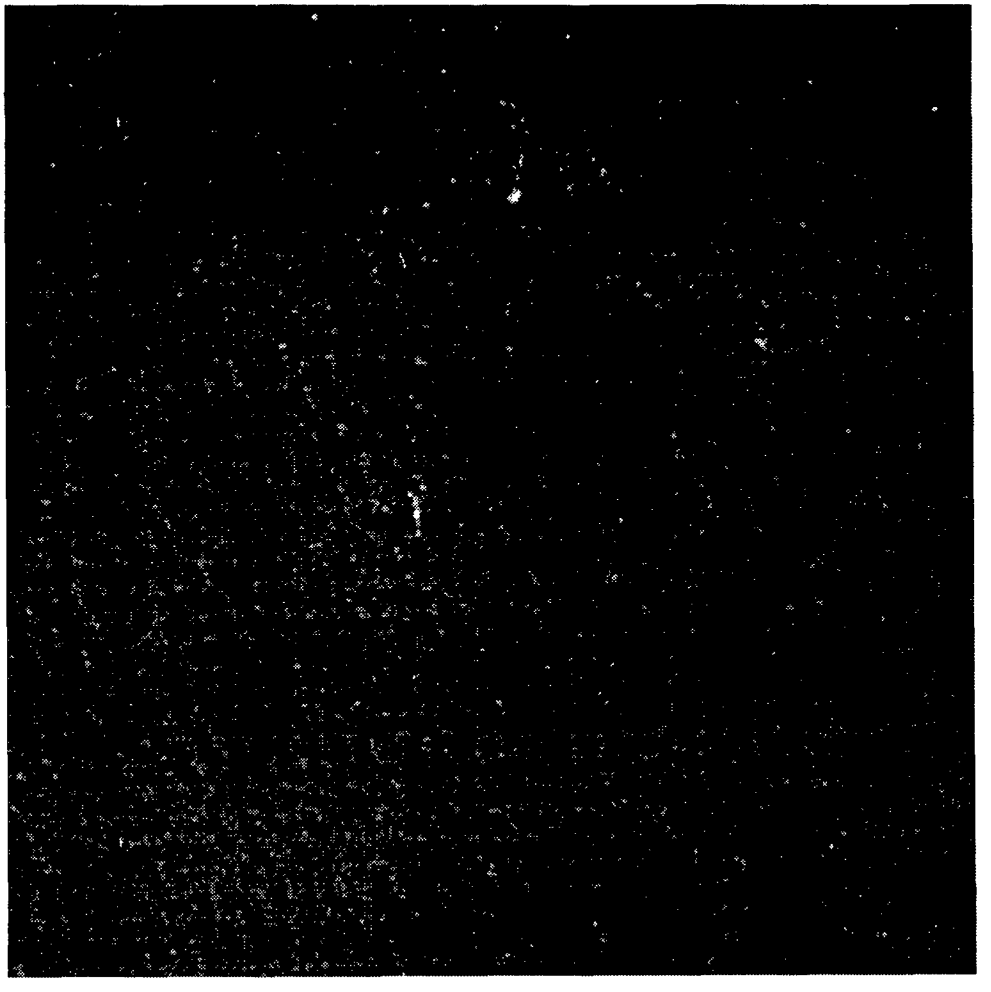


Figure 4.19 SAR image spectrum of 512X512 SAR sub-scene 'b' off Portugal (p023-783). Circles denote wavelengths of 50, 100, 200, 300 and 400m

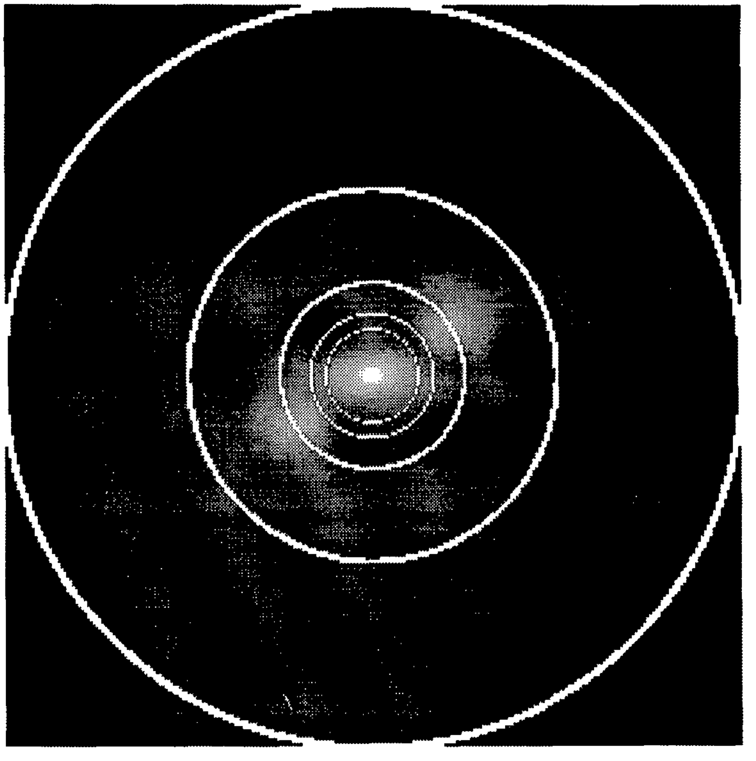


Table 4.3 Sea-truth (short term wave statistics) observed with an ENDECO wave directional buoy off Goa, and with a DATAWELL wave directional buoy off Visakhapatnam and Paradeep. H_s and T_z are the significant wave height (mean of the highest 1/3 waves) and the zero-crossing period (mean period) respectively; T_p and θ_p are the wave period and wave direction respectively corresponding to the principal peak in the energy spectrum; T'_p and θ'_p are the wave period and wave direction respectively corresponding to the secondary peak in the energy spectrum; † indicates time of wave buoy observation nearest to the time of ERS-1 satellite overpass

Location	Date	Time (IST)	H_s (m)	T_z (s)	T_p (s)	θ_p (^{o}N)	T'_p (s)	θ'_p (^{o}N)
Goa	11.3.92	0900	0.51	4.35	5.00	310	12.50	205
		1030	0.56	4.03	4.76	311	12.50	202
		1050†	0.57	3.77	5.00	320	12.50	228
		1200	0.57	3.63	5.26	316	12.50	263
		1300	0.59	3.33	5.00	314	12.50	242
Visakhapatnam	2.12.97	0530	0.55	5.41	15.38	162	5.88	132
		0900†	0.54	5.48	14.29	172	5.56	121
		1530	0.58	3.51	10.52	155	4.76	124
		1730	0.62	3.51	15.38	150	5.00	122
Paradeep	31.5.96	1245	1.66	5.56	8.33	194	5.56	118
		1545†	1.57	5.06	7.69	198	5.00	151
		1815	2.06	4.89	8.33	198	5.00	198
		2145	1.93	5.13	7.69	202	5.00	201

Fractional modulation comprises of substracting the mean value of the back scatter from each element of the sub-scene and dividing the difference by the mean value. Stationary response correction is performed to make allowance for the well known azimuthal and range fall off of energy by using polynomials of even degree, the coefficients of which are evaluated separately from azimuthal and range spectral profiles of spectrally "white" sub-scenes, i.e., scenes which do not show any wave like features. Gaussian smoothing and speckle noise removal along with stationary response correction are meant to enhance the signal due to ocean waves. Speckle, or the graininess in the radar imagery is due to the fact that the image is obtained by a coherent source of radiation. Speckle is present in LASER (Light Amplification by Stimulated emission of Radiation) also. Tilt and velocity bunching modulation transfer functions are applied to take care of the imaging mechanism of ocean waves by SAR. It may be noted that in the scheme of Monaldo and Lyzenga [1986] the effect of another imaging mechanism, the hydrodynamic modulation transfer function is not taken into consideration as its amplitude is small compared to that of the tilt modulation transfer function.

Prior to January 1998 computer programs in FORTRAN on Microsoft DOS/Windows personal computers were developed and tested for (i) simulating images with sinusoidal waves; (ii) performing 2-dimensional Fourier Transform on the computer simulated images, and then viewing both the images as well as their Fourier Transforms using a computer program display.exe, kindly provided by Dr Raj Kumar of Space Applications Centre, Ahmedabad; and (iii) converting "direct access" image data files in the format used by display.exe, into PCX format, which could be viewed by using Microsoft Paintbrush/ Word/ Excel.

Analysis of digital ERS-1 image mode SAR data was started in January 1998, when a 32Mb ram, CDROM drive, 2.1Gb hard disk Pentium Debian Linux 1.3.1 personal computer, christened Aneerudh (Mathur), with X Windows environment and LAN connection to other computers including the SUN work station named Himalaya – was acquired.

The first scene that was successfully downloaded from CCT onto the hard disk of Himalaya was that off Paradeep (descending orbit 5813, path 857, row 201, scene centre 20.0630N 87.2920E) observed on 31 May 1996 at 1044 GMT, i.e., 1614 IST. A decimated image, i.e., an image formed by taking every tenth pixel/line was extracted from the downloaded full image, then converted to PCX format and then viewed on Aneerudh using ImageMagick, an image display package that displays an image just by invoking the command "display" followed by the name of the image file in any of the usual formats like PCX, BMP, TIFF, etc. The decimated image did not show any land part or any wave like features. Since the NRSA did not provide a glossy photograph of the full image along with the CCT, we extracted at random several 512X512 sub-scenes of area $7.68X7.68\ Km^2$ and obtained Gaussian smoothed SAR image spectra, which showed that the Paradeep scene was entirely of "white noise" nature. Figure 4.1 shows the decimated full image at Paradeep. Figure 4.2 shows a 512X512 sub-scene with top left coordinates [pixel = 2910; scanline = 1020]. Gaussian smoothed SAR image spectrum for this sub-scene is given in Figure 4.3.

The next scene analyzed was that off Goa (descending orbit 3413, path 727, row 207, scene centre 15.2798N 73.3497E) observed on 11 March 1992 at 0534 GMT, i.e., 1104 IST. Sea truth was obtained with an ENDECO directional wave track buoy deployed for eight days (from 5 to 13 March 1992) off Candolim (Lat $15^o30'N$; Long$73^o44'E$) in a mean water depth of 14 metres. Fernandes et al. [1994] report that the buoy measurements showed that low wave conditions prevailed during the entire period of observation. The significant wave height was in the range 0.53–0.96m and the zero crossing period was in the range 4.36–5.98s. As computed by the ENDECO program 1156DBP.EXE, which computes spectral density and wave direction separately as a function of frequency using the digital band pass filtering method, the buoy observation at 1050 IST showed (see Table 4.3) that there were two main spectral peaks, both due to "swell" (waves generated by distant storms), the dominant peak being centred at 5.00s (direction 320^{o}N, deep water wavelength $\approx 39m$), and the subsidiary peak was centred at 12.50s (direction 228^{o}N, deep water wavelength $\approx 244m$). At 1100 hours on 10 March 1992, the swell direction corresponding to the dominant swell peak was roughly estimated by the author as 330^{o}N by visual observation. The glossy photograph of the full image accompanying the CCT, showed the presence of internal waves. We selected several 512X512 sub-scenes, some of which were centred around the prominent internal waves in the glossy photograph, and obtained the Gaussian smoothed SAR image spectra, which showed only the signature of internal waves of wavelength $> 400m$. Figure 4.4 shows the decimated full image at Goa. Figure 4.5 shows a 512X512 sub-scene with top left co-ordinates [pixel = 2200; scanline = 4000], from an area showing the signature of internal waves. Gaussian smoothed SAR image spectrum for this sub-scene is given in Figure 4.6. Because of the well known azimuthal and range fall off with increasing wave number, as expected the signature of the the "swell" of 5.00s was not present in the SAR sub-scenes. Neither was the signature of the "swell" of 12.50s probably because the significant wave height was less than one metre. Gonzalez et al. [1979] from an analysis of SEASAT SAR imagery concluded that when the significant wave height is lower than 1–2m, the waves are not imaged. It may also be pointed out that the zero-crossing period, i.e., the mean wave period was $< 5s$ such that the waves could not be imaged by SAR.

The scene off Visakhapatnam (descending orbit 13686, path 821, row 204, scene centre 17.6727N 83.1856E) observed on 2 December 1997 at 0456 GMT, i.e., 1026 IST, showed some land part but no signature of any wave like features. Figure 4.7 shows the decimated full image at Visakhapatnam. Figure 4.8 shows a 512X512 sub-scene with top left coordinates [pixel = 4950; scanline = 4300]. Gaussian smoothed SAR image spectrum for this sub-scene is given in Figure 4.9.

Thus none of the the Gaussian smoothed SAR image spectra from the three scenes along the coast of India analyzed, viz., Paradeep, Goa and Visakhapatnam showed any ocean waves. As mentioned above, the reason for non-imaging of the buoy observed ocean waves (see Table 4.3), is probably due to the fact that the observed significant wave height $< 2m$ and the zero-crossing period during the satellite overpass is small ($< 6s$, $\lambda < 60m$). Therefore the visit of one of one of our colleagues, Dr. Y. V. B. Sarma to the Southampton Oceanographic Centre, U. K., was utilized to procure two ERS-1 digital image mode SAR scenes (p023-747 and p023-783) off Portugal, an area in which swell and internal waves were simultaneously imaged by SEASAT as reported by Allan [1983]. The SAR scenes off Portugal had 8201 lines each of 8006 pixels, the data being of 16 bits. The pixel/line spacing of the Portugal data is 12.5m as per the header files. Both the scenes off Portugal showed the signature of swell as well as internal waves.

Figure 4.10 shows the decimated full image of the scene p023-747 at Portugal observed on 15 June 1993 at 2254 GMT. Figure 4.11 shows a 512X512 sub-scene 'a' of area $6.4X6.4\ Km^2$ with top left coordinates [pixel = 4280; scanline = 3770]. Gaussian smoothed SAR image spectrum of this sub-scene 'a' is given in Figure 4.12. Figure 4.13 shows a 512X512 sub-scene 'b' with top left coordinates [pixel = 6190; scanline = 5860]. Gaussian smoothed SAR image spectrum of this sub-scene 'b' is given in Figure 4.14.

Figure 4.15 shows the decimated full image of the scene p023-783 at Portugal also on 15 June

1993 at 2254 GMT, but 31s earlier than the previous scene (i.e., p023-747). Figure 4.16 shows a 512X512 sub-scene 'a' with top left coordinates [pixel = 4280; scanline = 3770]. Gaussian smoothed SAR image spectrum of this sub-scene 'a' is given in Figure 4.17. Figure 4.18 shows a 512X512 sub-scene 'b' with top left coordinates [pixel = 6190; scanline = 5860]. Gaussian smoothed SAR image spectrum of this sub-scene 'b' is given in Figure 4.19.

Gaussian smoothed SAR image spectra of the Portugal subscenes show swell of wavelength $\approx 200m$ with direction $\approx 40^o$ with respect to the range direction, and internal waves of wavelength $> 400m$ travelling in the range direction.

Analysis of the 512X512 pixel sub-scenes was restricted to just Gaussian smoothing of the raw SAR image spectra, to ensure that what was being enhanced was actually the ocean wave signal and not "noise". It is planned to develop subroutines for the other enhancements of the wave signal outlined by Monaldo and Lyzenga [1986], using the scenes off Portugal as they definitely contain ocean waves. If feasible it is also planned to try to adopt the more sohisticated strategy of inverting the SAR image spectrum by the method of Hasselmann and Hasselmann [1991] to yield the wave directional spectrum; the method being based on the iterative minimization of a cost function, which requires a model derived wave spectrum as a starting point. The original source code for the above inversion has already been procured. The method of Hasselmann and Hasselmann [1991] assumes a nonlinear mapping between the ocean waves and the image observed by SAR. In contrast Monaldo and Lyzenga [1986] assume a linear mapping between the ocean waves and the image observed by SAR.

4.4 REMOVAL OF 180 DEGREES AMBIGUITY

Some of the instruments used for obtaining radar imageries are (i) navigational radar mounted on ships (ii) SLAR (Side Looking Airborne Radar) mounted on aircraft and (iii) SAR (Synthetic Aperture Radar) mounted on satellites. These radar imageries are used to obtain information about the wave directional spectrum. However the wave directional spectra obtained from radar imageries suffer from a serious drawback, viz., the 180^o ambiguity in the determination of the wave propagation direction. We may recall that a similar ambiguity in wave direction is present in case of linear arrays also. This drawback is usually overcome by assuming that that the waves travel towards shore or downwind. The above assumptions therefore require additional knowledge of the wind field and the shore boundaries.

Atanassov et al. [1985] has proposed a method for removal of the 180^o ambiguity which requires just two images of the same area separated by a time interval τ which is small compared to the wave period corresponding to the dominant wavelength in the imageries. The processing of the imageries is done in spectral (frequency or wave number) domain and uses the well known wave dispersion relation:

$$\omega^2 = (2\pi f)^2 = \kappa g \tanh \kappa d \tag{4.3}$$

where $\kappa = (2\pi)/\lambda$, where κ and λ are the wave number and wavelength. Atanassov et al. [1985] successfully implemented their method both with computer simulated imageries as well as with actual PPI (Plan Position Indicator) imageries obtained with a ship radar. The method of Atanassov et al. [1985] has been applied to SLAR by Vachon and Raney [1989] and to SAR by Rosenthal et al. [1989] respectively. In SAR multi-look data (imagery) is essentially data observed at different times, the time interval being small. Multi-look data, which is normally used for reducing the "speckle" noise from SAR imagery, was used by Rosenthal et al. [1989] for removing the 180^o ambiguity in wave direction.

Atanassov et al. [1985] have derived the following formula for unambiguously determining the image spectrum Δ as a function of the vector wave number $\mathbf{k}$:

$$\begin{aligned} \Delta_+(\mathbf{k}) &= 2\{1-\cos[\omega(\mathbf{k})+\omega(-\mathbf{k})]\tau\}^{-1} \\ &\cdot\{|\zeta(\mathbf{k},t_1|^2+|\zeta(\mathbf{k},t_2|^2 \\ &-Re[\zeta(\mathbf{k},t_1)\zeta^*(\mathbf{k},t_2)exp(i\omega(-(k))\tau)]\} \end{aligned} \tag{4.4}$$

where τ is the time interval between two images observed at times t_1 and $t_2(=t_1+\tau)$, ζ is the 2-dimensional Fourier transform of the images with the superscript indicating the complex conjugate, and $i = \sqrt{-1}$.

We shall now derive a criterion which gives the maximum wavenumber for which Equation 4.4 can be used for unambiguously determining the image spectrum. It is assumed that

$$\omega(-\mathbf{k}) = \omega(\mathbf{k}) > 0$$

so that

$$[\omega(\mathbf{k})]\tau = 2\pi\tau/T \tag{4.5}$$

where T is the wave period. If we assume that $\tau < T/2$ (this is analogous to the criterion of Barber and Doyle (1956), $d < \lambda/2$ associated with wave directional arrays) and also assume that the images are taken in deep water so that the wave dispersion relation Equation 4.3 reduces to $\omega(\mathbf{k}) = \sqrt{\kappa g}$, then Equation 4.5 may be rewritten as follows

$$\sqrt{\kappa g}\,\tau < \pi$$

Making κ as the subject of the inequality, we obtain

$$\kappa < (\pi/\tau)^2/g \tag{4.6}$$

Equation 4.6 gives an approximate wave number upper limit above which Equation 4.4 will fail to give unambiguous image spectra - we may emphasize that Equation 4.6 is exact in deep water.

Figure 4.20 Computer simulated image of a monochromatic wave field

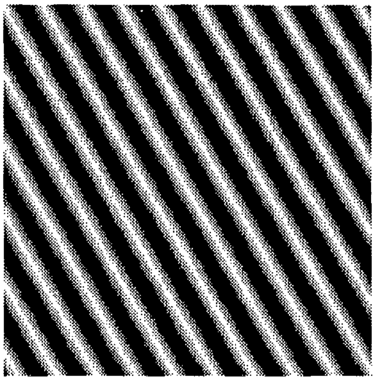
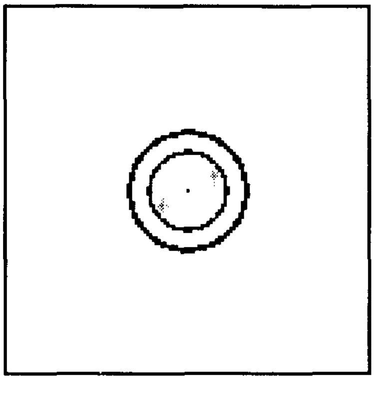


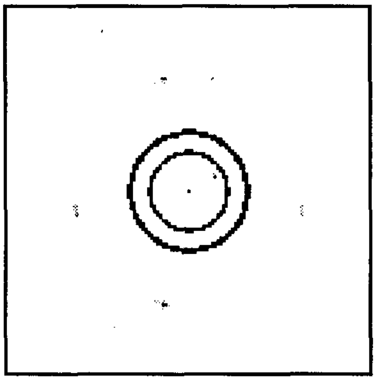
Figure 4.21 2-dimensional Fourier Transform of the computer simulated wave field showing the 180^o ambiguity in wave direction



Multichromatic (i.e. with many frequencies) monochrome (i.e. in grey shades) images can be simulated in the computer using the following relation:

$$G(x_m, y_n, t) = \sum_{i=1}^{I} A_i\{1 + \cos[k_i(x_m \cos\alpha_i + y_n \sin\alpha_i) - \omega(k_i)t + \phi_i]\} \tag{4.7}$$

Figure 4.22 Unambiguous 2-dimensional Fourier Transform of the computer simulated wave field



$$\text{for} m, n = 1, 2 \cdots N$$

where G gives the grey value in the range (0-255) in a square area of side $L = 676$ metres; $N = 128$; so that the image size is 128 X 128 pixels; $x_m = (m-1)L/N$, $y_n = (n-1)L/N$, are the x and y coordinates; t is the time;A_i are the amplitudes of the simulated waves having wavenumber κ_i and propagation direction α_i and initial phase ϕ_i; κ_i satisfying the dispersion relation Equation 4.3

Using Equation 4.7 we simulated two monochromatic images (i.e. with single frequency) at time $t_1 = 0$ and $t_2 = 2.3$ seconds in $d = 30$ m water depth, so that $\tau = 2.3$ s, Other parameters chosen were $A_1 = 127$, $\alpha_1 = 30^o$, $\phi_1 = 10^o$; and $f_1 = 0.157$ Hz; which works out to $T_1 = 6.4$ s, $\kappa_1 = 0.997 m^{-1}$ and wavelength $\lambda_1 = 63$ m.

Figure 4.20 represents the radar image simulated at time $t_1 = 0$, which is indistinguishable to the naked eye from the image simulated at time $t_2 = 2.3$ (not shown). Figure 4.21 is the 2-dimensional Fourier Transform $\zeta(\mathbf{k}, t_1)$. Note that Figure 4.21 displays the correct wavelength, but there is as expected a 180^o ambiguity in the wave direction. Figure 4.22 is the image spectrum computed using Equation 4.4. Figure 4.22 not only displays the correct wavelength, but also the unambiguously correct wave direction. The inner circle in Figure 4.22 depicts a wavelength of 50 m; the outer circle depicts a wavelength of 33 m, which corresponds to the maximum wave number given by Equation 4.6, for which Figure 4.22 gives correct results. The dot in Figure 4.22 representing the simulated wavelength of 63 m and wave direction of 30^o, lies exactly along the the circle of wavelength of 63 m (not shown).

Chapter 5

SUMMARY

The conclusions of this thesis are as follows:

- Phase/time/path difference (PTPD) methods of Esteva [1977] and Borgman [1974] with two modifications, viz., *true phase* and *coherence* proposed in this thesis, have for the first time been successfully used for computing wave direction as a function of frequency from actual field measurements at the Coastal Engineering Research Center's (CERC) Field Research Facility at Duck, North Carolina, USA, using polygonal and linear arrays respectively in case of swell, sea and surf beat as the directional spread is generally unimodal. PTPD methods fail in case of multimodal directional spreads, which can be easily spotted from the large value of the standard deviation of redundant estimates of wave direction. In this thesis it is shown that PTPD methods are adept in describing the propagation of waves generated by distant storms (swell); locally generated wind waves (sea); infra gravity waves (surf beat) locally generated by energetic incident swell; and surf beat of remote origin occurring when low swell energies are present. Results of PTPD methods are consistent with those obtained by the CERC using the Iterative Maximum Likelihood Estimation (IMLE) method.

- Software has been developed indigenously for the determination of wave direction from time series measurements of heave, pitch and roll of an orbital following buoy. The software has been tested and validated with computer simulated data. Some modifications are needed for dealing with field data.

- Having failed to find a clear signature of ocean waves from three SAR scenes along the coast of India, two scenes off Portugal showing "swell" waves were analysed. Software developed for removal of 180^o ambiguity in wave direction from computer simulated images should be useful to remove the said ambiguity from actual ERS-1 SAR imagery if at least two looks of the multi-look data is available.

5.1 STATEMENT ABOUT CONTRIBUTION OF CO-AUTHORS IN PUBLISHED WORK

I registered for Ph.D. degree on 7 June 1994. As my work progressed, I published the following:

1. **A. A. Fernandes**, Y. V. B. Sarma, and H. B. Menon, 1995. *Directional spectrum of ocean waves at Duck, North Carolina, USA from array measurements using phase/time/path difference methods*. NIO Technical Report No. NIO/TR-2/95, 35 pages + 20 figures + 65 tables, September 1995.

2. **A. A. Fernandes**, Y. V. B. Sarma, and H. B. Menon, 1996. Wave directional spectrum from array measurements. *Proceedings International Conference in Ocean Engineering, COE'96*, held at IIT, Madras, India during 17-20 December 1996, pp 243–248.

3. **A. A. Fernandes**, Y. V. B. Sarma, and H. B. Menon, 2000. Directional spectrum of ocean waves from array measurements using phase/time/path difference methods. *Ocean Engineering*, 27(4), pp 345–363.

4. **A. A. Fernandes**, Y. V. B. Sarma, H. B. Menon, and P. Vethamony. Wave directional spectrum from SAR imagery (Communicated to *Photonirvachak*).

The work reported in the above four publications has been done by me independently under the guidance of Dr. H. B. Menon. Dr. Y. V. B. Sarma and Dr. Vethamony were on occasion used as sounding boards for my ideas.

The following work has been done by me independently, *prior* to registration for Ph.D. in which Dr. P. Vethamony organized the deployment of an ENDECO orbital following buoy off Candolim, Goa. Mr. Vaithiyanathan and Mr. Almeida provided technical support during the field observations. Mr. Almeida also wrote a computer program to convert ASCII data into Motorola Format which enabled me to test the ENDECO software for determining wave directional spectrum with computer simulated data generated by me:

- **A. A. Fernandes**, A. M. Almeida, R. Vaithiyanathan, and P. Vethamony, 1994. Determination of wave direction using an orbital following buoy. In: *Ocean technology perspectives*. Edited by S. K. Agadi, V. Kesava Das and B. N. Desai, pp 378–388, Publications and Information Directorate, New Delhi.

Appendix A

Modified Borgman's analysis — 10 redundant estimates

Table A.1 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 01/02/94 01:00 HOURS Hmo=1.10 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	2.024	-41.98	-41.87	-41.13	-42.19	-26.42	-19.48	-41.77	-41.04	-1.67	-26.95	-32.59	13.01
3	64.00	4.655	-25.80	-26.03	-18.38	-20.69	-15.96	-21.58	-25.51	-21.43	9.99	-18.92	-18.54	10.00
4	42.67	6.480	-18.22	-17.67	-9.88	-12.19	-8.57	-15.54	-18.65	-12.88	17.07	-13.61	-11.12	9.91
5	32.00	5.326	-17.42	-15.63	-7.26	-10.08	-4.36	-11.96	-18.63	-10.45	19.72	-11.54	-8.87	10.37
6	25.60	4.091	-13.71	-13.41	-5.67	-8.07	-2.25	-8.56	-14.81	-8.67	19.89	-8.54	-6.46	9.48
7	21.33	3.969	-12.17	-11.55	-7.18	-9.07	-3.06	-6.49	-12.93	-9.01	16.78	-9.63	-6.49	8.22
8	18.29	6.579	-8.73	-8.31	-7.05	-7.82	-6.19	-5.77	-9.01	-7.67	4.77	-11.06	-6.69	4.08
9	16.00	16.652	-6.09	-6.16	-5.82	-6.01	-8.74	-6.21	-7.23	-6.02	-1.60	-11.56	-6.54	2.38
10	14.22	26.962	-5.00	-5.11	-4.94	-5.01	-6.94	-6.58	-8.86	-5.03	-.62	-8.77	-5.68	2.23
11	12.80	24.715	-6.34	-6.62	-6.38	-6.45	-7.01	-5.74	-8.92	-6.55	-2.02	-9.54	-6.56	1.90
12	11.64	40.442	-6.94	-9.60	-8.85	-8.45	-9.19	-5.05	-6.77	-9.21	-8.01	-11.09	-8.32	1.62
13	10.67	100.174	-6.65	-8.78	-8.26	-7.85	-9.99	-6.22	-6.71	-8.40	-7.98	-10.60	-8.14	1.34
14	9.85	167.566	-6.18	-7.19	-7.03	-6.78	-9.23	-6.88	-7.35	-6.98	-6.63	-10.33	-7.46	1.23
15	9.14	196.438	-5.46	-6.49	-6.16	-5.96	-7.32	-7.64	-8.38	-6.16	-5.70	-8.97	-6.82	1.13
16	8.53	163.433	-5.51	-5.54	-5.81	-5.80	-5.97	-8.06	-8.27	-5.58	-4.36	-8.87	-6.38	1.40
17	8.00	113.330	-4.70	-4.18	-4.91	-5.09	-5.23	-4.21	-5.19	-4.70	-2.84	-8.62	-4.97	1.39
18	7.53	93.929	1.56	3.45	2.25	2.18	-.55	.33	-1.19	3.41	4.28	-1.92	1.38	2.02
19	7.11	95.420	5.89	7.74	6.85	6.97	7.64	3.68	4.27	8.37	8.33	4.36	6.41	1.67
20	6.74	83.034	8.54	8.53	9.33	9.83	11.49	9.10	9.33	10.42	9.77	8.93	9.53	.86
21	6.40	60.901	12.28	9.15	12.04	13.18	13.86	13.01	10.89	12.42	10.81	12.90	12.05	1.33
22	6.10	49.536	13.95	11.14	13.44	14.52	17.58	17.57	13.97	13.68	12.82	15.66	14.43	1.92
23	5.82	45.126	16.03	14.27	16.41	17.38	19.87	15.62	17.77	17.27	16.01	20.11	17.07	1.74
24	5.57	42.009	15.65	16.42	17.92	18.36	19.59	16.84	19.72	19.52	17.74	23.07	18.48	2.02
25	5.33	36.532	14.44	16.90	17.35	17.88	20.03	20.82	20.10	19.48	17.68	20.77	18.55	1.94
26	5.12	33.704	16.62	18.42	18.87	19.80	21.47	18.79	21.28	21.71	19.85	22.59	19.94	1.74
27	4.92	24.246	18.63	19.62	19.88	21.08	24.47	21.62	22.60	23.15	21.75	23.61	21.64	1.78
28	4.74	18.328	19.60	22.99	22.78	23.48	23.94	24.78	9999.99	28.25	25.79	26.43	24.23	2.34
29	4.57	14.480	22.76	24.11	23.39	25.29	9999.99	24.71	9999.99	29.86	27.37	28.36	25.73	2.37
30	4.41	12.354	22.21	22.71	23.28	25.74	9999.99	26.72	9999.99	33.90	25.20	28.12	25.98	3.55
31	4.27	8.312	21.28	21.60	26.82	28.84	9999.99	24.69	9999.99	35.15	23.82	31.69	26.73	4.59

Table A.2 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 01/02/94 04:00 HOURS Hmo=1.10 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	3.406	-40.68	-31.83	-32.42	-34.76	-20.23	-22.07	-30.87	-31.93	8.14	-23.95	-26.24	12.82
3	64.00	6.460	-32.27	-27.68	-21.89	-24.81	-18.52	-19.80	-23.67	-23.81	12.16	-22.14	-20.40	11.42
4	42.67	6.434	-24.96	-21.00	-15.42	-18.26	-15.29	-16.94	-22.01	-17.42	15.43	-18.27	-15.56	10.68
5	32.00	4.856	-18.04	-14.38	-9.31	-11.78	-9.13	-8.76	-13.65	-11.09	18.16	-11.12	-9.01	9.42
6	25.60	3.726	-14.82	-13.64	-6.46	-8.84	-2.71	-6.94	-6.11	-9.26	16.40	-7.69	-6.06	8.19
7	21.33	3.278	-6.39	-6.53	-1.25	-2.80	-2.57	-6.97	-5.77	-3.23	13.89	-6.21	-2.81	5.88
8	18.29	5.110	-5.71	-4.90	-3.53	-4.31	-11.44	-10.84	-10.04	-4.03	2.87	-9.49	-6.14	4.17
9	16.00	13.460	-5.50	-6.37	-5.82	-5.87	-13.63	-7.91	-7.51	-6.03	-3.93	-11.28	-7.38	2.79
10	14.22	26.153	-4.89	-6.94	-6.15	-5.92	-11.30	-7.10	-7.54	-6.52	-5.91	-10.49	-7.28	1.95
11	12.80	39.737	-4.77	-7.22	-6.62	-6.24	-7.71	-6.50	-7.50	-6.91	-7.20	-9.16	-6.98	1.07
12	11.64	78.403	-5.73	-7.64	-7.66	-7.27	-7.98	-8.35	-7.88	-7.72	-8.39	-9.43	-7.81	.89
13	10.67	137.501	-5.75	-7.61	-7.35	-7.00	-10.11	-8.87	-9.34	-7.53	-7.83	-9.72	-8.11	1.30
14	9.85	165.793	-5.48	-7.40	-7.08	-6.83	-10.41	-7.02	-5.94	-7.48	-7.60	-10.31	-7.55	1.54
15	9.14	174.560	-6.18	-8.02	-7.80	-7.56	-8.79	-7.13	-6.18	-8.17	-7.89	-10.56	-7.83	1.21
16	8.53	140.376	-5.25	-8.35	-7.28	-6.83	-8.74	-7.68	-7.77	-7.86	-8.21	-8.41	-7.64	.96
17	8.00	97.958	-3.92	-7.39	-6.13	-5.65	-7.28	-7.59	-8.41	-6.85	-7.01	-6.35	-6.66	1.18
18	7.53	78.279	1.32	-1.20	-.13	.29	-1.26	-2.43	-4.53	-.22	-.84	-.30	-.93	1.53
19	7.11	85.752	5.98	4.47	5.47	5.88	3.95	3.07	3.24	5.96	4.96	5.56	4.85	1.06
20	6.74	85.588	7.22	6.76	7.22	7.46	7.85	4.57	8.35	7.75	7.48	9.00	7.37	1.11
21	6.40	69.764	9.24	7.98	9.55	9.97	11.13	8.18	8.99	10.15	8.92	10.54	9.47	.95
22	6.10	51.440	11.67	10.61	12.97	13.74	13.90	12.13	13.58	14.21	11.85	13.01	12.77	1.10
23	5.82	44.116	13.44	11.48	14.58	15.77	15.27	14:01	16.66	15.86	13.18	17.88	14.81	1.77
24	5.57	40.835	13.03	10.81	14.16	15.39	15.75	15.70	18.55	15.38	12.00	19.77	15.05	2.60
25	5.33	31.952	14.54	13.51	16.47	18.13	17.44	19.30	20.83	17.85	14.72	20.64	17.34	2.41
26	5.12	29.249	16.35	15.50	19.10	20.94	18.52	21.09	23.69	21.62	16.91	19.16	19.29	2.45
27	4.92	25.536	15.88	16.03	20.12	21.47	21.77	22.02	28.36	22.62	17.36	20.16	20.58	3.50
28	4.74	19.193	16.55	15.77	19.48	21.11	27.11	22.88	28.68	23.76	17.69	26.59	21.96	4.36
29	4.57	16.483	18.46	21.28	22.40	23.87	28.66	27.52	25.52	30.05	23.01	29.98	25.07	3.73
30	4.41	11.368	20.25	21.76	22.89	24.75	30.41	27.72	26.74	29.77	24.23	32.90	26.14	3.87
31	4.27	8.156	21.17	20.91	24.04	26.58	31.77	29.10	9999.99	29.93	23.82	9999.99	25.91	3.82

Table A.3 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 01/02/94 07:00 HOURS Hmo=1.08 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	4.439	-24.16	-40.42	-28.54	-27.97	-34.86	-29.24	-30.32	-32.61	-2.05	-43.04	-29.40	10.61
3	64.00	7.093	-18.72	-21.99	-17.08	-17.96	-19.42	-19.53	-18.90	-18.82	12.59	-22.40	-16.34	9.73
4	42.67	6.423	-18.93	-19.82	-15.22	-16.68	-16.96	-17.81	-18.39	-17.12	14.13	-19.96	-14.80	9.70
5	32.00	5.048	-11.73	-14.72	-8.66	-9.90	-15.23	-15.67	-18.04	-11.00	17.28	-17.90	-10.66	9.78
6	25.60	3.693	-6.60	-7.61	-1.88	-3.48	-9.11	-9.36	-10.15	-3.90	20.73	-9.78	-4.19	8.73
7	21.33	3.592	-7.31	-4.64	-1.18	-3.27	-8.28	-5.37	-6.97	-2.43	18.96	-9.32	-3.03	7.72
8	18.29	5.565	-4.16	-5.48	-2.76	-3.45	-8.13	-6.79	-10.90	-3.81	10.21	-7.31	-4.27	5.37
9	16.00	13.747	-4.40	-8.37	-6.74	-6.28	-6.10	-5.44	-10.02	-7.58	-4.21	-6.88	-6.60	1.68
10	14.22	25.673	-3.46	-6.19	-4.63	-4.40	-4.95	-6.25	-8.69	-5.31	-2.85	-6.08	-5.28	1.57
11	12.80	54.688	-3.29	-5.17	-4.30	-4.08	-6.01	-5.52	-6.18	-4.63	-3.79	-6.97	-4.99	1.11
12	11.64	127.474	-1.74	-4.47	-3.15	-2.82	-4.92	-7.13	-8.29	-3.65	-3.05	-5.05	-4.43	1.92
13	10.67	189.778	-2.89	-5.74	-4.32	-4.03	-6.22	-8.02	-8.75	-4.94	-3.59	-5.64	-5.42	1.78
14	9.85	221.836	-5.03	-6.83	-6.29	-6.11	-6.98	-7.29	-7.62	-6.68	-4.97	-8.04	-6.58	.96
15	9.14	168.015	-5.09	-6.57	-5.89	-5.76	-7.48	-7.07	-7.53	-6.25	-4.47	-9.04	-6.51	1.26
16	8.53	96.791	-4.23	-5.00	-4.19	-4.27	-6.23	-7.18	-6.92	-4.52	-2.29	-8.74	-5.36	1.79
17	8.00	80.718	-2.97	-2.59	-2.40	-2.59	-3.72	-3.57	-5.34	-2.25	.13	-6.73	-3.20	1.76
18	7.53	70.610	-2.85	-1.95	-2.19	-2.48	-2.07	1.99	-1.46	-1.97	.61	-5.53	-1.79	1.90
19	7.11	60.464	.67	.37	.38	.44	1.93	5.54	2.62	.59	2.48	-.15	1.49	1.63
20	6.74	57.959	4.68	3.56	4.17	4.48	5.14	9.30	10.32	4.38	4.62	4.41	5.50	2.20
21	6.40	54.323	7.05	5.98	7.20	7.51	9.00	10.86	15.22	7.54	7.01	8.50	8.58	2.55
22	6.10	44.113	10.26	7.84	9.89	10.60	10.53	10.59	15.37	10.10	9.29	11.47	10.59	1.84
23	5.82	33.795	12.23	7.25	10.71	12.11	10.39	10.48	15.74	10.96	9.58	14.44	11.39	2.29
24	5.57	23.909	13.57	7.99	12.75	15.19	12.58	13.04	19.04	15.52	10.51	19.96	14.01	3.43
25	5.33	22.595	13.26	12.25	14.66	16.36	15.74	14.93	18.52	18.86	14.71	19.26	15.85	2.26
26	5.12	21.913	13.37	12.87	14.30	15.53	16.49	18.23	16.85	18.48	16.09	9999.99	15.80	1.87
27	4.92	17.488	16.89	12.25	15.06	17.13	20.68	20.66	9999.99	20.92	15.54	9999.99	17.39	2.95
28	4.74	14.201	16.71	11.81	17.05	18.87	23.75	19.91	9999.99	9999.99	14.41	9999.99	17.50	3.58
29	4.57	11.400	15.35	10.55	16.21	17.96	26.66	20.90	9999.99	9999.99	13.41	9999.99	17.29	4.88
30	4.41	7.971	16.28	13.86	18.06	19.63	26.37	20.89	9999.99	9999.99	16.99	9999.99	18.87	3.72
31	4.27	5.878	17.40	19.90	20.61	20.77	9999.99	26.06	9999.99	9999.99	22.05	9999.99	21.13	2.61

Table A.4 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 01/02/94 13:00 HOURS Hmo= .84 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

NO	Period (sec)	Energy (cm**2)	DIRECTION (degrees) for 10 different gauge pairs 43	21	32	42	65	78	89	31	01	54	Mean dir	Std dev
2	128.00	2.193	-45.10	-31.62	-22.49	-28.87	-27.86	-20.92	-13.45	-26.63	22.51	-25.97	-22.42	16.74
3	64.00	4.582	-31.88	-26.23	-18.44	-22.19	-20.36	-19.05	-18.15	-21.47	11.47	-20.08	-18.76	10.80
4	42.67	4.987	-26.82	-22.26	-15.95	-19.15	-17.80	-16.47	-18.42	-18.45	11.78	-18.20	-16.28	9.79
5	32.00	3.636	-19.73	-14.77	-10.40	-13.29	-11.95	-10.25	-13.72	-12.30	17.78	-13.38	-10.31	9.67
6	25.60	2.505	-12.46	-10.80	-4.46	-6.89	-3.26	-7.60	-14.79	-7.14	23.40	-6.64	-5.17	10.06
7	21.33	2.457	-7.93	-9.96	-3.18	-4.82	-4.60	-2.26	-7.37	-6.05	17.12	-5.02	-3.45	7.18
8	18.29	4.193	-7.85	-9.03	-4.41	-5.47	-7.71	-2.00	-4.41	-6.64	7.75	-6.96	-4.68	4.58
9	16.00	7.852	-6.73	-6.78	-4.62	-5.26	-7.73	-8.28	-9.82	-5.77	3.38	-9.16	-6.08	3.53
10	14.22	12.456	-3.31	-4.15	-2.72	-2.93	-6.21	-9.65	-10.14	-3.39	1.31	-6.53	-4.77	3.27
11	12.80	19.701	-2.66	-5.71	-3.77	-3.53	-7.00	-8.98	-7.78	-4.61	-3.08	-6.46	-5.36	2.05
12	11.64	57.623	-7.12	-9.12	-8.32	-8.18	-8.80	-6.87	-6.97	-8.84	-7.32	-11.17	-8.27	1.25
13	10.67	114.409	-5.88	-7.46	-6.84	-6.76	-8.00	-6.80	-7.40	-7.26	-5.74	-10.26	-7.24	1.20
14	9.85	123.656	-3.24	-5.10	-4.28	-4.14	-5.93	-8.76	-9.30	-4.71	-3.47	-7.26	-5.62	2.04
15	9.14	117.017	-4.24	-6.00	-5.66	-5.45	-6.44	-8.81	-10.98	-6.01	-4.77	-7.68	-6.60	1.93
16	8.53	97.931	-4.21	-6.22	-5.76	-5.55	-6.70	-7.85	-9.38	-6.19	-4.89	-7.56	-6.43	1.44
17	8.00	68.181	-2.30	-5.33	-4.22	-3.85	-4.32	-5.39	-4.30	-4.87	-3.93	-4.65	-4.32	.84
18	7.53	51.802	-1.76	-5.02	-3.42	-3.05	-3.19	-1.01	-2.10	-4.34	-3.73	-4.75	-3.24	1.24
19	7.11	38.084	1.30	-2.01	.04	.63	-.35	-1.79	-1.73	-.52	-.24	-.40	-.51	1.02
20	6.74	31.287	5.90	1.03	4.05	5.17	2.98	.82	1.52	3.76	3.80	6.79	3.58	1.93
21	6.40	27.642	9.92	5.16	8.12	9.45	6.24	10.19	7.07	8.28	8.68	13.35	8.65	2.18
22	6.10	25.746	10.64	8.69	10.36	11.50	7.18	13.00	13.53	11.55	11.55	14.16	11.22	2.03
23	5.82	18.754	12.04	11.37	13.11	14.76	11.12	14.30	19.38	15.36	13.78	16.59	14.18	2.40
24	5.57	12.851	11.63	12.42	13.10	16.27	17.21	16.08	22.59	21.15	15.40	18.17	16.40	3.40
25	5.33	10.601	11.46	9.80	10.42	12.69	14.42	18.27	25.43	18.21	12.85	17.55	15.10	4.55
26	5.12	9.969	13.08	12.28	13.65	15.21	15.76	20.30	25.58	18.11	13.98	9999.99	16.43	4.02
27	4.92	8.498	13.94	11.05	15.15	17.01	16.77	20.78	28.87	17.30	12.06	9999.99	16.98	5.03
28	4.74	5.709	13.85	12.77	16.24	17.89	9999.99	19.42	30.70	20.63	13.79	9999.99	18.15	5.43
29	4.57	4.146	13.35	16.65	20.27	21.99	9999.99	22.62	32.25	24.48	17.68	9999.99	21.16	5.37
30	4.41	3.180	13.04	19.25	22.35	25.31	9999.99	30.72	9999.99	27.03	19.88	9999.99	22.51	5.38
31	4.27	2.360	16.56	19.04	24.21	27.71	9999.99	31.08	9999.99	9999.99	19.47	9999.99	23.01	5.14

Table A.5 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 01/02/94 16:00 HOURS Hmo= .82 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

NO	Period (sec)	Energy (cm**2)	DIRECTION (degrees) for 10 different gauge pairs 43	21	32	42	65	78	89	31	01	54	Mean dir	Std dev
2	128.00	1.478	-34.88	-20.72	-23.01	-27.28	-13.56	-9.78	-22.90	-21.80	20.49	-17.59	-17.34	14.15
3	64.00	3.424	-26.54	-15.35	-11.88	-15.73	-12.78	-15.37	-24.04	-13.03	19.32	-12.76	-12.96	11.70
4	42.67	4.052	-21.68	-15.87	-10.55	-13.32	-15.22	-13.20	-18.77	-12.39	16.85	-15.73	-12.10	10.08
5	32.00	3.259	-16.10	-12.24	-6.71	-9.09	-10.60	-12.21	-15.74	-8.70	22.74	-11.97	-8.20	10.64
6	25.60	2.127	-11.42	-8.36	-3.01	-5.31	-5.61	-9.49	-10.99	-5.05	24.57	-6.72	-4.25	9.91
7	21.33	1.909	-6.96	-4.46	.98	-1.40	-.96	-3.52	-3.71	-1.12	20.88	-3.11	-.39	7.38
8	18.29	2.745	-6.20	-3.52	-1.23	-2.90	-7.34	-6.46	-6.03	-2.29	12.96	-11.18	-3.44	6.12
9	16.00	6.015	-5.33	-4.64	-3.70	-4.36	-9.97	-8.63	-10.64	-4.36	1.95	-11.07	-6.08	3.82
10	14.22	12.800	-4.32	-5.25	-4.73	-4.73	-7.65	-7.58	-8.64	-5.14	-3.57	-10.36	-6.20	2.10
11	12.80	15.536	-6.27	-7.64	-6.78	-6.77	-8.54	-7.21	-7.90	-7.27	-5.61	-11.24	-7.52	1.47
12	11.64	27.545	-11.24	-12.54	-12.90	-12.75	-12.05	-8.91	-9.47	-13.18	-12.73	-16.25	-12.20	1.94
13	10.67	73.529	-10.87	-13.46	-13.22	-12.90	-10.27	-11.44	-10.92	-13.91	-13.98	-14.29	-12.53	1.42
14	9.85	118.982	-7.01	-10.37	-9.14	-8.80	-8.75	-10.43	-9.96	-10.16	-10.26	-10.10	-9.50	1.03
15	9.14	113.258	-3.87	-5.99	-4.96	-4.71	-8.44	-9.59	-9.84	-5.40	-5.53	-8.41	-6.67	2.07
16	8.53	106.647	-3.89	-6.34	-5.10	-4.78	-7.61	-8.09	-11.23	-5.50	-5.50	-8.62	-6.66	2.10
17	8.00	79.925	-4.02	-6.42	-5.45	-5.16	-5.92	-5.46	-10.42	-5.89	-4.94	-7.32	-6.10	1.67
18	7.53	56.331	-2.10	-2.77	-2.81	-2.69	-4.51	-4.09	-10.04	-2.69	-1.83	-4.99	-3.85	2.29
19	7.11	47.582	-1.67	-1.78	-1.68	-1.75	-5.32	-1.83	-4.87	-1.54	-.71	-6.55	-2.77	1.90
20	6.74	41.117	-.27	1.16	.25	.20	-2.98	-.87	.80	1.18	2.06	-6.14	-.46	2.30
21	6.40	29.649	1.23	1.70	1.23	1.53	-.03	3.60	7.77	2.28	2.63	.27	2.22	2.11
22	6.10	20.500	3.63	3.50	4.88	5.97	4.52	5.42	11.00	7.08	4.60	8.89	5.95	2.28
23	5.82	18.070	6.35	6.35	8.38	10.22	10.32	7.47	12.69	12.12	7.59	12.60	9.41	2.38
24	5.57	14.908	7.67	8.05	9.47	11.68	14.20	9.63	14.21	14.30	9.57	9999.99	10.97	2.54
25	5.33	12.754	8.01	8.76	9.51	12.21	14.97	11.84	19.40	15.92	10.39	9999.99	12.33	3.55
26	5.12	10.200	11.27	12.44	12.33	16.00	14.50	19.18	25.12	19.85	13.31	9999.99	16.00	4.29
27	4.92	8.850	11.72	11.92	12.85	16.88	18.89	20.15	9999.99	20.75	12.86	9999.99	15.75	3.59
28	4.74	6.936	10.82	9.11	14.32	17.51	22.47	20.42	9999.99	19.30	10.18	9999.99	15.52	4.79
29	4.57	4.801	10.44	9.41	15.16	17.11	26.51	22.12	9999.99	20.31	10.76	9999.99	16.47	5.79
30	4.41	3.651	11.85	12.78	18.17	18.77	9999.99	22.16	9999.99	20.68	14.19	9999.99	16.94	3.72
31	4.27	2.558	13.53	13.58	20.62	19.89	9999.99	9999.99	9999.99	21.56	15.12	9999.99	17.38	3.38

Table A.6 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 01/02/94 19:00 HOURS Hmo= .84 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

NO	Period (sec)	Energy (cm**2)	DIRECTION (degrees) for 10 different gauge pairs 43	21	32	42	65	78	89	31	01	54	Mean dir	Std dev
2	128.00	1.594	-13.08	-27.40	-1.81	-4.63	-24.53	-29.81	-20.81	-11.06	14.21	-22.93	-14.28	13.07
3	64.00	2.386	-16.94	-20.80	-4.76	-7.90	-8.60	-17.14	-16.61	-10.39	17.88	-9.19	-9.54	10.34
4	42.67	2.430	-15.39	-11.92	-2.10	-5.49	-5.75	-14.49	-17.05	-5.48	26.43	-6.05	-5.88	11.77
5	32.00	2.612	-13.47	-14.19	-4.99	-7.28	-9.63	-16.48	-19.61	-8.41	24.33	-10.96	-8.23	11.58
6	25.60	2.525	-9.07	-9.75	-2.07	-4.10	-3.70	-14.02	-15.69	-5.00	23.77	-5.83	-4.65	10.35
7	21.33	2.073	-4.28	-5.02	1.01	-.67	-1.38	-7.82	-10.20	-1.30	20.19	-2.86	-1.28	7.84
8	18.29	2.901	-5.47	-7.65	-3.59	-4.33	-5.47	-6.33	-10.69	-5.35	9.04	-6.90	-4.69	4.94
9	16.00	6.039	-7.03	-7.84	-5.59	-6.15	-7.65	-7.69	-9.19	-6.76	.87	-9.12	-6.62	2.72
10	14.22	11.117	-5.41	-7.49	-5.48	-5.60	-8.21	-4.17	-5.79	-6.39	-1.90	-9.42	-5.99	2.00
11	12.80	19.395	-4.40	-6.37	-5.15	-5.05	-8.46	-4.26	-5.72	-5.66	-3.14	-9.37	-5.76	1.81
12	11.64	38.531	-6.76	-8.32	-7.85	-7.68	-10.17	-8.79	-10.98	-8.10	-6.99	-11.95	-8.76	1.64
13	10.67	86.662	-7.04	-9.41	-8.82	-8.51	-10.63	-10.08	-11.91	-9.21	-8.65	-11.79	-9.61	1.45
14	9.85	129.962	-6.54	-10.08	-8.65	-8.26	-8.80	-9.29	-11.94	-9.44	-8.15	-9.88	-9.10	1.35
15	9.14	118.196	-6.74	-9.80	-8.59	-8.27	-9.02	-7.30	-11.52	-9.33	-8.05	-10.39	-8.90	1.36
16	8.53	97.537	-5.13	-6.85	-6.22	-6.00	-10.78	-7.50	-12.11	-6.58	-5.09	-10.19	-7.65	2.36
17	8.00	79.002	-2.54	-4.17	-3.34	-3.06	-9.67	-6.83	-13.04	-3.60	-3.19	-7.64	-5.71	3.32
18	7.53	61.712	-2.63	-6.39	-4.20	-3.74	-8.13	-5.49	-11.07	-5.21	-5.22	-7.18	-5.93	2.30
19	7.11	46.525	-1.84	-5.12	-3.29	-2.84	-6.07	-3.83	-6.78	-3.84	-3.80	-4.50	-4.19	1.41
20	6.74	35.763	-2.99	-4.29	-3.98	-3.96	-5.18	-2.82	-5.96	-4.29	-2.63	-6.64	-4.27	1.26
21	6.40	31.429	-3.62	-2.35	-3.31	-3.92	-4.25	-.62	-1.38	-2.97	-.27	-11.75	-3.44	3.06
22	6.10	27.519	-.56	1.05	.37	.14	.96	1.37	5.29	1.88	2.75	9999.99	1.47	1.63
23	5.82	23.005	1.29	2.57	2.61	2.92	2.23	4.57	12.14	6.17	4.04	9999.99	4.28	3.09
24	5.57	15.917	2.70	1.93	4.31	5.71	8.22	8.18	19.00	9999.99	4.41	9999.99	6.80	5.08
25	5.33	11.953	3.24	-.80	3.62	9.37	9999.99	13.20	17.43	9999.99	2.62	9999.99	6.95	6.07
26	5.12	12.400	5.05	2.10	6.61	12.34	9999.99	20.72	14.87	9999.99	5.11	9999.99	9.54	6.15
27	4.92	9.409	4.90	6.43	10.84	15.91	9999.99	25.11	9999.99	9999.99	8.51	9999.99	11.94	6.86
28	4.74	6.763	4.17	7.89	10.83	15.97	9999.99	9999.99	9999.99	9999.99	9.90	9999.99	9.75	3.86
29	4.57	5.204	5.35	8.70	9.47	13.98	9999.99	9999.99	9999.99	9999.99	9.85	9999.99	9.47	2.76
30	4.41	3.524	7.60	6.11	16.13	19.86	9999.99	9999.99	9999.99	9999.99	6.85	9999.99	11.30	5.60
31	4.27	2.391	10.11	11.12	21.75	22.47	9999.99	9999.99	9999.99	9999.99	12.36	9999.99	15.56	5.40

Table A.7 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 01/02/94 22:00 HOURS Hmo= .75 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.987	-23.43	-21.12	-14.54	-17.43	-11.74	-13.92	-21.03	-16.39	20.66	-21.30	-14.23	12.11
3	64.00	1.701	-22.50	-18.35	-15.56	-17.64	-11.47	-16.88	-18.07	-15.85	15.25	-13.43	-13.56	9.97
4	42.67	1.956	-20.12	-13.89	-10.75	-13.38	-9.69	-11.72	-14.04	-11.44	20.95	-11.39	-9.68	10.53
5	32.00	1.899	-12.52	-8.61	-4.09	-6.60	-5.95	-5.49	-9.87	-5.57	25.83	-6.18	-4.03	10.19
6	25.60	1.909	-4.95	-7.09	1.56	-.10	-.03	-10.00	-11.43	-1.43	25.94	.78	-.76	9.89
7	21.33	2.007	-4.46	-5.91	1.36	-.01	.95	-10.04	-11.65	-1.41	22.32	-.83	-1.02	8.87
8	18.29	2.429	-9.46	-7.62	-4.67	-6.11	-6.77	-6.44	-12.05	-6.23	12.09	-10.73	-5.83	6.35
9	16.00	4.098	-10.76	-10.48	-8.62	-9.46	-6.98	-4.74	-10.53	-9.88	.21	-12.11	-8.34	3.48
10	14.22	8.178	-7.96	-8.51	-7.44	-7.78	-6.26	-5.29	-7.69	-8.10	-1.86	-10.02	-7.09	2.11
11	12.80	12.558	-6.71	-7.81	-7.54	-7.48	-8.57	-8.07	-6.40	-7.72	-3.86	-10.81	-7.50	1.66
12	11.64	28.919	-7.60	-9.78	-8.72	-8.53	-9.67	-10.84	-9.26	-9.15	-7.81	-11.17	-9.25	1.11
13	10.67	67.105	-5.97	-8.99	-7.06	-6.84	-8.35	-10.18	-9.04	-7.85	-5.99	-9.20	-7.94	1.37
14	9.85	97.072	-5.61	-8.28	-6.74	-6.56	-6.96	-9.01	-8.01	-7.47	-5.06	-8.85	-7.25	1.25
15	9.14	101.188	-4.68	-6.24	-5.11	-5.07	-7.84	-8.28	-7.59	-5.60	-3.74	-9.05	-6.32	1.68
16	8.53	83.469	-3.54	-4.94	-3.71	-3.68	-7.75	-5.20	-5.22	-4.09	-2.21	-7.34	-4.77	1.64
17	8.00	65.463	-4.64	-6.10	-5.39	-5.33	-5.94	-3.09	-1.76	-5.87	-3.46	-6.91	-4.85	1.52
18	7.53	52.642	-5.65	-7.25	-6.08	-6.13	-6.39	-5.30	-3.22	-6.79	-3.39	-9.10	-5.93	1.64
19	7.11	33.238	-5.02	-6.10	-4.36	-4.31	-7.59	-6.37	-3.41	-4.54	-1.92	-10.74	-5.43	2.32
20	6.74	26.843	-3.89	-4.94	-3.53	-3.48	-3.42	-3.91	-7.27	-3.47	-1.09	-4.61	-3.96	1.47
21	6.40	23.767	-1.09	-2.08	-.40	.07	-1.74	1.07	-6.42	.55	1.27	9999.99	-.97	2.22
22	6.10	20.266	-.31	-.40	.75	1.55	-2.95	.17	.48	2.68	2.98	9999.99	.55	1.68
23	5.82	16.008	-.66	1.63	1.20	1.90	1.22	.31	9999.99	5.96	4.12	9999.99	1.96	1.98
24	5.57	12.026	2.69	1.97	3.50	5.81	7.80	10.22	9999.99	7.79	4.86	9999.99	5.58	2.68
25	5.33	10.183	5.16	3.25	6.52	9.19	13.14	16.36	9999.99	11.35	6.93	9999.99	8.98	4.11
26	5.12	9.744	2.49	5.42	9.52	11.78	13.93	17.47	9999.99	17.74	9.30	9999.99	10.96	5.06
27	4.92	7.906	4.56	5.58	14.33	18.36	9999.99	9999.99	9999.99	24.38	8.80	9999.99	12.66	7.11
28	4.74	5.089	5.80	5.87	9.71	9999.99	9999.99	9999.99	9999.99	28.07	6.86	9999.99	11.22	8.52
29	4.57	3.761	5.83	7.65	10.12	9999.99	9999.99	9999.99	9999.99	23.58	9.47	9999.99	11.31	6.30
30	4.41	2.638	8.81	8.20	18.75	9999.99	9999.99	9999.99	9999.99	22.24	12.42	9999.99	14.08	5.54
31	4.27	1.546	11.82	13.38	23.91	9999.99	9999.99	9999.99	9999.99	23.54	16.66	9999.99	17.86	5.04

Table A.8 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 02/02/94 01:00 HOURS Hmo= .71 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(16f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	1.004	-23.79	-25.55	-20.84	-21.98	-5.72	-22.68	-17.87	-22.58	8.14	-18.47	-17.22	9.92
3	64.00	1.807	-13.95	-16.31	-14.28	-14.33	-12.63	-23.50	-19.48	-14.92	14.56	-15.31	-13.11	9.68
4	42.67	2.111	-15.16	-12.62	-10.20	-11.60	-12.55	-14.49	-17.01	-11.08	17.13	-13.47	-10.20	9.28
5	32.00	1.889	-20.62	-13.48	-9.31	-12.31	-15.93	-8.03	-14.02	-11.00	21.19	-17.89	-10.29	11.05
6	25.60	1.558	-21.40	-13.07	-9.70	-13.08	-14.08	-13.27	-16.02	-11.40	20.40	-17.74	-11.08	10.91
7	21.33	1.459	-16.63	-9.68	-7.09	-9.97	-8.92	-17.63	-21.81	-8.31	17.12	-12.04	-9.58	9.96
8	18.29	1.825	-10.49	-7.83	-5.47	-6.86	-9.40	-13.66	-15.18	-6.29	13.21	-12.30	-7.47	7.53
9	16.00	2.963	-8.59	-8.12	-5.31	-6.22	-10.12	-10.55	-11.47	-6.39	7.56	-10.21	-6.96	5.22
10	14.22	7.002	-8.07	-7.27	-5.73	-6.42	-10.74	-8.90	-8.75	-6.27	1.29	-10.39	-7.13	3.23
11	12.80	14.110	-7.81	-8.52	-7.08	-7.35	-7.59	-10.47	-10.65	-7.74	-2.29	-8.86	-7.84	2.19
12	11.64	28.701	-6.42	-8.45	-7.28	-7.08	-8.08	-10.45	-12.02	-7.84	-5.63	-8.59	-8.18	1.78
13	10.67	68.858	-5.09	-6.57	-6.07	-5.86	-9.00	-10.24	-12.21	-6.32	-5.80	-8.76	-7.59	2.22
14	9.85	107.258	-5.00	-4.95	-4.93	-5.00	-8.97	-8.97	-11.35	-4.94	-3.05	-9.24	-6.64	2.58
15	9.14	82.317	-3.77	-5.15	-4.15	-4.11	-6.65	-6.37	-8.25	-4.58	-2.39	-6.45	-5.19	1.64
16	8.53	65.526	-2.65	-5.77	-3.95	-3.64	-3.40	-4.65	-5.19	-4.73	-2.74	-3.90	-4.06	.97
17	8.00	49.016	-4.30	-5.51	-4.69	-4.65	-4.39	-4.97	-4.82	-4.98	-2.60	-6.95	-4.79	1.02
18	7.53	36.887	-5.41	-4.72	-4.97	-5.10	-6.20	-7.18	-5.11	-4.45	-2.58	-7.61	-5.33	1.35
19	7.11	28.513	-5.15	-5.35	-5.06	-5.05	-4.26	-7.09	-7.39	-4.75	-2.19	-4.35	-5.06	1.38
20	6.74	17.834	-3.11	-5.93	-4.27	-3.79	-4.54	-4.00	-7.12	-4.39	-2.02	-2.88	-4.20	1.40
21	6.40	14.530	-1.36	-4.72	-1.98	-1.00	-4.63	-3.68	9999.99	-1.09	-1.05	9999.99	-2.44	1.53
22	6.10	11.124	-2.72	-4.47	-2.31	-1.35	-1.35	-5.51	9999.99	-.11	-.71	9999.99	-2.32	1.74
23	5.82	10.274	-2.37	-2.37	-1.32	-.69	-1.94	-.86	9999.99	9999.99	.86	9999.99	-1.24	1.07
24	5.57	8.051	-1.72	-2.51	-.75	1.26	9999.99	7.76	9999.99	9999.99	1.25	9999.99	.88	3.38
25	5.33	6.695	-.46	-2.22	-1.47	.50	9999.99	14.70	9999.99	9999.99	.58	9999.99	1.92	5.79
26	5.12	6.904	4.70	.02	2.01	5.22	9999.99	19.24	9999.99	9999.99	1.44	9999.99	5.42	6.43
27	4.92	6.386	8.24	7.34	9.77	9999.99	9999.99	18.63	9999.99	9999.99	7.21	9999.99	10.23	4.29
28	4.74	5.591	11.64	16.68	20.98	9999.99	9999.99	20.26	9999.99	9999.99	17.00	9999.99	17.31	3.31
29	4.57	5.043	16.46	16.66	27.73	9999.99	9999.99	29.21	9999.99	9999.99	19.59	9999.99	21.92	5.47
30	4.41	4.479	22.68	23.82	34.87	9999.99	9999.99	36.71	9999.99	9999.99	27.53	9999.99	29.12	5.71
31	4.27	4.201	28.16	33.78	39.59	9999.99	9999.99	40.29	9999.99	9999.99	37.54	9999.99	35.88	4.47

Table A.9 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 02/02/94 04:00 HOURS Hmo= .91 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(16f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	1.303	-32.10	-39.47	-32.42	-33.27	-11.45	-17.91	-26.12	-35.50	11.28	-18.74	-23.76	14.37
3	64.00	2.355	-22.13	-16.12	-14.34	-16.91	-13.76	-16.55	-15.77	-14.77	17.63	-12.14	-12.62	10.34
4	42.67	2.213	-20.00	-19.62	-13.77	-15.84	-13.59	-15.34	-16.30	-15.87	15.26	-13.77	-12.99	9.62
5	32.00	1.784	-15.83	-11.58	-6.79	-9.71	-8.87	-14.90	-16.39	-8.64	22.99	-10.36	-8.15	10.79
6	25.60	1.404	-9.28	-4.88	-.64	-3.31	-7.15	-7.09	-13.33	-1.99	26.67	-8.22	-3.05	10.48
7	21.33	1.399	-11.66	-7.03	-5.18	-7.81	-10.60	-.64	-10.04	-6.28	19.55	-15.47	-5.59	9.18
8	18.29	2.178	-9.27	-8.79	-7.05	-8.28	-6.49	-6.66	-11.85	-8.42	7.40	-11.35	-7.09	5.12
9	16.00	3.203	-6.30	-11.20	-10.03	-9.50	-4.07	-10.03	-8.59	-11.32	-2.94	-8.73	-8.27	2.75
10	14.22	5.480	-6.12	-12.21	-10.37	-9.55	-7.82	-10.13	-7.35	-11.49	-8.28	-10.10	-9.34	1.82
11	12.80	10.441	-5.24	-9.84	-7.84	-7.32	-9.49	-10.10	-8.35	-8.81	-8.13	-8.88	-8.40	1.35
12	11.64	21.476	-6.21	-7.89	-7.73	-7.45	-10.13	-10.54	-8.85	-7.93	-8.13	-10.08	-8.49	1.31
13	10.67	61.905	-7.12	-8.69	-8.87	-8.50	-13.10	-11.87	-11.66	-8.90	-9.36	-12.60	-10.07	1.94
14	9.85	131.924	-6.99	-9.21	-8.59	-8.25	-12.93	-11.65	-11.92	-8.92	-9.10	-12.14	-9.97	1.90
15	9.14	125.030	-6.43	-8.69	-7.58	-7.37	-10.77	-10.63	-11.07	-8.10	-7.46	-11.24	-8.93	1.72
16	8.53	73.514	-5.36	-7.87	-6.80	-6.50	-8.98	-7.91	-9.72	-7.38	-6.75	-10.13	-7.74	1.43
17	8.00	58.121	-4.08	-5.94	-5.59	-5.32	-6.38	-7.15	-7.30	-5.95	-4.96	-7.74	-6.04	1.08
18	7.53	44.022	-3.90	-4.20	-4.29	-4.24	-5.83	-7.87	-7.98	-4.21	-2.69	-6.03	-5.12	1.66
19	7.11	24.993	-3.35	-4.84	-3.03	-2.61	-5.17	-8.66	-9.52	-2.58	-2.77	-5.61	-4.81	2.39
20	6.74	19.190	-.19	-2.12	-.53	.38	-3.61	-6.13	.04	.49	-.14	-2.03	-1.38	2.02
21	6.40	16.235	1.00	1.54	1.14	1.93	1.49	-.53	3.04	3.12	3.16	2.74	1.86	1.12
22	6.10	15.680	6.39	5.32	6.74	8.15	13.61	6.86	9999.99	9.12	7.04	16.30	8.83	3.48
23	5.82	16.449	9.04	11.18	10.76	11.67	20.82	13.00	9999.99	15.16	12.93	10.81	12.82	3.27
24	5.57	17.310	15.88	17.49	18.89	21.04	24.15	22.25	9999.99	24.14	18.89	16.93	19.96	2.90
25	5.33	26.299	22.05	21.41	23.15	24.91	26.93	27.23	9999.99	25.39	23.22	32.63	25.21	3.24
26	5.12	47.552	27.03	28.93	29.10	29.96	28.96	27.03	9999.99	31.87	30.46	38.44	30.20	3.25
27	4.92	63.392	31.01	33.63	34.07	34.74	31.81	31.01	9999.99	35.72	34.90	35.85	33.64	1.81
28	4.74	58.110	31.43	34.48	34.46	35.13	35.22	36.55	9999.99	35.94	35.71	36.24	35.02	1.44
29	4.57	44.219	34.68	35.46	37.05	37.89	37.44	36.84	9999.99	38.83	37.35	40.43	37.33	1.60
30	4.41	32.076	37.14	35.40	39.36	40.79	39.72	37.81	9999.99	41.39	38.13	41.43	39.02	1.95
31	4.27	31.392	35.89	37.38	39.59	40.10	41.72	38.01	9999.99	41.59	39.98	42.44	39.63	2.06

Table A.10 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 02/02/94 07:00 HOURS Hmo=1.22 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(16f5.1) FACTOR=1.0

NO	Period (sec)	Energy (cm**2)	DIRECTION (degrees) for 10 different gauge pairs 43	21	32	42	65	78	89	31	01	54	Mean dir	Std dev
2	128.00	1.262	-11.68	-17.98	8.72	3.27	7.04	-6.05	-14.37	-1.81	9.02	-15.52	-3.94	10.05
3	64.00	2.012	-2.33	-.70	5.88	3.44	7.82	-2.02	-5.82	3.63	28.31	-1.12	3.64	9.11
4	42.67	2.351	-5.20	1.11	4.01	1.36	8.07	-.43	-2.07	3.00	30.91	-.05	3.98	9.56
5	32.00	2.220	-8.53	-2.43	2.25	-.97	2.12	-1.11	-3.93	.11	30.31	-3.82	1.28	10.10
6	25.60	1.759	-3.71	-3.54	3.14	.83	-.53	.65	-1.62	.51	27.01	-2.86	1.91	8.59
7	21.33	1.663	-2.06	-1.71	2.61	.44	.54	1.53	4.49	1.42	23.46	-.89	2.94	7.08
8	18.29	2.367	-2.36	1.74	3.72	1.41	-1.31	-1.19	-1.33	3.11	20.43	-2.43	2.15	6.44
9	16.00	2.806	3.12	2.26	4.05	3.34	-4.82	-3.66	-4.75	3.05	14.90	-2.75	1.46	5.65
10	14.22	4.387	2.13	-1.51	.06	-.16	-4.26	-7.86	-10.48	-1.58	4.98	-3.88	-2.25	4.34
11	12.80	8.049	-.35	-4.20	-2.77	-2.80	-9.16	-10.25	-14.21	-4.27	-.90	-5.85	-5.47	4.21
12	11.64	18.766	-6.91	-8.25	-8.97	-8.75	-10.94	-9.82	-12.78	-9.13	-7.64	-9.64	-9.28	1.59
13	10.67	61.424	-8.36	-9.68	-9.72	-9.50	-11.38	-9.51	-9.84	-9.82	-9.30	-12.04	-9.91	1.00
14	9.85	114.578	-9.05	-9.78	-10.05	-9.95	-12.86	-10.20	-9.78	-10.09	-8.98	-13.90	-10.46	1.53
15	9.14	116.105	-8.66	-10.01	-10.01	-9.89	-11.26	-9.87	-10.34	-10.29	-8.65	-12.15	-10.11	1.00
16	8.53	75.044	-7.37	-8.78	-8.52	-8.45	-8.50	-6.84	-9.81	-8.89	-7.47	-10.55	-8.52	1.06
17	8.00	58.326	-4.99	-6.28	-6.24	-6.14	-7.87	-5.89	-9.18	-6.52	-4.75	-9.72	-6.76	1.57
18	7.53	43.153	-2.48	-5.00	-3.69	-3.29	-7.42	-8.45	-10.09	-3.99	-3.27	-7.25	-5.49	2.48
19	7.11	47.797	-.79	-3.63	-2.13	-1.67	-2.27	-7.65	-9.36	-2.58	-1.75	-3.63	-3.54	2.64
20	6.74	48.943	1.34	-.85	.12	.55	3.54	-1.95	1.74	-.05	1.12	1.93	.75	1.47
21	6.40	56.264	8.10	7.43	7.74	8.34	8.20	5.72	9.44	8.72	8.79	9.48	8.20	1.04
22	6.10	82.394	15.67	13.64	14.84	15.76	12.91	13.22	13.42	15.44	14.71	13.24	14.28	1.06
23	5.82	123.724	19.17	16.92	18.96	19.67	16.58	16.76	17.13	18.97	17.99	14.82	17.70	1.44
24	5.57	163.574	21.21	20.09	22.41	22.57	19.49	19.09	19.95	22.20	21.31	18.26	20.66	1.42
25	5.33	182.440	21.29	21.74	22.88	22.69	22.82	23.22	23.07	22.81	23.06	20.66	22.42	.83
26	5.12	160.031	23.20	23.90	24.46	24.37	26.26	25.35	24.06	24.23	25.32	25.15	24.63	.84
27	4.92	111.467	26.48	28.22	28.63	28.86	27.39	26.76	26.15	29.01	29.92	29.10	28.05	1.21
28	4.74	85.557	29.11	33.47	32.30	32.63	27.87	30.22	31.32	35.22	35.49	9999.99	31.96	2.45
29	4.57	82.776	26.99	32.66	31.92	31.61	29.83	31.42	9999.99	35.02	35.29	9999.99	31.84	2.51
30	4.41	57.710	26.73	27.57	31.75	32.00	30.81	32.84	9999.99	33.96	30.41	9999.99	30.76	2.33
31	4.27	35.561	27.41	28.70	31.34	32.42	31.16	34.40	9999.99	9999.99	31.43	9999.99	30.98	2.14

Table A.11 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 02/02/94 10:00 HOURS Hmo=1.50 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(16f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	1.692	24.49	17.34	28.75	25.61	23.49	24.38	31.43	26.68	48.15	18.57	26.85	8.13
3	64.00	2.971	10.27	2.78	12.44	10.72	6.43	9.91	14.33	9.70	31.43	13.24	12.09	7.17
4	42.67	2.835	8.12	2.18	11.88	10.08	10.64	10.83	17.03	8.96	30.80	12.34	12.26	7.11
5	32.00	2.481	3.63	2.24	10.75	8.28	11.03	13.26	15.72	8.30	31.15	12.74	11.68	7.60
6	25.60	2.327	-.76	3.85	6.54	3.87	4.54	4.56	4.84	5.90	31.08	4.18	6.79	8.28
7	21.33	2.407	2.23	9.83	8.90	6.30	7.77	6.31	3.61	9.97	36.01	5.94	9.60	9.09
8	18.29	2.797	3.31	5.51	6.72	4.99	6.43	5.48	-3.45	6.24	23.10	6.87	6.50	6.24
9	16.00	3.304	1.41	.83	3.16	1.84	3.46	2.37	-3.25	1.76	12.23	2.40	2.62	3.66
10	14.22	4.327	-3.80	-3.87	-2.99	-4.13	.43	.32	-3.92	-4.20	4.16	-5.04	-2.30	2.80
11	12.80	8.774	-7.68	-9.27	-8.60	-8.87	-7.88	-4.29	-9.61	-9.61	-5.10	-14.26	-8.52	2.58
12	11.64	20.890	-6.97	-9.03	-8.30	-8.14	-12.02	-11.26	-11.37	-8.86	-6.54	-13.01	-9.55	2.11
13	10.67	46.384	-7.17	-8.60	-8.23	-8.08	-11.27	-14.00	-14.03	-8.52	-6.87	-12.50	-9.93	2.62
14	9.85	73.700	-7.85	-8.95	-8.74	-8.74	-12.53	-13.54	-14.36	-9.06	-6.83	-13.22	-10.38	2.58
15	9.14	81.973	-9.10	-11.07	-10.52	-10.44	-13.45	-11.87	-13.15	-11.19	-8.82	-13.56	-11.32	1.61
16	8.53	83.670	-7.56	-10.18	-9.15	-8.96	-11.65	-10.85	-10.89	-9.97	-8.31	-12.59	-10.01	1.47
17	8.00	68.258	-5.29	-8.48	-7.36	-7.25	-9.38	-12.14	-9.43	-8.60	-6.37	-8.99	-8.33	1.80
18	7.53	69.334	2.99	1.83	2.77	2.58	-5.30	-3.81	-1.00	2.06	4.13	-1.53	.47	3.03
19	7.11	99.170	11.47	13.50	13.27	13.38	9.79	10.35	13.71	14.86	15.98	13.38	12.97	1.82
20	6.74	139.853	19.60	20.63	20.51	21.04	20.64	18.06	18.64	21.70	22.89	22.06	20.58	1.42
21	6.40	227.877	21.25	21.24	21.33	21.65	22.97	21.42	23.48	21.49	23.39	21.99	22.02	.86
22	6.10	343.037	22.58	23.39	23.62	23.57	24.71	22.64	25.17	23.58	25.53	21.64	23.64	1.15
23	5.82	366.210	23.61	24.63	24.89	24.70	24.82	26.85	28.55	24.81	27.10	21.59	25.15	1.85
24	5.57	302.155	24.37	24.99	26.15	25.84	25.89	28.10	27.57	25.96	27.96	25.63	26.25	1.18
25	5.33	233.735	25.93	28.30	28.70	28.20	29.43	29.36	27.56	29.42	31.16	28.03	28.61	1.32
26	5.12	185.783	26.80	30.90	30.57	30.18	30.39	28.17	31.19	31.75	33.89	28.51	30.23	1.90
27	4.92	146.341	27.37	29.30	30.83	30.89	28.80	25.50	30.57	31.36	32.76	28.42	29.58	2.03
28	4.74	92.954	27.96	28.74	31.25	31.58	30.47	31.75	34.41	31.66	32.30	9999.99	31.12	1.80
29	4.57	59.575	29.83	29.16	32.14	33.59	33.06	35.30	9999.99	33.75	33.07	9999.99	32.49	1.92
30	4.41	44.508	30.13	30.74	34.07	35.99	36.33	31.62	9999.99	38.21	34.97	9999.99	34.01	2.72
31	4.27	33.496	28.26	32.16	32.98	35.59	37.70	9999.99	9999.99	38.40	36.41	9999.99	34.50	3.32

Table A.12 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 02/02/94 13:00 HOURS Hmo=1.55 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(16f5.1) FACTOR=1.0

NO	Period (sec)	Energy (cm**2)	DIRECTION (degrees) for 10 different gauge pairs 43	21	32	42	65	78	89	31	01	54	Mean dir	Std dev
2	128.00	2.687	8.87	7.05	16.82	13.34	4.27	12.46	-3.47	14.42	25.54	7.59	10.69	7.42
3	64.00	4.832	5.67	5.33	13.14	10.63	5.26	15.99	16.26	10.75	34.22	-3.32	11.35	9.45
4	42.67	4.811	9.78	5.57	11.84	10.72	15.00	10.71	10.57	10.35	32.60	4.39	12.11	7.39
5	32.00	4.430	8.89	7.28	11.56	10.55	17.07	9.42	4.96	10.61	30.90	14.33	12.53	6.91
6	25.60	3.332	9.46	10.46	10.96	10.33	11.15	12.78	11.93	11.13	29.28	13.25	13.05	5.51
7	21.33	2.143	16.40	12.25	14.22	14.85	9.24	9.29	10.00	14.64	31.14	9.19	14.10	6.23
8	18.29	2.076	13.65	13.42	16.71	16.30	3.10	-.75	-2.03	17.32	29.79	1.56	10.90	9.62
9	16.00	3.002	2.90	.83	3.74	2.56	-1.53	-2.58	-7.28	2.32	12.78	-2.89	1.08	5.07
10	14.22	6.311	-2.04	-5.74	-3.87	-4.11	-6.23	-5.30	-12.23	-5.60	1.52	-6.03	-4.96	3.30
11	12.80	9.142	-5.17	-7.42	-7.09	-7.16	-8.65	-7.04	-9.28	-8.12	-4.33	-9.30	-7.36	1.55
12	11.64	18.202	-9.15	-9.19	-10.95	-10.94	-9.91	-10.02	-9.03	-10.84	-8.71	-12.57	-10.13	1.14
13	10.67	47.803	-9.52	-9.47	-10.73	-10.63	-13.65	-13.21	-11.68	-10.52	-8.91	-14.86	-11.32	1.89
14	9.85	89.170	-10.01	-9.87	-10.67	-10.65	-13.20	-11.57	-12.03	-10.52	-8.62	-14.49	-11.16	1.63
15	9.14	96.663	-7.50	-9.48	-9.06	-8.78	-9.15	-10.69	-11.88	-9.33	-7.86	-10.56	-9.43	1.25
16	8.53	74.398	-5.04	-7.47	-6.95	-6.57	-3.27	-9.16	-10.01	-7.30	-5.74	-6.96	-6.85	1.83
17	8.00	73.858	-1.64	-2.20	-2.63	-2.55	-.76	-4.74	-2.26	-2.60	-.65	-3.80	-2.38	1.18
18	7.53	110.361	6.29	4.54	5.02	5.34	5.85	3.09	7.69	4.98	5.96	6.03	5.48	1.15
19	7.11	225.095	14.60	13.63	14.54	14.85	14.61	12.57	16.60	15.08	15.02	15.39	14.69	1.00
20	6.74	401.960	20.45	20.45	21.20	21.36	19.48	19.93	20.60	21.66	22.08	20.38	20.76	.76
21	6.40	450.796	23.86	24.36	25.06	25.14	24.23	25.06	25.09	25.51	26.57	24.04	24.89	.77
22	6.10	402.381	26.00	26.48	27.85	27.92	27.14	27.83	29.32	28.37	29.39	27.26	27.75	1.04
23	5.82	261.003	27.53	27.42	29.91	30.28	27.28	30.40	29.79	30.32	30.44	28.35	29.17	1.29
24	5.57	176.829	27.90	28.05	29.93	30.44	29.97	31.16	28.82	30.57	31.04	29.69	29.76	1.10
25	5.33	121.340	26.44	29.94	29.91	29.88	31.00	30.40	31.91	31.71	33.08	32.35	30.66	1.76
26	5.12	92.395	25.48	29.73	28.35	28.51	29.80	31.22	32.52	31.25	32.90	32.68	30.24	2.23
27	4.92	79.767	26.08	29.34	28.40	29.45	28.94	31.25	9999.99	32.51	32.98	30.77	29.97	2.03
28	4.74	67.648	24.94	29.25	28.68	29.55	30.53	31.14	9999.99	33.92	33.24	35.35	30.73	2.97
29	4.57	48.276	24.06	30.03	30.11	30.85	34.19	32.34	9999.99	36.93	34.30	9999.99	31.60	3.62
30	4.41	35.528	24.28	28.26	30.43	30.84	37.37	32.94	9999.99	35.66	32.91	9999.99	31.59	3.87
31	4.27	30.229	25.69	28.91	32.82	34.22	40.07	35.84	9999.99	40.11	34.61	9999.99	34.03	4.67

Table A.13 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 02/02/94 16:00 HOURS Hmo=1.39 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(16f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	2.345	-4.40	17.14	12.57	7.36	26.14	-1.28	6.98	15.23	43.49	5.42	12.75	13.25
3	64.00	4.325	2.88	9.52	16.33	12.61	17.41	1.49	4.18	14.74	37.98	14.92	13.15	9.93
4	42.67	4.332	2.52	7.46	14.14	11.13	10.38	3.43	1.90	12.41	36.05	10.56	10.93	9.30
5	32.00	3.604	11.82	11.63	17.25	16.20	9.18	15.93	10.79	16.10	36.43	12.74	15.77	7.35
6	25.60	2.942	18.14	16.12	21.77	21.14	9.16	15.77	8.37	20.58	36.48	19.34	18.67	7.41
7	21.33	2.384	19.79	21.06	24.55	23.61	10.93	7.94	.57	24.55	36.29	22.13	19.16	9.61
8	18.29	2.349	8.95	11.21	10.94	9.68	3.33	7.08	-2.53	11.12	22.30	6.97	8.90	6.03
9	16.00	2.951	3.59	1.66	1.96	1.42	-2.02	-1.77	-4.39	1.35	10.33	-3.22	.89	3.99
10	14.22	3.864	-1.74	-5.84	-4.43	-4.57	-2.53	-4.92	-4.09	-5.95	.91	-7.41	-4.06	2.27
11	12.80	6.934	-4.93	-6.33	-6.19	-6.47	-6.12	-8.78	-8.14	-6.84	-4.33	-9.67	-6.78	1.57
12	11.64	21.082	-8.27	-9.83	-10.19	-10.02	-9.26	-8.35	-7.68	-10.22	-11.01	-13.15	-9.80	1.49
13	10.67	59.135	-7.81	-8.93	-9.59	-9.29	-11.12	-8.44	-7.06	-9.48	-9.54	-13.68	-9.49	1.74
14	9.85	93.747	-7.19	-9.07	-9.47	-9.03	-11.70	-10.48	-8.73	-9.56	-9.29	-13.42	-9.79	1.63
15	9.14	97.146	-4.17	-6.85	-6.21	-5.79	-9.49	-10.71	-10.93	-6.60	-6.45	-10.36	-7.76	2.27
16	8.53	81.971	-.91	-2.90	-1.91	-1.71	-5.53	-8.11	-8.49	-2.30	-1.82	-6.37	-4.00	2.70
17	8.00	98.579	1.87	-.13	.56	.87	-1.31	-3.20	-2.97	.28	.26	-1.66	-.54	1.59
18	7.53	132.660	5.19	2.79	3.47	3.84	4.79	2.65	2.56	3.01	2.95	4.27	3.55	.89
19	7.11	194.197	13.12	9.82	11.21	11.76	10.62	11.14	10.76	10.69	10.41	12.90	11.24	1.01
20	6.74	274.525	20.70	17.61	19.62	20.37	18.08	15.19	15.21	19.59	18.78	20.26	18.54	1.92
21	6.40	282.809	23.88	22.50	24.80	25.39	24.18	20.12	20.09	25.34	24.01	24.13	23.44	1.84
22	6.10	223.190	25.25	24.30	26.48	27.06	23.95	24.13	25.13	27.06	26.06	25.33	25.47	1.10
23	5.82	199.551	24.97	25.31	27.14	27.47	23.92	25.49	26.94	28.01	27.26	27.15	26.37	1.27
24	5.57	143.168	24.67	24.56	26.74	27.33	26.26	25.67	27.17	27.84	26.70	28.46	26.54	1.21
25	5.33	104.244	24.22	24.45	26.22	26.90	28.34	25.27	27.53	27.49	26.64	29.69	26.68	1.63
26	5.12	95.655	24.49	26.82	28.35	29.19	29.44	25.83	30.22	30.74	29.14	29.29	28.35	1.90
27	4.92	64.970	26.05	26.85	29.31	30.57	28.62	26.36	31.58	32.00	29.21	30.58	29.11	2.03
28	4.74	45.480	27.14	26.41	30.11	31.64	27.67	31.82	9999.99	32.67	29.14	33.77	30.04	2.46
29	4.57	41.080	25.48	27.62	31.11	32.59	30.10	32.95	9999.99	35.52	30.56	37.34	31.47	3.46
30	4.41	37.012	24.78	30.55	35.74	37.06	35.22	36.02	9999.99	40.35	33.88	42.14	35.09	4.84
31	4.27	25.940	25.94	30.99	38.47	40.89	38.96	38.10	9999.99	41.82	35.50	41.81	36.95	5.05

Table A.14 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 02/02/94 19:00 HOURS Hmo=1.24 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(16f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	2.385	3.23	9.53	10.35	8.32	-6.57	12.60	8.11	9.89	30.42	-4.03	8.15	9.57
3	64.00	3.838	-.59	-3.70	1.09	.15	-6.10	10.06	-.40	-.27	28.23	-3.77	2.39	9.51
4	42.67	3.462	1.36	-.45	3.97	3.00	-1.93	9.39	7.88	2.93	31.25	-4.85	5.18	9.56
5	32.00	2.548	1.72	3.09	5.55	4.32	2.40	8.01	5.66	5.37	32.67	-1.22	6.67	8.97
6	25.60	2.215	11.67	10.04	11.75	11.40	7.57	8.63	5.17	11.81	33.67	12.01	12.33	7.42
7	21.33	2.248	10.41	8.60	11.95	11.46	12.21	3.43	3.99	11.67	29.25	12.41	11.52	6.69
8	18.29	2.206	-3.04	-4.68	-1.73	-2.62	5.93	-4.30	3.79	-3.24	12.36	-4.59	-.22	5.41
9	16.00	2.887	-7.03	-7.20	-7.51	-8.31	-4.57	-4.67	.12	-8.30	3.11	-12.12	-5.65	4.19
10	14.22	3.372	-3.54	-5.62	-5.85	-5.88	-4.89	-5.16	-3.22	-6.44	-.16	-11.28	-5.20	2.68
11	12.80	5.191	-3.39	-7.59	-6.84	-6.37	-6.22	-5.48	-5.08	-7.97	-5.23	-9.33	-6.35	1.60
12	11.64	17.979	-4.49	-8.40	-7.17	-6.62	-7.56	-8.12	-8.68	-7.99	-8.22	-8.20	-7.54	1.17
13	10.67	43.272	-4.70	-7.91	-6.78	-6.32	-7.36	-10.12	-10.14	-7.37	-7.55	-8.58	-7.68	1.57
14	9.85	79.453	-5.05	-6.98	-7.01	-6.60	-7.52	-8.04	-8.70	-7.11	-6.87	-8.99	-7.29	1.07
15	9.14	97.441	-4.95	-6.13	-6.62	-6.31	-5.97	-7.99	-9.71	-6.57	-5.39	-8.02	-6.77	1.35
16	8.53	86.101	-2.35	-3.08	-3.29	-3.14	-3.78	-6.54	-6.67	-3.27	-1.63	-4.91	-3.87	1.59
17	8.00	76.193	1.16	.10	.29	.43	-1.07	-1.04	-1.75	.16	1.63	-.24	-.03	.98
18	7.53	107.058	6.78	5.88	6.09	6.30	4.09	4.11	2.74	6.13	6.26	4.61	5.30	1.25
19	7.11	196.587	10.43	9.48	9.55	9.79	9.01	10.21	8.77	9.52	10.00	9.09	9.59	.51
20	6.74	239.080	13.04	12.38	12.55	12.63	13.32	15.41	14.91	12.31	13.52	11.71	13.18	1.11
21	6.40	208.515	18.02	18.81	19.01	18.95	17.45	19.12	21.10	19.36	20.25	16.21	18.83	1.30
22	6.10	174.892	22.28	22.54	23.04	23.28	22.40	21.22	23.53	23.27	24.02	22.75	22.83	.74
23	5.82	134.862	21.08	20.82	21.76	22.07	21.89	22.64	25.19	21.90	22.53	21.38	22.13	1.16
24	5.57	99.063	21.72	22.19	23.87	24.02	20.96	23.23	26.25	24.85	24.52	23.78	23.54	1.49
25	5.33	82.558	23.54	25.16	26.02	26.56	23.33	23.39	25.52	28.36	27.66	29.58	25.91	2.06
26	5.12	61.944	23.29	26.84	27.50	28.75	25.35	24.12	29.30	31.14	29.20	28.70	27.42	2.38
27	4.92	48.018	22.08	25.78	26.07	27.25	25.15	25.91	33.11	30.55	28.04	27.50	27.14	2.87
28	4.74	39.709	23.94	23.45	25.95	28.01	23.94	29.49	33.58	29.52	26.00	29.58	27.34	3.09
29	4.57	37.055	24.06	21.83	27.19	29.43	27.35	30.66	34.46	31.16	24.75	33.18	28.41	3.89
30	4.41	26.753	25.28	22.99	29.26	33.08	31.51	32.28	38.08	35.84	25.97	39.59	31.39	5.27
31	4.27	17.626	24.07	23.61	27.75	31.95	34.40	39.31	9999.99	9999.99	26.96	41.74	31.22	6.38

Table A.15 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 02/02/94 22:00 HOURS Hmo=1.01 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(16f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	1.457	-14.48	2.69	-3.55	-6.99	2.22	-3.20	1.19	1.05	34.49	3.52	1.54	12.12
3	64.00	2.136	-8.90	-2.39	3.05	-.46	2.61	.67	-2.28	2.16	27.64	1.71	2.31	9.06
4	42.67	1.963	-3.13	.49	6.86	3.87	2.47	6.03	1.53	5.53	29.79	2.81	5.56	8.52
5	32.00	2.151	7.65	10.23	16.30	14.09	11.36	12.58	10.32	15.32	37.80	12.06	14.71	8.05
6	25.60	2.326	11.60	14.55	19.08	17.36	15.21	13.75	12.99	18.83	39.90	14.75	17.75	7.72
7	21.33	2.249	7.02	10.50	14.12	12.38	9.10	8.43	5.04	13.81	33.51	9.09	12.25	7.58
8	18.29	2.389	2.52	3.14	7.08	5.61	-.67	3.39	1.37	6.07	24.62	2.42	5.52	6.72
9	16.00	3.189	-4.27	-2.98	-1.42	-2.77	-6.65	-6.38	-1.74	-2.44	13.33	-4.98	-2.05	5.40
10	14.22	4.847	-6.31	-6.31	-4.73	-5.57	-7.28	-4.55	-3.09	-5.95	4.38	-10.30	-4.98	3.60
11	12.80	11.048	-5.97	-7.94	-5.78	-6.04	-5.92	-4.91	-7.50	-6.91	-2.42	-9.62	-6.30	1.82
12	11.64	25.367	-6.15	-7.72	-6.72	-6.76	-4.34	-6.91	-8.81	-7.28	-4.61	-8.29	-6.76	1.36
13	10.67	44.899	-5.42	-6.03	-6.20	-6.19	-5.49	-6.01	-8.34	-6.31	-3.38	-7.78	-6.11	1.27
14	9.85	59.598	-3.77	-4.49	-4.46	-4.40	-5.52	-6.56	-6.69	-4.51	-2.07	-6.87	-4.93	1.42
15	9.14	56.463	-2.73	-3.88	-3.14	-3.05	-7.22	-7.02	-4.98	-3.37	-2.06	-6.61	-4.41	1.82
16	8.53	53.784	.16	-2.12	-.68	-.34	-3.84	-3.67	-2.45	-1.02	-.20	-3.16	-1.73	1.43
17	8.00	70.455	3.79	1.33	2.81	3.26	3.24	1.05	-.40	2.58	3.34	1.73	2.27	1.25
18	7.53	89.872	8.55	6.39	8.03	8.46	6.52	7.76	5.04	7.93	7.88	6.02	7.26	1.12
19	7.11	111.072	11.74	9.45	11.11	11.46	7.37	9.22	6.95	10.82	10.70	9.62	9.84	1.57
20	6.74	131.850	14.38	12.24	13.81	14.11	10.55	11.80	9.42	13.51	13.78	11.47	12.51	1.59
21	6.40	144.085	18.31	16.49	17.84	18.12	17.73	15.28	14.18	17.65	18.35	16.10	17.01	1.36
22	6.10	123.260	20.87	20.81	21.94	22.09	20.44	19.85	18.55	22.24	23.06	20.55	21.04	1.25
23	5.82	88.450	19.87	21.51	22.22	22.21	22.26	23.19	20.28	23.13	23.85	20.98	21.95	1.23
24	5.57	54.351	18.86	20.17	20.32	20.41	22.82	23.11	22.18	21.36	22.53	19.95	21.17	1.36
25	5.33	40.844	21.84	20.40	21.94	22.79	23.85	23.62	25.84	23.21	23.17	28.42	23.51	2.13
26	5.12	35.336	22.76	22.19	23.99	25.30	23.37	23.33	27.78	27.90	24.73	33.23	25.46	3.18
27	4.92	30.762	21.81	20.64	22.20	23.92	26.16	27.27	9999.99	25.86	22.84	35.93	25.17	4.34
28	4.74	27.180	21.31	20.56	20.48	21.67	28.05	31.39	9999.99	23.30	22.50	38.32	25.27	5.78
29	4.57	20.683	22.75	23.06	22.49	24.16	28.55	26.09	9999.99	27.42	25.65	34.72	26.10	3.64
30	4.41	12.570	23.82	24.53	26.53	29.24	25.97	31.51	9999.99	31.36	27.44	36.77	28.57	3.88
31	4.27	9.096	23.16	26.11	28.86	29.76	29.53	33.20	9999.99	33.02	28.97	39.51	30.23	4.40

Table A.16 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 03/02/94 01:00 HOURS Hmo= .82 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	1.090	17.96	3.45	-4.01	.49	-6.93	-.57	-4.21	-.59	25.54	1.63	3.21	9.82
3	64.00	1.917	-.08	-6.14	-1.68	-1.85	-.33	-1.24	-2.07	-3.17	26.88	-2.88	.66	8.86
4	42.67	2.406	-2.90	-2.39	2.86	.90	1.37	4.85	1.07	.98	28.95	.28	3.52	8.71
5	32.00	2.192	-3.80	1.17	5.58	2.83	2.47	6.73	1.73	4.05	32.03	.21	5.21	9.33
6	25.60	1.830	-1.24	5.35	10.31	7.24	7.27	3.71	-1.74	9.06	35.29	3.94	7.82	9.87
7	21.33	1.792	1.83	7.63	12.38	9.85	9.07	1.79	-2.09	11.66	34.01	8.33	9.38	9.34
8	18.29	2.517	-.60	-.25	3.23	2.11	2.49	-1.57	-3.07	1.96	20.12	2.30	2.65	6.13
9	16.00	3.869	-4.44	-5.95	-2.89	-3.63	-5.23	-2.44	-3.95	-4.36	8.29	-5.13	-2.98	3.89
10	14.22	4.954	-3.58	-5.41	-2.33	-2.80	-4.59	-4.72	-7.11	-3.72	5.43	-5.13	-3.40	3.22
11	12.80	9.107	-3.53	-5.46	-3.76	-3.87	-3.99	-7.35	-7.20	-4.55	.41	-6.35	-4.56	2.14
12	11.64	23.250	-4.07	-6.00	-5.06	-4.91	-4.70	-7.40	-8.14	-5.37	-2.56	-7.55	-5.58	1.64
13	10.67	41.943	-5.55	-8.05	-6.82	-6.61	-6.67	-7.91	-9.19	-7.25	-4.37	-9.24	-7.17	1.44
14	9.85	47.664	-5.93	-8.24	-7.00	-6.88	-6.72	-7.71	-8.73	-7.62	-4.90	-9.03	-7.28	1.20
15	9.14	41.797	-2.11	-3.63	-2.10	-2.02	-4.69	-6.04	-6.26	-2.42	-.53	-5.42	-3.52	1.88
16	8.53	38.730	2.58	1.14	2.49	2.68	-1.64	-.25	.05	2.47	3.98	1.11	1.46	1.61
17	8.00	49.795	5.92	4.83	5.62	5.87	2.42	3.35	3.94	5.77	6.86	5.94	5.05	1.32
18	7.53	66.350	8.57	7.82	8.62	8.87	6.37	5.84	6.07	8.94	9.43	7.39	7.79	1.24
19	7.11	73.840	10.90	9.77	10.75	11.01	9.39	9.92	10.63	10.79	10.84	9.11	10.31	.66
20	6.74	68.881	15.04	12.99	14.73	14.98	11.06	13.63	14.80	14.26	13.73	11.85	13.71	1.30
21	6.40	77.715	18.49	16.34	18.04	18.31	14.93	17.11	18.86	17.61	17.50	15.86	17.31	1.19
22	6.10	75.624	19.12	19.80	20.05	20.14	18.89	20.60	21.76	20.52	21.43	18.35	20.06	1.03
23	5.82	56.583	20.76	22.04	22.37	22.43	22.32	23.70	25.33	23.35	23.78	21.91	22.80	1.21
24	5.57	35.436	21.47	22.43	22.57	22.94	23.10	23.07	26.93	23.72	24.36	25.16	23.57	1.48
25	5.33	23.960	20.62	23.38	23.29	23.91	20.55	23.61	25.92	25.42	25.55	22.89	23.51	1.77
26	5.12	20.786	20.50	24.00	24.25	24.60	22.78	25.25	29.20	27.61	26.28	9999.99	24.94	2.43
27	4.92	17.064	20.99	23.59	24.69	24.86	26.29	26.77	33.69	28.25	26.09	9999.99	26.14	3.31
28	4.74	13.682	21.59	20.90	25.13	25.46	30.85	26.33	32.42	26.29	23.98	9999.99	25.88	3.58
29	4.57	9.728	20.33	19.14	24.24	24.55	27.80	9999.99	31.70	24.17	22.01	9999.99	24.24	3.79
30	4.41	6.716	21.96	20.19	26.74	27.76	27.71	9999.99	9999.99	28.07	22.30	9999.99	24.96	3.09
31	4.27	5.830	21.62	19.93	25.24	25.91	28.79	9999.99	9999.99	9999.99	21.13	9999.99	23.77	3.12

Table A.17 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 03/02/94 04:00 HOURS Hmo= .66 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	1.038	-27.51	-31.19	-9.28	-14.26	-13.92	-13.55	-26.99	-17.75	2.41	-14.22	-16.64	9.40
3	64.00	1.621	-21.41	-24.20	-9.45	-12.68	-11.76	-17.85	-20.31	-14.84	8.16	-12.04	-13.68	8.57
4	42.67	1.731	-10.39	-13.00	-3.18	-5.20	-5.72	-9.06	-10.48	-6.70	20.34	-6.04	-5.02	8.88
5	32.00	1.467	-2.25	-1.12	4.98	3.00	1.36	3.31	.28	3.19	32.79	.71	4.51	9.62
6	25.60	1.132	-3.71	1.45	5.64	2.89	4.23	6.64	2.03	4.78	32.16	.15	5.54	9.29
7	21.33	1.412	-3.83	.15	2.73	.73	1.98	1.74	-.12	1.79	23.71	-3.22	2.52	7.34
8	18.29	1.754	-4.45	-1.75	-.07	-1.39	-3.51	-5.54	-5.41	-.99	14.99	-10.63	-1.90	6.33
9	16.00	2.373	-7.66	-6.07	-5.25	-6.34	-6.11	-7.66	-9.37	-6.15	5.67	-13.50	-6.25	4.58
10	14.22	4.164	-8.44	-8.59	-8.33	-8.83	-8.92	-6.01	-9.20	-8.90	-3.22	-13.36	-8.38	2.42
11	12.80	10.448	-6.27	-7.17	-7.35	-7.41	-8.29	-5.33	-7.71	-7.60	-5.29	-10.94	-7.34	1.53
12	11.64	25.571	-2.40	-4.93	-3.93	-3.67	-7.27	-6.63	-6.27	-4.49	-3.87	-7.14	-5.06	1.59
13	10.67	44.979	-2.72	-5.28	-4.01	-3.73	-7.28	-8.84	-7.81	-4.55	-3.88	-6.43	-5.45	1.93
14	9.85	47.575	-4.95	-6.96	-6.33	-6.05	-5.90	-8.24	-8.33	-6.65	-5.57	-7.00	-6.60	1.03
15	9.14	46.165	-3.24	-5.45	-4.50	-4.18	-4.52	-5.45	-8.34	-4.78	-4.02	-5.77	-5.03	1.32
16	8.53	40.596	-.85	-2.17	-1.43	-1.23	-2.03	-1.72	-2.18	-1.51	-1.10	-4.22	-1.84	.90
17	8.00	32.792	4.13	1.62	3.13	3.52	2.49	3.00	5.31	2.85	3.06	1.77	3.09	1.03
18	7.53	29.272	6.63	3.80	5.62	6.20	4.48	5.59	7.40	5.45	4.68	4.11	5.40	1.09
19	7.11	36.478	8.31	6.37	7.27	7.83	6.63	7.11	8.33	7.43	6.52	6.45	7.23	.71
20	6.74	39.469	11.05	8.62	9.99	10.63	9.60	9.24	9.99	10.04	8.84	9.53	9.75	.72
21	6.40	36.693	13.81	11.23	12.41	13.03	11.87	13.65	14.28	12.54	11.55	11.35	12.57	1.03
22	6.10	33.312	16.83	14.59	16.06	16.63	17.26	18.08	18.56	16.25	15.42	14.92	16.46	1.22
23	5.82	28.273	20.74	20.50	23.28	23.70	22.63	23.38	22.64	24.41	21.39	21.06	22.37	1.30
24	5.57	22.558	24.16	24.07	27.47	28.08	25.11	24.33	26.00	28.54	24.41	26.95	25.91	1.64
25	5.33	17.789	22.58	24.72	27.30	27.58	25.29	22.44	27.18	28.18	24.83	26.24	25.63	1.92
26	5.12	11.843	22.29	22.96	25.14	26.79	24.26	22.00	9999.99	26.57	23.99	25.64	24.41	1.66
27	4.92	10.600	21.56	21.71	22.22	24.52	30.48	19.28	9999.99	26.00	23.21	26.22	23.91	3.13
28	4.74	7.417	19.59	19.99	19.89	21.40	28.89	23.15	9999.99	22.59	21.15	9999.99	22.08	2.84
29	4.57	4.175	21.01	21.23	20.37	22.20	26.97	26.47	9999.99	23.48	22.27	9999.99	23.00	2.33
30	4.41	2.670	24.12	21.42	22.44	26.60	30.85	29.79	9999.99	26.92	22.03	9999.99	25.52	3.36
31	4.27	2.555	23.61	20.14	27.86	30.66	9999.99	35.27	9999.99	29.51	21.04	9999.99	26.87	5.11

Table A.18 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 03/02/94 07:00 HOURS Hmo= .61 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.955	-18.02	-17.00	-6.23	-9.72	-20.16	-17.39	-20.70	-10.40	16.77	-16.50	-12.05	10.59
3	64.00	1.471	-20.51	-17.96	-10.16	-13.08	-13.65	-14.08	-14.60	-13.14	11.47	-16.34	-12.27	8.35
4	42.67	1.321	-20.96	-16.25	-9.13	-12.61	-7.19	-11.75	-13.14	-12.08	16.28	-12.61	-10.03	9.43
5	32.00	1.306	-11.04	-7.44	-.02	-3.41	.75	-1.93	-5.09	-2.85	27.13	-2.71	-.76	9.83
6	25.60	1.305	-2.96	-2.76	5.78	3.18	3.17	2.81	.17	2.78	30.28	1.27	4.29	9.02
7	21.33	1.173	-4.63	-2.32	2.92	.76	.90	.62	2.91	.77	22.49	-.59	2.34	7.04
8	18.29	1.738	-4.98	-4.18	-.95	-2.28	-.80	-2.71	-2.16	-2.40	8.62	-2.60	-1.45	3.56
9	16.00	2.822	-10.34	-9.21	-7.41	-8.45	-7.61	-8.46	-7.54	-8.44	-.29	-10.87	-7.86	2.75
10	14.22	3.701	-9.95	-9.58	-9.02	-9.61	-6.86	-11.77	-10.31	-9.75	-3.57	-11.62	-9.20	2.28
11	12.80	10.692	-3.80	-6.59	-5.41	-5.20	-5.75	-8.53	-9.14	-6.12	-5.65	-7.41	-6.36	1.53
12	11.64	33.873	-1.53	-3.89	-3.03	-2.75	-5.92	-5.35	-5.71	-3.38	-3.20	-5.84	-4.06	1.46
13	10.67	63.148	-2.15	-4.19	-3.55	-3.28	-6.56	-4.53	-5.97	-3.80	-3.18	-6.67	-4.39	1.46
14	9.85	63.988	-4.05	-6.40	-5.58	-5.34	-7.83	-4.80	-7.95	-6.12	-5.13	-8.38	-6.16	1.39
15	9.14	46.828	-5.72	-7.29	-6.99	-6.90	-7.99	-5.71	-9.25	-7.38	-5.91	-9.07	-7.22	1.21
16	8.53	32.577	-3.86	-5.74	-5.22	-5.05	-5.75	-4.90	-5.84	-5.56	-4.47	-6.10	-5.25	.66
17	8.00	25.285	.34	-1.61	-.86	-.53	-1.90	-1.09	-1.83	-.86	-.37	-2.57	-1.13	.82
18	7.53	24.601	3.79	3.49	3.43	3.84	1.69	2.42	.80	4.40	4.03	2.66	3.06	1.08
19	7.11	28.244	6.89	5.89	6.48	7.02	5.14	6.55	4.48	7.21	5.88	6.24	6.18	.81
20	6.74	28.380	7.75	6.00	7.25	7.91	7.63	7.41	7.97	7.86	6.37	7.76	7.39	.64
21	6.40	21.408	9.94	5.83	7.86	9.02	8.73	9.18	11.01	8.22	7.03	11.49	8.83	1.64
22	6.10	17.471	11.17	8.43	9.45	10.73	12.58	12.71	13.58	10.64	9.07	13.55	11.19	1.77
23	5.82	15.240	14.21	13.87	13.89	15.03	15.70	18.43	18.62	15.58	13.93	16.19	15.54	1.69
24	5.57	13.431	19.05	17.79	20.50	22.29	20.31	24.20	23.53	22.22	18.22	20.86	20.90	2.06
25	5.33	10.227	21.06	20.70	24.29	26.30	24.87	24.10	26.79	25.91	21.57	25.72	24.13	2.14
26	5.12	8.369	18.24	20.54	21.55	23.12	27.15	25.38	30.24	24.02	21.53	9999.99	23.53	3.44
27	4.92	6.054	16.14	19.75	20.44	21.85	24.20	25.88	35.63	27.20	20.07	9999.99	23.46	5.36
28	4.74	3.591	15.34	19.56	18.73	21.24	27.44	29.45	9999.99	28.12	19.44	9999.99	22.41	4.86
29	4.57	1.878	16.26	19.39	20.87	24.20	9999.99	9999.99	9999.99	28.45	19.89	9999.99	21.51	3.88
30	4.41	1.311	13.97	15.90	26.47	31.58	9999.99	9999.99	9999.99	29.51	17.58	9999.99	22.50	6.93
31	4.27	.917	9.67	12.54	28.83	33.02	9999.99	9999.99	9999.99	9999.99	15.00	9999.99	19.80	9.32

Table A.19 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 03/02/94 10:00 HOURS Hmo= .57 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	1.141	-41.98	-10.30	-15.52	-22.26	-17.09	-19.26	-24.55	-12.75	21.84	-20.18	-16.40	15.14
3	64.00	1.388	-26.92	-16.31	-10.51	-14.92	-16.07	-15.18	-14.00	-12.29	17.54	-15.69	-12.56	10.80
4	42.67	1.330	-21.32	-20.48	-15.50	-17.20	-20.75	-11.89	-12.93	-17.17	11.03	-20.46	-14.75	9.13
5	32.00	1.416	-16.19	-14.91	-9.31	-11.27	-20.88	-6.91	-13.00	-11.26	14.90	-17.54	-10.71	9.36
6	25.60	1.120	-10.45	-6.94	-1.68	-4.31	-5.73	-5.97	-14.79	-3.46	23.50	-7.13	-3.79	9.72
7	21.33	1.014	-2.29	1.48	3.93	1.79	-.06	-4.44	-11.30	3.40	27.09	-1.55	1.73	9.43
8	18.29	1.858	-2.74	-1.49	2.38	.70	-2.48	-2.99	-7.40	.81	19.07	-2.59	.30	6.75
9	16.00	2.747	-3.98	-6.09	-1.71	-2.62	-4.09	-7.36	-12.69	-3.67	9.32	-4.81	-3.78	5.25
10	14.22	3.479	-3.80	-7.31	-2.81	-3.35	-7.62	-11.24	-12.21	-4.74	5.33	-5.62	-5.34	4.67
11	12.80	9.482	-4.70	-6.46	-4.98	-5.12	-7.30	-7.43	-5.18	-5.77	-.43	-8.25	-5.56	2.06
12	11.64	31.764	-5.21	-5.95	-5.74	-5.76	-5.26	-3.74	-2.33	-6.05	-2.88	-8.28	-5.12	1.64
13	10.67	68.757	-4.48	-5.76	-5.03	-5.01	-6.43	-4.56	-3.44	-5.48	-2.41	-8.05	-5.07	1.47
14	9.85	73.864	-4.37	-6.52	-5.23	-5.18	-8.42	-7.16	-7.31	-5.90	-3.00	-8.47	-6.16	1.67
15	9.14	53.833	-5.67	-7.84	-6.77	-6.72	-9.58	-9.45	-9.48	-7.47	-4.60	-10.22	-7.78	1.78
16	8.53	38.046	-5.87	-7.51	-6.56	-6.52	-8.48	-10.37	-8.80	-7.13	-4.16	-10.15	-7.55	1.84
17	8.00	27.098	-6.88	-7.75	-7.20	-7.29	-8.93	-9.85	-9.25	-7.54	-4.14	-13.17	-8.20	2.23
18	7.53	22.106	-4.23	-5.31	-4.69	-4.86	-4.89	-5.33	-5.21	-5.07	-2.60	-9.54	-5.17	1.64
19	7.11	18.093	.42	-2.29	-.60	-.03	3.31	-.62	2.64	-.36	-.15	2.65	.50	1.70
20	6.74	14.384	1.62	-.86	.55	1.56	3.78	.94	6.64	1.41	1.92	3.57	2.11	1.98
21	6.40	9.915	-.71	-.51	-.05	.95	3.50	-.52	11.48	2.46	3.31	6.22	2.61	3.65
22	6.10	7.983	-3.65	-2.48	-2.19	-1.65	4.71	.49	14.05	1.61	2.49	9999.99	1.47	5.12
23	5.82	5.563	-3.37	-5.89	-5.09	-4.15	7.09	9999.99	19.33	9999.99	-.99	9999.99	.95	8.51
24	5.57	4.894	-2.73	-2.37	-5.32	9999.99	9999.99	9999.99	9999.99	9999.99	.10	9999.99	-2.58	1.92
25	5.33	4.161	-1.73	-2.07	-1.05	9999.99	9999.99	9999.99	9999.99	9999.99	1.45	9999.99	-.85	1.38
26	5.12	3.216	.92	-3.19	2.73	9999.99	9999.99	9999.99	9999.99	9999.99	3.71	9999.99	1.04	2.64
27	4.92	2.038	-.32	-3.50	3.52	9999.99	9999.99	9999.99	9999.99	9999.99	3.84	9999.99	.88	3.02
28	4.74	1.044	-5.30	-8.20	9999.99	9999.99	9999.99	9999.99	9999.99	9999.99	-.22	9999.99	-4.58	3.30
29	4.57	.704	-8.09	-16.62	9999.99	9999.99	9999.99	9999.99	9999.99	9999.99	-11.25	9999.99	-11.99	3.52
30	4.41	.473	-6.10	-20.03	9999.99	9999.99	9999.99	9999.99	9999.99	9999.99	-11.86	9999.99	-12.66	5.71
31	4.27	.291	-9.27	-21.86	9999.99	9999.99	9999.99	9999.99	9999.99	9999.99	-11.99	9999.99	-14.37	5.41

Table A.20 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 03/02/94 13:00 HOURS Hmo= .43 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

NO	Period (sec)	Energy (cm**2)	DIRECTION (degrees) for 10 different gauge pairs										Mean dir	Std dev
			43	21	32	42	65	78	89	31	01	54		
2	128.00	.861	-24.16	-20.13	-26.53	-26.10	-21.98	-21.45	-23.30	-23.99	8.31	-30.58	-21.11	10.17
3	64.00	1.016	-19.07	-21.00	-15.25	-16.45	-16.51	-16.18	-18.59	-17.61	11.81	-21.08	-15.09	9.13
4	42.67	.928	-17.39	-22.59	-12.61	-14.43	-9.79	-15.54	-17.12	-16.57	14.64	-15.01	-12.74	9.63
5	32.00	.950	-14.35	-18.38	-8.75	-10.78	-8.85	-18.45	-19.42	-12.42	20.18	-12.51	-10.51	10.84
6	25.60	.871	-12.60	-11.63	-4.58	-6.84	-6.09	-10.33	-14.58	-7.33	24.07	-9.21	-6.04	10.42
7	21.33	1.030	-10.11	-8.55	-1.88	-4.08	-4.62	-10.95	-13.44	-4.57	21.44	-6.92	-4.45	9.25
8	18.29	1.928	-9.42	-9.40	-6.28	-7.40	-10.33	-14.89	-13.73	-7.51	11.75	-12.07	-7.96	7.07
9	16.00	2.836	-10.42	-11.83	-9.88	-10.32	-13.65	-12.68	-12.51	-10.90	3.02	-16.49	-10.58	4.90
10	14.22	3.022	-9.87	-10.21	-9.14	-9.54	-11.99	-12.65	-14.12	-9.91	-.86	-15.71	-10.40	3.79
11	12.80	5.197	-7.04	-5.91	-5.87	-6.32	-8.68	-10.76	-10.93	-5.94	1.45	-12.61	-7.26	3.72
12	11.64	15.840	-3.83	-4.85	-4.13	-4.24	-5.35	-6.33	-6.90	-4.57	-.29	-8.83	-4.93	2.12
13	10.67	34.484	-2.72	-5.34	-4.16	-4.05	-4.08	-6.27	-6.85	-4.93	-2.41	-6.80	-4.76	1.49
14	9.85	43.033	-4.27	-7.18	-5.85	-5.71	-5.27	-8.02	-7.61	-6.71	-4.32	-7.93	-6.29	1.34
15	9.14	32.862	-6.76	-10.84	-8.74	-8.51	-7.91	-8.89	-9.08	-10.09	-7.76	-10.20	-8.88	1.18
16	8.53	22.844	-8.03	-10.62	-9.36	-9.18	-10.51	-10.14	-11.52	-10.17	-8.28	-11.90	-9.97	1.21
17	8.00	16.725	-9.04	-9.98	-9.81	-9.80	-10.91	-10.72	-10.40	-10.11	-7.34	-12.93	-10.10	1.34
18	7.53	12.419	-7.13	-8.57	-8.01	-8.09	-10.34	-11.92	-11.07	-8.42	-5.07	-11.87	-9.05	2.10
19	7.11	8.998	-6.20	-9.87	-7.83	-7.90	-9.88	-10.84	-9.40	-9.29	-5.27	-11.62	-8.81	1.89
20	6.74	7.696	-4.45	-9.96	-6.84	-6.23	-9.51	-10.58	-11.38	-8.72	-5.11	9999.99	-8.09	2.36
21	6.40	5.285	-6.07	-11.67	-8.98	-8.22	-12.41	-15.41	9999.99	-10.75	-6.66	9999.99	-10.02	2.94
22	6.10	3.816	-14.83	-18.60	-17.53	-19.58	-30.71	-24.98	9999.99	-22.50	-12.48	9999.99	-20.15	5.44
23	5.82	3.213	-18.16	-22.60	-22.24	-25.44	-32.72	-43.14	9999.99	-30.97	-16.90	9999.99	-26.50	8.15
24	5.57	2.432	-21.37	-27.54	-30.97	-36.36	-38.17	-42.21	9999.99	-40.12	-20.34	9999.99	-32.14	7.88
25	5.33	2.208	-22.32	-32.43	-32.81	-36.65	-43.46	-41.51	9999.99	-39.62	-22.92	9999.99	-33.97	7.48
26	5.12	1.833	-25.56	-32.10	-33.84	-39.00	-42.27	-40.92	9999.99	-41.42	-22.84	9999.99	-34.76	6.99
27	4.92	1.320	-29.29	-31.97	-39.81	-42.99	-43.51	-39.50	9999.99	-44.27	-21.60	9999.99	-36.64	7.63
28	4.74	.892	-29.73	-33.26	-43.05	-44.52	-44.60	-44.91	9999.99	-44.82	-25.27	9999.99	-38.78	7.53
29	4.57	.637	-32.28	-36.64	-43.77	-45.54	-46.26	-48.05	9999.99	-48.38	-28.19	9999.99	-41.15	7.24
30	4.41	.484	-38.02	-41.46	-44.51	-47.74	-50.95	-54.08	9999.99	-51.05	-30.87	9999.99	-44.85	7.27
31	4.27	.387	-35.98	-45.03	-42.88	-44.79	-50.94	-53.96	9999.99	-50.05	-34.35	9999.99	-44.75	6.52

Table A.21 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 03/02/94 16:00 HOURS Hmo= .39 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.600	-9.25	-25.75	-14.54	-13.54	-4.72	-11.37	-29.12	-18.35	13.01	-9.52	-12.36	11.06
3	64.00	.786	-14.82	-24.00	-9.39	-10.85	-10.65	-15.00	-21.88	-14.99	12.25	-16.05	-12.60	9.37
4	42.67	.685	-19.52	-26.09	-10.75	-12.87	-13.23	-19.05	-22.03	-16.67	9.64	-16.78	-14.80	9.21
5	32.00	.547	-16.19	-22.21	-9.49	-11.62	-11.45	-16.67	-19.49	-14.35	16.26	-14.48	-12.07	10.08
6	25.60	.462	-9.83	-16.04	-9.59	-10.54	-12.28	-14.43	-18.17	-12.13	15.55	-15.03	-10.33	9.00
7	21.33	.807	-5.14	-9.11	-5.93	-6.09	-10.10	-11.13	-13.88	-7.09	9.87	-10.48	-6.93	6.17
8	18.29	1.747	-4.93	-8.07	-4.95	-5.06	-8.73	-11.41	-13.22	-6.06	3.53	-9.17	-6.81	4.37
9	16.00	2.339	-8.59	-11.60	-8.12	-8.37	-9.19	-11.28	-13.60	-9.48	-1.55	-10.59	-9.24	3.04
10	14.22	2.041	-10.85	-13.28	-10.41	-10.89	-8.27	-12.02	-15.41	-11.91	-3.57	-12.04	-10.87	3.01
11	12.80	2.755	-11.31	-15.84	-13.01	-13.05	-9.37	-14.52	-16.98	-14.84	-8.19	-13.33	-13.04	2.63
12	11.64	8.794	-9.36	-14.08	-12.14	-11.82	-10.00	-13.40	-14.62	-13.59	-11.62	-12.60	-12.32	1.62
13	10.67	25.198	-4.15	-9.08	-6.74	-6.36	-9.51	-11.62	-11.76	-8.02	-7.74	-9.39	-8.44	2.23
14	9.85	38.717	-3.02	-7.28	-5.38	-4.95	-8.87	-9.25	-9.32	-6.36	-5.82	-7.71	-6.80	1.96
15	9.14	34.335	-5.02	-9.02	-7.62	-7.13	-9.57	-10.05	-9.52	-8.56	-7.22	-8.97	-8.27	1.45
16	8.53	20.973	-8.76	-11.97	-11.52	-11.16	-11.80	-13.18	-12.13	-12.29	-9.59	-11.75	-11.42	1.24
17	8.00	10.700	-9.00	-10.55	-10.61	-10.49	-11.93	-15.39	-16.41	-10.88	-7.21	-11.74	-11.42	2.59
18	7.53	6.723	-5.95	-9.74	-7.50	-7.14	-11.95	-17.61	-20.22	-8.27	-5.91	-10.10	-10.43	4.63
19	7.11	6.075	-8.61	-13.29	-11.12	-10.67	-16.70	-18.99	-20.66	-12.49	-8.96	-14.39	-13.59	3.89
20	6.74	4.699	-11.46	-15.39	-14.03	-14.31	-19.99	-22.44	-24.53	-16.76	-11.21	-21.24	-17.14	4.43
21	6.40	3.174	-16.10	-18.23	-17.65	-20.23	-23.30	-33.03	-33.54	-22.99	-13.98	-36.73	-23.57	7.65
22	6.10	2.627	-22.81	-20.41	-24.21	-28.07	-32.81	-36.48	-39.70	-28.29	-15.96	-38.69	-28.74	7.65
23	5.82	2.313	-30.26	-29.37	-34.05	-38.17	-39.94	-37.95	-42.07	-38.60	-23.98	-43.94	-35.84	5.96
24	5.57	2.260	-31.62	-36.15	-37.33	-39.84	-41.35	-43.32	-43.69	-39.99	-29.35	-45.99	-38.87	5.05
25	5.33	2.038	-32.82	-39.82	-38.05	-39.37	-40.01	-42.77	-43.89	-40.66	-35.97	-45.19	-39.85	3.49
26	5.12	2.050	-35.10	-44.11	-38.07	-39.86	-41.60	-44.38	-46.53	-43.28	-41.20	-50.13	-42.43	4.06
27	4.92	2.153	-36.81	-47.63	-42.84	-44.46	-46.55	-46.95	-49.54	-47.33	-43.73	-54.41	-46.02	4.37
28	4.74	1.745	-39.90	-46.40	-48.29	-49.87	-50.19	-49.48	-53.83	-50.59	-40.27	-54.29	-48.32	4.67
29	4.57	1.425	-40.62	-48.05	-51.26	-52.36	-50.97	-52.08	-54.93	-53.65	-40.01	-56.33	-50.03	5.31
30	4.41	1.303	-42.38	-53.03	-51.11	-50.71	-52.17	-53.21	-55.53	-54.91	-42.50	-58.21	-51.38	4.93
31	4.27	1.012	-46.12	-54.60	-49.44	-50.42	-52.38	-55.32	-56.59	-54.18	-44.31	-58.64	-52.20	4.36

Table A.22 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 03/02/94 19:00 HOURS Hmo= .40 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.469	-27.13	-39.47	-17.60	-20.48	-32.89	-17.76	-16.16	-26.06	-15.04	-36.63	-24.91	8.47
3	64.00	.643	-19.61	-26.03	-14.28	-16.00	-20.21	-14.12	-12.35	-18.63	.04	-24.13	-16.55	6.92
4	42.67	.484	-14.92	-20.80	-9.02	-10.89	-13.45	-12.45	-12.87	-13.47	9.76	-17.13	-11.57	7.74
5	32.00	.344	-11.47	-15.63	-6.04	-7.74	-9.65	-11.49	-13.04	-9.58	17.49	-12.83	-8.08	8.89
6	25.60	.350	-18.12	-16.73	-9.35	-11.62	-9.64	-12.81	-15.80	-12.32	12.90	-13.61	-10.77	8.33
7	21.33	.555	-11.25	-8.03	-5.56	-7.21	-6.55	-12.98	-17.24	-6.51	13.15	-10.12	-7.27	7.60
8	18.29	1.478	-7.32	-7.28	-5.49	-6.21	-8.95	-10.45	-11.98	-6.28	5.91	-9.96	-6.81	4.68
9	16.00	2.706	-5.92	-8.97	-6.64	-6.59	-9.45	-9.37	-11.41	-7.67	-.33	-9.51	-7.59	2.90
10	14.22	2.574	-7.84	-11.65	-9.83	-9.42	-10.80	-12.22	-13.13	-10.80	-6.05	-12.46	-10.42	2.09
11	12.80	2.563	-12.39	-15.38	-14.43	-14.10	-13.47	-16.85	-17.62	-15.23	-10.64	-17.54	-14.77	2.14
12	11.64	6.492	-9.42	-13.44	-11.92	-11.51	-15.55	-12.19	-13.49	-12.88	-12.65	-16.55	-12.96	1.91
13	10.67	22.506	-8.80	-12.72	-11.09	-10.69	-15.71	-8.35	-10.95	-12.04	-12.63	-15.42	-11.84	2.31
14	9.85	37.255	-8.30	-11.97	-10.19	-9.86	-12.51	-8.15	-10.74	-11.15	-10.54	-14.21	-10.76	1.75
15	9.14	28.988	-6.48	-9.96	-7.93	-7.64	-10.28	-9.08	-10.17	-8.93	-7.64	-12.78	-9.09	1.71
16	8.53	15.218	-6.41	-8.96	-7.30	-7.14	-12.53	-9.97	-10.48	-8.07	-6.94	-14.38	-9.22	2.50
17	8.00	7.873	-10.15	-11.75	-11.28	-11.17	-14.82	-12.91	-12.98	-11.69	-10.07	-16.86	-12.37	2.01
18	7.53	5.002	-13.65	-15.93	-16.03	-15.90	-17.19	-17.17	-18.85	-16.89	-14.24	-18.39	-16.42	1.56
19	7.11	3.421	-15.46	-17.54	-17.52	-18.11	-20.67	-21.07	-21.86	-19.72	-14.85	-23.94	-19.07	2.74
20	6.74	3.030	-17.70	-22.68	-22.37	-23.32	-26.43	-28.18	-30.05	-28.53	-19.25	-35.32	-25.38	5.07
21	6.40	2.905	-21.58	-27.02	-26.31	-27.08	-34.36	-34.84	-38.32	-31.04	-24.14	-40.89	-30.56	6.04
22	6.10	2.476	-28.89	-29.39	-32.67	-34.23	-37.54	-36.76	-41.05	-34.55	-26.10	-39.79	-34.10	4.64
23	5.82	2.180	-32.41	-34.31	-37.54	-38.86	-39.46	-39.52	-41.97	-39.21	-29.97	-44.99	-37.82	4.25
24	5.57	2.656	-34.74	-38.73	-40.15	-40.81	-44.46	-41.36	-46.15	-42.46	-32.82	-47.84	-40.95	4.47
25	5.33	3.401	-35.34	-44.02	-42.66	-42.30	-45.69	-44.75	-49.27	-45.47	-37.66	-49.07	-43.63	4.21
26	5.12	4.179	-36.60	-46.97	-43.78	-43.23	-45.47	-47.66	-50.13	-46.89	-41.20	-51.60	-45.35	4.16
27	4.92	4.871	-40.56	-50.14	-46.76	-46.64	-47.53	-52.05	-51.80	-49.83	-44.26	-53.41	-48.30	3.74
28	4.74	5.291	-43.87	-51.11	-48.73	-48.51	-50.25	-53.40	-53.23	-51.46	-45.99	-53.59	-50.02	3.10
29	4.57	5.944	-45.08	-50.97	-48.62	-48.43	-51.49	-53.02	-54.76	-50.88	-44.02	-54.78	-50.21	3.50
30	4.41	5.957	-45.28	-53.18	-48.29	-47.90	-51.24	-52.69	-54.98	-51.41	-45.15	-55.70	-50.58	3.58
31	4.27	5.093	-46.05	-53.38	-48.99	-48.85	-51.82	-52.85	-54.72	-52.00	-43.74	-55.08	-50.75	3.55

Table A.23 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 03/02/94 22:00 HOURS Hmo= .31 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.381	-30.94	-34.23	-11.54	-16.07	-12.97	-17.53	-26.52	-19.80	-6.70	-15.74	-19.19	8.34
3	64.00	.494	-15.00	-23.19	-8.09	-10.19	-11.51	-12.48	-14.11	-13.51	1.15	-13.48	-12.05	5.79
4	42.67	.303	-6.12	-18.32	-9.72	-8.92	-9.10	-10.74	-11.60	-12.76	7.07	-12.38	-9.28	6.23
5	32.00	.192	-6.12	-17.94	-10.64	-8.76	-7.83	-12.81	-13.90	-13.76	11.40	-12.07	-9.28	7.61
6	25.60	.209	-13.36	-19.25	-10.22	-11.14	-9.27	-14.44	-18.87	-14.38	8.00	-14.59	-11.79	7.28
7	21.33	.392	-7.36	-13.81	-7.59	-7.98	-9.76	-9.85	-15.05	-10.39	8.63	-13.37	-8.68	6.31
8	18.29	1.095	-6.98	-10.95	-7.22	-7.32	-9.51	-11.10	-13.19	-8.76	3.53	-10.94	-8.25	4.37
9	16.00	2.284	-8.43	-11.15	-8.95	-8.99	-11.04	-7.96	-10.78	-10.00	-1.90	-12.83	-9.21	2.81
10	14.22	2.262	-11.64	-13.22	-11.18	-11.58	-13.19	-7.63	-9.95	-12.44	-5.04	-15.72	-11.16	2.87
11	12.80	1.909	-15.14	-16.37	-14.62	-15.21	-16.61	-14.69	-16.36	-16.16	-10.48	-19.48	-15.51	2.14
12	11.64	3.389	-14.82	-17.96	-16.09	-16.09	-18.35	-17.42	-19.96	-17.54	-13.63	-21.70	-17.35	2.25
13	10.67	8.316	-12.75	-15.60	-14.22	-14.09	-16.21	-15.17	-15.75	-15.21	-12.71	-19.86	-15.16	1.94
14	9.85	15.627	-10.47	-13.24	-11.43	-11.37	-14.20	-12.29	-14.32	-12.37	-9.96	-15.93	-12.56	1.78
15	9.14	14.254	-9.47	-12.21	-10.70	-10.64	-12.40	-10.01	-14.57	-11.64	-8.18	-13.54	-11.34	1.83
16	8.53	8.767	-10.33	-13.45	-12.37	-12.27	-11.84	-11.89	-15.31	-13.48	-9.86	-13.75	-12.45	1.54
17	8.00	5.398	-12.49	-16.08	-14.69	-14.55	-13.56	-15.92	-17.86	-16.24	-12.86	-16.58	-15.08	1.66
18	7.53	3.885	-17.90	-20.85	-19.85	-20.27	-20.82	-23.13	-26.14	-22.23	-15.99	-27.55	-21.47	3.31
19	7.11	4.156	-23.38	-29.42	-26.20	-26.71	-29.67	-30.42	-35.96	-30.50	-23.72	-35.56	-29.15	4.11
20	6.74	4.225	-28.60	-34.27	-31.13	-31.92	-37.54	-35.53	-42.03	-35.36	-28.34	-39.67	-34.44	4.31
21	6.40	4.263	-33.07	-36.66	-34.61	-35.73	-40.26	-38.24	-42.18	-37.86	-29.61	-42.50	-37.07	3.84
22	6.10	3.725	-34.03	-38.19	-37.17	-38.15	-42.36	-40.49	-43.09	-40.28	-31.37	-42.92	-38.81	3.67
23	5.82	3.369	-36.49	-40.20	-39.89	-40.61	-43.69	-42.04	-44.30	-41.82	-33.10	-45.36	-40.75	3.51
24	5.57	3.143	-37.90	-43.10	-39.84	-40.54	-43.21	-42.70	-45.16	-42.34	-35.67	-47.76	-41.82	3.32
25	5.33	3.316	-39.37	-45.72	-41.55	-41.88	-44.18	-46.52	-46.52	-44.07	-39.26	-49.90	-43.90	3.24
26	5.12	3.555	-40.88	-47.20	-44.13	-44.33	-46.72	-48.99	-47.84	-46.03	-39.26	-50.33	-45.57	3.30
27	4.92	3.419	-41.91	-47.65	-48.02	-47.21	-47.69	-50.02	-51.07	-48.44	-37.73	-50.90	-47.07	3.96
28	4.74	3.463	-43.97	-50.12	-48.93	-48.04	-48.10	-49.92	-53.55	-49.94	-39.99	-52.63	-48.52	3.78
29	4.57	3.434	-44.60	-51.90	-49.24	-48.29	-49.68	-50.95	-53.64	-50.48	-40.62	-52.80	-49.22	3.75
30	4.41	2.676	-45.14	-52.06	-49.62	-48.74	-51.47	-51.92	-53.77	-50.79	-39.71	-53.50	-49.68	4.09
31	4.27	2.221	-45.83	-54.07	-49.64	-49.30	-51.93	-51.50	-54.34	-51.98	-41.56	-53.91	-50.41	3.85

Table A.24 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 04/02/94 01:00 HOURS Hmo= .25 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.408	22.92	-3.89	-17.60	-7.87	-15.98	-12.97	-15.18	-12.46	14.72	-20.29	-7.02	13.71
3	64.00	.499	-8.03	-10.86	-13.62	-12.27	-14.42	-14.45	-16.45	-12.51	15.16	-14.91	-10.32	8.76
4	42.67	.379	-22.40	-11.10	-6.79	-10.80	-12.33	-14.49	-15.45	-8.58	17.30	-10.54	-9.60	9.83
5	32.00	.208	-19.01	-9.13	-.43	-5.45	-9.29	-12.05	-14.33	-4.08	17.44	-8.03	-6.49	9.40
6	25.60	.157	-14.82	-3.58	1.56	-2.91	-5.44	-8.23	-11.13	-.53	19.79	-6.39	-3.22	8.93
7	21.33	.281	-13.73	-6.35	-4.64	-7.27	-5.61	-9.95	-13.86	-5.51	10.88	-7.54	-6.38	6.53
8	18.29	.842	-10.10	-9.75	-8.43	-9.07	-8.53	-10.92	-14.75	-9.06	-2.65	-11.36	-9.46	2.88
9	16.00	2.478	-9.87	-9.85	-8.36	-8.92	-9.26	-11.48	-14.23	-9.08	-2.69	-12.65	-9.64	2.91
10	14.22	2.661	-9.80	-9.88	-8.51	-9.01	-9.75	-10.66	-13.16	-9.31	-1.82	-12.84	-9.48	2.94
11	12.80	1.760	-12.39	-15.10	-14.74	-14.47	-14.43	-12.94	-15.15	-15.48	-10.52	-15.65	-14.09	1.55
12	11.64	3.330	-16.33	-21.84	-20.07	-19.35	-20.73	-16.70	-18.22	-21.50	-19.38	-19.87	-19.40	1.76
13	10.67	6.707	-16.10	-19.63	-18.21	-18.04	-20.57	-17.80	-19.42	-19.50	-16.56	-22.85	-18.87	1.88
14	9.85	8.882	-13.11	-15.97	-14.93	-14.85	-17.69	-19.19	-20.36	-15.94	-12.89	-20.38	-16.53	2.63
15	9.14	9.471	-12.96	-15.99	-15.09	-14.91	-16.82	-18.75	-17.91	-16.18	-12.60	-18.91	-16.01	2.08
16	8.53	6.679	-13.84	-16.20	-15.33	-15.33	-17.08	-17.33	-14.90	-16.31	-12.09	-20.37	-15.88	2.10
17	8.00	2.928	-14.11	-17.20	-15.24	-15.45	-18.59	-19.29	-19.11	-16.86	-11.74	-22.64	-17.02	2.92
18	7.53	2.024	-18.69	-23.72	-20.75	-21.43	-26.17	-25.30	-30.44	-24.92	-18.25	-33.14	-24.28	4.58
19	7.11	2.297	-25.48	-28.24	-26.69	-28.12	-34.18	-33.38	-39.78	-30.31	-22.02	-38.62	-30.68	5.44
20	6.74	2.164	-28.23	-33.41	-30.38	-31.44	-36.66	-36.21	-41.10	-34.66	-26.68	-39.31	-33.81	4.44
21	6.40	1.975	-29.80	-35.54	-32.87	-33.86	-35.40	-39.01	-42.78	-37.32	-28.36	-42.03	-35.70	4.52
22	6.10	2.395	-30.93	-37.17	-35.38	-36.11	-37.70	-41.47	-43.40	-39.98	-29.51	-45.10	-37.67	4.77
23	5.82	2.643	-31.56	-39.99	-38.04	-38.42	-42.47	-42.09	-42.88	-42.95	-32.81	-47.03	-39.82	4.54
24	5.57	2.361	-34.11	-40.09	-38.92	-40.29	-42.97	-42.52	-44.84	-42.77	-32.22	-46.13	-40.49	4.22
25	5.33	2.274	-33.67	-41.58	-41.91	-43.38	-44.26	-45.18	-48.24	-45.88	-32.29	-44.58	-42.10	4.91
26	5.12	2.516	-37.19	-42.57	-45.72	-45.68	-46.23	-46.14	-50.13	-47.42	-32.39	-47.25	-44.08	5.08
27	4.92	2.614	-40.59	-44.33	-46.39	-45.91	-48.16	-45.82	-50.39	-47.86	-34.27	-49.82	-45.36	4.56
28	4.74	2.422	-42.37	-47.30	-45.37	-45.31	-47.54	-48.29	-51.34	-47.43	-36.22	-50.40	-46.16	4.11
29	4.57	1.801	-43.62	-48.03	-45.94	-46.46	-46.92	-50.11	-51.29	-47.67	-35.68	-51.05	-46.68	4.31
30	4.41	1.490	-42.37	-48.85	-47.91	-47.53	-48.62	-51.20	-51.54	-48.38	-36.43	-52.26	-47.51	4.53
31	4.27	1.165	-44.45	-50.45	-49.83	-49.32	-49.46	-50.28	-51.94	-50.50	-35.56	-54.83	-48.67	5.00

Table A.25 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 04/02/94 04:00 HOURS Hmo= .24 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.574	-15.89	-26.37	-8.93	-10.69	-25.16	-25.17	-17.59	-15.64	-5.32	-24.98	-17.58	7.25
3	64.00	.570	-11.68	-24.60	-5.58	-7.51	-15.33	-19.16	-18.43	-12.51	2.98	-16.89	-12.88	7.52
4	42.67	.304	-6.12	-21.53	-8.04	-8.28	-12.91	-19.70	-20.94	-12.52	5.12	-12.88	-11.80	7.67
5	32.00	.209	-12.78	-23.81	-14.45	-14.45	-11.50	-16.74	-19.14	-17.67	-1.34	-14.72	-14.67	5.55
6	25.60	.164	-16.99	-25.92	-18.71	-19.03	-12.46	-16.65	-17.69	-22.68	-2.98	-20.48	-17.37	5.89
7	21.33	.302	-15.82	-13.78	-8.93	-11.03	-8.16	-18.55	-19.47	-11.66	4.39	-11.56	-11.47	6.38
8	18.29	.885	-7.81	-7.04	-2.09	-3.57	-8.51	-15.93	-15.87	-4.05	9.01	-5.85	-6.18	6.76
9	16.00	2.068	-6.05	-6.11	-4.14	-4.69	-7.57	-13.83	-14.16	-4.98	4.88	-7.20	-6.39	5.05
10	14.22	2.586	-8.74	-8.90	-7.61	-8.05	-6.45	-9.80	-11.31	-8.42	.07	-9.55	-7.88	2.93
11	12.80	1.804	-11.82	-11.89	-10.62	-11.26	-11.28	-11.11	-14.48	-11.66	-3.94	-14.80	-11.29	2.79
12	11.64	2.669	-17.32	-17.87	-17.27	-17.81	-20.62	-18.92	-22.77	-18.42	-14.46	-22.05	-18.75	2.35
13	10.67	6.079	-16.52	-19.38	-17.64	-17.68	-21.82	-19.42	-23.31	-18.96	-16.78	-22.90	-19.44	2.34
14	9.85	8.829	-14.86	-18.45	-16.21	-16.10	-19.62	-18.98	-20.83	-17.50	-15.34	-21.75	-17.96	2.23
15	9.14	8.859	-14.65	-17.52	-15.75	-15.74	-20.91	-19.81	-20.99	-16.88	-14.55	-22.06	-17.89	2.68
16	8.53	6.667	-14.86	-17.03	-15.62	-15.79	-21.39	-18.56	-21.96	-16.81	-13.78	-21.08	-17.69	2.77
17	8.00	4.023	-16.51	-18.23	-17.52	-17.90	-20.43	-20.41	-24.73	-18.85	-14.90	-21.72	-19.12	2.67
18	7.53	2.336	-19.11	-22.91	-23.04	-23.50	-24.86	-25.57	-31.56	-25.89	-18.56	-27.33	-24.23	3.61
19	7.11	1.664	-22.28	-27.00	-26.75	-27.51	-30.29	-27.88	-37.01	-31.11	-21.72	-35.87	-28.74	4.77
20	6.74	1.378	-24.39	-25.03	-25.69	-28.21	-33.84	-32.17	-39.82	-30.55	-19.58	-42.42	-30.16	6.76
21	6.40	1.286	-23.84	-25.22	-26.36	-29.37	-41.52	-41.46	-44.54	-32.21	-18.76	-46.19	-32.94	9.25
22	6.10	1.311	-27.65	-29.03	-30.27	-33.36	-45.12	-44.07	-42.97	-37.76	-22.83	-44.18	-35.73	7.73
23	5.82	1.406	-28.49	-33.35	-36.51	-38.32	-45.38	-43.66	-41.73	-43.88	-27.21	-44.02	-38.26	6.33
24	5.57	1.500	-32.96	-37.38	-41.49	-42.33	-45.36	-43.73	-44.55	-43.81	-30.30	-45.51	-40.75	5.11
25	5.33	1.648	-34.91	-41.00	-40.23	-41.50	-44.31	-45.16	-46.43	-43.07	-34.38	-46.85	-41.79	4.15
26	5.12	2.071	-37.10	-43.49	-41.43	-41.90	-46.06	-46.53	-48.00	-44.25	-37.00	-48.40	-43.42	3.88
27	4.92	2.238	-36.53	-44.78	-41.17	-41.18	-45.74	-48.53	-50.47	-44.03	-36.79	-47.93	-43.72	4.52
28	4.74	1.718	-37.51	-45.25	-42.08	-42.62	-45.50	-48.40	-50.39	-44.92	-37.49	-49.35	-44.35	4.27
29	4.57	1.804	-40.78	-45.50	-44.96	-45.10	-48.27	-47.93	-49.89	-47.29	-37.25	-51.01	-45.80	3.95
30	4.41	1.546	-40.79	-46.46	-48.55	-47.38	-49.45	-49.30	-51.87	-49.46	-37.13	-51.33	-47.18	4.45
31	4.27	1.185	-41.85	-48.54	-47.16	-46.48	-50.26	-51.40	-52.79	-48.30	-37.98	-55.46	-48.03	4.87

Table A.26 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 04/02/94 07:00 HOURS Hmo= .24 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.503	-14.84	-12.58	-27.33	-23.69	-23.06	-20.77	-20.53	-21.57	11.11	-24.75	-17.92	10.51
3	64.00	.575	-12.20	-21.30	-19.06	-17.27	-18.52	-17.03	-16.58	-19.81	3.71	-23.53	-16.20	7.21
4	42.67	.369	-15.27	-18.39	-13.61	-14.28	-16.15	-14.10	-14.64	-15.05	3.56	-18.79	-13.70	5.98
5	32.00	.206	-18.30	-16.21	-10.16	-12.55	-13.74	-13.28	-15.48	-11.98	7.00	-14.64	-11.97	6.68
6	25.60	.180	-14.26	-11.82	-7.18	-9.03	-5.98	-15.66	-18.61	-8.82	8.91	-9.56	-9.23	7.11
7	21.33	.317	-7.93	-8.12	-5.74	-6.62	-8.20	-11.83	-18.42	-7.17	6.04	-7.57	-7.56	5.71
8	18.29	.875	-7.95	-6.96	-4.39	-5.40	-7.93	-8.58	-14.40	-5.58	2.33	-6.33	-6.52	3.95
9	16.00	2.140	-6.14	-6.46	-4.21	-4.79	-7.75	-9.05	-12.47	-5.15	1.88	-7.39	-6.15	3.52
10	14.22	3.312	-5.71	-7.61	-5.11	-5.40	-8.50	-9.15	-12.51	-6.23	2.38	-9.10	-6.70	3.71
11	12.80	2.894	-9.19	-12.34	-10.45	-10.43	-13.32	-12.26	-14.93	-11.64	-4.55	-12.93	-11.21	2.71
12	11.64	3.022	-14.66	-19.10	-17.67	-17.33	-19.48	-20.33	-21.04	-19.20	-15.72	-20.45	-18.50	2.00
13	10.67	5.142	-19.72	-23.05	-22.94	-22.67	-23.98	-22.87	-25.17	-24.03	-22.09	-26.80	-23.33	1.78
14	9.85	8.658	-18.80	-23.32	-22.01	-21.64	-23.65	-23.54	-28.03	-23.55	-21.84	-25.93	-23.23	2.37
15	9.14	8.636	-17.94	-24.01	-21.84	-21.42	-22.44	-23.30	-27.15	-23.86	-21.13	-24.16	-22.73	2.30
16	8.53	6.521	-19.02	-21.78	-20.98	-20.98	-22.05	-20.86	-23.74	-22.08	-18.74	-25.93	-21.62	2.00
17	8.00	4.541	-20.68	-20.39	-20.93	-21.51	-23.64	-20.14	-24.69	-21.64	-17.38	-29.87	-22.08	3.20
18	7.53	2.964	-21.64	-22.06	-21.96	-22.93	-25.86	-27.07	-30.97	-23.65	-18.33	-32.64	-24.71	4.22
19	7.11	2.183	-21.63	-26.59	-24.97	-25.67	-28.89	-32.51	-34.93	-29.30	-22.01	-33.98	-28.05	4.47
20	6.74	1.858	-24.21	-28.91	-27.14	-28.37	-31.58	-34.08	-36.72	-32.67	-24.19	-36.81	-30.47	4.42
21	6.40	1.485	-24.08	-28.18	-27.21	-29.01	-35.25	-33.24	-38.90	-32.83	-23.48	-39.34	-31.15	5.37
22	6.10	1.265	-25.84	-28.67	-29.59	-32.46	-39.13	-36.21	-40.15	-34.19	-23.53	-43.24	-33.30	6.13
23	5.82	1.168	-29.45	-31.52	-30.74	-35.47	-43.82	-40.96	-44.92	-37.69	-25.77	-45.66	-36.60	6.73
24	5.57	1.128	-23.94	-32.64	-28.20	-32.33	-41.82	-41.11	-44.17	-39.77	-27.33	-46.14	-35.75	7.41
25	5.33	1.148	-21.81	-29.01	-30.38	-34.45	-40.47	-42.33	-43.60	-41.72	-24.28	-46.75	-35.49	8.28
26	5.12	1.273	-26.24	-32.45	-39.12	-40.41	-40.91	-44.87	-44.61	-43.11	-27.15	-45.26	-38.43	6.86
27	4.92	1.491	-30.43	-40.44	-40.95	-42.80	-44.10	-46.20	-45.75	-43.52	-34.39	-45.59	-41.42	4.94
28	4.74	1.442	-36.00	-42.96	-40.52	-42.23	-44.68	-46.11	-47.85	-43.77	-35.93	-45.95	-42.60	3.86
29	4.57	1.201	-36.31	-42.77	-41.84	-41.73	-43.62	-45.17	-48.19	-44.06	-34.73	-46.50	-42.49	3.99
30	4.41	1.093	-37.76	-44.89	-45.25	-45.30	-46.32	-46.07	-49.21	-46.06	-35.86	-49.76	-44.65	4.23
31	4.27	1.030	-37.60	-47.16	-45.39	-45.38	-48.66	-47.13	-50.30	-45.13	-38.74	-50.92	-45.64	4.19

Table A.27 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 04/02/94 10:00 HOURS Hmo= .27 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	D I R E C T I O N (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.613	-13.78	-11.25	-9.40	-10.42	-15.98	-19.33	-17.76	-10.18	6.37	-16.23	-11.82	6.88
3	64.00	.679	-13.60	-12.66	-11.05	-11.87	-14.09	-12.48	-16.37	-11.67	5.68	-14.02	-11.24	5.81
4	42.67	.392	-15.63	-12.62	-11.86	-12.85	-13.01	-14.76	-19.29	-12.15	8.95	-13.79	-11.74	7.19
5	32.00	.194	-15.48	-13.38	-7.64	-9.71	-10.37	-14.68	-21.35	-9.57	9.54	-11.67	-10.46	7.62
6	25.60	.191	-19.61	-18.08	-7.22	-10.52	-8.64	-15.39	-21.59	-11.21	5.07	-11.71	-11.91	7.26
7	21.33	.271	-16.51	-15.91	-8.85	-10.90	-8.09	-11.69	-16.60	-11.87	.88	-13.22	-11.28	4.95
8	18.29	.695	-5.86	-8.76	-5.61	-5.91	-7.77	-10.18	-11.32	-6.99	4.02	-10.82	-6.92	4.16
9	16.00	1.927	-5.92	-6.92	-4.39	-4.86	-8.37	-10.01	-11.62	-5.39	4.00	-8.92	-6.24	4.08
10	14.22	2.928	-6.46	-6.60	-3.59	-4.40	-8.08	-12.23	-14.90	-4.80	3.22	-7.77	-6.56	4.67
11	12.80	2.456	-7.24	-9.75	-6.53	-6.78	-9.76	-15.73	-18.69	-8.12	-2.46	-9.50	-9.45	4.43
12	11.64	3.079	-14.42	-18.59	-16.44	-16.17	-15.38	-20.91	-22.39	-18.10	-13.57	-19.03	-17.50	2.68
13	10.67	6.012	-19.80	-23.59	-21.36	-21.34	-21.14	-26.00	-24.54	-22.99	-20.03	-27.27	-22.81	2.40
14	9.85	10.325	-22.23	-25.10	-23.27	-23.34	-22.93	-26.10	-25.08	-24.61	-22.37	-28.70	-24.37	1.89
15	9.14	10.875	-22.04	-25.64	-23.20	-23.22	-23.51	-26.22	-27.28	-24.75	-22.84	-27.83	-24.65	1.90
16	8.53	7.580	-20.70	-23.45	-21.90	-22.22	-24.20	-26.13	-27.27	-23.60	-19.63	-26.72	-23.58	2.43
17	8.00	5.072	-19.32	-20.50	-20.41	-20.96	-24.47	-23.89	-27.32	-21.66	-15.62	-24.88	-21.90	3.16
18	7.53	3.733	-17.76	-19.70	-19.64	-20.22	-24.68	-24.58	-28.69	-21.49	-15.34	-26.50	-21.86	3.94
19	7.11	3.174	-17.41	-21.09	-19.56	-20.40	-24.86	-25.24	-32.69	-23.39	-16.70	-32.31	-23.36	5.30
20	6.74	2.908	-15.86	-22.90	-18.66	-19.63	-24.82	-27.93	-40.50	-25.38	-18.33	-38.25	-25.20	7.91
21	6.40	2.486	-14.67	-23.13	-18.24	-19.97	-28.47	-31.57	-42.47	-28.04	-18.18	-41.26	-26.58	9.14
22	6.10	2.060	-14.03	-21.64	-16.31	-19.51	-46.58	-38.67	-44.79	-27.85	-15.50	-46.64	-29.12	12.95
23	5.82	2.088	-12.97	-22.32	-16.61	-25.12	-53.54	-46.57	-45.36	-40.43	-16.14	-46.49	-32.56	14.58
24	5.57	1.698	-12.53	-18.24	-22.31	-46.46	-48.77	-50.64	-43.53	-48.45	-11.65	-45.60	-34.91	15.57
25	5.33	1.222	-18.72	-19.10	-36.45	-48.01	-48.39	-48.15	-44.04	-48.07	-11.68	-44.61	-36.82	13.79
26	5.12	1.559	-21.61	-27.97	-37.50	-44.69	-50.33	-48.02	-43.49	-49.44	-19.04	-44.19	-38.68	11.05
27	4.92	1.690	-16.85	-24.39	-45.19	-53.36	-46.97	-48.64	-44.01	-48.30	-15.48	-44.51	-38.87	13.41
28	4.74	2.073	-12.58	-16.47	-80.62	-55.05	-45.41	-48.20	-43.39	-44.08	-8.06	-41.93	-39.53	20.81
29	4.57	2.361	-.78	-2.85	999.99	-52.75	-43.87	-46.99	-38.00	-41.20	3.50	-39.16	-34.30	201.72
30	4.41	2.411	8.38	11.97	999.99	-51.80	-41.57	-42.61	9999.99	-39.14	12.26	9999.99	-27.91	219.88
31	4.27	2.626	8.65	33.08	999.99	-49.68	-38.94	-41.06	9999.99	-36.60	21.19	9999.99	-23.50	218.58

Table A.28 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 04/02/94 13:00 HOURS Hmo= .32 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.660	-30.17	-23.32	-20.72	-22.74	-9.36	-16.12	-21.54	-22.03	-13.95	-23.67	-20.36	5.53
3	64.00	.695	-14.30	-19.03	-12.42	-12.72	-12.31	-11.97	-15.38	-15.29	4.16	-15.07	-12.45	5.89
4	42.67	.398	-13.64	-16.70	-10.39	-11.16	-12.24	-11.75	-15.85	-13.10	12.01	-13.58	-10.70	7.78
5	32.00	.235	-21.79	-15.15	-7.87	-11.34	-10.48	-12.54	-18.27	-11.07	18.20	-11.71	-10.31	10.23
6	25.60	.211	-15.38	-9.60	-5.11	-7.99	-10.64	-13.37	-17.35	-7.04	20.97	-10.80	-7.74	10.17
7	21.33	.353	-5.77	-8.21	-4.22	-5.07	-9.83	-11.67	-13.04	-6.10	12.61	-10.84	-6.24	6.89
8	18.29	.760	-3.52	-7.59	-4.69	-4.53	-7.92	-10.02	-12.46	-6.12	5.43	-7.48	-5.90	4.55
9	16.00	1.963	-4.40	-7.52	-6.01	-5.67	-8.05	-8.23	-11.70	-6.83	.15	-8.93	-6.72	2.98
10	14.22	2.803	-6.23	-7.82	-6.42	-6.42	-8.64	-7.79	-9.09	-7.18	-1.11	-10.55	-7.12	2.38
11	12.80	2.036	-9.06	-11.31	-8.85	-9.00	-11.76	-9.12	-9.99	-10.23	-4.82	-14.13	-9.83	2.29
12	11.64	2.968	-15.25	-19.68	-16.72	-16.64	-21.06	-16.84	-17.64	-18.54	-17.57	-21.98	-18.19	2.02
13	10.67	6.287	-20.17	-23.82	-21.93	-21.87	-24.55	-22.23	-23.26	-23.46	-22.52	-27.25	-23.11	1.80
14	9.85	9.941	-23.27	-26.28	-25.43	-25.36	-24.45	-25.07	-26.11	-26.81	-23.84	-27.90	-25.45	1.32
15	9.14	10.396	-23.63	-26.35	-26.72	-26.62	-26.12	-23.86	-27.60	-27.92	-23.01	-27.06	-25.89	1.66
16	8.53	7.724	-21.73	-24.14	-24.10	-24.24	-25.88	-21.80	-30.06	-25.46	-20.35	-30.24	-24.80	3.14
17	8.00	6.801	-17.55	-24.01	-21.08	-20.87	-23.60	-21.31	-31.14	-23.91	-19.95	-28.94	-23.23	3.92
18	7.53	5.522	-15.60	-21.78	-18.75	-18.78	-20.91	-20.28	-35.11	-21.82	-17.29	-26.72	-21.69	5.31
19	7.11	4.009	-12.78	-15.24	-15.09	-15.48	-18.88	-17.72	-31.99	-17.49	-10.86	9999.99	-17.27	5.71
20	6.74	3.616	-7.68	-7.25	-8.36	-8.80	-20.40	-15.29	9999.99	-9.09	-3.84	9999.99	-10.08	4.90
21	6.40	3.531	-2.78	-3.01	-1.80	-.45	9999.99	9999.99	9999.99	4.30	-.04	9999.99	-.63	2.46
22	6.10	3.764	2.14	1.04	3.84	7.20	9999.99	9999.99	9999.99	15.99	4.96	9999.99	5.85	4.94
23	5.82	4.270	11.53	8.02	13.80	19.58	9999.99	9999.99	9999.99	23.68	11.40	9999.99	14.66	5.33
24	5.57	5.459	17.51	16.76	21.77	25.72	9999.99	9999.99	9999.99	27.69	18.12	9999.99	21.26	4.20
25	5.33	5.936	20.22	22.54	24.36	28.50	9999.99	9999.99	9999.99	30.29	22.23	9999.99	24.69	3.57
26	5.12	6.253	20.91	24.47	26.46	30.27	9999.99	9999.99	9999.99	30.02	23.85	9999.99	26.00	3.35
27	4.92	6.337	19.01	25.29	29.77	31.25	9999.99	9999.99	9999.99	29.82	25.74	9999.99	26.82	4.12
28	4.74	5.499	20.97	27.52	33.53	32.83	9999.99	9999.99	9999.99	32.22	27.46	9999.99	29.09	4.37
29	4.57	4.243	21.18	24.98	35.04	32.82	9999.99	9999.99	9999.99	31.65	24.81	9999.99	28.41	5.01
30	4.41	3.639	20.01	25.70	35.12	32.00	9999.99	9999.99	9999.99	29.49	23.65	9999.99	27.66	5.10
31	4.27	3.372	23.88	29.94	35.34	31.78	9999.99	9999.99	9999.99	29.23	27.96	9999.99	29.69	3.50

Table A.29 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 04/02/94 16:00 HOURS Hmo= .32 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.789	-26.76	-29.28	-15.52	-18.26	-19.63	-18.28	-17.87	-21.11	-7.49	-17.86	-19.21	5.64
3	64.00	.918	-17.29	-16.31	-10.63	-12.27	-14.23	-11.18	-12.89	-12.88	4.43	-14.02	-11.75	5.74
4	42.67	.540	-18.45	-13.38	-11.62	-13.41	-11.47	-12.81	-11.96	-12.27	5.77	-11.62	-11.14	5.96
5	32.00	.311	-13.30	-15.68	-12.72	-13.22	-12.33	-18.56	-16.39	-13.67	9.58	-13.15	-11.99	7.41
6	25.60	.254	-11.35	-16.31	-9.80	-10.38	-9.23	-17.77	-15.98	-12.54	9.77	-9.46	-10.34	7.32
7	21.33	.387	-10.34	-9.43	-10.53	-10.42	-9.86	-17.25	-13.76	-10.19	9.96	-9.54	-9.17	6.77
8	18.29	.834	-8.44	-8.74	-8.21	-8.43	-6.65	-14.58	-11.84	-8.72	5.10	-9.44	-8.00	4.85
9	16.00	1.543	-9.32	-11.55	-8.31	-8.94	-8.27	-12.77	-12.77	-9.92	-1.07	-11.43	-9.44	3.22
10	14.22	2.408	-8.52	-10.79	-8.04	-8.48	-11.20	-13.12	-14.44	-9.32	-2.07	-12.12	-9.81	3.28
11	12.80	2.715	-10.70	-11.23	-9.49	-10.09	-14.91	-13.21	-11.37	-10.42	-4.87	-15.71	-11.20	2.88
12	11.64	4.345	-16.08	-19.05	-17.28	-17.28	-21.34	-20.32	-18.07	-18.73	-16.34	-22.09	-18.66	1.95
13	10.67	8.243	-19.95	-23.48	-21.65	-21.53	-24.24	-25.81	-25.02	-23.09	-21.40	-27.02	-23.32	2.12
14	9.85	12.007	-22.15	-24.77	-23.92	-23.91	-25.71	-25.18	-26.36	-25.08	-22.51	-29.52	-24.91	1.99
15	9.14	11.289	-22.26	-24.98	-24.25	-24.28	-25.87	-24.30	-27.30	-25.40	-22.54	-30.59	-25.18	2.29
16	8.53	7.890	-21.19	-23.31	-23.27	-23.76	-24.16	-23.07	-28.24	-24.99	-20.18	-29.92	-24.21	2.79
17	8.00	5.944	-16.11	-19.80	-19.50	-20.30	-18.17	-21.09	-25.14	-23.34	-16.36	-24.51	-20.43	2.99
18	7.53	5.245	-7.53	-11.86	-9.68	-9.87	-14.28	-13.51	-15.66	-13.15	-8.64	9999.99	-11.57	2.62
19	7.11	4.444	-4.36	-7.04	-5.68	-5.41	-13.89	-6.41	9999.99	-6.56	-4.04	9999.99	-6.67	2.90
20	6.74	3.156	-1.78	-5.38	-4.08	-3.17	-7.76	1.11	9999.99	-4.61	-2.63	9999.99	-3.54	2.46
21	6.40	3.437	-1.96	-4.82	-3.73	-2.78	-2.03	19.69	9999.99	-3.02	-2.40	9999.99	-.18	7.54
22	6.10	3.986	.71	-.97	.69	2.98	12.45	17.20	9999.99	6.59	1.87	9999.99	5.18	6.05
23	5.82	4.303	8.35	4.62	10.14	15.21	19.14	16.84	9999.99	15.22	6.01	9999.99	11.94	5.03
24	5.57	4.810	9.54	7.77	14.49	19.87	18.96	20.62	9999.99	19.45	9.15	9999.99	14.98	5.09
25	5.33	5.232	11.30	13.57	19.39	22.70	21.45	23.16	9999.99	23.31	14.54	9999.99	18.68	4.52
26	5.12	5.482	14.16	16.09	23.94	26.05	25.63	24.96	9999.99	24.89	16.54	9999.99	21.54	4.68
27	4.92	5.557	18.13	15.19	25.52	29.00	26.35	29.01	9999.99	24.32	15.43	9999.99	22.87	5.40
28	4.74	4.630	23.13	19.21	27.02	30.85	28.36	33.74	9999.99	24.32	17.76	9999.99	25.55	5.17
29	4.57	3.532	25.32	25.08	33.45	32.21	29.04	33.15	9999.99	28.05	23.95	9999.99	28.78	3.58
30	4.41	2.467	27.58	32.21	36.76	33.10	29.26	26.25	9999.99	31.70	30.22	9999.99	30.89	3.11
31	4.27	2.483	27.71	42.38	45.61	37.98	23.10	9999.99	9999.99	9999.99	38.27	9999.99	35.85	7.93

Table A.30 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 04/02/94 19:00 HOURS Hmo= .28 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

NO	Period (sec)	Energy (cm**2)	DIRECTION (degrees) for 10 different gauge pairs										Mean dir	Std dev
			43	21	32	42	65	78	89	31	01	54		
2	128.00	.702	-13.43	-18.37	-20.97	-19.46	-23.52	-18.51	-14.04	-19.80	-2.24	-31.18	-18.16	7.10
3	64.00	.883	-24.88	-22.39	-13.74	-16.77	-18.85	-15.63	-13.76	-16.86	.97	-21.30	-16.34	6.74
4	42.67	.552	-30.48	-18.39	-11.42	-16.05	-17.21	-17.68	-19.88	-13.99	6.60	-17.47	-15.64	8.78
5	32.00	.272	-18.75	-17.41	-6.33	-8.98	-14.38	-21.06	-23.52	-10.73	11.91	-13.67	-12.35	9.55
6	25.60	.233	-11.83	-17.12	-5.39	-6.82	-8.50	-14.81	-15.63	-10.04	14.16	-8.58	-8.51	8.39
7	21.33	.369	-7.88	-15.05	-9.12	-9.05	-5.25	-11.20	-12.88	-11.63	4.33	-8.89	-8.67	5.05
8	18.29	.830	-6.39	-8.58	-5.57	-6.00	-7.20	-12.01	-14.10	-6.81	1.27	-10.44	-7.59	3.98
9	16.00	1.884	-8.72	-8.77	-7.14	-7.81	-10.36	-9.09	-10.71	-8.01	-1.99	-12.64	-8.53	2.66
10	14.22	2.754	-8.03	-8.57	-7.67	-8.00	-10.74	-9.26	-12.03	-8.35	-3.59	-12.61	-8.89	2.42
11	12.80	2.603	-9.93	-9.58	-9.46	-9.91	-12.47	-11.36	-15.79	-9.93	-5.14	-16.59	-11.02	3.14
12	11.64	3.766	-14.05	-16.82	-16.15	-15.97	-21.00	-18.77	-21.40	-17.26	-16.05	-21.98	-17.94	2.57
13	10.67	7.150	-16.49	-20.79	-19.97	-19.51	-23.10	-22.85	-28.28	-21.05	-20.20	-23.79	-21.60	2.99
14	9.85	11.545	-17.74	-23.14	-20.81	-20.51	-23.81	-22.79	-29.01	-22.59	-21.31	-25.48	-22.72	2.90
15	9.14	10.497	-17.91	-22.96	-20.44	-20.31	-24.86	-22.35	-27.47	-22.41	-20.55	-27.99	-22.73	3.07
16	8.53	6.222	-17.44	-21.98	-20.34	-20.36	-24.96	-23.25	-25.61	-22.51	-19.60	-30.67	-22.67	3.56
17	8.00	4.767	-12.63	-15.31	-14.54	-15.06	-20.08	-17.07	-25.20	-16.87	-12.24	-26.84	-17.58	4.74
18	7.53	4.432	-6.72	-5.14	-7.07	-7.73	-6.91	-14.45	-24.97	-6.60	-2.72	-13.99	-9.61	6.17
19	7.11	4.560	-1.10	-1.33	-1.28	-.65	.98	-8.07	9999.99	.22	-.19	2.01	-1.04	2.70
20	6.74	4.614	1.47	.77	2.22	3.40	9.69	-1.48	9999.99	4.30	1.97	6.41	3.19	3.11
21	6.40	4.112	4.28	2.02	5.69	7.95	9999.99	1.27	9999.99	9.31	4.46	9999.99	5.00	2.71
22	6.10	3.700	7.30	2.44	7.03	10.61	9999.99	9999.99	9999.99	10.93	5.65	9999.99	7.33	2.90
23	5.82	3.258	6.53	3.41	7.79	12.87	9999.99	9999.99	9999.99	16.24	5.60	9999.99	8.74	4.42
24	5.57	3.072	5.09	8.41	11.49	18.77	9999.99	9999.99	9999.99	26.93	8.21	9999.99	13.13	7.48
25	5.33	3.485	8.25	16.82	13.94	18.84	9999.99	9999.99	9999.99	27.76	14.95	9999.99	16.75	5.90
26	5.12	3.438	12.73	17.19	17.21	21.12	9999.99	9999.99	9999.99	24.62	16.86	9999.99	18.29	3.73
27	4.92	2.772	17.34	18.61	21.24	25.69	9999.99	9999.99	9999.99	25.48	18.33	9999.99	21.11	3.37
28	4.74	2.140	19.67	20.78	22.35	28.73	9999.99	9999.99	9999.99	24.06	19.30	9999.99	22.48	3.23
29	4.57	1.487	17.49	21.21	23.79	34.62	9999.99	9999.99	9999.99	20.81	19.03	9999.99	22.81	5.62
30	4.41	1.159	16.06	25.66	9999.99	9999.99	9999.99	9999.99	9999.99	9999.99	23.37	9999.99	21.70	4.09
31	4.27	.823	20.30	29.42	9999.99	9999.99	9999.99	9999.99	9999.99	9999.99	25.47	9999.99	25.06	3.74

Table A.31 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 04/02/94 22:00 HOURS Hmo= .26 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.788	-2.32	-9.73	-21.10	-15.98	-20.23	-16.42	-23.92	-16.62	.57	-19.46	-14.54	7.73
3	64.00	1.058	-11.50	-12.85	-11.46	-11.43	-12.38	-13.57	-15.44	-12.00	7.98	-15.42	-10.84	6.43
4	42.67	.619	-16.33	-17.67	-10.16	-11.72	-10.99	-13.71	-15.36	-13.13	7.01	-14.45	-11.68	6.61
5	32.00	.284	-21.52	-22.61	-13.40	-15.41	-11.68	-13.01	-14.00	-16.92	3.84	-14.81	-13.98	6.83
6	25.60	.211	-14.68	-17.77	-6.99	-9.07	-10.28	-13.43	-16.78	-10.94	7.82	-10.80	-10.32	6.84
7	21.33	.294	-7.82	-10.89	-.64	-2.56	-6.20	-8.34	-17.43	-4.46	12.50	-6.24	-5.23	7.36
8	18.29	.657	-6.98	-8.58	-3.54	-4.49	-9.24	-7.35	-12.35	-5.68	8.05	-8.81	-5.91	5.23
9	16.00	1.379	-5.16	-6.83	-3.57	-4.20	-11.10	-9.39	-9.44	-5.08	8.31	-9.22	-5.58	5.24
10	14.22	2.173	-6.65	-7.23	-5.19	-5.89	-14.96	-11.47	-12.98	-6.11	5.25	-12.74	-7.80	5.49
11	12.80	2.550	-10.74	-12.28	-10.52	-10.88	-15.93	-15.07	-16.67	-11.58	-4.35	-17.63	-12.57	3.73
12	11.64	3.748	-15.09	-18.62	-16.34	-16.36	-17.64	-18.15	-18.70	-17.84	-12.97	-23.26	-17.50	2.56
13	10.67	6.516	-17.48	-19.94	-18.68	-18.70	-20.72	-23.08	-24.67	-19.79	-16.28	-24.25	-20.36	2.69
14	9.85	11.023	-19.74	-23.43	-21.20	-21.09	-23.94	-23.66	-25.62	-22.54	-19.43	-27.98	-22.86	2.52
15	9.14	11.368	-20.76	-25.35	-22.82	-22.68	-25.25	-24.88	-27.38	-24.42	-19.72	-28.16	-24.14	2.55
16	8.53	7.578	-20.68	-26.20	-24.44	-24.18	-25.70	-26.97	-30.13	-26.73	-22.09	-27.56	-25.47	2.60
17	8.00	5.310	-19.43	-21.32	-21.53	-22.05	-22.77	-24.17	-28.95	-23.95	-17.39	-27.42	-22.90	3.28
18	7.53	3.874	-12.35	-13.71	-13.24	-13.88	-20.57	-20.54	-28.21	-15.55	-9.44	-20.61	-16.80	5.29
19	7.11	3.685	-5.89	-10.09	-7.34	-7.26	-9.16	-15.78	9999.99	-9.98	-6.39	9999.99	-8.99	2.97
20	6.74	3.488	-1.51	-5.11	-2.75	-2.32	-2.18	-3.59	9999.99	-3.78	-1.95	9999.99	-2.90	1.11
21	6.40	2.982	.17	.78	.87	1.23	4.08	.02	9999.99	4.41	4.85	9999.99	2.05	1.90
22	6.10	2.378	2.54	5.52	4.42	5.59	5.99	6.46	9999.99	10.62	8.58	9999.99	6.22	2.31
23	5.82	2.257	4.14	9.25	9.05	12.41	15.51	9999.99	9999.99	20.41	11.19	9999.99	11.71	4.80
24	5.57	2.386	4.43	5.78	9.56	15.77	9999.99	9999.99	9999.99	22.62	8.75	9999.99	11.14	6.26
25	5.33	2.350	8.60	3.45	11.92	18.23	9999.99	9999.99	9999.99	19.25	6.54	9999.99	11.33	5.82
26	5.12	1.978	7.65	4.02	10.79	9999.99	9999.99	9999.99	9999.99	26.39	6.97	9999.99	11.13	7.91
27	4.92	1.489	3.23	7.50	9999.99	9999.99	9999.99	9999.99	9999.99	32.01	8.19	9999.99	12.65	11.29
28	4.74	1.264	1.72	13.35	9999.99	9999.99	9999.99	9999.99	9999.99	31.49	11.82	9999.99	14.56	10.73
29	4.57	.954	3.95	15.86	9999.99	9999.99	9999.99	9999.99	9999.99	29.78	13.85	9999.99	15.85	9.21
30	4.41	.745	3.11	9.62	9999.99	9999.99	9999.99	9999.99	9999.99	30.61	7.95	9999.99	12.76	10.54
31	4.27	.477	-.81	9.64	9999.99	9999.99	9999.99	9999.99	9999.99	30.87	6.70	9999.99	11.53	11.76

Table A.32 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 05/02/94 01:00 HOURS Hmo= .22 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.677	-34.48	-17.00	-8.11	-14.80	-15.31	-16.12	-20.59	-11.13	.57	-18.25	-15.51	8.54
3	64.00	.939	-16.76	-13.43	-7.86	-10.06	-12.38	-12.48	-14.81	-9.84	9.82	-12.92	-10.11	7.06
4	42.67	.538	-10.16	-14.40	-9.09	-9.07	-11.95	-13.61	-13.47	-11.27	12.81	-12.52	-9.33	7.57
5	32.00	.235	-14.69	-17.22	-8.20	-9.93	-10.83	-12.05	-13.99	-11.78	9.19	-13.04	-10.29	6.92
6	25.60	.188	-15.24	-12.04	-3.75	-7.05	-9.51	-6.03	-8.15	-7.26	8.38	-9.96	-7.08	5.98
7	21.33	.260	-7.88	-10.77	-8.09	-7.92	-7.56	-7.11	-9.49	-9.41	5.31	-10.14	-7.32	4.36
8	18.29	.519	-4.35	-11.75	-9.39	-8.22	-5.07	-10.39	-12.66	-10.58	-1.90	-9.60	-8.39	3.32
9	16.00	1.219	-8.34	-12.58	-10.99	-10.50	-9.76	-11.25	-11.72	-12.12	-8.02	-12.36	-10.76	1.53
10	14.22	2.109	-10.85	-12.02	-11.32	-11.47	-12.24	-12.10	-11.66	-12.12	-6.61	-14.87	-11.53	1.93
11	12.80	2.248	-13.95	-12.56	-12.40	-13.18	-13.64	-10.92	-11.34	-13.07	-5.42	-17.78	-12.43	2.93
12	11.64	3.229	-18.03	-18.14	-18.29	-18.80	-17.02	-16.87	-18.73	-19.24	-13.89	-20.92	-17.99	1.74
13	10.67	6.149	-19.63	-20.88	-21.26	-21.36	-22.23	-23.26	-25.27	-21.87	-17.12	-24.69	-21.76	2.25
14	9.85	9.728	-22.68	-23.84	-23.42	-23.74	-24.82	-25.60	-27.95	-24.29	-18.92	-28.17	-24.34	2.51
15	9.14	8.416	-23.70	-24.93	-24.33	-24.75	-25.35	-25.98	-28.22	-25.41	-20.20	-28.55	-25.14	2.22
16	8.53	5.812	-20.84	-23.25	-21.96	-22.22	-24.34	-26.48	-28.55	-23.45	-18.63	-27.25	-23.70	2.89
17	8.00	4.156	-18.67	-24.21	-21.96	-21.90	-22.73	-26.66	-30.54	-24.44	-19.44	-26.16	-23.67	3.36
18	7.53	2.889	-15.88	-22.22	-19.47	-19.86	-21.80	-24.65	-27.51	-22.95	-17.00	-25.99	-21.73	3.56
19	7.11	2.139	-11.06	-14.72	-14.00	-15.33	-14.18	-16.39	-21.84	-17.68	-8.57	-20.71	-15.45	3.81
20	6.74	1.778	-6.21	-6.54	-8.08	-9.89	-6.47	-13.72	9999.99	-10.40	-1.54	9999.99	-7.86	3.38
21	6.40	1.657	-.99	-1.99	-1.60	-1.83	9999.99	9999.99	9999.99	-2.03	1.72	9999.99	-1.12	1.32
22	6.10	1.420	2.45	-1.16	2.15	5.70	9999.99	9999.99	9999.99	4.08	2.70	9999.99	2.66	2.09
23	5.82	1.403	1.37	-3.79	-.23	9999.99	9999.99	9999.99	9999.99	9999.99	.67	9999.99	-.50	1.99
24	5.57	1.215	4.06	-1.35	4.06	9999.99	9999.99	9999.99	9999.99	9999.99	2.86	9999.99	2.41	2.22
25	5.33	1.038	.80	-3.13	-.03	9999.99	9999.99	9999.99	9999.99	9999.99	.49	9999.99	-.47	1.56
26	5.12	1.092	-4.62	-10.03	-8.53	9999.99	9999.99	9999.99	9999.99	9999.99	-5.59	9999.99	-7.19	2.18
27	4.92	.870	-6.24	-12.01	9999.99	9999.99	9999.99	9999.99	9999.99	9999.99	-6.38	9999.99	-8.21	2.69
28	4.74	.480	-6.00	-16.27	9999.99	9999.99	9999.99	9999.99	9999.99	9999.99	-11.17	9999.99	-11.14	4.19
29	4.57	.367	-9.27	-21.52	9999.99	9999.99	9999.99	9999.99	9999.99	9999.99	-15.54	9999.99	-15.45	5.00
30	4.41	.362	-12.79	-23.76	9999.99	9999.99	9999.99	9999.99	9999.99	9999.99	-20.82	9999.99	-19.12	4.64
31	4.27	.300	-11.31	-20.84	9999.99	9999.99	9999.99	9999.99	9999.99	9999.99	-18.12	9999.99	-16.76	4.01

Table A.33 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 05/02/94 04:00 HOURS Hmo= .22 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.786	-19.09	-18.95	-9.17	-11.93	-19.55	-18.06	-13.07	-13.04	10.93	-19.35	-13.19	8.77
3	64.00	1.163	-23.04	-19.62	-8.86	-12.36	-15.41	-9.08	-10.24	-12.81	8.51	-16.18	-11.94	8.07
4	42.67	.649	-18.22	-18.00	-6.94	-9.69	-12.50	-7.70	-9.47	-11.03	12.18	-13.42	-9.52	8.09
5	32.00	.256	-15.75	-14.43	-8.66	-10.37	-12.96	-12.21	-15.08	-11.07	11.14	-12.10	-10.20	7.39
6	25.60	.227	-13.78	-15.31	-10.20	-11.07	-12.06	-14.08	-17.58	-12.60	9.01	-13.64	-11.17	7.00
7	21.33	.319	-13.50	-13.18	-10.53	-11.30	-10.35	-13.72	-15.91	-11.92	7.21	-15.25	-10.87	6.27
8	18.29	.676	-13.14	-12.60	-8.84	-10.18	-9.48	-10.90	-11.20	-10.31	5.20	-12.47	-9.41	5.04
9	16.00	1.766	-9.91	-12.48	-9.24	-9.60	-12.81	-9.01	-9.59	-10.68	-1.14	-13.73	-9.82	3.29
10	14.22	2.783	-11.64	-14.11	-12.30	-12.31	-13.82	-11.26	-11.28	-13.32	-6.16	-15.82	-12.20	2.43
11	12.80	2.570	-12.53	-13.54	-12.26	-12.53	-11.76	-11.32	-12.68	-13.29	-7.62	-15.01	-12.25	1.82
12	11.64	3.092	-13.04	-14.49	-14.64	-14.59	-13.36	-12.71	-14.28	-15.35	-11.07	-17.02	-14.05	1.54
13	10.67	5.548	-15.82	-18.63	-17.88	-17.83	-19.60	-18.24	-21.43	-19.21	-15.13	-21.30	-18.51	1.94
14	9.85	7.511	-18.44	-21.73	-20.63	-20.70	-23.61	-21.28	-25.26	-22.39	-18.11	-25.66	-21.78	2.41
15	9.14	6.981	-19.42	-22.44	-21.91	-21.94	-24.84	-24.82	-28.03	-23.28	-19.32	-27.00	-23.30	2.76
16	8.53	5.096	-19.68	-21.65	-20.89	-21.18	-25.09	-25.09	-27.24	-22.00	-17.74	-27.81	-22.84	3.14
17	8.00	3.601	-20.45	-22.15	-21.33	-21.83	-25.24	-26.84	-26.59	-22.85	-17.27	-28.25	-23.28	3.22
18	7.53	2.834	-19.49	-21.55	-20.94	-21.39	-24.01	-24.96	-26.17	-23.19	-16.49	-29.06	-22.72	3.38
19	7.11	1.834	-16.07	-16.52	-16.27	-17.10	-21.38	-21.33	-29.78	-18.49	-11.24	-29.76	-19.79	5.68
20	6.74	1.286	-10.36	-12.72	-11.87	-13.45	-22.92	-23.49	-32.92	-16.63	-7.86	-27.98	-18.01	7.91
21	6.40	1.450	-8.82	-16.66	-14.11	-17.04	-24.62	-24.73	-32.00	-27.03	-11.68	-39.96	-21.65	9.26
22	6.10	1.991	-8.02	-18.93	-15.37	-19.11	-32.36	-33.41	-36.91	-40.50	-13.65	-44.75	-26.30	12.09
23	5.82	1.953	-10.46	-19.28	-16.44	-23.52	-37.39	-45.70	-42.04	-42.07	-13.28	-39.93	-29.02	12.97
24	5.57	1.496	-12.41	-21.55	-18.01	-25.25	-41.28	-44.05	-39.89	-39.26	-15.54	-38.26	-29.57	11.53
25	5.33	1.435	-16.72	-24.40	-28.63	-35.60	-42.60	-39.68	-37.03	-40.03	-18.44	-38.43	-32.18	8.95
26	5.12	1.210	-22.79	-26.29	-33.57	-40.39	-40.39	-39.67	-36.97	-41.09	-21.16	-37.19	-33.97	7.30
27	4.92	.956	-25.87	-30.69	-35.95	-41.39	-39.50	-41.32	-37.50	-39.77	-24.26	-40.24	-35.66	6.09
28	4.74	.734	-21.80	-32.91	-39.77	-41.54	-39.04	-40.24	-38.19	-38.15	-25.67	-41.83	-35.93	6.58
29	4.57	.563	-20.50	-32.53	-43.34	-41.83	-38.54	-39.91	-40.09	-38.16	-25.80	-41.08	-36.20	7.16
30	4.41	.429	-23.91	-33.93	-39.59	-38.35	-41.17	-41.38	-43.76	-37.53	-26.36	-42.58	-36.87	6.45
31	4.27	.320	-23.01	-37.45	-36.72	-35.19	-37.74	-39.79	-43.56	-35.98	-31.50	9999.99	-35.67	5.44

Table A.34 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 05/02/94 07:00 HOURS Hmo= .24 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.940	-21.97	-23.52	-18.22	-19.09	-23.60	-18.80	-24.55	-20.18	-7.49	-22.93	-20.05	4.69
3	64.00	1.073	-20.15	-19.72	-14.89	-16.18	-18.00	-12.99	-15.96	-16.93	.78	-20.22	-15.44	5.85
4	42.67	.742	-23.50	-19.17	-12.89	-15.57	-15.56	-12.57	-14.17	-15.45	5.48	-17.51	-14.12	7.20
5	32.00	.320	-25.16	-19.75	-15.15	-17.84	-15.38	-16.50	-18.94	-16.97	5.80	-17.52	-15.79	7.68
6	25.60	.248	-17.63	-17.35	-15.20	-16.30	-18.20	-15.70	-19.98	-16.12	4.43	-20.35	-15.28	6.76
7	21.33	.470	-11.83	-13.85	-13.54	-13.72	-11.62	-10.40	-16.62	-14.13	.85	-15.10	-12.01	4.60
8	18.29	.817	-11.81	-11.93	-9.89	-10.79	-7.39	-7.92	-14.44	-11.24	1.22	-11.85	-9.61	4.10
9	16.00	1.436	-5.58	-8.79	-5.96	-6.03	-4.02	-7.12	-12.05	-7.58	-.74	-6.94	-6.48	2.80
10	14.22	2.596	-5.41	-9.66	-7.23	-6.99	-7.80	-8.06	-11.17	-8.50	-3.32	-8.76	-7.69	2.07
11	12.80	3.176	-8.28	-10.97	-9.36	-9.30	-10.79	-11.27	-11.14	-10.14	-4.16	-13.24	-9.87	2.30
12	11.64	3.282	-12.31	-14.86	-13.86	-13.77	-14.84	-17.15	-15.61	-14.61	-10.39	-19.15	-14.66	2.29
13	10.67	5.494	-16.10	-18.66	-17.17	-17.33	-21.29	-20.38	-22.19	-18.59	-15.37	-24.62	-19.17	2.77
14	9.85	7.325	-18.99	-21.89	-20.72	-20.82	-23.10	-23.46	-25.74	-22.31	-19.36	-26.25	-22.26	2.32
15	9.14	7.712	-20.74	-24.16	-23.80	-23.55	-24.19	-23.74	-25.68	-25.12	-23.10	-28.60	-24.27	1.91
16	8.53	7.312	-20.17	-25.05	-23.53	-23.06	-26.22	-25.95	-28.91	-24.99	-22.41	-29.42	-24.97	2.71
17	8.00	4.858	-19.79	-23.70	-22.56	-22.36	-26.11	-26.94	-28.48	-23.88	-19.96	-29.65	-24.34	3.20
18	7.53	3.039	-23.21	-22.38	-24.53	-25.28	-26.18	-26.34	-26.22	-25.09	-18.52	-29.56	-24.73	2.78
19	7.11	2.690	-20.30	-23.42	-24.41	-24.99	-27.20	-26.97	-28.98	-26.85	-20.06	-29.19	-25.24	3.07
20	6.74	1.911	-16.82	-22.06	-21.90	-22.67	-26.93	-26.04	-33.95	-26.16	-18.75	-34.28	-24.95	5.50
21	6.40	1.465	-15.58	-19.29	-18.78	-20.47	-25.30	-28.93	-33.39	-24.38	-17.05	-40.24	-24.32	7.47
22	6.10	1.492	-13.04	-18.85	-18.91	-21.85	-28.51	-31.90	-34.74	-28.15	-15.36	-37.68	-24.90	8.04
23	5.82	1.746	-14.50	-22.37	-22.46	-26.39	-31.20	-34.92	-36.65	-34.04	-16.87	-35.27	-27.48	7.69
24	5.57	2.179	-17.54	-29.31	-26.54	-29.91	-35.29	-35.56	-35.44	-36.79	-25.09	-37.07	-30.86	6.07
25	5.33	2.241	-22.33	-29.95	-32.49	-35.77	-38.73	-36.33	-37.13	-37.24	-26.98	-38.57	-33.56	5.24
26	5.12	2.059	-25.94	-30.72	-36.65	-37.65	-37.62	-35.96	-36.63	-37.90	-26.64	-39.48	-34.52	4.65
27	4.92	1.904	-25.61	-33.08	-35.86	-35.68	-37.28	-37.99	-38.54	-38.42	-27.52	-40.66	-35.07	4.68
28	4.74	1.330	-25.25	-35.49	-34.11	-34.83	-39.72	-38.78	-41.33	-36.81	-30.90	-40.20	-35.75	4.63
29	4.57	1.094	-27.37	-38.74	-38.54	-37.73	-41.63	-39.15	-39.81	-38.33	-34.45	-41.59	-37.74	3.96
30	4.41	1.025	-31.20	-43.64	-40.99	-39.09	-42.69	-39.84	-41.60	-41.49	-39.17	-46.41	-40.61	3.77
31	4.27	.767	-34.38	-44.38	-40.55	-39.68	-43.95	-41.75	-43.45	-42.85	-40.97	-47.48	-41.94	3.30

Table A.35 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 05/02/94 10:00 HOURS Hmo= .26 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

NO	Period (sec)	Energy (cm**2)	DIRECTION (degrees) for 10 different gauge pairs										Mean dir	Std dev
			43	21	32	42	65	78	89	31	01	54		
2	128.00	.764	-8.55	-22.92	-22.11	-18.44	-20.08	-20.16	-17.92	-21.96	-15.48	-20.02	-18.77	4.00
3	64.00	1.240	-8.90	-18.54	-15.01	-13.43	-16.33	-12.59	-11.66	-16.33	.60	-19.66	-13.20	5.52
4	42.67	.800	-13.87	-16.06	-11.42	-12.13	-13.76	-11.55	-11.91	-13.10	7.84	-16.78	-11.31	6.60
5	32.00	.364	-13.56	-12.81	-9.60	-10.98	-14.58	-17.18	-17.51	-10.51	10.53	-16.47	-11.32	7.73
6	25.60	.295	-13.57	-12.54	-10.29	-11.67	-13.62	-14.47	-18.30	-10.96	8.94	-17.19	-11.41	7.19
7	21.33	.325	-14.71	-11.36	-8.07	-10.14	-10.03	-11.84	-14.99	-9.37	6.83	-13.51	-9.74	5.93
8	18.29	.647	-10.49	-10.17	-5.44	-7.02	-7.41	-11.85	-14.66	-7.35	4.17	-8.06	-7.84	4.75
9	16.00	1.285	-9.87	-10.34	-7.63	-8.36	-11.17	-10.29	-11.96	-9.01	-3.20	-11.01	-9.28	2.38
10	14.22	2.392	-9.65	-10.66	-8.93	-9.19	-13.91	-13.39	-12.64	-9.84	-5.95	-13.99	-10.81	2.49
11	12.80	2.880	-8.28	-11.10	-8.24	-8.32	-11.77	-12.82	-12.05	-9.58	-4.24	-11.81	-9.82	2.48
12	11.64	3.293	-8.72	-11.39	-8.54	-8.72	-14.19	-14.81	-18.07	-9.92	-4.24	-12.56	-11.12	3.75
13	10.67	5.147	-15.06	-17.04	-15.04	-15.48	-22.07	-21.01	-24.76	-16.46	-12.15	-23.34	-18.24	4.01
14	9.85	8.769	-20.42	-23.76	-21.42	-21.64	-25.29	-24.65	-26.80	-23.21	-19.62	-28.46	-23.53	2.69
15	9.14	11.820	-22.53	-26.35	-25.23	-24.96	-28.52	-26.28	-29.03	-26.46	-22.93	-28.53	-26.08	2.13
16	8.53	10.040	-23.39	-26.85	-26.49	-26.15	-28.47	-25.89	-29.96	-27.45	-23.36	-29.00	-26.70	2.07
17	8.00	6.783	-24.37	-26.01	-26.17	-26.28	-27.90	-26.03	-30.29	-27.02	-22.28	-30.39	-26.67	2.33
18	7.53	5.529	-24.64	-27.05	-26.77	-26.79	-28.56	-29.18	-31.62	-27.85	-24.23	-31.04	-27.77	2.30
19	7.11	4.203	-25.24	-28.58	-27.13	-27.26	-29.28	-31.21	-32.70	-28.77	-25.84	-31.94	-28.79	2.40
20	6.74	3.439	-27.46	-28.97	-28.19	-28.95	-31.85	-32.55	-34.81	-29.76	-25.27	-33.35	-30.11	2.80
21	6.40	2.234	-26.53	-27.54	-27.76	-29.15	-33.24	-33.66	-35.93	-30.39	-22.26	-35.84	-30.23	4.20
22	6.10	1.582	-21.79	-26.73	-27.72	-28.95	-31.90	-36.65	-37.86	-33.89	-21.93	-38.02	-30.55	5.79
23	5.82	1.322	-22.64	-25.28	-26.41	-29.36	-32.20	-36.34	-37.60	-31.91	-22.98	-38.11	-30.28	5.57
24	5.57	1.282	-25.29	-27.07	-28.19	-32.69	-34.03	-34.98	-36.51	-33.01	-24.56	-37.84	-31.42	4.52
25	5.33	1.442	-25.45	-28.54	-28.36	-33.22	-38.00	-38.12	-36.83	-34.72	-24.70	-38.10	-32.60	5.11
26	5.12	1.667	-25.41	-30.50	-32.95	-36.23	-39.59	-39.44	-38.55	-37.36	-25.41	-38.85	-34.43	5.30
27	4.92	1.599	-27.56	-32.24	-40.42	-39.84	-39.24	-40.60	-40.16	-39.53	-26.96	-40.55	-36.72	5.28
28	4.74	1.391	-25.55	-33.03	-41.94	-39.26	-38.85	-43.53	-41.63	-39.01	-28.37	-40.65	-37.19	5.79
29	4.57	1.107	-29.00	-35.62	-38.06	-36.58	-38.73	-42.68	-42.31	-38.30	-30.97	-42.35	-37.46	4.42
30	4.41	1.050	-33.07	-39.43	-37.85	-36.86	-38.46	-38.57	-42.68	-39.54	-35.99	-43.46	-38.59	2.88
31	4.27	.785	-33.92	-37.14	-37.01	-36.47	-39.83	-37.52	-43.04	-37.85	-32.39	-44.09	-37.93	3.44

Table A.36 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 05/02/94 13:00 HOURS Hmo= .30 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.741	-27.13	-12.20	-18.34	-20.76	-14.00	-11.59	-15.40	-16.02	8.66	-24.98	-15.23	9.34
3	64.00	1.238	-16.41	-9.63	-5.58	-8.34	-12.74	-7.54	-10.64	-7.05	17.20	-14.23	-7.57	8.84
4	42.67	.878	-13.17	-13.63	-4.92	-7.09	-12.89	-8.72	-11.09	-8.22	16.51	-13.40	-7.73	8.55
5	32.00	.351	-12.78	-19.21	-10.14	-11.20	-13.21	-13.96	-15.97	-13.75	11.83	-15.36	-11.43	8.10
6	25.60	.230	-9.14	-16.19	-11.59	-11.70	-9.23	-18.35	-20.62	-13.59	10.64	-12.17	-11.24	8.10
7	21.33	.360	-10.51	-14.73	-11.55	-11.56	-9.54	-14.56	-16.75	-13.03	8.58	-11.24	-10.52	6.69
8	18.29	.722	-9.66	-9.88	-9.01	-9.28	-11.97	-9.85	-12.18	-9.66	2.72	-12.65	-9.15	4.14
9	16.00	1.389	-9.23	-8.14	-6.45	-7.34	-9.80	-9.10	-12.46	-7.51	-.29	-10.71	-8.10	3.09
10	14.22	2.812	-9.46	-8.70	-7.28	-8.07	-11.48	-9.13	-12.98	-8.19	-1.19	-13.22	-8.97	3.25
11	12.80	3.783	-10.00	-8.68	-7.07	-7.95	-12.44	-10.48	-13.41	-7.89	-.74	-14.16	-9.29	3.67
12	11.64	4.298	-10.76	-11.94	-9.78	-10.16	-14.82	-15.82	-16.82	-10.80	-5.41	-16.84	-12.31	3.51
13	10.67	6.945	-16.30	-19.77	-17.02	-17.15	-21.29	-20.92	-20.15	-18.55	-14.71	-23.94	-18.98	2.62
14	9.85	10.709	-20.86	-23.02	-21.23	-21.42	-25.26	-25.99	-25.80	-22.39	-18.92	-27.81	-23.27	2.67
15	9.14	12.238	-22.26	-25.51	-23.55	-23.46	-26.82	-28.76	-29.25	-24.88	-22.21	-28.72	-25.54	2.58
16	8.53	10.886	-24.41	-26.82	-26.02	-25.96	-26.95	-29.06	-29.34	-26.93	-23.16	-31.48	-27.01	2.31
17	8.00	8.538	-26.47	-27.35	-27.88	-27.88	-27.34	-28.49	-30.36	-28.25	-22.78	-31.33	-27.81	2.17
18	7.53	7.425	-26.41	-27.56	-27.78	-27.89	-29.25	-27.86	-29.90	-28.44	-23.15	-31.02	-27.93	2.02
19	7.11	7.864	-24.68	-28.42	-26.73	-26.70	-29.75	-31.04	-31.51	-28.31	-24.33	-31.27	-28.27	2.50
20	6.74	6.854	-24.28	-29.95	-27.52	-27.23	-28.87	-31.43	-32.94	-29.94	-27.05	-31.66	-29.09	2.48
21	6.40	4.908	-26.07	-29.60	-29.23	-29.28	-29.34	-31.22	-32.58	-31.26	-26.23	-33.47	-29.83	2.30
22	6.10	3.201	-25.93	-28.49	-29.44	-30.27	-31.81	-30.90	-33.22	-32.25	-24.35	-35.43	-30.21	3.16
23	5.82	2.930	-23.59	-25.49	-27.92	-29.77	-33.20	-29.77	-34.92	-32.36	-21.06	-36.05	-29.42	4.68
24	5.57	2.999	-22.11	-25.44	-28.18	-29.43	-30.78	-32.21	-34.36	-31.13	-20.52	-33.68	-28.79	4.48
25	5.33	2.446	-22.69	-28.28	-26.73	-27.39	-30.84	-32.80	-34.37	-29.67	-23.66	-34.34	-29.08	3.90
26	5.12	2.000	-25.12	-30.14	-27.59	-28.93	-31.25	-32.85	-34.80	-30.32	-25.37	-34.65	-30.10	3.26
27	4.92	1.874	-26.29	-31.61	-30.74	-31.75	-33.59	-34.55	-36.88	-33.39	-27.21	-35.49	-32.15	3.23
28	4.74	1.631	-26.76	-33.48	-31.21	-31.46	-35.56	-36.89	-36.98	-33.99	-28.52	-35.55	-33.04	3.31
29	4.57	1.182	-28.53	-34.71	-31.62	-31.62	-36.00	-38.31	-36.94	-34.62	-28.11	-36.35	-33.68	3.35
30	4.41	.905	-30.75	-36.04	-35.52	-35.16	-36.03	-36.95	-39.06	-36.82	-30.02	-38.25	-35.46	2.78
31	4.27	.703	-31.64	-37.69	-36.70	-36.38	-35.65	-38.04	-40.05	-37.97	-31.07	-38.28	-36.35	2.75

Table A.37 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 05/02/94 16:00 HOURS Hmo= .26 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.698	-10.29	-10.11	-14.42	-13.81	-15.24	-22.07	-22.10	-12.75	9.37	-22.54	-13.45	8.82
3	64.00	1.312	-10.63	-15.83	-10.69	-11.03	-14.23	-14.63	-14.46	-12.59	4.34	-16.26	-11.62	5.67
4	42.67	1.137	-11.32	-16.06	-9.53	-10.24	-11.92	-14.39	-13.95	-11.95	7.60	-14.26	-10.63	6.37
5	32.00	.469	-16.10	-16.69	-11.44	-12.91	-11.73	-14.21	-15.74	-13.38	10.01	-14.65	-11.73	7.42
6	25.60	.262	-18.19	-15.35	-9.28	-11.93	-15.30	-16.20	-21.35	-11.79	8.73	-17.50	-12.86	7.91
7	21.33	.421	-8.11	-12.87	-5.83	-6.45	-10.06	-15.29	-21.15	-8.86	8.20	-10.65	-9.12	7.20
8	18.29	.866	-9.56	-13.03	-8.96	-9.53	-10.10	-10.30	-16.30	-10.86	1.66	-11.41	-9.85	4.35
9	16.00	1.651	-10.98	-11.78	-9.78	-10.35	-9.30	-9.94	-13.19	-10.84	-3.18	-12.41	-10.18	2.60
10	14.22	2.935	-9.57	-10.68	-8.47	-8.91	-8.82	-10.08	-13.04	-9.48	-2.72	-11.52	-9.33	2.57
11	12.80	3.338	-7.51	-10.33	-7.75	-7.84	-9.89	-11.20	-13.43	-8.94	-3.32	-11.95	-9.22	2.69
12	11.64	3.617	-9.84	-13.21	-11.20	-11.14	-13.86	-17.32	-16.78	-12.52	-8.75	-16.03	-13.06	2.79
13	10.67	6.422	-17.17	-20.73	-19.53	-19.34	-22.19	-23.64	-22.77	-20.95	-17.01	-23.83	-20.72	2.33
14	9.85	8.746	-20.13	-22.88	-21.99	-21.90	-25.10	-27.65	-26.19	-23.08	-19.09	-26.42	-23.44	2.68
15	9.14	9.123	-21.03	-24.86	-23.41	-23.18	-25.81	-28.32	-25.44	-24.75	-21.23	-26.95	-24.50	2.21
16	8.53	7.960	-22.07	-26.57	-24.35	-24.16	-25.94	-27.03	-25.19	-26.17	-23.55	-30.02	-25.50	2.08
17	8.00	5.867	-23.01	-25.37	-23.34	-23.58	-27.43	-27.32	-27.68	-24.86	-21.31	-30.80	-25.47	2.69
18	7.53	5.771	-24.72	-27.09	-25.84	-25.81	-28.37	-28.89	-31.33	-26.96	-24.35	-30.87	-27.42	2.29
19	7.11	5.946	-25.39	-28.50	-27.86	-27.61	-30.33	-31.96	-35.14	-29.00	-25.81	-31.11	-29.27	2.80
20	6.74	4.666	-26.95	-30.52	-29.13	-29.17	-33.22	-32.55	-34.74	-30.95	-26.77	-33.12	-30.71	2.58
21	6.40	3.156	-28.00	-32.32	-30.40	-30.50	-34.11	-33.78	-36.15	-32.58	-28.92	-35.68	-32.24	2.62
22	6.10	2.779	-28.62	-33.27	-32.25	-32.22	-36.00	-35.10	-38.15	-33.72	-30.01	-38.13	-33.75	3.01
23	5.82	2.095	-27.16	-31.97	-31.26	-31.42	-36.29	-37.42	-38.26	-32.87	-28.04	-38.01	-33.27	3.84
24	5.57	1.564	-26.97	-30.50	-31.59	-31.95	-33.26	-35.53	-35.18	-33.01	-26.40	-36.39	-32.08	3.22
25	5.33	1.235	-26.24	-28.28	-31.70	-31.66	-31.19	-31.35	-33.32	-32.40	-23.64	-34.00	-30.38	3.13
26	5.12	1.121	-21.01	-27.05	-30.35	-29.18	-32.25	-30.17	-31.17	-30.82	-23.21	-31.64	-28.69	3.59
27	4.92	1.012	-18.80	-29.47	-30.26	-28.55	-32.74	-31.15	-29.07	-31.08	-26.51	-31.10	-28.88	3.74
28	4.74	.828	-20.17	-28.39	-29.60	-27.74	-31.52	-30.28	-29.33	-29.40	-24.65	-31.24	-28.24	3.26
29	4.57	.717	-24.12	-29.45	-32.20	-30.43	-31.74	-29.41	-29.97	-31.72	-25.18	-31.75	-29.60	2.66
30	4.41	.536	-29.33	-32.60	-33.62	-33.20	-32.29	-30.46	-31.10	-34.77	-29.81	-38.99	-32.62	2.69
31	4.27	.419	-30.77	-33.81	-31.83	-31.91	-30.98	-30.49	-30.13	-32.94	-31.09	-36.46	-32.04	1.82

Table A.38 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 05/02/94 19:00 HOURS Hmo= .24 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

NO	Period (sec)	Energy (cm**2)	D I R E C T I O N (degrees) for 10 different gauge pairs 43	21	32	42	65	78	89	31	01	54	Mean dir	Std dev
2	128.00	.950	-30.55	-23.32	-24.04	-26.00	-26.18	-15.46	-15.40	-23.99	-8.91	-25.39	-21.93	6.21
3	64.00	1.460	-20.69	-20.90	-12.12	-14.47	-16.96	-13.61	-12.38	-15.47	2.53	-16.62	-14.09	6.24
4	42.67	1.071	-11.90	-15.93	-7.57	-8.81	-12.33	-13.27	-12.59	-10.88	8.89	-12.19	-9.69	6.56
5	32.00	.436	-8.45	-15.39	-6.91	-7.71	-12.47	-15.62	-16.27	-10.18	8.75	-12.78	-9.73	6.94
6	25.60	.332	-12.94	-14.32	-7.99	-9.72	-12.20	-16.57	-17.74	-10.49	10.53	-12.24	-10.41	7.52
7	21.33	.460	-9.13	-12.71	-10.41	-10.32	-11.82	-8.78	-9.67	-11.58	5.07	-12.94	-9.24	4.96
8	18.29	.830	-11.03	-14.41	-11.22	-11.44	-10.78	-9.82	-11.35	-12.78	-.08	-12.22	-10.52	3.67
9	16.00	1.338	-8.98	-11.04	-7.83	-8.30	-12.02	-10.51	-12.58	-9.55	-3.86	-12.04	-9.67	2.48
10	14.22	2.775	-7.69	-9.31	-7.32	-7.63	-13.50	-10.12	-14.36	-8.39	-3.49	-13.18	-9.50	3.20
11	12.80	3.570	-9.96	-11.80	-10.41	-10.52	-14.96	-13.64	-17.03	-11.28	-6.85	-15.80	-12.23	2.94
12	11.64	3.435	-14.17	-17.18	-15.56	-15.61	-17.06	-17.25	-19.00	-17.05	-12.86	-20.18	-16.59	2.04
13	10.67	5.375	-18.38	-23.15	-21.88	-21.54	-21.20	-18.51	-20.91	-23.71	-21.30	-23.31	-21.39	1.73
14	9.85	8.325	-21.44	-25.91	-25.18	-24.71	-24.46	-23.32	-25.81	-26.47	-25.24	-27.23	-24.98	1.57
15	9.14	9.647	-22.09	-26.06	-24.78	-24.49	-26.69	-25.93	-27.35	-26.11	-24.02	-29.32	-25.68	1.88
16	8.53	7.767	-21.84	-26.46	-24.51	-24.34	-27.67	-27.15	-29.22	-26.28	-23.54	-29.00	-26.00	2.28
17	8.00	5.128	-20.62	-26.54	-23.62	-23.37	-27.21	-29.15	-31.40	-25.73	-23.35	-29.17	-26.02	3.15
18	7.53	3.600	-23.54	-26.80	-26.41	-26.44	-29.28	-30.87	-32.11	-27.78	-23.56	-32.23	-27.90	3.01
19	7.11	3.506	-25.37	-29.04	-29.01	-28.82	-30.86	-32.47	-33.09	-30.10	-27.20	-34.24	-30.02	2.59
20	6.74	3.028	-26.38	-32.26	-29.43	-29.47	-32.87	-33.58	-34.73	-31.88	-30.11	-35.70	-31.64	2.67
21	6.40	2.428	-27.49	-33.64	-29.59	-30.22	-34.06	-33.80	-37.41	-33.08	-30.72	-36.75	-32.68	2.99
22	6.10	1.744	-29.23	-32.08	-31.15	-32.36	-34.05	-36.35	-39.15	-33.86	-27.99	-37.29	-33.35	3.35
23	5.82	1.232	-28.58	-31.47	-33.29	-34.09	-32.83	-37.43	-38.46	-35.21	-26.26	-36.11	-33.37	3.62
24	5.57	1.072	-29.66	-30.69	-32.07	-33.34	-35.34	-36.77	-42.16	-32.72	-26.22	-37.38	-33.63	4.27
25	5.33	1.064	-30.21	-29.93	-30.35	-31.91	-35.71	-38.25	-42.21	-30.62	-26.45	-38.20	-33.38	4.68
26	5.12	.880	-28.10	-27.71	-29.67	-30.69	-36.71	-36.62	-41.16	-29.51	-22.87	-40.21	-32.32	5.69
27	4.92	.761	-25.46	-30.12	-35.39	-37.10	-37.55	-35.57	9999.99	-32.58	-25.25	-41.24	-33.37	5.19
28	4.74	.788	-16.07	-35.39	-46.00	-41.35	-35.47	-33.69	9999.99	-34.70	-32.72	9999.99	-34.45	8.10
29	4.57	.638	-11.76	-29.24	-46.41	-36.96	-34.11	-32.59	9999.99	-30.84	-31.97	9999.99	-31.76	9.05
30	4.41	.505	-6.11	-24.59	-47.34	-33.73	-25.23	-31.15	9999.99	-27.00	-26.08	9999.99	-27.67	10.72
31	4.27	.317	-4.66	-22.34	-49.70	-32.78	-21.72	-27.92	9999.99	-25.36	-25.20	9999.99	-26.19	11.72

Table A.39 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 05/02/94 22:00 HOURS Hmo= .25 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

NO	Period (sec)	Energy (cm**2)	DIRECTION (degrees) for 10 different gauge pairs 43	21	32	42	65	78	89	31	01	54	Mean dir	Std dev
2	128.00	.701	-22.70	-16.42	-9.05	-12.82	-13.78	-12.02	-16.49	-11.94	8.84	-17.70	-12.45	7.95
3	64.00	1.136	-12.37	-12.09	-13.14	-13.21	-13.61	-12.30	-14.51	-12.88	7.45	-16.70	-11.37	6.39
4	42.67	.874	-9.00	-11.16	-11.26	-10.98	-9.93	-12.83	-14.73	-11.20	7.13	-13.40	-9.76	5.84
5	32.00	.417	-13.39	-16.98	-12.39	-12.91	-9.90	-10.86	-12.83	-14.08	5.32	-15.13	-11.34	5.86
6	25.60	.283	-24.22	-18.27	-14.16	-16.74	-12.10	-11.36	-15.29	-16.00	.38	-17.31	-14.52	6.01
7	21.33	.428	-18.03	-14.54	-12.14	-13.63	-12.96	-14.85	-17.69	-13.31	-.96	-15.02	-13.32	4.50
8	18.29	.904	-11.03	-10.25	-7.50	-8.56	-13.56	-12.39	-15.41	-8.63	1.64	-12.72	-9.85	4.49
9	16.00	1.438	-7.19	-9.14	-6.17	-6.66	-12.10	-9.49	-13.19	-7.51	2.24	-10.92	-8.02	4.08
10	14.22	2.422	-8.48	-10.70	-8.75	-8.91	-12.52	-10.44	-10.41	-9.73	-3.80	-12.36	-9.61	2.34
11	12.80	3.522	-10.00	-12.61	-10.63	-10.60	-13.99	-11.46	-11.64	-11.61	-6.75	-13.59	-11.29	1.94
12	11.64	3.824	-14.05	-15.81	-13.55	-13.91	-15.90	-18.82	-19.95	-14.98	-10.09	-18.33	-15.54	2.78
13	10.67	5.379	-19.06	-21.45	-19.33	-19.64	-20.32	-24.87	-26.37	-21.04	-17.07	-24.98	-21.41	2.87
14	9.85	7.978	-22.18	-25.23	-23.73	-23.77	-26.62	-25.59	-29.58	-25.25	-21.20	-29.12	-25.23	2.57
15	9.14	10.209	-23.75	-27.31	-26.39	-26.20	-28.64	-28.06	-31.97	-27.64	-24.09	-30.55	-27.46	2.44
16	8.53	9.636	-26.22	-31.09	-29.76	-29.31	-28.92	-29.98	-32.55	-31.09	-28.30	-32.28	-29.95	1.81
17	8.00	7.893	-26.96	-31.82	-30.16	-29.75	-29.58	-32.02	-32.76	-31.63	-29.18	-33.94	-30.78	1.93
18	7.53	6.164	-26.87	-32.12	-29.74	-29.49	-31.44	-34.15	-34.03	-31.45	-28.97	-33.99	-31.23	2.33
19	7.11	3.791	-28.46	-31.48	-30.27	-30.58	-33.80	-35.05	-34.54	-31.77	-27.23	-35.30	-31.85	2.65
20	6.74	2.741	-31.37	-33.89	-33.21	-33.78	-33.98	-36.72	-36.67	-35.35	-30.44	-38.90	-34.43	2.42
21	6.40	2.431	-29.96	-33.46	-31.84	-32.75	-35.71	-36.71	-38.93	-35.14	-30.23	-38.47	-34.32	3.03
22	6.10	1.831	-22.77	-28.64	-31.01	-32.74	-38.75	-37.69	-37.28	-35.81	-23.47	-38.54	-32.68	5.74
23	5.82	1.649	-18.38	-21.86	-33.60	-38.17	-40.27	-38.88	-35.45	-38.30	-14.78	-37.00	-31.70	9.04
24	5.57	1.402	-18.53	-24.73	-31.64	-37.75	-40.51	-38.33	-35.02	-36.82	-17.82	-36.66	-31.80	7.97
25	5.33	1.004	-20.88	-29.16	-34.33	-36.29	-36.78	-36.45	-35.11	-35.84	-24.59	-36.82	-32.63	5.45
26	5.12	.937	-21.66	-29.18	-38.05	-36.69	-35.66	-36.56	-35.32	-37.09	-24.21	-37.31	-33.18	5.65
27	4.92	.772	-24.49	-32.30	-37.39	-36.30	-35.16	-36.53	-36.28	-38.16	-26.78	-38.50	-34.19	4.61
28	4.74	.555	-25.24	-32.74	-36.73	-35.42	-35.88	-35.52	-36.15	-36.46	-27.86	9999.99	-33.56	3.95
29	4.57	.361	-22.89	-31.22	-37.31	-35.09	-34.17	-37.02	9999.99	-34.73	-28.60	9999.99	-32.63	4.57
30	4.41	.258	-21.98	-28.94	-36.57	-34.07	-33.46	-37.72	9999.99	-32.09	-27.43	9999.99	-31.54	4.86
31	4.27	.226	-19.56	-27.78	-36.47	-33.56	-29.25	-33.58	9999.99	-29.32	-27.23	9999.99	-29.60	4.86

Table A.40 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 06/02/94 01:00 HOURS Hmo= .29 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.676	-30.94	-29.91	-28.95	-29.17	-26.82	-27.07	-23.01	-29.16	-1.30	-25.79	-25.28	8.27
3	64.00	1.181	-25.24	-19.62	-12.00	-15.46	-15.85	-14.45	-15.30	-14.80	3.89	-15.12	-14.42	7.00
4	42.67	1.233	-19.52	-12.87	-7.37	-10.51	-11.13	-11.53	-12.86	-9.38	10.45	-11.35	-9.64	7.33
5	32.00	.571	-18.93	-12.39	-6.65	-9.97	-9.74	-8.96	-12.22	-8.99	11.83	-12.24	-8.86	7.56
6	25.60	.357	-18.83	-18.97	-11.42	-13.58	-9.48	-9.13	-13.32	-14.62	-.10	-14.67	-12.42	5.18
7	21.33	.445	-17.33	-13.56	-12.06	-13.38	-7.68	-12.53	-14.33	-13.06	-2.39	-11.21	-11.76	3.88
8	18.29	.703	-13.09	-12.85	-11.94	-12.37	-8.68	-11.13	-11.22	-12.93	-2.70	-11.50	-10.84	2.98
9	16.00	1.255	-11.79	-13.49	-10.68	-11.21	-8.27	-10.76	-10.54	-12.41	-5.79	-10.75	-10.57	2.05
10	14.22	2.185	-10.89	-11.92	-9.67	-10.26	-11.49	-9.44	-12.78	-11.17	-5.21	-12.95	-10.58	2.11
11	12.80	3.228	-10.64	-11.29	-9.75	-10.19	-14.65	-10.57	-16.74	-10.80	-4.84	-14.55	-11.40	3.13
12	11.64	3.424	-10.60	-10.96	-10.37	-10.71	-15.55	-13.58	-20.32	-10.98	-6.73	-15.34	-12.51	3.59
13	10.67	4.358	-16.16	-16.96	-16.57	-17.25	-20.44	-20.42	-26.40	-17.83	-11.62	-21.38	-18.50	3.73
14	9.85	6.947	-20.79	-24.33	-22.73	-22.91	-23.23	-25.07	-27.85	-24.64	-19.04	-25.95	-23.65	2.40
15	9.14	8.933	-23.65	-25.97	-24.85	-25.01	-26.34	-29.96	-29.80	-26.10	-21.41	-30.67	-26.38	2.82
16	8.53	8.211	-25.44	-24.66	-25.86	-26.75	-28.45	-30.30	-31.97	-26.84	-19.32	-32.37	-27.20	3.67
17	8.00	8.363	-23.99	-24.04	-25.77	-27.57	-31.80	-31.27	-35.19	-28.83	-18.40	-35.27	-28.21	5.09
18	7.53	8.821	-27.91	-29.77	-29.71	-31.19	-34.50	-35.35	-37.39	-33.47	-25.11	-38.87	-32.33	4.12
19	7.11	10.325	-31.91	-37.50	-35.44	-35.42	-37.03	-37.89	-40.30	-37.99	-34.42	-40.19	-36.81	2.45
20	6.74	9.534	-32.86	-39.55	-36.07	-35.79	-37.96	-38.50	-39.82	-38.49	-35.55	-40.80	-37.54	2.30
21	6.40	6.764	-34.28	-41.78	-37.11	-37.19	-39.50	-40.63	-41.15	-40.30	-37.42	-42.30	-39.16	2.43
22	6.10	4.623	-36.20	-38.72	-37.93	-39.25	-41.06	-41.02	-42.24	-40.52	-33.36	-44.46	-39.48	2.99
23	5.82	3.635	-33.88	-35.20	-37.02	-40.49	-41.78	-43.55	-42.48	-40.53	-28.32	-44.31	-38.76	4.81
24	5.57	2.649	-29.18	-35.48	-33.71	-38.42	-39.55	-46.42	-40.50	-39.97	-29.00	-40.15	-37.24	5.16
25	5.33	1.858	-28.85	-36.10	-34.69	-37.77	-38.33	-41.51	-39.26	-38.30	-30.87	-39.58	-36.53	3.80
26	5.12	1.729	-27.70	-35.46	-36.48	-38.16	-37.46	-38.34	-38.99	-36.82	-31.16	-39.96	-36.05	3.61
27	4.92	1.364	-25.66	-34.27	-37.86	-37.69	-35.72	-37.15	-39.09	-35.23	-29.88	-40.04	-35.26	4.19
28	4.74	.935	-28.90	-39.30	-39.95	-38.95	-34.51	-38.76	-41.29	-40.03	-35.94	-41.31	-37.90	3.63
29	4.57	.631	-30.51	-42.39	-41.32	-41.00	-37.46	-41.31	9999.99	-42.82	-38.40	-42.00	-39.69	3.66
30	4.41	.449	-29.23	-39.23	-42.33	-40.50	-38.08	-41.82	9999.99	-39.59	-35.33	-42.14	-38.70	3.95
31	4.27	.316	-27.53	-42.35	-42.42	-39.18	-36.47	-41.09	9999.99	-40.98	-40.03	-43.25	-39.26	4.57

Table A.41 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 06/02/94 04:00 HOURS Hmo= .30 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.854	-1.63	-18.37	-9.88	-7.78	-12.10	-13.92	-21.48	-13.49	11.80	-18.41	-10.57	9.23
3	64.00	1.287	-12.55	-12.85	-6.86	-8.30	-7.74	-12.81	-17.32	-9.08	12.16	-11.40	-8.72	7.55
4	42.67	1.064	-14.57	-10.02	-8.43	-10.04	-8.52	-9.68	-13.14	-8.82	13.73	-10.56	-8.06	7.49
5	32.00	.550	-17.42	-12.67	-9.66	-11.67	-12.62	-8.85	-12.31	-10.67	10.92	-12.82	-9.82	7.24
6	25.60	.320	-20.75	-19.71	-14.09	-16.32	-14.59	-11.81	-16.07	-16.14	1.73	-17.74	-14.57	5.97
7	21.33	.458	-11.60	-14.76	-10.57	-11.43	-11.29	-12.44	-14.72	-12.06	4.98	-14.44	-10.85	5.47
8	18.29	.906	-7.95	-11.91	-7.37	-7.66	-10.83	-11.45	-14.51	-9.15	4.98	-10.47	-8.64	5.00
9	16.00	1.559	-6.52	-8.88	-4.74	-5.25	-10.28	-10.01	-14.06	-6.37	3.98	-8.26	-7.04	4.52
10	14.22	2.333	-7.36	-10.11	-6.69	-7.03	-10.24	-12.69	-13.74	-8.31	-.14	-8.86	-8.52	3.57
11	12.80	2.807	-9.56	-13.41	-10.50	-10.57	-11.88	-11.83	-13.30	-12.40	-5.50	-11.69	-11.06	2.19
12	11.64	4.056	-9.24	-13.31	-10.51	-10.40	-13.23	-14.49	-17.04	-11.93	-7.76	-12.77	-12.07	2.56
13	10.67	6.188	-14.03	-18.18	-16.34	-16.10	-20.49	-19.88	-21.03	-17.61	-13.91	-18.99	-17.66	2.40
14	9.85	7.903	-21.71	-23.99	-23.88	-23.71	-24.76	-24.96	-24.28	-24.66	-20.39	-27.15	-23.95	1.74
15	9.14	9.468	-24.29	-26.84	-25.86	-25.70	-27.03	-28.33	-28.00	-26.82	-22.74	-30.17	-26.58	1.99
16	8.53	9.089	-24.48	-30.26	-27.51	-27.24	-29.83	-28.53	-29.82	-29.66	-26.38	-31.41	-28.51	1.99
17	8.00	7.324	-25.98	-31.77	-30.51	-30.50	-33.48	-30.54	-31.76	-33.36	-27.60	-33.94	-30.95	2.43
18	7.53	6.839	-30.82	-33.24	-33.96	-34.53	-36.58	-34.35	-37.61	-35.84	-30.17	-38.85	-34.60	2.62
19	7.11	8.054	-32.24	-32.78	-34.35	-35.08	-37.51	-35.57	-39.82	-35.65	-28.46	-38.83	-35.03	3.17
20	6.74	5.981	-29.87	-31.71	-32.47	-33.27	-37.19	-36.26	-37.21	-34.64	-26.05	-39.36	-33.81	3.78
21	6.40	4.777	-30.25	-35.32	-33.30	-33.61	-39.93	-37.08	-36.62	-36.52	-29.84	-42.13	-35.46	3.69
22	6.10	4.786	-31.03	-34.86	-34.51	-35.58	-40.14	-40.15	-40.06	-38.57	-29.17	-40.19	-36.43	3.85
23	5.82	4.597	-26.78	-31.38	-34.91	-36.40	-40.95	-42.15	-41.29	-39.84	-25.70	-39.11	-35.86	5.73
24	5.57	4.137	-26.50	-32.85	-33.28	-34.93	-40.20	-39.44	-37.81	-37.25	-27.41	-38.83	-34.85	4.60
25	5.33	3.269	-29.39	-36.23	-32.04	-33.63	-38.53	-33.96	-35.00	-35.29	-31.76	-38.23	-34.41	2.73
26	5.12	2.766	-29.28	-33.11	-32.33	-32.15	-36.83	-32.49	-33.35	-33.02	-28.95	-37.57	-32.91	2.59
27	4.92	3.037	-28.72	-31.83	-32.40	-31.57	-35.59	-33.42	-30.16	-32.12	-29.01	-36.50	-32.13	2.42
28	4.74	2.391	-31.30	-34.13	-33.90	-33.65	-34.26	-34.44	-30.49	-33.61	-32.12	-35.10	-33.30	1.41
29	4.57	1.967	-31.07	-36.36	-35.01	-34.25	-32.12	-35.12	-35.04	-35.03	-33.61	-34.74	-34.23	1.49
30	4.41	1.408	-28.23	-35.51	-35.78	-33.63	-33.40	-33.91	9999.99	-33.69	-32.48	-36.80	-33.72	2.33
31	4.27	1.077	-26.23	-36.51	-36.96	-32.96	-33.01	-32.06	9999.99	-32.63	-35.56	9999.99	-33.24	3.18

Table A.42 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 06/02/94 07:00 HOURS Hmo= .27 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.740	-19.45	-22.92	-17.48	-17.89	-25.08	-25.01	-20.31	-20.03	1.31	-19.74	-18.70	7.12
3	64.00	1.227	-19.25	-19.52	-12.48	-14.29	-18.89	-13.21	-14.33	-15.21	1.89	-18.23	-14.37	5.96
4	42.67	1.247	-14.11	-14.33	-8.00	-9.63	-12.99	-11.46	-14.57	-10.28	7.66	-14.08	-10.20	6.32
5	32.00	.737	-9.48	-12.39	-8.08	-8.50	-11.68	-13.54	-16.16	-9.53	9.14	-13.46	-9.40	6.63
6	25.60	.401	-14.33	-13.10	-9.16	-10.44	-15.08	-13.40	-15.76	-10.63	7.05	-14.31	-10.94	6.33
7	21.33	.488	-13.56	-15.52	-9.88	-10.89	-10.48	-13.79	-16.99	-12.26	1.67	-12.87	-11.47	4.85
8	18.29	.977	-8.59	-12.77	-7.91	-8.33	-8.05	-13.99	-14.55	-9.94	-2.67	-10.31	-9.71	3.32
9	16.00	1.803	-7.28	-9.07	-5.61	-6.28	-8.59	-12.41	-13.62	-7.18	.60	-10.28	-7.97	3.76
10	14.22	3.003	-9.31	-10.97	-8.05	-8.61	-9.75	-11.32	-13.17	-9.42	-2.41	-11.06	-9.41	2.73
11	12.80	4.081	-11.28	-13.32	-10.83	-11.20	-10.86	-13.24	-15.80	-12.08	-6.89	-13.98	-11.95	2.27
12	11.64	4.419	-13.44	-15.82	-13.77	-14.10	-13.23	-13.88	-17.12	-15.17	-10.36	-16.70	-14.36	1.86
13	10.67	5.574	-16.72	-20.00	-17.85	-17.98	-18.82	-16.64	-19.55	-19.37	-15.90	-20.69	-18.35	1.51
14	9.85	8.419	-20.97	-23.99	-22.67	-22.64	-23.01	-22.82	-23.84	-23.94	-21.22	-24.75	-22.99	1.15
15	9.14	9.943	-22.41	-27.36	-25.08	-24.71	-24.34	-25.96	-25.17	-26.69	-25.24	-26.66	-25.36	1.35
16	8.53	8.823	-24.35	-27.79	-26.18	-26.14	-26.77	-27.82	-29.45	-27.59	-24.93	-30.43	-27.15	1.79
17	8.00	6.285	-26.62	-27.16	-27.50	-27.96	-28.93	-28.67	-33.34	-28.45	-23.94	-33.08	-28.57	2.68
18	7.53	5.836	-28.56	-29.81	-29.97	-30.69	-33.24	-30.55	-37.23	-31.74	-26.87	-37.42	-31.61	3.28
19	7.11	6.085	-30.41	-32.94	-31.37	-32.58	-35.89	-38.13	-39.79	-34.46	-29.59	-41.48	-34.66	3.85
20	6.74	4.529	-30.69	-33.75	-31.02	-32.93	-36.06	-40.23	-40.62	-35.55	-29.34	-41.55	-35.17	4.19
21	6.40	2.903	-29.43	-33.30	-33.85	-36.04	-36.85	-39.12	-43.39	-39.48	-28.77	-42.73	-36.30	4.79
22	6.10	2.621	-27.75	-35.45	-34.81	-36.81	-39.76	-38.40	-44.21	-43.11	-30.73	-44.17	-37.52	5.29
23	5.82	2.001	-23.94	-33.04	-30.02	-32.72	-40.29	-38.41	-41.23	-40.26	-28.79	-44.11	-35.29	6.19
24	5.57	1.563	-25.13	-30.33	-31.30	-34.82	-38.44	-35.14	-39.73	-37.01	-27.06	-41.67	-34.07	5.19
25	5.33	1.490	-26.99	-31.33	-32.94	-35.58	-34.52	-35.11	-39.77	-37.16	-28.21	-37.98	-33.96	3.93
26	5.12	1.373	-28.74	-31.85	-32.31	-34.82	-32.76	-33.71	-37.71	-35.32	-27.83	-37.25	-33.23	3.09
27	4.92	1.569	-29.15	-34.14	-32.06	-34.18	-32.77	-32.71	-37.99	-35.45	-30.35	-38.12	-33.69	2.79
28	4.74	1.734	-30.31	-36.32	-32.69	-33.57	-35.01	-35.80	9999.99	-36.20	-32.32	9999.99	-34.03	2.03
29	4.57	1.359	-30.94	-34.69	-31.82	-32.56	-34.87	-38.23	9999.99	-33.03	-31.51	9999.99	-33.45	2.24
30	4.41	1.015	-28.48	-33.66	-33.09	-32.57	-32.55	-40.46	9999.99	-33.35	-30.28	9999.99	-33.05	3.25
31	4.27	.830	-28.94	-35.46	-35.94	-35.24	-33.52	-45.47	9999.99	-38.55	-30.68	9999.99	-35.47	4.73

Table A.43 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 06/02/94 10:00 HOURS Hmo= .27 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.633	-30.94	-31.62	-23.14	-25.13	-16.20	-23.99	-24.15	-26.47	-13.95	-17.65	-23.32	5.59
3	64.00	1.342	-14.47	-19.91	-14.77	-14.78	-14.38	-15.59	-17.54	-16.82	.69	-17.74	-14.55	5.35
4	42.67	1.218	-9.47	-17.67	-13.13	-12.25	-12.91	-12.74	-15.31	-14.98	1.87	-16.58	-12.33	5.23
5	32.00	.601	-8.27	-14.72	-12.24	-11.23	-13.58	-11.47	-15.23	-13.36	2.49	-15.12	-11.29	5.01
6	25.60	.450	-13.64	-15.35	-11.28	-11.88	-15.14	-12.39	-14.97	-13.12	.52	-16.22	-12.36	4.56
7	21.33	.620	-9.19	-10.64	-7.30	-7.91	-10.25	-14.15	-15.77	-8.72	5.45	-12.32	-9.09	5.48
8	18.29	1.167	-7.85	-8.92	-4.97	-5.93	-9.35	-12.15	-12.94	-6.54	3.74	-9.53	-7.45	4.44
9	16.00	2.099	-8.17	-10.02	-6.37	-7.04	-8.29	-11.42	-9.11	-7.93	-.56	-8.01	-7.69	2.74
10	14.22	3.611	-9.38	-10.85	-8.50	-8.84	-9.89	-8.73	-9.61	-9.65	-5.16	-9.87	-9.05	1.45
11	12.80	5.325	-10.80	-12.69	-11.39	-11.48	-11.71	-10.24	-13.10	-12.32	-8.27	-12.23	-11.42	1.33
12	11.64	5.440	-11.61	-14.46	-12.89	-12.88	-10.94	-13.46	-15.73	-14.09	-10.23	-13.29	-12.96	1.58
13	10.67	5.358	-16.63	-18.20	-16.22	-16.86	-13.04	-17.39	-18.58	-17.78	-13.07	-20.91	-16.87	2.27
14	9.85	7.375	-20.39	-21.15	-19.42	-20.32	-21.02	-22.88	-23.95	-20.87	-16.28	-28.22	-21.45	2.97
15	9.14	9.678	-20.62	-22.98	-21.06	-21.36	-25.00	-24.32	-26.50	-22.50	-19.00	-27.04	-23.04	2.50
16	8.53	9.770	-21.19	-22.98	-22.44	-22.39	-26.53	-26.33	-28.02	-23.32	-19.41	-25.97	-23.86	2.59
17	8.00	8.386	-22.55	-23.62	-23.73	-23.75	-25.28	-26.28	-27.90	-24.35	-21.14	-26.82	-24.54	1.94
18	7.53	7.282	-23.62	-25.69	-24.15	-24.36	-27.18	-26.93	-28.49	-25.42	-24.08	-30.51	-26.04	2.11
19	7.11	5.506	-23.96	-26.25	-23.67	-24.55	-29.59	-29.37	-30.30	-26.17	-23.15	-32.86	-26.99	3.16
20	6.74	3.464	-23.23	-24.89	-22.76	-24.58	-30.95	-31.42	-31.08	-26.49	-19.70	-34.89	-27.00	4.58
21	6.40	2.510	-21.81	-24.87	-23.31	-25.15	-28.77	-31.26	-32.91	-29.73	-19.22	-33.45	-27.05	4.63
22	6.10	1.692	-19.48	-20.83	-20.91	-23.07	-28.67	-29.42	-40.29	-28.14	-15.96	-37.65	-26.43	7.52
23	5.82	1.252	-16.98	-19.41	-18.86	-22.02	-31.95	-30.17	-49.37	-29.51	-13.91	-42.94	-27.47	11.02
24	5.57	1.034	-15.05	-20.70	-18.26	-22.43	-39.59	9999.99	-44.88	-30.52	-15.99	-41.82	-27.67	11.09
25	5.33	.976	-15.10	-23.73	-16.58	-20.89	-41.13	9999.99	-40.71	-34.14	-19.65	-45.64	-28.60	11.13
26	5.12	.904	-18.29	-24.74	-24.30	-30.21	-34.54	9999.99	-42.99	-37.49	-20.13	-46.11	-30.97	9.38
27	4.92	.921	-18.73	-25.72	-29.67	-31.16	9999.99	9999.99	9999.99	-35.95	-20.42	9999.99	-26.94	6.03
28	4.74	.706	-21.41	-24.72	-30.34	-32.56	9999.99	9999.99	9999.99	-33.36	-19.13	9999.99	-26.92	5.49
29	4.57	.638	-25.51	-21.90	-31.12	-32.59	9999.99	9999.99	9999.99	-31.00	-18.74	9999.99	-26.81	5.17
30	4.41	.562	-25.53	-23.37	-31.51	-31.88	9999.99	9999.99	9999.99	9999.99	-19.41	9999.99	-26.34	4.79
31	4.27	.480	-24.41	-26.96	-32.18	-32.26	9999.99	9999.99	9999.99	9999.99	-22.57	9999.99	-27.68	3.96

Table A.44 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 06/02/94 13:00 HOURS Hmo= .30 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.538	-32.10	-33.57	-18.84	-22.45	-14.58	-20.31	-22.90	-24.94	-6.10	-25.21	-22.11	7.59
3	64.00	1.030	-27.29	-21.00	-16.04	-19.06	-16.33	-13.54	-16.91	-17.99	1.80	-20.24	-16.69	7.09
4	42.67	1.067	-17.51	-16.19	-13.29	-14.57	-13.01	-9.15	-11.69	-14.36	6.66	-15.91	-11.93	6.59
5	32.00	.669	-14.87	-12.91	-10.90	-12.00	-9.31	-9.46	-11.87	-11.71	8.49	-11.08	-9.59	6.21
6	25.60	.499	-13.22	-9.33	-7.99	-9.56	-7.51	-10.73	-14.66	-8.75	7.33	-8.33	-8.29	5.64
7	21.33	.598	-9.65	-8.77	-6.70	-7.82	-7.75	-9.29	-14.07	-7.74	6.83	-8.61	-7.37	5.10
8	18.29	1.085	-8.93	-9.72	-7.28	-7.84	-9.24	-8.86	-12.22	-8.59	1.69	-10.68	-8.17	3.54
9	16.00	1.974	-7.36	-7.86	-6.51	-6.75	-11.28	-10.18	-13.24	-7.29	.53	-12.13	-8.21	3.70
10	14.22	3.262	-10.62	-11.44	-9.88	-10.15	-14.88	-12.86	-13.93	-10.78	-4.11	-15.33	-11.40	3.07
11	12.80	5.242	-13.37	-15.96	-14.10	-14.15	-15.53	-13.31	-12.31	-15.37	-9.31	-17.52	-14.09	2.15
12	11.64	6.113	-14.85	-17.53	-15.58	-15.77	-15.24	-11.66	-14.03	-17.19	-10.02	-18.69	-15.06	2.50
13	10.67	6.867	-17.45	-17.95	-17.42	-17.89	-17.59	-16.21	-20.56	-18.49	-11.85	-21.76	-17.72	2.49
14	9.85	9.690	-21.44	-21.99	-21.86	-22.18	-23.90	-22.58	-24.83	-22.65	-18.77	-27.94	-22.81	2.28
15	9.14	14.198	-21.82	-24.43	-23.23	-23.17	-26.80	-24.34	-26.03	-24.23	-22.17	-28.84	-24.51	2.06
16	8.53	16.653	-22.52	-26.20	-24.26	-24.03	-28.36	-25.47	-27.34	-25.54	-23.41	-29.00	-25.61	2.03
17	8.00	12.545	-23.30	-26.66	-24.56	-24.46	-27.25	-27.01	-29.46	-25.96	-23.13	-28.76	-26.05	2.06
18	7.53	7.313	-23.82	-26.62	-25.28	-25.32	-25.96	-27.82	-31.43	-26.71	-23.91	-31.28	-26.82	2.55
19	7.11	5.751	-23.05	-27.08	-25.20	-25.18	-27.39	-27.27	-32.42	-26.97	-24.69	-32.79	-27.20	3.00
20	6.74	4.521	-23.43	-28.47	-25.76	-26.11	-29.25	-28.04	-32.27	-28.66	-25.00	-34.57	-28.15	3.19
21	6.40	2.956	-22.83	-26.59	-24.93	-25.72	-28.56	-29.14	-37.73	-28.22	-22.98	-38.85	-28.55	5.29
22	6.10	2.319	-21.13	-24.35	-23.69	-24.69	-29.96	-31.94	-39.53	-27.30	-20.96	-41.16	-28.46	6.81
23	5.82	1.879	-18.45	-21.98	-20.87	-23.12	-30.85	-33.06	-40.85	-28.70	-16.57	-43.12	-27.74	8.72
24	5.57	1.590	-15.76	-21.15	-19.46	9999.99	-35.41	-33.33	-45.67	9999.99	-15.01	-44.62	-28.78	11.75
25	5.33	1.343	-11.34	-17.98	-17.97	9999.99	-42.17	9999.99	-50.26	9999.99	-13.45	-47.53	-28.61	15.88
26	5.12	1.083	-11.21	-17.98	-20.08	9999.99	-43.60	9999.99	-50.85	9999.99	-14.87	-48.39	-29.51	15.95
27	4.92	.979	-15.23	-17.39	-22.49	9999.99	-47.52	9999.99	-58.61	9999.99	-14.83	-62.25	-33.89	19.69
28	4.74	.885	-18.48	-11.94	-24.77	9999.99	-47.51	9999.99	9999.99	9999.99	-9.35	-57.29	-28.05	18.01
29	4.57	.667	-21.39	-9.72	-23.34	9999.99	-50.60	9999.99	9999.99	9999.99	-6.53	-53.30	-27.35	18.30
30	4.41	.480	-18.45	-15.82	9999.99	9999.99	-54.65	9999.99	9999.99	9999.99	-13.05	-55.20	-31.29	19.26
31	4.27	.445	-17.36	-22.96	9999.99	9999.99	-57.64	9999.99	9999.99	9999.99	-18.74	9999.99	-28.91	16.56

Table A.45 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 06/02/94 16:00 HOURS Hmo= .31 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

NO	Period (sec)	Energy (cm**2)	DIRECTION (degrees) for 10 different gauge pairs 43	21	32	42	65	78	89	31	01	54	Mean dir	Std dev
2	128.00	.610	-21.25	-15.84	-13.58	-15.79	-27.78	-19.56	-20.47	-14.75	17.28	-15.85	-14.91	11.39
3	64.00	1.075	-12.02	-10.76	-8.33	-9.40	-11.58	-12.48	-15.03	-9.19	16.86	-11.37	-8.41	8.59
4	42.67	1.244	-9.58	-9.71	-4.84	-6.15	-9.19	-10.16	-12.55	-6.63	17.64	-9.05	-6.09	8.17
5	32.00	.814	-12.60	-12.53	-5.48	-7.34	-9.90	-8.91	-11.50	-8.10	13.54	-10.76	-7.40	7.30
6	25.60	.509	-11.76	-14.63	-6.83	-8.18	-9.91	-11.28	-13.22	-9.82	9.39	-11.16	-8.77	6.41
7	21.33	.552	-11.66	-18.72	-10.70	-11.15	-8.43	-12.08	-12.27	-14.09	1.09	-10.84	-10.89	4.74
8	18.29	1.139	-10.34	-12.39	-7.57	-8.40	-11.06	-11.22	-12.83	-9.69	.26	-11.18	-9.45	3.59
9	16.00	2.176	-7.45	-8.93	-6.41	-6.74	-13.19	-10.93	-13.08	-7.60	-1.20	-12.80	-8.83	3.59
10	14.22	3.529	-8.14	-10.91	-9.02	-8.94	-14.64	-11.43	-13.44	-9.94	-5.63	-14.06	-10.62	2.71
11	12.80	5.262	-10.77	-13.09	-11.91	-11.85	-14.45	-13.67	-15.97	-12.61	-8.85	-15.35	-12.85	2.04
12	11.64	6.138	-12.67	-14.39	-13.71	-13.75	-16.34	-15.12	-19.23	-14.39	-10.65	-18.02	-14.83	2.39
13	10.67	7.573	-14.87	-16.64	-16.16	-16.18	-19.22	-19.77	-22.11	-16.99	-13.82	-21.10	-17.69	2.59
14	9.85	12.000	-18.83	-21.11	-20.68	-20.51	-23.95	-22.81	-22.87	-21.47	-18.99	-25.73	-21.70	2.06
15	9.14	16.635	-21.75	-24.94	-23.84	-23.58	-24.30	-24.55	-24.55	-24.75	-23.33	-27.56	-24.32	1.40
16	8.53	14.619	-22.74	-25.29	-23.96	-23.93	-23.51	-26.32	-26.50	-24.91	-22.88	-27.36	-24.74	1.52
17	8.00	10.402	-22.92	-26.64	-25.04	-24.85	-24.58	-27.52	-29.01	-26.41	-23.64	-27.59	-25.82	1.83
18	7.53	7.178	-23.23	-28.44	-26.65	-26.32	-26.23	-28.52	-30.74	-28.62	-25.49	-29.12	-27.34	2.05
19	7.11	5.465	-25.98	-29.07	-28.06	-28.33	-30.04	-30.39	-30.38	-30.16	-25.40	-33.20	-29.10	2.17
20	6.74	5.423	-25.50	-26.01	-27.02	-27.67	-30.08	-29.19	-30.60	-28.63	-21.91	-33.16	-27.98	2.97
21	6.40	4.039	-25.36	-27.02	-29.02	-29.73	-30.06	-27.20	-32.02	-31.28	-23.07	-33.16	-28.79	2.97
22	6.10	2.952	-25.61	-28.05	-28.16	-29.49	-32.03	-29.09	-34.06	-32.08	-24.16	-37.27	-30.00	3.73
23	5.82	2.094	-26.15	-26.69	-27.30	-29.38	-29.86	-26.75	-35.18	-31.75	-22.89	-40.72	-29.66	4.88
24	5.57	1.971	-22.44	-24.40	-23.83	-25.99	-29.09	-25.97	-37.40	-28.15	-21.05	9999.99	-26.48	4.55
25	5.33	1.745	-17.75	-21.60	-19.19	-21.06	-35.59	9999.99	-35.38	-26.96	-17.33	9999.99	-24.34	7.01
26	5.12	1.374	-18.81	-20.92	-23.01	-27.85	-46.35	9999.99	9999.99	-39.16	-16.65	9999.99	-27.49	10.34
27	4.92	1.308	-18.51	-20.75	-33.38	-48.36	-42.18	9999.99	9999.99	-51.09	-17.19	9999.99	-33.06	13.40
28	4.74	1.222	-9.22	-12.39	-33.99	-36.95	9999.99	9999.99	9999.99	9999.99	-10.61	9999.99	-20.60	12.19
29	4.57	1.038	-3.52	-5.68	-22.91	9999.99	9999.99	9999.99	9999.99	9999.99	-4.46	9999.99	-9.12	7.99
30	4.41	.703	-1.63	-1.17	9999.99	9999.99	9999.99	9999.99	9999.99	9999.99	-.15	9999.99	-.98	.62
31	4.27	.655	-2.71	2.84	9999.99	9999.99	9999.99	9999.99	9999.99	9999.99	.39	9999.99	.17	2.27

Table A.46 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 06/02/94 19:00 HOURS Hmo= .36 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.550	-51.85	-28.44	-10.59	-20.48	-28.83	-30.47	-29.60	-16.92	-3.77	-21.75	-24.22	12.44
3	64.00	1.089	-31.49	-18.45	-10.04	-15.28	-16.99	-17.10	-19.89	-13.21	5.41	-17.22	-15.45	8.74
4	42.67	1.206	-23.13	-17.41	-12.77	-15.17	-16.20	-16.35	-18.19	-14.68	4.88	-18.73	-14.81	7.06
5	32.00	.878	-19.82	-20.09	-15.87	-16.97	-18.13	-15.34	-17.23	-17.63	4.96	-22.07	-15.86	7.19
6	25.60	.719	-14.12	-10.87	-9.35	-10.74	-14.69	-14.84	-16.82	-9.88	12.11	-14.63	-10.44	7.87
7	21.33	.846	-14.19	-10.89	-9.37	-10.62	-13.34	-12.25	-17.79	-10.08	9.44	-14.89	-10.44	7.05
8	18.29	1.307	-13.43	-13.55	-10.79	-11.55	-12.20	-11.43	-16.89	-11.99	3.10	-13.73	-11.26	5.06
9	16.00	2.281	-10.42	-11.50	-9.75	-10.06	-9.75	-9.98	-13.71	-10.66	-.17	-12.48	-9.85	3.45
10	14.22	3.914	-8.59	-10.11	-9.11	-9.12	-10.67	-10.22	-12.62	-9.84	-3.38	-12.50	-9.62	2.44
11	12.80	6.344	-11.61	-13.87	-13.58	-13.32	-11.65	-13.38	-16.35	-14.25	-11.80	-14.18	-13.40	1.38
12	11.64	7.510	-14.30	-16.79	-16.59	-16.37	-14.34	-17.86	-19.59	-17.23	-15.89	-18.11	-16.71	1.55
13	10.67	9.310	-19.15	-20.32	-20.63	-20.81	-20.09	-19.66	-22.25	-21.32	-19.13	-24.91	-20.83	1.64
14	9.85	14.741	-22.87	-24.58	-24.88	-24.92	-24.46	-24.41	-29.08	-25.75	-24.14	-28.89	-25.40	1.92
15	9.14	20.077	-23.09	-26.10	-25.51	-25.28	-26.78	-25.63	-28.34	-26.54	-25.65	-29.89	-26.28	1.74
16	8.53	17.922	-21.98	-25.50	-24.07	-23.82	-26.51	-26.39	-27.58	-25.22	-24.35	-28.87	-25.43	1.90
17	8.00	12.780	-20.62	-24.47	-22.82	-22.52	-26.16	-27.53	-29.11	-24.08	-22.94	-26.99	-24.72	2.52
18	7.53	7.656	-21.33	-24.53	-23.21	-23.25	-27.30	-27.59	-30.85	-24.68	-22.63	-28.05	-25.34	2.83
19	7.11	5.734	-23.22	-26.17	-25.24	-25.54	-28.37	-26.84	-29.85	-27.17	-24.38	-33.65	-27.04	2.85
20	6.74	4.943	-23.75	-27.79	-26.50	-26.97	-27.40	-28.76	-30.32	-29.96	-25.79	-33.36	-28.06	2.55
21	6.40	4.671	-21.55	-27.02	-23.89	-24.63	-29.38	-29.19	-32.06	-28.33	-23.96	-33.10	-27.31	3.58
22	6.10	3.976	-19.11	-23.86	-21.95	-22.38	-28.41	-27.59	-30.91	-25.22	-21.36	9999.99	-24.53	3.60
23	5.82	3.426	-16.95	-20.81	-20.57	-20.98	-22.23	-24.51	9999.99	-25.86	-19.33	9999.99	-21.41	2.64
24	5.57	3.241	-15.33	-18.98	-18.12	-18.72	-17.43	-18.71	9999.99	9999.99	-17.76	9999.99	-17.86	1.16
25	5.33	2.799	-11.90	-16.01	-13.61	-12.58	-13.98	9999.99	9999.99	9999.99	-13.87	9999.99	-13.66	1.29
26	5.12	2.508	-7.21	-13.25	-7.57	-3.87	9999.99	9999.99	9999.99	9999.99	-11.20	9999.99	-8.62	3.28
27	4.92	2.524	-5.98	-13.10	-8.02	-2.73	9999.99	9999.99	9999.99	9999.99	-11.15	9999.99	-8.20	3.68
28	4.74	2.533	-2.70	-9.04	-2.70	1.63	9999.99	9999.99	9999.99	9999.99	-8.14	9999.99	-4.19	3.93
29	4.57	2.269	-.21	-3.99	-.37	1.12	9999.99	9999.99	9999.99	9999.99	-4.05	9999.99	-1.50	2.12
30	4.41	2.297	1.35	.95	3.06	5.15	9999.99	9999.99	9999.99	9999.99	1.83	9999.99	2.47	1.51
31	4.27	2.216	3.62	3.01	7.70	8.64	9999.99	9999.99	9999.99	9999.99	3.15	9999.99	5.22	2.43

Table A.47 TABLE : LINEAR ARRAY - 10 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 06/02/94 22:00 HOURS Hmo= .41 m (Hmo and spectral energy are for gauge 4) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 10 different gauge pairs										Mean	Std
NO	(sec)	(cm**2)	43	21	32	42	65	78	89	31	01	54	dir	dev
2	128.00	.663	-37.32	-9.92	-19.84	-24.17	-27.70	-20.09	-30.08	-15.94	8.66	-39.53	-21.69	13.32
3	64.00	1.184	-31.68	-15.25	-18.38	-21.95	-20.13	-19.53	-18.67	-17.16	1.70	-20.38	-18.17	7.83
4	42.67	1.301	-24.60	-16.25	-14.74	-17.29	-15.49	-16.35	-14.58	-15.32	6.60	-15.55	-14.40	7.51
5	32.00	.876	-18.39	-18.72	-12.30	-13.93	-13.94	-16.94	-16.22	-14.78	7.57	-15.92	-13.40	7.24
6	25.60	.740	-12.39	-18.39	-12.37	-12.53	-12.69	-20.04	-21.96	-14.80	1.98	-15.90	-13.92	6.23
7	21.33	.885	-3.77	-8.55	-4.93	-4.81	-11.65	-18.89	-20.27	-6.34	8.63	-10.36	-8.10	7.78
8	18.29	1.567	-6.73	-8.34	-4.69	-5.42	-10.76	-11.97	-14.56	-6.10	7.53	-9.73	-7.09	5.70
9	16.00	2.495	-11.06	-12.09	-8.85	-9.62	-10.05	-11.16	-12.76	-10.25	-.56	-13.58	-10.00	3.43
10	14.22	4.163	-10.06	-10.56	-8.40	-9.05	-10.84	-13.12	-12.48	-9.41	-4.83	-13.85	-10.26	2.48
11	12.80	6.126	-12.09	-13.26	-11.74	-12.12	-14.91	-17.02	-16.71	-12.67	-10.06	-16.90	-13.75	2.35
12	11.64	8.692	-16.11	-17.87	-17.02	-17.14	-19.81	-18.55	-19.12	-17.90	-14.87	-22.10	-18.05	1.92
13	10.67	11.779	-19.26	-21.34	-20.97	-20.95	-22.62	-21.11	-23.81	-21.83	-19.28	-24.81	-21.60	1.68
14	9.85	17.290	-21.89	-24.28	-24.17	-23.96	-24.22	-24.96	-28.71	-24.82	-23.56	-26.16	-24.67	1.70
15	9.14	22.244	-21.49	-24.67	-23.50	-23.23	-25.67	-26.10	-29.23	-24.44	-24.18	-26.95	-24.94	2.05
16	8.53	19.842	-22.81	-24.92	-24.38	-24.34	-26.61	-27.97	-28.69	-25.17	-24.33	-28.96	-25.82	2.00
17	8.00	13.239	-22.59	-25.50	-24.67	-24.54	-25.62	-28.02	-29.44	-25.87	-24.94	-29.28	-26.05	2.09
18	7.53	9.727	-20.95	-27.24	-24.28	-23.96	-25.12	-25.68	-28.30	-27.14	-26.17	-29.66	-25.85	2.34
19	7.11	8.785	-19.25	-26.51	-22.67	-22.60	-23.67	-28.24	-28.46	-26.50	-24.49	-28.87	-25.13	2.97
20	6.74	6.840	-18.74	-22.90	-21.19	-21.72	-20.53	-27.33	-26.77	-25.01	-20.39	-29.01	-23.36	3.28
21	6.40	6.620	-19.51	-20.03	-21.07	-22.00	-22.24	-22.70	-20.81	-23.66	-17.80	-29.89	-21.97	3.09
22	6.10	6.859	-16.02	-17.61	-17.48	-17.79	-20.21	-18.60	-19.00	-18.60	-15.19	9999.99	-17.83	1.44
23	5.82	6.692	-10.87	-12.93	-12.80	-12.22	-9.72	-15.10	9999.99	-11.48	-11.07	9999.99	-12.02	1.53
24	5.57	6.359	-8.23	-10.64	-10.00	-8.58	-3.76	-10.94	9999.99	-7.07	-9.42	9999.99	-8.58	2.19
25	5.33	6.194	-7.74	-7.24	-8.15	-7.02	-5.56	-5.58	9999.99	-2.80	-6.26	9999.99	-6.29	1.59
26	5.12	5.973	-5.58	-8.37	-6.59	-4.07	-6.09	-1.79	9999.99	.08	-6.86	9999.99	-4.91	2.64
27	4.92	6.544	-3.99	-6.02	-5.48	-2.99	3.89	-1.41	9999.99	1.80	-5.18	9999.99	-2.43	3.38
28	4.74	5.992	-1.48	-3.25	-1.84	.86	8.38	1.45	9999.99	2.89	-2.33	9999.99	.58	3.54
29	4.57	5.031	2.65	3.11	3.12	5.47	9.50	7.33	9999.99	7.23	3.76	9999.99	5.27	2.36
30	4.41	4.408	5.87	8.62	6.08	6.64	9999.99	4.93	9999.99	7.33	8.94	9999.99	6.92	1.36
31	4.27	3.444	5.64	10.14	7.95	8.28	9999.99	5.91	9999.99	7.16	10.28	9999.99	7.91	1.71

Appendix B

Modified Esteva's analysis — 15 redundant estimates

Table B.1 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 01/02/94 01:00 HOURS Hmo=1.07 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	1.859	-109.46	-92.50	-99.80	-98.33	-100.18	-74.93	-103.11	-120.37	-122.61	-123.34	-96.94	-99.78	-105.23	-96.53	-92.93	-102.40	12.30
3	64.00	4.429	-119.10	-106.21	-119.94	-120.00	-117.92	-101.28	-120.34	-129.43	-134.05	-135.17	-119.35	-118.45	-120.11	-117.54	-104.93	-118.93	9.24
4	42.67	6.134	-129.20	-107.83	-129.23	-129.96	-128.95	-105.35	-129.39	-142.01	-150.41	-150.64	-129.05	-128.34	-129.53	-128.15	-106.25	-128.31	13.21
5	32.00	5.255	-137.09	-118.49	-137.18	-138.98	-138.76	-115.74	-137.09	-154.61	-164.18	-165.79	-137.22	-137.33	-136.78	-133.80	-115.99	-137.88	14.42
6	25.60	3.993	-132.38	-104.54	-137.19	-139.78	-133.67	-92.12	-136.86	-154.66	-167.09	-170.93	-137.39	-137.23	-136.73	-124.88	-99.68	-133.81	21.37
7	21.33	3.720	-84.39	-40.11	-57.09	-43.72	-61.42	-37.15	-69.77	-77.60	-74.94	-74.87	-45.67	-43.85	-84.88	-57.81	-49.54	-60.16	15.99
8	18.29	6.587	-12.78	-10.76	-7.57	-8.96	-13.31	-16.11	-9.87	-13.08	-15.33	-17.94	-6.39	4.09	-18.52	-11.89	-12.46	-11.40	5.35
9	16.00	17.082	-6.94	-6.28	-5.30	-6.39	-7.64	-13.30	-5.73	-6.70	-7.53	-7.76	-4.99	.26	-10.23	-6.65	-6.27	-6.76	2.75
10	14.22	28.523	-5.90	-5.06	-6.23	-6.41	-5.91	-9.95	-1.46	-5.96	-7.07	-8.53	-5.79	-2.26	-10.30	-5.62	-5.21	-6.11	2.28
11	12.80	26.181	-7.80	-6.55	-8.61	-8.61	-7.38	-10.78	-1.86	-7.76	-8.79	-10.83	-8.16	-5.08	-12.50	-7.39	-6.92	-7.94	2.42
12	11.64	41.125	-10.13	-6.88	-9.25	-8.95	-8.77	-11.13	-5.59	-8.57	-8.03	-8.61	-8.62	-6.46	-11.36	-9.05	-8.39	-8.65	1.51
13	10.67	100.914	-9.17	-6.56	-8.90	-8.42	-7.28	-10.44	-6.50	-6.93	-6.14	-6.31	-8.37	-6.73	-9.72	-8.18	-7.49	-7.81	1.29
14	9.85	170.327	-7.49	-6.14	-7.56	-7.08	-6.11	-10.35	-7.35	-5.31	-4.46	-4.07	-7.22	-6.33	-8.41	-6.83	-6.44	-6.74	1.49
15	9.14	190.153	-6.70	-5.45	-6.53	-6.05	-5.56	-9.08	-7.99	-4.49	-3.53	-2.73	-6.22	-5.76	-7.54	-6.03	-5.77	-5.96	1.56
16	8.53	153.843	-5.69	-5.50	-6.31	-6.20	-5.06	-9.00	-6.93	-3.94	-3.14	-2.07	-6.13	-5.28	-6.83	-5.76	-5.74	-5.57	1.58
17	8.00	96.541	-4.30	-4.70	-5.21	-5.38	-4.34	-8.83	-5.61	-3.09	-2.46	-1.07	-5.07	-4.32	-5.99	-5.11	-5.15	-4.71	1.67
18	7.53	69.287	3.44	1.61	1.99	1.51	4.35	-1.97	1.93	6.16	5.60	7.15	2.01	2.75	1.90	3.62	2.11	2.94	2.17
19	7.11	79.713	7.67	5.91	6.39	6.24	9.86	4.46	6.59	12.05	11.44	12.61	6.44	7.28	6.57	9.11	6.99	7.97	2.38
20	6.74	76.729	8.81	8.78	8.68	8.81	11.56	9.07	8.32	13.97	13.86	14.89	8.79	9.32	8.27	11.92	9.46	10.30	2.22
21	6.40	64.330	9.79	12.53	11.75	11.96	13.33	12.98	11.00	15.57	16.07	17.07	12.01	12.27	11.07	14.54	12.35	12.95	1.96
22	6.10	57.727	11.96	14.14	13.78	13.81	14.72	15.41	13.05	16.68	17.28	18.12	14.02	14.41	13.41	15.57	13.68	14.67	1.61
23	5.82	54.983	15.42	16.48	16.91	16.54	18.31	19.38	16.17	20.30	20.34	21.31	17.01	17.41	16.87	19.23	16.68	17.89	1.73
24	5.57	42.309	17.31	16.64	18.68	18.04	20.57	21.71	18.18	22.63	21.93	23.08	18.60	19.03	19.20	21.24	17.72	19.64	1.99
25	5.33	30.758	17.39	15.25	18.69	17.31	20.08	19.73	18.28	22.41	21.23	22.70	18.37	19.21	19.55	21.23	16.47	19.19	2.06
26	5.12	28.902	19.55	17.37	19.13	18.30	21.76	21.46	18.89	24.25	22.91	24.07	18.92	19.74	19.40	24.13	18.22	20.54	2.28
27	4.92	24.668	21.45	19.72	19.39	19.67	23.67	23.02	18.95	26.01	24.12	24.63	19.51	19.88	18.93	25.55	20.11	21.64	2.49
28	4.74	17.462	25.82	21.11	22.18	22.11	27.97	25.30	21.75	31.11	27.96	28.34	22.17	22.71	21.16	30.56	22.37	24.84	3.41
29	4.57	13.202	27.55	24.07	24.38	24.61	29.02	27.28	23.87	32.44	28.70	29.11	24.45	24.97	23.50	33.52	23.88	26.76	3.13
30	4.41	9.299	25.18	24.05	25.16	9999.99	29.51	27.37	24.64	32.88	27.08	27.91	24.99	25.70	25.11	37.95	23.33	27.20	3.83
31	4.27	6.144	23.65	24.30	29.48	9999.99	32.03	30.08	29.40	33.90	29.16	29.64	29.01	29.75	30.07	38.82	25.60	29.63	3.68

Table B.2 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 01/02/94 04:00 HOURS Hmo=1.07 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	3.254	-125.32	-92.24	-111.59	-111.67	-114.75	-74.75	-119.25	-129.12	-130.79	-129.08	-110.12	-110.18	-115.71	-112.79	-91.06	-112.06	15.09
3	64.00	6.198	-129.94	-112.20	-127.65	-127.75	-128.32	-107.50	-127.97	-132.50	-134.41	-133.31	-127.48	-126.92	-127.88	-127.45	-109.90	-125.45	8.13
4	42.67	5.950	-130.25	-116.17	-132.54	-132.02	-135.73	-112.61	-132.67	-136.72	-138.64	-137.97	-132.47	-132.33	-132.24	-132.73	-113.46	-129.94	8.27
5	32.00	4.347	-126.26	-105.08	-131.55	-130.77	-140.38	-93.83	-132.04	-142.60	-147.02	-146.22	-131.40	-131.38	-130.65	-132.26	-100.40	-128.31	15.50
6	25.60	3.431	-106.39	-73.91	-105.76	-103.67	-108.26	-47.32	-108.06	-123.70	-137.29	-133.37	-103.14	-106.39	-108.15	-99.30	-68.37	-102.70	22.79
7	21.33	3.311	-19.87	-10.60	-14.92	-12.55	-10.95	-17.48	-19.32	-2.60	6.81	12.93	-11.27	-7.66	-23.85	-12.48	-10.77	-10.35	9.45
8	18.29	5.323	-6.22	-6.10	-5.64	-7.49	-7.72	-12.37	-14.57	-2.53	-2.10	1.02	-4.93	3.46	-12.93	-5.52	-5.60	-5.95	4.73
9	16.00	13.672	-6.88	-5.54	-6.43	-7.32	-6.73	-12.00	-5.24	-5.67	-5.52	-4.84	-6.03	-1.96	-7.71	-6.41	-6.42	-6.31	2.00
10	14.22	27.046	-7.22	-4.88	-6.63	-6.75	-6.50	-10.67	-6.09	-5.19	-3.96	-2.95	-6.19	-4.09	-7.84	-6.40	-6.12	-6.10	1.77
11	12.80	39.046	-7.31	-4.75	-6.67	-6.26	-6.41	-9.01	-8.88	-4.87	-3.29	-2.10	-6.19	-5.10	-8.13	-6.46	-6.00	-6.10	1.84
12	11.64	71.591	-7.63	-5.63	-7.75	-7.15	-6.56	-8.99	-9.13	-5.44	-4.16	-3.41	-7.28	-6.49	-9.04	-7.16	-6.56	-6.83	1.62
13	10.67	126.532	-7.77	-5.68	-7.75	-7.13	-6.37	-9.49	-9.11	-5.29	-3.90	-3.16	-7.29	-6.57	-8.55	-7.16	-6.41	-6.78	1.70
14	9.85	160.437	-7.51	-5.44	-7.52	-6.98	-6.47	-10.27	-8.68	-5.57	-4.21	-3.45	-7.09	-6.67	-7.87	-7.27	-6.23	-6.75	1.63
15	9.14	182.894	-8.18	-6.13	-8.13	-7.59	-7.30	-10.60	-8.80	-6.56	-5.35	-4.73	-7.68	-7.31	-8.55	-8.03	-7.05	-7.47	1.39
16	8.53	139.642	-8.55	-5.23	-7.32	-6.81	-6.87	-8.39	-7.37	-5.98	-4.32	-3.43	-6.79	-6.18	-7.10	-7.53	-6.46	-6.56	1.34
17	8.00	89.268	-7.71	-3.93	-6.36	-5.82	-5.85	-6.40	-6.16	-4.97	-3.24	-2.24	-5.75	-5.25	-5.58	-6.62	-5.37	-5.42	1.34
18	7.53	66.538	-1.43	1.27	-.42	-.15	.96	-.30	-.07	2.05	2.88	3.91	.03	.50	.31	.21	.48	.68	1.32
19	7.11	76.132	4.47	5.83	4.88	5.08	6.81	5.49	4.54	8.28	8.59	9.46	5.16	5.54	4.76	6.66	5.70	6.08	1.51
20	6.74	79.359	6.89	7.24	6.90	7.08	8.27	8.80	5.71	9.99	10.19	11.13	7.05	7.18	6.12	8.23	7.34	7.88	1.50
21	6.40	61.058	8.23	9.26	8.95	8.94	11.13	10.38	8.01	12.97	13.23	14.20	9.08	9.41	8.56	11.22	9.73	10.22	1.87
22	6.10	50.837	11.11	11.58	12.00	11.98	15.50	12.72	11.66	17.69	17.69	18.42	12.04	12.76	11.59	16.06	12.83	13.71	2.50
23	5.82	43.533	12.29	13.56	14.88	14.88	16.65	16.90	14.55	19.12	19.05	19.91	14.86	15.41	14.11	18.02	14.18	15.89	2.20
24	5.57	33.228	11.14	13.49	14.62	14.30	16.35	18.46	14.38	18.16	17.75	18.79	14.57	15.08	14.90	18.01	13.98	15.60	2.14
25	5.33	32.496	14.04	15.36	16.75	15.85	18.34	19.68	16.52	20.05	19.40	20.61	16.56	17.21	17.16	20.76	16.00	17.62	2.00
26	5.12	27.477	16.29	17.28	19.88	18.85	21.35	19.17	19.77	23.93	22.63	23.96	19.59	20.22	19.85	24.42	18.10	20.35	2.37
27	4.92	23.070	16.83	16.86	20.86	19.69	22.91	19.87	20.76	25.57	24.68	25.98	20.44	21.34	21.48	25.60	18.91	21.45	2.87
28	4.74	17.154	17.08	17.67	20.72	19.48	24.15	24.15	20.49	26.42	24.05	25.27	20.49	21.24	21.41	27.07	18.99	21.91	3.00
29	4.57	12.985	22.86	20.11	24.51	23.69	29.66	27.00	24.48	32.49	27.13	28.29	24.18	24.92	25.17	31.68	21.64	25.85	3.40
30	4.41	10.328	24.15	22.32	25.18	24.77	29.29	29.33	25.21	31.90	27.26	28.23	25.01	25.52	25.66	32.63	22.96	26.63	2.97
31	4.27	7.241	23.66	23.43	26.77	26.03	28.54	9999.99	26.51	30.23	26.33	26.82	26.43	27.15	26.97	9999.99	23.50	26.34	1.87

Table B.3 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 01/02/94 07:00 HOURS Hmo=1.08 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	4.192	-111.00	-93.19	-108.43	-105.26	-107.72	-105.49	-114.70	-116.57	-121.00	-119.83	-103.77	-107.08	-111.61	-101.40	-100.08	-108.48	7.32
3	64.00	6.712	-118.87	-93.75	-115.39	-114.08	-112.26	-100.26	-115.75	-127.01	-131.00	-131.63	-112.86	-111.96	-116.47	-111.67	-98.28	-114.09	10.53
4	42.67	6.234	-119.97	-112.01	-121.25	-120.16	-121.08	-111.12	-121.41	-134.30	-137.23	-140.00	-119.79	-120.08	-120.06	-117.73	-110.75	-121.77	8.53
5	32.00	5.244	-119.21	-140.48	-131.05	-130.04	-131.30	-126.56	-131.26	-151.83	-157.03	-166.31	-130.49	-131.20	-129.62	-124.21	-129.39	-135.20	12.59
6	25.60	3.760	-109.11	-133.56	-122.87	-122.95	-152.62	-119.52	-123.49	-176.28	174.12	165.79	-120.14	-124.20	-114.02	-130.32	-120.27	-135.48	26.36
7	21.33	3.426	-31.45	-20.77	-53.05	-44.66	-3.73	-49.01	-64.96	20.11	32.25	35.84	-46.04	-48.28	-40.81	-35.67	-17.80	-25.86	30.84
8	18.29	5.221	-10.08	-3.94	-3.15	-3.81	-10.28	-13.40	-3.25	-9.10	-10.51	-11.86	-.93	7.90	-9.54	-7.93	-9.48	-6.63	5.29
9	16.00	13.028	-9.51	-4.40	-6.15	-6.74	-8.30	-7.56	-6.42	-7.67	-7.40	-7.52	-5.16	-.49	-8.10	-7.88	-6.71	-6.67	2.06
10	14.22	25.790	-6.83	-3.44	-5.01	-4.80	-4.91	-6.34	-3.94	-4.29	-3.43	-3.90	-4.40	-1.23	-7.78	-5.41	-4.15	-4.66	1.51
11	12.80	55.117	-5.40	-3.33	-4.40	-4.15	-4.08	-6.91	-5.50	-2.69	-1.31	-.94	-4.01	-1.95	-7.07	-4.42	-3.81	-4.00	1.74
12	11.64	133.508	-4.61	-1.81	-3.47	-3.05	-3.31	-5.05	-4.86	-2.22	-.85	-.60	-3.01	-1.61	-5.80	-3.34	-2.79	-3.09	1.48
13	10.67	202.397	-5.98	-2.89	-4.92	-4.21	-4.94	-5.76	-6.45	-4.00	-2.69	-2.55	-4.39	-3.63	-8.11	-4.74	-4.18	-4.63	1.45
14	9.85	225.144	-7.09	-5.03	-6.76	-6.40	-6.31	-8.21	-7.75	-5.14	-3.61	-2.65	-6.34	-5.33	-8.11	-6.81	-6.10	-6.11	1.51
15	9.14	170.324	-7.03	-5.11	-6.48	-6.48	-5.70	-9.45	-6.45	-4.52	-3.00	-1.79	-6.18	-4.74	-6.54	-6.58	-5.84	-5.73	1.72
16	8.53	101.243	-5.52	-4.22	-5.86	-5.36	-4.90	-9.40	-7.26	-3.92	-3.13	-2.76	-5.55	-5.11	-8.80	-4.79	-4.76	-5.42	1.79
17	8.00	85.858	-2.81	-2.91	-4.05	-3.32	-2.87	-7.17	-5.88	-1.68	-1.56	-1.27	-3.79	-3.89	-8.30	-2.42	-3.24	-3.68	1.95
18	7.53	72.649	-2.17	-2.76	-3.77	-3.00	-2.58	-5.92	-5.95	-1.35	-1.48	-1.04	-3.55	-4.09	-7.98	-2.25	-2.88	-3.38	1.87
19	7.11	54.923	.26	.82	-1.00	-.40	1.51	-.13	-.70	3.18	3.43	4.49	-.57	-.35	-3.34	.75	.53	.57	1.90
20	6.74	53.722	3.58	4.79	3.58	3.55	6.25	4.49	4.31	8.05	8.45	10.01	3.88	4.36	3.72	5.06	4.97	5.27	1.95
21	6.40	49.716	6.19	7.36	6.85	6.57	8.97	8.60	6.83	10.92	11.24	12.98	7.00	7.18	7.21	8.49	7.80	8.28	1.91
22	6.10	42.439	8.21	10.62	8.65	8.98	11.28	11.59	7.97	13.45	14.10	15.33	9.01	9.05	8.12	11.61	10.56	10.57	2.24
23	5.82	35.796	7.93	12.67	9.37	10.24	12.15	14.36	9.08	14.36	15.05	16.05	10.02	10.09	8.53	13.75	11.45	11.67	2.50
24	5.57	23.474	8.59	14.63	12.43	12.93	17.66	19.25	12.55	19.88	17.23	18.45	12.95	12.88	12.06	21.49	13.74	15.11	3.51
25	5.33	22.726	13.52	14.18	13.24	13.61	20.27	18.60	13.24	22.68	19.30	20.20	13.51	13.71	12.20	22.18	14.98	16.36	3.58
26	5.12	22.584	14.99	14.53	11.90	12.55	19.90	9999.99	11.97	22.77	19.49	20.38	12.33	12.25	10.29	21.65	15.20	15.73	4.07
27	4.92	17.614	14.31	18.65	13.48	14.41	22.51	9999.99	12.81	24.75	19.04	20.08	14.45	13.55	12.75	9999.99	17.20	16.77	3.79
28	4.74	11.399	13.02	18.71	15.72	16.33	27.50	9999.99	15.36	30.26	21.96	23.78	16.66	15.89	15.89	9999.99	18.34	19.18	4.98
29	4.57	8.959	11.68	16.99	13.16	12.42	24.95	9999.99	12.66	28.16	22.67	24.47	14.29	13.75	12.90	9999.99	17.47	17.35	5.49
30	4.41	7.058	15.83	17.42	15.46	13.90	24.30	9999.99	14.55	27.23	23.17	24.57	16.16	16.37	14.32	9999.99	17.96	18.55	4.39
31	4.27	5.031	21.70	18.73	19.62	17.89	26.28	9999.99	18.65	29.49	25.00	25.91	19.81	20.36	18.62	9999.99	19.42	21.65	3.59

Table B.4 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 01/02/94 13:00 HOURS Hmo= .85 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	2.167	-151.82	-132.65	-131.64	-138.98	-137.57	-135.04	32.05	-106.20	-104.28	-100.17	-131.57	-131.90	-132.93	-132.66	-132.49	-127.19	42.30
3	64.00	4.460	-124.98	-110.22	-122.71	-123.51	-121.83	-104.46	-121.51	-126.80	-129.28	-128.50	-122.94	-121.95	-123.88	-121.60	-107.33	-120.79	7.18
4	42.67	4.751	-116.31	-107.03	-124.87	-123.54	-125.13	-102.56	-125.46	-128.47	-131.35	-132.62	-125.03	-123.65	-121.89	-124.45	-104.68	-121.17	9.00
5	32.00	3.376	-123.84	-109.73	-133.95	-131.47	-136.28	-105.75	-134.04	-136.19	-138.75	-140.15	-133.95	-133.88	-133.67	-131.96	-107.29	-128.81	11.16
6	25.60	2.524	-146.31	-129.66	-154.35	-156.23	-146.66	-125.93	-153.83	-156.89	-165.08	-168.27	-154.76	-152.61	-152.66	-137.81	-123.38	-148.36	13.04
7	21.33	2.420	-63.60	-24.05	-27.14	-19.89	-42.71	-22.29	-47.93	-102.79	-164.86	120.51	-21.86	-20.50	-62.68	-38.86	-35.65	-42.52	56.72
8	18.29	3.878	-17.61	-11.51	-12.12	-14.72	-14.06	-13.71	-13.43	-12.26	-10.43	-10.27	-11.49	1.40	-18.99	-14.61	-10.67	-12.31	4.39
9	16.00	8.018	-9.88	-7.65	-7.75	-10.63	-9.96	-12.97	-10.74	-7.36	-8.28	-9.40	-7.42	4.38	-19.38	-7.94	-6.27	-8.75	4.67
10	14.22	12.945	-4.90	-3.15	-2.95	-5.28	-6.23	-7.63	-10.68	-3.19	-3.45	-2.79	-2.74	4.80	-11.07	-3.72	-2.94	-4.39	3.63
11	12.80	20.001	-6.29	-2.61	-3.27	-4.30	-5.05	-6.82	-4.77	-4.03	-3.68	-3.70	-2.88	1.46	-7.17	-4.43	-3.13	-4.05	1.99
12	11.64	62.034	-9.59	-7.03	-8.70	-8.23	-8.15	-11.08	-5.58	-7.99	-7.40	-8.32	-8.22	-6.37	-12.63	-8.70	-7.70	-8.38	1.68
13	10.67	122.937	-7.79	-5.87	-7.66	-6.94	-6.91	-10.44	-6.79	-6.22	-5.33	-5.42	-7.23	-6.51	-11.16	-7.23	-6.52	-7.20	1.58
14	9.85	133.820	-5.32	-3.25	-5.09	-4.73	-4.24	-7.38	-4.11	-3.11	-1.77	-1.10	-4.69	-3.56	-6.74	-4.72	-4.14	-4.26	1.58
15	9.14	119.943	-6.07	-4.24	-5.76	-5.62	-5.43	-7.73	-5.88	-4.27	-2.82	-1.64	-5.36	-4.30	-6.74	-6.00	-5.28	-5.14	1.46
16	8.53	93.684	-6.33	-4.21	-5.55	-5.21	-5.60	-7.72	-6.63	-4.57	-3.30	-2.22	-5.10	-4.61	-6.86	-6.15	-5.27	-5.29	1.36
17	8.00	61.863	-5.59	-2.30	-4.79	-4.28	-3.87	-4.73	-5.20	-2.89	-1.45	-.44	-4.17	-3.61	-5.44	-4.76	-3.59	-3.81	1.44
18	7.53	48.280	-5.44	-1.71	-4.28	-3.86	-3.16	-4.94	-4.57	-2.06	-.72	.66	-3.71	-3.51	-5.14	-4.15	-2.63	-3.28	1.66
19	7.11	40.665	-2.19	1.32	-1.20	-.68	1.28	-.39	-1.39	2.78	3.87	5.33	-.64	-.26	-2.71	.36	.85	.42	2.15
20	6.74	37.411	1.53	5.74	2.53	3.53	5.63	6.58	2.38	7.18	8.24	8.98	3.25	3.45	-.44	5.57	4.77	4.59	2.51
21	6.40	33.542	6.48	9.80	6.88	8.04	10.48	12.68	5.87	12.13	12.49	12.90	7.54	7.28	2.34	10.33	9.33	8.97	2.90
22	6.10	30.069	10.04	10.83	9.06	9.89	13.14	13.75	8.17	15.13	14.61	15.25	9.42	9.19	5.21	13.36	11.49	11.24	2.81
23	5.82	19.433	12.63	12.31	12.75	13.17	17.02	15.94	12.09	19.18	18.26	18.98	12.91	13.03	10.22	17.68	14.07	14.68	2.78
24	5.57	10.789	14.17	12.21	12.72	12.77	22.53	17.35	11.80	25.09	19.57	20.51	12.92	12.90	9.67	25.20	14.78	16.27	4.90
25	5.33	8.849	11.54	12.21	8.25	8.22	22.31	17.05	7.78	25.05	17.11	19.06	9.06	8.26	6.45	23.20	13.28	13.92	6.05
26	5.12	9.052	13.01	13.84	10.57	11.30	20.49	9999.99	10.29	22.99	19.20	20.22	11.36	10.91	9.76	20.47	14.88	14.95	4.53
27	4.92	7.400	10.69	14.91	13.22	14.12	18.11	9999.99	12.80	20.22	19.55	20.19	13.82	13.82	12.81	9999.99	15.88	15.40	3.02
28	4.74	5.723	12.88	14.91	15.94	15.58	21.47	9999.99	15.81	23.82	21.06	22.92	16.15	16.66	16.87	9999.99	16.62	17.74	3.25
29	4.57	4.486	17.08	14.45	20.03	19.83	24.45	9999.99	20.25	27.72	25.00	26.51	19.80	20.73	20.28	9999.99	17.97	21.08	3.68
30	4.41	3.291	19.46	14.15	20.21	20.30	26.44	9999.99	19.62	29.38	26.17	26.60	19.75	20.66	19.69	9999.99	19.39	21.68	4.02
31	4.27	2.294	18.84	17.79	22.85	9999.99	29.59	9999.99	22.33	32.19	28.87	28.85	22.51	23.11	22.20	9999.99	22.67	24.32	4.30

Table B.5 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 01/02/94 16:00 HOURS Hmo= .81 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	1.469	-145.59	-72.57	-107.66	-106.63	-110.62	-43.26	-87.82	-156.20	-167.16	-156.32	-104.19	-101.60	-118.93	-108.44	-61.42	-110.02	34.37
3	64.00	3.329	-135.59	-98.09	-124.37	-125.38	-132.38	-77.39	-124.74	-142.22	-144.68	-141.31	-124.61	-122.78	-125.54	-128.91	-89.17	-122.87	18.83
4	42.67	3.882	-123.43	-105.68	-120.83	-121.25	-125.72	-102.81	-122.79	-140.31	-143.34	-144.76	-121.10	-120.01	-121.00	-124.67	-102.41	-122.66	12.52
5	32.00	3.163	-145.80	-128.20	-144.82	-145.09	-151.14	-127.20	-144.76	-157.10	-161.17	-161.36	-144.89	-145.56	-145.44	-146.40	-127.42	-145.11	10.41
6	25.60	2.181	-150.89	-132.83	-151.15	-153.32	-162.82	-129.60	-154.04	-164.86	-171.15	-170.20	-152.03	-150.59	-154.52	-151.75	-127.85	-151.89	12.78
7	21.33	2.084	-27.40	-20.77	-11.34	-4.77	-12.22	-12.96	-6.59	-8.34	10.37	11.09	-5.17	-16.87	-16.95	-21.39	-18.57	-10.84	10.48
8	18.29	2.921	-4.93	-7.74	-1.27	-4.87	-8.58	-20.68	-1.61	-9.57	-12.42	-16.65	-.81	10.27	-10.07	-6.86	-8.48	-6.96	7.02
9	16.00	5.915	-5.31	-5.49	-3.38	-6.11	-7.14	-13.30	-1.69	-5.92	-6.55	-7.19	-3.26	3.60	-9.46	-5.64	-5.56	-5.49	3.56
10	14.22	12.658	-5.63	-4.32	-5.71	-6.37	-5.38	-11.03	-6.34	-3.48	-2.56	-1.46	-5.49	-2.91	-8.56	-5.25	-4.41	-5.26	2.30
11	12.80	16.096	-8.31	-6.34	-8.00	-7.93	-7.46	-12.00	-6.32	-6.83	-6.31	-6.53	-7.71	-6.22	-10.82	-7.50	-6.67	-7.66	1.63
12	11.64	27.641	-12.63	-10.83	-12.64	-12.25	-12.06	-15.62	-12.76	-11.52	-10.45	-10.28	-12.17	-10.74	-14.62	-12.72	-11.77	-12.20	1.41
13	10.67	66.174	-13.40	-10.54	-12.93	-11.98	-12.86	-13.80	-15.59	-12.12	-10.34	-9.64	-12.30	-12.22	-15.32	-13.05	-11.99	-12.54	1.59
14	9.85	101.285	-10.55	-6.96	-9.81	-8.86	-9.47	-10.09	-12.22	-8.67	-6.77	-6.18	-9.20	-9.30	-11.37	-9.74	-8.31	-9.17	1.60
15	9.14	104.075	-6.10	-3.88	-5.94	-5.39	-4.67	-8.51	-7.13	-3.57	-2.16	-1.31	-5.57	-5.28	-6.95	-5.17	-4.40	-5.07	1.80
16	8.53	109.772	-6.45	-3.90	-5.65	-5.02	-4.47	-8.60	-5.55	-3.36	-1.76	-1.07	-5.23	-4.58	-6.97	-5.18	-4.49	-4.82	1.82
17	8.00	79.152	-6.71	-4.03	-6.13	-5.39	-5.06	-7.37	-5.80	-4.16	-2.70	-2.19	-5.59	-4.95	-7.47	-5.78	-5.08	-5.23	1.46
18	7.53	54.577	-2.90	-2.14	-3.42	-3.17	-1.75	-5.00	-3.30	-.50	.38	1.48	-3.11	-2.29	-3.83	-2.67	-2.57	-2.32	1.61
19	7.11	49.905	-1.79	-1.71	-2.42	-2.25	-.58	-6.67	-2.62	.75	1.63	2.65	-2.24	-1.49	-3.12	-1.62	-1.58	-1.54	2.09
20	6.74	38.535	1.26	-.33	-.37	-.45	2.48	-6.33	-.43	4.14	4.17	5.49	-.31	.59	-.56	1.29	.40	.74	2.68
21	6.40	31.294	1.65	1.17	.38	.54	3.96	.27	.68	5.69	5.54	6.77	.62	1.37	.25	2.98	1.68	2.24	2.14
22	6.10	23.900	3.54	3.59	3.58	3.70	8.78	8.30	3.75	10.72	9.05	10.46	3.72	4.17	2.42	9.94	5.05	6.05	2.95
23	5.82	20.585	6.59	6.35	6.30	6.31	13.75	11.63	6.27	16.03	13.08	14.95	6.44	6.91	5.30	15.88	8.33	9.61	3.94
24	5.57	16.887	8.56	7.49	7.96	7.76	15.58	9999.99	7.76	18.23	14.95	16.92	8.15	9.09	7.09	17.85	9.04	11.17	4.22
25	5.33	12.840	9.27	8.19	8.42	8.00	17.17	9999.99	8.62	19.46	14.59	16.83	8.78	9.34	7.76	20.20	9.76	11.88	4.49
26	5.12	10.604	12.39	11.76	10.37	11.11	19.90	9999.99	10.61	21.93	16.58	18.09	11.09	11.04	9.59	23.18	12.89	14.32	4.49
27	4.92	8.876	11.75	12.21	9.86	10.89	21.16	9999.99	9.48	23.45	17.55	19.37	10.73	10.70	9.27	23.18	13.16	14.48	5.09
28	4.74	6.148	8.80	11.32	9.98	10.46	20.86	9999.99	8.74	22.94	20.03	22.22	10.80	10.83	9.58	19.87	14.78	14.37	5.31
29	4.57	4.363	9.63	11.05	10.35	10.12	21.59	9999.99	9.09	24.24	21.02	23.16	11.20	11.27	10.07	19.60	15.29	14.83	5.54
30	4.41	3.581	13.01	12.71	12.58	12.33	21.50	9999.99	12.01	24.17	22.74	23.71	13.23	13.33	10.62	19.93	17.02	16.35	4.79
31	4.27	2.425	13.76	14.61	12.85	14.24	22.15	9999.99	12.23	24.46	23.92	24.21	13.87	13.24	9.80	19.82	18.71	16.99	4.87

Table B.6 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 01/02/94 19:00 HOURS Hmo= .82 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

NO	Period (sec)	Energy (cm**2)	DIRECTION (degrees) for 15 different gauge triads															Mean dir	Std dev
			012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24		
2	128.00	1.498	-137.22	-173.54	-104.77	-121.84	-129.14	-158.49	-119.96	-143.23	-144.76	-143.26	-99.41	-122.86	-125.57	-102.22	-169.70	-132.92	22.13
3	64.00	2.440	-138.53	-151.42	-145.62	-150.85	-143.95	-154.89	-142.61	-152.10	-158.74	-159.17	-146.01	-143.89	-142.62	-142.01	-150.74	-148.21	6.10
4	42.67	2.520	-157.23	-152.23	-159.98	-163.12	-163.00	-160.82	-158.47	-168.16	-172.24	-172.77	-160.41	-159.02	-156.90	-159.74	-153.96	-161.20	5.74
5	32.00	2.559	-152.19	-154.57	-153.33	-158.10	-158.38	-149.48	-155.23	-165.68	-171.60	-172.62	-154.39	-153.11	-151.91	-154.28	-150.67	-157.01	6.99
6	25.60	2.437	-148.18	-156.18	-150.77	-154.79	-163.55	-151.64	-149.79	-175.75	175.55	170.21	-151.94	-150.63	-153.85	-155.85	-149.84	-158.98	12.87
7	21.33	2.223	-34.02	-3.33	-46.25	-30.36	-8.91	-20.24	-68.72	150.28	132.82	121.52	-32.28	-42.46	-25.31	-26.59	-11.84	-23.65	67.61
8	18.29	2.974	-14.93	-6.42	-12.55	-12.94	-10.51	-12.72	-14.34	-11.79	-13.20	-18.34	-10.64	.98	-19.94	-11.59	-8.01	-11.80	4.76
9	16.00	6.018	-11.08	-7.77	-9.34	-10.73	-9.65	-11.83	-9.73	-7.83	-7.94	-9.35	-8.88	-.22	-19.50	-8.77	-6.89	-9.30	3.75
10	14.22	11.912	-8.98	-5.53	-5.75	-6.57	-8.34	-10.84	-8.06	-5.91	-5.08	-4.59	-5.36	.09	-14.41	-6.87	-5.95	-6.81	3.10
11	12.80	20.510	-6.81	-4.40	-5.08	-5.23	-6.65	-10.00	-8.06	-4.62	-3.66	-2.86	-4.73	-2.10	-11.61	-5.55	-5.17	-5.77	2.46
12	11.64	40.933	-8.35	-6.67	-7.59	-7.57	-7.48	-11.88	-9.14	-5.91	-4.24	-2.92	-7.28	-5.41	-10.14	-7.92	-7.23	-7.31	2.14
13	10.67	87.276	-9.38	-6.93	-8.64	-8.26	-8.30	-11.64	-10.53	-7.07	-5.29	-4.02	-8.18	-7.10	-10.31	-8.88	-7.98	-8.16	1.89
14	9.85	116.021	-10.45	-6.55	-9.13	-8.33	-9.04	-10.18	-10.39	-8.25	-6.66	-6.02	-8.45	-8.05	-11.49	-9.28	-8.12	-8.69	1.50
15	9.14	110.577	-10.29	-6.76	-8.96	-8.45	-8.45	-10.80	-8.91	-7.61	-5.96	-5.08	-8.35	-7.47	-9.98	-9.39	-7.72	-8.28	1.52
16	8.53	89.567	-7.28	-5.12	-6.47	-6.23	-5.10	-10.56	-5.69	-3.91	-2.33	-1.24	-6.03	-4.58	-6.62	-6.75	-5.37	-5.55	2.08
17	8.00	71.641	-4.56	-2.55	-4.47	-4.18	-1.89	-7.91	-3.51	-.48	.87	2.02	-4.03	-2.97	-4.29	-3.44	-2.36	-2.92	2.33
18	7.53	67.741	-6.85	-2.63	-5.22	-4.59	-3.97	-7.43	-4.99	-2.81	-.86	.22	-4.54	-3.95	-5.65	-4.84	-3.47	-4.11	1.96
19	7.11	48.255	-5.49	-1.82	-3.82	-3.42	-2.68	-4.60	-3.94	-1.49	-.25	1.11	-3.23	-2.86	-4.48	-3.40	-2.77	-2.88	1.65
20	6.74	35.672	-4.62	-2.98	-5.00	-4.45	-2.67	-6.86	-5.55	-1.38	-.48	.86	-4.47	-4.19	-6.42	-4.57	-3.26	-3.74	2.06
21	6.40	31.913	-2.54	-3.60	-4.88	-4.55	-1.05	-12.66	-5.55	.52	.62	2.14	-4.60	-4.14	-6.60	-4.11	-2.75	-3.58	3.42
22	6.10	25.587	.97	-.44	-.76	-.65	3.44	9999.99	-1.51	5.33	4.05	6.10	-.58	-.24	-1.87	2.14	.52	1.18	2.50
23	5.82	17.215	2.38	1.53	1.90	1.68	7.93	9999.99	1.99	9.92	6.60	8.82	2.05	2.48	1.68	9999.99	2.98	3.99	2.98
24	5.57	11.666	2.11	3.17	2.76	3.01	9999.99	9999.99	2.77	9999.99	8.22	10.24	3.11	2.95	1.66	9999.99	4.76	4.07	2.57
25	5.33	10.819	-.59	3.68	-.21	1.93	9999.99	9999.99	-.95	9999.99	9.65	12.40	1.25	.37	-2.60	9999.99	5.52	2.77	4.47
26	5.12	12.701	2.36	5.47	3.14	4.11	9999.99	9999.99	2.71	9999.99	13.85	16.47	4.14	4.05	.73	9999.99	8.59	5.96	4.76
27	4.92	9.597	6.22	5.52	5.97	6.39	9999.99	9999.99	5.56	9999.99	18.27	20.42	6.31	6.72	3.82	9999.99	11.31	8.76	5.29
28	4.74	6.538	7.69	5.05	4.77	5.24	9999.99	9999.99	3.85	9999.99	17.71	19.92	5.34	5.03	2.29	9999.99	11.86	8.06	5.59
29	4.57	3.954	7.82	6.52	2.73	3.09	9999.99	9999.99	1.68	9999.99	16.79	19.24	3.96	2.90	1.55	9999.99	12.16	7.12	5.96
30	4.41	2.534	3.31	9.08	4.05	5.55	9999.99	9999.99	2.71	9999.99	21.91	23.14	5.55	4.24	1.37	9999.99	15.50	8.74	7.44
31	4.27	1.753	9.92	11.43	15.36	15.72	9999.99	9999.99	15.37	9999.99	25.33	26.41	15.57	15.83	13.03	9999.99	18.03	16.54	4.90

Table B.7 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 01/02/94 22:00 HOURS Hmo= .76 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

NO	Period (sec)	Energy (cm**2)	012	34C	D03	D24	C1D	DIRECTION (degrees) for 15 different gauge triads 4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	Mean dir	Std dev
2	128.00	.980	-146.10	-92.18	-147.88	-148.23	-149.19	-85.95	-152.73	-80.85	-81.33	-83.62	-148.77	-153.65	-147.87	-143.94	-87.36	-124.03	31.28
3	64.00	1.612	-119.45	-94.44	-132.49	-129.33	-128.21	-75.33	-131.69	-127.45	-127.50	-129.47	-132.42	-131.91	-131.21	-128.50	-92.64	-121.23	17.38
4	42.67	1.814	-138.84	-102.04	-136.70	-136.57	-134.69	-85.23	-137.02	-135.49	-135.04	-134.46	-136.77	-137.15	-136.75	-132.20	-97.74	-128.17	16.76
5	32.00	1.850	-156.46	-138.42	-165.12	-165.23	-159.31	-138.31	-164.26	-160.15	-160.78	-162.73	-166.13	-168.35	-172.70	-153.74	-131.13	-157.61	11.77
6	25.60	1.786	-157.36	-179.08	-173.46	178.40	-173.17	158.42	-172.71	179.77	170.85	166.56	-176.66	-172.62	-172.01	-168.47	-158.94	-176.67	11.35
7	21.33	2.036	-111.46	-6.30	-144.47	-155.04	174.89	-.83	-143.64	168.87	150.04	142.20	-147.02	-145.84	-162.85	-148.57	-39.35	-152.20	65.41
8	18.29	2.439	-20.25	-17.74	-21.07	-23.32	-14.94	-27.90	-30.24	-15.51	-16.63	-19.28	-19.72	-4.80	-15.10	-23.37	-16.13	-19.07	5.83
9	16.00	3.942	-15.78	-13.60	-12.70	-15.08	-14.37	-17.53	-16.60	-12.78	-12.98	-12.97	-12.26	-.90	-19.72	-14.55	-12.71	-13.64	3.97
10	14.22	7.561	-10.64	-8.79	-6.98	-9.13	-11.39	-12.45	-14.34	-8.48	-8.41	-6.07	-6.71	.86	-14.78	-9.44	-9.25	-9.07	3.64
11	12.80	11.870	-8.64	-6.97	-5.42	-7.66	-9.75	-12.33	-13.81	-6.84	-6.41	-3.00	-5.20	.35	-9.85	-8.12	-8.20	-7.46	3.36
12	11.64	29.276	-10.13	-7.68	-7.34	-8.40	-9.96	-11.71	-14.23	-8.20	-7.16	-4.91	-7.09	-4.17	-11.04	-8.92	-8.72	-8.64	2.48
13	10.67	75.177	-9.80	-6.03	-7.45	-7.12	-8.63	-9.74	-10.11	-7.51	-6.49	-5.94	-6.92	-5.40	-12.80	-7.69	-7.32	-7.93	1.90
14	9.85	100.166	-9.06	-5.65	-6.85	-7.01	-7.78	-9.32	-8.10	-6.46	-5.04	-3.79	-6.38	-4.23	-10.10	-7.66	-7.06	-6.97	1.75
15	9.14	96.389	-6.74	-4.69	-5.07	-5.25	-5.90	-9.86	-7.81	-4.59	-3.76	-2.30	-4.77	-3.97	-7.48	-5.76	-5.29	-5.55	1.79
16	8.53	80.980	-5.37	-3.49	-4.06	-3.83	-4.07	-7.97	-6.82	-2.66	-1.76	-.50	-3.73	-3.37	-6.71	-4.17	-3.76	-4.15	1.87
17	8.00	62.351	-6.73	-4.65	-6.24	-5.92	-5.69	-7.36	-7.53	-4.45	-3.26	-2.01	-5.76	-5.27	-8.00	-6.23	-5.45	-5.64	1.54
18	7.53	53.167	-8.20	-5.76	-7.56	-6.73	-6.55	-10.08	-8.78	-5.63	-4.54	-3.80	-6.92	-6.87	-11.04	-7.38	-6.12	-7.06	1.85
19	7.11	39.408	-6.81	-5.07	-5.89	-5.13	-3.24	-12.20	-5.75	-2.12	-1.73	-.66	-5.29	-5.14	-9.32	-4.55	-3.87	-5.12	2.80
20	6.74	29.123	-5.40	-3.85	-6.02	-5.21	-2.10	-4.92	-6.35	-.79	-.67	.82	-5.38	-5.41	-8.98	-3.42	-3.40	-4.07	2.47
21	6.40	23.866	-2.28	-.87	-2.81	-2.22	2.80	9999.99	-3.38	4.54	3.53	5.30	-2.31	-2.29	-4.93	2.22	.05	-.19	3.14
22	6.10	20.448	-.23	-.02	-.87	-.32	5.82	9999.99	-1.31	7.50	5.03	7.01	-.42	-.51	-2.89	5.44	1.69	1.85	3.38
23	5.82	15.380	1.67	-.39	-.18	-.06	9.95	9999.99	.63	12.14	6.88	9.74	.21	.58	.27	10.13	2.48	3.86	4.57
24	5.57	14.219	2.26	3.18	1.96	2.42	12.44	9999.99	2.57	14.79	10.70	13.78	2.86	2.71	1.97	13.41	5.91	6.50	5.02
25	5.33	13.246	4.23	5.84	4.45	5.35	14.97	9999.99	3.70	17.56	14.27	16.95	5.63	5.21	3.23	15.43	9.04	8.99	5.31
26	5.12	10.734	6.46	3.17	5.90	6.17	19.52	9999.99	5.25	22.30	17.93	20.22	6.33	6.69	3.57	20.64	10.87	11.06	7.00
27	4.92	6.866	5.68	5.53	11.59	10.00	23.97	9999.99	11.61	26.82	21.25	23.31	11.27	12.64	10.17	25.67	13.55	15.21	7.13
28	4.74	4.987	3.88	6.72	4.26	4.07	27.46	9999.99	4.72	30.61	19.60	21.80	5.10	6.09	4.32	29.02	12.86	12.86	10.10
29	4.57	4.306	6.87	6.79	5.02	4.21	24.43	9999.99	4.35	27.45	20.20	22.08	5.80	6.69	4.17	25.70	13.64	12.65	8.84
30	4.41	3.094	9.53	10.29	10.45	7.38	22.45	9999.99	9.92	25.99	24.31	25.90	10.79	11.88	7.21	23.36	17.14	15.46	7.06
31	4.27	1.946	14.73	13.59	9999.99	9999.99	24.21	9999.99	9999.99	26.89	26.77	27.04	9999.99	9999.99	9999.99	25.62	19.97	22.36	5.20

Table B.8 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 02/02/94 01:00 HOURS Hmo= .70 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(16f5.1) FACTOR=1.0

	Period	Energy						DIRECTION (degrees) for 15 different gauge triads										Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.949	-112.17	-54.62	-123.96	-120.07	-104.27	-45.10	-127.68	-134.41	-152.77	-156.53	-124.15	-111.26	-120.46	-121.36	-58.99	-112.75	32.18
3	64.00	1.693	-110.82	-86.47	-122.46	-119.37	-121.58	-94.80	-119.48	-131.48	-133.21	-135.83	-120.76	-119.27	-115.80	-120.49	-96.90	-116.68	13.63
4	42.67	2.031	-106.84	-96.90	-131.85	-127.46	-132.84	-98.91	-132.00	-139.01	-140.64	-147.33	-131.75	-131.01	-126.16	-132.31	-99.09	-125.09	15.73
5	32.00	1.891	-140.99	-123.02	-144.86	-143.17	-153.08	-121.58	-144.57	-149.41	-150.38	-149.91	-144.71	-146.35	-149.76	-146.95	-122.26	-142.13	10.35
6	25.60	1.570	-136.88	-118.02	-136.52	-137.33	-146.40	-117.17	-136.80	-151.07	-153.44	-153.77	-136.48	-136.60	-137.06	-138.71	-116.81	-136.90	11.55
7	21.33	1.495	-78.59	-70.58	-98.70	-99.75	-94.96	-65.55	-96.97	-114.89	-118.78	-120.26	-100.05	-93.40	-78.36	-104.02	-60.83	-93.12	18.02
8	18.29	1.991	-24.16	-19.27	-28.68	-31.37	-16.23	-30.04	-52.07	-16.07	-18.06	-23.71	-27.79	-.89	-35.06	-24.36	-17.64	-24.33	10.93
9	16.00	3.167	-15.47	-11.10	-9.14	-11.74	-12.53	-16.15	-25.73	-11.28	-13.29	-16.54	-8.08	11.58	-22.83	-11.85	-10.56	-12.35	7.91
10	14.22	6.835	-9.18	-9.07	-4.13	-6.36	-11.41	-13.24	-9.73	-9.11	-10.47	-10.53	-4.14	3.12	-19.98	-7.25	-8.75	-8.68	4.84
11	12.80	12.966	-9.80	-8.37	-7.36	-8.21	-10.79	-10.28	-3.81	-10.50	-11.48	-12.88	-7.22	-3.78	-16.74	-8.47	-8.95	-9.24	3.16
12	11.64	28.316	-9.15	-6.48	-8.22	-8.72	-8.10	-8.94	-3.64	-7.95	-7.65	-8.26	-7.86	-4.57	-10.64	-8.08	-7.25	-7.70	1.68
13	10.67	71.741	-6.84	-5.07	-6.73	-7.14	-5.99	-8.79	-7.99	-4.61	-3.25	-1.91	-6.47	-4.23	-6.98	-6.29	-5.86	-5.88	1.74
14	9.85	108.959	-5.20	-5.02	-5.66	-5.74	-5.11	-9.72	-7.70	-3.79	-3.02	-1.96	-5.51	-4.45	-7.47	-5.19	-5.18	-5.38	1.82
15	9.14	85.967	-5.53	-3.75	-5.13	-4.60	-4.66	-6.86	-6.65	-3.64	-2.79	-2.42	-4.74	-4.32	-8.50	-4.70	-4.09	-4.82	1.53
16	8.53	64.151	-6.19	-2.59	-4.65	-3.85	-4.61	-4.03	-5.12	-3.69	-2.30	-2.01	-4.03	-3.55	-8.11	-4.59	-3.85	-4.21	1.47
17	8.00	44.122	-6.26	-4.30	-5.77	-5.38	-4.35	-7.36	-4.13	-3.45	-2.72	-2.15	-5.33	-4.39	-7.69	-5.27	-4.78	-4.89	1.48
18	7.53	33.640	-5.44	-5.47	-6.18	-6.08	-3.59	-8.15	-6.00	-2.53	-3.26	-2.06	-5.97	-5.75	-8.21	-4.69	-4.90	-5.22	1.73
19	7.11	27.702	-6.14	-5.21	-6.48	-5.79	-3.91	-4.62	-6.64	-2.79	-3.22	-1.97	-6.00	-6.16	-9.65	-4.86	-4.90	-5.22	1.80
20	6.74	17.583	-6.84	-3.04	-6.26	-5.16	-2.71	-2.98	-4.32	-1.73	-1.71	-.62	-5.27	-4.97	-9.59	-3.86	-4.02	-4.21	2.21
21	6.40	13.446	-5.25	-1.12	-3.85	-3.14	.87	9999.99	-3.11	1.88	.02	1.94	-3.07	-3.58	-7.10	1.23	-1.67	-1.85	2.67
22	6.10	10.163	-5.36	-2.53	-5.49	-4.56	3.34	9999.99	-4.84	4.44	-.70	2.21	-4.77	-6.01	-9.91	9999.99	-1.91	-2.78	3.98
23	5.82	8.283	-3.32	-2.17	-5.54	-4.51	8.19	9999.99	-5.17	9.59	.94	4.00	-4.51	-5.30	-8.27	9999.99	-1.20	-1.33	5.30
24	5.57	6.169	-3.90	-1.54	-6.90	-4.14	9999.99	9999.99	-6.88	9999.99	7.07	9.66	-4.96	-5.39	-11.44	9999.99	2.05	-2.41	6.02
25	5.33	5.089	-4.51	-.21	-8.58	-5.11	9999.99	9999.99	-8.86	9999.99	8.48	10.35	-5.98	-6.50	-13.00	9999.99	2.94	-2.83	7.05
26	5.12	5.350	-2.67	5.49	-4.05	-2.02	9999.99	9999.99	-4.07	9999.99	9.64	12.51	-1.55	-2.55	-6.26	9999.99	5.69	.91	5.99
27	4.92	5.350	3.93	9.47	.43	2.16	9999.99	9999.99	-.46	9999.99	17.33	19.71	2.51	1.73	-1.71	9999.99	11.63	6.05	7.02
28	4.74	4.622	15.95	13.57	9999.99	9999.99	9999.99	9999.99	9999.99	9999.99	27.65	29.22	9999.99	9999.99	9999.99	9999.99	19.42	21.16	6.24
29	4.57	4.037	18.70	19.68	9999.99	9999.99	9999.99	9999.99	9999.99	9999.99	31.55	31.90	9999.99	9999.99	9999.99	9999.99	24.68	25.30	5.62
30	4.41	4.504	27.86	26.77	9999.99	9999.99	9999.99	9999.99	9999.99	9999.99	36.63	36.24	9999.99	9999.99	9999.99	9999.99	30.94	31.69	4.11
31	4.27	5.318	38.74	33.07	9999.99	9999.99	9999.99	9999.99	9999.99	9999.99	43.67	43.63	9999.99	9999.99	9999.99	9999.99	36.42	39.11	4.13

Table B.10 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 02/02/94 07:00 HOURS Hmo=1.22 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(16f5.1) FACTOR=1.0

	Period	Energy						DIRECTION (degrees) for 15 different gauge triads										Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	1.272	-87.60	-17.70	11.60	27.28	12.87	-28.95	-119.48	133.64	111.37	109.55	.47	32.56	-75.75	-33.23	3.95	-.68	70.19
3	64.00	2.017	168.88	125.72	159.30	139.82	140.44	-172.39	155.85	149.69	143.10	139.26	149.39	164.88	175.74	146.27	116.57	150.79	17.97
4	42.67	2.256	159.05	-175.81	-178.31	173.58	158.27	168.20	-172.60	158.23	159.36	156.81	179.29	-175.02	-179.44	170.09	-180.00	172.13	10.94
5	32.00	2.125	-177.53	-161.50	-168.39	-172.58	178.23	-162.08	-173.14	173.84	169.49	167.34	-169.06	-165.14	-171.66	-172.02	-162.90	-173.78	9.69
6	25.60	1.747	-165.76	169.71	-170.70	179.20	174.57	-163.79	173.51	171.53	163.45	160.37	-175.13	-161.24	171.90	-176.09	-166.57	-179.67	11.82
7	21.33	1.550	-2.82	8.85	-18.49	19.88	66.65	-1.15	-91.82	93.23	92.65	92.63	8.87	-52.25	22.60	1.14	-9.96	15.25	51.28
8	18.29	2.064	8.57	.31	-1.22	-1.17	7.72	-4.52	3.45	2.46	-1.44	-9.45	.22	9.48	-10.44	4.47	1.69	.68	5.66
9	16.00	2.847	5.35	7.01	5.68	3.07	-1.31	-3.99	3.52	3.20	1.95	.12	6.86	16.85	-6.45	3.97	3.83	3.31	5.18
10	14.22	4.790	-1.36	2.93	-.92	-3.40	-2.66	-4.49	-2.73	-1.79	-1.03	-2.23	-.04	8.78	-3.52	-2.33	.99	-.92	3.16
11	12.80	8.089	-5.00	.03	-4.86	-5.41	-3.25	-6.63	.15	-4.34	-4.40	-5.89	-3.87	.67	-3.45	-5.06	-1.41	-3.52	2.23
12	11.64	17.468	-8.60	-6.78	-9.45	-9.39	-7.69	-9.31	-8.73	-6.75	-5.60	-5.07	-8.86	-6.26	-10.37	-9.09	-7.75	-7.98	1.52
13	10.67	62.968	-9.83	-8.14	-9.80	-9.55	-8.57	-11.64	-9.37	-7.53	-5.89	-4.96	-9.42	-7.80	-10.31	-9.68	-8.79	-8.75	1.65
14	9.85	125.977	-10.05	-8.92	-10.32	-10.05	-9.22	-13.86	-10.14	-8.21	-6.78	-5.68	-9.97	-8.71	-10.56	-10.25	-9.52	-9.48	1.77
15	9.14	121.447	-10.36	-8.65	-10.43	-10.03	-9.76	-12.35	-11.02	-8.83	-7.31	-6.18	-9.99	-9.18	-10.80	-10.59	-9.69	-9.68	1.46
16	8.53	73.057	-9.09	-7.39	-8.85	-8.50	-8.42	-10.83	-9.63	-7.43	-6.01	-4.75	-8.44	-7.87	-8.94	-9.20	-8.35	-8.25	1.41
17	8.00	49.311	-6.64	-5.00	-7.04	-6.61	-5.97	-10.15	-6.73	-5.00	-3.83	-2.75	-6.50	-5.88	-6.79	-6.86	-6.19	-6.13	1.60
18	7.53	40.809	-5.35	-2.48	-4.59	-4.13	-2.48	-7.52	-3.53	-1.26	.03	1.00	-3.99	-3.06	-4.63	-3.65	-3.12	-3.25	2.03
19	7.11	47.966	-3.84	-.77	-3.19	-2.44	-1.00	-3.72	-2.67	.25	1.44	2.25	-2.53	-2.07	-4.46	-2.05	-1.29	-1.74	1.86
20	6.74	52.993	-.93	1.43	-1.40	-.74	1.55	1.95	-.90	2.91	3.84	4.75	-.76	-.30	-2.18	.51	.82	.70	1.95
21	6.40	62.103	7.71	8.19	6.56	7.03	10.34	9.38	6.63	12.35	12.20	13.02	6.97	7.39	5.92	9.98	8.30	8.80	2.23
22	6.10	103.228	14.19	15.47	13.87	14.43	16.30	13.55	13.77	18.82	19.32	20.06	14.19	14.44	13.15	16.76	15.17	15.57	2.15
23	5.82	139.888	17.62	19.04	18.51	18.94	19.80	15.70	18.49	22.59	23.63	24.38	18.71	18.97	18.05	20.13	18.96	19.57	2.23
24	5.57	163.821	21.11	21.28	21.79	21.82	22.97	19.15	21.64	25.73	26.96	27.63	21.80	22.26	21.47	23.16	21.91	22.71	2.24
25	5.33	182.699	22.93	21.92	22.08	21.79	23.98	21.41	21.95	26.73	27.64	28.28	22.08	22.55	21.85	23.77	22.78	23.45	2.18
26	5.12	165.702	25.32	24.30	24.49	23.57	25.94	25.38	24.32	28.64	29.40	30.13	24.47	25.04	24.58	25.67	24.80	25.74	1.93
27	4.92	108.766	30.22	28.32	30.36	29.30	30.79	29.65	30.21	33.15	33.36	33.83	30.22	30.81	30.54	31.79	29.05	30.77	1.56
28	4.74	79.302	36.04	31.13	31.83	31.07	33.54	9999.99	31.61	37.57	36.73	36.91	31.69	32.20	30.93	37.31	31.91	33.61	2.56
29	4.57	66.289	36.00	29.49	29.48	28.44	32.59	9999.99	29.60	37.58	36.77	36.82	29.33	29.97	27.74	36.56	30.85	32.23	3.54
30	4.41	46.357	30.96	29.76	29.89	27.58	32.41	9999.99	30.41	33.12	32.45	31.48	29.74	30.53	29.40	9999.99	31.36	30.70	1.44
31	4.27	33.321	32.14	31.03	9999.99	9999.99	32.16	9999.99	9999.99	33.90	32.07	31.11	9999.99	9999.99	9999.99	9999.99	32.01	32.06	.88

Table B.9 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 02/02/94 04:00 HOURS Hmo= .92 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(16f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	1.235	-139.86	-131.16	-146.19	-148.12	-148.93	-137.76	96.59	-69.65	-72.49	-76.67	-147.14	-148.48	-149.28	-143.96	-130.30	-133.17	44.11
3	64.00	2.316	-128.49	-103.25	-120.97	-120.79	-123.95	-89.81	-117.56	-117.09	-115.21	-112.75	-120.03	-119.30	-121.14	-121.49	-101.33	-115.61	9.75
4	42.67	2.159	-126.00	-111.70	-123.91	-123.93	-124.91	-105.28	-121.91	-132.37	-134.95	-134.11	-122.80	-122.87	-124.22	-121.70	-109.08	-122.67	8.19
5	32.00	1.784	-145.91	-121.81	-141.25	-143.76	-145.16	-116.89	-142.45	-151.92	-155.80	-155.54	-141.62	-141.65	-141.00	-138.23	-117.24	-140.08	11.86
6	25.60	1.541	-164.77	-111.01	-151.17	-161.63	-159.05	-106.50	-147.70	-177.64	175.52	169.42	-152.34	-148.75	-146.01	-142.14	-100.93	-150.06	25.75
7	21.33	1.426	-60.50	-42.81	-68.33	-58.66	-56.81	-66.20	-87.09	-73.75	-71.79	-69.07	-59.40	-56.25	-65.27	-64.20	-44.05	-62.94	10.78
8	18.29	2.060	-20.60	-15.20	-23.37	-23.50	-16.45	-24.67	-20.43	-16.30	-18.49	-21.23	-19.72	-6.31	-20.33	-21.63	-17.07	-19.03	4.35
9	16.00	3.016	-15.32	-6.85	-12.17	-14.81	-13.67	-11.29	-16.40	-13.87	-14.79	-16.46	-10.35	2.39	-8.39	-15.27	-11.68	-11.94	4.71
10	14.22	5.084	-13.91	-6.30	-9.76	-10.82	-12.80	-11.40	-16.28	-11.70	-11.07	-10.24	-8.59	-2.79	-13.32	-11.49	-10.39	-10.72	3.08
11	12.80	10.496	-10.54	-5.26	-7.77	-7.69	-8.99	-9.33	-10.36	-7.57	-6.32	-5.30	-7.03	-4.71	-11.58	-8.26	-7.06	-7.85	1.97
12	11.64	23.570	-8.02	-6.14	-7.83	-7.73	-7.28	-9.91	-8.33	-6.17	-5.16	-4.21	-7.41	-5.91	-9.06	-7.53	-6.91	-7.17	1.43
13	10.67	67.299	-8.69	-6.92	-8.74	-8.36	-7.71	-12.06	-8.91	-6.70	-5.41	-4.57	-8.32	-7.12	-9.64	-8.36	-7.83	-7.96	1.70
14	9.85	131.791	-9.32	-6.89	-8.87	-8.37	-8.13	-12.06	-9.23	-7.32	-5.96	-5.33	-8.47	-7.81	-9.81	-8.57	-7.86	-8.27	1.56
15	9.14	123.184	-9.00	-6.44	-8.26	-7.72	-7.56	-11.62	-8.38	-6.79	-5.44	-4.84	-7.86	-7.37	-9.20	-8.08	-7.17	-7.72	1.56
16	8.53	76.830	-8.25	-5.36	-7.56	-6.95	-6.41	-10.47	-7.37	-5.55	-4.08	-3.43	-7.04	-6.45	-8.11	-7.30	-6.05	-6.69	1.66
17	8.00	57.243	-6.30	-4.08	-6.45	-5.70	-5.16	-7.94	-6.80	-4.22	-3.07	-2.36	-5.88	-5.64	-7.13	-5.91	-5.05	-5.45	1.46
18	7.53	42.831	-4.52	-3.89	-5.30	-4.83	-3.55	-6.20	-5.50	-2.38	-1.70	-.68	-4.89	-4.48	-5.81	-4.38	-4.28	-4.16	1.48
19	7.11	26.699	-5.22	-3.34	-4.11	-3.58	-1.07	-5.75	-4.37	.35	.41	1.70	-3.63	-3.10	-5.61	-1.48	-2.87	-2.78	2.21
20	6.74	21.130	-2.36	-.19	-1.22	-.63	2.51	-2.05	-1.27	4.05	3.38	4.85	-.54	-.07	-2.79	2.45	-.22	.39	2.35
21	6.40	14.672	1.27	1.05	.14	.59	5.87	2.68	.56	7.81	5.87	7.66	.75	1.51	-.48	5.03	1.47	2.78	2.75
22	6.10	14.650	5.37	6.54	4.52	5.11	11.95	14.49	3.46	14.33	12.03	13.59	5.19	5.50	3.18	12.20	7.26	8.31	4.08
23	5.82	15.191	11.79	9.40	8.32	8.56	17.28	10.77	7.08	20.17	16.12	17.18	8.77	9.02	6.25	17.37	10.86	11.93	4.31
24	5.57	20.251	18.45	16.42	15.27	14.86	24.09	17.20	14.85	27.76	25.28	26.12	15.39	15.81	14.11	26.96	18.90	19.43	4.89
25	5.33	37.780	23.07	22.64	23.18	22.76	26.10	28.54	22.72	28.83	28.32	28.92	23.11	23.64	22.94	27.95	23.48	25.08	2.56
26	5.12	47.345	30.70	27.96	31.78	31.55	32.44	33.13	31.26	34.60	33.69	34.08	31.61	32.13	31.97	33.97	28.65	31.97	1.82
27	4.92	59.820	35.21	32.22	37.13	36.88	36.18	34.32	36.91	38.87	38.61	39.27	36.95	37.32	37.29	37.76	32.99	36.53	1.98
28	4.74	58.261	36.07	33.20	38.23	37.90	36.99	35.21	38.02	40.17	39.85	40.69	38.06	38.41	38.43	38.58	33.91	37.58	2.09
29	4.57	46.477	37.95	36.81	41.72	42.07	40.21	38.85	41.60	43.58	43.40	44.15	41.64	41.79	41.85	41.75	37.33	40.98	2.20
30	4.41	33.121	38.99	39.17	45.09	45.94	41.81	40.81	45.08	45.07	45.15	45.98	45.08	45.10	45.11	44.65	39.68	43.51	2.52
31	4.27	29.842	40.88	38.71	44.58	45.04	42.54	40.93	44.53	44.88	44.59	45.10	44.55	44.59	44.60	44.59	39.48	43.31	2.13

Table B.11 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 02/02/94 10:00 HOURS Hmo=1.48 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(16f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	1.535	115.94	60.01	62.85	67.69	73.39	56.00	52.09	91.22	91.25	91.24	59.56	60.64	-157.90	74.29	57.08	75.53	36.66
3	64.00	2.805	128.55	49.52	46.65	57.13	57.70	44.18	46.20	86.59	87.47	87.25	46.33	46.58	-136.11	47.52	36.19	62.29	47.01
4	42.67	2.791	130.36	70.10	77.68	75.10	82.85	60.78	73.87	104.66	102.54	102.39	68.83	81.53	152.69	64.27	60.46	86.13	25.76
5	32.00	2.332	132.11	72.51	107.85	101.86	107.96	61.78	93.51	112.91	109.87	109.48	101.54	108.99	123.83	101.10	62.59	100.83	19.70
6	25.60	2.179	100.02	47.13	114.71	103.01	111.63	42.03	108.95	127.59	125.24	122.38	102.71	140.66	107.00	102.80	28.42	100.94	31.96
7	21.33	2.249	88.57	35.86	83.11	80.94	90.99	30.75	86.06	71.12	66.56	59.64	76.16	92.85	88.24	78.52	20.49	70.63	22.48
8	18.29	2.579	18.83	13.35	5.02	7.34	14.79	15.12	-.11	15.13	13.57	10.30	8.48	14.71	4.53	13.56	9.42	10.94	4.94
9	16.00	3.421	2.26	4.75	-1.50	-3.11	-1.89	4.10	-7.45	2.24	2.20	1.21	.43	9.44	-8.14	1.08	2.81	.56	4.37
10	14.22	4.522	-5.63	-3.59	-9.76	-10.88	-7.22	-6.51	-9.03	-6.95	-8.33	-11.91	-8.18	-1.70	-16.67	-6.62	-4.35	-7.82	3.52
11	12.80	9.347	-11.00	-7.97	-12.70	-12.68	-9.95	-15.99	-13.95	-9.29	-8.60	-9.74	-11.78	-7.99	-16.77	-10.88	-8.76	-11.20	2.67
12	11.64	21.127	-9.87	-7.02	-10.33	-9.76	-8.37	-13.78	-12.16	-7.45	-6.29	-6.37	-9.66	-8.04	-13.52	-9.06	-7.72	-9.29	2.30
13	10.67	46.616	-9.27	-7.20	-9.19	-8.79	-7.79	-13.05	-9.64	-6.75	-5.62	-5.01	-8.70	-7.55	-10.73	-8.71	-7.72	-8.38	1.92
14	9.85	72.425	-9.63	-7.89	-9.62	-9.20	-8.53	-13.80	-9.42	-7.57	-6.33	-5.54	-9.14	-8.11	-10.95	-9.53	-8.66	-8.93	1.86
15	9.14	75.524	-11.79	-9.20	-11.54	-10.96	-10.99	-14.18	-11.72	-10.39	-8.97	-8.41	-10.96	-10.29	-12.88	-11.68	-10.55	-10.97	1.43
16	8.53	77.530	-10.78	-7.67	-9.85	-9.36	-9.82	-13.38	-9.84	-9.28	-7.80	-7.15	-9.26	-8.84	-10.13	-10.31	-9.13	-9.51	1.43
17	8.00	64.157	-9.17	-5.33	-8.66	-8.03	-8.25	-9.61	-8.17	-7.73	-5.89	-5.26	-7.83	-7.56	-8.63	-9.18	-7.15	-7.76	1.30
18	7.53	66.141	1.96	3.47	.99	1.23	3.47	-1.62	.18	4.89	5.90	6.92	1.45	1.55	.59	1.89	3.29	2.41	2.19
19	7.11	94.002	15.01	12.74	13.55	13.04	16.62	14.11	12.92	18.97	18.01	19.09	13.48	14.11	13.49	17.19	13.50	15.05	2.20
20	6.74	154.970	22.68	20.72	22.03	21.59	23.28	22.24	21.92	26.51	26.54	27.61	21.97	22.67	21.98	24.37	20.79	23.13	2.08
21	6.40	249.764	23.22	22.14	22.41	21.83	23.35	22.49	22.07	26.89	27.72	28.79	22.47	23.18	22.28	23.57	21.85	23.62	2.18
22	6.10	332.867	25.54	23.76	24.76	23.94	25.44	22.90	24.22	28.56	29.33	30.12	24.76	25.49	24.65	25.54	23.84	25.52	2.06
23	5.82	355.348	27.25	25.21	26.01	25.43	26.60	23.60	25.67	30.12	30.95	31.75	26.00	26.59	25.60	26.81	25.34	26.86	2.22
24	5.57	255.429	28.24	26.63	28.45	27.28	28.49	27.06	27.71	30.95	31.66	32.23	28.39	29.08	28.52	28.77	26.87	28.69	1.64
25	5.33	187.453	31.76	29.04	30.35	28.65	31.75	29.84	29.64	34.81	34.82	35.19	30.31	31.01	30.39	32.52	29.70	31.32	2.07
26	5.12	171.918	34.75	30.40	32.26	30.48	32.92	30.99	31.71	37.55	37.39	37.90	32.10	32.85	31.84	35.00	31.33	33.30	2.50
27	4.92	148.769	33.67	30.92	33.84	32.08	32.77	31.22	33.48	37.12	37.30	37.87	33.61	34.39	33.57	35.36	31.61	33.92	2.10
28	4.74	95.350	33.28	31.96	35.28	33.58	33.60	9999.99	35.05	37.95	38.07	38.52	35.06	35.84	35.23	36.64	32.62	35.19	1.99
29	4.57	61.800	34.20	34.21	9999.99	9999.99	33.97	9999.99	9999.99	38.22	37.78	37.97	9999.99	9999.99	9999.99	9999.99	34.63	35.85	1.86
30	4.41	49.248	36.26	35.26	9999.99	9999.99	9999.99	9999.99	9999.99	38.91	37.52	37.25	9999.99	9999.99	9999.99	9999.99	36.07	36.88	1.18
31	4.27	37.928	37.78	33.37	9999.99	9999.99	9999.99	9999.99	9999.99	38.97	36.88	36.51	9999.99	9999.99	9999.99	9999.99	34.19	36.28	1.95

Table B.12 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 02/02/94 13:00 HOURS Hmo=1.54 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(16f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	2.563	26.05	55.80	139.50	128.88	95.22	38.65	81.45	121.13	117.00	111.72	124.59	101.49	61.92	115.94	44.26	92.09	35.59
3	64.00	4.561	123.39	88.84	110.44	101.66	105.57	-153.03	102.93	109.48	108.10	108.54	101.32	108.98	125.20	101.13	80.81	109.62	27.49
4	42.67	4.485	87.17	62.37	83.83	77.91	78.61	50.33	85.11	81.80	82.62	82.61	75.75	78.97	87.32	71.21	54.28	76.08	11.19
5	32.00	3.649	54.08	41.90	47.74	51.22	51.42	41.63	48.09	76.05	77.68	78.83	47.35	47.49	48.08	46.61	33.20	52.64	13.26
6	25.60	2.866	37.33	34.79	31.87	35.83	42.43	34.32	29.44	68.58	69.34	72.59	33.76	32.62	34.28	37.38	26.65	41.19	14.81
7	21.33	2.453	41.53	43.01	48.98	50.19	47.40	27.71	49.36	51.80	51.24	55.12	48.35	48.75	48.26	45.41	28.32	45.73	7.65
8	18.29	2.527	34.71	29.58	39.60	40.79	20.30	4.97	36.18	46.40	47.71	54.53	40.10	40.99	38.85	32.05	21.29	35.28	11.97
9	16.00	2.880	4.13	6.18	5.60	3.77	-3.25	-3.99	-1.71	3.59	6.12	8.28	7.09	13.68	-5.14	1.39	2.40	3.21	4.94
10	14.22	5.096	-6.71	-1.53	-7.39	-6.87	-8.36	-7.37	-4.06	-8.06	-7.96	-10.11	-5.80	-3.60	-16.48	-6.70	-4.91	-7.06	3.26
11	12.80	8.252	-8.31	-5.22	-10.34	-9.37	-8.82	-10.09	-9.38	-7.44	-6.36	-6.09	-9.17	-7.72	-15.59	-8.49	-7.13	-8.63	2.35
12	11.64	18.388	-9.33	-8.83	-11.16	-11.11	-9.47	-11.96	-11.18	-8.00	-6.15	-4.42	-10.67	-8.17	-11.61	-11.02	-9.84	-9.53	2.07
13	10.67	47.511	-9.71	-9.29	-11.51	-11.25	-9.33	-14.62	-11.79	-8.28	-7.05	-5.92	-11.07	-9.58	-11.83	-10.68	-9.87	-10.12	2.04
14	9.85	92.473	-10.31	-9.98	-11.67	-11.20	-10.14	-14.71	-12.29	-9.32	-8.57	-7.87	-11.31	-10.70	-13.21	-10.78	-10.49	-10.84	1.67
15	9.14	103.072	-9.94	-7.54	-9.63	-8.99	-9.35	-10.88	-10.39	-8.50	-7.30	-6.45	-9.08	-8.75	-10.78	-9.39	-9.11	-9.07	1.21
16	8.53	75.575	-7.74	-5.04	-7.15	-6.47	-7.07	-7.06	-8.14	-5.90	-4.25	-3.10	-6.51	-6.09	-8.11	-7.24	-6.80	-6.45	1.36
17	8.00	74.176	-2.26	-1.68	-3.25	-2.69	-1.94	-3.81	-4.11	-.38	.83	1.80	-2.76	-2.06	-4.52	-2.69	-2.55	-2.14	1.68
18	7.53	114.422	4.86	6.24	4.65	5.03	5.89	5.99	3.49	7.69	8.80	9.71	5.14	5.67	4.14	5.43	5.31	5.87	1.63
19	7.11	214.846	14.43	14.74	14.56	14.50	16.43	15.31	14.05	19.03	19.58	20.60	14.72	15.33	14.69	16.39	14.66	15.93	2.03
20	6.74	373.262	21.87	20.95	21.98	21.86	23.20	20.84	21.64	26.21	26.90	27.75	21.97	22.55	21.99	23.32	21.29	22.95	2.12
21	6.40	435.710	26.66	25.17	26.98	26.71	27.44	25.17	26.48	30.55	31.21	32.05	26.90	27.41	27.00	27.82	25.57	27.54	2.03
22	6.10	391.301	29.81	28.22	30.95	30.82	30.70	28.77	30.51	33.65	34.24	34.89	30.84	31.31	30.99	31.71	28.64	31.07	1.88
23	5.82	267.722	31.00	30.26	34.35	34.32	32.94	30.55	34.05	35.70	36.38	37.02	34.20	34.65	34.60	34.62	30.78	33.70	2.07
24	5.57	186.215	31.65	30.52	34.59	34.48	32.92	31.26	34.22	36.18	36.63	37.39	34.46	34.90	34.74	34.58	30.75	33.95	2.04
25	5.33	123.143	33.85	29.59	33.60	33.44	33.41	32.32	33.21	37.30	36.98	37.61	33.42	33.97	33.47	35.21	30.33	33.85	2.19
26	5.12	101.296	33.66	28.74	31.18	31.18	32.09	32.15	30.77	36.20	34.97	35.42	31.03	31.61	30.69	34.59	29.15	32.23	2.18
27	4.92	77.991	33.79	29.34	32.21	32.91	32.02	31.58	31.99	36.30	34.32	34.74	31.98	32.51	31.48	36.07	29.29	32.70	2.00
28	4.74	55.938	34.06	28.33	31.48	31.94	32.37	33.25	30.84	35.92	33.49	33.50	31.19	31.94	30.76	37.58	28.91	32.37	2.33
29	4.57	43.392	35.25	28.17	34.03	9999.99	34.35	9999.99	33.20	38.32	35.29	34.83	33.52	34.37	33.31	40.15	30.11	34.22	2.91
30	4.41	34.571	33.95	28.91	9999.99	9999.99	33.60	9999.99	9999.99	36.52	33.97	33.28	9999.99	9999.99	9999.99	39.87	30.50	33.82	3.15
31	4.27	27.635	35.95	30.92	9999.99	9999.99	9999.99	9999.99	9999.99	37.66	34.52	33.51	9999.99	9999.99	9999.99	45.38	32.21	35.73	4.45

Table B.13 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 02/02/94 16:00 HOURS Hmo=1.40 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(16f5.1) FACTOR=1.0

NO	Period (sec)	Energy (cm**2)	DIRECTION (degrees) for 15 different gauge triads															Mean dir	Std dev
			012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24		
2	128.00	2.400	98.92	175.60	140.73	146.98	141.61	153.48	67.02	16.25	-45.22	-55.28	144.05	144.76	96.65	143.50	159.39	131.07	75.10
3	64.00	4.431	110.78	107.13	116.50	119.09	113.66	75.77	122.65	112.58	112.38	111.82	118.89	111.88	104.65	119.92	85.59	109.71	12.37
4	42.67	4.509	110.67	89.30	110.33	110.49	107.04	70.02	144.80	113.95	112.49	111.82	110.67	106.11	107.26	111.11	73.51	106.06	17.10
5	32.00	3.614	77.68	65.15	71.25	70.86	72.05	59.87	85.32	102.43	101.49	100.45	68.64	71.77	76.86	68.28	59.82	76.68	13.82
6	25.60	2.898	57.96	55.05	55.26	56.93	55.25	51.24	56.06	76.31	77.25	78.40	54.47	55.50	57.09	53.49	50.32	59.32	9.19
7	21.33	2.328	47.51	45.69	50.84	52.06	52.06	43.54	51.38	52.53	51.85	52.60	50.48	50.47	50.26	52.46	42.76	49.77	3.19
8	18.29	2.049	20.18	15.69	15.55	15.04	13.85	11.15	8.69	14.39	12.07	10.81	17.02	22.45	15.46	16.55	13.07	14.80	3.42
9	16.00	2.786	3.81	4.86	2.29	1.54	-1.51	-3.74	2.34	-1.91	-3.19	-5.53	3.72	9.20	-5.12	.69	-.23	.48	3.95
10	14.22	3.769	-6.84	-1.47	-6.93	-7.08	-7.28	-8.35	-2.58	-8.21	-8.57	-11.47	-5.46	-.08	-13.04	-7.15	-5.21	-6.65	3.31
11	12.80	6.836	-6.69	-4.92	-6.11	-6.76	-6.82	-9.67	-4.72	-6.30	-5.75	-6.14	-5.59	-1.98	-9.53	-7.16	-6.05	-6.28	1.77
12	11.64	20.606	-9.62	-7.96	-9.42	-9.19	-9.30	-12.42	-11.22	-8.33	-7.30	-6.42	-8.97	-7.99	-11.37	-9.49	-9.13	-9.21	1.52
13	10.67	56.063	-8.92	-7.63	-9.25	-8.69	-8.70	-13.37	-10.95	-7.72	-6.80	-5.90	-8.81	-8.54	-10.73	-8.94	-8.74	-8.91	1.72
14	9.85	86.877	-9.11	-7.08	-9.35	-8.78	-8.69	-13.36	-10.40	-7.65	-6.32	-5.11	-8.78	-8.40	-9.67	-9.14	-8.60	-8.70	1.80
15	9.14	94.658	-6.93	-4.17	-6.63	-5.98	-5.84	-10.48	-7.53	-4.66	-3.01	-1.90	-6.06	-5.70	-7.10	-6.28	-5.59	-5.86	1.93
16	8.53	76.357	-3.01	-.97	-2.85	-1.99	-1.82	-6.53	-3.73	-.46	.93	1.43	-2.42	-2.32	-5.06	-2.11	-1.61	-2.17	1.97
17	8.00	91.648	-.25	1.70	-.44	.32	1.16	-1.66	-1.06	2.61	3.82	4.47	.05	.16	-1.67	.54	1.14	.73	1.76
18	7.53	137.993	2.64	4.88	2.69	3.18	4.21	4.15	1.94	5.64	7.02	7.83	3.20	3.53	2.67	3.27	4.08	4.06	1.61
19	7.11	225.281	9.98	12.62	10.77	11.08	11.69	12.51	10.44	13.62	15.15	15.98	11.19	11.62	10.90	11.34	11.54	12.03	1.64
20	6.74	308.136	18.47	20.46	19.95	20.07	20.29	20.16	19.67	22.69	23.76	24.51	20.11	20.52	19.96	21.10	19.77	20.77	1.58
21	6.40	300.805	23.93	24.45	25.79	25.78	25.84	24.56	25.36	28.57	29.17	29.89	25.70	26.14	25.82	27.39	24.65	26.20	1.72
22	6.10	245.378	26.10	26.06	27.47	27.39	27.47	26.08	26.96	30.54	31.19	31.98	27.34	27.78	27.36	29.26	26.41	27.96	1.84
23	5.82	187.559	27.38	26.22	28.55	28.28	28.92	27.45	28.26	31.85	32.33	33.12	28.37	28.89	28.64	30.39	27.08	29.05	1.94
24	5.57	137.334	26.80	26.08	28.85	28.75	29.30	28.24	28.56	31.91	32.30	32.92	28.66	29.26	29.19	30.96	26.98	29.25	1.94
25	5.33	102.308	26.74	25.46	28.76	28.30	28.28	28.46	28.13	31.14	31.34	31.96	28.54	29.32	28.91	30.76	25.96	28.80	1.84
26	5.12	84.187	29.44	26.14	32.21	31.91	30.72	28.74	31.82	33.37	32.77	33.19	31.83	32.65	32.24	34.44	27.20	31.24	2.28
27	4.92	68.456	29.55	28.31	34.86	34.96	32.67	30.66	34.66	35.02	34.12	34.51	34.54	35.20	35.20	36.53	29.18	33.33	2.51
28	4.74	50.526	29.49	29.38	35.88	36.82	32.20	32.49	35.48	35.34	34.94	35.34	35.58	36.16	36.01	36.82	29.87	34.12	2.60
29	4.57	34.113	31.04	27.98	37.03	9999.99	32.72	33.48	36.81	35.69	34.04	34.04	36.60	37.30	36.95	38.60	29.06	34.38	3.12
30	4.41	29.271	34.68	28.58	43.99	9999.99	37.11	36.24	43.98	39.36	37.12	36.51	43.85	44.01	43.97	42.19	31.57	38.80	4.90
31	4.27	23.759	36.77	31.29	50.57	9999.99	41.85	38.20	50.51	41.41	39.71	39.21	51.08	50.75	50.55	44.88	34.49	42.95	6.55

Table B.14 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 02/02/94 19:00 HOURS Hmo=1.24 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(16f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	2.254	47.84	121.82	80.93	71.75	102.70	-155.35	59.47	137.71	138.24	127.09	76.83	126.15	57.38	83.05	110.87	100.48	39.90
3	64.00	3.616	-171.10	101.04	-151.83	-174.27	171.00	-134.60	-156.11	166.07	160.78	163.46	-162.01	-157.97	-147.64	-172.17	-144.63	-172.22	29.80
4	42.67	3.501	170.65	118.63	-175.03	159.96	159.50	-151.27	-166.84	159.12	157.53	159.57	167.94	178.16	-168.03	159.97	172.61	169.66	20.25
5	32.00	2.604	141.65	103.90	166.60	149.12	143.76	-173.84	-178.30	144.26	146.68	147.55	151.23	164.06	143.92	147.04	143.07	150.79	18.54
6	25.60	2.153	70.32	58.86	82.68	74.09	86.68	54.02	124.71	95.56	95.50	95.33	71.23	83.89	68.60	77.76	52.03	79.22	18.30
7	21.33	2.048	40.89	36.88	32.23	38.57	46.65	34.30	29.38	56.85	57.69	57.53	34.42	33.19	31.45	42.49	29.49	40.10	9.78
8	18.29	2.155	-9.10	-1.70	-9.09	-8.24	-7.53	-8.38	-5.94	-2.81	-.15	-1.33	-5.91	1.12	-21.44	-7.89	-6.04	-6.29	5.22
9	16.00	2.654	-9.91	-7.70	-9.14	-10.60	-11.96	-15.40	-22.41	-8.46	-7.43	-6.41	-7.33	3.07	-21.48	-11.32	-10.33	-10.45	5.91
10	14.22	3.285	-7.36	-3.45	-6.89	-9.11	-8.29	-12.82	-19.00	-3.90	-2.70	.06	-5.21	4.79	-11.76	-7.49	-6.67	-6.65	5.40
11	12.80	5.274	-8.89	-3.42	-7.72	-7.77	-6.93	-9.43	-13.46	-4.59	-2.75	-1.96	-6.48	-1.52	-12.79	-7.76	-5.54	-6.73	3.46
12	11.64	16.061	-8.73	-4.49	-8.39	-7.37	-7.68	-8.08	-12.81	-6.27	-4.82	-4.27	-7.57	-7.21	-13.08	-7.10	-6.35	-7.61	2.47
13	10.67	39.175	-8.17	-4.69	-8.25	-7.22	-7.38	-8.60	-12.52	-5.95	-4.49	-3.67	-7.54	-7.73	-11.96	-6.71	-6.32	-7.41	2.36
14	9.85	75.896	-7.20	-5.03	-7.72	-6.97	-6.49	-8.92	-9.74	-5.28	-4.16	-3.33	-7.10	-6.80	-9.31	-6.70	-6.31	-6.74	1.74
15	9.14	90.350	-6.32	-4.94	-7.40	-6.79	-5.98	-8.01	-8.08	-5.03	-4.17	-3.62	-6.87	-6.36	-8.68	-6.43	-6.09	-6.32	1.39
16	8.53	84.884	-3.19	-2.35	-4.43	-3.64	-3.11	-4.98	-6.03	-1.97	-1.27	-.91	-4.00	-3.98	-7.01	-3.23	-3.18	-3.55	1.59
17	8.00	81.607	.06	1.17	-.73	.08	.74	-.23	-2.10	1.94	2.64	2.89	-.29	-.24	-3.25	.28	.59	.24	1.56
18	7.53	111.536	5.88	6.46	4.97	5.31	6.84	4.57	4.14	8.47	9.21	9.90	5.27	5.60	3.87	6.32	6.27	6.21	1.72
19	7.11	217.211	9.67	9.98	9.00	9.20	10.32	8.91	8.58	12.25	13.31	14.12	9.26	9.73	8.50	9.75	9.61	10.15	1.65
20	6.74	251.537	12.93	12.91	11.89	12.16	13.44	11.80	11.67	15.77	16.96	17.65	12.15	12.59	11.12	12.67	12.73	13.23	1.90
21	6.40	204.814	19.95	18.42	18.67	18.54	20.64	16.99	18.26	23.28	23.94	24.61	18.70	19.30	18.36	20.48	19.01	19.94	2.20
22	6.10	172.186	23.95	22.86	24.05	23.58	24.70	23.13	23.32	27.24	27.97	28.73	24.01	24.64	24.22	25.10	23.13	24.71	1.77
23	5.82	126.034	22.33	21.91	22.54	21.99	23.49	22.05	21.56	25.69	26.26	26.88	22.52	23.14	22.64	23.84	22.14	23.27	1.63
24	5.57	95.815	24.45	23.18	24.01	23.89	25.87	24.43	23.80	28.92	29.09	29.66	23.91	24.37	23.53	26.92	24.09	25.34	2.14
25	5.33	74.764	27.85	25.48	28.19	28.37	29.28	28.87	28.35	32.13	31.39	31.89	28.00	28.48	28.05	31.23	26.36	28.93	1.88
26	5.12	56.631	29.49	25.33	31.59	31.68	30.58	28.44	31.55	33.99	32.54	33.13	31.11	31.97	31.45	34.79	26.76	30.96	2.47
27	4.92	49.564	28.24	24.00	28.57	28.28	29.21	27.16	28.18	33.70	31.87	32.49	28.09	29.09	28.19	33.85	25.32	29.08	2.72
28	4.74	45.434	26.06	25.84	31.65	32.58	28.72	28.81	31.45	32.36	30.95	31.67	31.22	32.03	31.72	33.53	25.69	30.29	2.52
29	4.57	30.593	24.68	26.17	34.30	9999.99	29.29	30.80	34.17	30.70	29.07	29.23	33.83	34.73	34.56	36.49	26.15	31.01	3.61
30	4.41	22.120	26.04	28.14	9999.99	9999.99	31.89	34.90	9999.99	31.71	29.41	29.10	9999.99	9999.99	9999.99	42.15	29.00	31.36	4.50
31	4.27	19.085	27.16	27.10	9999.99	9999.99	30.73	35.06	9999.99	32.97	30.28	30.15	9999.99	9999.99	9999.99	9999.99	27.46	30.11	2.69

Table B.15 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 02/02/94 22:00 HOURS Hmo=1.03 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(16f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	1.407	163.11	-135.96	-150.67	-158.73	164.76	107.56	56.75	-27.14	-51.21	-61.05	-152.56	-150.04	-155.13	-173.44	-137.32	-152.10	69.20
3	64.00	2.102	-174.36	-61.52	-153.39	-161.55	138.86	17.43	-175.11	137.29	139.46	148.12	-152.89	-160.34	-149.41	178.95	-24.46	-175.10	70.00
4	42.67	1.925	155.31	65.67	156.23	149.36	128.58	48.54	159.64	139.87	136.62	132.66	156.61	155.88	162.52	143.24	37.55	133.73	40.52
5	32.00	2.101	105.07	75.63	96.71	97.61	96.37	69.69	99.92	110.08	109.35	108.43	96.99	98.01	107.73	98.07	71.07	96.16	12.93
6	25.60	2.222	85.39	68.38	81.56	82.48	82.68	64.48	90.00	94.90	94.91	94.71	81.73	82.29	85.18	83.38	64.83	82.49	9.55
7	21.33	2.275	58.96	41.82	61.56	61.49	57.35	36.96	71.32	55.28	53.24	53.70	61.62	60.80	61.31	59.87	35.49	55.42	9.65
8	18.29	2.426	22.26	13.29	28.53	29.01	12.60	7.30	21.93	3.61	.11	-6.52	28.99	32.28	24.14	17.49	5.22	16.04	11.62
9	16.00	2.994	-3.67	-4.17	-4.21	-8.72	-7.77	-8.19	-6.39	-9.82	-12.84	-17.93	-3.57	10.38	-8.80	-7.47	-7.57	-6.73	5.83
10	14.22	4.912	-8.80	-7.01	-9.35	-12.97	-10.12	-14.30	-7.06	-10.60	-12.34	-16.16	-9.07	1.15	-16.91	-9.25	-7.97	-10.05	4.23
11	12.80	10.551	-9.57	-6.17	-7.36	-8.09	-8.74	-11.00	-5.81	-7.94	-7.69	-9.24	-7.02	-3.18	-15.51	-7.64	-6.74	-8.11	2.64
12	11.64	23.798	-8.57	-6.23	-7.94	-7.92	-8.06	-8.74	-11.54	-6.40	-5.40	-4.83	-7.44	-5.56	-13.75	-7.46	-7.01	-7.79	2.25
13	10.67	43.412	-6.54	-5.43	-7.51	-7.28	-6.40	-7.98	-10.71	-4.75	-3.70	-2.79	-7.01	-5.43	-11.31	-6.59	-6.32	-6.65	2.18
14	9.85	60.518	-4.81	-3.75	-5.63	-5.56	-4.62	-7.19	-7.92	-3.07	-2.13	-1.03	-5.25	-4.10	-7.99	-4.73	-4.61	-4.83	1.88
15	9.14	60.261	-4.36	-2.66	-3.92	-4.09	-3.02	-7.08	-4.90	-1.61	-.74	.38	-3.62	-2.52	-4.61	-3.43	-2.94	-3.27	1.73
16	8.53	57.688	-2.45	.23	-1.55	-1.22	-.01	-3.28	-.99	1.42	2.60	3.33	-1.08	.01	-2.51	-.60	-.21	-.42	1.77
17	8.00	73.035	1.48	3.75	2.69	3.02	3.98	1.78	3.70	5.61	6.97	7.75	3.09	4.19	1.66	3.30	3.38	3.76	1.75
18	7.53	93.456	6.82	8.42	8.65	8.38	9.68	6.17	9.92	11.71	13.06	14.38	8.82	9.94	8.86	8.97	8.49	9.48	2.09
19	7.11	121.077	9.94	11.74	11.39	11.37	12.02	9.91	11.39	14.21	15.57	16.74	11.58	12.04	11.22	11.65	11.52	12.15	1.84
20	6.74	151.872	13.06	14.41	13.55	13.75	14.64	11.98	13.07	17.06	18.45	19.44	13.79	14.12	12.86	14.36	14.21	14.58	2.03
21	6.40	158.106	17.83	18.28	18.14	18.17	19.33	16.61	17.82	22.30	23.80	24.79	18.36	18.99	17.93	18.98	18.06	19.29	2.30
22	6.10	119.177	22.87	21.67	23.31	23.03	24.03	21.37	22.74	26.80	27.66	28.50	23.26	23.86	23.20	24.27	22.09	23.91	2.05
23	5.82	85.365	23.73	21.28	23.20	22.81	24.55	21.91	22.56	27.43	27.60	28.40	23.00	23.59	22.77	25.17	22.36	24.02	2.11
24	5.57	59.087	22.27	20.31	19.80	19.88	22.96	20.91	19.45	26.62	26.68	27.59	19.88	20.20	19.05	23.13	20.98	21.98	2.76
25	5.33	39.694	22.93	23.54	22.73	22.68	25.37	27.31	22.24	28.05	27.83	28.57	22.93	23.21	22.63	26.22	23.41	24.64	2.24
26	5.12	30.989	24.67	24.71	26.39	25.85	28.48	30.22	26.07	30.27	28.51	29.16	26.35	26.90	26.85	31.90	24.92	27.42	2.15
27	4.92	26.142	22.62	23.40	25.03	23.88	26.51	30.71	24.73	28.06	26.23	27.01	24.89	25.68	25.64	29.77	23.26	25.83	2.25
28	4.74	26.315	22.25	22.92	22.13	21.37	25.04	31.44	21.44	26.70	24.62	25.12	22.26	22.77	22.57	26.08	22.24	23.93	2.59
29	4.57	19.908	25.68	24.97	24.96	24.44	27.76	31.15	24.28	29.37	26.50	26.66	25.04	25.40	25.05	9999.99	24.43	26.12	1.96
30	4.41	12.921	27.66	26.44	9999.99	9999.99	29.73	32.76	9999.99	30.94	28.09	27.50	9999.99	9999.99	9999.99	9999.99	26.67	28.72	2.08
31	4.27	9.104	29.36	25.91	9999.99	9999.99	30.23	33.65	9999.99	33.47	31.36	30.88	9999.99	9999.99	9999.99	9999.99	27.58	30.31	2.51

Table B.16 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 03/02/94 01:00 HOURS Hmo= .82 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	1.010	25.95	29.91	-45.30	-2.55	20.28	4.89	-122.97	126.45	117.82	109.60	14.61	26.35	29.73	12.37	-2.59	24.75	60.61
3	64.00	1.791	-162.65	80.31	-136.95	-150.57	-148.21	-138.56	-136.07	-172.47	177.45	178.25	-138.09	-138.13	-136.05	-147.96	-131.98	-153.37	36.24
4	42.67	2.267	178.52	143.47	-175.86	177.44	172.56	151.02	-161.48	171.61	166.27	168.34	-179.20	172.60	-173.26	-178.41	-168.23	175.11	13.82
5	32.00	2.111	149.51	158.96	151.74	153.62	148.15	138.78	175.97	148.90	146.55	146.98	155.57	145.63	159.82	160.03	141.63	152.09	8.84
6	25.60	1.740	127.02	127.90	130.22	136.74	126.13	108.37	128.33	130.66	129.25	128.27	137.33	132.21	128.92	135.03	101.50	127.26	9.41
7	21.33	1.745	95.96	80.45	132.68	133.23	111.30	74.26	102.35	105.46	105.69	106.10	135.14	144.32	95.72	121.92	73.40	107.86	21.51
8	18.29	2.621	3.70	6.83	-5.51	-3.35	9.99	8.16	-2.71	11.35	11.66	9.46	-1.93	8.20	-3.48	5.64	5.46	4.24	5.81
9	16.00	4.084	-9.63	-4.47	-10.11	-12.40	-8.65	-7.94	-9.09	-8.62	-9.55	-12.50	-8.82	3.13	-15.42	-8.61	-6.74	-8.63	3.99
10	14.22	4.812	-7.84	-3.25	-6.06	-8.60	-6.01	-6.92	1.85	-8.04	-10.21	-14.48	-5.33	5.09	-8.85	-5.90	-4.35	-5.93	4.53
11	12.80	9.097	-7.00	-3.46	-5.25	-7.30	-4.70	-6.91	2.02	-5.21	-5.92	-8.23	-4.57	4.33	-7.01	-5.55	-4.33	-4.61	3.32
12	11.64	24.673	-6.55	-4.07	-5.32	-6.30	-4.64	-7.53	-3.44	-3.23	-1.89	-1.37	-4.91	.12	-7.53	-5.64	-5.04	-4.49	2.15
13	10.67	39.957	-8.65	-5.57	-7.19	-7.31	-6.87	-9.53	-5.07	-5.64	-4.13	-3.21	-6.71	-3.94	-9.71	-7.57	-6.95	-6.54	1.89
14	9.85	44.258	-9.25	-5.97	-8.05	-7.95	-6.46	-9.42	-3.82	-5.58	-4.20	-3.86	-7.50	-4.81	-9.39	-8.21	-6.64	-6.74	1.92
15	9.14	40.616	-4.49	-1.95	-3.72	-2.89	-1.80	-5.90	-4.45	-.50	-.25	-.34	-3.21	-2.56	-8.03	-2.26	-1.68	-2.93	2.07
16	8.53	41.013	1.18	2.99	1.02	1.98	2.52	1.26	-.94	3.77	3.72	3.61	1.42	1.21	-3.68	2.95	2.78	1.72	1.90
17	8.00	49.910	5.21	6.18	4.64	5.12	6.13	6.11	4.08	7.43	7.65	7.85	4.92	5.33	2.32	6.38	5.85	5.68	1.39
18	7.53	62.864	8.39	8.74	7.91	8.12	9.31	7.60	7.38	11.12	11.43	12.25	8.07	8.42	6.38	9.63	8.60	8.89	1.56
19	7.11	68.866	10.21	10.96	10.77	10.72	11.54	9.36	10.05	13.55	14.28	15.53	10.90	11.25	10.28	11.42	10.86	11.44	1.64
20	6.74	75.931	13.33	14.99	14.67	14.65	15.34	12.37	14.60	17.65	19.09	20.35	14.82	15.17	14.89	14.95	14.97	15.45	1.99
21	6.40	88.752	17.13	18.60	18.75	18.66	18.71	16.55	19.52	21.39	22.79	24.07	18.87	19.27	18.92	18.58	18.26	19.34	1.92
22	6.10	72.430	21.21	19.97	21.33	20.83	21.67	19.29	21.80	24.66	25.22	26.63	21.25	21.68	21.24	21.85	20.32	21.93	1.95
23	5.82	53.093	23.68	21.82	23.35	23.02	24.76	22.55	23.22	27.68	27.99	29.06	23.27	23.73	23.29	25.04	22.72	24.34	2.11
24	5.57	34.717	24.29	22.70	24.10	24.17	25.33	25.00	23.53	27.98	28.11	28.95	24.12	24.40	23.96	25.63	23.31	25.04	1.81
25	5.33	22.661	25.56	22.15	24.70	25.01	26.24	23.48	23.98	28.96	28.18	28.81	24.57	24.90	24.06	27.76	23.24	25.44	2.04
26	5.12	19.529	26.35	21.97	24.53	24.66	26.74	9999.99	23.93	29.65	28.48	28.81	24.36	25.00	23.46	29.82	23.20	25.78	2.45
27	4.92	17.681	26.15	22.55	22.34	22.25	26.46	9999.99	21.90	30.25	29.17	29.57	22.39	22.95	21.06	30.46	23.63	25.08	3.35
28	4.74	15.104	23.83	23.30	25.17	24.49	26.02	9999.99	24.90	28.99	29.16	29.71	25.03	25.65	24.49	28.52	24.37	25.97	2.09
29	4.57	11.755	21.62	22.29	23.18	22.14	25.23	9999.99	22.82	28.08	29.12	29.58	23.21	23.75	22.77	26.33	24.16	24.59	2.57
30	4.41	7.719	22.00	24.18	28.65	9999.99	27.63	9999.99	28.43	30.79	31.60	32.31	28.45	28.88	28.94	9999.99	26.05	28.16	2.83
31	4.27	5.116	20.81	23.53	9999.99	9999.99	28.33	9999.99	9999.99	30.72	29.43	30.49	9999.99	9999.99	9999.99	9999.99	24.37	26.81	3.60

Table B.17 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 03/02/94 04:00 HOURS Hmo= .67 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

NO	Period (sec)	Energy (cm**2)	DIRECTION (degrees) for 15 different gauge triads															Mean dir	Std dev
			012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24		
2	128.00	1.047	-102.21	-111.47	-100.35	-105.34	-99.73	-97.28	-103.04	-147.83	-166.18	177.88	-104.14	-103.93	-108.73	-97.78	-103.07	-114.04	25.94
3	64.00	1.657	-103.97	-106.58	-123.42	-121.73	-115.88	-96.86	-123.29	-133.70	-146.74	-155.04	-123.98	-122.28	-118.64	-117.24	-102.09	-120.65	15.25
4	42.67	1.783	-134.20	-131.03	-140.76	-143.38	-135.45	-123.69	-140.12	-154.94	-167.91	-170.24	-141.40	-141.62	-139.76	-135.30	-122.26	-141.37	13.26
5	32.00	1.533	173.61	163.03	174.17	168.21	170.30	169.15	175.62	167.87	164.61	163.63	170.30	174.32	178.57	169.29	178.49	170.74	4.80
6	25.60	1.120	150.61	158.79	163.89	166.47	145.72	146.15	172.08	143.66	144.12	145.65	165.76	161.65	148.10	161.27	129.85	153.60	11.21
7	21.33	1.373	13.16	-1.72	-2.98	-7.64	26.13	-12.63	-33.26	31.27	31.94	30.67	-.36	12.12	9.69	4.61	2.97	7.02	17.67
8	18.29	2.012	-2.80	-4.51	-6.36	-10.16	-.66	-24.77	-13.22	-3.79	-7.52	-12.00	-5.15	7.98	-1.50	-5.23	-3.52	-6.20	6.97
9	16.00	2.605	-9.26	-9.18	-11.01	-14.65	-10.18	-20.16	-12.57	-11.59	-14.91	-19.37	-10.09	1.91	-15.23	-11.03	-9.69	-11.81	4.97
10	14.22	4.466	-10.34	-8.78	-10.33	-12.68	-10.46	-14.75	-11.88	-10.12	-11.08	-12.67	-9.81	-1.51	-14.99	-10.64	-9.78	-10.66	3.00
11	12.80	10.346	-7.54	-6.20	-7.63	-8.25	-7.22	-10.79	-8.89	-5.93	-4.95	-4.58	-7.26	-3.53	-11.27	-7.80	-6.91	-7.25	2.03
12	11.64	24.314	-5.00	-2.48	-4.60	-4.51	-4.08	-7.09	-2.74	-3.25	-2.04	-1.80	-4.15	-2.51	-6.55	-4.29	-3.67	-3.92	1.49
13	10.67	43.814	-5.52	-2.75	-4.87	-4.49	-3.88	-6.47	-1.52	-3.33	-2.21	-2.17	-4.39	-3.13	-6.03	-4.40	-3.79	-3.93	1.40
14	9.85	49.231	-7.46	-4.95	-7.33	-6.65	-5.95	-7.02	-6.57	-5.16	-4.11	-3.96	-6.78	-5.96	-9.14	-6.56	-5.95	-6.24	1.29
15	9.14	47.327	-5.76	-3.26	-5.37	-4.48	-4.15	-5.79	-6.29	-3.07	-1.94	-1.65	-4.84	-4.40	-8.01	-4.49	-4.08	-4.50	1.60
16	8.53	43.862	-2.35	-.89	-2.37	-1.75	-.79	-4.27	-3.07	.74	1.81	2.50	-2.01	-1.57	-4.11	-1.28	-1.08	-1.37	1.85
17	8.00	38.318	1.71	3.95	2.09	3.22	3.34	1.77	.92	5.11	6.36	6.73	2.60	2.67	-.82	3.30	3.28	3.08	1.90
18	7.53	31.282	3.86	6.30	4.99	5.68	6.27	4.09	4.64	7.81	8.79	9.25	5.38	5.70	3.33	6.17	5.90	5.88	1.64
19	7.11	38.653	6.37	7.75	7.17	7.43	8.12	6.25	6.95	9.83	10.65	11.54	7.43	7.89	6.66	7.95	7.32	7.95	1.49
20	6.74	39.850	8.64	10.40	9.99	10.22	10.78	9.26	9.61	12.66	13.72	14.67	10.25	10.74	9.77	10.65	10.01	10.76	1.60
21	6.40	33.984	11.39	12.91	12.17	12.27	13.23	11.07	11.96	15.14	16.24	17.15	12.48	13.05	12.11	13.03	12.33	13.10	1.68
22	6.10	27.226	15.08	16.23	15.55	15.56	17.39	14.84	15.10	19.54	20.40	21.24	15.83	16.27	15.27	16.91	16.13	16.76	1.96
23	5.82	25.731	21.26	20.79	22.57	22.20	24.61	21.04	22.11	27.46	27.72	28.66	22.42	22.91	22.37	25.29	22.38	23.58	2.47
24	5.57	23:432	24.39	24.74	28.23	27.58	27.89	26.42	28.01	30.59	30.85	32.12	27.96	28.34	28.60	29.40	26.23	28.09	2.06
25	5.33	17.016	24.82	23.25	28.54	27.62	27.66	25.42	28.36	30.44	30.75	32.02	28.09	28.70	28.91	29.05	25.18	27.92	2.31
26	5.12	13.014	23.93	22.53	25.55	25.46	25.68	24.56	24.88	28.40	28.34	28.89	25.22	25.80	24.87	28.23	23.61	25.73	1.85
27	4.92	11.693	23.09	21.75	22.93	23.09	24.54	24.63	22.61	27.32	25.70	26.23	22.83	23.27	21.89	28.72	21.81	24.03	2.05
28	4.74	8.238	20.95	19.68	18.98	18.38	22.66	9999.99	18.52	25.54	24.43	25.19	19.12	19.64	18.38	24.55	20.13	21.15	2.63
29	4.57	5.855	22.13	21.32	19.27	18.68	24.19	9999.99	18.69	27.56	25.78	26.65	19.61	19.96	19.06	26.29	21.29	22.18	3.15
30	4.41	3.427	21.86	24.22	9999.99	9999.99	26.83	9999.99	9999.99	30.68	27.85	29.26	9999.99	9999.99	9999.99	9999.99	23.15	26.27	3.04
31	4.27	2.414	20.73	23.66	9999.99	9999.99	28.47	9999.99	9999.99	30.76	30.31	31.32	9999.99	9999.99	9999.99	9999.99	24.78	27.15	3.80

Table B.18 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 03/02/94 07:00 HOURS Hmo= .61 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.944	-129.64	-113.74	-78.37	-77.91	-92.46	-109.33	-38.77	-89.89	-89.76	-89.46	-77.41	-91.91	-113.47	-77.64	-105.61	-91.94	20.80
3	64.00	1.446	-94.40	-85.17	-99.51	-99.82	-96.46	-82.55	-92.02	-93.14	-93.59	-93.48	-100.52	-96.56	-95.47	-98.54	-78.30	-93.32	6.30
4	42.67	1.353	-121.81	-110.08	-126.88	-126.70	-133.29	-106.04	-126.35	-138.44	-143.93	-144.74	-127.05	-126.50	-125.60	-127.91	-107.30	-126.19	11.27
5	32.00	1.349	-161.64	-144.52	-166.96	-165.79	-170.61	-162.10	-162.58	-173.09	179.55	178.83	-165.85	-169.36	-169.70	-161.23	-146.61	-165.47	9.79
6	25.60	1.265	179.69	163.55	164.72	162.59	168.76	159.61	176.22	166.10	157.18	154.89	165.76	167.79	171.31	171.83	170.07	166.67	6.51
7	21.33	1.092	-9.43	-6.87	-30.27	-31.88	32.63	1.80	-3.36	130.52	119.12	112.50	-34.42	-43.38	2.03	-11.61	6.70	2.72	55.75
8	18.29	1.624	-7.06	-5.47	-9.52	-13.14	-4.75	-4.09	-9.97	-2.02	-2.07	-.93	-9.50	1.53	-8.57	-6.27	-2.41	-5.62	3.91
9	16.00	2.600	-13.03	-12.39	-13.77	-16.42	-11.77	-14.55	-13.87	-11.35	-12.38	-14.40	-13.90	-5.85	-19.91	-12.28	-10.44	-13.09	2.93
10	14.22	3.635	-12.08	-10.81	-10.43	-12.34	-12.41	-13.55	-17.27	-11.07	-11.64	-13.04	-10.14	-4.35	-22.82	-10.80	-10.37	-12.20	3.82
11	12.80	10.707	-6.89	-3.81	-5.67	-5.45	-6.65	-7.47	-11.30	-5.35	-4.62	-4.44	-5.09	-3.99	-11.74	-5.60	-4.88	-6.19	2.31
12	11.64	32.469	-3.79	-1.64	-3.21	-2.56	-3.41	-5.80	-4.06	-2.81	-2.26	-2.36	-2.77	-2.45	-6.87	-3.02	-2.67	-3.31	1.34
13	10.67	57.476	-4.17	-2.20	-3.80	-3.38	-3.33	-6.73	-3.90	-2.44	-1.45	-.94	-3.38	-2.62	-5.27	-3.59	-3.21	-3.36	1.38
14	9.85	57.762	-6.64	-4.05	-6.44	-5.98	-5.38	-8.53	-6.11	-4.43	-2.87	-2.09	-5.90	-5.01	-6.96	-6.14	-5.20	-5.45	1.57
15	9.14	46.421	-7.62	-5.70	-8.35	-7.90	-6.57	-9.14	-7.84	-5.60	-4.02	-3.27	-7.84	-6.75	-8.87	-7.66	-6.63	-6.92	1.63
16	8.53	36.028	-5.96	-3.88	-5.89	-5.58	-4.49	-6.07	-5.51	-3.38	-1.84	-.86	-5.46	-4.27	-6.13	-5.66	-4.81	-4.65	1.54
17	8.00	26.676	-1.60	.22	-.45	-.36	.76	-2.57	.13	2.11	2.96	4.27	-.11	1.03	-.78	-.49	-.38	.32	1.68
18	7.53	23.814	3.59	3.53	3.28	3.33	5.91	2.58	3.51	7.80	7.62	9.14	3.56	4.35	3.15	5.05	3.61	4.67	1.95
19	7.11	27.692	5.78	6.51	5.80	6.19	7.86	6.03	5.04	9.93	10.07	11.33	6.12	6.41	5.19	7.78	6.49	7.10	1.85
20	6.74	28.649	6.07	7.37	6.53	6.93	8.40	7.47	5.57	10.33	10.60	11.67	6.79	6.99	5.52	8.65	7.26	7.74	1.79
21	6.40	23.322	6.21	9.45	7.01	7.91	9.16	10.82	6.65	10.63	11.13	11.68	7.63	7.80	5.71	9.51	8.35	8.64	1.81
22	6.10	17.211	8.57	10.55	8.78	9.38	12.15	12.58	8.38	13.51	13.27	14.05	9.34	9.70	8.28	11.97	10.18	10.71	1.95
23	5.82	16.134	13.69	13.55	13.34	13.62	16.79	15.20	12.63	18.91	18.73	19.80	13.63	14.09	13.11	16.61	14.22	15.19	2.29
24	5.57	13.499	17.95	18.53	19.78	19.49	22.61	19.83	19.43	25.31	25.37	26.68	19.86	20.31	19.44	23.31	19.75	21.18	2.66
25	5.33	11.202	21.39	20.86	23.18	22.57	25.40	23.75	22.98	28.25	28.42	29.54	23.11	23.62	22.48	26.63	22.61	24.32	2.60
26	5.12	8.147	21.35	18.71	21.65	21.07	23.87	9999.99	21.50	26.71	25.87	26.95	21.48	21.99	20.84	25.29	20.67	22.71	2.46
27	4.92	4.617	19.79	16.95	19.83	19.25	26.39	9999.99	19.62	29.43	25.81	27.06	19.71	20.25	19.65	28.45	19.72	22.28	3.99
28	4.74	3.277	19.06	16.26	16.00	15.89	26.93	9999.99	15.25	29.25	23.74	24.40	16.37	16.51	15.54	9999.99	19.04	19.55	4.65
29	4.57	2.209	19.36	17.13	16.91	18.77	27.87	9999.99	16.05	30.24	24.99	24.55	17.55	17.39	15.03	9999.99	19.77	20.43	4.66
30	4.41	1.277	16.36	15.10	9999.99	9999.99	28.59	9999.99	9999.99	30.79	27.78	27.08	9999.99	9999.99	9999.99	9999.99	20.42	23.73	5.87
31	4.27	.797	12.85	11.40	9999.99	9999.99	29.46	9999.99	9999.99	31.55	26.77	27.00	9999.99	9999.99	9999.99	9999.99	19.45	22.65	7.51

Table B.19 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 03/02/94 10:00 HOURS Hmo= .59 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	1.151	-134.09	-83.25	-93.35	-101.75	-87.63	-56.05	-14.38	-112.71	-108.63	-107.48	-100.81	-88.72	-104.82	-111.07	-64.92	-92.72	27.77
3	64.00	1.389	-126.44	-100.23	-114.43	-117.62	-116.94	-92.33	-111.20	-129.83	-132.09	-130.47	-116.85	-113.18	-118.52	-121.03	-93.44	-115.69	11.98
4	42.67	1.231	-100.95	-103.28	-116.04	-113.83	-113.44	-107.33	-116.43	-119.03	-119.79	-123.62	-116.62	-115.24	-106.20	-112.85	-106.18	-112.73	6.32
5	32.00	1.328	-91.59	-91.65	-114.42	-111.38	-107.68	-100.88	-119.03	-113.88	-115.93	-121.58	-116.20	-112.83	-92.16	-108.82	-94.35	-107.52	10.23
6	25.60	1.088	-131.50	-97.20	-161.30	-148.32	-143.44	-96.64	-151.31	-162.37	-173.34	173.01	-156.77	-166.03	164.90	-140.59	-94.75	-147.75	30.07
7	21.33	1.009	40.16	9.43	75.09	73.43	49.66	-6.11	150.97	64.77	66.48	73.67	77.45	63.84	58.67	51.39	3.13	55.72	36.37
8	18.29	1.749	2.80	.09	11.70	8.41	-3.03	-5.69	10.39	-5.32	-7.14	-9.57	11.80	21.87	10.38	-.86	-2.24	2.89	8.72
9	16.00	2.484	-9.14	-3.66	-2.75	-6.50	-9.72	-7.99	1.87	-10.61	-12.08	-15.54	-2.45	8.13	-10.19	-7.43	-6.13	-6.29	5.69
10	14.22	3.422	-10.12	-3.55	-2.81	-4.91	-9.72	-7.81	3.94	-11.63	-13.76	-18.42	-2.36	6.14	-12.99	-7.00	-6.27	-6.75	6.32
11	12.80	9.163	-7.57	-4.74	-5.72	-5.83	-8.28	-9.65	-.83	-8.73	-10.23	-12.81	-5.14	-1.86	-15.51	-6.25	-5.90	-7.27	3.70
12	11.64	31.911	-6.57	-5.26	-6.64	-6.26	-6.77	-8.92	-4.05	-7.08	-8.03	-9.86	-6.20	-4.68	-12.91	-6.19	-5.50	-6.99	2.15
13	10.67	73.471	-6.19	-4.48	-5.36	-4.80	-5.58	-8.53	-3.75	-5.53	-5.47	-6.71	-4.92	-3.55	-10.77	-5.61	-4.71	-5.73	1.78
14	9.85	83.290	-6.93	-4.37	-5.29	-4.83	-5.76	-8.93	-5.19	-5.08	-3.95	-4.11	-4.80	-3.26	-9.66	-6.08	-4.96	-5.55	1.71
15	9.14	61.189	-8.42	-5.68	-6.74	-6.49	-6.66	-10.59	-5.27	-5.61	-3.70	-3.01	-6.25	-4.29	-9.36	-7.90	-6.36	-6.42	1.97
16	8.53	41.599	-8.24	-5.89	-7.02	-6.92	-6.62	-10.55	-4.97	-5.59	-4.11	-3.42	-6.63	-4.82	-10.18	-7.53	-6.65	-6.61	1.93
17	8.00	27.187	-8.19	-6.96	-7.44	-7.74	-7.83	-14.13	-6.63	-6.94	-6.08	-4.84	-7.23	-6.01	-11.16	-8.03	-7.77	-7.80	2.16
18	7.53	21.117	-5.40	-4.23	-4.43	-5.01	-4.96	-10.37	-3.47	-4.17	-3.54	-1.62	-4.23	-3.46	-6.27	-5.58	-4.67	-4.76	1.84
19	7.11	17.959	-2.57	.45	-.15	-.40	1.76	2.63	2.15	2.85	2.95	5.10	.38	1.35	-1.41	.71	.52	1.09	1.85
20	6.74	14.977	-.72	1.55	.54	.49	4.12	3.46	2.74	5.66	5.40	7.91	1.16	2.02	-1.73	3.28	1.61	2.50	2.47
21	6.40	11.260	-.19	-.62	-.61	-.37	6.94	5.93	.50	9.03	5.27	9.00	-.14	.02	-5.33	5.24	1.16	2.39	4.05
22	6.10	8.469	-2.74	-3.60	-4.06	-2.96	9.39	9999.99	-3.49	11.50	2.37	6.75	-3.41	-4.03	-11.59	6.39	-.70	-.02	6.17
23	5.82	5.176	-5.65	-3.26	-5.91	-5.04	9999.99	9999.99	-4.85	9999.99	-2.45	5.69	-4.52	-5.86	-8.49	9999.99	-3.89	-4.02	3.42
24	5.57	3.778	-2.87	-2.57	-6.15	-4.04	9999.99	9999.99	-5.44	9999.99	-1.95	9.79	-4.03	-5.28	-4.68	9999.99	-4.13	-2.86	4.18
25	5.33	3.284	-3.76	-1.53	-3.92	.04	9999.99	9999.99	-4.45	9999.99	7.32	17.52	-1.48	-2.65	-8.25	9999.99	1.99	.05	6.70
26	5.12	2.763	-2.86	1.60	-2.92	.98	9999.99	9999.99	-3.66	9999.99	15.62	24.11	-.81	-2.26	-10.99	9999.99	10.02	2.58	9.58
27	4.92	1.890	-3.67	.66	-10.47	-4.11	9999.99	9999.99	-9.87	9999.99	23.66	26.66	-7.03	-9.58	-19.30	9999.99	17.96	.33	14.59
28	4.74	1.181	-10.34	-5.47	-17.33	-8.17	9999.99	9999.99	-15.68	9999.99	9999.99	26.82	-11.00	-11.19	-26.14	9999.99	9999.99	-8.94	13.80
29	4.57	.891	-24.57	-9.01	-22.45	-11.55	9999.99	9999.99	-22.00	9999.99	9999.99	9999.99	-12.71	-16.14	-31.19	9999.99	9999.99	-18.70	7.10
30	4.41	.509	-28.37	-6.49	-27.62	-13.32	9999.99	9999.99	-27.74	9999.99	9999.99	9999.99	-15.21	-19.18	-36.77	9999.99	9999.99	-21.84	9.31
31	4.27	.281	-25.91	-9.88	-29.32	9999.99	9999.99	9999.99	-31.32	9999.99	9999.99	9999.99	9999.99	9999.99	-32.13	9999.99	9999.99	-25.75	8.20

Table B.20 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 03/02/94 13:00 HOURS Hmo= .45 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.880	-79.15	-68.02	-91.44	-88.00	-85.82	-84.13	-80.16	-72.72	-74.92	-75.55	-88.32	-86.17	-82.13	-89.23	-81.09	-81.80	6.53
3	64.00	1.082	-110.30	-92.34	-108.66	-107.56	-105.88	-100.76	-114.25	-118.56	-121.71	-123.06	-106.94	-106.02	-109.87	-105.38	-97.81	-108.60	8.11
4	42.67	.912	-128.83	-113.27	-126.65	-127.93	-122.90	-112.83	-125.79	-141.65	-152.07	-153.57	-126.03	-125.54	-128.18	-121.22	-113.38	-127.91	12.03
5	32.00	.906	-142.51	-139.00	-140.29	-144.00	-141.31	-135.38	-141.24	-155.17	-163.70	-164.94	-140.71	-140.73	-139.13	-137.85	-134.90	-144.00	9.12
6	25.60	.870	-150.27	-142.64	-151.31	-153.95	-154.41	-141.51	-151.87	-168.49	-176.14	178.29	-151.60	-151.73	-151.16	-149.11	-141.53	-154.40	11.47
7	21.33	.983	-113.40	-66.71	-109.49	-118.11	-99.95	-65.48	-122.05	-157.18	-179.54	163.97	-112.59	-108.78	-119.61	-95.63	-66.07	-113.56	36.92
8	18.29	1.706	-23.72	-17.32	-15.59	-18.41	-22.57	-30.86	-7.49	-22.65	-23.88	-26.07	-14.89	-.42	-30.68	-21.19	-22.98	-19.94	7.82
9	16.00	2.664	-19.87	-14.47	-15.82	-18.24	-19.53	-28.50	-12.37	-18.95	-19.54	-20.71	-15.06	-2.29	-30.67	-17.07	-18.28	-18.09	6.28
10	14.22	3.041	-13.04	-11.56	-8.39	-10.68	-14.41	-21.40	-10.66	-12.24	-11.88	-10.08	-8.15	.81	-19.31	-12.11	-12.02	-11.68	4.81
11	12.80	5.812	-6.72	-7.37	-6.15	-6.88	-7.84	-14.76	1.34	-7.78	-9.38	-11.49	-5.85	.62	-16.22	-7.05	-6.61	-7.48	4.47
12	11.64	17.674	-5.24	-3.80	-3.35	-3.88	-4.90	-9.49	3.31	-5.03	-5.35	-6.57	-2.89	1.51	-8.22	-5.01	-4.07	-4.20	3.12
13	10.67	39.797	-5.62	-2.70	-2.96	-3.59	-5.17	-7.08	-1.02	-4.25	-3.18	-2.58	-2.42	.53	-5.87	-5.06	-4.04	-3.67	1.90
14	9.85	46.742	-7.65	-4.27	-5.68	-5.94	-7.40	-8.37	-6.34	-6.28	-4.93	-3.90	-5.11	-3.36	-8.86	-6.88	-6.15	-6.07	1.54
15	9.14	32.109	-11.88	-6.95	-9.96	-9.47	-11.19	-11.20	-12.87	-10.58	-9.47	-8.93	-9.20	-8.97	-14.55	-10.20	-9.29	-10.31	1.78
16	8.53	23.019	-11.80	-8.17	-10.58	-10.26	-10.41	-12.59	-12.22	-9.51	-8.41	-7.32	-9.97	-8.88	-14.05	-10.31	-9.64	-10.27	1.74
17	8.00	16.747	-11.10	-9.07	-10.58	-10.16	-9.56	-13.31	-12.16	-8.41	-7.25	-6.06	-10.03	-8.81	-14.92	-10.39	-9.56	-10.09	2.16
18	7.53	13.628	-9.53	-7.23	-8.66	-7.80	-8.26	-12.66	-10.74	-7.25	-6.65	-5.64	-8.02	-7.92	-14.40	-8.76	-8.21	-8.78	2.21
19	7.11	10.777	-10.96	-6.30	-9.07	-7.62	-9.83	-12.49	-10.30	-9.18	-7.46	-6.70	-8.15	-8.69	-16.58	-9.76	-8.54	-9.44	2.47
20	6.74	9.367	-11.16	-4.45	-9.41	-7.02	-8.59	9999.99	-10.30	-8.15	-6.07	-5.71	-8.08	-9.37	-16.66	-8.50	-6.64	-8.58	2.86
21	6.40	6.055	-13.77	-6.17	-10.39	-7.78	-9.02	9999.99	-10.34	-8.40	-6.83	-5.14	-8.65	-9.38	-17.10	-10.16	-8.34	-9.39	2.95
22	6.10	4.738	-22.23	-15.62	-18.87	-17.06	-26.02	9999.99	-17.88	-26.27	-18.75	-14.73	-17.49	-17.69	-25.78	-26.34	-19.86	-20.33	4.03
23	5.82	3.937	-26.41	-19.99	-25.12	-23.12	-36.18	9999.99	-23.00	-36.87	-26.56	-23.27	-23.73	-25.33	-28.80	-33.72	-26.85	-27.06	4.94
24	5.57	2.707	-33.10	-24.04	-31.47	-28.87	-43.35	9999.99	-29.43	-44.42	-38.29	-37.63	-29.88	-33.10	-37.38	-38.48	-38.15	-34.83	5.59
25	5.33	2.083	-41.39	-26.14	-33.69	-30.81	-43.53	9999.99	-32.98	-44.54	-41.12	-42.09	-32.03	-35.83	-46.58	-38.37	-41.35	-37.89	5.81
26	5.12	1.629	-42.59	-30.69	-36.35	-34.71	-45.69	9999.99	-35.78	-46.11	-42.67	-44.09	-35.74	-38.78	-48.01	-41.36	-43.17	-40.41	4.92
27	4.92	1.136	-46.02	-35.46	-40.50	-38.48	-48.55	9999.99	-40.00	-49.19	-49.26	-52.56	-39.50	-43.27	-54.25	-44.28	-50.21	-45.11	5.55
28	4.74	.830	-49.84	-36.39	-44.09	-43.37	-49.47	9999.99	-43.41	-50.16	-51.22	-53.94	-43.56	-45.63	-56.17	-47.19	-52.16	-47.62	5.05
29	4.57	.583	-55.61	-38.43	-46.80	-47.69	-50.76	9999.99	-46.18	-52.39	-52.00	-53.95	-47.52	-45.74	-60.16	-50.99	-51.57	-49.99	5.02
30	4.41	.467	-61.33	-45.15	-51.17	-54.00	-54.50	9999.99	-48.01	-56.16	-54.84	-56.87	-53.65	-50.77	-65.20	-55.50	-53.85	-54.35	4.83
31	4.27	.343	-65.32	-44.20	-52.52	-52.79	-53.69	9999.99	-50.79	-56.30	-54.89	-56.25	-52.78	-50.17	-68.29	-54.06	-53.83	-54.70	5.75

Table B.21 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 03/02/94 16:00 HOURS Hmo= .39 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.571	-127.81	-18.47	-135.48	-135.46	-117.47	-27.72	-138.44	-47.77	-41.45	-57.04	-135.66	-139.09	-135.66	-134.22	-41.77	-98.84	47.11
3	64.00	.761	-122.08	-73.47	-97.21	-99.17	-91.22	-89.24	-92.70	-100.57	-107.32	-102.02	-95.24	-91.23	-115.64	-95.74	-79.37	-96.80	11.94
4	42.67	.640	-115.77	-101.57	-108.86	-111.23	-106.81	-103.51	-108.37	-121.56	-134.10	-132.35	-108.63	-108.11	-116.90	-106.20	-101.21	-112.29	9.79
5	32.00	.489	-132.91	-120.03	-131.87	-134.96	-128.19	-118.66	-131.47	-138.71	-151.21	-148.98	-131.69	-131.77	-132.67	-123.01	-118.65	-131.63	9.33
6	25.60	.418	-103.64	-78.26	-109.26	-102.13	-105.67	-99.90	-113.43	-124.62	-132.99	-140.76	-101.84	-107.98	-106.52	-93.79	-95.55	-107.67	15.08
7	21.33	.722	-17.08	-6.07	-17.06	-17.97	-18.13	-24.60	-17.34	-16.91	-14.74	-10.85	-13.86	-1.39	-19.39	-16.61	-16.29	-15.23	5.38
8	18.29	1.676	-10.37	-5.16	-7.70	-12.03	-11.36	-13.40	-10.18	-10.18	-10.50	-11.52	-7.51	5.16	-13.37	-8.61	-7.62	-8.97	4.38
9	16.00	2.569	-14.93	-9.86	-8.73	-13.38	-14.27	-13.93	-14.66	-13.10	-12.98	-13.28	-8.93	3.75	-15.87	-12.18	-11.25	-11.59	4.59
10	14.22	2.409	-17.79	-12.83	-12.81	-16.14	-16.65	-15.76	-19.62	-15.51	-15.44	-15.40	-12.51	-.57	-23.72	-14.82	-14.23	-14.93	4.73
11	12.80	2.814	-20.06	-13.11	-16.05	-15.67	-18.44	-16.89	-19.36	-18.28	-19.79	-22.46	-14.72	-10.35	-33.36	-15.10	-15.91	-17.96	5.04
12	11.64	8.832	-15.38	-9.66	-12.64	-11.25	-14.54	-13.57	-16.15	-14.30	-14.81	-16.19	-11.51	-10.91	-23.97	-12.29	-12.10	-13.95	3.29
13	10.67	26.602	-9.49	-4.16	-6.92	-6.19	-8.07	-9.55	-10.76	-6.96	-5.53	-5.05	-6.08	-5.05	-12.71	-7.32	-6.07	-7.33	2.30
14	9.85	36.874	-7.56	-3.03	-5.75	-5.13	-6.31	-7.87	-10.52	-4.96	-3.42	-2.60	-5.03	-4.59	-10.60	-5.79	-4.77	-5.86	2.32
15	9.14	28.662	-9.52	-5.03	-8.42	-7.45	-8.25	-9.36	-11.61	-7.36	-6.07	-5.56	-7.59	-7.68	-12.32	-8.14	-6.91	-8.08	1.94
16	8.53	18.233	-12.70	-8.76	-12.60	-11.55	-11.58	-11.97	-13.37	-10.95	-9.45	-8.95	-11.68	-11.21	-16.15	-12.28	-10.79	-11.60	1.78
17	8.00	11.429	-11.64	-8.99	-12.49	-10.84	-10.27	-11.93	-13.70	-9.45	-8.35	-8.25	-11.60	-11.53	-19.32	-10.98	-10.05	-11.29	2.60
18	7.53	7.607	-11.21	-5.97	-9.46	-6.99	-8.10	-10.53	-12.44	-7.40	-6.48	-7.08	-8.30	-9.32	-19.67	-7.68	-7.17	-9.18	3.32
19	7.11	5.794	-14.87	-8.64	-13.28	-11.29	-11.98	-14.92	-13.63	-11.56	-9.65	-9.36	-11.96	-12.01	-20.93	-12.29	-10.84	-12.48	2.87
20	6.74	4.461	-17.14	-11.82	-16.29	-14.58	-17.40	-23.10	-15.80	-17.21	-13.89	-12.84	-15.17	-15.54	-21.69	-17.95	-14.62	-16.34	2.90
21	6.40	3.762	-20.37	-16.82	-20.41	-19.83	-24.07	-39.17	-19.38	-24.15	-18.07	-15.83	-20.05	-19.45	-23.43	-27.41	-18.99	-21.81	5.48
22	6.10	3.076	-23.72	-23.77	-26.53	-25.74	-28.80	-39.59	-24.65	-29.16	-25.44	-23.83	-26.35	-25.95	-30.08	-31.58	-25.99	-27.41	3.98
23	5.82	2.792	-34.72	-31.88	-35.16	-34.21	-38.27	-44.27	-32.91	-39.13	-35.17	-35.61	-35.08	-34.08	-39.89	-38.88	-34.96	-36.28	3.10
24	5.57	2.799	-42.48	-33.96	-39.49	-37.92	-41.51	-47.09	-36.90	-42.43	-40.01	-40.81	-38.80	-38.52	-46.64	-40.66	-39.69	-40.46	3.28
25	5.33	2.448	-44.21	-35.03	-39.82	-38.62	-42.68	-46.16	-37.49	-43.62	-41.40	-41.38	-39.13	-39.31	-44.35	-41.12	-40.96	-41.02	2.82
26	5.12	2.109	-48.13	-37.98	-40.97	-40.20	-45.21	-50.49	-39.42	-45.74	-42.84	-43.58	-40.79	-41.00	-46.61	-43.46	-42.55	-43.26	3.33
27	4.92	1.941	-51.11	-41.11	-45.39	-44.70	-49.04	-54.58	-43.96	-49.50	-47.88	-48.56	-45.16	-45.76	-50.11	-47.36	-47.82	-47.47	3.18
28	4.74	1.637	-50.94	-43.88	-49.05	-49.94	-52.18	-54.25	-46.64	-53.16	-52.64	-52.62	-49.89	-49.29	-51.00	-51.57	-52.00	-50.61	2.58
29	4.57	1.177	-53.59	-44.58	-51.61	-52.26	-53.96	-55.81	-51.47	-56.16	-55.11	-55.55	-52.24	-51.18	-54.64	-53.63	-53.40	-53.01	2.74
30	4.41	1.066	-57.69	-47.10	-54.49	-53.37	-55.16	-57.73	-55.24	-57.37	-55.47	-56.37	-53.70	-53.76	-59.56	-54.43	-53.50	-55.00	2.76
31	4.27	.993	-58.32	-51.70	-54.84	-54.96	-56.58	-59.69	-55.83	-58.26	-56.71	-57.50	-55.14	-55.66	-59.52	-55.61	-55.41	-56.38	1.99

Table B.22 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 03/02/94 19:00 HOURS Hmo= .39 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

NO	Period (sec)	Energy (cm**2)	DIRECTION (degrees) for 15 different gauge triads															Mean dir	Std dev
			012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24		
2	128.00	.466	-75.06	-39.70	-58.81	-58.07	-46.21	-53.74	-42.35	-49.43	-30.87	-36.41	-59.28	-43.48	-70.49	-60.37	-31.51	-50.36	12.94
3	64.00	.649	-71.99	-43.37	-62.54	-60.59	-54.23	-59.15	-46.55	-55.08	-47.36	-49.48	-60.70	-48.84	-66.68	-62.40	-42.79	-55.44	8.55
4	42.67	.505	-94.62	-52.15	-71.94	-69.18	-66.28	-70.61	-67.31	-71.75	-65.04	-68.72	-69.66	-62.48	-94.39	-70.27	-54.19	-69.84	11.20
5	32.00	.352	-120.84	-60.01	-89.43	-87.38	-80.53	-81.51	-94.96	-99.98	-108.14	-102.58	-85.97	-80.77	-110.62	-86.92	-66.24	-90.39	15.77
6	25.60	.339	-89.64	-70.61	-80.92	-81.81	-74.18	-65.43	-92.04	-94.98	-97.53	-97.77	-81.82	-73.33	-89.85	-82.02	-63.71	-82.39	10.81
7	21.33	.542	-21.86	-25.14	-26.60	-29.41	-22.30	-29.37	-17.98	-22.43	-21.51	-20.89	-26.63	-13.73	-32.04	-24.78	-23.29	-23.86	4.52
8	18.29	1.523	-11.51	-8.96	-12.34	-13.73	-11.72	-15.86	-.11	-12.36	-15.22	-19.77	-12.19	-2.73	-25.25	-10.25	-9.56	-12.10	5.83
9	16.00	2.889	-11.90	-6.29	-9.96	-10.87	-10.20	-12.12	-4.05	-10.82	-12.25	-15.60	-9.17	-1.23	-16.84	-9.46	-7.84	-9.91	3.87
10	14.22	2.776	-13.81	-8.19	-10.96	-12.48	-12.28	-14.10	-13.67	-11.55	-11.06	-11.54	-10.13	-2.29	-14.50	-11.83	-10.54	-11.26	2.89
11	12.80	2.653	-18.19	-12.93	-16.52	-17.01	-16.40	-19.09	-19.90	-16.06	-16.02	-17.41	-15.57	-10.38	-24.41	-15.76	-15.31	-16.73	3.03
12	11.64	6.604	-14.11	-9.45	-13.42	-12.33	-12.82	-17.31	-16.28	-12.49	-12.26	-13.10	-12.61	-12.46	-20.01	-11.86	-11.16	-13.44	2.53
13	10.67	22.072	-12.94	-8.68	-11.76	-10.69	-11.40	-15.56	-14.28	-10.90	-9.75	-9.86	-11.03	-11.05	-15.54	-11.13	-10.13	-11.65	1.99
14	9.85	35.325	-12.53	-8.27	-11.10	-10.14	-10.68	-14.57	-11.66	-10.12	-8.57	-8.57	-10.42	-10.00	-14.27	-10.80	-9.63	-10.76	1.82
15	9.14	27.237	-10.74	-6.52	-9.46	-8.40	-8.73	-13.51	-9.19	-8.12	-6.58	-6.66	-8.79	-8.44	-12.65	-8.85	-7.78	-8.96	1.96
16	8.53	15.414	-9.79	-6.44	-8.89	-7.97	-7.54	-15.36	-8.94	-6.75	-5.41	-5.24	-8.33	-7.85	-11.61	-8.10	-7.01	-8.35	2.45
17	8.00	8.760	-12.57	-10.21	-12.56	-11.72	-11.16	-17.59	-13.80	-10.47	-9.48	-8.84	-12.03	-11.77	-15.31	-11.82	-10.96	-12.02	2.16
18	7.53	5.516	-17.11	-13.82	-17.37	-16.14	-16.50	-19.06	-19.10	-16.21	-14.92	-14.53	-16.56	-16.54	-20.11	-17.18	-15.70	-16.72	1.67
19	7.11	3.855	-19.79	-15.86	-19.49	-17.97	-19.27	-25.46	-21.98	-19.11	-16.53	-16.92	-18.70	-18.47	-24.11	-21.10	-17.32	-19.47	2.62
20	6.74	2.954	-24.65	-18.32	-23.85	-22.19	-29.03	-37.40	-24.29	-29.43	-21.89	-21.66	-22.71	-22.44	-26.73	-29.54	-22.45	-25.10	4.52
21	6.40	2.930	-28.90	-22.49	-27.51	-26.16	-31.55	-42.15	-26.33	-32.14	-26.78	-25.98	-26.36	-26.08	-28.62	-31.23	-27.12	-28.62	4.36
22	6.10	2.623	-32.18	-29.71	-33.37	-32.58	-34.88	-40.09	-32.54	-35.62	-33.49	-33.17	-32.78	-32.04	-34.05	-35.62	-33.39	-33.70	2.23
23	5.82	2.456	-37.52	-33.90	-38.75	-37.75	-40.13	-45.31	-37.73	-40.83	-39.18	-39.48	-38.06	-38.02	-40.60	-39.70	-38.95	-39.06	2.32
24	5.57	2.695	-42.68	-36.78	-42.64	-41.13	-43.37	-48.25	-41.15	-44.08	-41.95	-42.77	-41.64	-41.62	-45.89	-42.75	-41.61	-42.55	2.41
25	5.33	3.035	-47.94	-38.18	-45.53	-42.91	-45.87	-50.14	-45.10	-46.60	-44.47	-45.68	-43.67	-44.36	-50.29	-44.65	-44.18	-45.31	2.83
26	5.12	3.481	-50.41	-39.70	-46.62	-44.34	-47.18	-52.28	-46.26	-48.09	-46.04	-47.12	-45.01	-45.62	-51.80	-46.08	-45.66	-46.81	2.99
27	4.92	4.379	-53.15	-43.63	-50.06	-48.88	-50.42	-53.70	-49.14	-51.12	-49.24	-50.20	-49.26	-48.97	-53.72	-50.12	-48.62	-50.02	2.39
28	4.74	4.956	-53.62	-46.37	-51.95	-51.40	-52.25	-53.61	-50.66	-52.97	-51.25	-51.98	-51.58	-51.00	-53.81	-52.19	-50.32	-51.66	1.76
29	4.57	5.760	-54.17	-48.40	-52.77	-52.31	-53.26	-55.42	-51.62	-54.59	-53.02	-53.39	-52.45	-52.38	-54.54	-52.92	-51.64	-52.86	1.60
30	4.41	5.282	-56.61	-49.35	-53.90	-53.08	-54.13	-56.84	-54.53	-55.85	-53.95	-54.28	-53.33	-53.38	-56.85	-53.76	-52.19	-54.14	1.88
31	4.27	4.937	-57.71	-50.55	-55.45	-54.95	-55.41	-57.13	-55.85	-56.36	-54.77	-55.38	-55.15	-54.92	-58.21	-55.42	-53.43	-55.38	1.74

Table B.23 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 03/02/94 22:00 HOURS Hmo= .32 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.384	-76.34	-47.23	-46.87	-64.88	-45.70	-25.14	-25.00	-36.76	-28.74	-37.11	-63.87	-24.42	-64.11	-66.86	-29.06	-45.39	17.22
3	64.00	.485	-60.82	-37.59	-37.90	-48.24	-47.34	-41.31	-21.97	-46.51	-35.33	-35.19	-44.86	-29.60	-30.65	-52.96	-34.67	-40.32	9.64
4	42.67	.291	-63.76	-12.84	-61.79	-56.81	-60.27	-62.12	-64.78	-67.16	-61.80	-56.20	-55.23	-49.45	-39.09	-59.92	-55.18	-55.35	13.12
5	32.00	.188	-92.46	-16.56	-96.89	-93.08	-84.55	-83.16	-99.80	-101.85	-108.36	-109.46	-93.27	-83.41	-92.92	-92.88	-77.11	-89.54	21.11
6	25.60	.208	-77.20	-40.87	-74.17	-73.68	-64.16	-57.70	-57.31	-76.59	-69.96	-70.66	-73.55	-56.98	-71.78	-73.91	-50.08	-65.96	10.54
7	21.33	.371	-39.78	-11.25	-29.25	-25.32	-25.02	-32.09	-16.25	-24.69	-21.54	-28.56	-23.56	-11.90	-43.74	-28.32	-20.33	-25.43	8.69
8	18.29	1.009	-18.19	-8.47	-12.67	-13.76	-15.22	-17.75	-3.78	-15.31	-16.31	-20.40	-11.21	-.17	-23.69	-13.67	-12.30	-13.53	5.83
9	16.00	2.208	-14.82	-9.57	-10.75	-12.03	-14.49	-16.89	-11.88	-13.26	-13.19	-13.96	-9.97	-1.68	-21.22	-11.99	-12.05	-12.52	4.03
10	14.22	2.351	-17.10	-13.26	-14.00	-14.73	-15.60	-19.64	-14.92	-14.71	-13.77	-14.33	-13.53	-7.17	-22.98	-14.97	-13.79	-14.97	3.28
11	12.80	1.916	-19.65	-16.77	-19.03	-19.32	-17.87	-22.85	-16.32	-17.71	-16.93	-18.08	-18.75	-15.38	-24.75	-18.74	-16.45	-18.57	2.39
12	11.64	3.532	-20.54	-15.54	-19.21	-18.57	-18.23	-23.78	-18.32	-18.12	-17.22	-18.58	-18.45	-16.40	-26.27	-18.28	-16.78	-18.95	2.68
13	10.67	9.109	-17.28	-12.99	-16.05	-15.61	-15.38	-21.04	-14.90	-15.11	-14.05	-14.62	-15.38	-13.37	-20.24	-15.65	-14.36	-15.73	2.18
14	9.85	16.895	-14.86	-10.79	-13.22	-12.41	-12.86	-17.21	-12.54	-12.54	-11.61	-12.29	-12.63	-11.73	-18.01	-12.80	-11.87	-13.16	1.95
15	9.14	15.758	-13.93	-9.92	-12.50	-11.41	-12.42	-15.08	-14.05	-12.09	-11.41	-12.18	-11.84	-11.70	-18.44	-12.19	-11.20	-12.69	1.97
16	8.53	9.121	-15.13	-10.78	-13.40	-12.59	-13.92	-15.07	-15.16	-13.44	-12.17	-11.81	-12.65	-12.29	-17.72	-14.18	-12.70	-13.53	1.67
17	8.00	5.423	-18.15	-13.02	-16.33	-15.56	-16.42	-17.99	-16.40	-16.02	-13.97	-13.02	-15.44	-14.41	-18.77	-17.22	-15.08	-15.85	1.71
18	7.53	3.900	-23.57	-18.83	-22.85	-21.79	-23.73	-30.00	-22.43	-23.82	-20.54	-20.19	-22.01	-21.14	-26.36	-24.42	-21.23	-22.86	2.64
19	7.11	3.560	-33.12	-24.96	-30.51	-29.22	-32.64	-38.23	-28.03	-32.93	-28.27	-28.70	-29.55	-28.55	-33.63	-32.78	-28.46	-30.64	3.13
20	6.74	3.788	-38.27	-30.75	-35.32	-34.23	-37.47	-42.11	-34.70	-38.05	-33.98	-34.65	-34.65	-33.83	-38.87	-37.38	-33.87	-35.87	2.69
21	6.40	3.981	-41.50	-35.57	-38.76	-37.89	-40.29	-44.66	-40.11	-41.19	-38.14	-38.88	-38.43	-37.87	-43.88	-40.09	-37.76	-39.67	2.33
22	6.10	3.353	-42.64	-36.76	-41.09	-40.09	-42.41	-45.25	-42.03	-43.19	-40.50	-41.19	-40.51	-40.09	-44.58	-42.02	-40.10	-41.50	1.99
23	5.82	3.509	-45.09	-39.93	-43.97	-43.03	-44.76	-48.08	-42.89	-45.69	-44.10	-44.62	-43.41	-43.39	-46.95	-44.22	-43.59	-44.25	1.81
24	5.57	3.417	-48.17	-41.29	-44.66	-44.06	-45.71	-49.96	-43.88	-46.90	-44.78	-45.26	-44.45	-43.99	-48.89	-45.39	-43.92	-45.42	2.16
25	5.33	3.533	-49.50	-42.56	-46.38	-45.98	-46.92	-51.40	-44.89	-48.35	-46.00	-46.09	-46.16	-45.11	-48.71	-47.09	-44.81	-46.66	2.08
26	5.12	3.651	-51.52	-44.71	-48.82	-48.34	-49.33	-52.64	-47.51	-50.85	-49.18	-49.36	-48.55	-47.83	-51.47	-49.29	-47.93	-49.15	1.88
27	4.92	3.255	-53.46	-46.40	-52.77	-51.73	-52.15	-53.90	-51.40	-52.90	-52.16	-52.79	-51.92	-51.51	-54.75	-52.21	-51.36	-52.09	1.78
28	4.74	3.212	-55.57	-48.88	-54.04	-52.98	-53.62	-55.77	-54.17	-54.22	-53.47	-54.07	-53.19	-53.19	-56.65	-53.46	-52.84	-53.74	1.68
29	4.57	3.429	-57.88	-50.15	-55.58	-54.63	-54.89	-56.62	-54.56	-55.55	-54.82	-55.39	-54.84	-54.65	-58.71	-55.01	-53.97	-55.15	1.83
30	4.41	2.955	-59.16	-51.90	-57.23	-56.49	-56.87	-58.39	-55.18	-57.18	-56.62	-57.27	-56.65	-56.88	-59.99	-56.73	-55.99	-56.83	1.76
31	4.27	2.313	-60.34	-52.56	-57.43	-56.87	-57.69	-58.75	-56.31	-58.12	-57.11	-57.77	-57.06	-57.26	-60.85	-57.32	-56.35	-57.45	1.81

Table B.24 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 04/02/94 01:00 HOURS Hmo= .26 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.410	-4.95	55.80	-103.69	-62.38	-64.15	-110.28	26.64	-45.80	-58.06	-50.08	-57.52	-71.40	22.61	-54.57	-96.66	-49.50	47.37
3	64.00	.496	-55.80	-18.71	-77.89	-67.57	-54.41	-58.88	-33.94	-56.39	-59.28	-59.60	-67.90	-60.90	-68.53	-66.22	-53.94	-57.53	13.97
4	42.67	.370	-92.65	-66.03	-67.06	-75.90	-53.01	-37.91	-63.03	-59.49	-56.75	-61.79	-75.91	-59.17	-91.93	-75.89	-44.14	-65.35	14.85
5	32.00	.199	-72.80	-54.08	-26.96	-36.95	-22.02	-26.29	-61.70	-22.10	-3.46	-16.11	-41.43	-27.94	-83.14	-35.19	-19.20	-36.24	21.53
6	25.60	.157	-10.50	-36.62	-18.14	-28.08	-3.57	-18.85	-40.75	1.44	5.66	-2.58	-30.54	-17.39	-58.61	-13.56	-4.77	-18.28	17.14
7	21.33	.268	-12.74	-22.50	-21.55	-25.52	-10.89	-13.80	-24.29	-9.06	-9.76	-12.62	-23.84	-11.57	-36.32	-15.77	-11.32	-17.42	7.56
8	18.29	.857	-12.34	-11.12	-13.62	-14.66	-11.47	-13.41	-16.85	-9.39	-8.64	-8.53	-13.24	-6.44	-22.22	-11.07	-10.17	-12.21	3.71
9	16.00	2.476	-11.86	-10.62	-10.98	-11.42	-11.31	-14.45	-9.17	-10.40	-9.76	-10.70	-10.74	-6.21	-19.05	-10.82	-10.51	-11.20	2.66
10	14.22	2.616	-12.15	-10.75	-11.97	-11.95	-11.50	-15.26	-7.73	-10.79	-10.03	-10.97	-11.51	-7.83	-19.45	-11.53	-10.78	-11.61	2.70
11	12.80	1.621	-16.81	-12.75	-16.74	-16.72	-15.54	-16.57	-18.61	-14.72	-12.76	-11.46	-15.75	-11.82	-19.77	-16.72	-14.82	-15.44	2.33
12	11.64	3.126	-23.26	-16.53	-21.21	-20.56	-20.82	-20.50	-22.29	-20.77	-18.91	-18.99	-20.13	-17.47	-22.68	-21.70	-19.36	-20.35	1.80
13	10.67	7.135	-21.14	-16.54	-19.80	-19.51	-19.89	-24.18	-20.95	-19.75	-17.73	-17.19	-19.11	-17.11	-21.53	-20.43	-18.65	-19.57	1.93
14	9.85	9.936	-17.23	-13.52	-16.11	-15.79	-16.35	-21.96	-17.43	-15.82	-13.77	-12.44	-15.45	-13.95	-17.69	-16.89	-15.37	-15.98	2.18
15	9.14	9.774	-17.72	-13.49	-17.05	-16.12	-16.50	-20.56	-17.84	-16.06	-14.24	-13.55	-16.18	-15.27	-19.55	-17.15	-15.50	-16.45	1.92
16	8.53	7.221	-18.47	-14.66	-18.10	-17.15	-17.11	-22.68	-20.13	-16.79	-15.28	-15.09	-17.37	-16.68	-21.01	-17.85	-16.34	-17.65	2.14
17	8.00	3.205	-19.95	-15.33	-18.20	-17.03	-18.56	-26.16	-21.10	-18.40	-16.72	-16.90	-17.43	-17.29	-22.72	-18.83	-17.17	-18.78	2.67
18	7.53	2.177	-27.49	-20.61	-25.08	-23.50	-26.88	-37.91	-25.99	-27.06	-23.13	-23.93	-24.14	-24.18	-29.89	-27.38	-23.22	-26.02	3.88
19	7.11	2.556	-32.93	-27.79	-30.98	-29.97	-32.86	-41.87	-33.11	-33.49	-29.85	-30.52	-30.61	-29.95	-35.83	-33.40	-29.99	-32.21	3.25
20	6.74	2.208	-38.23	-30.62	-34.40	-33.34	-37.31	-42.24	-36.25	-38.16	-33.77	-34.44	-33.89	-33.04	-39.62	-36.96	-33.66	-35.73	2.92
21	6.40	2.103	-40.61	-32.11	-36.85	-35.89	-39.32	-44.43	-35.28	-40.01	-35.55	-36.25	-36.31	-34.71	-41.43	-39.34	-35.34	-37.56	3.08
22	6.10	2.347	-42.37	-33.80	-39.39	-38.01	-42.01	-47.60	-37.74	-42.92	-38.61	-39.19	-38.52	-37.61	-43.32	-41.30	-38.19	-40.04	3.17
23	5.82	2.353	-44.74	-35.88	-42.63	-40.70	-45.46	-51.03	-42.04	-46.56	-42.97	-43.83	-41.25	-42.15	-45.45	-43.47	-42.61	-43.39	3.18
24	5.57	2.390	-45.14	-38.63	-43.31	-42.48	-46.57	-50.04	-42.31	-47.42	-44.94	-45.93	-42.77	-43.11	-45.47	-44.98	-44.54	-44.51	2.54
25	5.33	2.177	-47.09	-38.14	-45.54	-44.27	-48.55	-48.73	-45.26	-48.98	-47.33	-48.69	-44.71	-45.00	-48.66	-46.89	-47.33	-46.35	2.69
26	5.12	2.363	-48.66	-41.86	-49.54	-48.36	-50.10	-51.12	-49.28	-50.82	-50.00	-50.64	-48.58	-48.14	-50.73	-49.64	-49.58	-49.14	2.14
27	4.92	2.421	-50.59	-45.54	-51.61	-50.60	-51.20	-53.55	-52.74	-52.87	-51.75	-51.88	-50.81	-50.22	-52.27	-51.26	-50.44	-51.16	1.77
28	4.74	2.527	-53.58	-48.32	-52.30	-51.41	-52.44	-55.22	-52.45	-54.12	-53.01	-53.13	-51.72	-51.75	-54.47	-52.08	-51.68	-52.51	1.56
29	4.57	2.035	-55.05	-50.61	-53.77	-53.93	-54.57	-57.00	-53.29	-55.43	-55.03	-55.21	-54.11	-54.10	-55.60	-54.48	-54.28	-54.43	1.35
30	4.41	1.530	-56.31	-50.35	-55.81	-56.13	-56.47	-59.06	-53.91	-56.62	-56.60	-56.76	-56.18	-56.20	-56.39	-56.34	-56.51	-55.98	1.79
31	4.27	1.188	-59.47	-53.32	-59.63	-59.97	-60.15	-61.97	-56.69	-60.38	-59.90	-60.10	-60.03	-60.42	-60.33	-59.94	-59.17	-59.43	1.93

Table B.25 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 04/02/94 04:00 HOURS Hmo= .24 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.595	-54.61	-36.18	-27.73	-27.75	-41.09	-62.56	-60.32	-57.66	-32.11	-16.11	-27.77	-30.22	-41.72	-34.70	-32.11	-38.78	13.45
3	64.00	.581	-76.65	-33.88	-33.95	-28.30	-46.44	-60.71	-41.50	-54.93	-34.59	-38.46	-32.51	-35.89	-74.39	-39.71	-33.75	-44.19	14.81
4	42.67	.295	-67.66	-11.92	-44.36	-33.32	-49.51	-53.33	-47.51	-67.97	-51.86	-40.18	-34.60	-36.19	-58.28	-42.85	-41.35	-45.45	13.70
5	32.00	.201	-52.78	-30.34	-53.31	-51.53	-51.55	-43.08	-42.94	-63.66	-55.72	-45.07	-48.30	-36.20	-25.45	-53.71	-46.30	-46.69	9.69
6	25.60	.158	-59.87	-40.12	-52.54	-50.81	-53.44	-54.15	-49.06	-62.06	-57.77	-56.29	-49.21	-42.95	-55.75	-52.96	-54.07	-52.74	5.62
7	21.33	.311	-34.55	-31.47	-36.07	-37.50	-25.08	-25.70	-38.29	-25.17	-24.51	-28.23	-35.11	-21.83	-39.21	-32.32	-24.06	-30.61	5.76
8	18.29	.960	-14.33	-10.61	-12.78	-13.83	-8.66	-9.86	-3.80	-12.29	-15.97	-23.81	-11.71	2.18	-22.73	-9.38	-6.64	-11.61	6.32
9	16.00	2.221	-8.03	-6.57	-5.14	-7.51	-9.72	-9.21	-2.05	-10.20	-12.40	-16.15	-4.35	7.07	-13.47	-7.12	-7.83	-7.52	5.22
10	14.22	2.700	-11.05	-9.76	-8.21	-11.02	-12.57	-11.58	-9.76	-11.98	-12.75	-14.04	-8.00	1.43	-15.54	-10.74	-10.95	-10.44	3.71
11	12.80	1.814	-14.85	-13.17	-12.11	-14.65	-14.94	-17.60	-17.31	-13.75	-13.28	-13.22	-11.97	-3.51	-22.36	-13.84	-13.30	-13.99	3.79
12	11.64	2.600	-19.51	-17.70	-17.35	-18.71	-19.18	-22.95	-22.66	-18.76	-17.33	-16.32	-17.17	-13.04	-24.76	-18.76	-18.16	-18.83	2.78
13	10.67	5.998	-20.45	-16.82	-17.63	-17.39	-19.31	-23.92	-21.99	-19.08	-17.29	-16.71	-17.16	-16.11	-23.13	-18.72	-17.96	-18.91	2.35
14	9.85	8.558	-20.01	-15.25	-17.10	-16.61	-18.02	-22.96	-19.76	-17.73	-16.03	-15.64	-16.47	-15.20	-21.71	-17.69	-16.89	-17.80	2.26
15	9.14	8.156	-19.17	-15.00	-17.13	-16.97	-17.41	-23.25	-17.97	-16.99	-15.10	-14.04	-16.61	-15.02	-20.44	-17.51	-16.59	-17.28	2.26
16	8.53	6.225	-18.62	-15.37	-17.70	-17.39	-17.67	-22.50	-20.07	-17.31	-15.50	-14.49	-17.31	-16.63	-21.71	-17.66	-16.70	-17.78	2.14
17	8.00	4.011	-20.22	-17.08	-19.94	-19.72	-19.55	-23.03	-20.13	-19.42	-17.62	-16.96	-19.59	-18.27	-22.56	-20.54	-18.51	-19.54	1.68
18	7.53	2.323	-25.46	-19.66	-25.63	-25.12	-26.59	-28.65	-21.75	-26.75	-23.09	-22.37	-24.77	-22.45	-26.84	-28.35	-23.67	-24.74	2.47
19	7.11	1.490	-30.40	-23.36	-29.09	-27.93	-32.31	-37.75	-27.55	-32.75	-27.99	-27.75	-28.15	-27.14	-33.77	-32.13	-28.16	-29.75	3.37
20	6.74	1.425	-29.61	-26.23	-28.63	-27.95	-32.25	-44.77	-28.30	-32.98	-27.94	-27.93	-28.47	-27.66	-34.19	-33.03	-28.21	-30.53	4.45
21	6.40	1.467	-29.68	-26.16	-29.47	-28.66	-34.67	-49.15	-27.97	-35.36	-29.15	-29.22	-29.07	-28.41	-34.02	-34.86	-29.27	-31.66	5.42
22	6.10	1.358	-33.77	-30.32	-33.02	-32.33	-40.29	-46.80	-32.81	-40.86	-34.60	-35.46	-32.86	-32.92	-37.25	-38.44	-34.55	-35.75	4.15
23	5.82	1.257	-37.46	-31.58	-38.12	-36.22	-44.19	-47.13	-38.20	-44.83	-39.89	-41.17	-36.85	-38.13	-41.40	-41.16	-40.00	-39.75	3.72
24	5.57	1.521	-41.72	-35.87	-42.96	-41.28	-44.82	-47.57	-41.37	-45.50	-43.61	-44.55	-41.78	-42.29	-45.64	-43.45	-43.48	-43.06	2.59
25	5.33	1.764	-45.32	-36.97	-43.20	-42.21	-44.23	-47.37	-42.28	-45.26	-42.93	-43.76	-42.70	-41.51	-46.45	-44.29	-42.15	-43.38	2.36
26	5.12	2.205	-47.39	-39.05	-44.17	-43.11	-44.92	-48.61	-44.58	-46.89	-44.41	-44.58	-43.59	-42.59	-48.53	-44.89	-43.12	-44.70	2.38
27	4.92	2.265	-49.49	-39.82	-45.51	-44.04	-46.19	-50.01	-45.79	-48.20	-46.07	-46.27	-44.56	-44.59	-50.74	-45.53	-44.80	-46.11	2.63
28	4.74	1.954	-50.34	-40.93	-46.96	-45.96	-47.81	-51.16	-47.72	-49.36	-47.42	-48.25	-46.38	-46.38	-51.33	-47.31	-46.20	-47.57	2.45
29	4.57	1.713	-50.85	-44.74	-49.36	-49.11	-50.76	-53.08	-50.15	-52.30	-50.68	-51.34	-49.26	-49.18	-51.80	-50.12	-49.36	-50.14	1.86
30	4.41	1.367	-52.08	-45.87	-52.65	-52.51	-53.52	-54.64	-52.19	-55.22	-53.93	-54.42	-52.44	-52.50	-53.05	-52.93	-52.38	-52.69	2.05
31	4.27	1.239	-54.61	-47.60	-53.01	-52.95	-54.30	-58.05	-53.80	-57.52	-55.99	-55.96	-53.02	-53.99	-55.63	-53.18	-53.09	-54.18	2.38

Table B.26 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 04/02/94 07:00 HOURS Hmo= .24 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.511	-42.09	-19.48	-71.88	-62.35	-34.18	-37.54	-26.97	-36.71	-39.14	-44.07	-62.76	-46.45	-69.41	-58.91	-35.81	-45.81	15.20
3	64.00	.585	-61.58	-21.40	-56.10	-46.16	-43.14	-51.36	-44.81	-47.83	-43.86	-47.62	-47.54	-45.62	-70.12	-46.06	-40.50	-47.59	10.25
4	42.67	.369	-45.60	-38.85	-48.18	-48.30	-46.44	-56.68	-55.82	-50.64	-48.63	-46.77	-46.32	-44.65	-39.39	-46.75	-46.57	-47.30	4.63
5	32.00	.209	-45.02	-53.69	-44.61	-54.31	-48.14	-52.48	-59.73	-57.57	-54.44	-49.52	-51.65	-45.40	-35.52	-51.78	-47.89	-50.12	5.82
6	25.60	.191	-26.78	-33.61	-28.23	-34.02	-28.57	-26.46	-34.71	-31.24	-26.14	-20.51	-30.19	-22.92	-24.31	-29.90	-27.80	-28.36	3.94
7	21.33	.328	-12.25	-10.54	-8.73	-10.46	-15.60	-12.05	-13.84	-14.51	-14.33	-13.45	-6.14	5.24	-9.40	-13.18	-14.32	-10.92	4.98
8	18.29	.866	-8.62	-9.29	-4.43	-7.65	-11.70	-8.23	-9.09	-9.52	-9.74	-8.61	-4.50	4.77	-11.97	-7.75	-8.98	-7.69	3.88
9	16.00	1.994	-7.86	-6.75	-5.16	-6.32	-11.03	-9.83	-2.76	-9.49	-11.17	-12.11	-4.86	-.09	-20.30	-5.93	-7.18	-8.05	4.55
10	14.22	3.057	-10.26	-6.18	-8.03	-8.27	-11.30	-12.44	-1.22	-10.77	-12.71	-15.64	-7.19	-2.21	-25.89	-7.25	-7.75	-9.80	5.65
11	12.80	2.682	-15.28	-10.08	-12.45	-14.01	-14.71	-15.50	-8.48	-14.19	-14.65	-15.70	-11.76	-5.06	-22.81	-13.04	-12.80	-13.37	3.78
12	11.64	2.843	-20.98	-15.30	-19.08	-19.72	-19.78	-22.03	-20.22	-19.58	-18.54	-17.81	-18.08	-13.78	-23.66	-19.48	-18.51	-19.10	2.33
13	10.67	5.534	-23.98	-19.65	-24.88	-24.48	-22.96	-26.86	-27.11	-23.05	-21.84	-21.37	-23.91	-21.40	-27.67	-23.61	-22.27	-23.67	2.21
14	9.85	9.293	-24.36	-19.06	-24.00	-23.47	-23.19	-26.69	-25.57	-23.24	-21.92	-22.00	-23.07	-21.24	-26.08	-23.48	-21.97	-23.29	1.89
15	9.14	8.545	-25.50	-18.47	-23.73	-23.01	-24.06	-25.41	-24.50	-24.10	-22.43	-22.59	-22.59	-20.99	-26.62	-24.07	-22.29	-23.36	1.92
16	8.53	6.729	-23.69	-19.54	-22.95	-22.32	-22.28	-27.18	-24.45	-22.30	-21.13	-21.15	-22.32	-21.19	-26.85	-22.76	-21.37	-22.76	2.01
17	8.00	5.317	-22.27	-21.05	-22.39	-22.31	-21.58	-30.81	-22.95	-21.57	-20.30	-19.77	-22.33	-20.79	-25.25	-23.15	-21.16	-22.51	2.56
18	7.53	3.293	-24.35	-22.57	-23.68	-23.53	-24.57	-34.40	-24.13	-24.71	-22.72	-22.17	-23.62	-22.87	-26.80	-25.67	-23.29	-24.60	2.87
19	7.11	2.155	-29.79	-23.04	-27.53	-25.94	-30.56	-36.58	-27.64	-30.75	-27.06	-27.70	-26.54	-26.93	-33.49	-29.97	-27.02	-28.70	3.18
20	6.74	1.841	-31.92	-25.46	-29.07	-28.19	-33.19	-38.47	-28.16	-33.58	-28.69	-28.97	-28.65	-27.97	-34.16	-33.24	-28.81	-30.57	3.26
21	6.40	1.438	-31.08	-25.36	-28.19	-27.74	-33.69	-40.85	-26.50	-34.26	-28.82	-28.46	-27.99	-27.08	-32.22	-33.77	-29.00	-30.33	3.90
22	6.10	1.331	-32.39	-27.60	-30.37	-29.75	-35.45	-44.89	-29.14	-36.28	-31.85	-32.06	-30.26	-30.05	-35.35	-35.28	-31.86	-32.83	4.08
23	5.82	1.441	-35.96	-31.38	-31.93	-32.18	-38.78	-46.86	-32.41	-39.72	-33.69	-34.90	-32.80	-31.55	-37.86	-38.40	-33.60	-35.47	4.10
24	5.57	1.172	-35.95	-26.19	-30.01	-28.83	-40.05	-48.72	-31.32	-40.78	-31.31	-33.00	-29.69	-29.71	-34.80	-37.42	-31.34	-33.93	5.65
25	5.33	1.136	-31.62	-24.32	-31.88	-29.69	-41.39	-50.24	-32.45	-42.05	-33.02	-34.24	-30.44	-31.65	-32.12	-37.64	-33.02	-34.37	6.01
26	5.12	1.310	-34.79	-29.51	-37.64	-35.81	-43.08	-49.09	-36.86	-43.64	-40.84	-41.88	-36.12	-37.34	-37.23	-39.92	-41.34	-39.01	4.45
27	4.92	1.658	-42.89	-34.17	-40.41	-39.47	-44.88	-49.08	-38.61	-45.41	-44.25	-45.41	-39.87	-40.43	-43.28	-42.86	-44.82	-42.39	3.51
28	4.74	1.660	-46.48	-39.22	-42.36	-42.71	-45.78	-48.42	-41.24	-46.51	-45.03	-45.93	-43.06	-42.04	-46.41	-45.28	-44.84	-44.35	2.39
29	4.57	1.440	-47.76	-39.59	-45.32	-44.80	-45.97	-48.94	-45.29	-46.58	-45.68	-46.95	-45.23	-44.18	-49.22	-46.25	-45.35	-45.81	2.17
30	4.41	1.137	-49.55	-41.45	-47.91	-48.52	-48.59	-52.17	-47.91	-48.58	-49.18	-50.26	-48.71	-47.33	-50.60	-49.52	-49.38	-48.65	2.25
31	4.27	1.065	-49.86	-42.57	-47.58	-51.40	-50.09	-54.67	-45.93	-50.58	-51.28	-51.53	-51.31	-48.92	-48.59	-51.98	-51.37	-49.85	2.78

Table B.27 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 04/02/94 10:00 HOURS Hmo= .27 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.641	-21.78	-22.10	-23.80	-30.11	-19.84	-30.88	-11.45	-19.44	-15.45	-12.96	-26.98	-16.87	-20.57	-26.43	-20.46	-21.27	5.55
3	64.00	.706	-27.66	-25.06	-35.70	-38.76	-28.59	-30.92	-25.55	-30.36	-25.60	-16.59	-35.89	-22.98	-12.27	-37.79	-28.15	-28.13	7.17
4	42.67	.409	-36.11	-40.58	-56.20	-56.19	-44.46	-42.07	-38.42	-53.28	-51.34	-41.95	-54.08	-41.52	-24.30	-54.07	-43.15	-45.20	8.67
5	32.00	.197	-39.47	-47.74	-46.50	-48.77	-42.60	-42.24	-54.04	-51.22	-44.82	-33.61	-45.52	-37.44	-23.27	-47.61	-39.45	-42.98	7.40
6	25.60	.190	-47.19	-41.74	-29.46	-36.97	-32.88	-27.49	-44.87	-33.05	-25.70	-27.46	-36.36	-26.21	-40.79	-39.35	-27.01	-34.43	6.95
7	21.33	.287	-28.87	-25.06	-14.34	-22.04	-22.42	-21.89	-19.63	-22.46	-19.59	-21.71	-18.40	-3.91	-22.32	-24.40	-19.89	-20.47	5.43
8	18.29	.725	-12.50	-6.33	-5.93	-7.16	-12.47	-14.56	-7.95	-9.83	-8.47	-9.52	-5.27	5.95	-24.23	-9.03	-9.00	-9.09	6.04
9	16.00	1.953	-8.69	-6.30	-6.49	-7.63	-10.02	-11.16	-4.02	-8.71	-9.04	-11.29	-6.34	2.44	-22.93	-6.76	-7.21	-8.27	5.06
10	14.22	2.836	-8.49	-7.09	-7.19	-8.02	-9.71	-10.02	-3.90	-9.27	-10.34	-13.15	-7.21	-2.03	-22.65	-6.21	-6.81	-8.80	4.51
11	12.80	2.327	-12.59	-7.90	-10.12	-10.70	-10.78	-11.77	-5.52	-11.24	-12.13	-14.84	-9.59	-4.64	-17.82	-9.64	-8.27	-10.50	3.21
12	11.64	2.950	-21.25	-15.33	-18.61	-18.70	-19.55	-21.10	-17.24	-19.51	-18.79	-19.63	-17.74	-14.30	-24.58	-19.02	-17.94	-18.89	2.35
13	10.67	6.029	-25.86	-20.79	-23.07	-22.82	-23.94	-29.26	-24.20	-24.05	-22.87	-23.19	-22.39	-20.51	-28.77	-23.38	-22.77	-23.86	2.38
14	9.85	10.751	-26.82	-22.81	-24.08	-23.69	-24.76	-29.79	-26.97	-24.97	-23.46	-23.40	-23.62	-22.28	-29.00	-24.68	-23.80	-24.94	2.15
15	9.14	11.141	-27.41	-22.74	-24.10	-23.87	-24.96	-29.16	-25.59	-25.18	-23.20	-22.88	-23.66	-21.83	-26.85	-25.43	-23.71	-24.70	1.90
16	8.53	7.483	-25.69	-21.45	-24.24	-23.93	-24.24	-28.14	-22.90	-24.37	-22.21	-22.06	-23.79	-21.77	-26.72	-25.29	-22.83	-23.97	1.83
17	8.00	5.180	-22.93	-19.98	-23.00	-22.26	-22.83	-26.11	-22.62	-22.88	-21.12	-20.89	-22.50	-21.38	-28.08	-23.50	-21.82	-22.79	1.95
18	7.53	3.727	-21.43	-18.52	-20.76	-20.27	-22.82	-28.41	-19.47	-22.87	-20.35	-19.34	-20.16	-19.37	-24.16	-23.22	-20.95	-21.47	2.44
19	7.11	2.950	-23.33	-18.52	-21.30	-20.31	-24.70	-35.76	-20.67	-24.84	-20.35	-19.94	-20.51	-20.40	-25.00	-25.26	-20.76	-22.77	4.06
20	6.74	2.739	-25.53	-16.99	-21.41	-19.69	-27.36	-42.37	-22.04	-27.57	-19.76	-20.16	-20.33	-20.46	-25.10	-27.50	-20.17	-23.74	5.93
21	6.40	2.595	-25.47	-15.72	-21.31	-19.75	-31.36	-45.32	-21.51	-31.58	-19.94	-19.56	-20.06	-19.80	-22.97	-30.93	-20.41	-24.35	7.29
22	6.10	2.421	-24.24	-15.11	-18.99	-17.53	-32.50	-50.09	-19.38	-32.75	-18.20	-17.26	-17.87	-17.54	-21.86	-32.38	-18.99	-23.58	9.14
23	5.82	2.257	-25.44	-14.19	-16.92	-15.19	-42.28	-51.22	-17.26	-42.86	-20.65	-20.02	-15.78	-16.42	-21.51	-37.24	-21.03	-25.12	11.61
24	5.57	1.941	-21.20	-13.98	-19.81	-17.88	-46.02	-52.59	-20.65	-46.76	9999.99	9999.99	-18.31	-19.62	-23.31	-37.73	9999.99	-28.07	13.00
25	5.33	1.329	-23.26	-21.28	-31.26	-28.35	-46.70	-50.33	-30.76	-47.25	9999.99	9999.99	-29.25	-30.68	-33.32	-39.43	9999.99	-34.30	9.10
26	5.12	1.390	-31.74	-24.86	-36.09	-32.71	-46.88	-50.19	-35.35	-46.52	9999.99	9999.99	-33.93	-35.07	-37.33	-41.45	9999.99	-37.67	6.99
27	4.92	1.632	-27.38	-19.80	-36.93	-32.66	-47.03	-52.47	-34.45	-46.33	9999.99	9999.99	-34.40	-36.66	-35.15	-41.92	9999.99	-37.10	8.54
28	4.74	2.231	-20.44	-14.70	-38.27	-32.72	-44.68	-52.35	-35.95	-44.39	9999.99	9999.99	-35.11	-37.74	-38.10	-39.99	9999.99	-36.24	9.78
29	4.57	2.231	-5.06	.18	9999.99	9999.99	-40.45	-53.97	9999.99	-40.46	9999.99	9999.99	9999.99	9999.99	9999.99	-30.46	9999.99	-28.51	19.62
30	4.41	2.129	7.97	10.85	9999.99	9999.99	-36.58	9999.99	9999.99	-36.55	9999.99	9999.99	9999.99	9999.99	9999.99	-24.65	9999.99	-15.94	21.05
31	4.27	2.325	20.31	10.92	9999.99	9999.99	-32.30	9999.99	9999.99	-32.97	9999.99	9999.99	9999.99	9999.99	9999.99	9999.99	9999.99	-8.55	24.35

Table B.28 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 04/02/94 13:00 HOURS Hmo= .32 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.654	-29.61	-42.82	-40.11	-53.57	-40.98	-35.74	-48.20	-40.21	-37.18	-28.17	-47.98	-26.43	10.51	-53.58	-35.79	-36.97	14.98
3	64.00	.704	-53.30	-29.68	-50.85	-48.72	-43.70	-38.62	-32.74	-43.62	-37.01	-38.64	-47.98	-35.89	-41.91	-51.09	-35.86	-41.97	7.00
4	42.67	.394	-82.20	-35.95	-62.23	-57.43	-51.01	-45.46	-48.90	-53.15	-46.57	-52.88	-59.00	-49.77	-84.90	-58.71	-42.35	-55.25	12.89
5	32.00	.217	-126.00	-82.85	-101.24	-107.87	-100.05	-62.13	-99.78	-101.23	-104.32	-100.91	-104.75	-98.64	-114.60	-107.94	-69.01	-98.94	15.76
6	25.60	.206	-120.26	-64.77	-91.65	-94.02	-84.05	-55.67	-47.56	-88.90	-88.96	-88.91	-91.60	-86.29	-105.95	-94.76	-54.26	-83.98	19.31
7	21.33	.374	-23.40	-7.64	-22.82	-16.48	-14.62	-25.74	-8.57	-13.62	-12.45	-14.19	-17.78	-9.00	-41.45	-16.88	-14.18	-17.21	8.27
8	18.29	.805	-12.14	-3.10	-9.48	-9.54	-9.83	-11.27	-9.25	-9.55	-10.21	-12.84	-7.55	4.29	-15.95	-9.31	-6.92	-8.85	4.46
9	16.00	2.034	-9.31	-4.40	-7.88	-8.84	-9.03	-10.79	-7.83	-8.67	-9.30	-11.20	-6.86	1.01	-13.54	-7.87	-6.96	-8.10	3.17
10	14.22	2.802	-9.36	-6.58	-8.73	-9.44	-10.16	-12.79	-10.03	-8.70	-8.59	-8.69	-8.03	-2.92	-15.95	-8.12	-8.24	-9.09	2.72
11	12.80	2.029	-14.08	-10.22	-11.56	-12.54	-14.27	-18.08	-13.43	-12.94	-12.33	-11.73	-10.92	-6.80	-19.84	-11.48	-11.93	-12.81	2.98
12	11.64	2.943	-21.39	-15.81	-18.11	-18.48	-19.03	-23.58	-20.47	-18.85	-17.30	-17.12	-17.44	-14.55	-20.73	-18.93	-17.46	-18.62	2.19
13	10.67	6.321	-25.18	-20.50	-23.67	-23.54	-23.09	-28.08	-25.11	-23.17	-21.29	-20.88	-23.11	-21.09	-24.67	-23.99	-21.95	-23.29	1.94
14	9.85	9.993	-28.44	-23.58	-27.93	-27.28	-26.38	-28.41	-28.17	-26.73	-24.69	-24.55	-27.21	-25.29	-30.23	-27.64	-25.33	-26.79	1.75
15	9.14	10.661	-28.88	-24.05	-29.33	-28.40	-27.45	-27.75	-28.55	-27.85	-25.80	-25.79	-28.42	-26.36	-31.40	-29.14	-26.35	-27.70	1.75
16	8.53	8.478	-26.79	-22.23	-26.99	-26.36	-25.70	-31.30	-24.99	-25.98	-23.52	-23.16	-26.23	-23.82	-28.13	-27.51	-24.41	-25.81	2.21
17	8.00	5.780	-26.56	-18.27	-23.82	-22.56	-24.51	-31.03	-21.64	-24.64	-21.13	-21.06	-22.58	-21.27	-26.09	-25.15	-21.86	-23.48	2.94
18	7.53	4.987	-24.41	-16.35	-21.33	-19.86	-22.76	-29.20	-19.67	-22.80	-18.89	-18.84	-20.14	-19.40	-24.67	-23.21	-19.69	-21.41	3.05
19	7.11	3.943	-17.98	-13.38	-18.02	-16.49	-18.78	9999.99	-17.10	-18.62	-15.42	-15.76	-16.97	-16.52	-21.72	-19.89	-16.49	-17.37	1.97
20	6.74	3.428	-9.25	-7.98	-11.54	-10.01	-8.09	9999.99	-12.18	-7.39	-7.58	-6.98	-10.59	-10.84	-14.86	9999.99	-8.85	-9.70	2.19
21	6.40	3.821	-4.59	-2.62	-4.71	-3.36	14.27	9999.99	-5.74	16.21	2.42	4.51	-3.79	-4.13	-7.63	9999.99	-.18	.03	7.21
22	6.10	3.986	.82	2.63	.39	1.58	24.06	9999.99	-.42	27.01	12.03	15.49	1.33	.99	-3.61	9999.99	6.72	6.80	9.42
23	5.82	4.565	9.27	12.15	11.00	11.63	26.65	9999.99	10.20	29.41	23.58	26.44	11.95	11.70	8.54	9999.99	16.85	16.09	7.28
24	5.57	5.858	17.52	18.56	19.84	19.14	27.82	9999.99	19.44	29.14	27.19	28.96	20.08	20.01	19.18	9999.99	22.82	22.28	4.17
25	5.33	6.535	22.07	21.45	22.34	22.05	30.03	9999.99	22.26	31.05	28.55	29.94	22.76	22.63	22.48	9999.99	24.96	24.81	3.51
26	5.12	6.435	23.78	21.36	22.55	22.43	30.31	9999.99	22.28	33.00	33.05	34.41	23.26	23.41	22.57	9999.99	25.23	25.97	4.64
27	4.92	5.913	25.76	20.07	22.47	20.67	29.54	9999.99	21.98	32.90	35.19	36.12	22.80	23.58	21.30	9999.99	26.29	26.05	5.39
28	4.74	5.142	27.57	22.28	24.96	22.95	30.25	9999.99	24.65	33.93	36.42	36.96	25.16	25.92	23.79	9999.99	27.80	27.89	4.81
29	4.57	4.032	24.77	22.54	26.97	24.04	29.90	9999.99	26.85	33.27	37.03	37.67	27.19	28.07	26.30	9999.99	27.76	28.64	4.50
30	4.41	3.362	23.46	21.55	24.12	21.77	28.85	9999.99	24.18	31.75	35.92	35.93	24.84	25.74	23.01	9999.99	26.98	26.77	4.74
31	4.27	3.574	28.17	25.45	22.49	22.51	28.94	9999.99	22.17	31.95	34.53	33.82	23.63	24.31	20.34	9999.99	27.80	26.62	4.48

Table B.29 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 04/02/94 16:00 HOURS Hmo= .32 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.813	-59.06	-35.63	-40.34	-39.82	-32.97	-23.89	-30.71	-33.13	-22.76	-27.72	-41.17	-26.96	-57.59	-43.74	-25.80	-36.03	10.77
3	64.00	.913	-40.17	-34.14	-35.97	-36.07	-31.71	-31.22	-37.49	-32.08	-28.93	-30.32	-36.36	-31.23	-40.34	-36.39	-29.45	-34.12	3.60
4	42.67	.536	-31.25	-40.75	-40.93	-44.73	-35.27	-28.25	-39.13	-34.60	-36.63	-35.14	-42.75	-35.01	-21.48	-42.72	-36.24	-36.34	5.89
5	32.00	.306	-60.06	-34.24	-61.65	-55.23	-48.58	-42.25	-61.97	-52.65	-51.96	-51.89	-55.90	-51.00	-65.98	-54.57	-47.31	-53.03	7.81
6	25.60	.242	-62.57	-27.95	-57.11	-53.23	-45.99	-30.35	-57.69	-57.62	-45.67	-43.27	-52.99	-42.93	-65.66	-52.47	-38.85	-48.99	10.67
7	21.33	.384	-22.19	-17.69	-38.08	-40.06	-22.08	-20.91	-35.00	-22.12	-22.67	-23.05	-35.20	-15.50	-32.19	-30.11	-24.16	-26.73	7.44
8	18.29	.834	-16.09	-11.56	-21.20	-23.17	-14.47	-16.63	-16.73	-14.57	-17.90	-20.95	-19.34	-5.43	-21.82	-16.69	-14.58	-16.75	4.34
9	16.00	1.668	-16.68	-11.33	-14.99	-17.15	-14.40	-16.19	-14.64	-14.08	-15.34	-17.65	-14.36	-2.92	-22.26	-14.11	-12.01	-14.54	3.97
10	14.22	2.599	-14.02	-9.47	-10.66	-13.36	-12.32	-15.15	-8.76	-12.30	-13.45	-15.89	-10.42	-.23	-17.50	-11.95	-10.36	-11.73	3.87
11	12.80	2.711	-13.41	-11.77	-11.15	-13.92	-13.12	-18.77	-12.24	-12.66	-13.52	-14.79	-11.31	-4.33	-18.53	-12.20	-11.60	-12.89	3.21
12	11.64	3.978	-20.96	-17.00	-17.64	-17.83	-19.60	-24.29	-21.17	-19.43	-18.96	-19.24	-17.05	-15.07	-24.64	-18.47	-18.32	-19.31	2.51
13	10.67	7.568	-25.09	-20.58	-21.90	-20.99	-23.23	-28.46	-24.09	-23.32	-22.12	-22.29	-21.09	-20.85	-28.02	-22.35	-22.16	-23.10	2.34
14	9.85	12.033	-26.31	-22.54	-25.09	-24.25	-24.91	-30.38	-24.02	-25.07	-23.59	-23.65	-24.39	-23.69	-28.34	-25.29	-23.94	-25.03	1.94
15	9.14	12.286	-26.54	-22.85	-25.85	-25.25	-25.68	-31.78	-24.97	-25.82	-24.36	-24.40	-25.25	-24.34	-27.60	-26.21	-24.62	-25.70	1.95
16	8.53	8.705	-25.42	-22.04	-24.55	-23.75	-25.53	-31.75	-24.95	-25.70	-23.68	-23.89	-23.92	-23.37	-28.05	-26.03	-23.90	-25.10	2.24
17	8.00	5.925	-22.33	-16.93	-21.10	-19.78	-23.96	-26.89	-20.57	-24.05	-19.94	-20.57	-19.99	-19.62	-24.96	-25.05	-20.11	-21.72	2.61
18	7.53	4.698	-13.13	-7.80	-11.12	-10.50	-13.96	9999.99	-11.37	-13.70	-9.95	-8.92	-10.10	-10.28	-13.53	-15.55	-10.16	-11.43	2.12
19	7.11	4.678	-7.50	-4.36	-7.30	-7.13	-3.88	9999.99	-7.30	-2.94	-3.36	-.62	-6.50	-6.53	-8.51	9999.99	-4.78	-5.44	2.21
20	6.74	3.823	-5.77	-1.64	-4.41	-3.73	-1.10	9999.99	-4.36	.17	-.39	2.38	-3.39	-3.53	-5.88	9999.99	-2.39	-2.62	2.33
21	6.40	3.413	-5.56	-1.79	-3.92	-3.14	1.75	9999.99	-3.96	2.90	-1.35	1.35	-3.04	-3.86	-5.93	9999.99	-2.50	-2.23	2.64
22	6.10	3.752	-1.50	1.07	-1.96	-.36	15.35	9999.99	-2.06	17.36	5.23	8.02	-.85	-2.08	-5.93	9999.99	2.87	2.69	6.76
23	5.82	4.796	4.18	8.69	6.39	7.73	18.62	9999.99	6.04	20.86	16.69	19.61	7.53	6.60	4.14	9999.99	12.17	10.70	5.88
24	5.57	5.093	7.25	9.90	10.51	10.88	21.02	9999.99	10.05	23.20	21.53	24.76	11.27	11.10	7.56	9999.99	15.82	14.21	5.99
25	5.33	5.160	13.48	11.57	14.61	14.07	23.31	9999.99	13.48	26.37	26.97	28.92	14.92	15.48	12.02	9999.99	18.94	18.00	5.94
26	5.12	5.771	15.96	14.89	17.79	16.73	24.22	9999.99	17.10	27.81	30.36	31.57	17.77	18.36	16.53	9999.99	22.06	20.85	5.55
27	4.92	4.893	14.56	18.97	18.50	15.28	25.11	9999.99	18.99	26.42	29.31	30.11	18.66	19.47	18.29	9999.99	24.13	21.37	4.88
28	4.74	4.089	17.01	23.97	15.48	12.58	26.84	9999.99	16.69	26.80	28.85	28.80	16.94	17.02	15.50	9999.99	26.42	20.99	5.73
29	4.57	3.675	23.80	27.00	11.21	12.60	28.07	9999.99	11.81	30.75	33.49	32.49	14.62	15.26	9.64	9999.99	28.98	21.52	8.73
30	4.41	2.966	30.54	29.22	13.31	18.73	28.15	9999.99	9.55	36.46	38.20	37.36	16.57	18.06	8.59	9999.99	29.22	24.16	10.11
31	4.27	2.190	38.39	30.23	9999.99	14.53	30.83	9999.99	9999.99	38.15	38.21	36.59	9999.99	9999.99	9999.99	9999.99	30.21	32.17	7.51

Table B.30 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 04/02/94 19:00 HOURS Hmo= .28 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy						DIRECTION (degrees) for 15 different gauge triads										Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.709	-30.80	-20.50	-35.75	-30.53	-33.15	-53.78	-54.90	-38.24	-37.82	-32.73	-30.76	-33.45	-42.96	-29.80	-36.59	-36.09	8.64
3	64.00	.888	-56.71	-51.20	-45.37	-48.69	-45.84	-48.25	-49.90	-49.60	-44.83	-43.98	-48.94	-41.77	-54.76	-50.36	-41.28	-48.10	4.21
4	42.67	.547	-60.73	-71.32	-54.24	-67.24	-57.42	-49.96	-58.13	-64.80	-62.46	-60.39	-66.63	-54.09	-56.06	-66.94	-50.67	-60.07	6.24
5	32.00	.247	-94.81	-62.86	-72.99	-80.06	-63.38	-56.94	-58.89	-68.58	-59.67	-65.59	-80.05	-61.90	-94.73	-80.31	-45.63	-69.71	13.47
6	25.60	.231	-109.47	-61.11	-87.03	-92.45	-83.77	-63.26	-70.48	-123.25	-151.84	-145.99	-90.56	-83.03	-108.62	-90.71	-66.13	-94.37	27.07
7	21.33	.368	-31.32	-11.64	-17.41	-19.78	-25.34	-17.99	-17.94	-27.19	-21.35	-19.00	-16.09	-4.89	-36.00	-21.25	-23.05	-20.68	7.30
8	18.29	.821	-11.11	-6.96	-6.87	-9.83	-12.68	-13.55	-15.22	-9.08	-7.63	-6.06	-6.20	4.68	-20.28	-8.28	-9.19	-9.22	5.29
9	16.00	1.831	-11.14	-9.45	-8.45	-12.17	-11.19	-15.02	-15.36	-9.05	-8.90	-8.87	-8.16	4.38	-13.67	-10.05	-8.97	-9.75	4.41
10	14.22	2.587	-9.74	-8.40	-8.49	-12.16	-9.78	-14.32	-15.31	-7.34	-6.44	-4.36	-8.50	1.85	-10.61	-9.87	-7.99	-8.77	3.93
11	12.80	2.611	-10.61	-10.60	-11.23	-13.82	-12.12	-19.31	-18.92	-9.30	-8.43	-5.33	-11.33	-5.17	-18.94	-10.84	-10.33	-11.75	4.26
12	11.64	3.755	-17.80	-14.27	-17.37	-18.19	-17.20	-23.05	-23.47	-16.46	-15.23	-13.87	-16.86	-13.58	-22.17	-16.66	-15.97	-17.47	3.03
13	10.67	7.114	-21.69	-16.16	-20.52	-20.03	-20.07	-23.49	-24.40	-19.91	-18.27	-17.79	-19.54	-17.65	-24.25	-20.12	-19.12	-20.20	2.33
14	9.85	11.762	-24.57	-17.69	-22.13	-21.16	-22.11	-25.69	-21.17	-22.12	-20.14	-20.48	-21.12	-19.65	-25.68	-22.35	-20.61	-21.78	2.12
15	9.14	11.123	-24.91	-18.49	-22.70	-22.08	-22.76	-29.53	-20.91	-22.80	-20.93	-21.05	-21.90	-20.56	-25.20	-23.08	-21.21	-22.54	2.48
16	8.53	6.583	-23.94	-18.13	-22.24	-21.71	-22.99	-32.79	-21.90	-23.04	-20.95	-20.88	-21.47	-20.54	-24.65	-23.33	-21.17	-22.65	3.11
17	8.00	4.717	-17.07	-13.31	-15.00	-13.87	-18.63	-30.33	-17.35	-18.48	-15.98	-16.16	-14.15	-15.03	-20.01	-18.04	-15.81	-17.28	3.95
18	7.53	3.961	-5.59	-6.81	-8.73	-8.11	-6.82	-15.17	-10.31	-5.65	-5.87	-4.30	-8.11	-8.57	-12.47	-7.97	-7.51	-8.13	2.71
19	7.11	4.462	-1.56	-1.08	-3.43	-2.91	3.94	1.94	-4.24	5.85	3.11	5.05	-2.80	-2.68	-4.42	2.95	-.23	-.03	3.41
20	6.74	4.919	.39	1.57	.08	1.04	8.78	6.16	-.93	10.86	7.05	8.49	.72	.57	-1.50	8.87	3.38	3.70	4.06
21	6.40	4.752	2.17	4.40	2.97	3.98	14.72	9999.99	2.55	17.15	12.05	13.93	3.62	3.56	-.11	16.58	7.25	7.48	5.82
22	6.10	4.407	3.06	7.45	3.92	5.13	16.80	9999.99	3.90	18.94	13.99	16.01	4.93	4.57	-.02	19.11	9.87	9.11	6.32
23	5.82	3.466	3.39	6.96	3.30	4.75	21.69	9999.99	3.09	24.37	15.56	18.01	4.51	3.69	.61	24.29	10.79	10.34	8.33
24	5.57	2.782	7.15	5.60	4.95	5.10	27.55	9999.99	5.07	30.50	20.21	24.86	5.92	5.38	5.35	27.33	12.69	13.37	9.85
25	5.33	2.644	14.64	8.81	10.34	9.21	27.37	9999.99	10.39	29.33	20.28	24.45	10.88	11.14	11.37	26.46	14.15	16.33	7.28
26	5.12	3.271	16.20	13.35	11.33	11.41	24.72	9999.99	10.39	26.57	22.96	24.56	12.12	12.17	9.52	23.73	17.95	16.92	6.06
27	4.92	2.812	17.67	17.84	10.91	11.88	25.47	9999.99	9.41	27.57	27.00	27.51	12.45	12.36	8.78	24.51	21.96	18.24	7.00
28	4.74	2.347	18.80	20.04	9.89	11.59	24.41	9999.99	8.29	27.06	27.82	28.17	12.27	12.24	8.05	23.51	23.60	18.27	7.34
29	4.57	1.823	18.20	18.51	-2.68	2.64	23.67	9999.99	-1.52	26.47	28.75	28.42	2.24	2.46	-5.95	9999.99	23.86	12.71	12.73
30	4.41	1.347	23.13	18.06	-5.99	1.90	26.76	9999.99	-3.74	33.26	35.41	34.73	.00	1.96	-9.12	9999.99	24.75	13.94	16.11
31	4.27	.979	25.48	23.79	-10.34	3.07	9999.99	9999.99	-7.28	9999.99	37.84	36.80	-1.80	-.20	-13.03	9999.99	27.12	10.99	18.43

Table B.31 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 04/02/94 22:00 HOURS Hmo= .26 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.811	-13.38	-1.04	-37.55	-33.53	-25.91	-36.65	-45.44	-26.13	-32.11	-23.97	-28.57	-24.45	.31	-29.10	-32.11	-26.06	12.26
3	64.00	1.078	-33.89	-21.79	-40.15	-37.25	-30.99	-38.61	-47.49	-31.45	-30.60	-29.95	-36.84	-30.09	-33.00	-36.92	-30.88	-33.99	5.70
4	42.67	.612	-58.35	-41.15	-49.36	-50.52	-46.05	-44.02	-58.67	-50.13	-43.14	-42.73	-50.57	-41.33	-54.29	-52.00	-39.59	-48.12	5.94
5	32.00	.279	-71.32	-50.97	-58.63	-63.10	-56.29	-40.72	-63.23	-62.05	-55.77	-56.32	-62.70	-47.90	-67.63	-64.13	-47.13	-57.87	8.08
6	25.60	.206	-60.06	-31.10	-37.38	-38.63	-32.11	-26.59	-53.01	-32.05	-22.64	-30.13	-38.49	-21.80	-61.68	-40.19	-24.29	-36.60	12.24
7	21.33	.281	-36.18	-12.04	-12.43	-11.81	-12.29	-12.98	-18.21	-12.80	-8.63	-17.31	-12.83	1.50	-51.40	-13.51	-7.15	-15.71	12.11
8	18.29	.631	-14.22	-8.47	-3.89	-7.42	-11.83	-13.78	-7.63	-12.11	-12.37	-16.46	-3.81	9.60	-17.74	-10.37	-8.81	-9.31	6.41
9	16.00	1.357	-9.81	-5.59	-4.33	-6.99	-12.17	-14.50	-1.49	-12.23	-14.20	-18.40	-3.20	8.66	-20.80	-8.07	-8.42	-8.78	7.05
10	14.22	2.162	-8.92	-7.50	-6.29	-9.66	-12.28	-18.09	-2.40	-12.01	-13.86	-16.84	-6.05	3.65	-21.86	-8.55	-9.41	-10.01	6.11
11	12.80	2.519	-14.38	-11.72	-11.57	-14.76	-13.90	-21.04	-8.40	-13.58	-13.42	-13.75	-11.70	-3.20	-16.34	-14.22	-12.50	-12.97	3.71
12	11.64	3.756	-21.45	-16.15	-18.63	-19.90	-19.58	-26.10	-14.92	-19.47	-18.43	-18.77	-18.23	-12.34	-22.71	-19.88	-18.19	-18.98	3.09
13	10.67	6.405	-22.10	-18.09	-20.42	-21.05	-20.35	-25.75	-17.57	-20.25	-19.06	-18.99	-20.06	-15.97	-24.20	-20.92	-19.41	-20.28	2.37
14	9.85	11.390	-25.72	-20.84	-22.03	-21.37	-23.74	-30.28	-23.23	-23.82	-22.83	-23.29	-21.40	-20.60	-28.66	-22.72	-22.69	-23.55	2.66
15	9.14	11.462	-28.56	-22.46	-24.04	-22.42	-26.43	-31.33	-27.21	-26.50	-25.57	-26.75	-23.01	-23.76	-33.05	-24.67	-25.19	-26.06	2.98
16	8.53	7.062	-28.50	-21.84	-26.10	-25.00	-27.72	-29.83	-25.45	-27.87	-25.65	-25.89	-24.89	-24.05	-29.42	-27.43	-25.62	-26.35	2.05
17	8.00	4.856	-23.94	-20.78	-24.02	-23.19	-25.37	-30.25	-25.62	-25.50	-23.14	-23.36	-23.29	-23.31	-27.53	-25.64	-23.24	-24.55	2.16
18	7.53	3.773	-15.54	-13.18	-15.50	-13.93	-16.83	-23.64	-19.07	-16.53	-14.03	-13.85	-14.64	-16.07	-21.90	-17.16	-14.31	-16.41	2.92
19	7.11	3.865	-10.96	-6.01	-9.12	-7.92	-9.57	9999.99	-9.61	-8.83	-5.52	-4.25	-8.12	-8.53	-11.87	-10.88	-6.97	-8.44	2.10
20	6.74	3.652	-5.23	-1.24	-3.74	-3.23	-1.14	9999.99	-4.12	-.16	-.26	2.43	-2.78	-3.56	-4.64	-2.88	-1.52	-2.29	2.01
21	6.40	3.392	1.09	.52	-.99	-.55	11.47	9999.99	-1.35	13.38	6.40	9.35	-.26	-.50	-4.79	9999.99	3.07	2.83	5.35
22	6.10	3.071	5.43	2.90	.14	1.76	16.04	9999.99	-.07	19.03	12.46	14.36	1.01	1.19	-4.47	9999.99	6.71	5.88	7.01
23	5.82	2.328	9.29	4.81	5.39	5.71	22.73	9999.99	5.27	25.62	16.46	19.66	5.80	5.75	2.44	9999.99	10.63	10.72	7.43
24	5.57	2.115	6.25	5.12	6.09	5.90	25.62	9999.99	6.42	29.02	19.30	23.60	6.73	6.60	3.18	9999.99	11.87	11.95	8.69
25	5.33	2.252	3.14	9.43	6.31	7.07	23.07	9999.99	6.65	25.78	20.33	23.53	7.63	7.29	2.83	9999.99	13.91	12.06	7.91
26	5.12	1.677	2.99	8.84	-2.16	.20	26.39	9999.99	-1.10	28.44	20.34	24.60	.64	-.54	-5.66	9999.99	14.41	8.99	11.76
27	4.92	1.343	4.94	4.00	-9.47	-4.93	29.82	9999.99	-7.91	31.80	21.34	27.16	-5.59	-6.96	-11.01	9999.99	13.55	6.59	15.48
28	4.74	1.115	9.45	2.60	-.19	1.20	31.01	9999.99	-.50	34.67	32.91	34.48	1.84	1.93	-1.01	9999.99	18.83	12.78	14.53
29	4.57	.883	11.61	5.35	9999.99	9999.99	31.20	9999.99	9999.99	37.47	41.54	40.99	9999.99	9999.99	9999.99	9999.99	22.93	27.36	13.40
30	4.41	.609	2.39	4.33	9999.99	9999.99	31.16	9999.99	9999.99	38.68	44.66	43.09	9999.99	9999.99	9999.99	9999.99	23.99	27.01	16.27
31	4.27	.369	-.66	-.02	9999.99	9999.99	32.19	9999.99	9999.99	37.74	43.26	39.95	9999.99	9999.99	9999.99	9999.99	23.92	25.36	17.14

Table B.32 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 05/02/94 01:00 HOURS Hmo= .23 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.679	-30.59	-66.67	-19.43	-35.50	-37.94	-39.88	-15.65	-45.30	-41.69	-22.47	-33.58	-29.82	-12.55	-38.17	-37.83	-33.74	12.93
3	64.00	.929	-43.20	-50.16	-34.48	-36.51	-41.99	-45.50	-41.43	-51.33	-47.65	-40.21	-36.45	-37.72	-43.98	-38.40	-42.69	-42.11	4.87
4	42.67	.515	-75.81	-40.47	-68.35	-59.46	-62.60	-68.95	-59.74	-76.76	-74.50	-74.33	-59.84	-61.34	-77.15	-60.13	-62.20	-65.48	9.46
5	32.00	.225	-69.81	-41.96	-54.56	-55.71	-47.36	-47.10	-35.27	-49.14	-40.68	-45.26	-55.81	-43.85	-68.93	-56.13	-38.46	-49.97	9.85
6	25.60	.182	-29.80	-30.10	-21.55	-28.61	-17.18	-22.64	-18.97	-17.47	-12.73	-16.21	-25.99	-11.32	-23.60	-27.60	-14.41	-21.21	6.08
7	21.33	.262	-17.72	-10.11	-15.00	-15.30	-15.50	-17.05	-18.50	-13.70	-10.84	-9.41	-13.21	-3.36	-24.98	-15.74	-13.24	-14.24	4.70
8	18.29	.536	-16.48	-4.34	-15.47	-14.39	-13.04	-12.87	-26.17	-9.60	-7.28	-5.33	-12.84	-4.59	-28.01	-11.79	-9.56	-12.77	6.73
9	16.00	1.228	-15.40	-8.67	-15.43	-15.41	-12.23	-13.92	-25.85	-10.20	-8.48	-7.56	-14.39	-7.70	-21.53	-12.89	-10.26	-13.32	4.96
10	14.22	2.169	-14.30	-11.51	-14.47	-14.72	-13.58	-16.79	-19.81	-12.04	-10.50	-9.44	-14.00	-9.25	-21.47	-13.47	-12.35	-13.84	3.33
11	12.80	2.315	-15.38	-15.78	-14.78	-15.50	-16.27	-21.48	-18.35	-15.38	-15.31	-15.11	-14.69	-11.05	-26.26	-14.99	-15.34	-16.37	3.37
12	11.64	3.308	-20.50	-19.38	-20.17	-20.79	-20.66	-23.16	-23.81	-20.52	-19.86	-19.48	-19.97	-16.90	-26.50	-20.57	-19.97	-20.82	2.14
13	10.67	6.830	-22.91	-20.03	-22.84	-22.43	-22.20	-25.57	-23.92	-22.22	-21.18	-21.26	-22.19	-19.93	-27.06	-22.89	-21.67	-22.55	1.82
14	9.85	10.439	-27.03	-23.64	-26.23	-25.47	-25.56	-29.70	-25.62	-25.69	-24.71	-25.47	-25.59	-23.96	-31.28	-26.08	-24.95	-26.06	1.94
15	9.14	8.760	-28.20	-24.95	-27.97	-27.31	-26.90	-30.41	-29.16	-27.21	-25.75	-26.00	-27.47	-26.00	-31.91	-27.65	-26.13	-27.53	1.79
16	8.53	6.219	-26.26	-21.95	-25.30	-24.47	-24.82	-29.29	-25.94	-25.03	-22.78	-22.71	-24.73	-23.46	-28.61	-25.59	-23.51	-24.96	1.98
17	8.00	4.566	-27.32	-19.72	-25.37	-23.92	-25.62	-28.42	-23.55	-25.78	-22.63	-22.93	-24.21	-23.00	-28.04	-26.37	-23.19	-24.67	2.26
18	7.53	3.140	-25.36	-16.69	-22.41	-20.91	-24.38	-28.49	-20.31	-24.50	-20.05	-20.25	-21.13	-19.81	-25.57	-25.35	-20.83	-22.40	2.98
19	7.11	2.459	-17.63	-11.59	-17.67	-15.60	-19.70	-23.22	-18.23	-19.58	-14.30	-14.48	-16.19	-15.87	-23.97	-21.53	-15.46	-17.67	3.33
20	6.74	2.229	-7.70	-6.37	-12.04	-10.33	-8.22	9999.99	-12.94	-7.33	-5.20	-4.12	-10.79	-10.84	-16.95	-16.18	-7.24	-9.73	3.72
21	6.40	2.173	-2.48	-.63	-5.08	-3.65	2.58	9999.99	-6.03	4.09	2.47	4.23	-4.03	-4.45	-7.69	9999.99	.04	-1.59	3.84
22	6.10	2.035	-1.73	3.40	-1.49	.73	9.82	9999.99	-2.96	11.70	6.06	8.22	-.01	-1.72	-5.00	9999.99	4.03	2.39	5.07
23	5.82	1.890	-4.69	2.09	-3.30	-.77	9999.99	9999.99	-4.12	9999.99	4.84	8.21	-1.17	-2.72	-6.93	9999.99	2.66	-.54	4.33
24	5.57	1.632	-1.86	5.34	-1.93	1.52	9999.99	9999.99	-2.98	9999.99	12.02	15.75	1.04	-1.32	-3.88	9999.99	8.87	2.95	6.32
25	5.33	1.262	-5.29	1.72	-5.83	-1.19	9999.99	9999.99	-7.23	9999.99	7.57	12.40	-2.24	-5.15	-7.97	9999.99	4.48	-.81	6.31
26	5.12	1.061	-14.36	-4.66	-12.21	-7.05	9999.99	9999.99	-12.66	9999.99	9999.99	9999.99	-8.09	-11.29	-16.86	9999.99	9999.99	-10.90	3.78
27	4.92	.881	-17.27	-6.54	-13.44	-8.12	9999.99	9999.99	-14.01	9999.99	9999.99	9999.99	-9.47	-11.24	-22.20	9999.99	9999.99	-12.78	4.81
28	4.74	.594	-22.79	-6.32	-19.13	-11.51	9999.99	9999.99	-17.69	9999.99	9999.99	9999.99	-13.56	-15.78	-25.25	9999.99	9999.99	-16.50	5.73
29	4.57	.477	-28.03	-10.39	-25.84	-21.60	9999.99	9999.99	-24.46	9999.99	9999.99	9999.99	-22.89	-22.05	-32.00	9999.99	9999.99	-23.42	5.88
30	4.41	.393	-31.42	-14.85	-30.66	-29.66	9999.99	9999.99	-30.83	9999.99	9999.99	9999.99	-30.11	-26.65	-32.46	9999.99	9999.99	-28.34	5.34
31	4.27	.268	-26.79	-12.97	-29.35	-28.22	9999.99	9999.99	-31.93	9999.99	9999.99	9999.99	-28.26	-26.31	-29.66	9999.99	9999.99	-26.70	5.44

Table B.33 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 05/02/94 04:00 HOURS Hmo= .22 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.821	-99.49	-36.97	-58.97	-52.64	-37.48	-42.06	-48.63	-39.16	-25.04	-38.69	-56.78	-38.75	-96.08	-55.04	-28.48	-49.66	20.94
3	64.00	1.220	-80.32	-50.24	-46.58	-48.98	-41.99	-39.64	-59.49	-43.78	-34.38	-42.11	-51.88	-41.22	-83.35	-51.33	-33.54	-49.73	14.15
4	42.67	.674	-95.22	-50.35	-56.32	-54.75	-46.46	-44.01	-67.11	-50.65	-37.81	-49.30	-57.81	-48.37	-93.81	-56.42	-35.33	-55.92	16.84
5	32.00	.267	-62.63	-44.72	-70.87	-67.82	-48.42	-41.80	-49.30	-57.07	-46.86	-47.67	-67.80	-52.65	-60.90	-66.95	-38.36	-54.92	10.26
6	25.60	.242	-60.56	-39.97	-66.58	-61.86	-52.31	-48.23	-51.69	-57.27	-52.82	-52.08	-61.56	-52.36	-55.52	-61.42	-45.20	-54.63	6.86
7	21.33	.343	-36.65	-26.37	-43.17	-42.83	-28.11	-35.63	-40.32	-27.90	-27.87	-29.23	-40.31	-22.49	-33.41	-39.83	-28.30	-33.49	6.52
8	18.29	.702	-25.63	-19.90	-22.52	-25.40	-18.19	-21.65	-18.60	-18.42	-19.82	-24.65	-22.83	-7.66	-35.77	-21.84	-17.54	-21.36	5.72
9	16.00	1.771	-18.05	-11.85	-14.05	-14.94	-15.05	-18.87	-5.03	-15.67	-17.27	-21.15	-13.43	-5.59	-24.02	-14.54	-13.33	-14.86	4.85
10	14.22	2.672	-18.23	-13.11	-15.34	-16.17	-16.18	-19.35	-14.29	-15.99	-16.42	-18.12	-14.57	-7.97	-22.57	-15.79	-15.05	-15.94	3.09
11	12.80	2.453	-16.90	-13.78	-16.22	-17.03	-14.83	-17.56	-17.34	-14.47	-14.73	-16.02	-15.64	-9.71	-22.01	-15.41	-13.76	-15.69	2.53
12	11.64	3.228	-15.92	-13.49	-15.94	-15.73	-15.92	-18.24	-19.39	-15.52	-15.15	-15.11	-15.24	-13.20	-21.72	-15.74	-15.04	-16.09	2.11
13	10.67	5.224	-20.15	-16.17	-19.50	-19.17	-19.63	-22.27	-21.43	-19.48	-17.71	-17.25	-18.80	-17.14	-23.94	-19.79	-18.38	-19.39	1.97
14	9.85	6.893	-23.44	-19.02	-23.16	-22.94	-22.96	-27.02	-21.26	-23.02	-20.71	-20.00	-22.46	-20.55	-24.93	-23.82	-21.41	-22.45	1.97
15	9.14	6.708	-24.02	-19.99	-24.08	-23.71	-23.55	-28.32	-23.40	-23.67	-21.54	-20.58	-23.37	-21.63	-25.02	-24.67	-22.34	-23.33	1.94
16	8.53	5.410	-24.02	-20.61	-23.55	-22.79	-23.02	-29.81	-25.27	-23.09	-21.53	-21.30	-22.95	-22.10	-27.28	-23.52	-22.12	-23.53	2.30
17	8.00	3.773	-25.23	-21.72	-24.01	-22.56	-24.68	-30.63	-28.23	-24.86	-23.16	-23.41	-23.27	-23.97	-31.41	-24.01	-23.49	-24.97	2.76
18	7.53	2.701	-24.80	-20.90	-23.95	-22.29	-24.88	-31.99	-27.29	-25.06	-22.53	-22.93	-23.12	-23.86	-30.72	-24.53	-22.87	-24.78	2.96
19	7.11	1.839	-20.15	-17.13	-19.96	-18.15	-19.41	-33.18	-21.27	-19.22	-16.26	-16.88	-19.19	-18.86	-27.05	-20.86	-17.46	-20.33	4.23
20	6.74	1.313	-15.42	-10.90	-15.51	-13.59	-18.01	-32.10	-17.98	-17.69	-11.27	-10.53	-14.32	-14.63	-22.40	-20.78	-12.86	-16.52	5.35
21	6.40	1.468	-18.74	-9.38	-16.58	-14.18	-29.82	-46.36	-18.67	-30.13	-15.50	-13.58	-14.58	-16.48	-21.57	-29.67	-15.48	-20.66	9.19
22	6.10	1.591	-20.44	-8.45	-17.01	-14.17	-39.69	-50.88	-17.38	-39.97	-15.70	-13.74	-14.48	-15.93	-19.14	-34.14	-15.74	-22.36	11.99
23	5.82	1.760	-21.70	-11.22	-18.39	-16.03	-40.83	-46.24	-17.40	-41.19	-16.71	-14.74	-16.25	-17.03	-21.30	-35.07	-17.13	-23.35	10.96
24	5.57	1.602	-25.42	-13.28	-21.28	-17.85	-39.22	-44.01	-19.96	-39.74	-16.38	-14.69	-18.78	-19.11	-26.02	-34.32	-17.22	-24.45	9.69
25	5.33	1.389	-29.00	-18.23	-30.19	-25.24	-39.74	-43.22	-29.49	-40.49	-31.88	-32.01	-26.34	-28.24	-34.17	-34.44	-31.88	-31.64	6.15
26	5.12	1.442	-30.30	-25.54	-34.02	-31.33	-41.90	-41.67	-33.55	-42.69	-38.04	-38.74	-31.80	-33.47	-34.02	-37.35	-38.18	-35.51	4.68
27	4.92	1.322	-34.46	-29.27	-35.56	-33.90	-41.30	-45.04	-32.97	-41.71	-40.24	-41.56	-34.30	-34.47	-36.61	-38.50	-40.79	-37.38	4.15
28	4.74	.869	-37.42	-24.83	-36.69	-33.45	-39.31	-47.17	-35.34	-40.13	-42.13	-44.42	-34.36	-34.70	-41.04	-37.00	-43.13	-38.08	5.24
29	4.57	.653	-38.55	-23.06	-37.90	-33.37	-37.60	-45.87	-37.78	-38.71	-43.23	-44.66	-34.43	-34.85	-44.03	-36.50	-44.32	-38.33	5.65
30	4.41	.511	-41.10	-26.63	-38.83	-33.87	-37.55	-45.14	-36.68	-38.63	-41.57	-42.78	-34.95	-34.42	-45.60	-37.34	-41.71	-38.46	4.74
31	4.27	.374	-44.86	-26.54	-35.94	-31.34	-33.50	9999.99	-35.62	-35.09	-41.44	-42.56	-32.45	-28.57	-45.55	-36.13	-41.61	-36.52	5.71

Table B.34 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 05/02/94 07:00 HOURS Hmo= .23 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.941	-39.28	-41.70	-33.59	-32.30	-40.16	-47.89	-41.37	-43.31	-43.14	-40.81	-33.25	-39.50	-40.50	-33.33	-43.71	-39.59	4.41
3	64.00	1.085	-45.12	-40.31	-39.67	-37.87	-39.63	-45.39	-46.96	-41.95	-40.10	-40.23	-39.19	-40.31	-50.20	-38.52	-39.27	-41.65	3.46
4	42.67	.740	-60.14	-50.13	-46.27	-48.11	-43.94	-42.15	-50.17	-46.46	-42.92	-45.73	-49.47	-45.13	-67.12	-48.48	-40.37	-48.42	6.71
5	32.00	.314	-64.77	-54.62	-53.38	-56.37	-48.81	-43.86	-53.02	-57.45	-54.53	-55.22	-56.95	-51.09	-72.44	-55.26	-46.75	-54.95	6.65
6	25.60	.251	-44.60	-40.53	-45.04	-45.44	-44.78	-53.94	-29.85	-52.17	-51.11	-47.88	-44.24	-40.93	-46.88	-45.24	-47.10	-45.32	5.48
7	21.33	.446	-23.99	-17.62	-23.83	-24.39	-25.46	-26.67	-13.82	-25.83	-26.90	-26.56	-21.61	-14.87	-26.38	-24.67	-26.63	-23.29	4.21
8	18.29	.742	-19.41	-16.15	-14.76	-17.94	-18.81	-18.32	-13.23	-18.26	-18.65	-18.42	-14.43	-2.78	-21.89	-18.31	-18.30	-16.65	4.26
9	16.00	1.318	-12.04	-6.03	-7.08	-10.58	-11.71	-9.53	-7.65	-10.85	-12.37	-12.88	-6.23	5.14	-9.80	-9.69	-8.01	-8.63	4.25
10	14.22	2.559	-11.29	-5.63	-6.90	-8.76	-11.72	-10.87	-9.57	-10.73	-11.25	-11.38	-6.12	.14	-13.86	-9.09	-8.26	-9.02	3.29
11	12.80	3.251	-12.57	-8.80	-9.38	-10.19	-12.51	-15.44	-9.27	-11.65	-11.83	-12.17	-8.74	-3.78	-19.54	-10.73	-10.53	-11.14	3.35
12	11.64	3.215	-15.96	-12.73	-14.02	-15.58	-15.99	-20.75	-16.62	-15.20	-14.39	-12.92	-13.59	-8.36	-20.67	-14.91	-14.66	-15.09	2.91
13	10.67	4.720	-20.34	-16.92	-18.87	-19.08	-19.77	-26.84	-19.82	-19.66	-19.11	-19.29	-18.35	-16.71	-25.83	-18.70	-18.52	-19.85	2.72
14	9.85	6.214	-23.66	-19.73	-22.49	-22.04	-22.60	-27.88	-24.63	-22.64	-21.63	-21.58	-21.77	-20.98	-28.15	-22.24	-21.54	-22.90	2.27
15	9.14	7.348	-25.21	-20.74	-25.13	-24.55	-23.91	-28.85	-25.22	-24.04	-22.33	-21.72	-24.32	-22.70	-26.76	-25.01	-22.91	-24.23	1.96
16	8.53	7.009	-26.82	-20.39	-25.46	-24.16	-24.41	-30.12	-25.10	-24.54	-22.58	-22.65	-24.40	-23.39	-29.07	-24.98	-23.09	-24.74	2.39
17	8.00	4.374	-26.03	-20.42	-24.97	-23.46	-24.47	-31.01	-24.97	-24.60	-23.01	-23.04	-23.88	-23.63	-29.81	-24.35	-23.39	-24.74	2.54
18	7.53	3.063	-25.05	-23.70	-25.69	-24.58	-25.62	-30.25	-25.95	-25.76	-25.26	-25.70	-25.15	-24.95	-31.99	-26.03	-25.43	-26.07	2.08
19	7.11	2.617	-25.69	-20.69	-25.19	-23.88	-26.58	-30.12	-24.56	-26.75	-24.26	-24.28	-24.17	-23.60	-29.44	-27.34	-24.49	-25.40	2.29
20	6.74	2.015	-23.96	-17.24	-23.40	-22.20	-25.41	-35.99	-21.76	-25.55	-20.83	-19.65	-22.05	-21.11	-25.13	-27.06	-21.42	-23.51	4.14
21	6.40	1.583	-21.67	-16.38	-20.32	-19.08	-24.32	-43.13	-20.19	-24.44	-18.68	-17.37	-19.11	-19.74	-22.50	-25.69	-19.21	-22.09	6.17
22	6.10	1.485	-22.53	-13.72	-20.75	-17.66	-27.41	-41.08	-20.72	-27.62	-19.03	-19.36	-18.87	-20.59	-27.22	-27.92	-19.30	-22.90	6.33
23	5.82	1.653	-27.20	-15.11	-24.40	-19.83	-32.30	-37.78	-23.63	-32.54	-22.76	-24.05	-21.95	-23.74	-34.69	-30.31	-22.87	-26.21	5.92
24	5.57	1.957	-32.56	-18.39	-27.82	-23.37	-34.79	-39.36	-28.23	-35.10	-27.18	-28.20	-24.98	-26.77	-35.27	-31.74	-27.14	-29.39	5.23
25	5.33	2.228	-32.22	-23.73	-32.13	-28.77	-35.97	-40.96	-32.42	-36.44	-32.75	-32.94	-29.50	-30.77	-34.37	-33.81	-32.76	-32.64	3.72
26	5.12	2.345	-34.14	-27.58	-35.78	-32.98	-37.31	-41.47	-35.01	-37.95	-36.27	-36.79	-33.46	-34.14	-38.61	-35.61	-36.32	-35.56	3.00
27	4.92	1.767	-36.75	-27.31	-36.19	-32.90	-38.04	-42.47	-36.00	-38.57	-36.36	-37.58	-33.77	-34.48	-41.19	-35.91	-36.40	-36.26	3.41
28	4.74	1.141	-37.82	-27.06	-34.94	-31.85	-36.85	-42.17	-35.12	-37.87	-36.20	-36.52	-32.81	-33.31	-39.07	-35.02	-36.10	-35.52	3.36
29	4.57	1.020	-41.67	-29.77	-39.39	-35.65	-38.78	-44.06	-38.45	-39.74	-40.51	-40.69	-36.52	-37.59	-43.26	-37.84	-40.55	-38.97	3.32
30	4.41	1.007	-46.58	-34.12	-42.55	-39.82	-42.30	-48.19	-41.00	-42.59	-43.17	-44.05	-40.45	-40.80	-46.70	-42.05	-43.46	-42.52	3.24
31	4.27	.760	-46.89	-37.56	-43.37	-42.59	-44.27	-48.61	-40.63	-44.64	-44.07	-44.78	-42.82	-42.11	-45.21	-44.73	-43.89	-43.75	2.48

Table B.35 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 05/02/94 10:00 HOURS Hmo= .26 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.760	-25.13	-9.97	-31.81	-29.72	-29.24	-28.91	-46.08	-29.48	-27.11	-20.67	-26.61	-20.82	-3.03	-30.81	-27.52	-25.82	9.48
3	64.00	1.211	-38.48	-14.21	-41.15	-35.06	-35.58	-45.52	-35.09	-37.02	-33.52	-31.71	-34.42	-31.57	-31.19	-36.22	-33.35	-34.29	6.50
4	42.67	.791	-52.90	-34.33	-54.90	-51.70	-46.47	-51.15	-43.30	-49.74	-45.82	-45.27	-50.96	-43.03	-47.95	-52.24	-41.85	-47.45	5.21
5	32.00	.361	-45.76	-35.36	-55.14	-51.09	-40.99	-52.25	-63.25	-41.99	-41.36	-40.31	-50.54	-43.53	-45.80	-49.34	-39.15	-46.38	7.01
6	25.60	.287	-34.64	-30.43	-42.24	-39.25	-34.25	-46.52	-57.41	-33.47	-34.64	-35.40	-38.27	-32.53	-38.34	-37.64	-34.68	-37.96	6.49
7	21.33	.327	-23.42	-26.21	-18.20	-22.29	-23.75	-27.45	-29.40	-23.62	-25.04	-26.28	-19.55	-6.39	-19.18	-24.89	-24.14	-22.67	5.27
8	18.29	.648	-17.08	-14.36	-7.19	-11.62	-15.60	-12.38	-12.89	-15.40	-16.57	-18.37	-7.86	8.26	-13.26	-14.02	-13.58	-12.16	6.20
9	16.00	1.276	-13.17	-10.98	-8.21	-13.65	-12.86	-13.17	-16.14	-11.31	-10.85	-9.90	-8.80	4.81	-10.93	-11.73	-10.66	-10.51	4.53
10	14.22	2.566	-12.46	-10.21	-9.39	-12.96	-12.41	-15.81	-19.11	-10.36	-9.31	-7.31	-9.51	-.45	-13.90	-10.96	-10.60	-10.99	3.99
11	12.80	2.972	-13.76	-8.97	-9.44	-10.98	-12.98	-14.11	-15.43	-12.08	-12.22	-12.94	-8.94	-2.52	-19.96	-10.37	-10.44	-11.68	3.69
12	11.64	3.184	-13.75	-9.39	-9.30	-10.29	-13.33	-14.67	-10.66	-13.00	-13.60	-14.74	-8.74	-4.32	-22.04	-10.49	-11.10	-11.96	3.79
13	10.67	5.239	-19.73	-15.92	-16.46	-16.73	-17.96	-25.81	-17.53	-17.71	-17.02	-17.44	-15.90	-12.89	-25.19	-17.32	-16.64	-18.01	3.25
14	9.85	8.950	-26.89	-21.62	-23.77	-23.00	-24.15	-30.89	-22.45	-24.19	-23.45	-24.70	-22.92	-21.50	-31.43	-23.74	-22.99	-24.51	2.89
15	9.14	11.702	-28.49	-23.26	-26.45	-25.36	-26.66	-29.79	-26.32	-26.80	-25.88	-26.41	-25.45	-24.51	-31.71	-26.40	-25.81	-26.62	1.99
16	8.53	9.762	-28.67	-24.04	-27.80	-26.82	-27.88	-30.09	-27.76	-28.13	-26.84	-26.55	-26.80	-25.88	-31.03	-27.79	-26.98	-27.54	1.60
17	8.00	7.255	-28.06	-24.72	-27.68	-26.96	-27.31	-30.98	-27.39	-27.58	-26.18	-25.76	-27.05	-25.85	-31.54	-27.77	-26.48	-27.42	1.74
18	7.53	5.840	-28.96	-24.94	-28.08	-27.50	-27.70	-31.58	-26.70	-28.03	-26.18	-25.71	-27.50	-25.92	-30.18	-28.64	-26.59	-27.61	1.70
19	7.11	4.298	-30.91	-25.88	-28.49	-27.70	-28.89	-32.96	-26.86	-29.24	-27.04	-27.00	-27.85	-26.61	-31.04	-29.55	-27.34	-28.49	1.90
20	6.74	3.658	-32.06	-28.33	-30.34	-29.52	-30.44	-34.42	-29.41	-30.90	-28.95	-29.08	-29.90	-29.09	-33.93	-31.28	-29.17	-30.45	1.74
21	6.40	2.481	-32.43	-27.91	-30.93	-29.45	-31.54	-37.38	-29.76	-32.07	-29.42	-30.12	-30.37	-30.09	-36.86	-32.38	-29.63	-31.35	2.56
22	6.10	1.511	-31.82	-23.43	-30.68	-27.30	-34.18	-40.88	-29.60	-34.61	-29.40	-30.17	-28.59	-29.82	-36.80	-32.94	-29.44	-31.31	4.03
23	5.82	1.556	-27.68	-24.25	-27.98	-27.10	-32.66	-40.65	-27.69	-33.08	-28.15	-26.85	-27.23	-27.57	-27.69	-32.44	-28.28	-29.28	3.83
24	5.57	1.602	-29.81	-26.93	-28.20	-28.08	-34.14	-39.72	-28.95	-34.74	-30.57	-29.35	-28.05	-28.32	-29.76	-33.47	-30.63	-30.71	3.31
25	5.33	1.613	-31.86	-26.95	-28.42	-27.58	-35.52	-40.13	-29.40	-36.27	-30.47	-30.26	-28.02	-28.33	-33.03	-33.64	-30.54	-31.36	3.61
26	5.12	1.703	-34.77	-27.65	-34.31	-31.69	-38.09	-42.02	-33.95	-38.77	-35.02	-36.01	-32.57	-33.66	-38.95	-35.96	-35.03	-35.23	3.31
27	4.92	1.635	-36.92	-30.33	-39.96	-36.84	-40.26	-43.69	-38.76	-40.75	-40.87	-41.47	-37.40	-38.97	-42.74	-38.62	-41.24	-39.26	3.08
28	4.74	1.294	-38.06	-28.57	-41.01	-37.23	-39.80	-44.60	-39.23	-40.23	-41.96	-42.22	-37.78	-39.77	-42.96	-38.40	-42.59	-39.63	3.60
29	4.57	1.021	-40.44	-31.52	-39.40	-37.10	-39.20	-44.56	-37.66	-40.11	-39.65	-39.77	-37.62	-37.86	-43.22	-38.92	-39.51	-39.10	2.80
30	4.41	1.061	-42.60	-35.14	-39.97	-38.87	-40.10	-44.59	-38.65	-41.13	-39.72	-39.67	-39.10	-38.27	-42.41	-40.56	-39.28	-40.00	2.11
31	4.27	1.022	-40.58	-36.14	-39.40	-38.91	-39.25	-45.18	-38.59	-40.49	-39.59	-39.08	-39.08	-38.19	-41.63	-39.84	-39.03	-39.66	1.89

Table B.36 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 05/02/94 13:00 HOURS Hmo= .30 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.736	-31.54	-37.04	-40.31	-36.50	-26.17	-34.93	-53.96	-30.97	-25.93	-24.22	-39.42	-35.83	-66.96	-32.73	-29.77	-36.32	10.78
3	64.00	1.204	-60.63	-43.27	-40.04	-37.38	-29.56	-44.41	-35.32	-32.10	-27.77	-35.17	-41.83	-34.73	-79.00	-36.90	-29.49	-40.30	12.90
4	42.67	.840	-102.31	-46.73	-55.58	-49.52	-47.48	-61.08	-56.63	-52.58	-43.41	-53.70	-54.75	-50.71	-97.13	-52.33	-39.67	-57.10	17.34
5	32.00	.342	-98.48	-35.59	-61.51	-53.47	-53.27	-54.72	-59.62	-60.28	-52.04	-59.17	-56.92	-53.00	-95.63	-56.57	-45.36	-59.41	15.94
6	25.60	.224	-70.55	-21.09	-58.69	-48.31	-44.58	-41.30	-47.12	-51.57	-46.33	-50.95	-49.02	-45.50	-76.86	-49.43	-41.95	-49.53	12.31
7	21.33	.320	-51.39	-24.90	-53.98	-48.85	-40.64	-36.64	-29.18	-44.63	-42.47	-42.96	-46.85	-42.22	-53.00	-47.25	-39.99	-43.02	7.90
8	18.29	.626	-15.70	-13.19	-17.34	-20.33	-16.00	-21.46	-15.45	-13.99	-14.20	-11.85	-16.45	-4.40	-21.98	-15.75	-15.03	-15.54	4.09
9	16.00	1.345	-10.50	-10.54	-9.38	-12.55	-10.50	-13.58	-9.91	-8.92	-9.00	-8.68	-9.41	1.38	-12.38	-10.46	-8.76	-9.55	3.25
10	14.22	2.696	-10.71	-10.48	-8.28	-11.18	-11.56	-16.12	-7.34	-10.93	-11.55	-12.80	-8.52	-.85	-15.14	-10.42	-10.09	-10.40	3.40
11	12.80	3.476	-10.86	-11.29	-8.97	-10.29	-11.69	-17.80	-6.46	-11.32	-12.30	-14.31	-9.24	-5.54	-21.08	-9.64	-10.09	-11.39	3.83
12	11.64	3.917	-14.74	-11.90	-13.46	-12.61	-13.77	-20.50	-11.28	-13.52	-13.96	-15.93	-12.95	-12.17	-25.91	-11.74	-12.06	-14.43	3.77
13	10.67	6.630	-22.86	-17.50	-20.22	-19.43	-20.36	-26.85	-16.11	-20.33	-19.53	-20.71	-19.50	-18.01	-27.50	-19.68	-19.02	-20.51	3.01
14	9.85	10.129	-25.66	-21.87	-23.12	-22.76	-23.77	-29.67	-21.00	-23.86	-22.83	-23.13	-22.66	-21.40	-28.83	-23.33	-23.00	-23.79	2.39
15	9.14	11.661	-27.97	-23.35	-25.48	-24.85	-25.84	-30.65	-24.85	-26.03	-24.68	-24.78	-24.78	-24.06	-29.48	-25.61	-24.86	-25.82	1.95
16	8.53	12.132	-29.43	-25.39	-28.34	-27.60	-27.66	-33.06	-27.89	-27.88	-26.74	-26.92	-27.62	-26.61	-31.43	-28.16	-26.92	-28.11	1.87
17	8.00	9.446	-30.50	-27.27	-30.15	-29.17	-29.08	-32.42	-30.67	-29.46	-28.57	-28.81	-29.45	-28.64	-34.79	-29.55	-28.77	-29.82	1.74
18	7.53	7.465	-30.40	-27.26	-29.89	-28.81	-29.40	-32.13	-30.67	-29.77	-28.77	-29.03	-29.27	-29.10	-35.17	-29.35	-28.92	-29.86	1.76
19	7.11	7.566	-30.84	-25.71	-29.13	-27.81	-29.41	-32.84	-29.51	-29.72	-27.82	-27.69	-28.23	-28.23	-32.86	-29.15	-28.01	-29.13	1.85
20	6.74	6.509	-31.63	-25.43	-29.78	-28.61	-30.57	-33.54	-29.56	-30.87	-28.12	-27.71	-28.71	-28.37	-30.67	-30.46	-28.28	-29.49	1.86
21	6.40	5.058	-31.97	-27.53	-31.40	-30.38	-32.08	-35.58	-30.47	-32.51	-30.13	-29.80	-30.50	-29.99	-31.91	-32.37	-30.23	-31.12	1.73
22	6.10	3.043	-31.43	-27.94	-31.59	-30.72	-33.51	-38.44	-28.99	-33.95	-31.07	-31.02	-30.87	-30.39	-32.24	-33.76	-31.10	-31.80	2.37
23	5.82	2.538	-28.17	-25.51	-29.13	-28.05	-33.73	-39.51	-26.84	-34.28	-29.77	-29.58	-28.38	-28.49	-30.78	-33.29	-29.80	-30.35	3.42
24	5.57	2.907	-28.47	-23.71	-29.47	-27.40	-32.05	-36.68	-28.94	-32.45	-29.43	-29.40	-28.05	-28.69	-33.00	-31.46	-29.45	-29.91	2.86
25	5.33	2.673	-31.56	-24.39	-29.65	-27.52	-30.66	-37.37	-29.38	-31.00	-28.03	-28.01	-28.26	-28.65	-33.76	-30.17	-28.12	-29.77	2.90
26	5.12	2.459	-33.59	-26.74	-30.28	-29.23	-31.92	-37.10	-29.50	-32.33	-29.52	-29.40	-29.78	-29.19	-34.39	-31.80	-29.64	-30.96	2.50
27	4.92	2.003	-34.52	-27.88	-32.71	-31.71	-34.25	-37.73	-31.50	-34.86	-32.22	-31.54	-32.00	-30.97	-34.35	-34.45	-32.21	-32.86	2.19
28	4.74	1.648	-36.81	-28.36	-33.84	-31.94	-34.00	-37.83	-33.13	-34.89	-32.07	-31.43	-32.57	-31.45	-37.52	-34.35	-32.07	-33.48	2.47
29	4.57	1.130	-38.61	-30.77	-34.29	-32.28	-35.48	-39.12	-34.16	-36.30	-33.90	-33.84	-33.01	-32.56	-40.13	-34.92	-33.81	-34.88	2.56
30	4.41	.884	-40.04	-33.70	-37.57	-36.46	-38.74	-41.62	-37.44	-39.49	-38.88	-38.88	-36.84	-36.41	-41.05	-38.16	-38.78	-38.27	1.93
31	4.27	.752	-42.79	-34.48	-39.06	-38.29	-40.30	-41.32	-38.35	-40.75	-40.22	-40.85	-38.66	-37.49	-43.66	-40.08	-40.14	-39.76	2.14

Table B.37 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 05/02/94 16:00 HOURS Hmo= .26 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	D I R E C T I O N (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.716	-22.49	-16.68	-30.12	-22.61	-26.98	-47.38	-18.04	-29.93	-32.68	-29.92	-25.52	-31.48	-51.35	-22.92	-32.52	-29.33	9.23
3	64.00	1.329	-37.18	-19.80	-32.52	-26.88	-31.77	-40.39	-31.21	-33.72	-30.10	-27.63	-28.26	-28.72	-37.74	-29.85	-30.40	-31.08	4.84
4	42.67	1.150	-50.89	-25.20	-41.14	-34.13	-36.61	-42.26	-42.41	-39.56	-34.23	-35.01	-36.47	-35.08	-56.67	-36.25	-33.85	-38.63	7.27
5	32.00	.460	-69.35	-45.36	-61.81	-58.56	-51.95	-49.56	-61.61	-57.26	-54.10	-55.87	-59.08	-52.08	-73.57	-58.40	-47.87	-57.08	7.37
6	25.60	.242	-60.54	-41.25	-51.40	-47.54	-32.73	-44.94	-52.91	-33.90	-30.20	-37.50	-49.27	-41.27	-70.68	-44.71	-30.70	-44.59	10.98
7	21.33	.412	-37.96	-12.79	-29.30	-21.87	-18.32	-23.87	-22.39	-17.53	-12.05	-17.66	-24.30	-18.55	-54.66	-20.23	-14.85	-22.98	10.55
8	18.29	.845	-20.43	-11.98	-11.68	-11.79	-18.36	-16.27	-9.46	-17.72	-16.68	-17.41	-10.10	-2.04	-28.98	-15.27	-16.66	-14.99	5.83
9	16.00	1.644	-15.15	-12.56	-11.24	-12.85	-14.97	-15.19	-7.94	-14.44	-15.03	-15.88	-10.85	-3.70	-19.39	-13.42	-13.97	-13.11	3.56
10	14.22	3.094	-13.83	-10.74	-12.31	-12.70	-12.25	-14.16	-2.95	-12.95	-14.52	-17.94	-11.85	-6.60	-20.04	-11.69	-10.95	-12.37	3.90
11	12.80	3.440	-12.96	-8.07	-11.72	-11.38	-11.04	-14.45	-6.06	-11.26	-11.82	-14.63	-10.94	-7.25	-20.45	-10.15	-9.08	-11.42	3.35
12	11.64	3.733	-15.40	-10.26	-14.20	-14.22	-13.87	-17.73	-15.74	-13.19	-12.12	-12.68	-13.31	-9.92	-21.16	-13.16	-12.20	-13.94	2.72
13	10.67	6.400	-23.32	-17.83	-22.57	-21.62	-21.42	-25.43	-23.29	-21.41	-20.49	-21.55	-21.49	-20.06	-29.02	-21.33	-20.25	-22.07	2.49
14	9.85	9.347	-25.29	-20.81	-24.51	-23.31	-23.76	-27.78	-25.05	-23.82	-22.80	-23.49	-23.61	-23.22	-30.42	-23.55	-22.86	-24.28	2.19
15	9.14	9.498	-27.13	-21.71	-25.42	-24.27	-25.25	-28.24	-25.97	-25.39	-23.92	-24.19	-24.50	-23.95	-30.36	-25.11	-24.12	-25.30	1.98
16	8.53	8.202	-28.57	-22.93	-26.39	-25.54	-26.47	-31.66	-27.70	-26.74	-24.71	-24.44	-25.59	-24.82	-30.02	-26.54	-25.01	-26.47	2.19
17	8.00	6.609	-28.09	-24.18	-25.49	-24.38	-25.81	-32.82	-29.71	-26.06	-24.53	-24.68	-24.99	-25.29	-32.37	-25.38	-24.80	-26.57	2.75
18	7.53	5.967	-28.95	-25.09	-26.75	-25.83	-26.68	-31.50	-27.31	-26.98	-25.41	-25.29	-26.16	-25.53	-30.68	-27.13	-25.84	-27.01	1.87
19	7.11	5.559	-30.47	-25.91	-28.93	-27.92	-28.67	-31.90	-28.56	-29.02	-27.37	-27.35	-28.17	-27.42	-31.61	-29.27	-27.65	-28.68	1.58
20	6.74	4.240	-33.39	-28.07	-31.01	-29.96	-31.54	-34.58	-29.95	-32.03	-29.95	-29.98	-30.29	-29.93	-34.92	-31.61	-30.07	-31.15	1.84
21	6.40	3.235	-34.66	-29.25	-32.27	-31.34	-33.65	-37.12	-31.25	-34.29	-31.74	-31.16	-31.50	-31.29	-35.06	-33.15	-31.76	-32.63	1.93
22	6.10	2.902	-35.69	-29.94	-33.76	-32.60	-34.97	-39.39	-33.13	-35.76	-33.82	-33.00	-32.80	-33.03	-36.22	-34.26	-33.71	-34.14	2.06
23	5.82	2.169	-35.47	-28.85	-33.20	-31.45	-34.17	-39.82	-31.87	-34.95	-33.20	-32.68	-32.01	-32.90	-37.63	-33.26	-33.14	-33.64	2.52
24	5.57	1.647	-34.53	-27.95	-34.04	-31.95	-32.78	-37.12	-31.93	-33.51	-31.32	-30.93	-32.50	-32.26	-38.01	-33.34	-31.39	-32.90	2.37
25	5.33	1.380	-32.38	-26.89	-33.74	-31.23	-31.76	-34.56	-32.61	-32.33	-30.19	-30.01	-31.94	-31.58	-38.10	-32.30	-30.35	-32.00	2.37
26	5.12	1.104	-30.43	-21.72	-31.43	-27.73	-29.84	-32.94	-30.56	-30.19	-28.74	-28.17	-28.48	-28.66	-34.33	-29.34	-28.88	-29.43	2.70
27	4.92	.895	-33.39	-19.64	-32.46	-27.99	-29.64	-33.19	-31.34	-29.82	-28.37	-28.58	-28.88	-29.85	-36.07	-29.20	-28.40	-29.79	3.52
28	4.74	.891	-32.73	-21.16	-31.20	-26.94	-27.27	-33.55	-30.10	-27.50	-27.22	-26.87	-27.87	-28.03	-36.93	-27.85	-27.23	-28.83	3.54
29	4.57	.840	-33.34	-25.44	-33.13	-29.93	-29.58	-34.05	-30.41	-29.85	-30.45	-29.38	-30.50	-29.80	-37.17	-31.04	-30.44	-30.97	2.56
30	4.41	.544	-35.23	-30.71	-33.94	-32.94	-34.20	-40.22	-29.98	-34.64	-33.61	-32.22	-32.91	-31.37	-34.84	-35.11	-33.57	-33.70	2.32
31	4.27	.373	-36.60	-32.50	-33.54	-32.68	-31.92	-38.21	-32.06	-32.40	-32.73	-30.78	-32.84	-31.07	-36.00	-34.06	-32.72	-33.34	2.01

Table B.38 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 05/02/94 19:00 HOURS Hmo= .24 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.965	-36.34	-45.29	-44.68	-49.87	-42.49	-40.33	-45.69	-47.90	-46.11	-40.24	-47.20	-37.98	-24.78	-48.91	-41.58	-42.64	6.14
3	64.00	1.489	-55.43	-43.27	-44.92	-45.83	-41.67	-38.92	-45.23	-43.98	-37.39	-38.89	-46.15	-38.17	-54.00	-47.25	-35.99	-43.80	5.48
4	42.67	1.066	-57.82	-28.45	-44.89	-38.56	-36.96	-37.86	-37.85	-37.76	-30.06	-33.56	-40.77	-34.18	-58.95	-41.81	-30.46	-39.29	8.65
5	32.00	.419	-53.39	-17.89	-45.32	-37.36	-34.71	-43.44	-39.26	-35.85	-27.48	-28.68	-39.56	-32.81	-52.56	-39.71	-28.24	-37.09	9.19
6	25.60	.319	-48.66	-35.48	-49.15	-50.08	-41.97	-44.05	-42.16	-46.87	-39.33	-36.22	-49.43	-39.39	-49.53	-49.00	-37.25	-43.91	5.21
7	21.33	.459	-25.36	-13.20	-27.81	-26.66	-21.66	-24.90	-22.91	-21.61	-20.19	-19.14	-25.04	-12.20	-33.48	-23.65	-20.79	-22.58	5.17
8	18.29	.773	-23.65	-14.21	-17.08	-20.38	-19.98	-17.98	-23.33	-19.74	-19.94	-20.73	-16.46	-.33	-25.82	-20.07	-18.92	-18.59	5.63
9	16.00	1.252	-14.11	-10.09	-10.55	-14.57	-13.22	-15.35	-21.65	-10.59	-9.66	-8.15	-10.70	.51	-20.57	-11.18	-9.49	-11.96	5.06
10	14.22	2.738	-10.97	-8.12	-8.28	-11.08	-11.36	-15.41	-14.60	-9.26	-8.91	-7.67	-8.05	-.30	-18.13	-9.08	-8.66	-9.99	3.95
11	12.80	3.511	-13.54	-10.44	-11.06	-13.67	-12.90	-17.72	-15.79	-11.55	-10.66	-8.99	-10.63	-3.47	-16.10	-12.31	-11.36	-12.01	3.26
12	11.64	3.221	-18.91	-14.91	-16.08	-17.12	-18.42	-22.21	-21.55	-18.09	-17.00	-16.44	-15.51	-12.57	-24.14	-17.22	-16.68	-17.79	2.87
13	10.67	4.723	-24.19	-18.39	-21.89	-21.44	-22.67	-23.58	-23.47	-22.72	-20.90	-20.48	-20.94	-19.60	-27.32	-22.61	-21.09	-22.09	2.06
14	9.85	8.290	-26.70	-20.78	-25.66	-24.93	-24.43	-26.34	-25.68	-24.61	-22.39	-21.74	-24.66	-22.63	-27.73	-25.66	-23.24	-24.48	1.90
15	9.14	9.913	-27.73	-22.18	-26.57	-25.72	-25.26	-29.57	-24.74	-25.41	-23.75	-23.85	-25.69	-24.12	-29.14	-26.26	-24.21	-25.61	1.96
16	8.53	7.473	-28.64	-22.38	-26.51	-25.26	-25.99	-30.01	-25.69	-26.16	-24.41	-24.91	-25.50	-24.67	-31.29	-26.31	-24.61	-26.16	2.20
17	8.00	4.920	-28.51	-21.41	-25.20	-23.86	-26.13	-30.73	-26.62	-26.30	-24.30	-24.44	-24.16	-24.26	-30.74	-25.40	-24.40	-25.76	2.47
18	7.53	3.376	-28.75	-24.16	-27.02	-25.78	-28.08	-33.04	-28.30	-28.42	-27.04	-26.91	-26.19	-27.02	-33.98	-27.03	-27.14	-27.92	2.46
19	7.11	3.574	-30.67	-26.01	-29.34	-28.15	-30.17	-34.88	-29.76	-30.52	-29.39	-29.09	-28.45	-29.24	-33.56	-29.25	-29.44	-29.86	2.03
20	6.74	2.988	-34.19	-27.01	-30.71	-29.47	-32.00	-36.21	-30.29	-32.32	-30.08	-30.08	-29.88	-30.07	-35.11	-31.35	-30.14	-31.26	2.30
21	6.40	2.562	-35.88	-27.91	-31.58	-30.58	-32.78	-36.86	-30.49	-33.26	-29.85	-29.75	-31.08	-30.59	-36.76	-32.98	-30.00	-32.02	2.61
22	6.10	1.843	-35.59	-29.65	-33.09	-32.40	-33.65	-37.24	-32.20	-34.10	-31.42	-31.36	-32.94	-32.31	-38.82	-34.48	-31.47	-33.38	2.32
23	5.82	1.227	-36.33	-29.67	-33.98	-32.49	-35.78	-37.00	-32.95	-36.31	-33.98	-33.93	-33.23	-33.84	-42.06	-34.75	-33.91	-34.68	2.64
24	5.57	1.016	-35.93	-30.87	-32.48	-31.07	-34.72	-38.16	-33.13	-35.28	-33.55	-33.02	-31.93	-33.01	-41.08	-32.80	-33.49	-34.03	2.62
25	5.33	1.005	-35.18	-31.83	-31.73	-30.42	-30.65	-39.40	-32.60	-31.14	-31.45	-30.87	-31.36	-32.04	-39.47	-31.15	-31.48	-32.72	2.85
26	5.12	.910	-32.75	-29.96	-31.09	-29.24	-29.61	-41.49	-31.46	-30.22	-30.89	-27.73	-30.10	-31.16	-39.24	-29.42	-30.96	-31.68	3.60
27	4.92	.718	-35.22	-26.97	-32.42	-28.68	9999.99	-41.34	-32.58	9999.99	-36.13	-29.18	-28.94	-29.95	-40.10	9999.99	-35.82	-33.11	4.46
28	4.74	.623	-42.35	-18.25	-38.67	-29.76	9999.99	9999.99	-38.82	9999.99	-45.11	9999.99	-30.21	-35.62	-46.27	9999.99	-47.37	-37.27	8.63
29	4.57	.563	-42.25	-13.60	-40.66	-30.91	9999.99	9999.99	-39.90	9999.99	-45.32	9999.99	-31.64	-38.03	-47.53	9999.99	-49.12	-37.96	9.91
30	4.41	.565	-37.26	-6.65	-44.33	-31.18	9999.99	9999.99	-41.97	9999.99	-48.21	9999.99	-32.16	-42.81	-44.10	9999.99	-53.90	-38.39	12.40
31	4.27	.392	-35.27	-4.73	-43.14	-28.64	9999.99	9999.99	-40.10	9999.99	-50.43	9999.99	-29.76	9999.99	-41.00	9999.99	-56.99	-36.80	14.18

Table B.39 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 05/02/94 22:00 HOURS Hmo= .25 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.712	-56.43	-40.33	-40.48	-44.45	-30.48	-34.08	-35.07	-33.16	-19.39	-24.84	-45.89	-27.71	-63.04	-46.49	-26.42	-37.84	11.60
3	64.00	1.162	-27.90	-22.56	-37.90	-34.37	-31.66	-37.78	-28.94	-32.36	-33.01	-32.53	-33.68	-29.42	-31.59	-34.45	-32.88	-32.07	3.72
4	42.67	.882	-23.40	-14.72	-30.94	-26.36	-26.11	-30.23	-22.50	-26.94	-26.47	-23.13	-25.47	-22.50	-24.83	-26.82	-27.46	-25.19	3.70
5	32.00	.401	-46.74	-25.58	-41.61	-37.36	-33.24	-35.64	-29.23	-36.33	-32.18	-31.97	-37.65	-29.43	-51.86	-37.89	-32.16	-35.91	6.62
6	25.60	.275	-39.96	-43.25	-37.39	-43.85	-33.82	-33.97	-37.97	-38.11	-34.89	-31.09	-41.45	-26.30	-36.95	-41.78	-34.02	-36.99	4.63
7	21.33	.441	-24.45	-27.23	-25.17	-28.19	-22.59	-24.19	-29.69	-22.77	-21.67	-19.04	-25.17	-10.70	-22.31	-25.48	-23.19	-23.46	4.28
8	18.29	.927	-15.21	-14.10	-12.46	-14.51	-14.73	-18.49	-13.25	-13.12	-13.12	-13.31	-12.51	-2.37	-23.99	-12.75	-13.17	-13.81	4.21
9	16.00	1.425	-12.21	-8.06	-7.56	-9.57	-12.62	-14.42	-7.53	-11.59	-12.02	-14.02	-7.26	1.31	-23.66	-9.51	-9.80	-10.57	5.08
10	14.22	2.423	-12.80	-9.05	-8.36	-11.35	-12.94	-14.29	-17.83	-11.03	-10.50	-9.79	-8.15	.27	-19.50	-10.52	-10.51	-11.09	4.36
11	12.80	3.409	-14.86	-10.68	-11.17	-12.99	-14.01	-15.51	-18.37	-12.91	-12.46	-12.17	-10.85	-4.93	-20.36	-12.25	-12.11	-13.04	3.41
12	11.64	3.728	-19.09	-15.21	-16.36	-18.05	-17.30	-20.81	-16.88	-17.09	-16.89	-17.76	-16.18	-10.23	-23.96	-16.66	-15.90	-17.22	2.83
13	10.67	5.115	-24.71	-19.87	-22.08	-22.81	-22.00	-26.52	-19.78	-22.00	-20.87	-21.42	-21.69	-17.65	-28.17	-22.40	-20.92	-22.19	2.55
14	9.85	7.860	-27.91	-22.69	-25.26	-24.61	-25.21	-30.06	-26.33	-25.46	-24.00	-24.11	-24.51	-22.68	-33.00	-25.25	-24.27	-25.69	2.66
15	9.14	9.895	-29.24	-23.68	-27.42	-26.67	-26.77	-30.53	-27.01	-27.10	-25.24	-24.88	-26.52	-24.44	-31.67	-27.71	-25.73	-26.97	2.12
16	8.53	8.962	-32.98	-26.45	-31.39	-30.52	-30.52	-32.49	-27.75	-30.79	-29.26	-29.35	-30.32	-28.42	-33.72	-31.34	-29.38	-30.31	1.90
17	8.00	7.197	-33.46	-27.78	-31.49	-30.42	-31.54	-34.96	-31.30	-31.93	-30.47	-30.39	-30.56	-30.05	-34.89	-31.40	-30.51	-31.41	1.80
18	7.53	5.653	-34.13	-27.92	-31.48	-30.08	-31.77	-35.30	-32.76	-32.19	-30.58	-30.70	-30.55	-30.94	-36.68	-31.13	-30.61	-31.79	2.12
19	7.11	3.741	-34.58	-29.75	-32.62	-31.41	-32.57	-36.72	-34.10	-33.07	-31.65	-31.90	-31.97	-32.34	-38.70	-32.31	-31.67	-33.02	2.16
20	6.74	2.608	-36.44	-32.05	-35.00	-34.12	-35.32	-39.09	-33.44	-35.93	-33.85	-33.87	-34.46	-34.17	-39.05	-35.55	-33.75	-35.07	1.89
21	6.40	2.397	-36.23	-31.37	-34.55	-33.34	-35.67	-39.88	-32.66	-36.23	-33.41	-33.53	-33.74	-34.15	-38.24	-35.19	-33.36	-34.77	2.14
22	6.10	1.971	-32.46	-25.26	-34.87	-30.67	-36.77	-42.76	-34.53	-37.32	-33.37	-33.56	-31.62	-35.05	-39.11	-33.74	-33.40	-34.30	3.82
23	5.82	1.644	-26.39	-20.54	-35.73	-29.43	-38.46	-42.52	-35.12	-38.88	-34.48	-35.22	-30.92	-35.95	-41.43	-33.84	-34.67	-34.24	5.48
24	5.57	1.402	-30.48	-20.77	-32.61	-27.47	-37.85	-42.10	-31.59	-38.34	-34.43	-34.93	-28.86	-32.93	-40.42	-33.43	-34.59	-33.39	5.18
25	5.33	.996	-34.24	-22.92	-33.17	-28.26	-36.90	-40.43	-32.86	-37.75	-36.16	-35.00	-29.30	-32.98	-39.85	-32.51	-36.30	-33.91	4.41
26	5.12	.829	-33.35	-23.95	-36.29	-31.48	-37.66	-41.48	-35.67	-38.77	-38.31	-36.45	-32.21	-35.89	-40.96	-33.66	-38.57	-35.65	4.23
27	4.92	.737	-37.74	-27.21	-38.90	-33.54	-38.81	-42.29	-37.23	-39.40	-38.07	-37.51	-34.39	-38.16	-44.06	-35.21	-38.23	-37.39	3.75
28	4.74	.552	-39.03	-28.29	-38.54	-33.30	-37.26	9999.99	-37.68	-37.59	-38.10	-37.47	-34.05	-37.21	-43.95	-34.72	-38.41	-36.83	3.40
29	4.57	.370	-38.09	-26.07	-38.37	-33.06	-36.96	9999.99	-36.54	-37.23	-40.03	-39.12	-33.41	-37.56	-41.74	-34.45	-40.62	-36.66	3.83
30	4.41	.288	-35.10	-25.00	-37.12	-29.96	9999.99	9999.99	-35.70	9999.99	9999.99	9999.99	-30.47	-35.87	-38.37	9999.99	9999.99	-33.45	4.24
31	4.27	.211	-32.67	-22.42	-35.19	-27.39	9999.99	9999.99	-34.44	9999.99	9999.99	9999.99	-28.34	-32.48	-34.96	9999.99	9999.99	-30.99	4.24

Table B.40 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 06/02/94 01:00 HOURS Hmo= .29 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.704	-82.71	-43.40	-53.41	-47.93	-46.41	-38.61	-79.83	-71.65	-67.17	-67.69	-51.22	-51.31	-87.08	-48.34	-45.48	-58.71	15.22
3	64.00	1.204	-55.90	-53.83	-47.76	-53.97	-45.92	-35.71	-55.76	-50.93	-45.29	-44.51	-53.51	-42.69	-51.71	-54.42	-40.01	-48.80	6.02
4	42.67	1.226	-45.07	-54.52	-45.93	-54.00	-42.43	-36.31	-47.77	-49.72	-44.52	-38.99	-52.59	-38.86	-34.82	-53.32	-38.63	-45.17	6.48
5	32.00	.558	-53.12	-53.23	-43.01	-43.73	-36.77	-39.89	-57.62	-46.95	-40.16	-38.93	-45.58	-40.31	-63.59	-43.03	-36.11	-45.45	7.76
6	25.60	.330	-43.46	-34.96	-36.00	-36.50	-29.98	-30.33	-44.44	-32.74	-26.52	-25.66	-37.01	-31.16	-47.10	-35.04	-28.10	-34.59	6.25
7	21.33	.399	-21.11	-25.66	-23.90	-27.60	-19.96	-17.78	-25.22	-19.34	-17.74	-13.16	-25.38	-18.06	-21.56	-23.15	-20.41	-21.34	3.73
8	18.29	.631	-18.97	-17.44	-19.09	-20.59	-18.55	-17.02	-24.60	-17.25	-16.37	-14.08	-18.31	-10.10	-26.72	-17.72	-17.68	-18.30	3.74
9	16.00	1.112	-18.29	-14.29	-15.96	-17.79	-16.19	-14.39	-22.41	-14.31	-13.13	-11.50	-15.96	-7.97	-26.68	-14.97	-13.49	-15.82	4.26
10	14.22	2.124	-15.82	-12.70	-15.04	-15.84	-13.94	-16.90	-14.92	-13.24	-13.72	-15.16	-14.80	-9.85	-24.48	-13.36	-11.47	-14.75	3.13
11	12.80	3.323	-14.42	-11.80	-14.54	-15.17	-12.35	-17.68	-10.95	-12.26	-12.88	-14.84	-14.20	-9.13	-21.09	-13.02	-11.06	-13.69	2.82
12	11.64	3.525	-12.74	-11.04	-13.05	-14.36	-11.09	-16.85	-16.44	-9.46	-8.25	-6.69	-12.97	-6.90	-15.98	-12.64	-10.60	-11.94	3.12
13	10.67	4.263	-19.68	-17.31	-18.63	-18.78	-18.83	-23.78	-24.45	-18.36	-17.28	-16.39	-18.25	-15.55	-28.41	-19.07	-17.97	-19.51	3.31
14	9.85	6.704	-27.87	-22.27	-25.00	-23.99	-25.43	-28.50	-26.64	-25.67	-24.20	-24.71	-24.06	-22.84	-33.55	-25.34	-24.16	-25.61	2.67
15	9.14	9.948	-29.31	-25.07	-27.53	-26.65	-26.99	-33.02	-27.28	-27.18	-26.19	-26.80	-26.83	-25.68	-32.83	-27.44	-26.24	-27.67	2.26
16	8.53	10.179	-28.39	-26.84	-29.27	-28.69	-28.52	-34.31	-28.68	-28.80	-27.81	-28.22	-28.82	-27.33	-33.86	-29.42	-27.96	-29.13	2.05
17	8.00	9.593	-27.85	-25.44	-29.47	-28.51	-30.19	-37.49	-31.51	-30.84	-27.34	-27.07	-28.66	-27.55	-34.10	-31.42	-27.69	-29.67	2.98
18	7.53	9.107	-33.63	-29.67	-33.50	-32.42	-34.36	-40.77	-35.36	-35.16	-31.66	-31.62	-32.67	-32.08	-36.82	-35.07	-31.69	-33.76	2.60
19	7.11	10.250	-39.83	-33.25	-38.16	-36.99	-38.10	-41.26	-37.90	-38.93	-36.31	-36.25	-37.17	-36.24	-39.52	-38.57	-36.03	-37.63	1.87
20	6.74	9.260	-42.28	-34.75	-39.38	-38.27	-39.46	-42.45	-38.45	-40.19	-37.88	-37.92	-38.44	-37.48	-41.14	-39.75	-37.51	-39.02	1.93
21	6.40	6.193	-44.43	-37.03	-40.73	-39.51	-41.92	-44.79	-40.95	-42.68	-40.27	-40.44	-39.84	-39.91	-43.79	-41.23	-39.95	-41.16	2.00
22	6.10	5.320	-42.08	-38.65	-41.44	-40.99	-42.62	-46.39	-41.09	-43.70	-41.32	-41.18	-41.13	-40.64	-42.91	-42.47	-40.77	-41.83	1.67
23	5.82	4.705	-39.77	-36.70	-39.77	-39.36	-42.82	-46.84	-39.49	-43.71	-40.96	-41.20	-39.61	-39.11	-42.35	-42.06	-40.65	-40.96	2.31
24	5.57	3.043	-39.68	-32.43	-37.34	-36.47	-42.91	-44.38	-39.15	-43.52	-38.76	-39.06	-36.80	-37.04	-40.28	-40.57	-38.69	-39.14	2.95
25	5.33	2.061	-40.93	-32.04	-37.79	-36.38	-41.36	-43.87	-39.84	-42.34	-39.45	-39.38	-36.76	-37.80	-42.19	-38.94	-39.37	-39.23	2.80
26	5.12	1.682	-40.66	-31.07	-38.42	-36.62	-39.28	-44.54	-38.11	-40.18	-39.59	-38.59	-36.87	-37.85	-42.07	-38.00	-39.65	-38.77	2.84
27	4.92	1.268	-40.13	-29.30	-39.98	-36.66	-37.16	-45.26	-39.00	-37.97	-39.43	-37.78	-37.11	-38.79	-43.19	-36.75	-39.61	-38.54	3.37
28	4.74	.832	-45.38	-32.55	-41.77	-39.44	-42.40	-45.39	-41.10	-43.30	-41.87	-42.24	-39.76	-40.00	-46.08	-41.93	-41.93	-41.68	3.12
29	4.57	.516	-48.39	-34.52	-42.92	-41.32	-47.26	-45.58	-42.11	-47.32	-45.81	-49.11	-41.67	-42.88	-48.32	-46.27	-46.30	-44.66	3.69
30	4.41	.365	-45.72	-33.20	-42.26	-38.33	-41.92	-45.04	-40.95	-43.00	-46.21	-49.14	-38.84	-40.87	-47.19	-42.79	-46.45	-42.80	3.95
31	4.27	.340	-46.29	-31.45	-43.87	-39.50	-41.47	-44.46	-42.31	-42.71	-46.99	-48.36	-39.87	-40.76	-45.35	-42.94	-46.74	-42.88	4.01

Table B.41 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 06/02/94 04:00 HOURS Hmo= .29 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.878	-97.61	3.68	-47.29	-24.20	-36.35	-60.03	-59.58	-40.18	-29.14	-44.61	-32.57	-41.81	-93.94	-28.91	-29.45	-43.58	25.05
3	64.00	1.344	-50.34	-35.62	-39.97	-39.10	-40.18	-40.32	-48.97	-42.37	-37.07	-38.92	-38.20	-32.76	-48.79	-41.99	-35.79	-40.69	4.97
4	42.67	1.104	-35.06	-44.48	-45.56	-51.37	-45.04	-38.90	-53.38	-49.95	-50.81	-45.63	-48.24	-35.88	-24.92	-51.14	-44.99	-44.38	7.46
5	32.00	.542	-41.17	-43.01	-41.68	-45.92	-39.10	-36.51	-57.85	-40.80	-40.04	-39.92	-44.69	-33.19	-44.37	-45.39	-38.37	-42.12	5.36
6	25.60	.296	-43.90	-38.51	-35.72	-40.51	-36.43	-36.61	-47.11	-37.92	-35.24	-36.40	-38.36	-27.48	-44.59	-41.18	-34.87	-38.32	4.59
7	21.33	.448	-31.38	-18.49	-24.05	-25.83	-24.34	-28.87	-29.80	-25.19	-21.88	-22.19	-22.95	-9.89	-39.08	-25.96	-23.37	-24.89	6.19
8	18.29	.935	-22.00	-10.50	-14.08	-13.24	-17.33	-18.06	-11.17	-16.64	-16.10	-18.04	-12.17	-2.36	-31.91	-15.05	-14.94	-15.57	6.14
9	16.00	1.622	-13.38	-7.52	-7.41	-8.41	-11.11	-12.08	-.97	-12.26	-14.05	-17.94	-6.94	1.40	-16.87	-9.63	-8.79	-9.73	5.07
10	14.22	2.220	-13.74	-8.36	-9.38	-10.07	-12.44	-11.81	-5.11	-12.27	-13.19	-15.40	-8.66	-2.51	-20.68	-10.42	-9.64	-10.91	4.12
11	12.80	2.533	-16.94	-10.90	-12.08	-12.58	-15.49	-14.84	-13.65	-14.70	-14.44	-13.83	-11.04	-5.24	-21.87	-14.07	-12.81	-13.63	3.41
12	11.64	4.116	-15.27	-9.83	-10.83	-10.55	-13.68	-14.59	-15.04	-12.85	-12.03	-11.45	-10.00	-7.52	-20.11	-12.18	-11.50	-12.50	2.89
13	10.67	6.141	-20.46	-14.87	-18.03	-16.91	-18.70	-21.04	-20.05	-18.54	-17.52	-17.76	-16.96	-16.10	-24.07	-18.09	-17.32	-18.43	2.17
14	9.85	7.915	-26.39	-22.68	-25.61	-24.51	-25.12	-28.92	-26.04	-25.30	-24.28	-24.33	-24.72	-24.05	-29.83	-25.35	-24.50	-25.44	1.77
15	9.14	9.319	-29.55	-25.29	-28.38	-27.45	-27.73	-31.76	-27.24	-28.00	-26.66	-26.86	-27.63	-26.63	-31.91	-28.05	-26.90	-28.00	1.76
16	8.53	8.232	-32.86	-26.08	-30.16	-28.65	-30.77	-33.88	-31.59	-31.21	-29.09	-29.23	-29.00	-29.25	-34.62	-30.08	-29.15	-30.37	2.13
17	8.00	6.595	-34.82	-28.00	-32.89	-31.26	-34.33	-36.95	-33.41	-34.81	-32.26	-32.32	-31.47	-31.69	-36.31	-33.76	-32.26	-33.10	2.14
18	7.53	6.676	-35.38	-31.59	-35.45	-34.90	-35.66	-39.32	-32.96	-36.29	-34.16	-33.79	-34.71	-33.08	-35.91	-36.71	-34.04	-34.93	1.78
19	7.11	8.582	-35.72	-32.99	-36.63	-35.75	-36.11	-39.21	-35.24	-36.82	-35.05	-35.01	-35.97	-34.97	-38.37	-37.05	-34.83	-35.98	1.47
20	6.74	6.407	-35.68	-31.21	-35.96	-34.68	-35.95	-40.55	-34.10	-36.68	-33.97	-34.14	-35.09	-34.31	-38.82	-36.53	-33.82	-35.43	2.14
21	6.40	4.412	-38.87	-31.50	-37.02	-35.54	-37.42	-42.76	-34.76	-38.16	-34.56	-34.85	-36.01	-35.08	-40.18	-37.74	-34.35	-36.59	2.66
22	6.10	4.076	-38.73	-32.73	-37.90	-36.56	-39.67	-41.79	-36.80	-40.30	-36.52	-37.24	-37.03	-36.13	-40.22	-39.60	-36.26	-37.83	2.18
23	5.82	4.036	-35.54	-29.21	-36.96	-34.18	-40.48	-42.45	-35.92	-41.22	-37.19	-37.84	-34.90	-35.87	-39.59	-38.26	-37.16	-37.12	3.12
24	5.57	3.843	-36.66	-28.99	-35.26	-32.78	-38.60	-42.38	-34.90	-39.18	-35.80	-36.21	-33.41	-34.88	-39.62	-36.36	-35.83	-36.06	3.06
25	5.33	3.364	-39.68	-31.66	-34.86	-33.40	-36.52	-41.03	-33.57	-37.19	-34.30	-33.87	-33.95	-34.58	-39.83	-36.00	-34.21	-35.64	2.62
26	5.12	3.252	-36.53	-30.74	-34.52	-32.07	-31.69	-39.14	-34.19	-32.49	-31.63	-29.74	-32.67	-32.47	-38.76	-32.91	-31.67	-33.41	2.67
27	4.92	3.013	-34.45	-29.89	-33.47	-31.61	-30.88	-37.77	-32.43	-31.68	-31.52	-29.43	-31.89	-31.09	-35.44	-31.96	-31.56	-32.34	2.09
28	4.74	2.602	-36.35	-32.78	-35.05	-34.11	-33.33	-36.68	-33.90	-33.93	-34.36	-32.89	-34.07	-33.39	-35.60	-34.30	-34.26	-34.33	1.11
29	4.57	2.194	-39.09	-33.13	-37.43	-35.83	-35.22	-36.88	-35.59	-35.24	-35.89	-35.66	-36.01	-35.87	-38.54	-36.31	-35.90	-36.17	1.37
30	4.41	1.568	-39.97	-31.04	-37.66	-34.59	-32.79	-39.87	-36.43	-33.04	-36.51	-36.26	-35.06	-35.09	-40.80	-34.91	-36.63	-36.04	2.66
31	4.27	1.124	-41.86	-29.60	-36.69	-32.25	-28.75	9999.99	-37.82	-29.31	-38.23	-37.19	-32.81	-32.53	-41.45	-33.69	-38.45	-35.05	4.20

Table B.42 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 06/02/94 07:00 HOURS Hmo= .27 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.758	-63.55	-33.63	-70.11	-65.93	-49.12	-37.78	-21.66	-40.77	-37.01	-44.01	-65.61	-43.03	-55.06	-66.64	-36.39	-48.69	14.39
3	64.00	1.241	-48.20	-37.77	-42.85	-43.31	-38.07	-40.60	-36.50	-40.49	-34.11	-33.72	-43.30	-35.06	-43.91	-44.30	-33.52	-39.71	4.41
4	42.67	1.237	-40.55	-29.96	-32.73	-33.02	-29.78	-36.64	-38.34	-30.77	-26.01	-26.66	-33.62	-26.72	-40.88	-34.02	-27.31	-32.46	4.79
5	32.00	.710	-33.78	-19.02	-32.05	-30.13	-28.35	-39.25	-28.81	-29.68	-26.35	-25.04	-29.29	-25.19	-34.12	-29.81	-27.43	-29.22	4.51
6	25.60	.399	-33.36	-29.93	-35.43	-38.75	-27.38	-36.57	-33.91	-28.26	-26.11	-26.48	-36.34	-26.52	-33.72	-33.91	-27.19	-31.59	4.20
7	21.33	.487	-32.48	-21.32	-25.58	-28.70	-21.81	-23.89	-32.10	-21.80	-20.62	-23.15	-26.89	-11.63	-34.01	-26.15	-20.46	-24.71	5.55
8	18.29	.940	-18.06	-10.07	-10.68	-14.22	-14.89	-14.12	-23.88	-13.10	-12.11	-10.56	-10.26	4.36	-15.74	-13.57	-11.83	-12.59	5.69
9	16.00	1.784	-12.29	-8.18	-4.77	-8.80	-12.79	-13.47	-13.64	-10.80	-10.87	-9.81	-4.54	7.87	-12.33	-9.52	-10.10	-8.95	5.23
10	14.22	3.058	-14.76	-10.64	-9.34	-12.27	-14.14	-13.88	-5.60	-14.34	-16.18	-18.77	-9.05	-.07	-17.43	-11.84	-12.43	-12.06	4.58
11	12.80	4.113	-17.12	-12.72	-13.90	-16.20	-15.27	-16.93	-5.96	-16.01	-17.91	-21.23	-13.49	-6.38	-17.34	-14.78	-14.08	-14.62	3.89
12	11.64	3.952	-19.59	-14.71	-17.68	-18.80	-17.07	-19.16	-10.95	-17.40	-18.33	-21.28	-17.08	-12.06	-22.90	-17.43	-15.99	-17.36	3.01
13	10.67	4.819	-22.92	-17.65	-20.52	-20.29	-20.50	-22.42	-17.51	-20.51	-20.34	-22.10	-19.85	-17.48	-27.81	-20.10	-19.36	-20.62	2.49
14	9.85	7.505	-26.17	-21.43	-23.88	-23.21	-23.91	-25.54	-23.91	-23.97	-23.16	-24.01	-23.21	-21.94	-30.04	-23.86	-23.05	-24.09	1.95
15	9.14	8.997	-29.03	-22.85	-26.03	-25.13	-26.34	-27.44	-25.37	-26.51	-24.93	-25.24	-25.18	-24.14	-30.01	-26.35	-25.07	-25.98	1.74
16	8.53	8.952	-29.57	-25.02	-27.25	-26.36	-27.78	-31.53	-27.27	-28.01	-26.55	-26.75	-26.58	-26.06	-31.58	-27.65	-26.66	-27.64	1.82
17	8.00	6.985	-29.24	-27.20	-28.96	-28.45	-28.86	-33.84	-29.42	-29.11	-28.01	-28.09	-28.58	-27.86	-32.47	-29.35	-28.14	-29.17	1.69
18	7.53	6.668	-32.17	-28.60	-31.79	-31.17	-31.50	-36.89	-30.84	-31.87	-29.88	-30.19	-31.36	-29.97	-34.65	-32.61	-30.03	-31.57	1.98
19	7.11	7.096	-35.39	-31.00	-33.63	-33.03	-34.60	-41.25	-33.06	-35.13	-32.10	-32.42	-33.36	-32.32	-36.75	-35.30	-32.10	-34.09	2.44
20	6.74	5.210	-36.96	-32.17	-34.41	-33.97	-36.54	-42.60	-34.27	-37.02	-33.11	-33.63	-34.35	-33.51	-37.78	-37.06	-33.05	-35.36	2.58
21	6.40	2.927	-36.60	-31.14	-36.38	-35.12	-39.64	-43.88	-35.15	-40.25	-35.54	-36.37	-35.48	-35.06	-38.17	-39.51	-35.38	-36.91	2.89
22	6.10	2.262	-38.11	-29.60	-36.74	-34.40	-41.51	-45.64	-35.16	-42.17	-35.62	-37.03	-35.07	-35.18	-39.21	-39.96	-35.50	-37.39	3.75
23	5.82	1.744	-35.98	-25.59	-32.86	-30.18	-39.41	-46.00	-31.42	-40.31	-31.35	-31.27	-30.83	-31.24	-35.73	-37.19	-31.39	-34.05	4.92
24	5.57	1.569	-34.32	-26.15	-32.59	-30.59	-37.59	-42.44	-31.68	-38.47	-33.21	-32.65	-31.06	-31.14	-35.80	-35.93	-33.15	-33.78	3.75
25	5.33	1.477	-34.71	-28.04	-33.07	-31.99	-38.25	-39.14	-32.05	-38.74	-34.33	-34.39	-32.30	-31.61	-35.15	-36.90	-34.26	-34.33	2.93
26	5.12	1.414	-35.78	-30.21	-33.55	-32.66	-36.75	-38.74	-32.02	-37.35	-34.42	-34.50	-33.13	-33.11	-38.00	-35.93	-34.33	-34.70	2.30
27	4.92	1.389	-38.01	-30.19	-33.51	-32.37	-36.11	-39.05	-34.01	-36.83	-33.54	-33.05	-33.03	-32.72	-40.30	-35.69	-33.47	-34.79	2.69
28	4.74	1.406	-39.93	-31.34	-35.64	-34.16	-36.05	9999.99	-34.94	-36.71	-33.57	-33.22	-34.83	-33.80	-40.93	-36.75	-33.48	-35.38	2.51
29	4.57	1.203	-38.80	-32.27	-34.87	-33.69	9999.99	9999.99	-31.86	9999.99	-33.19	-31.42	-34.28	-32.86	-39.07	9999.99	-33.10	-34.13	2.46
30	4.41	.981	-38.13	-30.29	-34.64	-32.44	9999.99	9999.99	-33.86	9999.99	-33.28	-31.62	-33.07	-31.67	-40.00	9999.99	-33.22	-33.84	2.74
31	4.27	.782	-39.52	-31.05	-37.35	-34.93	9999.99	9999.99	-36.48	9999.99	-36.08	-36.16	-35.37	-33.63	-41.42	9999.99	-36.19	-36.20	2.62

Table B.43 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 06/02/94 10:00 HOURS Hmo= .27 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.635	-49.66	-40.79	-45.07	-50.75	-43.11	-23.58	-45.92	-49.36	-39.40	-35.59	-48.80	-35.73	-35.92	-51.64	-35.84	-42.09	7.56
3	64.00	1.365	-45.28	-28.08	-40.26	-37.61	-40.33	-40.96	-45.11	-43.99	-39.41	-37.26	-36.97	-35.27	-39.78	-40.24	-37.70	-39.22	4.12
4	42.67	1.202	-39.51	-16.38	-34.15	-29.73	-35.05	-40.23	-42.64	-37.35	-33.58	-31.01	-29.07	-27.87	-32.59	-33.37	-33.37	-33.07	6.03
5	32.00	.577	-30.40	-12.50	-28.47	-26.55	-27.52	-33.66	-32.23	-29.85	-25.13	-19.54	-25.10	-21.09	-26.82	-27.09	-26.95	-26.20	5.11
6	25.60	.417	-28.86	-21.56	-22.22	-22.85	-24.94	-30.46	-25.38	-26.84	-20.47	-14.35	-21.92	-16.90	-33.58	-23.04	-24.13	-23.83	4.76
7	21.33	.540	-20.57	-14.22	-19.16	-19.03	-18.78	-25.13	-20.32	-17.54	-15.62	-13.58	-16.67	-8.34	-26.93	-16.92	-17.69	-18.03	4.33
8	18.29	1.083	-14.95	-10.02	-12.49	-14.83	-11.72	-15.48	-10.65	-10.11	-10.69	-12.93	-11.67	.59	-21.26	-11.00	-8.62	-11.72	4.45
9	16.00	2.058	-13.91	-9.20	-8.22	-10.15	-11.72	-10.04	-8.37	-10.75	-11.37	-13.47	-8.12	1.98	-20.41	-10.05	-8.75	-10.17	4.44
10	14.22	3.505	-13.06	-9.81	-8.91	-10.95	-11.27	-10.71	-12.05	-10.54	-10.63	-11.49	-8.92	-1.10	-17.15	-10.62	-9.49	-10.45	3.16
11	12.80	4.842	-14.44	-11.04	-11.86	-13.14	-12.13	-12.78	-11.70	-11.79	-11.33	-11.86	-11.64	-5.75	-16.00	-13.41	-11.33	-12.01	2.11
12	11.64	4.847	-16.17	-12.02	-14.16	-15.02	-14.32	-14.18	-13.90	-14.17	-13.51	-13.94	-13.77	-9.33	-17.39	-15.32	-13.16	-14.02	1.75
13	10.67	6.133	-20.96	-17.68	-18.80	-19.42	-19.07	-22.99	-12.87	-19.13	-18.79	-20.13	-18.74	-14.55	-23.77	-20.01	-17.83	-18.98	2.65
14	9.85	8.597	-23.71	-21.13	-21.46	-21.79	-22.29	-29.71	-14.38	-22.29	-21.26	-21.78	-21.46	-18.51	-26.99	-22.85	-21.24	-22.06	3.27
15	9.14	10.205	-25.44	-21.41	-22.63	-21.70	-23.35	-28.56	-22.82	-23.39	-22.38	-23.05	-22.09	-21.61	-30.31	-22.82	-22.30	-23.59	2.49
16	8.53	9.896	-25.51	-21.76	-23.94	-22.70	-23.00	-27.13	-24.65	-23.05	-22.23	-22.85	-23.20	-22.58	-30.58	-23.51	-22.39	-23.94	2.23
17	8.00	9.329	-25.34	-22.60	-25.07	-24.47	-23.41	-27.18	-22.92	-23.48	-22.39	-22.47	-24.60	-22.92	-27.68	-25.05	-22.90	-24.17	1.61
18	7.53	7.630	-26.98	-23.84	-25.01	-24.78	-24.99	-30.97	-24.38	-25.11	-23.60	-23.42	-24.82	-23.62	-26.55	-26.00	-24.05	-25.21	1.85
19	7.11	5.355	-28.48	-25.10	-25.45	-25.26	-27.07	-34.63	-27.16	-27.29	-24.99	-24.84	-25.56	-25.40	-29.45	-27.41	-25.29	-26.89	2.47
20	6.74	3.564	-27.97	-24.92	-25.00	-24.44	-29.32	-37.50	-27.13	-29.65	-25.86	-25.89	-25.18	-26.01	-31.96	-28.77	-26.07	-27.71	3.33
21	6.40	2.147	-28.50	-23.48	-25.79	-24.08	-33.29	-36.52	-26.30	-33.60	-26.13	-27.17	-25.14	-26.41	-33.43	-31.42	-26.19	-28.49	3.93
22	6.10	1.576	-24.14	-20.79	-24.08	-22.68	9999.99	-40.93	-24.72	9999.99	-21.65	-20.76	-23.29	-24.02	-29.35	-30.89	-22.03	-25.32	5.35
23	5.82	1.106	-22.89	-18.24	-21.89	-20.33	9999.99	-46.54	-21.17	9999.99	-19.16	-15.63	-20.87	-21.70	-28.22	9999.99	-19.74	-22.98	7.65
24	5.57	.865	-24.74	-16.18	-20.81	-18.02	9999.99	-45.60	-20.36	9999.99	-21.45	-20.42	-19.36	-21.46	-28.95	9999.99	-21.55	-23.20	7.41
25	5.33	.871	-28.28	-16.49	-21.40	-18.11	9999.99	-49.73	-20.26	9999.99	-18.79	-19.27	-19.97	-21.83	-28.86	9999.99	-18.79	-23.41	8.71
26	5.12	.942	-29.40	-19.87	-26.10	-22.28	9999.99	-49.21	-25.44	9999.99	-24.01	9999.99	-23.77	-24.18	-32.45	9999.99	-23.80	-27.27	7.64
27	4.92	.885	-30.96	-20.08	-28.72	-24.13	9999.99	9999.99	-28.82	9999.99	-28.80	9999.99	-25.35	-25.86	-36.45	9999.99	-28.74	-27.79	4.14
28	4.74	.766	-29.82	-22.97	-29.43	-26.28	9999.99	9999.99	-29.26	9999.99	-30.83	9999.99	-26.92	-26.95	-36.07	9999.99	-30.83	-28.94	3.32
29	4.57	.673	-26.64	-26.80	-31.38	-29.90	9999.99	9999.99	-29.36	9999.99	-32.35	9999.99	-29.89	-27.88	-32.16	9999.99	-32.34	-29.87	2.10
30	4.41	.684	-28.58	-27.18	-33.33	-30.33	9999.99	9999.99	-30.47	9999.99	-33.59	9999.99	-30.47	-27.90	-33.94	9999.99	-33.64	-30.94	2.42
31	4.27	.496	-32.83	-26.07	-30.81	-26.70	9999.99	9999.99	-32.50	9999.99	-34.99	9999.99	-27.16	-25.92	-36.24	9999.99	-35.19	-30.84	3.87

Table B.44 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 06/02/94 13:00 HOURS Hmo= .30 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.553	-82.57	-51.54	-61.04	-59.31	-51.71	-44.63	-66.01	-56.95	-46.47	-51.15	-61.47	-50.83	-83.47	-61.70	-40.15	-57.86	12.01
3	64.00	1.062	-55.53	-47.54	-46.19	-47.56	-40.16	-38.20	-55.36	-45.74	-41.24	-41.95	-48.62	-40.86	-62.75	-47.57	-37.68	-46.45	6.83
4	42.67	1.104	-47.00	-35.06	-43.61	-41.44	-37.29	-35.89	-48.60	-39.34	-37.37	-38.96	-41.67	-34.79	-54.38	-41.88	-36.14	-40.89	5.41
5	32.00	.667	-36.62	-32.60	-42.90	-42.06	-35.31	-27.71	-33.75	-36.74	-35.53	-33.78	-40.20	-28.87	-31.08	-42.35	-34.68	-35.61	4.54
6	25.60	.470	-19.55	-27.59	-28.91	-33.07	-23.47	-20.00	-13.00	-23.82	-23.35	-16.33	-28.90	-19.53	-7.47	-29.25	-25.24	-22.64	6.60
7	21.33	.576	-16.49	-15.93	-18.59	-20.86	-17.45	-18.10	-7.41	-16.95	-17.42	-16.20	-17.72	-9.53	-14.26	-18.57	-17.25	-16.18	3.36
8	18.29	1.066	-14.77	-11.10	-13.35	-14.39	-13.28	-15.73	-10.06	-13.38	-14.57	-17.09	-12.30	-3.24	-18.13	-13.15	-11.67	-13.08	3.35
9	16.00	1.874	-10.01	-8.24	-9.31	-10.43	-11.34	-16.10	-9.04	-10.03	-10.66	-10.92	-8.62	-2.70	-17.93	-8.91	-9.31	-10.24	3.31
10	14.22	3.128	-13.63	-11.80	-10.91	-12.87	-14.06	-18.63	-10.23	-13.33	-13.58	-13.71	-10.69	-4.82	-18.90	-12.36	-12.59	-12.81	3.21
11	12.80	5.020	-19.11	-14.62	-15.43	-16.29	-17.60	-20.32	-15.95	-17.38	-17.17	-18.22	-14.85	-10.33	-23.84	-16.82	-16.18	-16.94	2.87
12	11.64	5.881	-22.09	-16.44	-18.63	-18.42	-19.46	-21.83	-15.78	-19.46	-19.42	-21.86	-17.72	-13.94	-29.41	-19.09	-18.01	-19.43	3.44
13	10.67	7.032	-21.36	-18.89	-19.21	-19.16	-20.38	-24.41	-17.57	-20.31	-20.21	-21.45	-18.74	-15.54	-28.61	-20.05	-19.56	-20.36	2.90
14	9.85	9.849	-23.52	-22.26	-22.18	-21.84	-23.66	-29.35	-31.52	-23.86	-23.08	-22.31	-21.91	-21.96	-30.71	-22.20	-23.32	-24.24	3.23
15	9.14	14.384	-25.67	-22.45	-23.77	-23.17	-24.74	-30.03	-29.67	-25.00	-23.68	-22.81	-23.24	-23.41	-28.69	-23.88	-24.08	-24.95	2.41
16	8.53	16.725	-28.12	-23.27	-25.81	-25.01	-25.92	-30.40	-26.37	-26.10	-24.64	-24.75	-25.16	-24.55	-29.27	-25.96	-24.87	-26.01	1.84
17	8.00	11.700	-29.37	-24.19	-26.91	-26.21	-26.46	-30.27	-25.62	-26.65	-25.00	-25.21	-26.35	-25.11	-30.26	-27.14	-25.34	-26.67	1.83
18	7.53	7.441	-28.67	-24.71	-27.61	-27.06	-27.01	-32.79	-25.67	-27.28	-25.53	-25.15	-27.10	-26.18	-29.30	-27.87	-25.92	-27.19	1.95
19	7.11	5.660	-28.83	-23.93	-26.77	-25.97	-27.35	-34.38	-25.30	-27.59	-25.53	-25.22	-26.09	-25.70	-28.40	-27.70	-25.84	-26.97	2.36
20	6.74	4.577	-30.88	-24.81	-27.98	-26.90	-29.52	-37.08	-26.69	-29.86	-26.74	-26.68	-27.24	-27.15	-30.75	-29.75	-26.96	-28.60	2.83
21	6.40	3.345	-28.96	-24.11	-27.60	-26.82	-29.33	-40.96	-26.93	-29.66	-25.74	-25.06	-26.98	-26.54	-29.02	-30.07	-26.11	-28.25	3.80
22	6.10	2.798	-26.86	-22.34	-26.12	-25.01	-28.34	-43.24	-25.68	-28.73	-24.00	-23.04	-25.22	-24.87	-27.37	-29.46	-24.56	-26.98	4.77
23	5.82	2.094	-25.58	-20.03	-23.69	-21.73	9999.99	-46.58	-23.63	9999.99	-22.15	-22.36	-22.55	-22.97	-28.42	-32.37	-22.51	-25.70	6.77
24	5.57	1.214	-25.03	-17.26	-21.35	-18.05	9999.99	-48.92	-20.96	9999.99	-19.61	9999.99	-19.35	-21.02	-28.06	-39.09	-20.18	-24.84	9.21
25	5.33	.978	-21.90	-12.18	-20.64	-15.95	9999.99	-51.91	-19.59	9999.99	9999.99	9999.99	-17.28	-19.63	-26.50	9999.99	9999.99	-22.71	10.94
26	5.12	.894	-21.97	-12.05	-22.89	-17.29	9999.99	-51.97	-22.84	9999.99	9999.99	9999.99	-18.29	-20.42	-23.69	9999.99	9999.99	-23.37	10.65
27	4.92	1.016	-21.56	-16.57	-25.20	-22.32	9999.99	-59.88	-26.50	9999.99	9999.99	9999.99	-22.82	-21.79	-24.43	9999.99	9999.99	-26.59	12.00
28	4.74	.877	-16.63	-20.17	-22.69	-21.42	9999.99	-57.20	-23.12	9999.99	9999.99	9999.99	-21.60	-19.70	-23.78	9999.99	9999.99	-24.97	11.51
29	4.57	.660	-13.46	-23.12	-21.07	-18.98	9999.99	-53.62	-22.16	9999.99	9999.99	9999.99	-19.39	-16.94	-22.68	9999.99	9999.99	-23.35	11.04
30	4.41	.509	-21.03	-20.48	-20.38	-10.22	9999.99	-56.17	-23.61	9999.99	9999.99	9999.99	-12.51	-14.01	-24.33	9999.99	9999.99	-22.33	12.79
31	4.27	.462	-28.38	-19.66	-25.71	9999.99	9999.99	9999.99	-26.29	9999.99	9999.99	9999.99	9999.99	-19.62	-31.64	9999.99	9999.99	-25.22	4.37

Table B.45 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 06/02/94 16:00 HOURS Hmo= .31 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.604	-126.22	-50.02	-64.52	-58.07	-48.07	-42.56	-73.31	-41.98	-44.20	-55.49	-61.71	-58.84	-103.63	-57.36	-45.39	-61.04	22.79
3	64.00	1.052	-80.55	-27.84	-49.59	-40.58	-34.44	-33.93	-64.18	-39.12	-34.87	-42.36	-45.93	-39.06	-86.80	-42.54	-33.60	-46.02	16.81
4	42.67	1.157	-74.20	-24.71	-52.81	-45.11	-33.97	-33.98	-47.80	-36.48	-26.86	-34.35	-48.69	-32.06	-80.28	-48.35	-29.43	-43.05	15.76
5	32.00	.747	-62.40	-34.23	-45.95	-42.62	-34.38	-37.29	-36.33	-36.48	-27.79	-33.22	-44.69	-34.80	-68.65	-43.50	-29.33	-40.69	11.03
6	25.60	.459	-48.07	-24.64	-30.05	-25.77	-28.42	-29.07	-26.20	-31.36	-21.89	-22.30	-27.33	-21.55	-58.76	-28.19	-25.20	-29.83	9.83
7	21.33	.559	-41.84	-20.12	-33.55	-29.87	-28.19	-22.59	-30.06	-29.74	-23.64	-24.40	-29.74	-21.96	-45.96	-29.47	-24.65	-29.03	6.91
8	18.29	1.203	-20.44	-13.69	-19.24	-19.98	-14.12	-17.43	-14.14	-15.45	-16.65	-21.14	-18.27	-6.86	-18.54	-17.41	-12.13	-16.37	3.63
9	16.00	2.378	-11.88	-8.08	-10.08	-10.64	-9.24	-16.01	-8.11	-9.33	-9.64	-11.87	-9.37	-1.38	-13.98	-9.77	-7.70	-9.81	3.13
10	14.22	3.870	-12.77	-8.40	-9.44	-9.93	-10.48	-15.55	-9.96	-9.87	-8.96	-9.41	-8.83	-3.17	-13.27	-11.00	-9.41	-10.03	2.62
11	12.80	5.573	-14.82	-11.12	-12.51	-12.75	-13.55	-16.54	-15.26	-12.78	-11.84	-11.43	-11.87	-7.78	-17.25	-13.36	-12.62	-13.03	2.25
12	11.64	6.545	-16.14	-13.06	-15.70	-15.68	-15.03	-19.28	-17.57	-14.33	-13.10	-12.51	-15.06	-11.92	-19.91	-15.35	-14.33	-15.26	2.23
13	10.67	7.938	-18.22	-15.07	-17.96	-17.57	-16.59	-21.98	-19.20	-16.17	-14.81	-14.49	-17.33	-15.09	-21.65	-17.68	-15.94	-17.32	2.21
14	9.85	11.768	-22.29	-18.85	-22.01	-21.33	-20.69	-26.18	-23.26	-20.60	-18.99	-18.44	-21.32	-20.01	-24.84	-21.67	-20.01	-21.37	2.09
15	9.14	15.708	-25.94	-21.66	-24.80	-24.51	-23.98	-27.64	-23.35	-24.14	-22.17	-21.25	-24.22	-22.19	-25.39	-25.19	-23.12	-23.97	1.68
16	8.53	14.586	-26.80	-23.04	-25.36	-24.98	-24.92	-27.94	-24.86	-25.12	-23.42	-22.78	-24.90	-23.49	-27.04	-25.71	-24.12	-24.96	1.44
17	8.00	9.556	-28.43	-23.44	-26.88	-26.02	-26.52	-28.47	-26.83	-26.76	-24.89	-24.62	-26.16	-25.42	-29.77	-26.96	-25.31	-26.43	1.57
18	7.53	6.525	-30.14	-23.75	-28.88	-27.77	-28.56	-29.98	-27.22	-28.93	-26.29	-25.57	-27.77	-26.93	-30.51	-29.09	-26.73	-27.87	1.79
19	7.11	5.039	-31.34	-26.58	-30.15	-29.00	-30.48	-33.96	-29.52	-30.94	-28.34	-28.26	-29.32	-28.99	-34.19	-30.60	-28.58	-30.02	1.98
20	6.74	4.768	-28.49	-26.40	-29.37	-28.34	-29.54	-34.42	-28.43	-29.91	-27.73	-27.65	-28.75	-28.71	-32.60	-30.11	-27.98	-29.23	1.94
21	6.40	3.810	-29.80	-26.42	-31.04	-29.66	-31.91	-34.53	-28.35	-32.34	-29.69	-29.58	-30.03	-29.95	-33.14	-32.57	-29.82	-30.59	1.97
22	6.10	2.941	-31.30	-27.31	-30.11	-28.58	-33.85	-39.34	-28.47	-34.30	-30.30	-30.50	-29.10	-29.92	-33.13	-33.31	-30.37	-31.32	2.94
23	5.82	2.230	-30.32	-28.24	-30.29	-28.60	-33.96	-43.02	-30.02	-34.46	-30.15	-29.87	-29.36	-30.92	-33.90	-33.25	-30.22	-31.77	3.56
24	5.57	2.325	-27.50	-23.66	-26.38	-24.87	-28.24	9999.99	-26.62	-28.46	-23.95	-22.43	-25.57	-25.59	-29.73	-29.99	-24.28	-26.23	2.24
25	5.33	2.077	-24.61	-18.82	-22.92	-20.01	9999.99	9999.99	-24.04	9999.99	-16.10	-13.30	-21.05	-21.49	-27.48	9999.99	-17.35	-20.65	3.92
26	5.12	1.466	-24.47	-20.53	-24.90	-20.87	9999.99	9999.99	-26.22	9999.99	-23.01	-19.06	-22.00	-23.75	-28.45	9999.99	-23.14	-23.31	2.57
27	4.92	1.209	-27.24	-21.16	-30.36	-25.24	9999.99	9999.99	-29.78	9999.99	9999.99	9999.99	-26.11	-29.64	-33.04	9999.99	9999.99	-27.82	3.45
28	4.74	1.088	-21.14	-10.18	-31.86	-22.78	9999.99	9999.99	-30.93	9999.99	9999.99	9999.99	-23.99	-28.47	-35.48	9999.99	9999.99	-25.62	7.43
29	4.57	1.015	-12.98	-3.38	-25.85	-17.89	9999.99	9999.99	-24.10	9999.99	9999.99	9999.99	-19.29	-20.32	-30.46	9999.99	9999.99	-19.30	7.80
30	4.41	.820	-6.59	-1.19	-21.14	-13.51	9999.99	9999.99	-21.39	9999.99	9999.99	9999.99	-14.97	-14.18	-25.19	9999.99	9999.99	-14.78	7.47
31	4.27	.587	-5.09	-2.47	-14.21	-9.34	9999.99	9999.99	-13.19	9999.99	9999.99	9999.99	-10.35	-9.72	-18.79	9999.99	9999.99	-10.40	4.81

Table B.46 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 06/02/94 19:00 HOURS Hmo= .35 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.537	-67.54	-79.72	-35.65	-61.34	-56.02	-44.12	-1.91	-53.23	-50.85	-50.33	-60.80	-44.62	-56.00	-63.84	-47.19	-51.87	16.86
3	64.00	1.071	-56.11	-58.67	-37.66	-48.64	-38.70	-36.06	-40.19	-40.09	-35.93	-38.75	-49.23	-35.45	-59.95	-49.25	-34.77	-43.94	8.58
4	42.67	1.211	-48.48	-50.18	-41.11	-45.69	-42.59	-45.74	-51.51	-44.90	-43.44	-43.52	-45.47	-39.10	-49.51	-46.37	-41.26	-45.26	3.45
5	32.00	.877	-63.89	-53.65	-63.18	-61.71	-59.23	-65.22	-64.57	-60.31	-59.87	-60.00	-61.48	-57.08	-63.24	-62.08	-57.42	-60.86	3.04
6	25.60	.701	-41.82	-39.52	-59.73	-59.22	-40.36	-50.75	-56.15	-40.50	-42.60	-42.25	-58.26	-45.02	-41.33	-56.01	-40.46	-47.59	7.75
7	21.33	.860	-32.30	-29.53	-40.84	-40.41	-25.27	-37.53	-36.53	-25.21	-27.49	-29.14	-39.51	-26.09	-36.98	-36.17	-27.84	-32.72	5.59
8	18.29	1.259	-26.21	-20.04	-19.58	-19.41	-20.46	-23.45	-12.05	-20.23	-21.17	-22.80	-18.62	-7.93	-37.32	-20.39	-20.65	-20.68	6.14
9	16.00	2.106	-17.29	-13.22	-13.98	-13.57	-16.46	-18.41	-6.87	-15.55	-17.13	-18.90	-13.01	-7.77	-32.97	-13.07	-14.74	-15.52	5.72
10	14.22	3.719	-13.12	-9.43	-12.54	-12.51	-12.64	-15.38	-12.12	-11.92	-13.24	-15.24	-11.67	-6.54	-25.29	-10.70	-10.45	-12.85	3.93
11	12.80	5.957	-15.12	-11.78	-14.48	-15.15	-14.23	-14.72	-21.52	-13.06	-12.01	-10.73	-13.92	-9.83	-19.41	-14.16	-13.10	-14.21	2.91
12	11.64	7.312	-17.52	-14.25	-17.62	-18.20	-16.82	-18.21	-21.19	-16.14	-14.50	-12.61	-17.06	-13.86	-18.91	-17.31	-16.21	-16.69	2.13
13	10.67	9.715	-21.23	-18.73	-21.22	-21.56	-20.32	-24.40	-21.63	-20.17	-18.66	-17.66	-20.75	-17.77	-23.46	-21.53	-19.91	-20.60	1.84
14	9.85	14.586	-25.08	-22.12	-25.06	-24.74	-24.07	-27.85	-25.15	-24.22	-22.62	-22.09	-24.51	-22.77	-26.94	-25.31	-23.36	-24.39	1.60
15	9.14	18.551	-26.52	-22.75	-25.80	-25.26	-25.45	-29.45	-24.75	-25.64	-23.97	-23.43	-25.17	-24.16	-26.92	-26.09	-24.49	-25.32	1.56
16	8.53	16.320	-26.20	-21.75	-24.67	-24.09	-24.33	-28.69	-22.94	-24.45	-22.53	-22.13	-24.06	-22.77	-25.86	-25.14	-23.21	-24.19	1.75
17	8.00	11.597	-25.42	-20.24	-23.92	-23.11	-22.97	-26.61	-22.53	-23.04	-20.65	-20.21	-23.20	-21.71	-25.57	-24.07	-21.78	-23.00	1.86
18	7.53	7.597	-25.76	-21.12	-24.85	-23.91	-23.70	-27.92	-24.58	-23.82	-21.38	-21.05	-24.21	-23.16	-27.43	-24.92	-22.37	-24.01	1.99
19	7.11	6.211	-27.50	-23.18	-26.68	-25.83	-26.05	-33.64	-26.62	-26.26	-23.72	-23.47	-26.13	-25.14	-28.86	-27.51	-24.34	-26.33	2.50
20	6.74	4.588	-29.24	-23.77	-27.29	-26.33	-28.23	-33.43	-26.92	-28.55	-24.83	-24.55	-26.65	-25.53	-30.04	-29.86	-25.34	-27.37	2.48
21	6.40	4.077	-29.43	-21.81	-25.76	-24.05	-27.25	-33.72	-25.34	-27.57	-23.01	-23.14	-24.91	-24.85	-32.17	-28.49	-23.65	-26.34	3.31
22	6.10	4.172	-26.34	-19.41	-25.01	-23.13	-24.89	9999.99	-23.82	-25.04	-20.96	-20.91	-23.87	-23.78	-28.92	-26.32	-21.78	-23.87	2.44
23	5.82	3.367	-23.11	-17.29	-23.59	-21.77	9999.99	9999.99	-22.23	9999.99	-18.55	-17.78	-22.26	-21.95	-24.11	9999.99	-19.54	-21.11	2.29
24	5.57	2.960	-21.17	-15.53	-21.80	-19.72	9999.99	9999.99	-21.37	9999.99	-13.53	-11.09	-20.23	-19.82	-22.19	9999.99	-15.35	-18.35	3.62
25	5.33	3.236	-18.55	-11.95	-17.54	-14.42	9999.99	9999.99	-17.88	9999.99	-7.49	-4.66	-15.33	-15.46	-21.01	9999.99	-10.17	-14.04	4.77
26	5.12	3.101	-15.40	-7.30	-12.71	-9.31	9999.99	9999.99	-13.35	9999.99	1.12	4.94	-10.08	-10.94	-16.84	9999.99	-3.21	-8.47	6.54
27	4.92	3.333	-14.84	-6.00	-13.34	-9.08	9999.99	9999.99	-13.59	9999.99	2.58	4.45	-9.93	-10.70	-15.94	9999.99	-2.10	-8.06	6.66
28	4.74	2.606	-11.28	-2.69	-8.48	-4.43	9999.99	9999.99	-9.18	9999.99	6.97	8.59	-5.47	-6.06	-11.18	9999.99	1.66	-3.79	6.54
29	4.57	2.281	-5.85	-.15	-4.91	-2.51	9999.99	9999.99	-4.47	9999.99	5.87	7.07	-2.90	-3.37	-5.46	9999.99	2.32	-1.31	4.32
30	4.41	2.342	-.17	1.47	-1.95	-.40	9999.99	9999.99	-1.45	9999.99	9.02	9.67	-.41	-.62	-4.17	9999.99	5.24	1.47	4.31
31	4.27	2.035	1.09	3.78	3.35	4.56	9999.99	9999.99	1.94	9999.99	12.45	12.95	4.29	4.08	-.32	9999.99	7.97	5.10	4.11

Table B.47 TABLE : POLYGONAL ARRAY - 15 REDUNDANT ESTIMATES OF THE WAVE DIRECTIONAL SPECTRUM PART=6 PASS=2 06/02/94 22:00 HOURS Hmo= .41 m (Hmo and spectral energy are for gauge 0) NP= 256 SAMIN= .5 NDF=160 UNITS=1 WINDOW=4 ICOR=1 CUT=.20 TH=21.40 TL=1.99 FORMAT=(8f5.1) FACTOR=1.0

	Period	Energy	DIRECTION (degrees) for 15 different gauge triads															Mean	Std
NO	(sec)	(cm**2)	012	34C	D03	D24	C1D	4C5	D0E	CB1	CB2	CB0	D04	D0C	02D	41D	C24	dir	dev
2	128.00	.678	-21.24	-69.40	-46.92	-55.36	-45.36	-76.08	-41.02	-58.53	-63.75	-59.03	-54.00	-50.61	-45.26	-49.66	-55.71	-52.85	12.44
3	64.00	1.201	-29.61	-56.53	-46.66	-56.11	-44.08	-40.45	-54.30	-46.32	-49.02	-44.19	-53.82	-42.31	-20.25	-53.89	-45.07	-45.56	9.64
4	42.67	1.307	-48.66	-60.37	-63.37	-67.49	-58.42	-43.11	-59.49	-64.25	-64.21	-60.36	-66.74	-54.89	-36.71	-67.31	-53.08	-57.93	8.83
5	32.00	.866	-69.58	-53.35	-68.06	-67.23	-62.56	-52.89	-63.15	-70.01	-66.93	-65.69	-67.17	-59.60	-66.55	-67.71	-53.78	-63.63	5.76
6	25.60	.736	-43.27	-21.72	-39.58	-38.37	-31.39	-35.41	-47.86	-32.21	-27.81	-29.54	-37.47	-26.29	-42.94	-36.91	-28.23	-34.60	7.01
7	21.33	.888	-18.21	-3.18	-14.23	-11.89	-12.98	-21.67	-18.10	-12.72	-12.75	-15.28	-11.35	-2.60	-22.34	-12.88	-10.91	-13.41	5.37
8	18.29	1.503	-15.85	-8.84	-11.02	-10.29	-13.74	-18.60	-.80	-13.50	-14.94	-17.67	-9.34	-.42	-21.65	-11.76	-11.66	-12.01	5.65
9	16.00	2.315	-18.96	-14.39	-14.94	-16.95	-16.46	-20.50	-11.40	-15.55	-16.60	-18.73	-14.40	-3.12	-28.54	-14.32	-14.24	-15.94	5.13
10	14.22	3.982	-13.24	-11.23	-11.48	-13.65	-12.44	-17.02	-10.65	-11.34	-11.96	-12.53	-11.57	-4.78	-19.50	-10.98	-10.37	-12.18	3.11
11	12.80	6.438	-15.07	-12.47	-13.46	-14.74	-13.22	-18.10	-16.20	-12.45	-11.86	-11.82	-13.25	-7.76	-17.85	-13.66	-12.20	-13.61	2.50
12	11.64	9.226	-19.79	-16.09	-18.73	-18.38	-17.30	-22.47	-19.47	-17.14	-16.28	-17.28	-18.10	-14.89	-23.74	-18.46	-16.64	-18.32	2.27
13	10.67	12.613	-22.93	-18.91	-22.83	-21.92	-20.45	-24.51	-23.16	-20.39	-19.13	-19.81	-22.05	-20.08	-26.94	-21.98	-19.82	-21.66	2.13
14	9.85	17.367	-24.94	-21.07	-24.30	-23.35	-23.12	-25.05	-26.17	-23.18	-21.94	-22.18	-23.55	-22.43	-27.84	-23.92	-22.53	-23.71	1.69
15	9.14	20.399	-25.36	-21.16	-23.89	-22.91	-23.38	-26.62	-24.76	-23.46	-21.95	-21.91	-23.19	-22.71	-26.77	-23.67	-22.52	-23.62	1.59
16	8.53	20.081	-25.46	-22.36	-24.90	-24.24	-24.13	-28.40	-25.71	-24.30	-22.55	-21.97	-24.43	-23.62	-26.76	-24.88	-23.38	-24.47	1.63
17	8.00	13.581	-25.95	-22.27	-24.92	-24.42	-24.80	-28.95	-25.11	-25.01	-22.80	-21.91	-24.42	-23.32	-25.37	-25.74	-23.65	-24.58	1.67
18	7.53	8.815	-28.12	-21.00	-25.27	-23.66	-25.97	-30.00	-26.05	-26.20	-22.95	-22.86	-24.18	-24.31	-28.89	-25.98	-23.45	-25.26	2.36
19	7.11	7.847	-27.69	-19.68	-24.44	-22.37	-25.64	-30.13	-25.96	-25.83	-21.94	-22.13	-23.24	-24.14	-29.54	-25.50	-22.27	-24.70	2.82
20	6.74	6.460	-24.80	-19.15	-23.93	-21.96	-24.54	-30.27	-25.35	-24.66	-20.55	-20.99	-22.93	-23.62	-28.72	-25.45	-21.07	-23.87	2.89
21	6.40	6.887	-21.57	-19.65	-23.24	-22.08	-22.94	-30.59	-22.70	-22.99	-19.72	-19.51	-22.66	-22.57	-26.44	-25.28	-20.53	-22.83	2.80
22	6.10	6.603	-19.22	-16.28	-18.85	-17.51	-17.95	9999.99	-18.46	-17.73	-16.45	-15.95	-18.11	-18.39	-22.82	-19.59	-17.39	-18.19	1.65
23	5.82	6.112	-14.23	-11.00	-14.29	-12.66	-8.93	9999.99	-14.23	-8.31	-11.01	-9.94	-13.17	-13.81	-17.36	-9.69	-12.12	-12.20	2.43
24	5.57	5.698	-11.67	-8.25	-12.58	-10.82	-.20	9999.99	-12.52	1.01	-5.25	-2.81	-11.14	-11.30	-13.73	-2.83	-7.62	-7.84	4.78
25	5.33	5.167	-8.25	-7.78	-10.47	-9.18	2.02	9999.99	-10.12	3.49	-3.48	-.20	-9.26	-9.26	-11.30	-.39	-6.06	-5.74	4.85
26	5.12	5.580	-9.64	-5.60	-9.19	-7.15	4.29	9999.99	-10.06	5.85	-1.87	1.32	-7.41	-7.99	-11.34	3.95	-4.42	-4.24	5.67
27	4.92	6.412	-6.90	-3.99	-9.14	-7.61	5.80	9999.99	-10.03	7.40	1.07	4.29	-7.51	-7.66	-9.98	5.10	-1.76	-2.93	6.20
28	4.74	6.805	-4.45	-1.46	-5.66	-4.15	5.53	9999.99	-5.99	6.97	4.11	5.70	-4.28	-4.19	-7.72	5.10	1.11	-.67	5.01
29	4.57	5.598	1.64	2.79	-.87	.89	8.38	9999.99	-.07	9.80	7.85	8.97	.81	.66	-3.39	6.82	4.41	3.48	4.05
30	4.41	4.293	7.52	6.02	1.24	2.54	9.28	9999.99	1.76	11.68	12.12	13.18	2.88	3.28	-1.21	5.14	6.93	5.88	4.29
31	4.27	3.940	9.21	5.71	2.00	2.42	10.36	9999.99	.90	13.38	14.81	15.47	2.85	3.73	-1.09	5.28	8.92	6.71	5.16

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