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PASSIVE 19.3 GHZ RADIOMETER AND AEROSOL DATA FROM THE NORTH SEA--ETC(U)

AUG 80 S G GATHMAN, B G JULIAN

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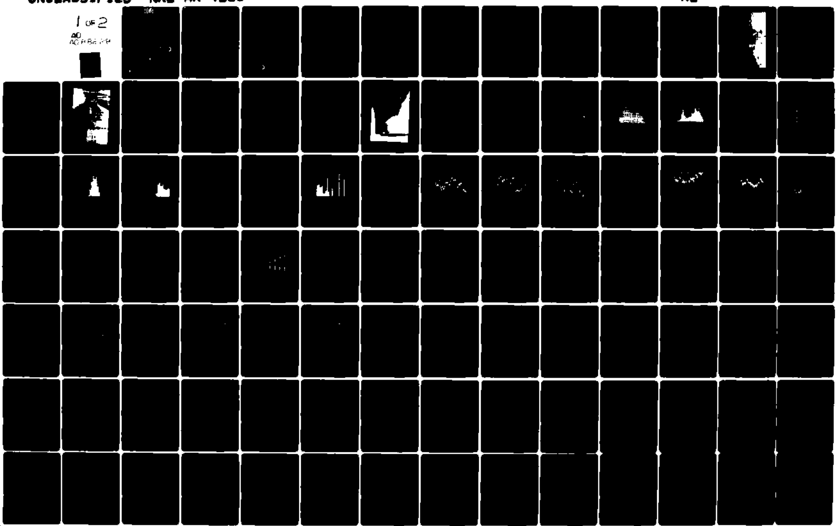

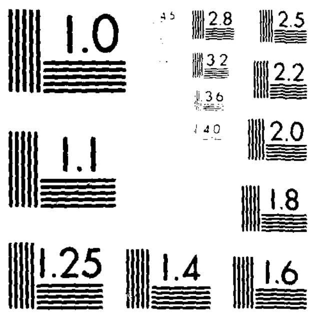

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NRL Memorandum Report [illegible]

Passive 19.3 GHz Radiometer and Aerosol Data from the North Sea During MARSEN

September-October 1979

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Atmospheric Physics Branch
Environmental Sciences Division

August [illegible] 1980

NAVAL RESEARCH LABORATORY
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Aerosol concentrations in five size ranges with a minimum detection size of d=0.5 microns and the horizontal and vertical polarities of passive 19.3 GHz microwave radiation at various angles to nadir were obtained in the North Sea during MARSEN I in the September—October 1979 time frame. These data together with pertinent simultaneous meteorological measurements are reported on an hourly basis.

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PASSIVE 19.3 GHz RADIOMETER AND AEROSOL DATA
FROM THE NORTH SEA DURING MARSEN I
SEPTEMBER—OCTOBER 1979

1. BACKGROUND

The truly marine atmosphere differs considerably from its continental counterpart both in its meteorological characteristics and in its aerosol composition. According to Junge, the typical continental aerosol size distribution can be described by:

$$\frac{dN}{d(\log r)} = C\, r^{-\beta}$$

where N is the aerosol concentration which is a function of the radius, r is the radius, β is about 3 and C is a constant.

In the simplest terms on the other hand, the marine aerosol is made up of both a residual continental population plus an additional marine component. As an air mass leaves a continental area, for the open sea, air mass modification takes place and the continental aerosol component is decreased because most of its sources are eliminated while the sink or dissipation processes are still operating. In addition a new source of aerosols comes into play, produced by the sea itself and present in the form of minute droplets formed about nuclei of sea salt.

It is well known that the total concentration of sea salt in the marine atmosphere increases with wind speed as any visitor to the sea shore with an automobile windshield to clean will attest. There are several known mechanisms by which these

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salt particles are introduced mechanically into the atmosphere. The first is by the bursting of minute air bubbles at the surface of the water. Blanchard (1963) has shown that depending on the size and age of the air bubbles, small jet drops can be ejected to altitudes of tens of centimeters above the water surface. These jet drops are then evaporated down to an equilibrium size in which it will no longer evaporate nor grow when reacting with the free water vapor in the immediate environment of the droplet. As a small salt particle, this former jet drop may now be transported vertically by the turbulent atmospheric forces in the boundary layer in which it now finds itself. For the most part the air bubbles are introduced into the surface waters of the sea by the action of white caps. When a wave becomes so steep that it is no longer stable, its crest in the process of falling back into the water entraps a volume of air which quickly breaks up into many small bubbles [Blanchard and Woodcock (1957) & Monahan and Zietlow (1969)].

A secondary source of extremely small droplets observed in the action of the bursting of air bubbles at the sea is the film droplets which are the residue of the bubble film remaining suspended as the film bursts just prior to the ejection of the jet droplets.

The film droplets are about two orders of magnitude more numerous than the jet droplets and they are considerably smaller in size than their cousins. However they are not mechanically placed in the turbulent zone and their effect on atmospheric aerosol concentration is not well known.

A third source of aerosol occurs at wind speeds higher than those associated with the onset of whitecapping. This process produces droplets by the wind mechanically shearing off the wave crests [Blanchard, (1974)]. Many of these resulting droplets strike the sea surface downwind of the crest of their origin and in the process produce many additional droplets and bubbles [Harlow and Shannon, (1967)].

Once introduced into the atmosphere, the growth and evaporation of the droplet depends on the chemical characteristic of the droplet water and its salt content. If the droplet were evaporated down in a desert environment it would eventually reach a minimum dry size. At higher relative humidities it will grow to larger sizes because of the hygroscopic salt of the nuclei attracting water molecules even at relative humidities less than 100%. Of course if the relative humidity reaches 100% the growth will be spectacular. The aggregate result of many droplets reaching this rapid growth stage is the phenomenon of fog.

The characteristics of the variability of size as a function of relative humidity of the hygroscopic portion of the total aerosol in the marine atmosphere is extremely important when we are concerned about the transmission of electromagnetic radiation of near optical wavelengths in the Navy. This is because of the scattering interaction which occurs when the electromagnetic radiation wavelength and the particle sizes are equivalent.

There are at present no satisfactory way of predicting precisely the size distribution of the aerosol as a function of altitude above the sea surface nor are there techniques to obtain this information from a remote sensor.

It has been shown [Droppleman, (1970)] that the emissivity of radiation at microwave wavelengths is strongly affected by the presence of white water or bubbles at the sea surface. If the percentage of the total sea surface covered by white caps can be measured remotely by a microwave technique, then the possibility of remotely monitoring the source of the marine aerosol from aircraft or satellite is achieved. Consequently with the aid of an appropriate boundary layer model utilizing this information the size distribution of atmospheric aerosols can be determined at various altitudes. This model requires as an input information on the flux of droplets produced at the sea surface which are injected into the lowest layers of the turbulent boundary layer and mixed throughout the boundary layer by eddy diffusion processes. This type of sensing would be useful for the high wind regimes where our knowledge of aerosol loading is particularly scanty.

MARSEN I was a cooperative experiment between European and American scientists designed to study the interaction of surface winds, waves and currents using in-situ and remote sensors. The measurements were carried out in the German Bight around the Island of Helgoland, the German North Sea Platform and the Island of Sylt.

It was the purpose of this part of the experiment to investigate the production and distribution of various aerosols by greatly expanding our measurement capability in utilizing the various measurements being made at the sea surface by experimenters from many countries. Thus by extending the suite of instruments, taking part in the large scale MARSEN I experiment to include measurements of specific interest to the problem of marine aerosols, we gain significant leverage in obtaining a sufficiently broad experiment at reasonable cost to provide specific data to be used as input data to the first order mixing model and as "ground truth" aerosol content data to be used in the testing of the model predictions themselves.

This experiment provides complementary information on the mechanism of maritime aerosol generation as well as an analysis of the utility of satellite derived data on sea surface properties. It is hoped that the use of this complementary study of aerosol generation by white caps, the resulting aerosol size distribution in the marine boundary layer and the feasibility to derive aerosol generation rates from microwave radiometric data from the SMMRs' of either aircraft or NIMBUS G will provide the ground work for an even greater application of remote sensing techniques in the study of the meteorology of remote sections of the worlds oceans.

Figure 1 shows the location of the Forschungsplattform Nordsee (FPN) located in the German Bight portion of the North Sea on which the data reported in this report were observed. The tower is located at approximately 54^{o} 42'N and 7^{o} 10' E.

Figure 2 is a photograph of the tower from the air showing a helicopter landing on the helicopter deck to transfer material and personnel to the tower. The tower is a well equipped and comfortable scientific laboratory providing an excellent solid base for many different experiments involving the sea and its interaction with the air.

2. INSTRUMENTATION - AEROSOL MEASUREMENTS

The aerosol data in this report were obtained with a Royco model 225/241 aerosol particle counter with a model 518 data interface. This instrument is designed to count particle

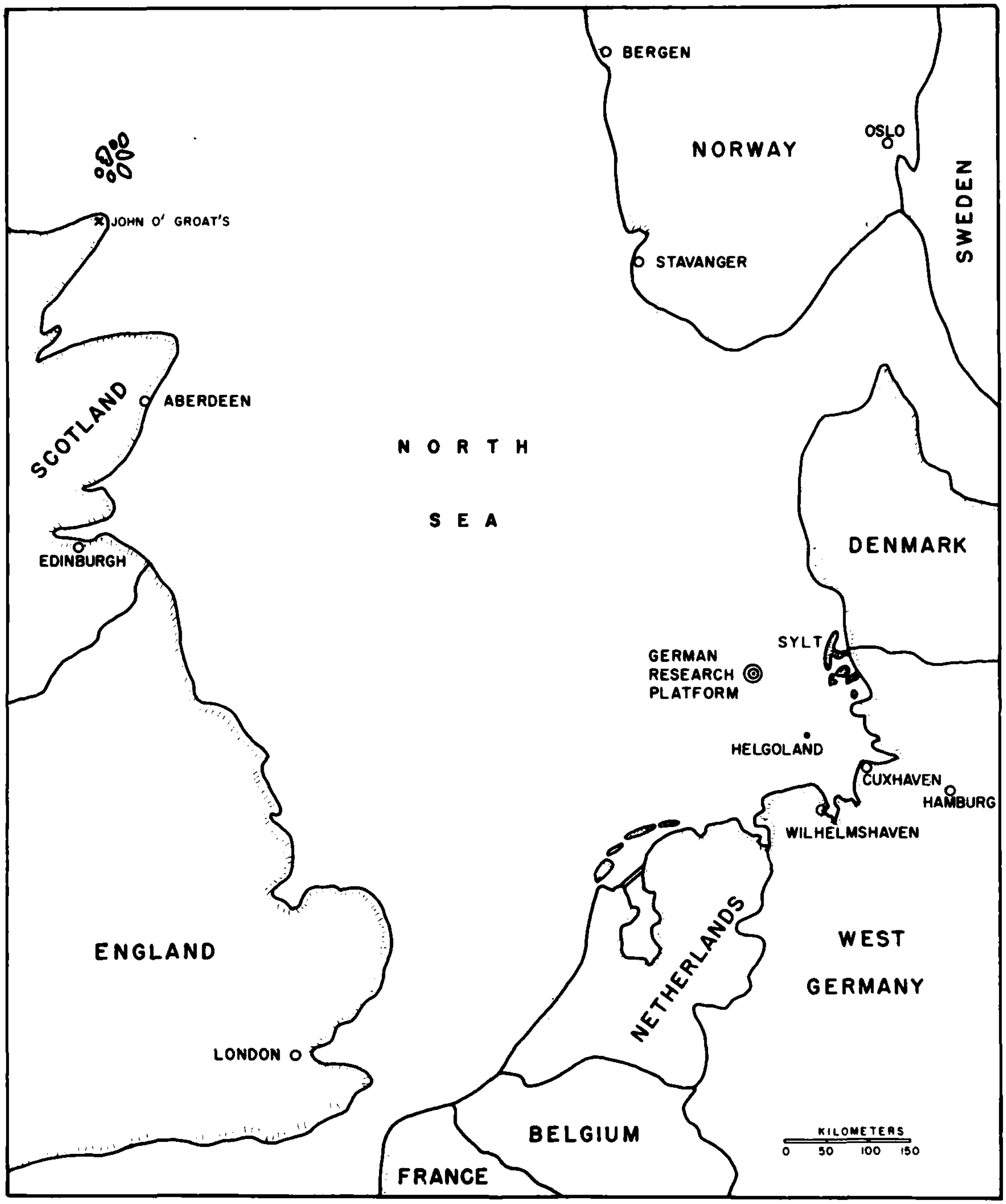

Fig. 1 — German research platform location

Fig. 2 — German research platform — North Sea

concentrations in a gaseous media. The counter will measure particles of 0.5 micron diameter and larger concentrations of up to 3500 per cc. and sort them into five adjustable size classifications counting into memories of all five channels simultaneously. The manufacturer claims a sizing accuracy about the stated size of ± 5% - based on the pulse height measurements.

The interface device was connected digitally to a microcomputer system which received the total counts of all five channels for a period of one minute. The microcomputer system provides both an immediate analog strip chart recording of all five channels in the form of histograms as well as a magnetic cassette recording of the data to provide a digital format from which to retrieve the data, for later manipulations in the analysis of the experiment.

The microcomputer system also allows for notes to be inserted by hand into the data stream to allow the coordination of the system with the rest of the experiment. The sensing head and the Royco control electronics can be separated from each other.

The air flow entering the sampling chamber was calibrated in situ with a Fisher Mark III flow meter. This calibration showed that the Royco operating at the 0.1 CFM setting was in reality only sampling 0.09677 CFM. This correction is applied to the calculations of aerosol concentrations.

The data was analyzed later from the magnetic tape cassette. The data presented in this report is a subset of the total data available and consists of the ten minutes of available data about the hour which is averaged and presented as the aerosol concentration at that hour.

The sensor was located in a weatherproof box with an inlet tube which could be rotated to face into the wind. The sensor enclosure was located on the outside of the catwalk surrounding the tower as shown in figure 3. Because of the physical inability to get adequately far from the tower the wind direction must be taken into account in the interpretation of the aerosol data. In general when the wind direction is from 180° to 360° the aerosol sample is unobstructed and the data should be representative of that over the free North Sea waters. On the other hand, when the wind direction is from 0° to 180°, the data is suspect and should not be used as the sole basis on which to make important conclusions.

The instrument was operated continuously day and night from the late evening of 13 September 1980 until mid morning of 13 October 1980. The hours of operation are shown in figure 4 where the darkened squares represent data available in the data base.

Fig. 3 – Aerosol measuring instrument (on left)

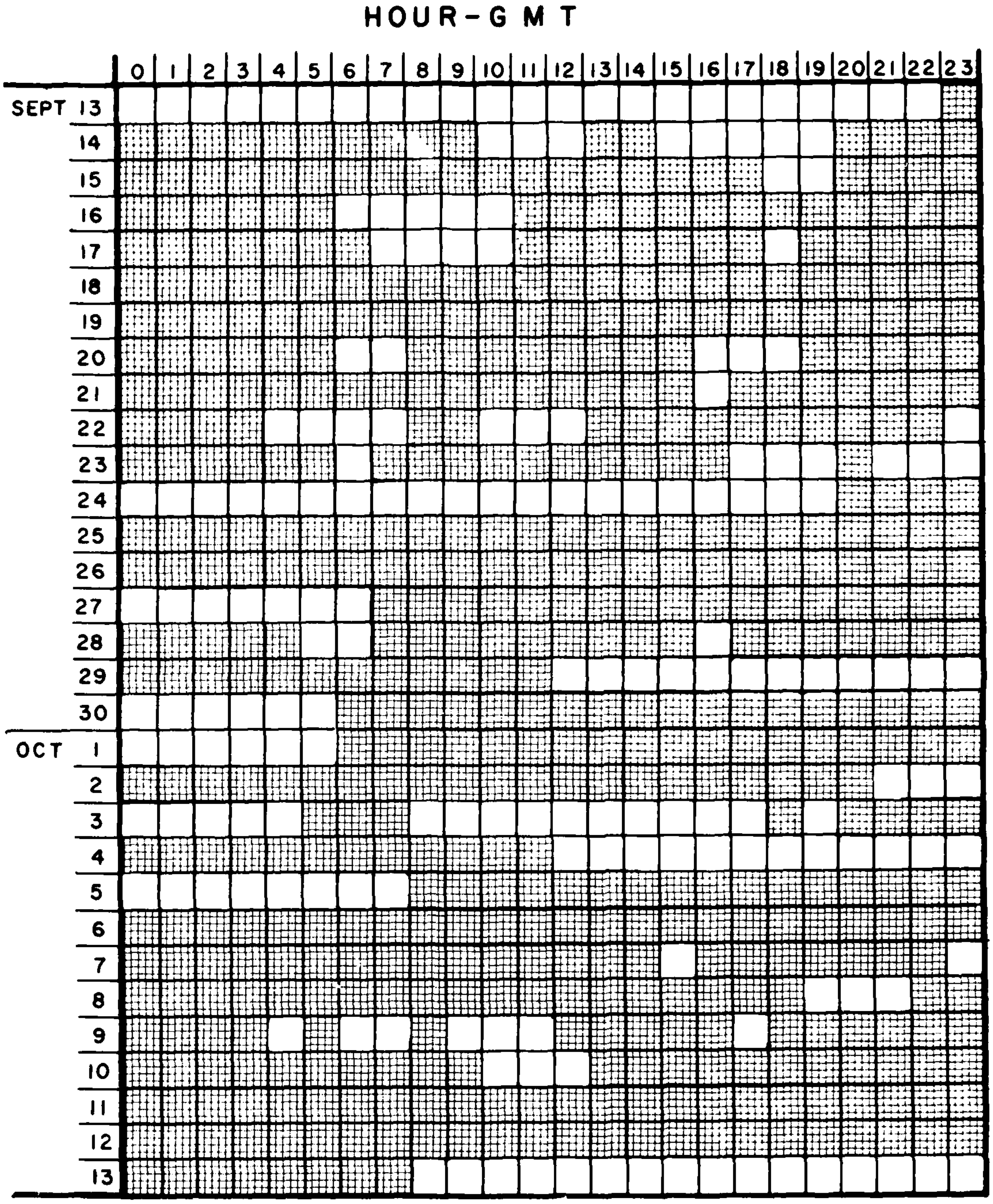

Fig. 4 — Aerosol instrument — hours of operation (indicated by darkened squares)

3. INSTRUMENTATION - RADIOMETER MEASUREMENTS

The second instrument, the 19.3 GHz microwave radiometer is used as an indicator of whitecaps on the sea surface. Over the past 30 years a wide variety of microwave radiometer configurations of varying complexity and sensitivity have been used. The device used in this experiment was designed by members of the Advanced Space Sensors Applications Branch of the Naval Research Laboratory Space Science Division.

The configuration of the radiometer is shown in figure 5. This device provides continuous analog outputs of both the vertical and the horizontal polarization components of microwave radiation entering the 6" aperture antenna.

The logic card operates both the electrically controlled horizontal/vertical antenna switch and the Dicke switch in such a way that both polarities of the incoming signals are compared with a reference load in a black box of a known temperature. The Gunn diode provides a heterodyning signal of an appropriate magnitude so that the amplified I.F. signal can be easily detected by the crystal detector and its magnitude processed by the logic card.

The instrument has an additional four way switch which is manually operated and allows the instrument to provide a zero reading - because in this mode both ends of the Dicke switch

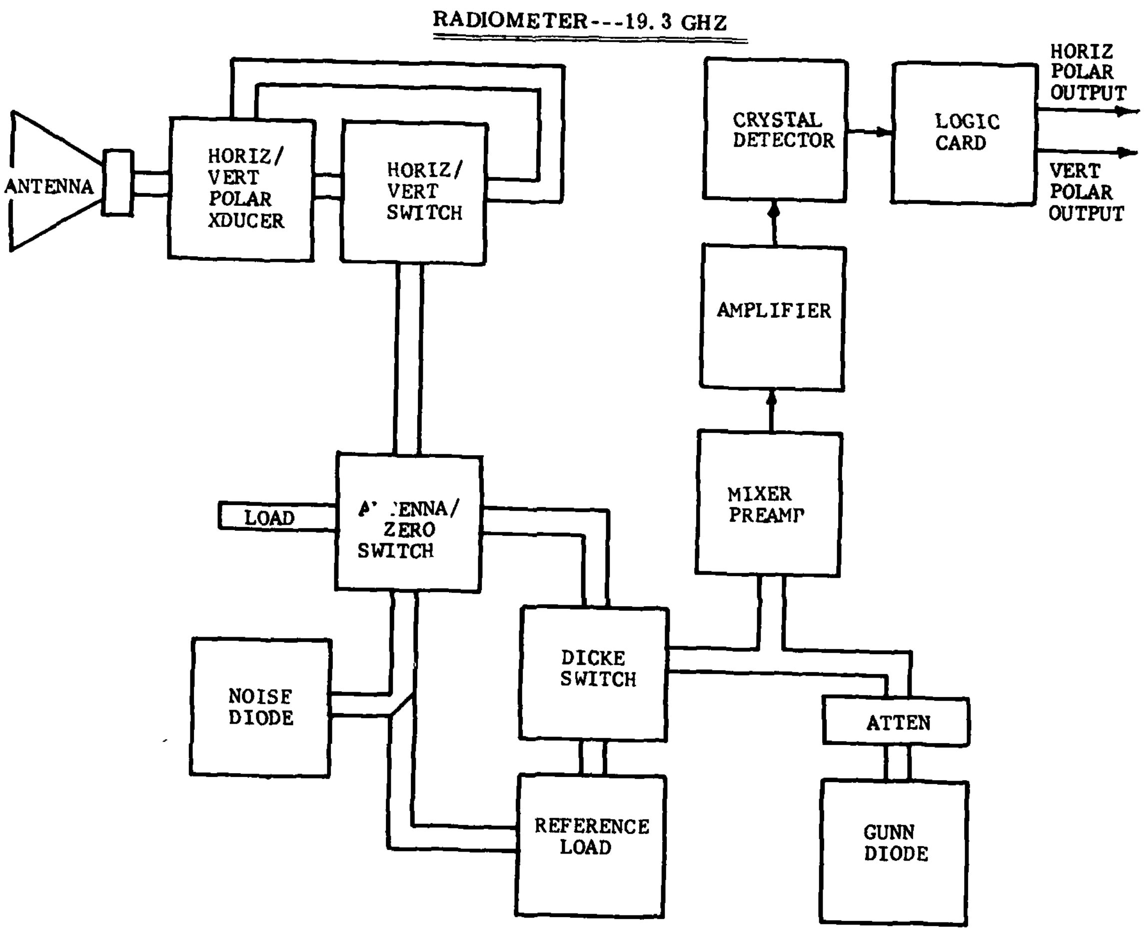

Fig. 5 — Radiometer block diagram

are looking into the constant temperature block and the differences in these signals should be a null signal. In addition, a noise diode can be turned on to provide a calibration source.

The outputs of this instrument were recorded on strip chart recorders in the high speed mode of 5 cm of chart per minute which was adequate to observe the growth and decay of individual white caps in its field of view.

The radiometer was mounted on the outside rail of the catwalk about the tower, figure 6, on a mount which allowed the radiometer to be looking at the sea surface at various angles from straight down to at the horizon. The general direction in which the radiometer was focusing was west. Throughout the period 3 or 4 times a day, high speed recordings were made at various angles with respect to the zenith. Figure 7 shows the times throughout the period when these high speed runs were made. These measurements were backed up by photographs of the sea surface taken at the same time and at the same angle during the daylight hours.

4. AUXILIARY MEASUREMENTS

In addition routine meteorological measurements were made by the tower personnel every hour. These measurements include the wind speed and directions, wave heights, barometric pressure, air temperature, water temperature at the depths of

Fig. 6 — Radiometer

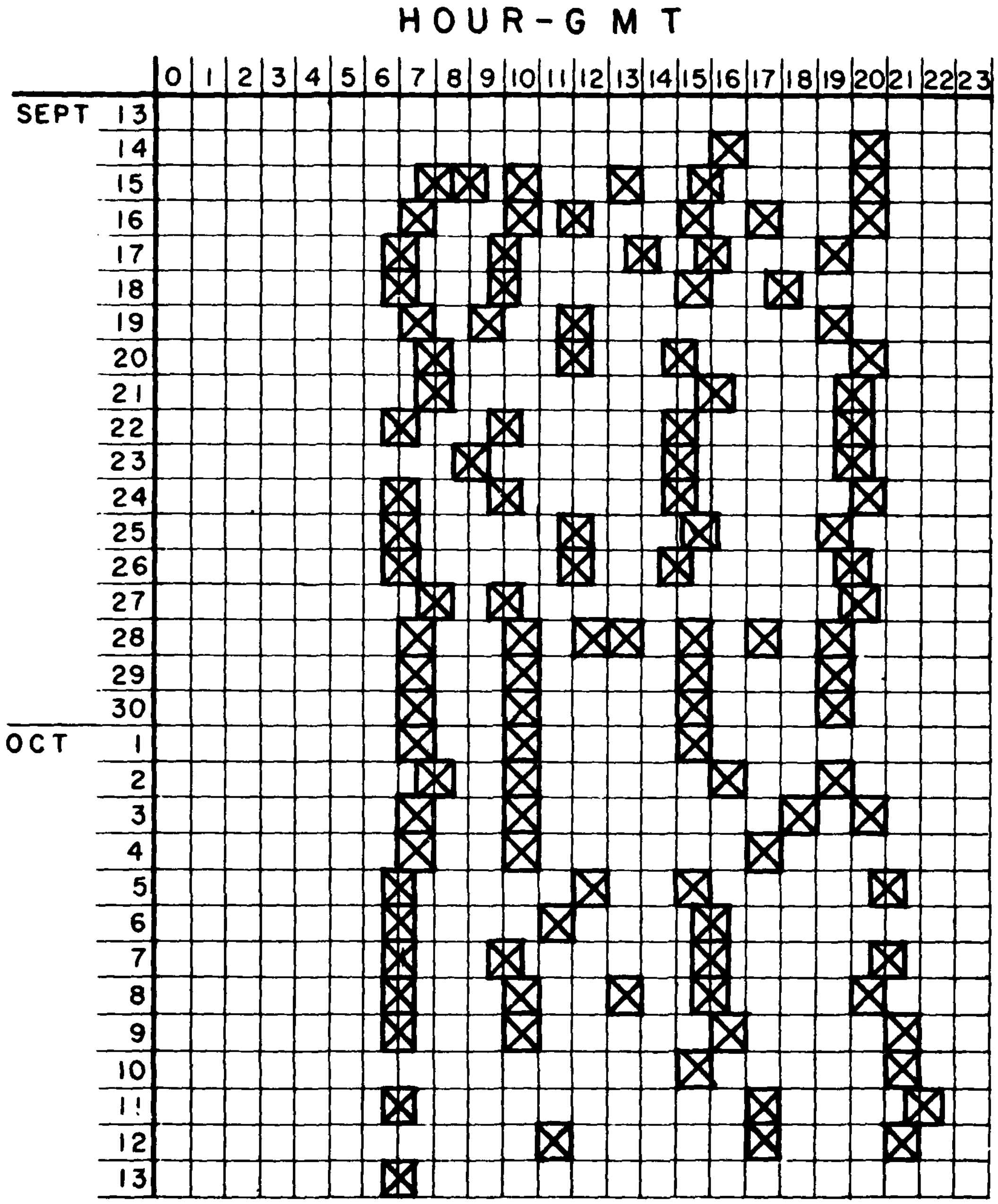

Fig. 7 — Radiometer — time of high speed data recording

4.5 meters and 19 meters, relative humidity, visibility, cloud cover and tidal measurements. From time to time when weather conditions permitted, the total aerosol loading of the atmosphere was obtained using a Voltz sun photometer. Data not reported here is available from the authors.

5. METEOROLOGICAL CONDITIONS

The meteorological data obtained on the platform have been digitized along with the aerosol data and put into a computerized archiving system reported by Gathman and Julian (1979). The products of this system are used to describe the meteorological conditions prevailing at the platform throughout the period of interest and hourly values are listed in appendix I.

The purpose of this experiment was to obtain data on the white cap coverage and aerosol loading at various sea states and therefore as functions of the wind speed. Because of the physical location of the instrumentation on the tower, we had hoped that there would be a good spread of wind speed data occuring at wind direction angles between 180^{o} and 360^{o}. Figure 8 is a scatter diagram of the wind speed and wind direction measurments made during the operation. It is seen that the data within the permissible limits of directions shows an excellent sampling of the variations in wind speed which are needed.

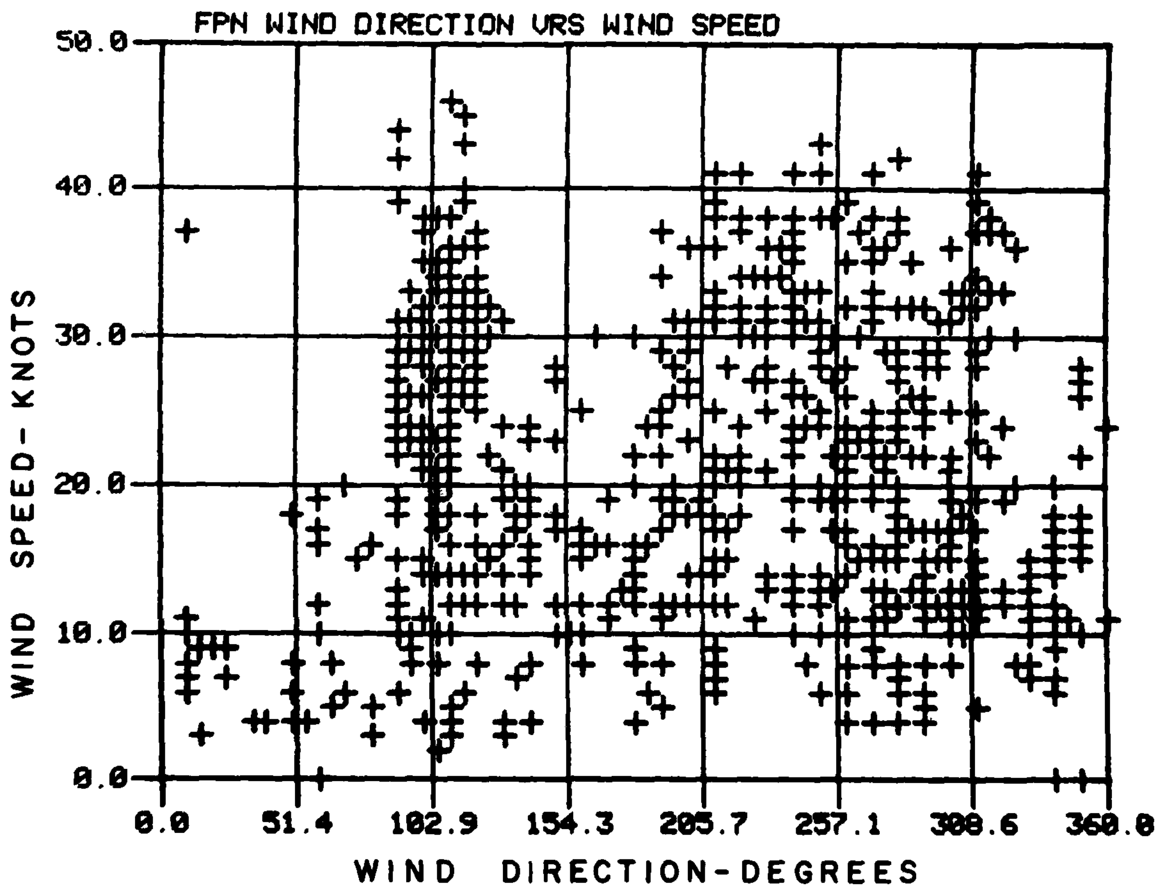

Fig. 8 — Wind direction vs wind speed

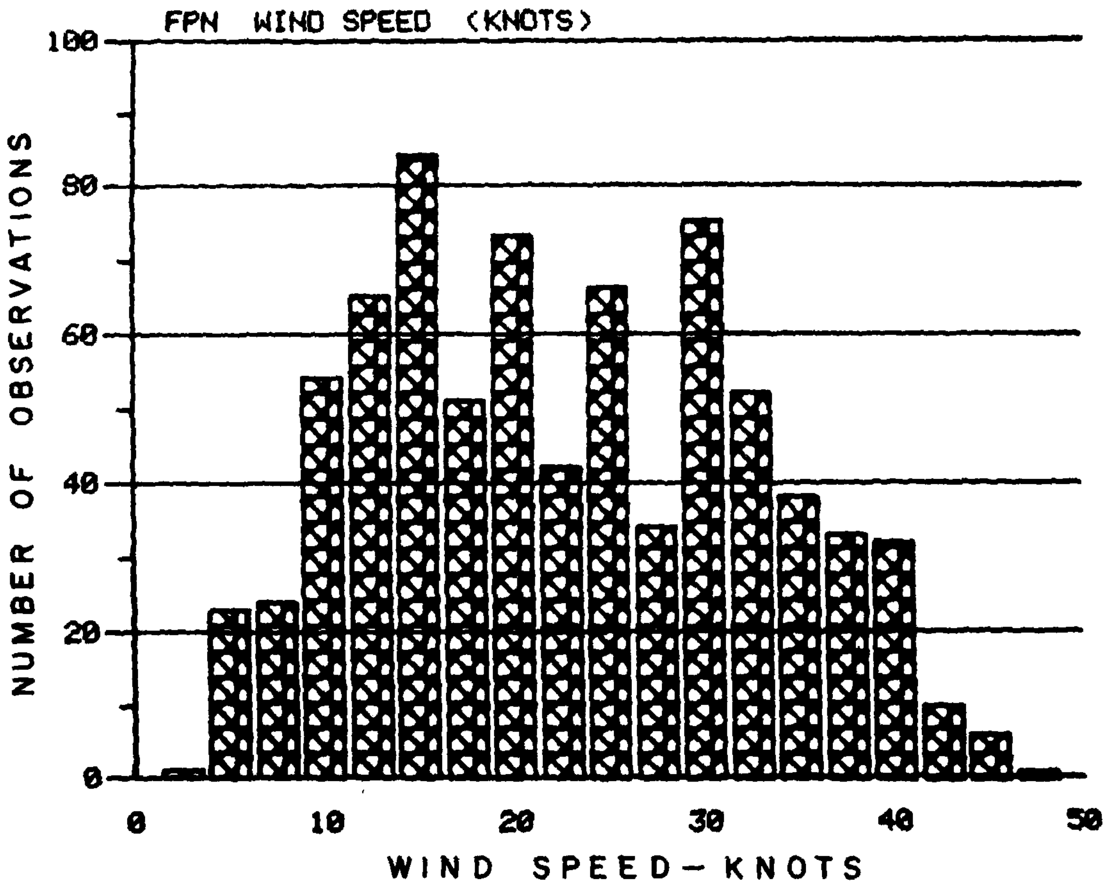

Fig. 9 — Wind speed — frequency of occurrence

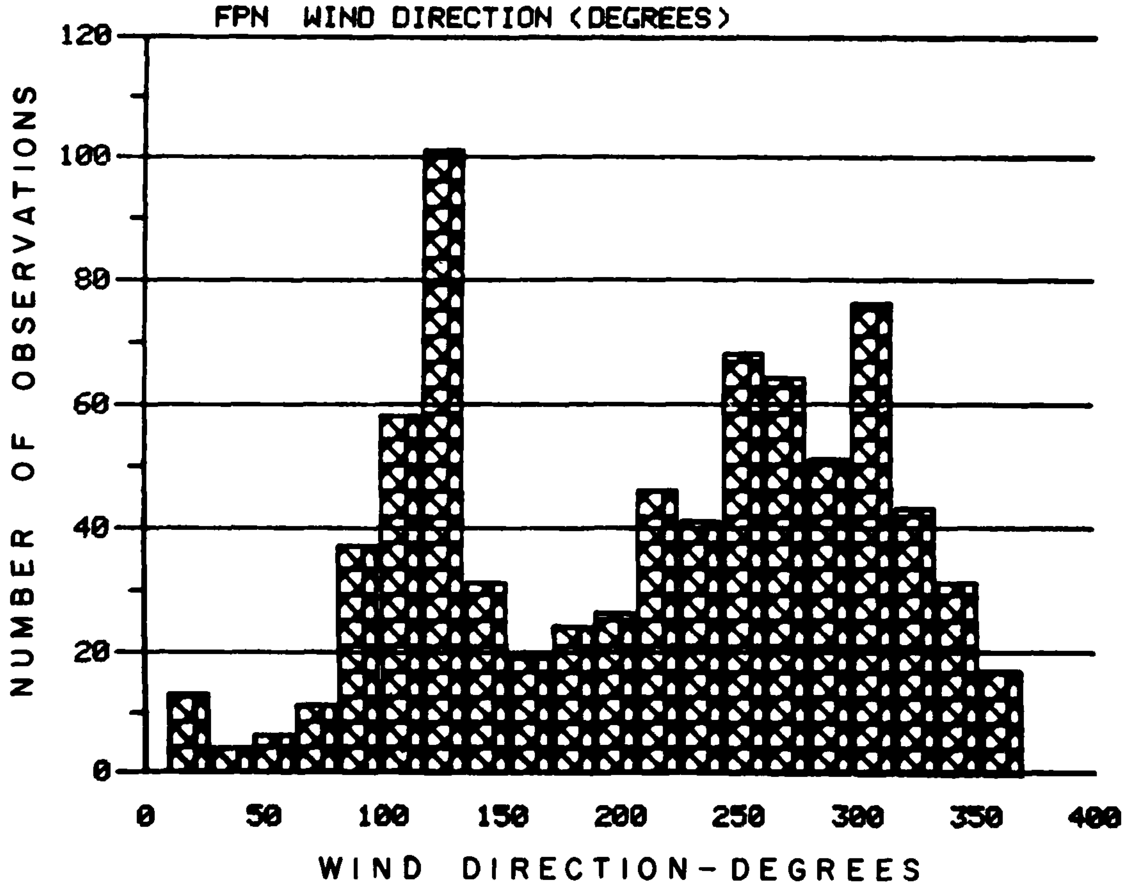

Fig. 10 — Wind direction — frequency of occurrence

In this area of good data we see that we have an almost uniform distribution of points indicating that all cases of interest are included in our data sampling.

Figure 9 is a histogram which shows that the wind speeds distribution encountered during this experiment is indeed broad and averaging about 22 knots but with extremes of 3 and 48 knots.

Figure 10 is a histogram of the measured wind directions showing that there are two preferred directions encountered during the experiment, but with the broadest peak occurring from the direction where the data is most valuable.

Figure 11 shows the frequency distribution of the wave height as measured at the platform with a wave staff. Figure 12 is a scatter plot of the wave heights as a function of the simultaneously measured wind speed. In general this figure shows that wave height does increase with wind speed but the effects of fetch and duration are not included in this figure and therefore the scatter of values is understandable.

Figure 13 shows the distribution of air temperatures at the tower during the experiment. Of more importance is the relative humidity which can cause size changes in the hygroscopic aerosol which occurs over the sea. This is particularly true for the sea salt nuclei which are produced by the white water phenomena. Figure 14 shows the frequency of occurance

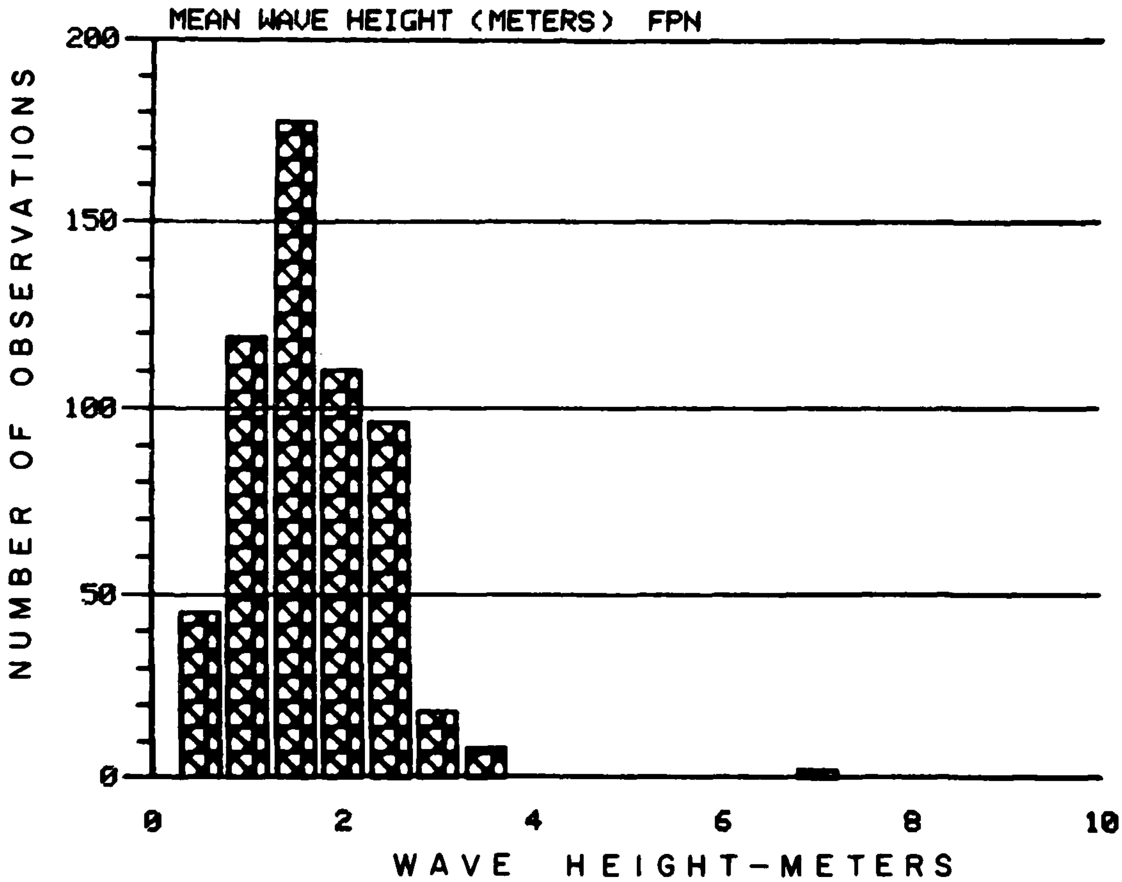

Fig. 11 — Wave height — frequency of occurrence

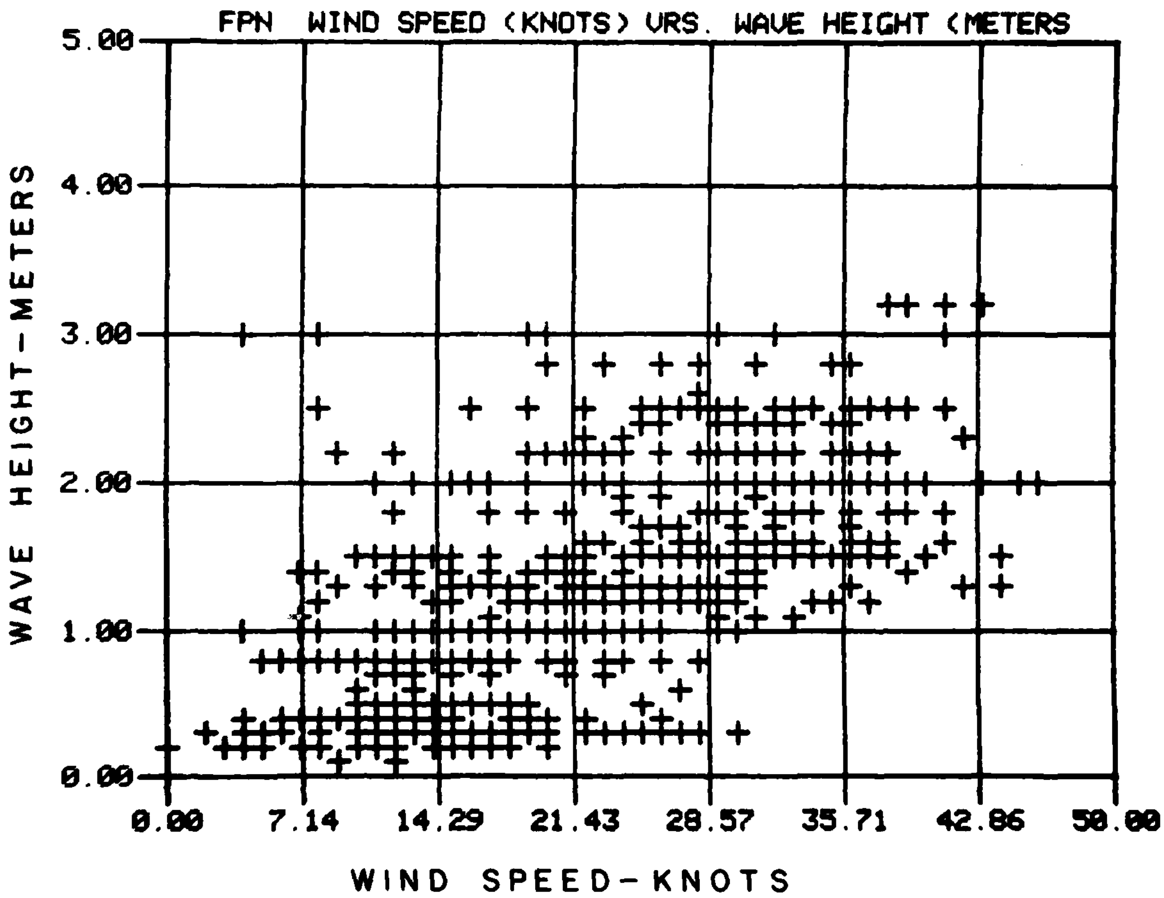

Fig. 12 — Wind speed vs wave height

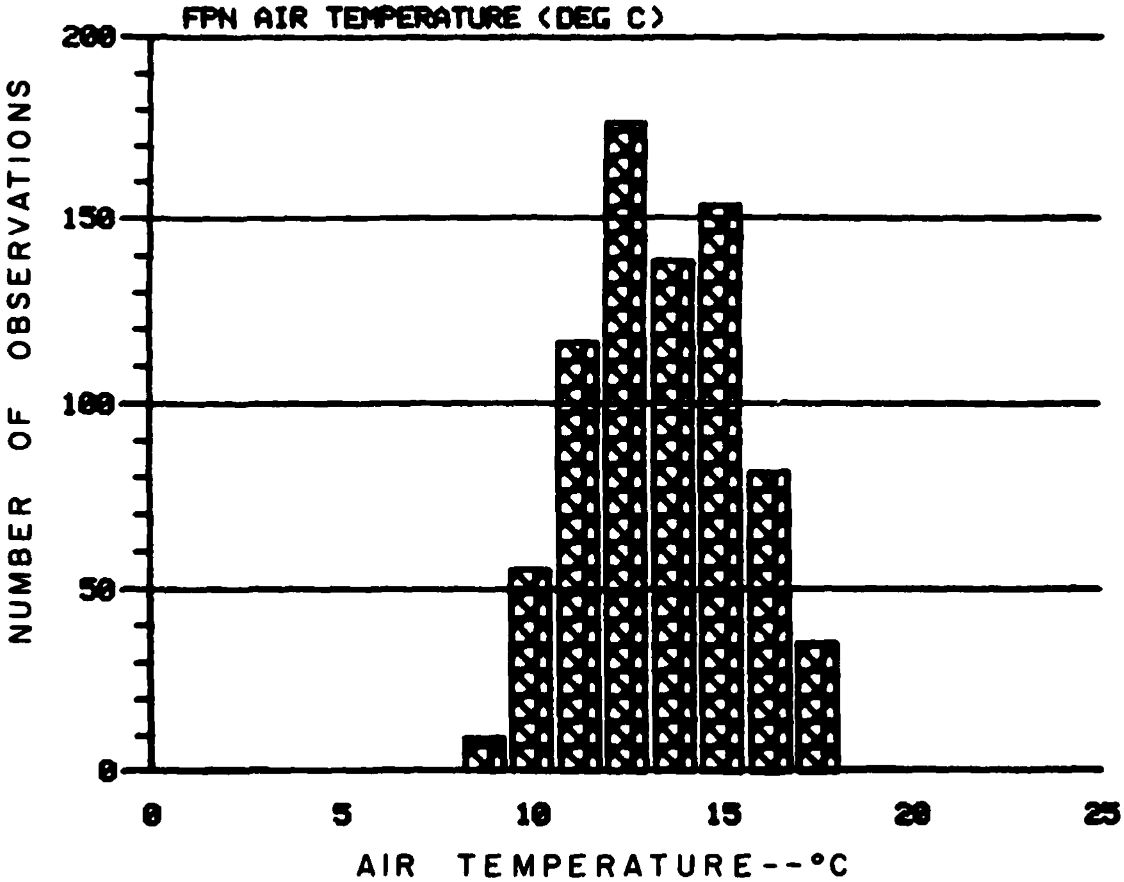

Fig. 13 — Air temperature — frequency of occurrence

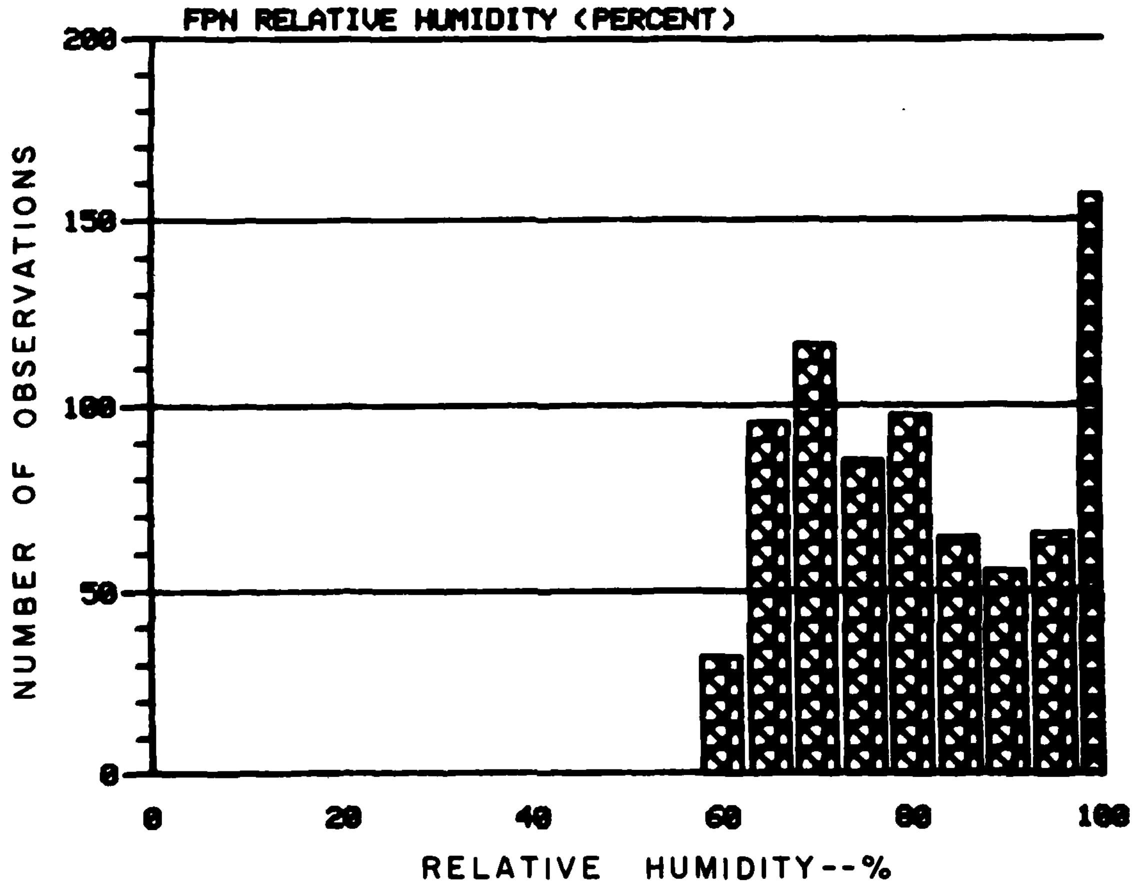

Fig. 14 — Relative humidity — frequency of occurrence

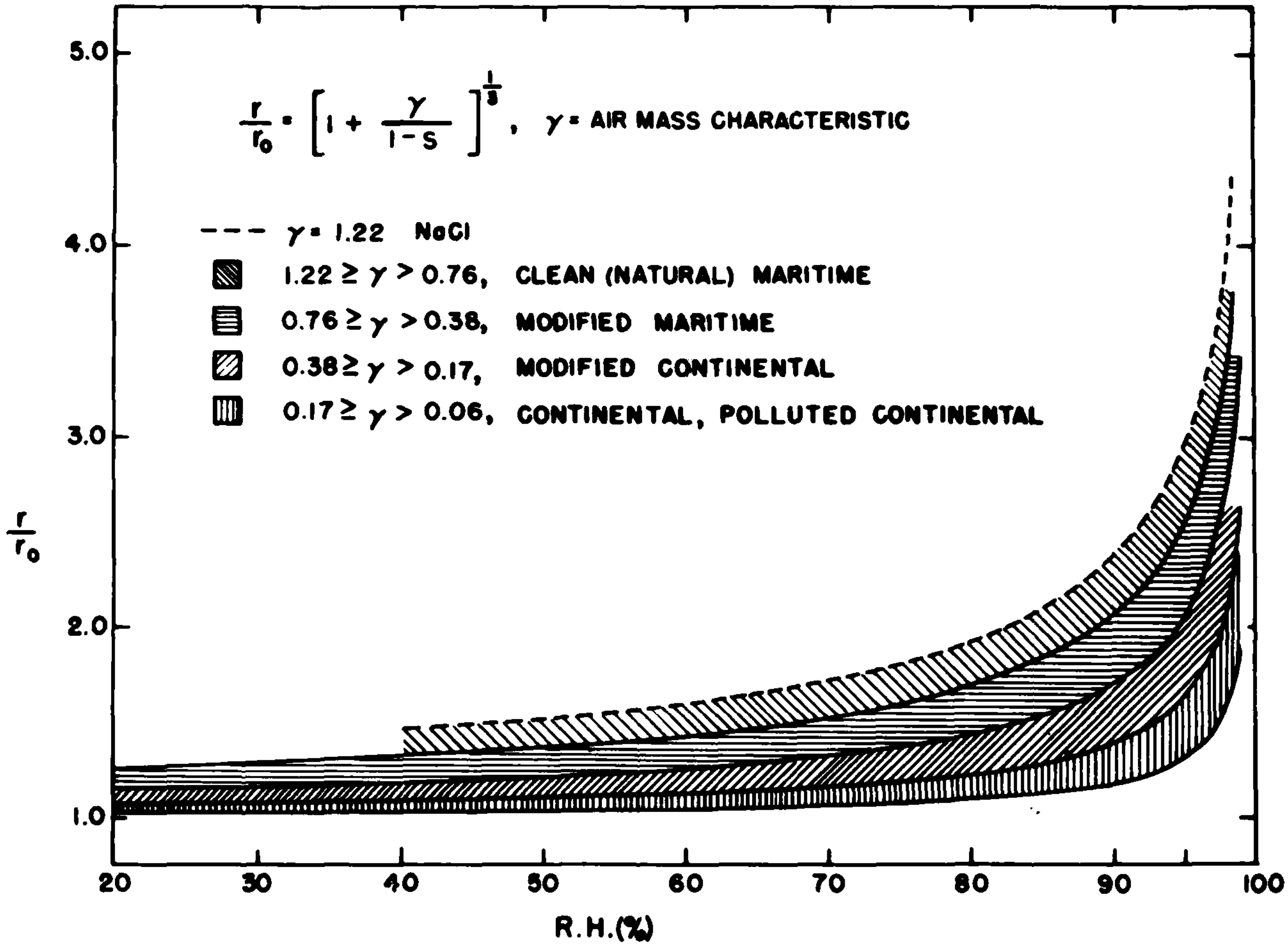

Fig. 15 — Plot of relative radii for different values of representing different aerosol types

distribution of measured relative humidities. This data shows that in 155 hours of the total time, that the air was very close to or actually saturated with water vapor. These very high relative humidities present a potential complication in the interpretations of the data because much of the hygroscopic nuclei will swell at these near saturation relative humidities. According to Fitzgerald (1978) the ratio of the aerosol radius at the ambient relative humidity to its dry size is plotted as a function of relative humidity in figure 15 for different air mass types represented by the parameter γ. (In the equations the saturation ratio, S is equal to the relative humidity in percent divided by 100.)

The accompaning visibility histogram for the experiment is shown in figure 16. This data shows that indeed most of the visibilities measured at the platform showed hazy conditions or worse - with the major part of the values being less than 12 km. Part of this reduction is no doubt due to the swelling of the aerosol as can be seen in figure 17 - where the measured mean relationship between visibility and relative humidity for the period of observation on the tower exhibit a form which is a direct consequence of the swelling of the aerosol with relative humidities above 70% which is characteristic of maritime or modified maritime air as shown in figure 15. There is a fair amount of variations about these average points however, indicating that

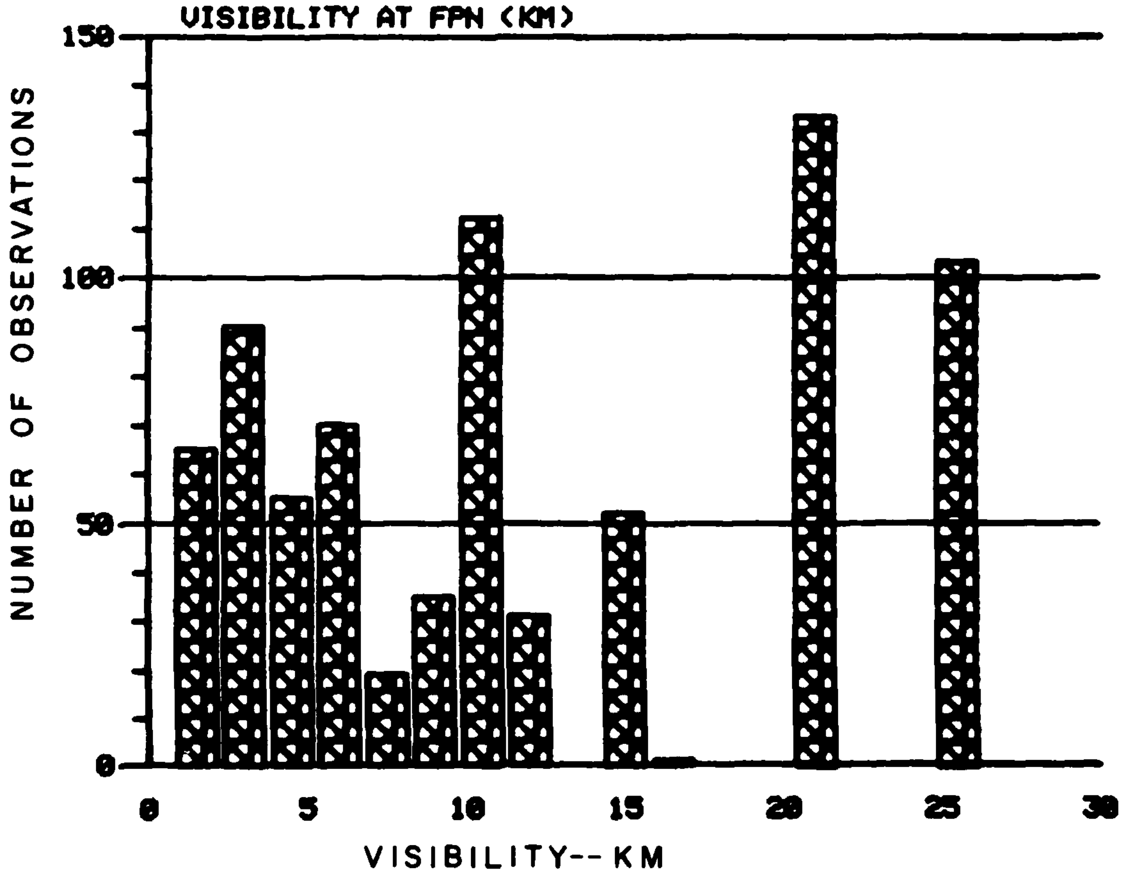

Fig. 16 — Visibility — frequency of occurrence

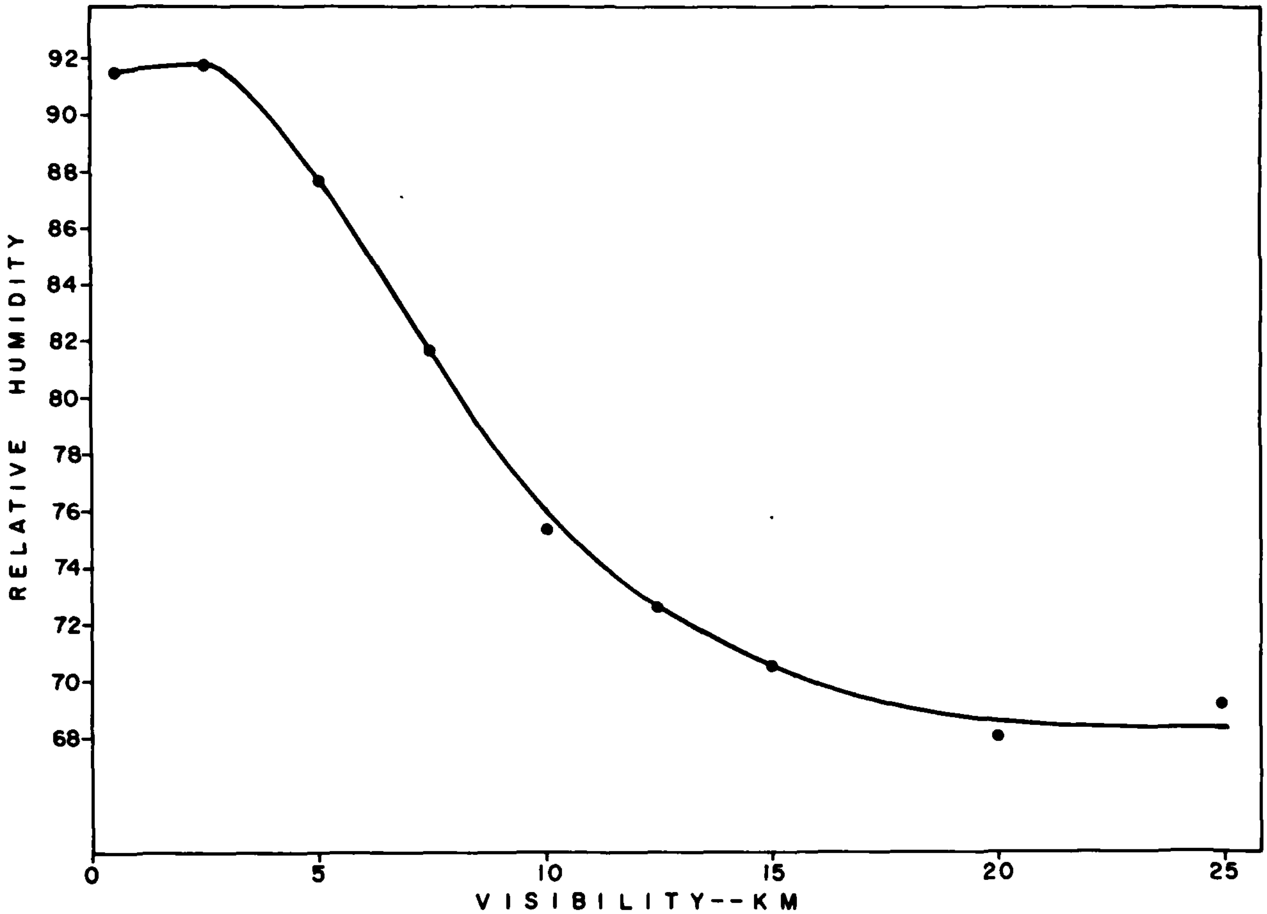

Fig. 17 — Visibility vs relative humidity

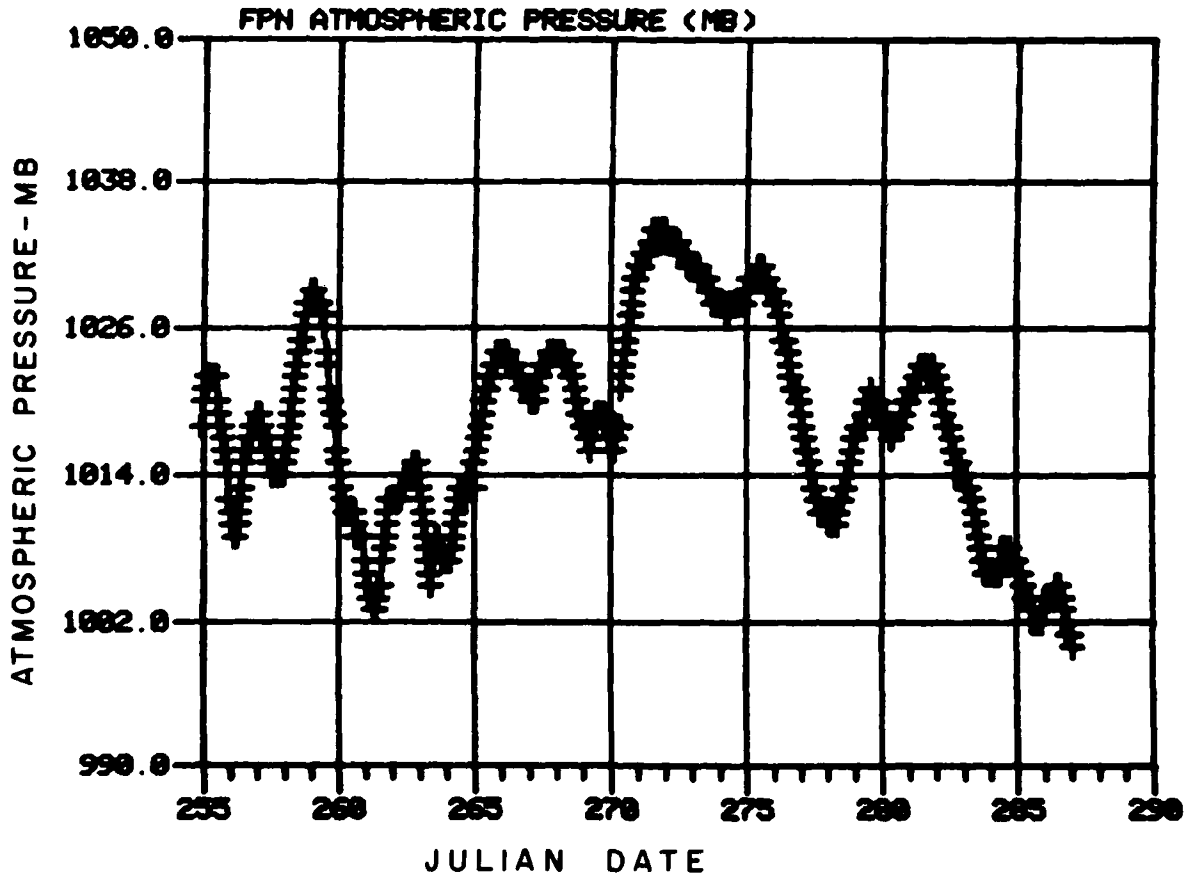

Fig. 18 — Atmospheric pressure

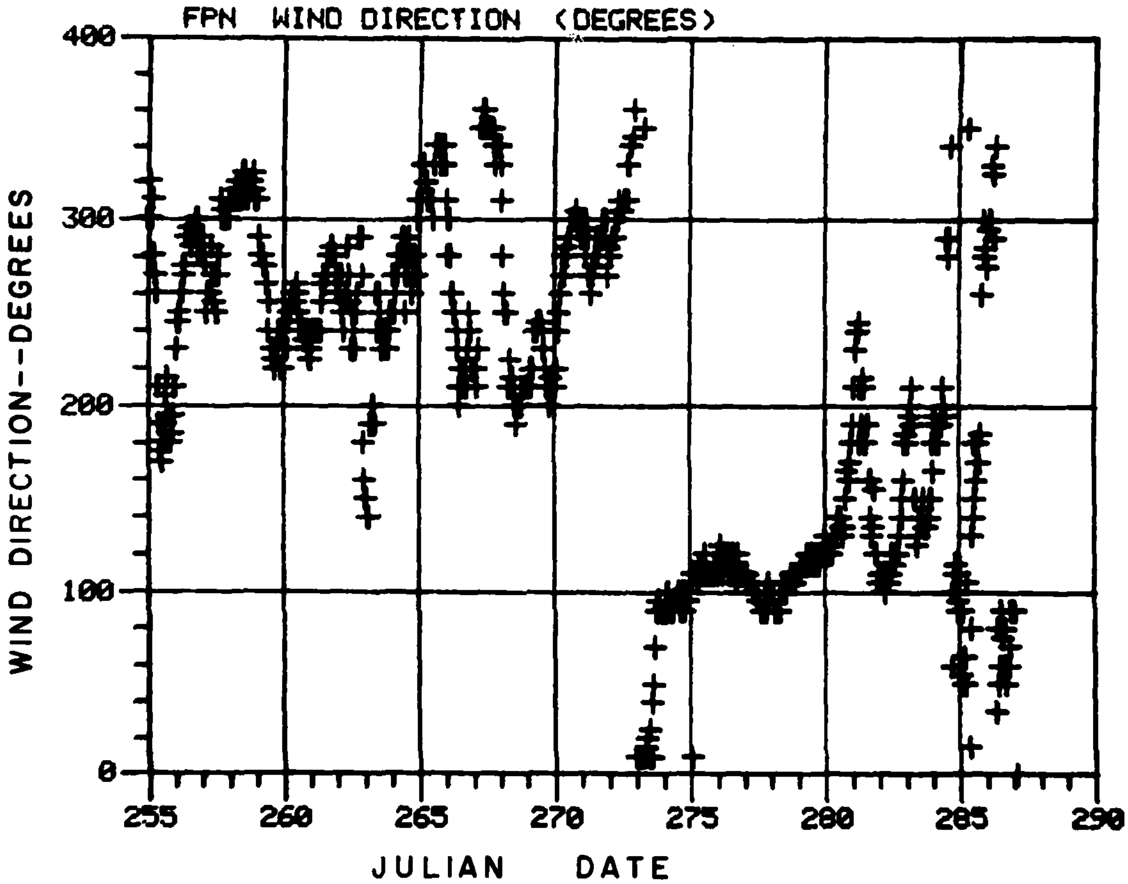

Fig. 19 — Wind direction

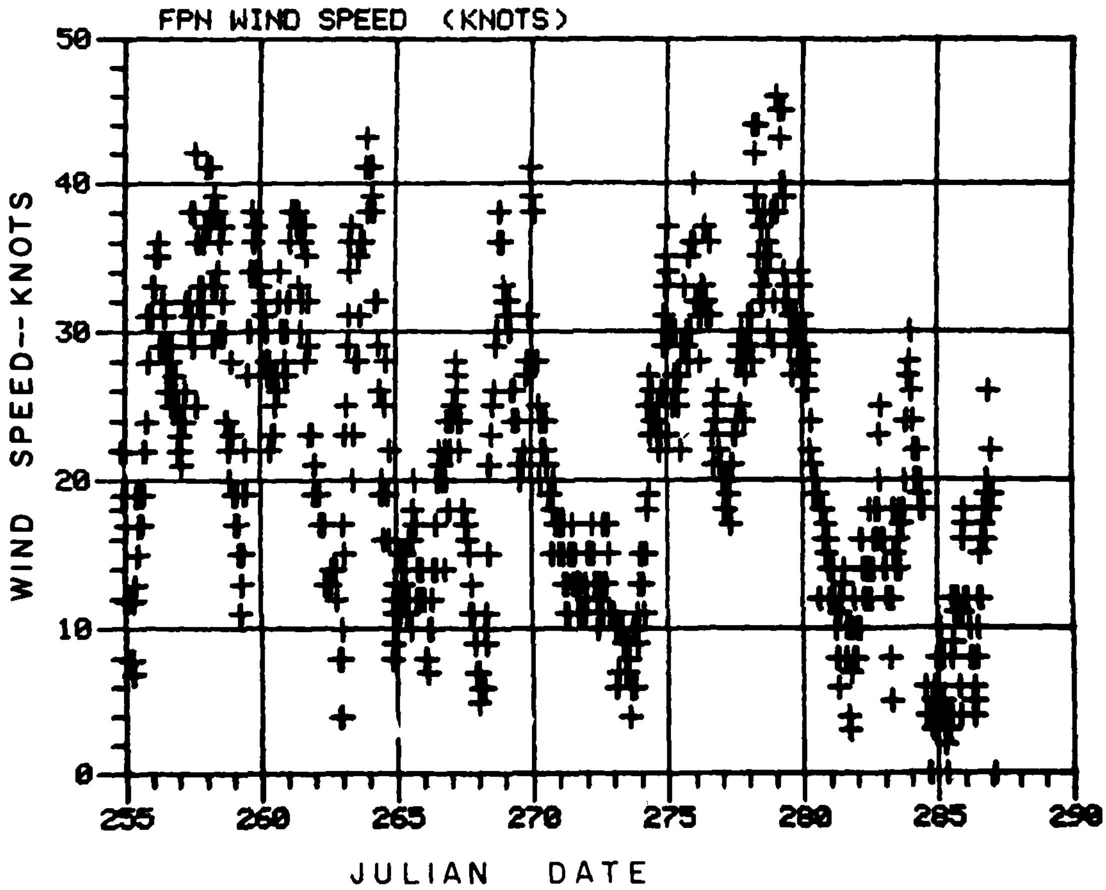

Fig. 20 — Wind speed

at any one point in time, visibility can not be estimated very accurately if all we know at that time is the relative humidity.

Figures 18 through 23 show the time variation of the various meteorological parameters for the period of observation at the tower.

Figure 18 is the variations of sea level pressure as a function of Julian Date. Figures 19 and 20 show the values of the wind direction and speed respectively plotted as functions of the Julian Date. These plots show that most of the southeasterly winds occur in a period of from day 274 thru day 281. That is from 1 October 1979 through 8 October the winds are continually contrary but in the period of time for the remainder of the experiment wind direction changed rapidly with time. The relative humidity, air temperature and visibility plotted with respect to the Julian Date are shown in figures 21 through 23 respectively.

6. DISCUSSION

Hourly values of the number concentration of aerosols within the size boundaries of the Royco instrument are found printed in appendix II of this report. This data shows wide variations in time with a highly significant skewness toward larger concentration values for all size classes. As discussed before these larger concentrations can be explained by two

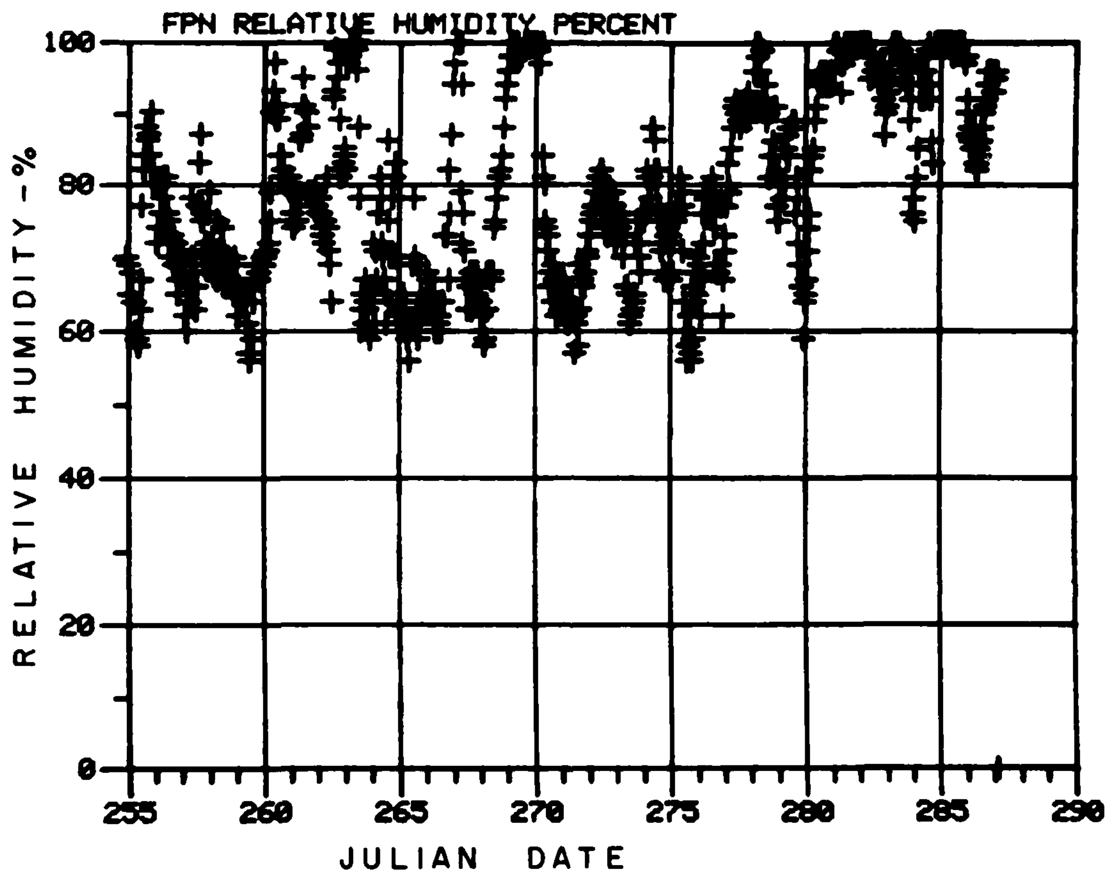

Fig. 21 — Relative humidity

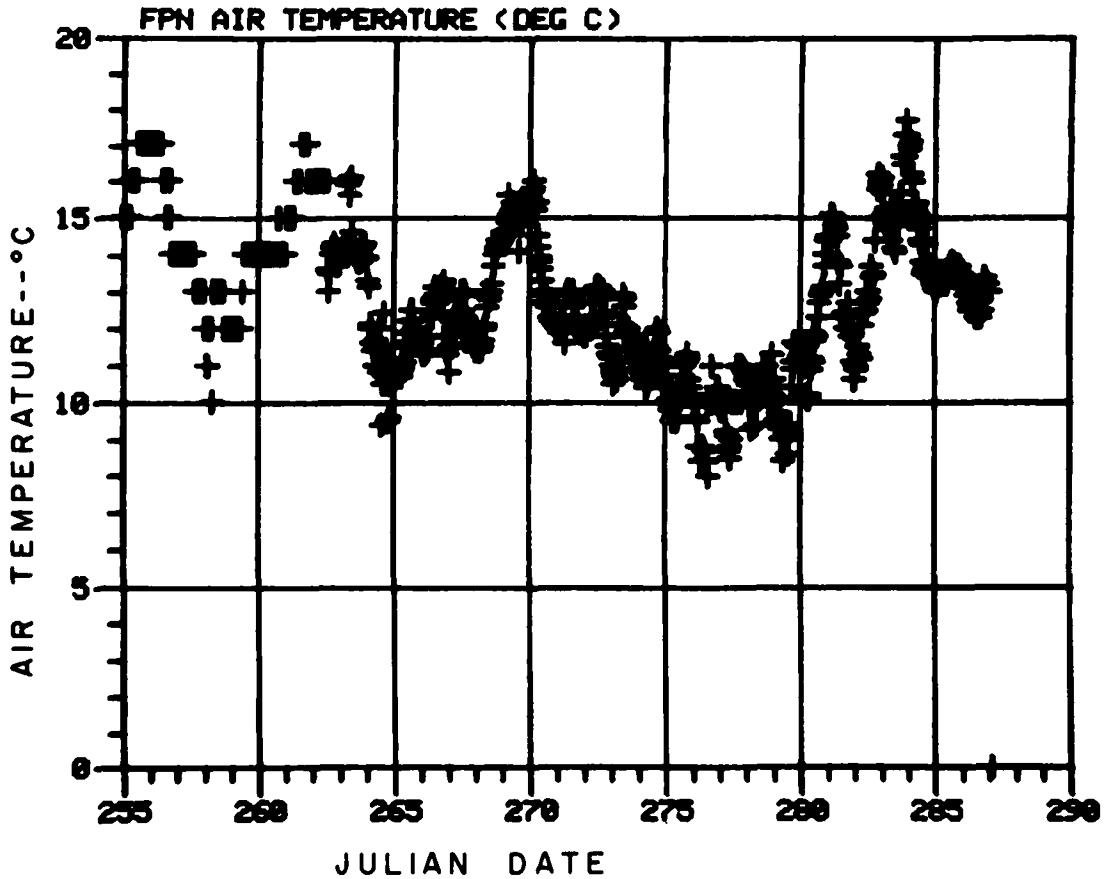

Fig. 22 — Air temperature

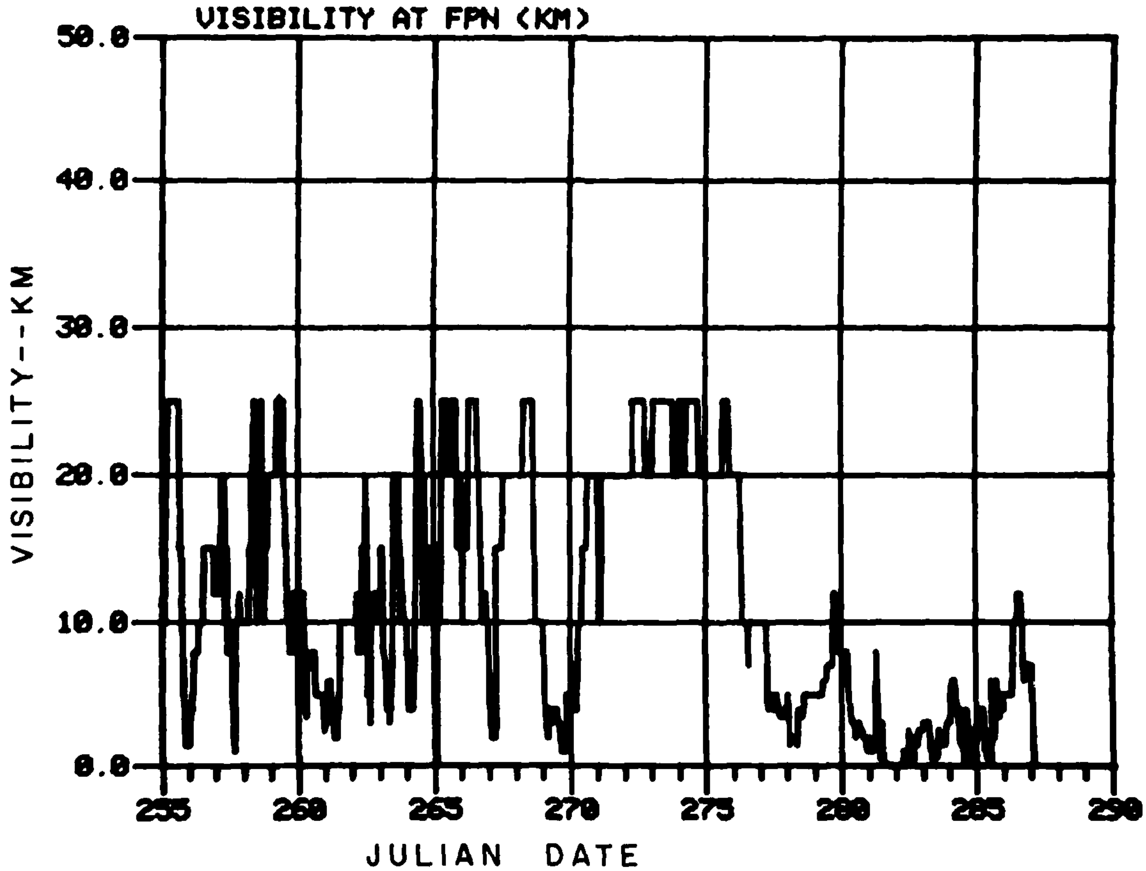

Fig. 23 — Visibility

mechanisms. The growth at high relative humidities of all elements in the size spectra causing the higher concentrations of the former smaller particles growing to larger sizes so as to now be counted by the instrument as larger particles is one mechanism which occurs at relative humidities above 95%. The production at the sea surface of particles in the white water phenomenon should be observable at high wind speeds or high wave heights or high occurance of white caps and constitutes the second mechanism responsible for the aerosol loading in the size classes of interest to us here.

These mechanisms can be recognized by utilizing the other information we have available. For instance if we wish to isolate out the effect of particle growth from high relative humidity effects we may plot out the aerosol concentration data as a function of relative humidity for all cases with wind speeds less than 10 knots and coming from the proper direction so as not to contain tower contamination effects. For the situation at FPN this means we can accept wind as long as it is coming from an angle greater than 180 degrees. The plot shown in figure 24 was obtained from the aerosol data base, printed in the appendix which has been sorted by the criterion mentioned above. Then for each 5 percentage point incremental step of relative humidity, the average of all of the measured concentration values for each size class was obtained. These are plotted in the figure in a relative way so as to determine what kind of

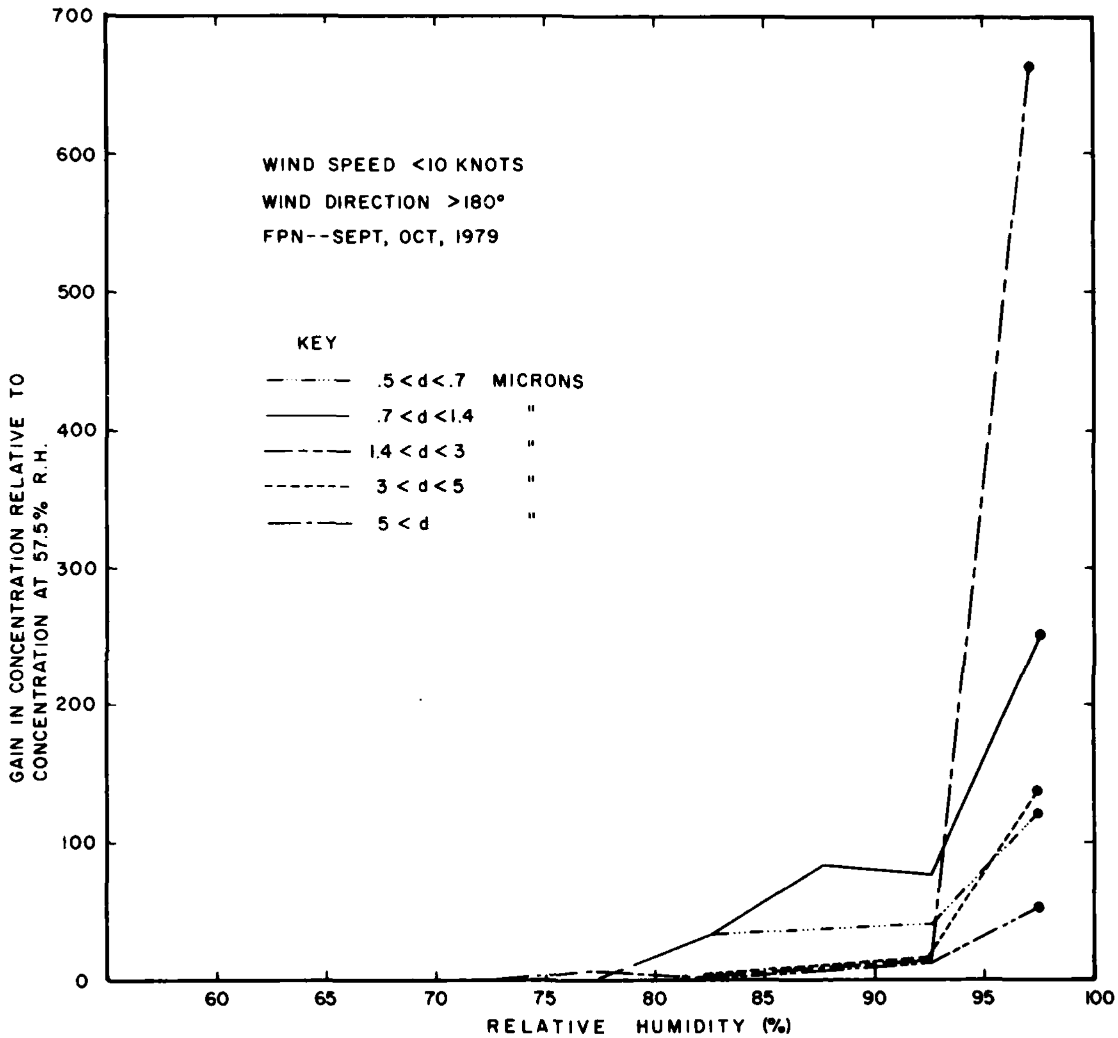

Fig. 24 — Aerosol concentration as a function of relative humidity

gain in concentration was experienced in each of the five size classes as a function of relative humidity. For instance if the relative humidity was in the increment of 70 to 75 percent, then the average concentration of each size class which were measured with relative humidities in this range is divided by the average concentration of the same size class which was measured in the relative humidity interval between 50 and 60 percent.

The data shown in the figure demonstrates that the really dramatic increases occur for all size classes when the relative humidities are between 95 and 100 percent. Relative humidities below this value produce very little gain in concentration for the largest three size classes. The two smallest size classes however show a plateau region of moderate gains in concentration at relative humidities greater than 80 percent but less than 95 percent.

The conclusion of this analysis is that if we are interested in the effects of the aerosol concentrations caused by the flux of aerosol from the sea surface from white water phenomena, then we had better isolate these cases in which the relative humidity is above 95 percent so as to not confuse the mechanical production process with the growth of aerosols phenomenon.

The passive microwave measurements of the sea surface has been studied for a number of years. Williams (1969) suggested that the very high microwave brightness temperature of sea foam compared to the average sea surface was the reason for the measured correlation of microwave brightness temperature with wind speed. Hollinger (1971) made a series of passive microwave measurements at Argus Island tower and showed definite frequency dependent correlation between the microwave brightness temperature and wind speed. He reports that the relatively high microwave brightness temperature of sea foam compared to the general surface made it easy to recognize the signal produced by a white cap or foam patch and he excluded these effects of the antenna temperature averages. One of the purposes of this experiment was to determine if these spurious effects of white caps and foam can indeed be detected remotely and utilized in the remote sensing of aerosol production. These effects are definitely not excluded in the antenna temperatures reported here for either the horizontal or the vertical polarization information and listed in the appendix. These temperatures are the temperatures seen at the antenna inlet and are corrected only for the effects of spurious radiation entering the side and back lobes of the antenna but they are not corrected for the sky radiation reflected from the sea. They are expressed in degrees Kelvin for a series of nadir angles expressed in degrees.

Figure 25 shows a plot of all of the 19.3 Ghz radiometer measurements made at FPN during MARSEN I. The upper branch of data points are those measured from the vertical polarization

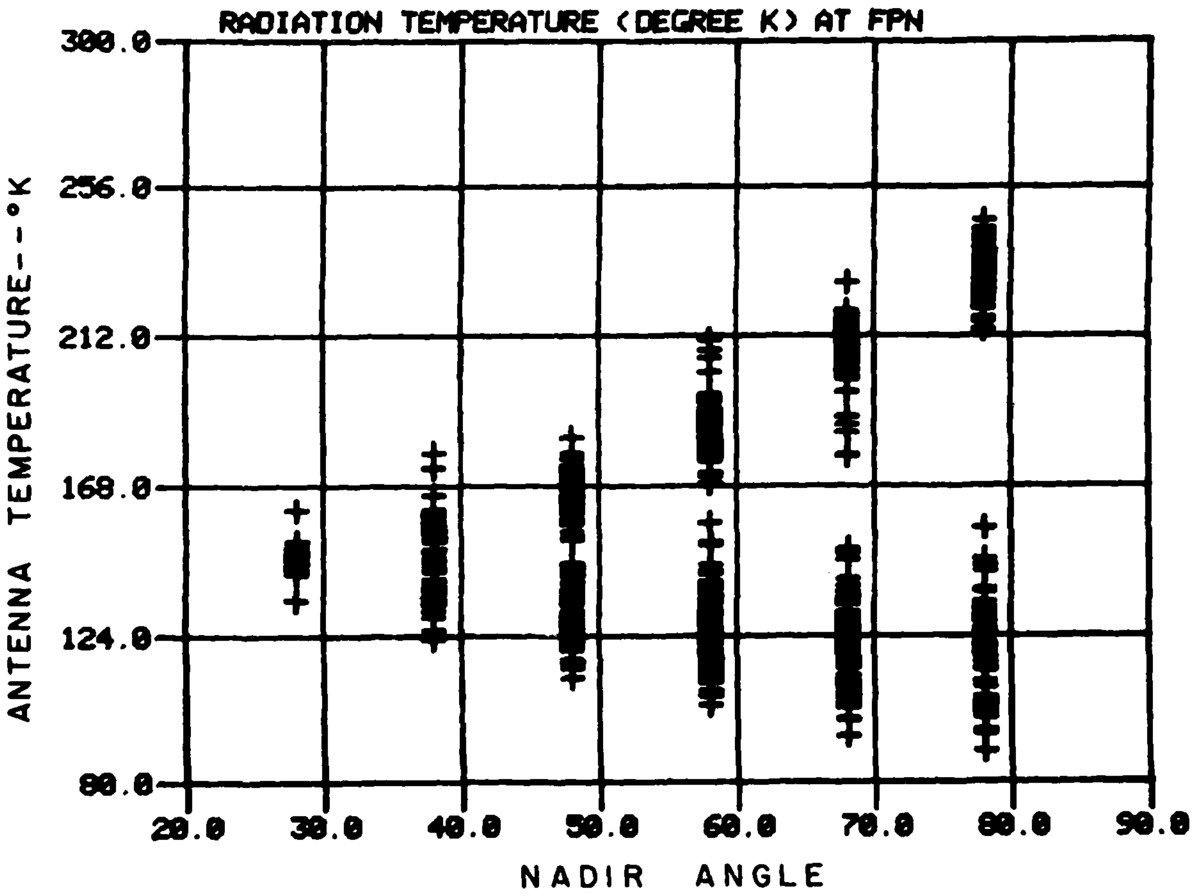

Fig. 25 — Passive radiometer measurements — FPN

channel of the instrument while the lower group of points come from the horizontal channel. The antenna temperatures of both channels merge as they approach 30 degrees from nadir.

Stogryn (1967) has theoretically found significant temperature changes which occur with increasing wind speed (neglecting the effects of white water and foam) for the horizontally polarized radiation. On the other hand his calculations show an invariance to sea state of the vertically polarized radiation at an angle near 50 degrees. This finding may prove very important in separating the effects of the increased microwave emissivity of sea foam and that of the geometry of an aroused sea state. The general characteristics of Stogryn's model are borne out by these measurements and in particular the larger spread of data exhibited by the horizontally polarized radiation as compared with the vertically polarized radiation.

As a preliminary study of the interactions of the standard meteorological parameters, the atmospheric aerosol and microwave temperatures contained in this report, a correlation matrix of key parameters is shown in figure 26. Here an H is shown in the appropriate box for a highly significant correlation between two parameters, a C for signs of a correlation and is left blank if the data shows no sign of a correlation.

In order to isolate the effects of tower contamination of

	1	2	3*	4*	5*	6*	7*	8	9	10
1. VERT. RAD. TEMP. @ 48°	1	H	-	-	-	C	C	C	C	-
2. HOR. RAD. TEMP @ 58°	H	1	-	-	-	C	C	C	C	C
3. AEROSOL* .5 < d < .7 μ	-	-	1	H	H	-	-	C	-	-
4. AEROSOL* .7 < d < 1.4 μ	-	-	H	1	H	-	-	-	-	-
5. AEROSOL* 1.4 < d < 3. μ	-	-	H	H	1	C	C	-	-	-
6. AEROSOL* 3. < d < 5. μ	C	C	-	-	C	1	H	-	-	-
7. AEROSOL* 5. < d μ	C	C	-	-	C	H	1	-	C	-
8. CLOUD COVER	C	C	C	-	-	-	-	1	-	-
9. WIND SPEED	C	C	-	-	-	-	C	-	1	C
10. WAVE HEIGHT	-	C	-	-	-	-	-	-	C	1

* FOR WIND DIRECTION > 180° AND RELATIVE HUMIDITY < 95%

KEY: H: CORR. COEFF. > 0.7

C: CORR. COEFF. > 0.35

Fig. 26 — Correlation matrix of aerosol parameters

the samples and high relative humidity on the correlation analysis with the aerosol data, only those data which were taken when the wind direction was from an angle of greater than 180 degrees and in which the relative humidity was less than 95% were used. This should eliminate contamination of the experiment by tower emissions and it should also avoid the change in concentrations in the standard size ranges which are caused by the growth of the droplets in a high relative humidity environment.

Parameters 1 and 2 are the two radiometer channels which should be of most interest in observing the effects of aerosol production at the sea surface. The vertical polarization at 48° is supposed to be independent of sea state while the horizontal polarization at 58° should show a maximum in variation with sea state. This theoretical result is borne out in the correlation matrix where only the horizontal channel exhibits a correlation with wave height. Both channels show a correlation with cloud cover showing that this known cause of signal variation has not been removed from the data. Finally a correlation is seen between both channels and the two largest size classes of aerosols but not the three smallest sizes. This indicates that the concentrations of aerosols in the sizes of d>3.0 during periods of relative humidity being less than 95%, is indeed dependent on the existance of sources of these particulates on the sea surface.

The aerosol concentrations in the three smallest size classifications correlate very well with each other but not well with most of the other parameters.

In conclusion, the data gathered at FPN during MARSEN I experiment appears to obey the general rules of atmospheric physics and should provide an useful data base with which to test hypothetical relationships between marine atmospheric aerosol, its sources and its predictions.

7. ACKNOWLEDGEMENTS

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8. REFERENCES

(1) Blanchard, D.C., 1963: The Electrification of the Atmosphere by Particles From Bubbles in the Sea, Progress in Oceanography, 1, pp 71-202. Pergamon Press, New York.

(2) Blanchard, D.C., 1974: International Symposium on the Chemistry of Sea/Air Particulate Exchange Processes; Summary and Recommendations, Journal de Recherches Atmospheriques, 8, pp 509-513.

(3) Blanchard, D.C., and Woodcock, A.H., 1957: Bubble Formation and Modification in the Sea and its Meteorological Significance, Tellus 9, pp 145-158.

(4) Droppleman, J.D., 1970: Apparent Microwave Emissivity of Sea Foam, J. G. R. 75, pp 696-698.

(5) Fitzgerald, J.W., 1978: On the Growth of Aerosol Particles With Relative Humidity, NRL Memorandum Report 3947.

(6) Gathman, S.G. and Julian, B.G., 1979: The EOMET Cruise of the USNS HAYES: May-June 1977, NRL Memorandum Report 3924.

(7) Harlow, F.H. and Shannon, J.P., 1967: Distortion of a Splashing Liquid Drop, Science, 157, pp 547-550.

(8) Hollinger, J.P., 1971: Microwave Measurements of Sea Surface Roughness, IEEE Transactions on Geoscience Electronics GE-9, pp 165-169.

(9) Monahan, E.C. and Zietlow, C.R., 1969: Laboratory Comparisons of Fresh-Water and Salt-Water Whitecaps, J. G. R. 74, pp 6961-6966.

(10) Stogryn, A., 1967: The Apparent Temperature of the Sea at Microwave Frequencies, IEEE Transactions on Antennas and Propagation, AP-15, pp 278-286.

(11) Williams, G.F.,Jr., 1969: Microwave Radiometry of the Ocean and the Possibility of Marine Wind Velocity Determination From Satellite Observations. J. G. R. 74, pp 4591-4594.

9. APPENDIX I — METEOROLOGICAL DATA

ATMOSPHERIC PRESSURE (MB) AT FPN

HOUR	9/12/79	9/13/79	9/14/79	9/15/79	9/16/79	9/17/79	9/18/79	9/19/79
0		1012	1093	1014	1029	1015	1006	1012
1	1018	1012	1019	1015	1028	1015	1006	1012
2	1020	1011	1019	1016	1029	1014	1005	1012
3	1021	1010	1019	1016	1029	1013	1005	1012
4	1021	1010	1018	1017	1028	1012	1004	1012
5	1021	1009	1018	1018	1028	1012	1004	1012
6	1022	1009	1017	1019	1028	1011	1004	1012
7	1022	1010	1017	1019	1028	1011	1004	1012
8	1022	1010	1017	1020	1028	1011	1003	1013
9	1022	1011	1017	1021	1027	1011	1003	1013
10	1022	1012	1016	1022	1027	1011	1004	1013
11	1022	1013	1016	1023	1027	1011	1004	1014
12	1022	1013	1015	1023	1026	1011	1005	1014
13	1022	1015	1015	1024	1025	1011	1005	1014
14	1022	1016	1015	1025	1024	1011	1005	1014
15	1020	1016	1014	1025	1023	1010	1007	1014
16	1019	1016	1014	1025	1021	1009	1008	1014
17	1018	1016	1014	1026	1020	1009	1009	1014
18	1018	1017	1014	1026	1020	1009	1009	1014
19	1017	1017	1014	1027	1019	1009	1010	1015
20	1016	1018	1014	1028	1019	1009	1011	1015
21	1016	1018	1014	1028	1019	1009	1012	1015
22	1015	1018	1014	1028	1018	1009	1012	1015
23	1014	1018	1014	1028	1016	1007	1012	1014

ATMOSPHERIC PRESSURE (MB) AT FPN

HOUR	9/20/79	9/21/79	9/22/79	9/23/79	9/24/79	9/25/79	9/26/79	9/27/79
0		1007	1015	1024	1021	1024	1018	1017
1	1013	1007	1013	1024	1021	1024	1018	1016
2	1012	1007	1016	1024	1020	1024	1018	1016
3	1011	1008	1017	1024	1020	1024	1017	1016
4	1010	1008	1017	1024	1020	1024	1017	1017
5	1009	1008	1018	1024	1020	1024	1017	1018
6	1008	1009	1018	1023	1020	1024	1016	1018
7	1007	1010	1019	1023	1021	1023	1017	1018
8	1007	1011	1020	1023	1022	1023	1017	1018
9	1006	1012	1020	1023	1022	1023	1018	1021
10	1005	1012	1021	1023	1022	1023	1018	1022
11	1007	1013	1021	1023	1023	1023	1019	1023
12	1007	1013	1021	1023	1023	1023	1019	1024
13	1008	1013	1022	1023	1023	1022	1019	1025
14	1008	1013	1022	1022	1023	1022	1019	1025
15	1009	1013	1022	1022	1023	1022	1019	1026
16	1009	1012	1023	1022	1023	1021	1019	1027
17	1008	1013	1023	1022	1023	1020	1019	1027
18	1008	1013	1023	1021	1024	1020	1019	1028
19	1008	1014	1023	1021	1024	1019	1018	1029
20	1008	1014	1024	1021	1024	1019	1018	1030
21	1007	1014	1024	1021	1024	1019	1018	1030
22	1007	1015	1024	1021	1024	1019	1017	1030
23	1007	1015	1024	1021	1024	1018	1017	1031

ATMOSPHERIC PRESSURE (MB) AT FPN

HOUR	9/28/79	9/29/79	9/30/79	10/1/79	10/2/79	10/3/79	10/4/79	10/5/79
0		1034	1031	1028	1029	1028	1018	1010
1	1031	1033	1031	1028	1030	1028	1018	1010
2	1031	1033	1031	1028	1030	1028	1017	1010
3	1032	1033	1031	1028	1030	1028	1017	1011
4	1032	1033	1031	1028	1030	1027	1016	1011
5	1032	1033	1031	1027	1030	1027	1016	1010
6	1032	1033	1030	1027	1030	1026	1015	1011
7	1032	1033	1030	1027	1030	1025	1015	1010
8	1032	1033	1030	1028	1030	1025	1014	1011
9	1033	1033	1030	1028	1031	1025	1014	1012
10	1033	1033	1030	1028	1031	1025	1014	1012
11	1033	1033	1030	1028	1031	1024	1013	1012
12	1033	1032	1030	1028	1031	1024	1013	1013
13	1034	1032	1030	1028	1031	1023	1012	1013
14	1034	1032	1029	1028	1030	1022	1012	1013
15	1034	1032	1029	1028	1030	1022	1012	1013
16	1034	1032	1029	1028	1030	1021	1011	1014
17	1033	1032	1028	1028	1030	1021	1011	1014
18	1033	1032	1028	1028	1029	1021	1011	1015
19	1033	1031	1028	1028	1029	1021	1011	1015
20	1034	1031	1028	1028	1029	1021	1011	1016
21	1034	1031	1028	1028	1029	1020	1011	1017
22	1034	1031	1028	1029	1029	1020	1011	1017
23	1034	1031	1028	1029	1029	1019	1011	1017

ATMOSPHERIC PRESSURE (MB) AT FPN

HOUR	10/6/79	10/7/79	10/8/79	10/9/79	10/10/9	10/11/9	10/12/9	10/13/9
0		1019	1021	1022	1014	1006	1006	1004
1	1018	1019	1021	1022	1014	1006	1006	1004
2	1018	1019	1021	1021	1013	1006	1006	1004
3	1018	1018	1021	1021	1013	1006	1005	1004
4	1018	1018	1021	1020	1013	1006	1005	1004
5	1018	1018	1022	1020	1013	1006	1005	1004
6	1018	1018	1022	1019	1012	1006	1004	1004
7	1019	1017	1022	1018	1012	1006	1004	1004
8	1019	1017	1022	1018	1012	1007	1004	1004
9	1020	1018	1023	1018	1011	1007	1004	1005
10	1020	1018	1023	1018	1010	1008	1004	1005
11	1020	1018	1023	1018	1010	1008	1003	1005
12	1020	1018	1023	1018	1009	1008	1003	1005
13	1021	1018	1023	1017	1009	1008	1002	1004
14	1020	1018	1023	1016	1008	1007	1002	1004
15	1020	1018	1023	1016	1008	1007	1002	1004
16	1019	1018	1023	1014	1007	1008	1002	1003
17	1019	1019	1022	1015	1007	1007	1002	1002
18	1019	1019	1022	1015	1006	1007	1002	1002
19	1019	1020	1023	1015	1006	1007	1002	1002
20	1020	1020	1023	1014	1006	1007	1002	1001
21	1019	1020	1022	1014	1006	1007	1003	1001
22	1019	1020	1022	1014	1006	1007	1003	1001
23	1019	1020	1022	1014	1006	1006	1003	1001

RELATIVE HUMIDITY (%) AT FPN

HOUR	9/12/79	9/13/79	9/14/79	9/15/79	9/16/79	9/17/79	9/18/79	9/19/79
0		80	71	76	69	70	80	76
1	70	80	69	79	65	69	79	76
2	69	80	68	71	62	70	76	78
3	65	72	62	72	66	71	74	76
4	65	74	62	68	65	71	75	74
5	68	74	60	70	65	72	75	73
6	64	76	64	70	65	75	75	72
7	64	78	64	67	64	79	78	75
8	60	74	66	75	64	90	86	81
9	59	81	78	71	61	93	87	74
10	58	80	70	68	57	97	91	71
11	60	81	68	68	56	89	95	69
12	63	76	66	74	57	91	91	64
13	67	75	63	71	58	89	90	92
14	77	70	66	66	59	84	90	93
15	82	73	77	68	64	81	88	99
16	84	73	83	70	67	81	79	99
17	88	70	87	69	69	84	79	95
18	86	69	75	66	69	82	79	97
19	87	70	76	69	68	81	78	89
20	84	72	71	67	67	80	77	81
21	90	65	69	66	68	80	79	82
22	82	67	71	65	69	80	79	83
23	80	69	72	70	69	81	77	84

RELATIVE HUMIDITY (%) AT FPN

HOUR	9/20/79	9/21/79	9/22/79	9/23/79	9/24/79	9/25/79	9/26/79	9/27/79
0		66	64	64	97	62	98	100
1	82	72	64	65	100	60	100	100
2	97	61	64	68	100	60	100	99
3	98	71	63	67	100	58	100	97
4	100	71	65	65	100	59	100	100
5	100	67	63	63	100	63	98	100
6	100	76	60	64	94	68	100	84
7	100	81	59	65	79	68	100	81
8	100	78	61	60	72	68	99	80
9	99	72	56	60	76	67	98	75
10	96	70	61	61	71	68	98	74
11	100	67	61	60	67	67	99	71
12	88	61	69	62	63	74	99	73
13	78	65	78	60	66	75	99	66
14	60	86	70	64	67	78	100	68
15	63	75	61	64	68	81	100	64
16	65	64	59	73	63	81	100	69
17	61	70	63	73	68	82	100	67
18	67	78	69	73	68	84	100	62
19	64	81	62	82	68	88	100	64
20	63	83	65	76	65	88	100	66
21	64	70	64	67	68	92	100	65
22	59	70	63	87	66	94	100	63
23	64	62	64	94	64	96	100	67

RELATIVE HUMIDITY (%) AT FPN

HOUR	9/28/79	9/29/79	9/30/79	10/1/79	10/2/79	10/3/79	10/4/79	10/5/79
0		73	73	75	67	70	73	91
1	67	75	75	76	72	69	77	96
2	66	76	74	82	68	62	83	100
3	63	77	74	81	45	67	80	98
4	62	77	76	80	75	72	79	100
5	61	79	76	78	77	76	85	100
6	63	79	70	81	76	79	88	96
7	62	80	73	88	81	78	91	91
8	64	81	66	88	81	76	92	99
9	63	81	66	86	79	78	92	92
10	57	82	65	82	77	79	90	91
11	62	82	62	80	71	79	90	94
12	63	77	61	82	64	81	89	89
13	61	76	62	77	60	79	88	90
14	58	74	63	75	56	76	90	90
15	69	78	64	71	58	74	91	81
16	63	73	65	71	62	69	91	84
17	66	76	72	72	57	68	92	84
18	67	77	75	68	56	68	90	86
19	66	79	75	67	59	69	89	91
20	68	79	72	73	66	77	93	91
21	70	79	70	74	64	62	91	77
22	70	77	68	76	68	67	91	82
23	71	72	76	73	65	71	91	75

RELATIVE HUMIDITY (%) AT FPN

HOUR	10/6/79	10/7/79	10/8/79	10/9/79	10/10/9	10/11/9	10/12/9	10/13/9
0		67	100	100	93	76	100	87
1	80	71	100	100	96	75	100	88
2	78	74	100	100	99	81	100	86
3	78	76	99	100	100	85	100	85
4	80	82	99	100	100	96	100	88
5	85	84	99	100	100	92	100	87
6	87	85	93	100	99	92	100	83
7	88	89	97	95	100	92	100	82
8	84	91	97	95	99	92	100	83
9	88	95	100	98	100	96	98	85
10	88	94	100	98	99	98	100	84
11	89	96	98	96	99	99	100	86
12	89	94	100	96	95	100	100	88
13	89	96	100	97	96	94	100	90
14	76	94	100	97	98	92	100	91
15	81	95	100	97	97	86	100	92
16	78	96	100	95	96	83	100	94
17	72	94	100	96	94	100	100	96
18	69	94	100	96	94	100	100	96
19	66	94	100	94	89	100	98	96
20	66	96	100	92	92	100	97	96
21	59	94	100	87	76	100	98	93
22	64	94	100	90	76	100	92	93
23	65	96	100	91	78	100	90	95

WIND SPEEDS (KNOTS) AT FPN

HOUR	9/12/79	9/13/79	9/14/79	9/15/79	9/16/79	9/17/79	9/18/79	9/19/79
0		31	25	36	23	34	27	19
1	22	31	22	37	19	33	30	21
2	19	31	23	41	19	34	32	19
3	19	31	21	37	17	32	32	19
4	17	33	22	37	19	31	36	19
5	17	33	24	41	17	31	38	19
6	12	35	24	38	15	28	38	17
7	12	35	26	33	11	30	38	17
8	8	35	32	29	13	27	38	17
9	8	36	32	39	15	28	38	17
10	7	29	32	33	19	22	38	13
11	12	29	30	38	19	27	37	13
12	13	32	38	34	22	23	33	13
13	19	31	31	30	25	23	30	13
14	19	29	29	36	27	25	32	13
15	15	26	38	37	30	27	36	13
16	17	28	42	37	30	27	37	14
17	19	28	25	32	34	26	28	14
18	17	26	36	30	38	32	35	14
19	19	29	32	24	36	34	32	14
20	22	25	33	24	37	30	29	12
21	22	25	33	22	37	30	23	8
22	24	27	31	20	37	28	23	4
23	28	25	33	28	34	27	23	4

WIND SPEEDS (KNOTS) AT FPN

HOUR	9/20/79	9/21/79	9/22/79	9/23/79	9/24/79	9/25/79	9/26/79	9/27/79
0		38	13	12	24	7	33	41
1	10	41	12	12	22	5	32	38
2	17	41	11	8	24	6	31	38
3	15	39	11	8	25	6	32	38
4	23	41	15	7	25	6	32	28
5	25	38	12	10	28	6	30	28
6	29	38	13	10	27	10	30	25
7	31	32	15	10	26	9	26	20
8	36	32	14	12	24	11	24	24
9	34	29	14	14	22	15	26	24
10	37	26	11	14	24	15	24	22
11	20	19	12	14	18	21	24	24
12	23	20	16	17	18	21	24	22
13	28	19	10	20	17	23	20	24
14	28	16	16	20	17	25	21	21
15	28	25	18	22	16	26	21	19
16	35	28	20	21	16	29	21	19
17	31	19	17	21	15	30	21	15
18	36	16	17	20	11	30	22	15
19	36	22	12	14	13	38	27	18
20	36	8	14	20	11	36	28	20
21	36	9	14	22	9	38	31	17
22	41	12	12	24	7	36	41	17
23	43	11	14	18	7	36	39	17

WIND SPEEDS (KNOTS) AT FPN

HOUR	9/28/79	9/29/79	9/30/79	10/1/79	10/2/79	10/3/79	10/4/79	10/5/79
0		13	11	15	23	36	21	31
1	17	12	10	15	37	32	20	30
2	17	15	6	13	34	32	18	31
3	17	15	6	11	30	32	18	28
4	15	15	7	15	30	31	20	44
5	13	17	10	18	25	28	19	42
6	11	15	10	19	27	31	19	39
7	13	13	10	25	30	33	17	44
8	11	13	9	27	26	33	21	38
9	15	13	9	23	25	37	21	35
10	15	10	7	26	27	32	21	33
11	17	12	9	24	27	31	23	37
12	15	13	7	24	22	31	23	32
13	13	13	8	24	29	31	24	32
14	15	11	4	24	29	36	28	38
15	13	17	6	25	33	31	29	35
16	13	13	6	23	29	23	25	34
17	11	13	10	22	30	21	30	36
18	13	13	6	23	28	25	29	30
19	11	17	10	26	35	24	28	35
20	11	15	9	29	30	26	24	38
21	11	11	10	31	30	22	27	29
22	11	11	11	33	36	21	29	32
23	11	11	13	35	40	21	29	38

WIND SPEEDS (KNOTS) AT FPN

HOUR	10/6/79	10/7/79	10/8/79	10/9/79	10/10/9	10/11/9	10/12/9	10/13/9
0		30	12	10	14	30	4	12
1	38	30	14	10	14	26	10	12
2	45	29	14	10	12	24	8	12
3	43	27	12	16	12	22	8	10
4	40	26	10	16	12	20	5	8
5	45	28	8	14	8	20	4	8
6	40	22	6	12	5	22	2	5
7	39	24	8	12	12	19	0	6
8	34	21	11	14	10	20	3	4
9	32	19	12	14	15	18	3	5
10	33	20	12	10	14	18	4	8
11	32	20	13	12	14	18	8	10
12	29	19	14	12	16	6	12	12
13	31	19	8	14	14	4	9	15
14	27	12	10	14	18	4	12	12
15	30	12	10	16	17	0	11	16
16	31	18	4	18	17	0	12	17
17	30	18	3	16	18	4	12	18
18	31	16	7	18	20	3	6	16
19	30	17	10	20	24	5	4	19
20	28	15	8	23	24	6	11	20
21	34	16	12	25	27	6	16	26
22	33	16	8	16	28	8	18	18
23	31	14	10	16	30	4	17	22

WIND DIRECTIONS AT FPN

HOUR	9/12/79	9/13/79	9/14/79	9/15/79	9/16/79	9/17/79	9/18/79	9/19/79
0		195	280	300	310	220	225	260
1	300	210	290	310	310	240	230	260
2	300	230	280	310	310	230	240	270
3	320	245	275	310	290	230	240	270
4	300	245	275	310	280	245	240	255
5	300	250	250	310	280	250	240	250
6	310	260	260	315	280	250	240	240
7	280	260	260	320	275	250	240	255
8	270	270	260	310	275	255	240	260
9	260	275	285	310	265	260	240	285
10	210	275	270	315	240	260	255	270
11	190	290	255	315	255	255	265	255
12	175	290	270	310	255	265	270	230
13	170	295	270	325	245	260	265	230
14	170	295	250	325	230	250	270	250
15	180	285	270	315	225	240	270	240
16	190	295	280	320	220	240	280	230
17	205	290	310	310	225	245	280	250
18	215	290	300	315	230	240	285	260
19	195	290	305	320	235	235	285	290
20	180	300	305	320	240	240	280	290
21	180	300	300	315	240	240	280	290
22	185	280	300	325	220	230	280	270
23	195	290	300	310	220	225	270	180

WIND DIRECTIONS AT FPN

HOUR	9/20/79	9/21/79	9/22/79	9/23/79	9/24/79	9/25/79	9/26/79	9/27/79
0		250	300	310	220	330	210	220
1	150	270	310	300	220	310	210	210
2	150	250	310	280	220	280	220	220
3	140	260	330	300	210	260	210	240
4	140	270	330	280	230	250	220	250
5	190	270	320	260	350	250	220	260
6	190	280	320	260	350	250	240	270
7	200	280	310	250	350	210	240	280
8	200	280	310	250	360	225	240	270
9	190	290	310	240	350	215	245	280
10	190	290	310	230	360	210	245	285
11	260	280	310	200	350	215	245	280
12	240	270	300	210	350	210	245	290
13	260	250	330	220	350	200	240	290
14	250	270	340	220	350	190	230	300
15	230	290	340	210	350	200	230	300
16	240	280	340	210	350	200	220	300
17	240	280	340	220	350	200	210	300
18	240	260	340	210	340	200	210	300
19	240	270	330	230	330	210	200	305
20	230	280	330	250	340	210	215	300
21	230	270	340	240	340	210	210	295
22	240	300	340	240	340	210	210	300
23	250	310	330	220	340	210	210	290

WIND DIRECTIONS AT FPN

HOUR	9/28/79	9/29/79	9/30/79	10/1/79	10/2/79	10/3/79	10/4/79	10/5/79
0		285	10	90	105	110	110	100
1	300	280	10	90	10	120	110	100
2	290	280	10	90	110	125	110	90
3	300	290	10	100	110	115	105	90
4	280	290	10	100	110	110	105	90
5	290	290	10	90	110	110	105	90
6	270	300	10	90	110	120	105	90
7	270	300	350	90	105	115	105	90
8	260	300	15	90	115	115	100	100
9	270	310	20	95	110	120	100	100
10	275	305	10	95	110	110	100	105
11	280	305	25	95	115	110	100	100
12	280	305	25	95	110	110	95	100
13	290	310	10	100	120	120	95	100
14	280	310	40	90	110	120	90	105
15	290	310	50	90	110	110	90	105
16	290	310	70	90	110	110	90	105
17	290	330	90	100	110	105	90	110
18	300	330	90	90	110	120	90	105
19	290	340	95	100	110	110	100	105
20	300	340	95	95	110	110	95	105
21	300	345	95	95	110	110	105	110
22	270	360	90	95	115	110	100	110
23	270	10	90	100	115	110	100	110

WIND DIRECTIONS AT FPN

HOUR	10/6/79	10/7/79	10/8/79	10/9/79	10/10/9	10/11/9	10/12/9	10/13/9
0		125	190	105	180	180	55	275
1	110	120	210	105	180	195	90	295
2	115	120	230	105	195	190	50	300
3	115	120	240	110	200	190	65	300
4	115	120	240	110	190	180	65	330
5	115	120	245	100	210	180	50	325
6	115	125	210	110	190	190	105	290
7	115	130	180	110	150	190	350	340
8	120	130	190	105	150	195	15	35
9	120	130	215	110	125	210	80	80
10	120	140	210	120	130	200	130	50
11	120	140	180	120	140	195	140	60
12	115	140	180	115	140	290	150	90
13	120	140	190	115	140	280	180	75
14	115	135	160	120	140	290	160	60
15	120	130	160	120	150	340	170	80
16	115	135	140	120	135	60	180	60
17	120	150	130	130	135	100	170	50
18	115	165	135	140	135	110	185	60
19	120	160	155	140	140	110	260	60
20	120	160	120	150	140	115	300	70
21	120	160	120	160	150	90	280	90
22	120	170	105	180	150	95	280	90
23	130	180	110	185	165	110	285	90

WAVE HEIGHT (M) AT FPN

HOUR	9/12/79	9/13/79	9/14/79	9/15/79	9/16/79	9/17/79	9/18/79	9/19/79
0		1.5	2.4	2.5	2.2	1.6	1.6	1.8
1	2.0	1.6	2.2	2.5	2.2	1.6	1.7	1.8
2	2.0	1.6	2.2	2.5	2.2	1.6	1.7	1.8
3	2.0	1.9	2.2	2.5	2.0	1.6	1.7	1.8
4	2.0	2.4	2.2	2.5	2.0	1.6	1.7	1.8
5	1.8	2.4	2.2	2.5	2.0	1.6	1.8	1.8
6	1.4	2.4	2.2	2.5	2.0	1.6	1.8	1.5
7	1.4	2.4	2.2	2.5	1.5	1.6	1.8	1.5
8	1.4	2.4	2.2	2.5	1.5	1.6	2.2	1.5
9	1.4	2.4	2.2	2.5	1.4	1.6	2.2	1.5
10	1.4	2.4	2.2	2.5	1.3	1.6	2.2	1.5
11	1.4	2.4	2.2	2.5	1.3	1.6	2.2	1.5
12	1.4	2.4	2.2	2.5	1.3	1.6	2.2	1.5
13	1.4	2.4	2.2	2.5	1.3	1.6	2.2	1.5
14	1.4	2.4	2.2	2.5	1.3	1.6	2.2	1.5
15	1.4	2.4	2.2	2.5	1.3	1.7	2.2	1.5
16	1.4	2.5	2.3	2.5	1.4	1.7	2.2	1.5
17	1.4	2.5	2.4	2.5	1.5	1.7	2.2	1.5
18	1.4	2.5	2.4	2.4	1.6	1.7	2.2	1.5
19	1.4	2.5	2.4	2.3	1.6	1.8	2.2	1.5
20	1.4	2.5	2.4	2.3	1.6	1.8	2.2	1.5
21	1.4	2.5	2.4	2.3	1.6	1.8	2.0	1.2
22	1.5	2.5	2.4	2.2	1.6	1.8	2.0	1.0
23	1.5	2.4	2.4	2.2	1.6	1.6	2.0	1.0

WAVE HEIGHT (M) AT FPN

HOUR	9/20/79	9/21/79	9/22/79	9/23/79	9/24/79	9/25/79	9/26/79	9/27/79
0		3.2	2.0	1.0	1.2	1.0	1.8	1.8
1	1.5	3.2	1.8	0.8	1.3	0.8	1.8	1.8
2	1.5	3.2	1.5	0.8	1.3	0.8	2.0	1.8
3	1.5	3.2	1.5	0.8	1.3	0.8	2.0	1.8
4	1.6	3.2	1.5	0.8	1.3	0.8	2.0	1.8
5	1.7	3.2	1.5	0.8	1.3	0.8	2.0	1.8
6	1.8	3.2	1.0	0.8	1.3	0.8	2.0	1.5
7	2.0	3.0	1.2	0.8	1.3	0.8	2.0	1.5
8	2.0	3.0	1.2	0.8	1.3	0.7	2.0	1.5
9	2.0	3.0	1.2	0.8	1.3	0.7	1.9	1.5
10	2.2	2.8	1.0	0.8	1.3	0.7	1.9	1.5
11	2.8	3.0	1.0	0.8	1.3	0.7	1.8	1.5
12	2.8	3.0	1.0	0.8	1.3	0.7	1.8	1.5
13	2.8	2.5	0.8	0.8	1.3	1.0	1.4	1.0
14	2.8	2.5	0.8	1.0	1.3	1.3	1.4	1.0
15	2.6	2.5	0.8	1.0	1.3	1.3	1.4	1.0
16	2.8	2.5	0.8	1.0	1.3	1.3	1.4	1.0
17	2.8	2.0	0.8	1.0	1.3	1.5	1.4	1.0
18	2.8	2.0	1.0	1.0	1.3	1.6	1.4	1.0
19	2.8	2.5	1.0	1.0	1.3	1.6	1.5	1.0
20	2.8	2.5	1.0	1.0	1.3	1.7	1.5	1.0
21	2.8	2.2	1.0	1.2	1.3	1.8	1.5	1.0
22	3.0	2.2	1.0	1.2	1.1	1.8	1.6	1.0
23	3.2	2.0	1.0	1.2	1.0	1.8	1.8	7.0

WAVE HEIGHT (M) AT FPN

HOUR	9/28/79	9/29/79	9/30/79	10/1/79	10/2/79	10/3/79	10/4/79	10/5/79
0		0.7	0.5	0.4	1.2	1.5	1.3	1.3
1	1.0	0.7	0.5	0.5	1.2	1.5	1.2	1.3
2	1.0	0.7	0.4	0.5	1.2	1.5	1.2	1.3
3	1.0	0.7	0.4	0.5	1.2	1.5	1.2	1.3
4	1.0	0.7	0.4	0.5	1.2	1.5	1.2	1.3
5	1.0	0.7	0.4	0.5	1.2	1.5	1.2	1.3
6	0.8	0.7	0.4	0.5	1.2	1.5	1.2	1.4
7	0.8	0.7	0.4	0.5	1.2	1.5	1.1	1.5
8	0.8	0.6	0.4	0.6	1.2	1.5	1.0	1.5
9	0.8	0.6	0.4	0.7	1.2	1.5	0.8	2.0
10	0.8	0.6	0.4	0.8	1.2	1.5	1.2	2.0
11	0.8	0.5	0.4	1.0	1.2	1.5	1.0	2.0
12	0.8	0.5	0.4	1.0	1.2	1.5	0.8	2.0
13	0.8	0.5	0.4	1.0	1.2	1.5	0.8	2.2
14	0.8	0.5	0.4	1.0	1.2	1.3	0.8	2.2
15	0.8	0.5	0.4	1.0	1.5	1.4	1.0	2.0
16	0.8	0.5	0.4	1.0	1.5	1.3	1.3	2.0
17	0.8	0.5	0.4	1.0	1.5	1.5	1.0	2.2
18	0.8	0.5	0.4	1.0	1.5	1.5	1.2	2.0
19	0.7	0.5	0.4	1.0	1.5	1.4	1.2	2.0
20	0.7	0.5	0.4	1.1	1.5	1.0	1.2	2.0
21	0.7	0.5	0.4	1.1	1.5	1.3	1.2	2.0
22	0.7	0.5	0.4	1.1	1.5	1.3	1.2	2.0
23	0.7	0.5	0.4	1.2	1.5	1.3	1.2	2.0

WAVE HEIGHT (M) AT FPN

HOUR	10/6/79	10/7/79	10/8/79	10/9/79	10/10/9	10/11/9	10/12/9	10/13/9
0		1.5	0.5	0.2	0.3	0.3	0.3	0.3
1	2.0	1.5	0.5	0.2	0.3	0.3	0.3	0.3
2	2.0	1.5	0.5	0.2	0.3	0.3	0.3	0.3
3	2.0	1.5	0.5	0.2	0.3	0.3	0.3	0.3
4	2.0	1.5	0.4	0.3	0.3	0.3	0.3	0.3
5	2.0	1.5	0.3	0.3	0.3	0.3	0.3	0.3
6	2.0	1.5	0.3	0.4	0.3	0.3	0.3	0.3
7	2.0	1.5	0.3	0.4	0.3	0.4	0.2	0.3
8	2.0	1.4	0.3	0.4	0.3	0.4	0.2	3.0
9	2.0	1.2	0.3	0.3	0.2	0.4	0.2	0.3
10	2.0	1.2	0.3	0.4	0.2	0.4	0.2	3.0
11	1.8	1.2	0.3	0.4	0.2	0.5	0.2	0.3
12	1.8	1.2	0.3	0.4	0.2	0.3	0.1	0.3
13	1.5	1.0	0.3	0.4	0.2	0.3	0.1	0.3
14	1.5	1.0	0.3	0.4	0.2	0.3	0.2	0.2
15	1.5	1.0	0.3	0.3	0.2	0.2	0.2	0.3
16	1.5	0.8	0.3	0.3	0.2	0.2	0.3	0.3
17	1.5	0.8	0.2	0.3	0.2	0.2	0.3	0.3
18	1.5	0.5	0.2	0.3	0.2	0.2	0.3	0.3
19	1.5	0.5	0.2	0.3	0.3	0.2	0.3	0.3
20	1.5	0.5	0.2	0.3	0.3	0.3	0.3	0.4
21	1.5	0.5	0.2	0.3	0.3	0.3	0.3	0.4
22	1.5	0.5	0.2	0.3	0.3	0.3	0.3	0.4
23	1.5	0.5	0.2	0.3	0.3	0.3	0.3	0.4

VISIBILITY (KM) AT FPN

HOUR	9/12/79	9/13/79	9/14/79	9/15/79	9/16/79	9/17/79	9/18/79	9/19/79
0		1.5	12.0	10.0	20.0	12.0	3.0	10.0
1	10.0	1.5	12.0	10.0	20.0	10.0	3.5	10.0
2	10.0	4.5	12.0	10.0	20.0	10.0	4.0	10.0
3	12.0	4.0	12.0	10.0	20.0	10.0	6.0	10.0
4	10.0	5.0	12.0	10.0	20.0	12.0	6.0	12.0
5	15.0	8.0	16.0	10.0	20.0	12.0	6.0	12.0
6	20.0	8.0	20.0	15.0	25.0	8.0	4.0	8.0
7	25.0	8.0	20.0	15.0	25.0	8.0	3.0	8.0
8	25.0	8.0	20.0	20.0	25.0	3.5	2.0	8.0
9	25.0	8.0	10.0	20.0	25.0	8.0	2.0	15.0
10	25.0	10.0	15.0	25.0	25.0	7.0	2.0	15.0
11	25.0	10.0	8.0	25.0	25.0	7.0	3.0	15.0
12	25.0	10.0	10.0	20.0	20.0	7.0	4.0	20.0
13	25.0	10.0	10.0	10.0	17.0	8.0	5.0	15.0
14	25.0	15.0	10.0	15.0	15.0	8.0	10.0	5.0
15	25.0	15.0	10.0	20.0	10.0	8.0	10.0	7.0
16	25.0	15.0	2.0	25.0	10.0	6.0	10.0	3.0
17	15.0	15.0	1.0	15.0	8.0	5.0	10.0	10.0
18	15.0	15.0	10.0	15.0	8.0	5.0	10.0	10.0
19	10.0	15.0	10.0	10.0	8.0	5.0	10.0	12.0
20	5.0	15.0	10.0	15.0	8.0	5.0	10.0	12.0
21	1.5	15.0	12.0	15.0	12.0	5.0	10.0	12.0
22	1.5	15.0	10.0	20.0	12.0	5.0	10.0	12.0
23	1.5	12.0	10.0	20.0	12.0	2.5	10.0	12.0

VISIBILITY (KM) AT FPN

HOUR	9/20/79	9/21/79	9/22/79	9/23/79	9/24/79	9/25/79	9/26/79	9/27/79
0		10.0	15.0	20.0	10.0	20.0	10.0	5.0
1	10.0	4.0	10.0	10.0	4.0	20.0	5.0	4.0
2	15.0	4.0	0.0	15.0	2.0	20.0	3.0	4.0
3	15.0	4.0	10.0	15.0	2.0	20.0	2.0	6.0
4	8.0	4.0	10.0	15.0	2.0	20.0	2.0	4.0
5	7.0	4.0	10.0	15.0	2.0	20.0	4.0	4.0
6	4.0	5.0	15.0	15.0	3.0	20.0	4.0	8.0
7	5.0	8.0	25.0	25.0	15.0	25.0	3.0	10.0
8	3.0	12.0	25.0	25.0	15.0	25.0	3.0	10.0
9	4.0	20.0	25.0	25.0	15.0	25.0	4.0	10.0
10	4.0	25.0	25.0	25.0	15.0	25.0	4.0	10.0
11	6.0	25.0	25.0	25.0	15.0	25.0	4.0	15.0
12	8.0	25.0	25.0	25.0	15.0	25.0	3.0	15.0
13	20.0	25.0	20.0	25.0	20.0	25.0	3.0	15.0
14	20.0	20.0	20.0	25.0	20.0	25.0	3.0	15.0
15	20.0	10.0	25.0	20.0	20.0	25.0	2.0	20.0
16	20.0	20.0	25.0	20.0	20.0	15.0	1.0	20.0
17	20.0	10.0	25.0	15.0	20.0	10.0	1.0	20.0
18	10.0	15.0	25.0	10.0	20.0	10.0	1.0	20.0
19	15.0	10.0	25.0	10.0	20.0	10.0	1.0	20.0
20	12.0	10.0	25.0	10.0	20.0	10.0	5.0	20.0
21	12.0	10.0	15.0	10.0	20.0	10.0	5.0	20.0
22	10.0	12.0	20.0	12.0	20.0	10.0	5.0	20.0
23	10.0	15.0	20.0	10.0	20.0	10.0	5.0	20.0

VISIBILITY (KM) AT FPN

HOUR	9/28/79	9/29/79	9/30/79	10/1/79	10/2/79	10/3/79	10/4/79	10/5/79
0		20.0	20.0	20.0	20.0	20.0	10.0	5.0
1	10.0	20.0	25.0	25.0	20.0	20.0	10.0	1.5
2	10.0	20.0	25.0	25.0	20.0	20.0	10.0	2.0
3	15.0	20.0	25.0	25.0	20.0	20.0	10.0	2.0
4	20.0	20.0	25.0	25.0	20.0	20.0	10.0	2.0
5	20.0	20.0	25.0	20.0	20.0	20.0	10.0	2.0
6	20.0	20.0	25.0	25.0	20.0	20.0	4.0	2.0
7	20.0	20.0	25.0	25.0	20.0	15.0	5.0	2.0
8	20.0	25.0	25.0	25.0	20.0	10.0	5.0	1.5
9	20.0	25.0	25.0	25.0	20.0	10.0	5.0	4.0
10	20.0	25.0	25.0	25.0	20.0	10.0	5.0	4.0
11	20.0	25.0	25.0	25.0	20.0	10.0	4.0	3.5
12	20.0	25.0	25.0	25.0	20.0	10.0	4.0	3.5
13	20.0	25.0	25.0	25.0	20.0	7.0	5.0	3.5
14	20.0	25.0	25.0	25.0	20.0	10.0	5.0	4.0
15	20.0	25.0	25.0	25.0	25.0	10.0	4.0	5.0
16	20.0	25.0	25.0	25.0	25.0	10.0	3.5	5.0
17	20.0	25.0	25.0	25.0	25.0	10.0	3.5	5.0
18	20.0	25.0	25.0	20.0	25.0	10.0	3.5	5.0
19	20.0	20.0	20.0	20.0	25.0	10.0	3.5	5.0
20	20.0	20.0	20.0	20.0	25.0	10.0	3.5	5.0
21	20.0	20.0	20.0	20.0	20.0	10.0	4.0	5.0
22	20.0	20.0	20.0	20.0	20.0	10.0	4.0	5.0
23	20.0	20.0	20.0	20.0	20.0	10.0	4.0	5.0

VISIBILITY (KM) AT FPN

HOUR	10/6/79	10/7/79	10/8/79	10/9/79	10/10/9	10/11/9	10/12/9	10/13/9
0		8.0	2.0	0.0	3.0	3.0	2.0	5.0
1	5.0	8.0	1.0	0.0	3.0	5.0	3.0	5.0
2	5.0	8.0	1.0	0.0	3.0	6.0	3.0	5.0
3	5.0	8.0	1.5	0.0	3.0	6.0	3.0	5.0
4	5.0	8.0	1.5	0.0	3.0	6.0	4.0	5.0
5	5.0	8.0	2.0	0.0	3.0	5.0	4.0	5.0
6	5.0	5.0	8.0	1.0	2.0	4.0	3.0	5.0
7	6.0	4.0	8.0	1.0	0.5	3.0	1.0	7.0
8	6.0	3.0	4.0	1.0	0.5	4.0	0.5	8.0
9	6.0	3.0	0.5	0.0	0.5	2.0	0.5	10.0
10	6.0	3.0	2.0	0.5	0.5	1.5	0.2	10.0
11	7.0	2.0	3.0	2.5	0.7	2.0	0.1	10.0
12	7.0	2.5	0.1	2.0	1.0	0.1	2.0	12.0
13	7.0	2.5	0.1	2.0	2.5	0.1	6.0	10.0
14	7.0	2.5	0.1	0.5	1.5	4.0	3.5	12.0
15	7.0	3.0	0.1	0.5	1.5	3.0	2.0	10.0
16	10.0	2.5	0.1	2.0	1.5	2.0	5.0	10.0
17	12.0	2.5	0.0	2.0	2.0	0.5	6.0	7.0
18	12.0	2.0	0.0	1.5	2.0	0.5	4.0	6.0
19	10.0	2.0	0.0	2.5	1.5	2.5	3.5	7.0
20	10.0	2.0	0.0	2.5	2.5	2.5	5.0	7.0
21	8.0	2.0	0.0	2.5	3.0	2.0	4.0	7.0
22	8.0	1.0	0.0	2.5	3.0	1.0	4.0	7.0
23	8.0	2.0	0.0	2.5	3.0	2.0	5.0	7.0

AIR TEMPERATURE (DEG. C) AT FPN

HOUR	9/12/79	9/13/79	9/14/79	9/15/79	9/16/79	9/17/79	9/18/79	9/19/79
0		17.0	14.0	13.0	12.0	14.0	14.0	16.0
1	15.0	17.0	14.0	13.0	12.0	14.0	14.0	16.0
2	15.0	17.0	14.0	12.0	12.0	14.0	15.0	16.0
3	15.0	17.0	14.0	11.0	12.0	14.0	15.0	16.0
4	15.0	17.0	14.0	11.0	12.0	14.0	15.0	16.0
5	15.0	17.0	14.0	12.0	12.0	14.0	15.0	16.0
6	15.0	17.0	14.0	12.0	12.0	14.0	15.0	16.0
7	15.0	17.0	14.0	12.0	12.0	14.0	15.0	16.0
8	15.0	17.0	14.0	10.0	12.0	14.0	16.0	16.0
9	16.0	17.0	14.0	13.0	12.0	14.0	16.0	16.0
10	16.0	17.0	14.0	13.0	13.0	14.0	16.0	16.0
11	16.0	17.0	14.0	13.0	14.0	14.0	16.0	16.0
12	16.0	16.0	14.0	13.0	14.0	14.0	16.0	16.0
13	16.0	16.0	14.0	13.0	14.0	14.0	16.0	16.0
14	16.0	16.0	14.0	13.0	14.0	14.0	17.0	13.6
15	17.0	15.0	14.0	13.0	14.0	14.0	17.0	13.0
16	17.0	15.0	14.0	13.0	14.0	14.0	17.0	13.5
17	17.0	16.0	13.0	13.0	14.0	14.0	17.0	14.0
18	17.0	16.0	13.0	13.0	14.0	15.0	17.0	14.2
19	17.0	15.0	13.0	12.0	14.0	15.0	17.0	14.3
20	17.0	14.0	13.0	12.0	14.0	14.0	16.0	14.2
21	17.0	14.0	13.0	12.0	14.0	14.0	16.0	14.0
22	17.0	14.0	13.0	12.0	14.0	14.0	16.0	13.7
23	17.0	14.0	13.0	12.0	14.0	14.0	16.0	13.8

AIR TEMPERATURE (DEG. C) AT FPN

HOUR	9/20/79	9/21/79	9/22/79	9/23/79	9/24/79	9/25/79	9/26/79	9/27/79
0		13.9	10.7	11.7	11.3	11.6	14.6	15.5
1	14.1	13.3	10.6	11.6	10.8	11.4	14.5	15.7
2	14.1	13.1	10.7	11.4	11.5	11.5	14.6	15.8
3	14.0	12.0	10.9	11.3	11.5	11.4	14.6	16.0
4	14.2	12.1	0.9	11.3	12.2	11.4	14.9	15.2
5	14.2	12.0	10.7	11.4	12.0	11.4	15.6	15.4
6	15.9	11.6	10.7	11.4	11.9	11.5	15.1	14.5
7	15.9	11.4	10.9	11.8	12.3	11.7	14.9	14.2
8	15.6	11.0	11.0	11.8	12.4	12.0	15.2	13.9
9	16.0	11.7	11.1	12.5	12.3	12.1	15.4	13.8
10	16.1	11.5	11.1	12.3	12.3	12.6	15.3	13.6
11	14.6	10.8	11.6	12.7	12.3	13.0	15.3	13.3
12	14.3	12.0	11.9	12.8	13.0	12.9	15.3	13.0
13	14.2	11.5	11.5	13.1	12.5	12.8	15.2	12.7
14	14.0	9.4	12.2	12.9	13.0	13.0	15.1	12.9
15	13.9	10.5	12.5	12.7	12.3	13.2	14.1	12.7
16	13.8	12.4	12.5	12.9	12.9	13.7	14.8	12.6
17	13.8	11.1	12.5	13.1	12.2	14.0	14.8	12.7
18	13.8	10.5	12.2	13.1	12.1	14.2	15.3	12.3
19	14.0	9.5	12.0	12.8	12.1	14.4	15.1	12.2
20	14.2	9.6	11.9	13.3	12.1	14.4	15.3	12.2
21	14.2	10.5	11.9	13.2	11.8	14.3	15.4	12.2
22	14.3	11.1	11.7	11.8	11.6	14.3	15.5	12.1
23	13.9	10.8	11.7	11.4	11.5	14.4	15.5	12.1

AIR TEMPERATURE (DEG. C) AT FPN

HOUR	9/28/79	9/29/79	9/30/79	10/1/79	10/2/79	10/3/79	10/4/79	10/5/79
0		11.9	11.0	11.4	11.0	10.2	9.9	10.7
1	12.0	11.8	10.8	11.3	10.7	9.9	9.8	10.5
2	11.9	11.8	10.5	11.1	10.4	9.9	10.1	9.9
3	11.9	12.0	10.7	11.3	10.1	9.6	9.9	10.2
4	12.1	12.0	10.7	10.9	9.8	9.5	9.8	9.3
5	12.3	12.0	10.6	10.7	9.9	8.8	9.2	9.9
6	12.3	12.0	10.9	10.8	9.5	8.8	9.1	10.0
7	11.6	12.7	10.9	10.4	9.6	8.4	8.7	10.0
8	12.9	12.2	12.1	10.5	9.6	8.8	8.8	9.4
9	13.0	12.3	12.1	10.6	9.5	8.8	8.5	10.4
10	13.0	12.9	12.9	10.7	9.6	8.7	9.0	10.1
11	12.9	13.1	12.8	10.7	10.1	8.4	10.0	10.4
12	12.9	13.1	12.6	11.1	10.2	8.4	10.0	10.5
13	12.9	13.1	11.8	11.3	10.4	8.0	10.0	10.2
14	13.0	12.9	11.9	11.4	10.4	10.0	10.0	10.6
15	12.6	13.0	12.0	11.5	10.7	10.0	11.0	10.9
16	12.7	13.0	11.8	11.9	11.0	10.0	11.0	11.0
17	12.2	12.8	11.4	12.0	11.1	11.0	11.0	11.0
18	12.1	12.3	11.1	11.9	11.1	10.0	10.0	10.5
19	12.0	12.4	10.9	11.4	11.2	10.0	11.0	10.2
20	11.9	11.8	11.2	11.2	11.3	10.0	11.0	9.9
21	12.0	11.5	11.4	10.7	10.6	10.4	10.9	10.2
22	11.9	11.3	11.8	10.5	10.4	10.4	10.8	10.2
23	11.9	11.2	11.7	11.0	10.2	10.2	10.6	11.3

AIR TEMPERATURE (DEG. C) AT FPN

HOUR	10/6/79	10/7/79	10/8/79	10/9/79	10/10/9	10/11/9	10/12/9	10/13/9
0		11.3	14.5	10.9	15.7	17.0	13.0	13.3
1	10.4	11.1	14.4	11.0	15.1	17.1	13.3	13.1
2	9.5	11.0	15.1	11.5	14.9	16.2	13.3	13.2
3	10.1	11.0	15.1	11.5	14.8	16.0	13.2	12.9
4	9.7	11.0	15.0	11.3	14.7	15.3	13.2	12.8
5	9.3	10.2	14.8	11.2	14.9	15.2	13.2	12.7
6	9.0	10.1	14.7	12.1	15.1	15.4	13.3	12.5
7	9.3	10.2	14.5	12.4	14.4	15.1	13.3	12.5
8	8.4	10.9	14.5	12.5	15.3	14.9	13.2	12.6
9	9.0	11.2	13.8	12.5	15.3	14.7	13.2	12.7
10	9.0	11.1	13.2	12.7	14.2	14.4	13.3	12.8
11	9.1	11.7	13.7	13.0	14.1	14.3	13.6	12.6
12	8.6	11.9	12.3	13.0	14.9	13.8	13.6	12.3
13	9.2	11.8	12.3	12.8	14.8	13.5	13.7	12.3
14	9.4	11.8	12.4	13.7	14.8	13.6	13.8	12.3
15	10.4	12.3	12.3	13.4	15.2	14.3	13.8	12.3
16	10.9	12.7	12.0	13.5	15.7	13.7	13.7	12.5
17	11.1	12.9	12.0	14.4	16.7	13.4	13.7	12.8
18	11.6	13.0	12.7	15.0	16.5	13.4	13.6	12.5
19	11.6	13.1	12.0	15.8	17.3	13.4	13.7	13.4
20	11.6	13.7	11.8	16.2	16.7	13.7	13.7	13.4
21	11.5	14.0	11.1	16.0	17.7	13.6	13.3	13.2
22	11.2	14.4	10.6	15.9	17.3	13.2	13.4	13.2
23	11.6	14.5	10.6	16.1	16.9	13.1	13.5	13.0

4.5 METER WATER TEMPERATURE (C) AT FPN

HOUR	9/12/79	9/13/79	9/14/79	9/15/79	9/16/79	9/17/79	9/18/79	9/19/79
0		15.3	15.3	15.1	14.7	14.5	14.5	14.7
1	15.5	15.3	15.3	15.1	14.6	14.5	14.5	14.7
2	15.5	15.4	15.3	15.1	14.6	14.5	14.5	14.7
3	15.5	15.4	15.3	15.1	14.6	14.5	14.5	14.7
4	15.5	15.4	15.3	15.1	14.6	14.4	14.5	14.6
5	15.5	15.4	15.3	15.1	14.6	14.4	14.5	14.6
6	15.5	15.4	15.3	15.1	14.6	14.5	14.5	14.6
7	15.4	15.4	15.3	15.1	14.6	14.5	14.5	14.6
8	15.4	15.4	15.3	15.1	14.6	14.5	14.5	14.6
9	15.4	15.4	15.2	15.0	14.6	14.5	14.5	14.6
10	15.3	15.4	15.2	15.0	14.5	14.5	14.7	14.6
11	15.3	15.3	15.2	14.9	14.5	14.6	14.6	14.6
12	15.3	15.3	15.2	14.9	14.5	14.6	14.8	14.6
13	15.4	15.3	15.2	14.8	14.5	14.6	14.8	14.6
14	15.4	15.4	15.2	14.8	14.5	14.6	14.8	14.4
15	15.4	15.4	15.2	14.8	14.5	14.5	14.8	14.4
16	15.4	15.4	15.3	14.8	14.5	14.5	14.7	14.3
17	15.4	15.4	15.3	14.8	14.5	14.5	14.6	14.3
18	15.5	15.4	15.3	14.9	14.5	14.5	14.6	14.2
19	15.5	15.4	15.2	14.8	14.5	14.6	14.6	14.2
20	15.5	15.3	15.2	14.8	14.5	14.5	14.6	14.2
21	15.4	15.3	15.2	14.8	14.5	14.5	14.6	14.2
22	15.4	15.3	15.2	14.8	14.5	14.5	14.6	14.2
23	15.3	15.3	15.2	14.7	14.5	14.5	14.6	14.2

4.5 METER WATER TEMPERATURE (C) AT FPN

HOUR	9/20/79	9/21/79	9/22/79	9/23/79	9/24/79	9/25/79	9/26/79	9/27/79
0		14.2	14.2	14.0	13.9	14.1	14.1	14.0
1	14.4	14.4	14.4	14.2	14.2	13.9	13.9	14.2
2	14.3	14.4	14.3	14.2	14.0	13.9	14.1	14.3
3	14.3	14.4	14.3	14.0	14.2	14.0	14.0	14.3
4	14.3	14.4	14.3	14.0	14.0	13.9	14.1	14.3
5	14.3	14.4	14.3	14.2	14.0	14.0	13.9	14.3
6	14.2	14.4	14.3	14.0	14.6	13.8	14.1	14.4
7	14.2	14.2	14.1	13.9	14.0	14.1	14.1	14.3
8	14.2	14.2	14.2	14.1	14.1	14.1	14.0	14.3
9	14.2	14.2	14.1	14.1	13.9	14.1	14.0	14.2
10	14.2	14.2	14.1	14.0	14.1	14.1	14.0	14.2
11	14.2	14.2	14.1	14.2	13.9	14.1	14.0	14.2
12	14.2	14.2	14.3	14.0	14.0	14.1	14.0	14.2
13	14.4	14.2	14.2	14.2	14.2	13.9	13.9	14.3
14	14.4	14.2	14.2	14.1	14.0	14.1	14.0	14.4
15	14.4	14.4	14.2	14.1	14.0	14.0	14.0	14.4
16	14.4	14.4	14.2	14.1	14.2	14.1	14.1	14.4
17	14.3	14.4	14.2	14.1	14.0	14.0	14.1	14.4
18	14.3	14.3	14.1	14.0	14.4	14.1	14.1	14.4
19	14.2	14.2	14.0	14.0	14.1	14.1	14.0	14.1
20	14.2	14.2	14.0	14.1	14.1	14.1	14.0	14.1
21	14.2	14.2	14.0	14.0	14.1	14.1	14.0	14.1
22	14.2	14.4	14.0	14.1	14.1	14.1	14.0	14.0
23	14.2	14.4	14.2	14.0	14.1	14.1	14.0	14.0

4.5 METER WATER TEMPERATURE (C) AT FPN

HOUR	9/28/79	9/29/79	9/30/79	10/1/79	10/2/79	10/3/79	10/4/79	10/5/79
0		13.9	13.9	13.8	13.7	13.4	13.3	13.4
1	14.0	13.9	13.9	13.7	13.6	13.3	13.3	13.4
2	14.0	13.9	13.9	13.7	13.5	13.3	13.3	13.4
3	14.0	13.9	13.9	13.7	13.6	13.3	13.3	13.4
4	14.0	13.9	13.9	13.8	13.6	13.3	13.3	13.5
5	13.9	14.0	13.9	13.7	13.6	13.3	13.4	13.5
6	13.9	14.0	13.9	13.7	13.6	13.3	13.4	13.5
7	14.0	13.9	14.0	13.7	13.6	13.3	13.4	13.5
8	13.9	13.9	13.8	13.7	13.5	13.3	13.2	13.5
9	13.9	13.9	13.8	13.7	13.5	13.3	13.0	13.3
10	14.0	13.9	13.7	13.7	13.5	13.4	13.0	13.3
11	13.9	13.8	13.7	13.7	13.5	13.3	13.2	13.3
12	13.9	13.8	13.7	13.6	13.5	13.3	13.2	13.3
13	13.9	13.9	13.7	13.7	13.5	13.1	13.2	13.4
14	13.9	13.9	13.7	13.7	13.4	13.1	13.3	13.4
15	13.9	13.9	13.7	13.7	13.4	13.1	13.3	13.3
16	14.0	13.9	13.7	13.7	13.4	13.2	13.3	13.4
17	14.0	14.0	13.7	13.7	13.4	13.2	13.3	13.3
18	14.0	13.9	13.8	13.7	13.4	13.1	13.3	13.3
19	14.0	13.9	13.8	13.7	13.4	13.1	13.4	13.3
20	14.0	13.9	13.8	13.7	13.4	13.1	13.2	13.3
21	13.9	13.9	13.8	13.7	13.4	13.3	13.4	13.4
22	13.9	13.9	13.8	13.7	13.4	13.3	13.4	13.4
23	13.9	13.9	13.7	13.7	13.4	13.3	13.4	13.4

4.5 METER WATER TEMPERATURE (C) AT FPN

HOUR	10/6/79	10/7/79	10/8/79	10/9/79	10/10/9	10/11/9	10/12/9	10/13/9
0		13.3	13.3	13.2	13.2	13.2	13.3	13.4
1	13.4	13.3	13.2	13.3	13.2	13.2	13.3	13.3
2	13.4	13.3	13.2	13.3	13.2	13.3	13.3	13.3
3	13.4	13.3	13.2	13.3	13.2	13.3	13.3	13.3
4	13.4	13.3	13.2	13.2	13.2	13.3	13.3	13.4
5	13.4	13.2	13.3	13.2	13.2	13.3	13.3	13.4
6	13.4	13.2	13.2	13.2	13.2	13.3	13.3	13.4
7	13.4	13.2	13.2	13.2	13.2	13.3	13.3	13.4
8	13.4	13.2	13.2	13.2	13.2	13.3	13.3	13.3
9	13.4	13.2	13.2	13.2	13.1	13.1	13.1	13.2
10	13.3	13.2	13.2	13.2	13.1	13.1	13.1	13.1
11	13.3	13.2	13.2	13.2	13.1	13.1	13.1	13.1
12	13.2	13.1	13.2	13.2	13.1	13.1	13.1	13.1
13	13.3	13.2	13.2	13.2	13.1	13.2	13.1	13.1
14	13.5	13.2	13.2	13.2	13.1	13.2	13.1	13.2
15	13.5	13.2	13.2	12.1	13.2	13.2	13.1	13.1
16	13.5	13.0	13.2	12.1	13.2	13.2	13.2	13.1
17	13.5	13.2	13.3	13.2	13.1	13.2	13.2	13.1
18	13.3	13.3	13.3	13.1	13.1	13.2	13.2	13.1
19	13.3	13.2	13.3	13.1	13.1	13.2	13.1	13.2
20	13.2	13.2	13.3	13.1	13.1	13.1	13.1	13.1
21	13.3	13.2	13.2	13.2	13.2	13.3	13.4	13.3
22	13.3	13.2	13.2	13.2	13.2	13.3	13.4	13.3
23	13.3	13.2	13.2	13.2	13.2	13.3	13.4	13.3

10. APPENDIX II — AEROSOL DATA

FPN PARTICLES/CC IN SIZE RANGE (0.5<DIA<0.7) MICRONS

HOUR	9/12/79	9/13/79	9/14/79	9/15/79	9/16/79	9/17/79	9/18/79	9/19/79
0				17	7	52	373	28
1				17	7	59	334	33
2				17	7	65	314	39
3				15	7	77	284	40
4				15	6	90	201	46
5				14	6	91	170	73
6				14	6		473	131
7				16	6			138
8				16	6			27
9				13	6			20
10					6		236	23
11					6	75	177	29
12					12	125	100	510
13				9	47	154	57	498
14				9	47	123	25	495
15					55	125	20	512
16					63	193	18	517
17					66	223	14	453
18						291		386
19						257	20	374
20				7	67	332	23	366
21				8	46	588	26	338
22				9	77	236	26	343
23			16	8	69	414	26	338

FPN PARTICLES/CC IN SIZE RANGE (0.5<DIA<0.7) MICRONS

HOUR	9/20/79	9/21/79	9/22/79	9/23/79	9/24/79	9/25/79	9/26/79	9/27/79
0		20	8	4		8	879	
1	454	20	7	4	74	7		
2	485	21	8	4	62	5	755	
3	375	14	9	4	64	7	686	
4	521	13	8		30	7	270	
5	507	12	7		15	6	131	
6	517		7			6	207	
7	765		7		10	3	154	52
8	449	12	8	4	11	4	121	32
9	535	14	7	4	11	4	135	35
10	179	13	6		11	3	189	22
11	145	11	5		10	9	159	24
12	23	12	13		10	15	246	8
13	17	14	15	7	12	20	886	9
14	26	16	15	8	9	69	702	24
15	20	14	11	9	9	73	659	6
16	18			10	7	71	1591	0
17	24		15	11		86	1117	0
18	29		13	8		135	1715	10
19	29	13	7	7		160	838	8
20	32	11	6	7	9	183	814	8
21	37	10	5	19	10	332	841	7
22	27	9	4	31	0	445	1063	7
23	23	8	4		2	559	808	7

FPN PARTICLES/CC IN SIZE RANGE (0.5<DIA<0.7) MICRONS

HOUR	9/28/79	9/29/79	9/30/79	10/1/79	10/2/79	10/3/79	10/4/79	10/5/79
0		11		65	59		261	
1	10	10			38		304	
2	12	9			55		300	
3	14	10			44		504	
4	14	8			37		440	
5		10			30		305	
6		13	17	60	47	127	390	
7	19	14	18	67	45	95	415	
8	22	21	17	66	45		570	26
9	26	11	10	50	56		5	215
10	27	12	13	93	47		42	271
11	26	10	9	52	23		60	
12	23		7	59	37			91
13	20		3	57	41			84
14	19		9	59	54			59
15	12		4	58	62			43
16			5	50	52			44
17	12		3	50	49			41
18	12		17	40	32	125		35
19	12		11	54	47			45
20	11		26	59	31	152		45
21	7		41	23		121		
22	7		91	51		203		70
23	9		62	38		153		65

FPN PARTICLES/CC IN SIZE RANGE (0.5<DIA<0.7) MICRONS

HOUR	10/6/79	10/7/79	10/8/79	10/9/79	10/10/9	10/11/9	10/12/9	10/13/9
0		60	651	1997	1302	426	410	264
1	67	64	764	4594	1089	441	500	255
2	64	74	587	4444	1750	495	555	203
3	68	85	556	1862	2949	508	608	164
4	63	96	375		1433	504	638	229
5	60	102	285	4063	1002	493	662	277
6	58	95	249		2032	484	3008	305
7	52	79	187		1019	502	1110	281
8	52	133	1747	830		579	959	0
9	49	143			495	581	5532	
10	52	138	542			548	1017	
11	58	143	1948			3103	399	
12	69	150	2908	2628		2943	132	
13	73	155	1441	11441	2132	313	283	
14	54	162	1930	827	1460	322	255	
15	41		2038	849	1417	305	236	
16	34	202	2553	869	712	378	289	
17	38	213	3973		737	395	305	
18	38	243	2092	870	731	347	294	
19	44	255		879	720	398	32	
20	49	2329		889	557	420	44	
21	50	927		869	442	395	152	
22	57	332		932	433	370	164	
23	59		2016	940	420	344	247	

FPN PARTICLES/CC IN SIZE RANGE (.7<DIA<1.4) MICRONS

HOUR	9/12/79	9/13/79	9/14/79	9/15/79	9/16/79	9/17/79	9/18/79	9/19/79
0				12	6	31	142	12
1				12	5	34	123	15
2				12	5	37	124	16
3				12	5	38	113	17
4				13	4	39	78	26
5				10	4	38	70	33
6				11	4			52
7				13	4			55
8				13	4			17
9				9	4			14
10					4		130	12
11					4	22	83	12
12					6	37	48	48
13				7	20	47	32	45
14				7	21	38	20	51
15					25	40	17	63
16					29	67	15	65
17					30	81	13	42
18						121		25
19						95	11	25
20				6	30	125	11	26
21				6	24	32	12	20
22				6	40	88	12	21
23			12	6	38	161	12	28

FPN PARTICLES/CC IN SIZE RANGE (.7<DIA<1.4) MICRONS

HOUR	9/20/79	9/21/79	9/22/79	9/23/79	9/24/79	9/25/79	9/26/79	9/27/79
0		11	2	3	39	4	300	
1	68	11	2	3	27	2		
2	101	10	3	3	24	2	305	
3	63	8	3	3	26	3	208	
4	161	7	3		15	0	67	
5	149	6	2		11	0	174	
6	151		2			4	100	
7	360		3		9	2	118	15
8	297	7	3	3	10	2	72	13
9	365	8	2	3	10	4	34	7
10	79	6	2		10	2	60	16
11	43	5	2		10	4	102	13
12	10	5	8		10	11	104	12
13	12	3	9	6	12	9	213	14
14	14	5	10	6	10	40	210	10
15	13	5	8	7	10	23	599	8
16	12			8	7	41	365	17
17	14		8	8		59	274	12
18	15		6	5		52	338	6
19	15	3	5	5		69	183	5
20	17	3	5	5	7	138	263	5
21	20	3	4	7	3	171	267	5
22	15	3	3	10	6	198	184	5
23	13	3	3		6	201	278	5

FPN PARTICLES/CC IN SIZE RANGE (.7<DIA<1.4) MICRONS

HOUR	9/28/79	9/29/79	9/30/79	10/1/79	10/2/79	10/3/79	10/4/79	10/5/79
0		7		30	18		109	
1	6	6			19		145	
2	7	6			22		137	
3	7	7			22		133	
4	7	5			17		97	
5		7			17		151	
6		9	4	21	21	67	224	
7	9	8	6	26	26	46	202	
8	10	12	12	12	20		199	11
9	12	6	9	24	16		62	135
10	12	7	11	61	27		30	109
11	12	5	8	31	24		28	
12	12		10	28	26			31
13	10		8	18	22			27
14	10		8	18	21			18
15	9		7	16	14			14
16			9	25	27			14
17	8		11	27	26			13
18	8		18	21	20	59		11
19	7		16	23	18			14
20	6		29	18	20	50		14
21	5		24	17		77		
22	5		37	23		92		26
23	6		41	16		110		22

FPN PARTICLES/CC IN SIZE RANGE (.7<DIA<1.4) MICRONS

HOUR	10/6/79	10/7/79	10/8/79	10/9/79	10/10/9	10/11/9	10/12/9	10/13/9
0		22	3087	3274	825	256	280	187
1	23	23	585	959	792	269	375	179
2	23	28	416	1799	785	316	488	133
3	24	33	380	3609	784	336	542	100
4	22	39	213		766	358	563	149
5	21	42	134	584	758	346	590	181
6	21	39	106		849	336	660	199
7	18	31	309		835	349	648	177
8	19	56	269	698	831	436	646	0
9	18	62			412	449	283	
10	19	60	330			402	591	
11	21	61	541			736	248	
12	25	65	391	431		2004	61	
13	26	69	511	2115	191	180	159	
14	19	73	661	568	77	172	171	
15	15		434	609	54	175	165	
16	13	96	737	651	476	265	228	
17	15	106	511		500	297	240	
18	15	123	2180	648	489	233	219	
19	16	131		641	487	290	18	
20	19	1275		675	340	345	25	
21	19	722		668	258	338	90	
22	21	3391		791	256	285	111	
23	22		2942	811	245	224	168	

FPN PARTICLES/CC IN SIZE RANGE (1.4<DIA<3.0) MICRONS

HOUR	9/12/79	9/13/79	9/14/79	9/15/79	9/16/79	9/17/79	9/18/79	9/19/79
0				25	19	93	143	62
1				26	17	98	128	65
2				24	16	109	141	62
3				24	15	77	150	64
4				23	12	72	138	88
5				19	12	70	146	96
6				22	12		237	114
7				29	13			106
8				26	11			57
9				35	13			53
10					12		229	37
11					11	33	170	38
12					13	64	119	75
13				25	23	76	95	73
14				28	26	73	73	75
15					33	74	71	76
16					44	100	61	76
17					52	124	51	51
18						155		40
19						119	66	43
20				20	57	138	66	52
21				26	63	173	60	46
22				27	88	104	58	46
23			24	21	93	170	59	47

FPN PARTICLES/CC IN SIZE RANGE (1.4<DIA<3.0) MICRONS

HOUR	9/20/79	9/21/79	9/22/79	9/23/79	9/24/79	9/25/79	9/26/79	9/27/79
0		55	13	14	43	18	126	
1	86	55	10	14	33	17	350	
2	113	54	15	14	32	18	248	
3	86	48	15	13	37	16	36	
4	180	40	15		44	19	181	
5	167	31	14		48	19	204	
6	162		15			15	219	
7	154		18		40	21	138	67
8	522	44	20	14	47	18	149	53
9	621	52	14	15	40	20	151	55
10	107	43	14		37	27	144	65
11	60	36	11		35	31	144	63
12	56	27	43		35	30	153	51
13	69	15	51	25	33	48	183	49
14	64	24	45	28	28	66	192	58
15	74	28	36	33	26	58	22	51
16	71			35	28	77	365	36
17	80		37	34		89	121	32
18	75		35	24		98	343	30
19	82	11	22	20		136	370	21
20	90	13	22	20	26	183	352	21
21	104	18	18	24	25	239	305	22
22	81	18	16	24	22	292	231	21
23	73	14	15		20	328	222	22

FPN PARTICLES/CC IN SIZE RANGE (1.4<DIA<3.0) MICRONS

HOUR	9/28/79	9/29/79	9/30/79	10/1/79	10/2/79	10/3/79	10/4/79	10/5/79
0		23		35	31		116	
1	24	22			38		117	
2	24	23			31		129	
3	26	23			39		133	
4	27	22			31		165	
5		22			35		146	
6		26	27	29	35	76	168	
7	31	21	25	30	37	58	190	
8	32	22	21	36	43		214	8
9	31	17	21	33	30		25	80
10	32	15	23	48	29		20	70
11	34	13	13	49	29		23	
12	33		13	34	21			15
13	32		13	33	28			16
14	33		14	31	38			11
15	42		15	33	33			10
16			19	27	34			9
17	41		19	31	37			8
18	39		31	30	24	58		7
19	26		32	29	33			9
20	22		33	31	33	55		9
21	19		27	32		60		
22	18		32	38		72		16
23	20		42	31		82		14

AD-A088 229 NAVAL RESEARCH LAB WASHINGTON DC F/G 4/2
PASSIVE 19.3 GHZ RADIOMETER AND AEROSOL DATA FROM THE NORTH SEA--ETC(U)
AUG 80 S G GATHMAN, B G JULIAN
UNCLASSIFIED NRL-MR-4285 NL

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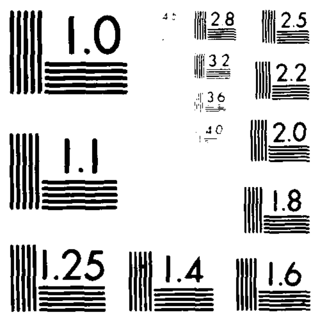

MICROCOPY RESOLUTION TEST CHART

FPN PARTICLES/CC IN SIZE RANGE (1.4<DIA<3.0) MICRONS

HOUR	10/6/79	10/7/79	10/8/79	10/9/79	10/10/9	10/11/9	10/12/9	10/13/9
0		16	2620	2662	2315	269	433	250
1	16	16	1176	2762	2222	288	709	252
2	15	19	621	2499	2445	371	1344	173
3	16	23	538	2782	2636	422	1510	132
4	15	28	238		2396	518	1468	193
5	15	33	110	2438	2164	493	1593	214
6	16	31	87		2496	490	2680	234
7	14	25	322		2078	501	2440	196
8	15	40	1290	1287	1601	761	2387	0
9	14	45	944		760	888	2798	
10	16	45	889			809	2130	
11	16	45	1497			1767	337	
12	18	49	1505	1466		1958	60	
13	18	55	1245	2779	20	272	174	
14	14	59	1519	635	132	213	292	
15	12		1624	794	100	243	326	
16	11	87	1903	965	543	534	549	
17	12	100	2271		628	720	535	
18	12	117	2485	962	593	435	416	
19	12	129		962	613	505	24	
20	14	1346		1061	374	854	31	
21	14	1118		1098	271	944	112	
22	17	1911	2445	1743	264	608	118	
23	17		2667	1906	249	318	218	

FPN PARTICLES / CC IN SIZE RANGE (3.0<DIA<5.0) MICRONS

HOUR	9/12/79	9/13/79	9/14/79	9/15/79	9/16/79	9/17/79	9/18/79	9/19/79
0				0.04	1.18	5.75	4.96	2.29
1				0.03	1.01	6.18	5.34	2.72
2				0.02	0.95	7.07	5.49	2.08
3				0.02	1.08	3.73	6.12	1.74
4				0.02	0.80	3.14	6.66	2.93
5				0.01	0.79	2.64	7.59	2.15
6				0.03	0.67		12.68	3.33
7				0.00	0.74			3.45
8				0.05	0.42			1.30
9				0.74	0.63			1.47
10					0.60		9.31	0.95
11					0.54	0.58	4.08	0.71
12					0.66	2.28	3.38	1.77
13				0.49	0.87	3.22	3.34	1.47
14				0.92	0.55	3.32	0.80	1.72
15					0.72	2.96	0.61	1.81
16					1.37	5.54	0.55	1.82
17					2.38	6.80	0.52	0.21
18						8.00		0.18
19						5.77	3.56	0.35
20				0.76	3.19	5.69	3.38	1.35
21				1.32	3.53	5.15	3.00	1.28
22				1.67	4.28	4.49	2.27	1.21
23			0.03	1.19	4.97	5.12	2.18	0.90

FPN PARTICLES / CC IN SIZE RANGE (3.0<DIA<5.0) MICRONS

HOUR	9/20/79	9/21/79	9/22/79	9/23/79	9/24/79	9/25/79	9/26/79	9/27/79
0		0.72	0.57	0.65	1.10	0.50	11.75	
1	1.85	0.72	0.43	0.61	1.36	0.44		
2	1.29	1.52	0.60	0.47	0.88	0.45	9.27	
3	2.18	0.95	0.70	0.44	0.55	0.33	9.20	
4	0.35	0.54	0.64		1.31	0.53	5.81	
5	0.31	0.32	0.58		1.31	0.24	7.69	
6	0.25		0.84			0.20	5.94	
7	11.42		1.27		1.45	0.47	5.53	2.84
8	4.78	2.13	1.46	0.43	1.58	0.59	4.80	2.45
9	3.83	1.93	0.79	0.50	1.24	0.65	4.90	2.81
10	3.36	2.03	0.77		1.09	1.28	4.67	3.32
11	3.01	2.20	0.66		0.99	1.73	4.89	3.58
12	2.29	0.93	1.43		0.98	1.42	4.66	2.78
13	3.09	1.00	2.08	1.35	0.55	2.28	11.81	2.21
14	1.82	1.19	1.45	1.60	0.64	3.21	8.80	2.73
15	3.49	1.61	1.28	1.99	0.49	2.11	13.74	2.10
16	3.54			1.92	1.19	3.53	33.95	1.57
17	4.01		1.49	1.85		4.61	20.80	1.91
18	3.22		1.61	1.01		2.96	28.03	1.69
19	3.76	0.28	1.02	0.61		3.94	9.97	0.68
20	4.92	0.54	1.04	0.82	0.87	4.88	15.62	0.70
21	6.60	0.86	1.00	1.59	0.72	4.86	10.76	0.74
22	3.27	0.81	0.95	1.09	0.64	5.42	11.55	0.70
23	2.64	0.61	0.76		0.67	8.38	9.42	0.84

FPN PARTICLES / CC IN SIZE RANGE (3.0<DIA<5.0) MICRONS

HOUR	9/28/79	9/29/79	9/30/79	10/1/79	10/2/79	10/3/79	10/4/79	10/5/79
0		0.77		0.58	0.53		1.11	
1	0.92	0.80			0.54		1.04	
2	0.93	0.88			0.66		0.92	
3	1.04	0.79			0.62		1.02	
4	1.15	0.78			0.61		0.92	
5		0.72			0.62		0.95	
6		0.76	0.67	0.44	0.64	0.80	0.99	
7	1.09	0.69	0.69	0.61	0.68	0.56	1.01	
8	1.06	0.62	0.50	0.70	0.69		1.06	0.01
9	0.94	0.55	0.60	0.48	0.49		0.09	0.27
10	0.95	0.45	0.50	0.60	0.42		0.14	0.13
11	1.13	0.37	0.45	0.65	0.45		0.08	
12	1.08		0.10	0.44	0.23			0.03
13	1.22		0.13	0.45	0.21			0.03
14	1.43		0.10	0.46	0.41			0.09
15	1.76		0.18	0.26	0.23			0.09
16			0.16	0.40	0.36			0.07
17	1.49		0.56	0.31	0.53			0.10
18	1.53		0.51	0.43	0.43	0.68		0.07
19	0.95		0.41	0.50	0.58			0.08
20	0.83		0.55	0.42	0.47	0.93		0.09
21	0.71		0.54	0.65		1.05		
22	0.70		0.50	0.68		1.15		0.13
23	0.72		0.69	0.57		0.81		0.11

FPN PARTICLES / CC IN SIZE RANGE (3.0<DIA<5.0) MICRONS

HOUR	10/6/79	10/7/79	10/8/79	10/9/79	10/10/9	10/11/9	10/12/9	10/13/9
0		0.28	54.23	120.22	28.87	3.47	0.66	0.77
1	0.11	0.28	9.01	214.31	29.45	2.99	1.57	0.84
2	0.11	0.19	3.80	161.20	43.72	2.70	8.03	0.51
3	0.09	0.18	4.49	103.07	57.81	2.30	10.51	0.84
4	0.09	0.15	2.55		42.12	3.50	9.01	0.55
5	0.09	0.13	1.72	65.33	31.13	3.21	11.61	0.44
6	0.10	0.16	2.08		38.03	3.21	71.13	0.51
7	0.07	0.42	5.69		20.00	2.81	44.01	0.58
8	0.06	0.06	148.43	3.94	7.96	5.51	39.20	0.00
9	0.07	0.07			3.07	11.39	95.69	
10	0.15	0.06	29.49			17.74	52.01	
11	0.11	0.07	172.37			275.04	3.32	
12	0.13	0.07	235.77	5.69		453.29	0.22	
13	0.09	0.04	127.52	18.50	2.47	1.82	1.06	
14	0.09	0.05	167.59	2.08	1.43	6.02	0.22	
15	0.09		160.51	3.14	1.40	5.15	0.26	
16	0.14	0.04	174.34	4.12	1.68	4.64	1.39	
17	0.16	0.03	209.45		2.12	6.39	1.53	
18	0.23	0.03	381.46	4.09	2.52	4.56	0.73	
19	0.25	0.03		3.58	2.59	4.05	1.06	
20	0.34	0.62		3.39	2.12	5.58	0.95	
21	0.32	2.74		2.08	2.04	3.32	1.61	
22	0.36	26.86		11.09	1.90	1.02	0.66	
23	0.33		139.45	12.88	2.63	0.22	0.55	

FPN PARTICLES / CC IN SIZE RANGE (5.0<DIA) MICRONS

HOUR	9/12/79	9/13/79	9/14/79	9/15/79	9/16/79	9/17/79	9/18/79	9/19/79
0				0.01	0.13	0.78	0.64	0.42
1				0.00	0.09	0.92	0.86	0.56
2				0.00	0.11	1.18	0.82	0.32
3				0.00	0.15	0.46	1.04	0.19
4				0.00	0.11	0.38	1.00	0.42
5				0.00	0.11	0.22	1.20	0.13
6				0.00	0.07		2.61	0.64
7				0.00	0.10			0.66
8				0.00	0.03			0.05
9				0.02	0.05			0.11
10					0.07		0.95	0.00
11					0.07	0.03	0.15	0.02
12					0.09	0.19	0.25	0.09
13				0.01	0.10	0.43	0.36	0.09
14				0.04	0.02	0.50	0.01	0.15
15					0.04	0.40	0.01	0.18
16					0.07	1.00	0.01	0.18
17					0.22	1.25	0.01	0.00
18						1.50		0.00
19						1.19	0.74	0.00
20				0.04	0.42	0.04	0.77	0.12
21				0.09	0.38	0.60	0.66	0.13
22				0.13	0.34	0.93	0.41	0.12
23			0.00	0.09	0.53	0.55	0.38	0.07

FPN PARTICLES / CC IN SIZE RANGE (5.0<DIA) MICRONS

HOUR	9/20/79	9/21/79	9/22/79	9/23/79	9/24/79	9/25/79	9/26/79	9/27/79
0		0.03	0.08	0.09	0.28	0.05	2.62	
1	0.17	0.03	0.06	0.07	0.16	0.05		
2	0.18	0.26	0.08	0.05	0.09	0.03	2.50	
3	0.62	0.09	0.08	0.04	0.04	0.03	1.71	
4	0.00	0.03	0.06		0.12	0.04	0.87	
5	0.00	0.01	0.06		0.10	0.01	1.11	
6	0.00		0.20			0.01	1.27	
7	2.13		0.23		0.15	0.05	0.95	0.46
8	0.58	0.28	0.31	0.03	0.30	0.05	0.76	0.26
9	0.29	0.15	0.16	0.05	0.09	0.06	0.83	0.39
10	0.73	0.37	0.15		0.10	0.12	0.72	0.46
11	0.84	0.36	0.14		0.08	0.20	0.84	0.51
12	0.36	0.11	0.23		0.08	0.21	0.82	0.32
13	0.49	0.29	0.34	0.23	0.04	0.22	5.73	0.22
14	0.17	0.26	0.19	0.25	0.06	0.41	2.62	0.42
15	0.56	0.30	0.19	0.36	0.04	0.21	6.39	0.29
16	0.70			0.36	0.12	0.38	6.19	0.33
17	0.81		0.24	0.31		0.46	5.73	0.27
18	0.51		0.33	0.12		0.34	4.35	0.24
19	0.56	0.02	0.13	0.04		0.48	1.63	0.05
20	1.12	0.10	0.15	0.09	0.08	0.51	2.47	0.06
21	1.64	0.17	0.13	0.31	0.08	0.53	1.76	0.06
22	0.48	0.12	0.14	0.18	0.08	1.06	1.76	0.07
23	0.34	0.09	0.11		0.05	1.13	1.65	0.08

FPN PARTICLES / CC IN SIZE RANGE (5.0<DIA) MICRONS

HOUR	9/28/79	9/29/79	9/30/79	10/1/79	10/2/79	10/3/79	10/4/79	10/5/79
0		0.07		0.04	0.06		0.15	
1	0.11	0.08			0.12		0.14	
2	0.10	0.09			0.07		0.09	
3	0.11	0.07			0.03		0.13	
4	0.10	0.08			0.06		0.11	
5		0.07			0.09		0.12	
6		0.07	0.06	0.05	0.09	0.14	0.07	
7	0.10	0.08	0.07	0.04	0.10	0.09	0.14	
8	0.09	0.07	0.04	0.07	0.06		0.19	0.00
9	0.09	0.05	0.05	0.05	0.05		0.01	0.01
10	0.07	0.05	0.05	0.10	0.06		0.01	0.00
11	0.10	0.04	0.04	0.06	0.05		0.02	
12	0.11		0.01	0.04	0.03			0.01
13	0.12		0.00	0.02	0.03			0.01
14	0.15		0.01	0.03	0.04			0.01
15	0.19		0.00	0.01	0.03			0.01
16			0.00	0.03	0.05			0.01
17	0.13		0.03	0.05	0.06			0.01
18	0.15		0.04	0.05	0.05	0.10		0.01
19	0.11		0.06	0.06	0.08			0.02
20	0.07		0.05	0.09	0.04	0.17		0.01
21	0.07		0.05	0.05		0.15		
22	0.05		0.04	0.08		0.15		0.01
23	0.07		0.03	0.06		0.10		0.01

FPN PARTICLES / CC IN SIZE RANGE (5.0<DIA) MICRONS

HOUR	10/6/79	10/7/79	10/8/79	10/9/79	10/10/9	10/11/9	10/12/9	10/13/9
0		0.05	1.20	14.16	0.73	0.44	0.15	0.15
1	0.01	0.04	0.40	32.81	1.53	0.44	0.15	0.15
2	0.01	0.04	0.55	22.99	2.12	0.40	0.26	0.07
3	0.01	0.03	0.62	8.32	3.14	0.29	0.58	0.07
4	0.01	0.03	0.36		2.74	0.44	0.69	0.07
5	0.00	0.02	0.18	1.61	2.15	0.40	0.77	0.07
6	0.01	0.03	0.26		1.61	0.47	2.08	0.07
7	0.00	0.13	0.95		1.13	0.40	1.75	0.07
8	0.01	0.01	54.16	0.22	0.55	0.80	1.61	0.00
9	0.01	0.01			0.15	2.66	7.88	
10	0.01	0.01	3.94			4.93	6.64	
11	0.01	0.01	40.07			89.01	1.24	
12	0.01	0.01	91.24	0.40		218.25	0.00	
13	0.01	0.01	59.89	1.86	0.28	0.33	0.22	
14	0.02	0.01	77.96	0.15	0.16	1.61	0.00	
15	0.01		98.07	0.33	0.15	1.35	0.00	
16	0.02	0.01	69.05	0.47	0.22	0.73	0.07	
17	0.03	0.00	64.16		0.26	0.99	0.26	
18	0.04	0.01	110.88	0.44	0.26	0.69	0.11	
19	0.04	0.01		0.29	0.29	0.62	0.33	
20	0.06	0.07		0.26	0.29	0.55	0.15	
21	0.06	0.15		0.04	0.26	0.07	0.36	
22	0.06	0.00		0.29	0.22	0.00	0.11	
23	0.05		19.16	0.33	0.44	0.04	0.11	

11. APPENDIX III — RADIOMETER DATA

RADIATION TEMPERATURE @19.3 GHZ (VERTICAL POL) AT FPN

DATE	TIME GMT	RAD TEMP @20 DEG	RAD TEMP @30 DEG	RAD TEMP @40 DEG	RAD TEMP @50 DEG	RAD TEMP @60 DEG	RAD TEMP @70 DEG
91479	1600					176.8	
91479	2000					180.1	
91579	700					186.1	
91579	800					186.0	
91579	1000					186.0	
91579	1300					183.7	
91579	1600					183.5	
91579	2000					177.2	
91679	700				176.1		
91679	1000				181.5	205.7	225.5
91679	1200			165.2			
91679	1500			164.8			
91679	1700			173.2	188.3		
91679	2000				187.2		
91779	700				207.9		
91779	1000				192.6		
91779	1400				184.8		
91779	1600				189.3		
91779	2000				184.9		
91879	700				192.6		
91879	1000				181.4		
91879	1600				183.9		
91879	1800				184.0		
91979	700				186.1		
91979	900				192.8		
91979	1200				189.3	211.0	237.1
92079	700				193.7		
92079	1200				175.9		
92079	1500				184.1		

RADIATION TEMPERATURE @19.3 GHZ (VERTICAL POL) AT FPN

DATE	TIME GMT	RAD TEMP @28 DEG	RAD TEMP @38 DEG	RAD TEMP @48 DEG	RAD TEMP @58 DEG	RAD TEMP @68 DEG	RAD TEMP @78 DEG
92079	2100				184.1		
92179	800				186.3		
92179	1600				181.7		
92179	2000				179.9		
92279	700				176.8		
92279	800				176.8		
92279	1600				182.8		
92279	2000				177.6		
92379	800				178.6		
92379	1000		134.6	164.7	179.8	204.6	
92379	1500		134.6	166.9	185.2	207.8	
92379	2000		173.4	182.0	194.9	214.3	
92479	700		177.7	177.7	190.6	210.0	
92479	1000			163.6	180.8	203.4	
92479	1500				168.9	204.0	
92479	2000			156.8	175.3	201.4	
92579	700			160.1	178.6	204.7	
92579	1200		155.0	164.7	181.9	204.5	
92579	1500		161.1	169.8	182.9	205.7	
92579	2000			174.2	187.2	209.0	
92679	700			171.1	187.2	208.8	
92679	1100			173.0	189.3	211.0	
92679	1500			173.9	189.3	212.4	
92679	2000		165.4	177.4	193.7	214.4	
92779	700			174.3	189.4	208.8	
92779	1000			172.5	190.0	206.4	
92779	1500			162.5	178.9	201.9	
92779	2000			162.6	177.7	201.4	
92879	700			163.3	180.7	203.5	

RADIATION TEMPERATURE @ 19.3 GHZ (VERTICAL POL) AT FPN

DATE	TIME GMT	RAD TEMP @28 DEG	RAD TEMP @38 DEG	RAD TEMP @48 DEG	RAD TEMP @58 DEG	RAD TEMP @68 DEG	RAD TEMP @78 DEG
92879	1100			161.8	179.9	202.3	
92879	1200			160.3	177.6	201.2	
92879	1400			163.1	181.4	201.8	
92879	1600			164.1	181.5	205.4	
92879	2000			157.5	176.2	201.5	
92979	700		151.8	161.5	178.7	202.4	
92979	1000			154.6	171.8	195.5	220.3
92979	1500			162.5	180.8	204.5	226.1
92979	2000			152.4	170.8	199.4	223.5
93079	700		146.5	158.3	177.7	205.7	230.4
93079	1200		146.9	160.0	179.5	207.8	233.9
93079	1600		146.0				
93079	2000			158.1	177.1	204.5	227.7
100179	700			165.6	179.3	203.5	
100179	1000			169.6	179.1	200.2	
100179	1500			164.4	178.5	201.4	219.9
100279	700				176.6	200.3	216.4
100279	1000				178.9	200.2	216.2
100279	1600			169.5	180.4	199.9	217.3
100279	2000				185.3	200.2	216.2
100379	700			176.0	184.4	199.2	214.0
100379	1000				182.0	199.2	216.4
100379	1800				184.4	205.5	220.2
100379	2000				184.4	205.5	226.6
100479	700				187.4	215.2	234.3
100479	1000				187.6	208.5	
100479	1800				180.1	206.5	222.3
100579	700				188.6	205.5	222.4
100579	1200				205.5	211.8	226.6

RADIATION TEMPERATURE @ 19.3 GHZ (VERTICAL POL) AT FPN

DATE	TIME GMT	RAD TEMP @20 DEG	RAD TEMP @30 DEG	RAD TEMP @40 DEG	RAD TEMP @50 DEG	RAD TEMP @60 DEG	RAD TEMP @70 DEG
100579	1600				201.4	218.6	227.2
100579	2000				190.7	209.7	225.6
100679	700				187.6	206.6	222.4
100679	1200				187.5	205.4	222.3
100679	1600				187.4	207.4	224.3
100779	700				187.5	209.7	230.8
100779	1100				184.3	209.6	230.7
100779	1600				210.7	227.6	246.2
100779	2100				188.5	213.8	237.0
100879	700				183.1	211.9	235.3
100879	1100				184.1	209.9	233.6
100879	1400						236.7
100879	1600			165.6	183.9	213.0	239.9
100879	2000		149.6	162.5	179.7	206.6	229.2
100979	700		155.0	166.8	184.0	209.9	229.2
100979	1000	151.9	160.5	171.2	188.5	214.3	232.6
100979	1600	148.7	156.4	171.8	189.4	215.7	237.7
100979	2100	151.7	159.3	173.3	190.5	217.4	240.0
101079	700	147.3					
101079	1600	148.0	155.1	169.3	186.7	212.8	235.6
101079	2100	148.1	155.7	168.7	187.2	213.3	235.1
101179	700				188.2	213.2	231.7
101179	1800	145.4	154.2	169.5	188.2	216.8	243.2
101179	2200	148.9	157.7	169.8	189.5	219.2	243.4
101279	1200	147.9	154.4	167.5	186.0	213.1	238.2
101279	1800	145.2	152.9	167.2	185.9	215.6	243.1
101279	2200	148.0	152.4	164.3	182.8	206.7	228.5
101379	700	161.0		162.1	180.6	212.1	241.5

RADIATION TEMPERATURE @ 19.3 GHZ (HORIZONTAL POL) AT FPN

DATE	TIME GMT	RAD TEMP @20 DEG	RAD TEMP @30 DEG	RAD TEMP @40 DEG	RAD TEMP @50 DEG	RAD TEMP @60 DEG	RAD TEMP @70 DEG
91479	1600					107.2	
91479	2000					123.9	
91579	700					126.9	
91579	1000					123.7	
91579	1300					127.8	
91579	1600					126.5	
91579	2000					116.2	
91679	700				114.0		
91679	1000				123.3	117.0	114.8
91679	1200			133.8			
91679	1500			130.5			
91679	1700			137.6	133.4		
91679	2000				131.7		
91779	700				131.7		
91779	1000				133.8		
91779	1400				135.8		
91779	1600				133.8		
91779	2000				143.3		
91879	700				138.0		
91879	1000				133.7		
91879	1600				128.1		
91879	1800				122.2		
91979	700				126.3		
91979	900				138.2		
91979	1200				134.8	133.8	143.3
91979	2000				119.0		
92079	700				144.9		
92079	1200				133.7		
92079	1500				125.2		

RADIATION TEMPERATURE @ 19.3 GHZ (HORIZONTAL POL) AT FPN

DATE	TIME GMT	RAD TEMP @20 DEG	RAD TEMP @30 DEG	RAD TEMP @40 DEG	RAD TEMP @50 DEG	RAD TEMP @60 DEG	RAD TEMP @70 DEG
92079	2000				125.2		
92179	800				129.8		
92179	1600				127.0		
92179	2000				117.9		
92279	700				110.6		
92279	800				110.6		
92279	1600				115.8		
92279	2000				114.8		
92379	800				112.9		
92379	1000		138.1	127.6	118.2	109.8	
92379	1500		138.1	131.8	125.5	119.1	
92379	2000		159.9	145.1	139.9	140.9	
92479	700		160.1	142.3	135.0	127.6	
92479	1000			126.8	139.4	111.0	
92479	1500				114.6	110.6	
92479	2000			116.4	107.9	99.5	
92579	700			120.3	112.2	105.5	
92579	1200		135.9	128.6	122.3	114.9	
92579	1500		148.7	138.1	131.8	128.6	
92579	2000			142.7	138.4	134.2	
92679	700			137.2	132.0	128.9	
92679	1100			138.0	133.8	129.6	
92679	1500			143.8	136.4	133.6	
92679	2000		159.2	144.4	142.3	136.0	
92779	700			134.9	130.7	125.4	
92779	1000			134.9	129.6	117.0	
92779	1500			123.4	116.1	107.6	
92779	2000			120.7	112.3	102.9	
92879	700			121.6	113.1	106.7	

RADIATION TEMPERATURE @ 19.3 GHZ (HORIZONTAL POL) AT FPN

DATE	TIME GMT	RAD TEMP @20 DEG	RAD TEMP @30 DEG	RAD TEMP @40 DEG	RAD TEMP @50 DEG	RAD TEMP @60 DEG	RAD TEMP @70 DEG
92879	1100			122.6	115.3	106.9	
92879	1200			120.5	112.2	105.9	
92879	1400			125.8	117.4	110.1	
92879	1600			123.1	116.8	109.4	
92879	2000			117.1	110.8	103.4	
92979	700		131.8	120.2	113.9	106.5	
92979	1000			124.8	118.5	112.2	104.9
92979	1600			124.8	117.4	110.1	103.8
92979	2000			111.6	103.9	94.0	89.6
93079	700		123.4	115.0	106.5	99.1	94.9
93079	1100		125.8	117.3	107.8	99.3	96.1
93079	2000			75.5	65.5	54.2	
100179	700			125.7	115.4	104.1	
100179	1000			136.4	120.2	110.0	
100179	1500			127.7	117.1	108.7	101.3
100279	800			126.6	119.4	110.2	103.0
100279	1000				121.7	115.5	99.8
100279	1600			152.9	121.3	121.3	103.4
100279	2000				130.3	116.1	105.9
100379	700			142.5	126.3	112.1	104.0
100379	1000			145.5	122.8	110.4	102.1
100379	1800				123.5	115.2	109.0
100379	2000				128.2	118.1	114.0
100479	700				134.8	140.9	143.0
100479	1000				126.5	122.4	
100479	1800				127.6	123.5	119.4
100579	700				150.6	146.6	144.5
100579	1200				150.6	148.6	146.5
100579	1600				151.7	149.7	155.9

RADIATION TEMPERATURE @ 19.3 GHZ (HORIZONTAL POL.) AT FPN

DATE	TIME GMT	RAD TEMP @20 DEG	RAD TEMP @30 DEG	RAD TEMP @40 DEG	RAD TEMP @50 DEG	RAD TEMP @60 DEG	RAD TEMP @70 DEG
100579	2100				138.9	138.9	145.0
100679	700				134.4	131.4	128.3
100679	1200				130.2	126.2	122.1
100679	1600				134.2	126.1	122.0
100779	700				130.6	122.4	118.4
100779	1000				124.4	120.3	116.2
100779	1600				130.2	128.1	120.9
100779	2100				129.5	127.5	128.5
100879	700				123.1	118.0	118.0
100879	1100				126.6	122.5	119.4
100879	1400						120.6
100879	1600		135.6	129.4	122.3	118.2	121.3
100879	2000		133.6	126.5	121.3	115.2	114.2
100979	700		137.1	129.9	123.7	120.6	118.5
100979	1000	146.1	146.1	141.9	134.6	129.4	126.3
100979	1600	147.3	143.2	140.0	137.9	134.8	133.8
100979	2100	150.0	145.9	139.8	136.7	134.7	137.8
101079	700	143.3					
101079	1600	144.0	139.8	133.4	127.1	122.9	125.0
101079	2100	145.0	140.9	135.6	134.6	130.4	132.5
101179	700				157.4	134.5	129.2
101179	1800	143.6	138.3	153.1	127.7	126.7	132.0
101179	2200	148.3	144.2	136.9	133.7	136.9	136.9
101279	700	143.8	138.5	131.2	130.2	130.2	126.0
101279	1800	142.2	137.0	131.7	126.4	123.3	130.6
101279	2200	142.3	133.9	127.5	122.3	115.9	110.7
101379	700	134.8	129.6	122.2	116.9	112.7	118.0