

NOAA Technical Memorandum ERL ARL-183



METEOROLOGICAL CONDITIONS OVER THE NORTH ATLANTIC OCEAN
DURING GCE/CASE/WATOX

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Air Resources Laboratory
Silver Spring, Maryland
June 1990

noaa

NATIONAL OCEANIC AND
ATMOSPHERIC ADMINISTRATION

Environmental Research
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CONTENTS

	Page
Abstract	
1. INTRODUCTION	1
2. PRODUCT DESCRIPTION AND AVAILABILITY	2
2.1 MRF Archive	2
2.2 CLASS Soundings	2
2.3 Cross-Sections	4
2.4 Air Mass Fluxes	4
2.5 Isentropic Trajectory Analysis	7
2.6 Isobaric Trajectory Analysis	7
3. METEOROLOGICAL OVERVIEW	8
3.1 Synoptic Meteorology	8
3.2 Upper-Air Soundings	12
3.3 Trajectories	25
3.4 <u>Mt. Mitchell</u> Deck Log Data	29
4. DISCUSSION OF METEOROLOGY BY CRUISE LEG	29
4.1 Leg 1: Norfolk to Bermuda	35
4.1.1 Norfolk area - <u>Mt. Mitchell</u> data and general overview	35
4.1.2 Norfolk area - King Air intensives	41
4.1.3 Norfolk to Bermuda	41
4.1.4 Bermuda area - <u>Mt. Mitchell</u> data and general overview	52
4.1.5 Bermuda area - King Air intensives	52
4.2 Leg 2: Bermuda to Iceland	61
4.3 Leg 3: Iceland to the Azores	61
4.4 Leg 4: The Azores to Barbados	72
4.4.1 The Azores to South Station	72
4.4.2 South Station to Barbados	72
5. SUMMARY	79
6. ACKNOWLEDGEMENTS	79
7. REFERENCES	82
Appendix A - 850 hPa synoptic analyses	
Appendix B - <u>Mt. Mitchell</u> deck log data	

METEOROLOGICAL CONDITIONS OVER THE NORTH ATLANTIC OCEAN DURING GCE/CASE/WATOX

Abstract. During the summer of 1988, a team of scientists aboard the NOAA ship Mt. Mitchell and the NOAA King Air aircraft investigated the spatial distributions of sulfur, nitrogen, and related species and their interactions during transport from North America. In support of these measurements, meteorological data from the National Meteorological Center and from rawinsonde data obtained from the ship were archived and back-trajectories were calculated. A summary of the meteorological conditions during the cruise is presented using synoptic maps, soundings, cross-sections and isobaric and isentropic back-trajectories. Since day-to-day variability of the synoptic situation was usually small, one representative day from each meteorological regime was chosen to illustrate the overall meteorology. During the cruise, three synoptic regimes were encountered: (1) north of the polar front, (2) the Bermuda/Azores High, and (3) the Intertropical Convergence Zone (ITCZ). Sounding data and derived parameters from three different days illustrate these regimes. Boundary layer depth and cloud layers were also estimated from all the soundings. Cross-sections of temperature and wind, potential temperature, relative humidity, mixing ratio, and air fluxes describing the vertical structure of the atmosphere along the cruise show the general day-to-day uniformity except near the polar front and at the ITCZ boundary. The back-trajectories show general air flow patterns and the land mass source regions of air reaching the ship within three days. For parts of the cruise, air reached the ship from North America, Iceland or Greenland, Africa, and South America.

1. INTRODUCTION

The spatial distributions of sulfur, nitrogen, and related species and their interactions during transport from North America were investigated from the NOAA ship Mt. Mitchell and the NOAA King Air aircraft during the Global Change Expedition/Coordinated Air-Sea Experiment/Western Atlantic Ocean Experiment (GCE/CASE/WATOX) in 1988. The Mt. Mitchell's cruise track is composed of 4 "Legs": (1) Norfolk, Virginia to Bermuda, (2) Bermuda to Iceland, (3) Iceland to the Azores, and (4) the Azores to Barbados. The King Air flew in the vicinity of the Mt. Mitchell near Norfolk and Bermuda (Gunter and Boatman, 1989). An overview of the experiment is given by Pszenny et al. (1990). An extensive meteorological data archive was produced to assist scientists in interpreting chemical data that were measured from the ship. The archive consists of synoptic maps, vertical profiles of measured and derived meteorological parameters obtained from upper-air soundings taken from the ship, vertical cross-sections of meteorological parameters and air flux, and isentropic and isobaric air-parcel back-trajectories.

This report describes the archived meteorological products and discusses the meteorology through selected synoptic maps, soundings, back-trajectories, and leg-by-leg vertical cross-sections. In addition, the back-trajectories were used to indicate overall air flow and source regions of atmospheric

constituents measured on the ship. Daily boundary layer depth and estimated cloud layer heights are also given.

2. PRODUCT DESCRIPTION AND AVAILABILITY

The GCE/CASE/WATOX cruise produced a wealth of meteorological information, owing principally to the availability of forecast initialization products archived from the Medium-Range Forecast (MRF) model of the National Weather Service (NWS) and the collection of rawinsonde data from the Mt. Mitchell. In addition, cross-sections of several measured or derived variables were plotted versus height for each leg of the cruise, and two trajectory models (one isentropic and one isobaric) were used to give additional information for use in understanding synoptic-scale flow over the cruise track. Product examples which illustrate the synoptic conditions encountered during the cruise and the observed flow patterns are presented in Sections 3 and 4. The following information gives a description of products available and their methods of calculation or collection.

2.1 MRF Archive

Synoptic weather maps were archived during the experiment using data produced by a global weather forecasting model at the National Meteorological Center (NMC) near Washington, DC. The synoptic maps were derived from the twice-daily Aviation (AVN) run of the MRF model (Sela, 1980). The primary purpose of the AVN run of the MRF model is to provide meteorological guidance in support of NMC's national and international aviation responsibilities. The synoptic maps in the MRF archive were produced using the WATOX AVN plotting routine described by Rolph and Stunder (1989). The MRF archive consists of six synoptic maps per cruise day beginning on July 15, 1988 and ending on September 7, 1988. Only the 12 GMT periods have been retained. Archived maps for the North Atlantic region include:

- mean sea level pressure analysis
- 850, 700, and 500 hPa height analyses
- 850 and 700 hPa relative humidity analyses,

All maps are included in the GCE/CASE/WATOX Meteorological Compendium available upon request from the authors.

2.2 CLASS Soundings

The Cross-chain LORAN Atmospheric Sounding System (CLASS) was developed by the National Center for Atmospheric Research (NCAR) to meet the rawinsonde needs of the meteorological research community (Lauritsen et al., 1987). CLASS is a self-contained system which includes a launch apparatus, an electronics rack for receiving the sonde radio frequency signals, and a microcomputer for data acquisition and processing. During the GCE/CASE/WATOX cruise, wind and thermodynamic data were collected one to four times each day using 200 gram balloons and the CLASS system. The location, day, and time of each sounding are presented in Fig. 2-1. Soundings continued to be recorded during the south end of leg 3 (from Iceland to the Azores), although no wind data were recorded over this portion of leg 3 or for any part of leg 4 due to the absence of LORAN signals. With a few notable exceptions, high quality wind data were recorded for legs 1 and 2 and for most of leg 3.

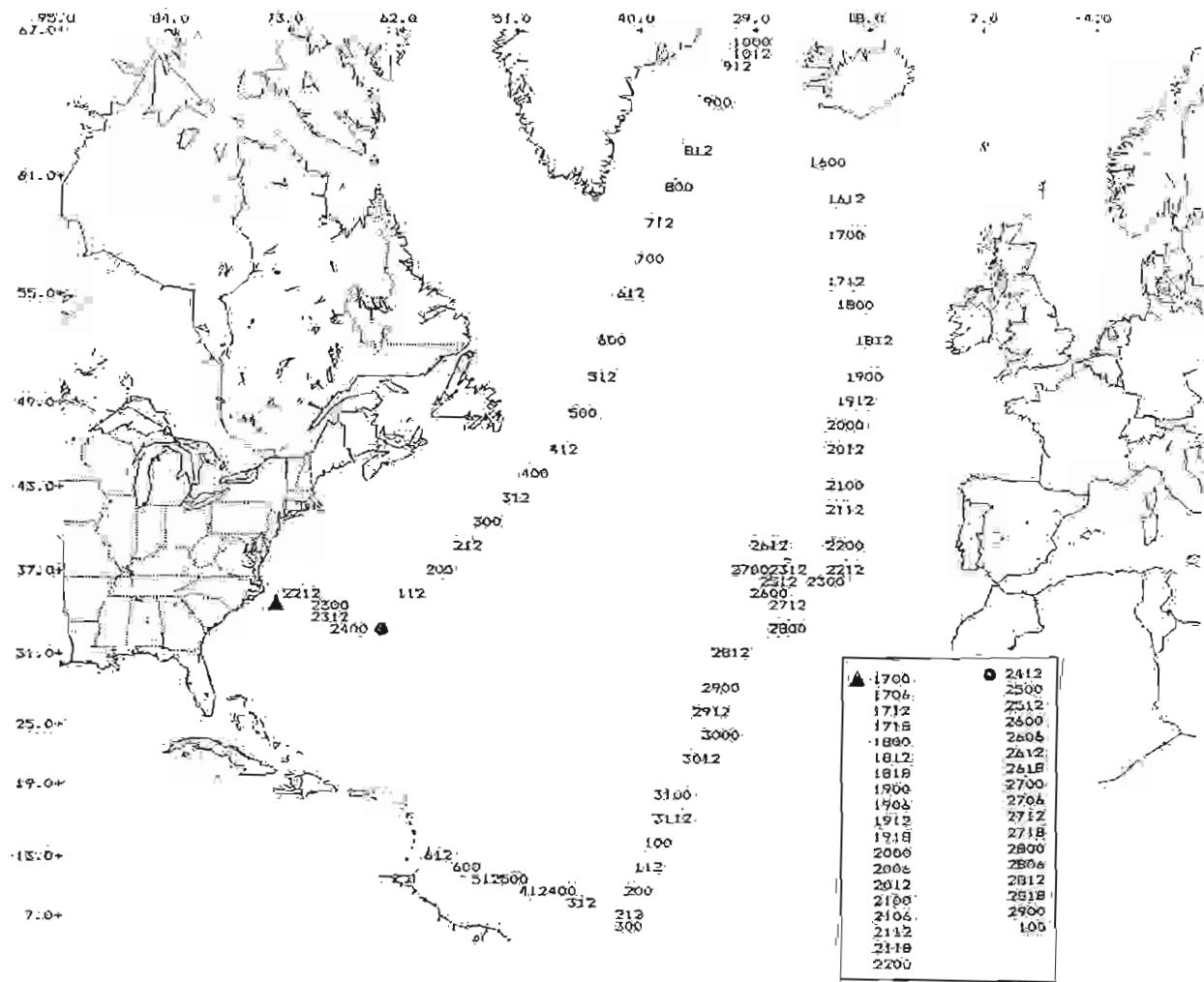


Figure 2-1. Cruise track as identified by CLASS sounding date/time (DDHH). Soundings began 17 July and ended 6 September 1988. Solid triangle and dot show the location of the Mt. Mitchell when it was nearly stationary off Norfolk and Bermuda, respectively; see inset for list of soundings recorded during these periods.

Data processing by the microcomputer on the ship produced two files: one formatted to meet the NWS data reporting requirements; and a second which contained all data recorded at 10-second intervals. NWS-formatted data were beamed via satellite to a mainframe computer on Wallops Island, Virginia, using a commercially available Handar Inc. Model 540 unit (J. Schiesl, personal communication, 1988) and subsequently were incorporated into the MRF model forecast runs performed at NMC. It is our belief that the additional upper-air data enhanced the initialization data used to run the MRF model and eventually resulted in improved trajectory calculations. Vertical profiles of the following parameters, using the 10-second data, are available: temperature and dew point; relative humidity; specific humidity; U and V wind components; potential temperature and equivalent potential temperature; virtual temperature; mixing ratio and saturation mixing ratio; and vapor pressure and saturation vapor pressure. Plots for all available soundings are included in the GCE/CASE/WATOX Meteorological Compendium. Examples of thermodynamic data collected using this system are shown in Section 3.2.

2.3 Cross-Sections

The meteorological cross-sections shown in Section 4 serve two purposes. They show meteorological data in time along the ship's course and in the vertical at a given time based on individual soundings. Meteorological parameters displayed in the cross-sections include:

- wind vectors and temperature
- relative humidity
- potential temperature
- mixing ratio.

The cross-sections were produced using the CLASS sounding data for altitudes from the surface to 10000 m. Sounding data were extracted at 100 s intervals before producing the cross-sections. Meteorological cross-sections usually are either a section in time or space; however, since the ship took soundings while moving, the sections produced for most of the cruise are actually time and space sections. The exceptions are the intensive periods near Norfolk and Bermuda when the ship was nearly stationary; for these periods, true time sections were produced. Cross-sections for the following cruise segments were produced and are included in Section 4: (1) Norfolk, (2) Norfolk to Bermuda, (3) Bermuda, (4) Bermuda to Iceland, (5) Iceland to the Azores, (6) The Azores to the southernmost position during the cruise, and (7) the southernmost position during the cruise to Barbados.

2.4 Air Mass Fluxes

Air mass fluxes must be known in order to compute fluxes of chemicals or other atmospheric constituents which were measured aboard the Mt. Mitchell. Air mass flux is defined as the mass of air passing through a unit cross-section of the atmosphere in a unit time period, or the product of air density and wind speed at a given altitude:

$$\dot{F} = \rho * U \quad (1)$$

where F is flux, p is air density, and U is wind speed. Substituting the ideal gas law for dry air and the dry air gas constant into Eq. (1) results in:

$$F = (p * U * 0.348) / T \quad (2)$$

where F is in $\text{kg/m}^2/\text{s}$, p is air pressure (hPa), U is in m/s , and T is temperature (K).

Air flux may be referenced to an arbitrary vertical plane in the atmosphere, but for consistency with flux calculations from the WATOX experiment in 1986 (Artz and Stunder, 1987), the standard meteorological reference system (U positive for west wind; V positive for south wind) was rotated clockwise 45° so that the U' flux component is approximately the flux component off the North American continent. The rotated components, U' and V' , are:

$$U' = - WS * \sin[(\pi/180) * (WD-45)] \quad (3)$$

$$V' = - WS * \cos[(\pi/180) * (WD-45)] \quad (4)$$

where WS and WD are wind speed and direction (deg). This coordinate system was used for flux calculations for the entire GCE/CASE/WATOX period for uniformity because flow off Europe, Africa or South America was not expected to be as prevalent as that off North America during the cruise. Figure 2-2 is a depiction of the rotated coordinate system: U' is positive for northwest winds and V' positive for southwest winds.

Air flux vertical profiles for heights up to 500 hPa were computed using nearly all the CLASS soundings during the period 12 GMT July 18 through 12 GMT August 21. Calculation of chemical fluxes above 500 hPa would not be of general interest as it is well above the boundary layer. Data from six soundings within this period were not used because problems during the sounding caused only a limited amount of data to be obtained. After August 21, no winds were obtained from the soundings because no signals were received by the LORAN tracking system; hence no fluxes were computed for this period. A small fraction of the 10 s CLASS sounding data records were deleted during the quality assurance process if pressure, wind or virtual temperature were clear outliers.

Mean fluxes were computed using two averaging methods. In both cases virtual temperature (T_v) was used rather than temperature because the air is relatively moist near the ocean surface and in clouds. Since virtual temperature is the temperature of dry air with the same density and pressure as the moist air, the dry air gas constant may be used in Eq. (2). 10 s U' - and V' -component flux values were computed from Eq. (2) using the appropriate wind component and virtual temperature. Mean fluxes for layers 25 hPa thick were computed from the 10 s flux values. In the other method, mean flux was computed from mean p , U' , V' and T_v . No differences between the two flux computation methods were apparent.

The mean fluxes are shown in cross-sections in Section 4 using the same time periods as the other meteorological cross-sections. No fluxes were computed after August 21, 1988 because wind data were not available (see Section 2.2).



Figure 2-2. Air flux coordinate system referenced to an idealized North American coast.

2.5 Isentropic Trajectory Analysis

We use trajectories of hypothetical air parcels backward in time from the sampling locations to determine the pattern of transport at large scales. The calculations use, as their basis, the NMC global analysis, which is a gridded set of fields, including horizontal wind components and geopotential height estimates, at 2.5 degree latitude and longitude spacing, available twice-daily. The fields are on isobaric surfaces, generally eight of which lie within the troposphere. Trajectory accuracy depends on the adequacy of the basic meteorological data. Meteorological observations used to initialize the NMC model are sparse over the poles and oceans compared to well-populated land areas; however, aircraft reports and satellite data supplement where regular radiosonde observations are not possible. Merrill et al. (1985) discuss uncertainties resulting from sparse data.

The isentropic trajectory technique (Merrill et al., 1986) is a kinematic analysis, requiring estimates of the winds on isentropic surfaces. These are interpolated from the isobaric levels to isentropic surfaces at intervals of 5 K (of potential temperature) using the technique discussed by Bleck (1984). For a good first approximation, the air flow in the troposphere is dry adiabatic, away from organized convection and above the boundary layer (Danielsen, 1961). A minimum lapse rate constraint in the lowest layers is used to insure hydrostatic stability and to extrapolate to potential temperature surfaces that are "underground", preventing the trajectory from undergoing premature truncation in a well-mixed boundary layer. Because air parcels move horizontally and vertically along the undulating isentropic surfaces, isentropic trajectory analysis accounts for the 3-dimensional motion without requiring explicit estimates of the vertical velocity of the air. These techniques have been used to study transport of various substances to remote marine regions. (Merrill et al., 1985, 1989). The isentropic trajectories are available directly from J. Merrill, Univ. of R.I.

2.6 Isobaric Trajectory Analysis

The computer model used to produce the isobaric trajectories shown in Section 3.3 and Section 4 was developed by Harris (1982). The primary input for the trajectory program consists of gridded wind components at mandatory pressure levels produced twice-daily (00 and 12 GMT) by NMC's global atmospheric model.

Each 10-day trajectory consists of 80 individually-computed 3-hour trajectory segments placed end to end. To compute each segment, the trajectory program interpolates the gridded wind fields in time between each 12-hour observation period to the midpoint of the 3-hour period in question. The winds at the previous trajectory segment endpoint are calculated from the winds at the four grid points surrounding the endpoint to determine the first-guess endpoint of the next segment. A modified Euler method (Stark, 1970) is then used to iterate to the final endpoint solution.

This trajectory method is best used to give an indication of the general air flow rather than the exact pathway of an air parcel. This model does not take into account most of the vertical motions of the atmosphere.

Three-day isobaric back-trajectories on the four levels (1000, 850, 700, and 500 hPa) for the entire cruise are presented in Section 3.3. Ten-day

isobaric back-trajectories on the four levels for the same 7 cruise segments as were used for the cross-sections are shown in Section 4.

3. METEOROLOGICAL OVERVIEW

Meteorological conditions during the cruise will be discussed through use of representative synoptic maps, soundings, and trajectories. These products describe the three meteorological synoptic regimes encountered by the Mt. Mitchell, the vertical structure of the atmosphere, the general flow patterns, and source regions of atmospheric constituents arriving at the ship. The synoptic regimes are (1) north of the polar front, (2) under the Bermuda/Azores high, and (3) within the Intertropical Convergence Zone (ITCZ). Portions of legs 2 and 3 extended north of the polar front. Portions of all four legs of the cruise occurred under the Bermuda/Azores high pressure system. Portions of leg 4 occurred within the ITCZ. The soundings also were used to identify cloud layers and boundary layers.

3.1 Synoptic Meteorology

Because the overall meteorological conditions over the Atlantic Ocean during the experiment were nearly constant on a day-to-day basis (see the daily 850 hPa synoptic maps in Appendix A), the synoptic situation on one typical day, July 27, is described here. The particular day chosen is not necessarily representative of the synoptic situation in the vicinity of the ship as it approached and departed Iceland, because more temporal variability was observed in the vicinity of the Icelandic low.

Figs. 3-1 through 3-6 show the mean sea-level pressure analysis; 850, 700 and 500 hPa height analyses; and 850 and 700 hPa relative humidity analyses over the Atlantic Ocean and adjacent land masses at 12 GMT July 27, 1988. [Note that this polar stereographic projection shows much of the United States and Canada. Iceland is near the top-center of the map. Northwest Africa, Spain, and part of the United Kingdom are more easily seen if the figure is rotated 90° degrees clockwise.] At the surface on July 27 (Fig. 3-1), the central pressure of the Bermuda/Azores high pressure system was 1029 hPa and was located in the central Atlantic approximately midway between Bermuda and the Azores. High pressure covered much of the Atlantic, with regions of high pressure extending north toward Newfoundland and Europe. The Icelandic low pressure system with a central pressure of 993 hPa was centered off the southeast coast of Iceland. Another low pressure system was centered to the west of Hudson Bay. Although not clearly defined by the sea-level pressure pattern over eastern North America and much of the Atlantic Ocean, a section of the polar front extended from the low pressure trough along the southern coast of Hudson Bay, across eastern North America and the Atlantic Ocean, to the small region of low pressure west of the United Kingdom and to the Icelandic low. The ITCZ is not apparent from the mean sea-level pressure analysis.

The 850, 700, and 500 hPa upper-air maps (Figs. 3-2, 3-3, and 3-4) all show features consistent with the mean sea-level pressure map: the large high pressure region over the central Atlantic and two low pressure regions to the north, one near Iceland and another northwest of Hudson Bay. The pressure gradients indicate light and variable winds in the vicinity of the high and strong winds north of the front.

MRF(AVN) MODEL

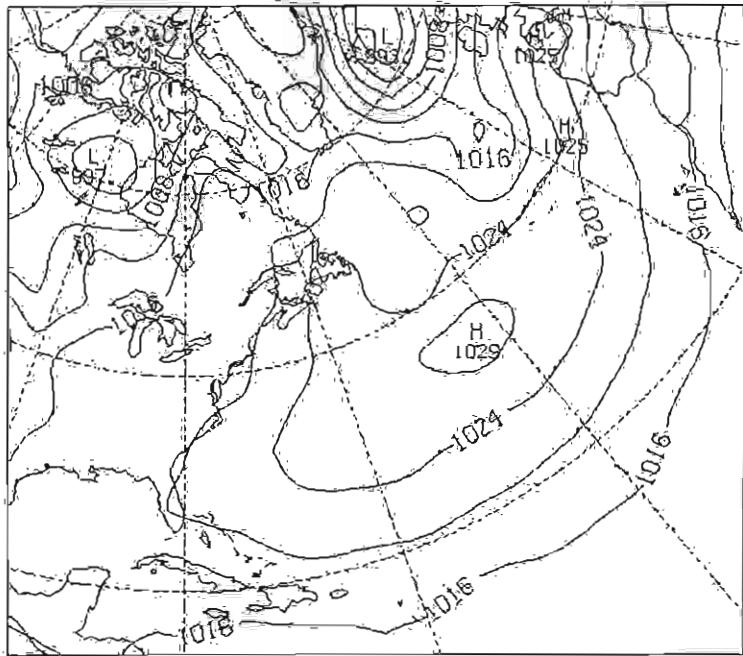


Figure 3-1. Surface synoptic analysis (pressure, hPa) for 12 GMT 27 July 1988.

MRF(AVN) MODEL

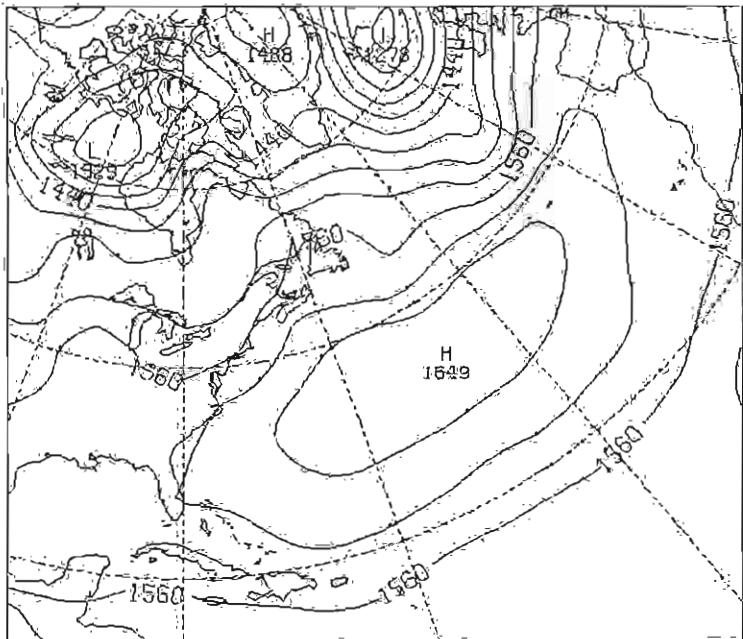


Figure 3-2. The 850-hPa synoptic analysis (geopotential height, m) for 12 GMT 27 July 1988.

MRF(AVN) MODEL

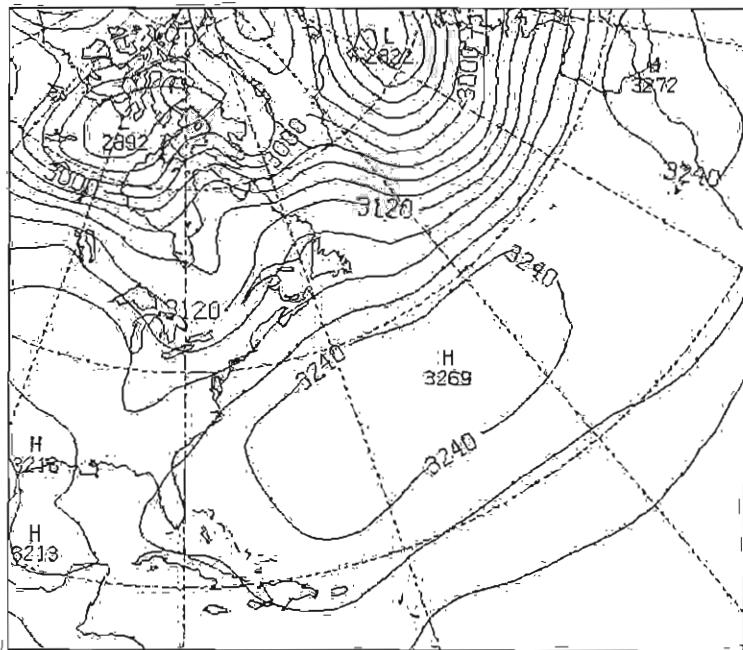


Figure 3-3. The 700-hPa synoptic analysis (geopotential height, m) for 12 GMT 27 July 1988.

MRF(AVN) MODEL

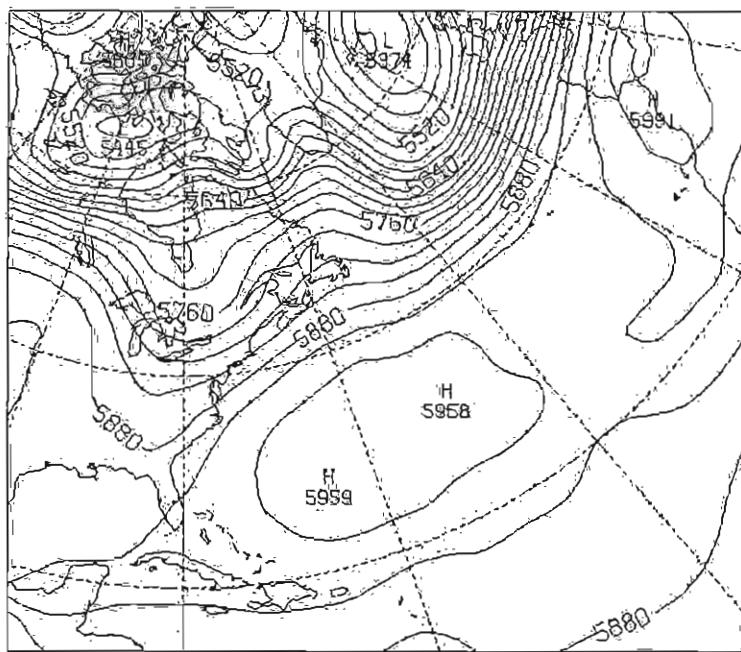
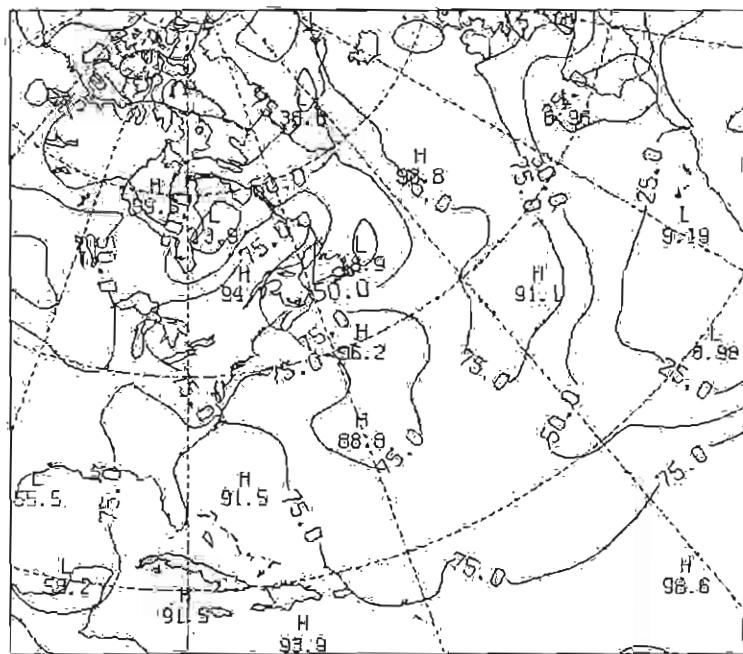


Figure 3-4. The 500-hPa synoptic analysis (geopotential height, m) for 12 GMT 27 July 1988.

MRF(AVN) MODEL



The 850 hPa and 700 hPa relative humidity (RH) maps (Figs. 3-5 and 3-6) show generally much higher RH at 850 hPa than at 700 hPa. Much of the region under the Bermuda/Azores High is at least 75% RH at 850 hPa, but only 25% RH at 700 hPa. Generally, air within the boundary layer (850 hPa) is expected to be more humid because of its contact with the ocean surface through vertical mixing, while air above the boundary layer under the broad area of subsidence associated with the high would be relatively dry. Near Iceland, RH greater than 75% is present at both altitudes because of the clouds associated with the low. Another region of at least 75% RH at 700 hPa is in the southern portion of the Atlantic shown in Fig. 3-6. This region is the ITCZ.

3.2 Upper-Air Soundings

Table 3-1 gives marine boundary layer depths and cloud layers as determined from the soundings, and a back-trajectory category (see Section 3.3). Typically, a relative humidity value of 70% at 700 hPa indicates the threshold level for clouds. Cloud layers near the surface are difficult to specify accurately; the layer is very moist, but the existence of clouds based on sounding interpretation is uncertain. Most questionable areas south of the polar front are probably partly cloudy and hazy. North of the front, fog is prevalent as well. (See Appendix B.) The existence of superadiabatic layers is noted in the table because such layers are unstable and frequently indicate frontal activity or some other unique feature.

Upper-air soundings typical of the three meteorological regimes encountered during the cruise and their representativeness are discussed. The following eight plots are shown for each of the three regimes:

- temperature and dew point
- relative humidity
- u-component of wind
- v-component of wind
- potential temperature and equivalent potential temperature
- virtual temperature
- mixing ratio and saturation mixing ratio
- vapor pressure and saturation vapor pressure.

On August 10, 1988 the Mt. Mitchell was between Iceland and Greenland and was north of the polar front. Sounding data are shown in Figs. 3-7 through 3-14. The 12 GMT temperature/dew point vertical profiles (Fig. 3-7) show a surface temperature near 4°C. The nearly saturated layer up to 250 m suggests fog or low-level clouds; relative humidity (Fig. 3-8) was greater than 80%. The maximum absolute humidity of 7.5 g/m³ at about 300 m (not shown) corresponds to the low-level relative humidity maximum of 95%. Another cloud layer occurred from about 2600 to 6500 m. The driest air, as indicated by the dew point depression and the relative humidity, occurs above the tropopause at 9500 m, near the top of the sounding, although absolute humidity was less than 1 g/m³ above 5000 m. The easterly wind component (Fig. 3-9) was about 8 m/s up to 5000 m and increased up to 34 m/s at 9000 m. The v-component (Fig. 3-10) was weaker, but steadily became more southerly from -6 to 10 m/s during the sonde ascent. These indicate northeast winds near the surface and east to east-southeast winds aloft. The potential temperature (Fig. 3-11) shows a stable atmosphere except for a shallow (100 m) unstable layer at the surface. Strong stable layers occurred just above the unstable layer and at the tropopause. The virtual temperature (Fig. 3-12) is nearly

Table 3-1. Marine boundary layer (MBL) depth, cloud layers, and back-trajectory category (1=heavily populated North America, 2=lightly populated North America, 3=oceanic tropical, 4=oceanic polar, 5=European, 6=African, 7=Iceland or Greenland, NA=not available; see Section 3.3). Date is given as DDHH where DD is date, HH is time (h). Ocean surface=sfc.

DATE	MBL (m)*	CLOUDS (m)	CATEGORY	COMMENTS
JULY, LEG 1.				
1600	no data	no data	1a	
1612	no data	no data	1a	
1700	2500	500-2500	1a	no data below 500 m
1706	300, 2300	1000-1300, 1900-2300	NA	
1712	2200	500-2200	1a	no data below 500 m
1718	200, 3000	2000-3000	NA	
1800	500, 3200	moist MBL, no clouds	1a	
1812	500, 3400	1400-1700	1a	no data above 6700 m
1900	400, 3700	1200-3600	1a	
1912	1200	none	1a	
1918	1500	none	NA	
2000	indeterminate	none	3	coastal influence
2006	500	none	NA	
2012	indeterminate	none	3	coastal influence
2100	no data	no data	3	
2106	600	600-2000	NA	no data above 3000 m
2112	indeterminate	500-1300, 2800-6500	3	
2200	1300	500-8000	3	superadiabatic 2300-2600 m
2212	600, 2500	none	3	
2300	700, 3700	700-1000, 1400-1900	3	no data above 8200 m
2312	1800	none	3	
2400	1800	none	3	no data above 9000 m
2412	no data	no data	3	
2500	2200	none	3	no data above 6700 m
2512	500, 3500	6300-6500, 7700-8300	3	
2600	500, 2400	7400-9800	3	
2606	1700, 3300	1700-3300, 6200-7300	NA	superadiabatic 2300-2600 m
2612	700, 2400	none	3	no data above 7000 m
2618	3100	500-3100	NA	
2700	600, 3200	600-1600	3	
2706	600, 2500	600-2500	NA	
2712	600, 2500	none	3	
2800	400, 3000	400-3000	3	
2806	2400	1000-2400	NA	no data above 7200 m
2812	500, 2800	500-1500	3	
2900	500	none	3	

* When two layers are given, the lower depth indicates a sub-layer within the boundary layer which may represent some decoupling of the boundary layer when a layer of clouds is present near the boundary layer top.

Table 3-1. Cont.

<u>DATE</u>	<u>MBL (m)*</u>	<u>CLOUDS (m)</u>	<u>CATEGORY</u>	<u>COMMENTS</u>
AUGUST, LEG 2				
0100	600, 3500	1500-3500	1c	
0112	500, 3400	indeterminate	1c	
0200	500	500-2600	3	no data above 8000 m
0212	--	--	3	no data below 3200 m
0300	800	3800-4300	3	no data above 9000 m
0312	indeterminate	moist sfc-3700	3	
0400	no data	no data	2a	near polar front
0412	300	none	2a	north of front, no data above 7200 m
0500	300	900-2000	2a	no data above 2500 m
0512	500	5500-7500	2b	
0600	indeterminate	sfc to 2300	2a	
0612	indeterminate	sfc to 4400	2b	superadiabatic 4300-4700, 5000-5100 m
0700	no data	no data	4	
0712	no data	no data	2c	
0800	indeterminate	sfc to at least 3700	4	
0812	2500	sfc to 2500	4	
0900	indeterminate	400-8000	4	no data below 400 m, 0900 & 0912 may reach Iceland or
0912	2600	none	4	Europe
1000	indeterminate	1000-7300	7a	superadiabatic at sfc
1012	indeterminate	2600-6500	7a	superadiabatic at sfc
1100	no data	no data	7a	

AUGUST, LEG 3

1512	no data	no data	7a	
1600	indeterminate	300-2500	7a	
1612	800	800-2400, 3000-3500, 5200-6400	4	
1700	no data	no data	4	
1712	500	500-5200	4	
1800	indeterminate	sfc to 5500	4	no data above 6000 m
1812	2000	sfc to 2000	4	
1900	no data	no data	4	
1912	1500	sfc to 1500	4	approaching front
2000	1000	none	4	near front, no data above 5000 m
2012	indeterminate	sfc to 3700	3	superadiabatic at sfc
2100	indeterminate	sfc to 2800, 3300-5000	3	no data above 8500 m
2112	indeterminate	sfc to 1800	3	

* When two layers are given, the lower depth indicates a sub-layer within the boundary layer which may represent some decoupling of the boundary layer when a layer of clouds is present near the boundary layer top.

Table 3-1. Cont.

<u>DATE</u>	<u>MBL (m)*</u>	<u>CLOUDS (m)</u>	<u>CATEGORY</u>	<u>COMMENTS</u>
2200	400, 1700	sfc to 1700, 5000-5500	3	no data above 7500 m
2212	1300	600-1300	3	superadiabatic 1300-1700 m
2300	1100	sfc to 1100	3	no data above 9200 m
2312	1200	none	3	

AUGUST, LEG 4

2512	1100	sfc to 1100	3	
2600	1100	sfc to 1100	3	no data above 7700 m
2612	no data	no data	3	
2700	600	moist to 6000	3	
2712	no data	no data	3	
2800	1600	none	3	
2812	800	none	3	no data above 7800 m
2900	1000	none	3	
2912	900	none	3	approaching ITCZ
3000	no data	no data	3	
3012	900	900-1200	3	cat 6b above 1700 m
3100	400	sfc to 6300	6c	
3112	1200	sfc to 1200, 3900-4600	6c	

SEPTEMBER, LEG 4

0100	400, 1500	sfc to 1500, 3000-3600	3	African influence
		4800-5300		possible
0112	2500	sfc to 2500, 6500-7500	3	African influence
0200	2200	sfc to 6000	3	deep convection
0212	500	sfc to 5000	3	deep convection
0300	500	sfc to 5500	3	interhemispheric
0312	no data	no data	3	flow, 0300-0400
0400	no data	no data	3	interhemispheric
0412	no data	no data	3	north hemis. flow
0500	1100	moist to 6000	3	mixed hemispheric
0512	500	moist to 5700	3	flow, 0500-0612,
0600	no data	no data	3	some possibly from
0612	500	moist to 10000	3	South America

* When two layers are given, the lower depth indicates a sub-layer within the boundary layer which may represent some decoupling of the boundary layer when a layer of clouds is present near the boundary layer top.

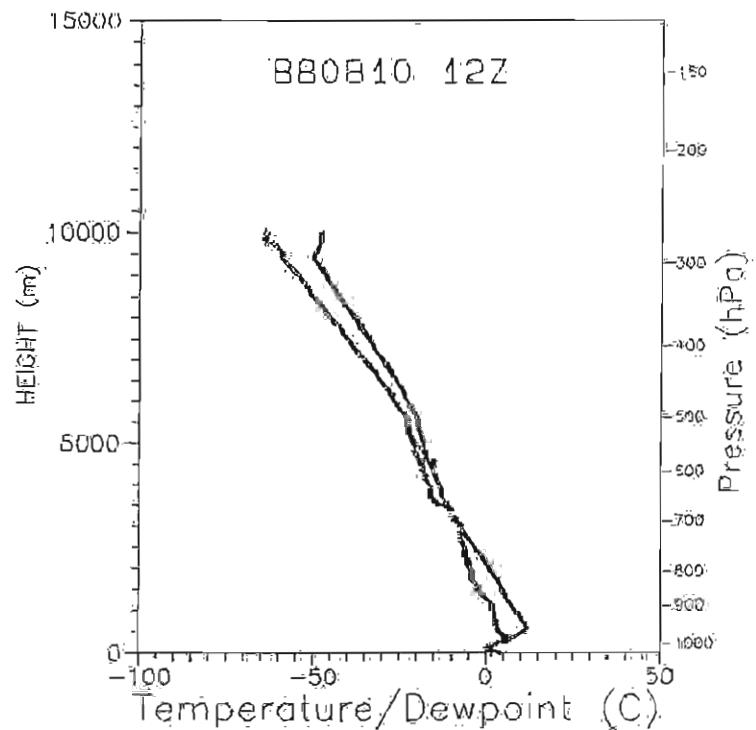


Figure 3-7. Temperature and dew point vertical profiles from the 12 GMT 10 August 1988 sounding.

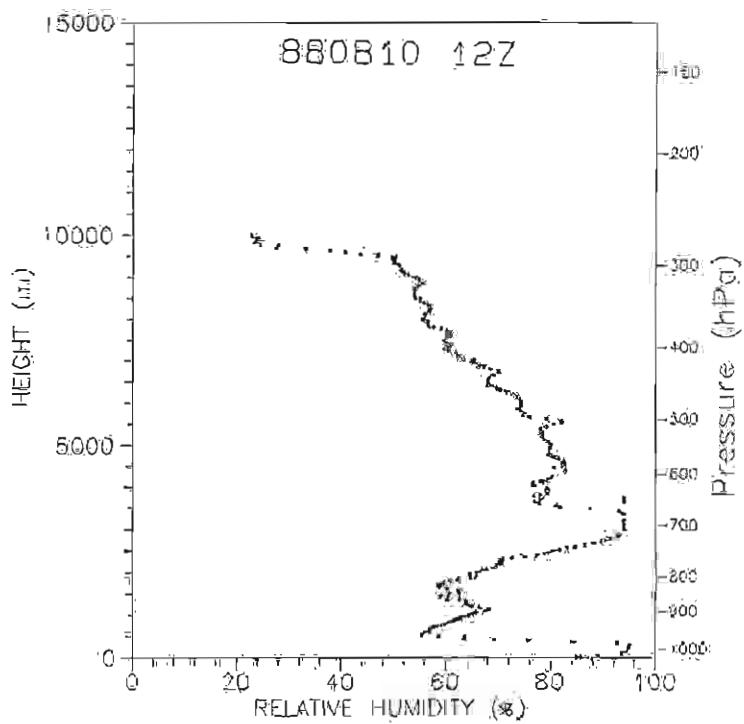


Figure 3-8. Relative humidity vertical profile from the 12 GMT 10 August 1988 sounding.

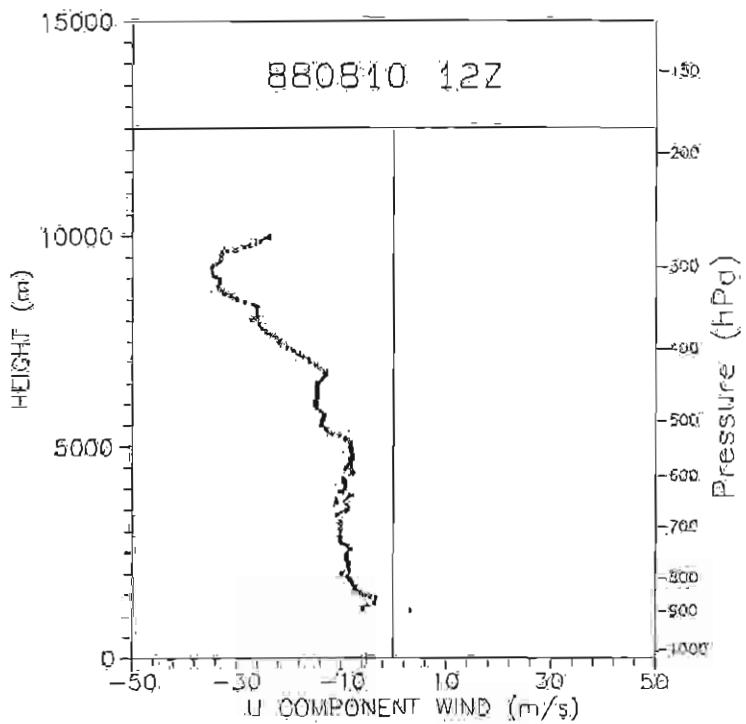


Figure 3-9. U wind component vertical profile from the 12 GMT 10 August 1988 sounding.

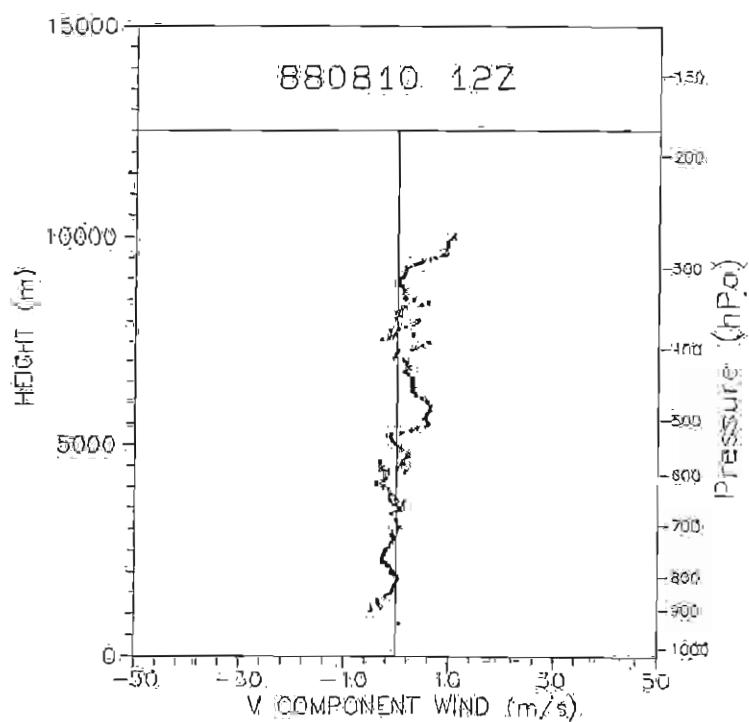


Figure 3-10. V wind component vertical profile from the 12 GMT 10 August 1988 sounding.

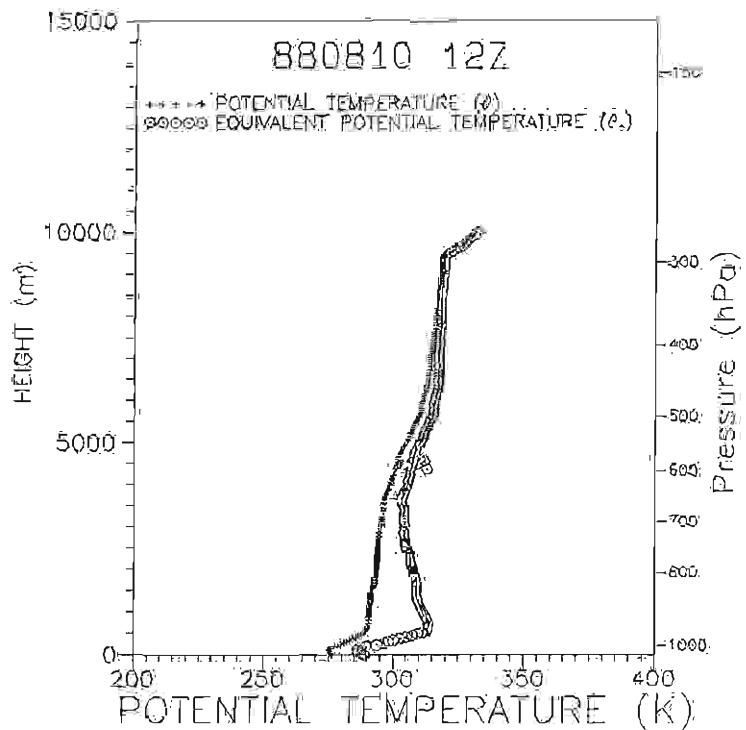


Figure 3-11. Potential temperature and equivalent potential temperature vertical profiles from the 12 GMT 10 August 1988 sounding.

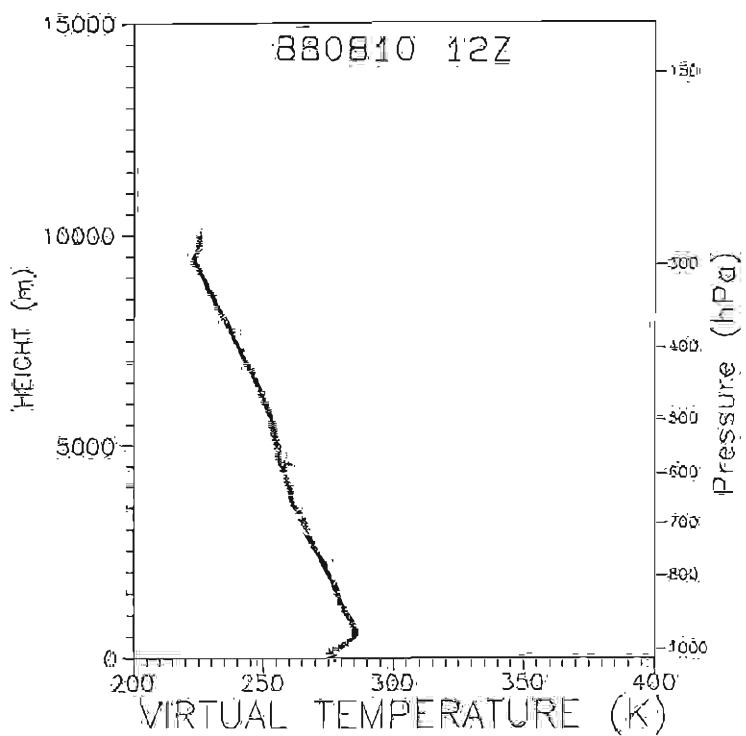


Figure 3-12. Virtual temperature vertical profile from the 12 GMT 10 August 1988 sounding.

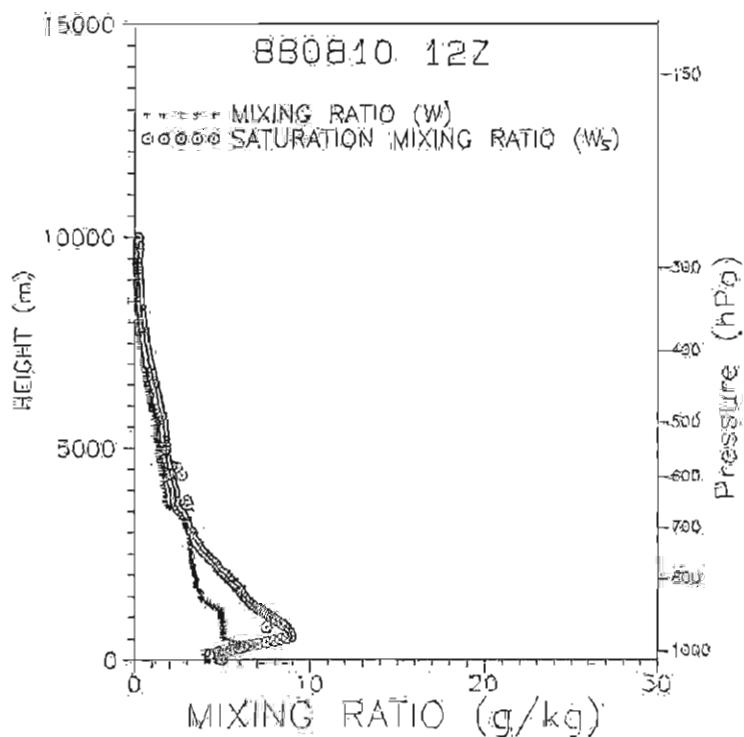


Figure 3-13. Mixing ratio and saturation mixing ratio vertical profiles from the 12 GMT 10 August 1988 sounding.

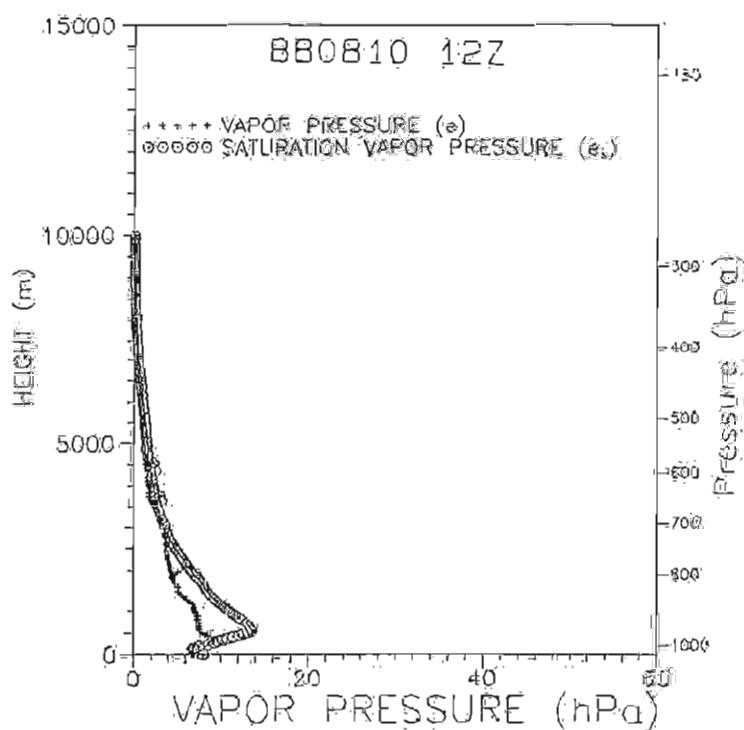


Figure 3-14. Vapor pressure and saturation vapor pressure vertical profiles from the 12 GMT 10 August 1988 sounding.

the same as the temperature (Fig. 3-7). The mixing ratio (w)/saturation mixing ratio (w_s) (Fig. 3-13) and vapor pressure (e)/saturation vapor pressure (e_s) (Fig. 3-14) plots are similar. They show a dry layer between 250 m and 2500 m and a nearly saturated layer above 5000 m.

One feature unique to this sounding, compared to most of the other soundings north of the front, is the shallow (100 m) superadiabatic layer at the surface capped by a strong inversion up to 600 m. Superadiabatic and inversion layers were also observed for the previous two soundings (12 GMT August 9 and 00 GMT August 10) although the layers were shallowest on August 9. Surface temperatures (air and water (see Appendix B)) were coldest for these three soundings which were taken at the northernmost portion of the cruise over the East Greenland current, a cold oceanic current flowing to the southwest between Greenland and Iceland. The cold ocean surface cooled the air, causing the inversion. In most of the other soundings north of the polar front (00 GMT August 6 to 00 GMT August 9, 00 GMT August 16 to 12 GMT August 18), surface temperatures were about 10 to 15°C and the air was nearly saturated to at least a few thousand meters above the surface. The soundings also show dry air (less than 20% RH) only above 8000 to 9000 m. The air was drier immediately north of the front on both legs 2 and 3 (12 GMT August 4 and 12 GMT August 19), away from the cloud-cover associated with the low.

On August 1, 1988 the Mt. Mitchell left Bermuda for Iceland and was under the Bermuda/Azores high pressure system. Sounding data are shown in Figs. 3-15 through 3-22. The 00 GMT temperature/dew point vertical profiles (Fig. 3-15) show a surface temperature (27°C) much warmer than that near Iceland. A cloud layer is apparent between 1500 and 3500 m because of the low dew point depressions and high RH (Fig. 3-16). Above 3500 m, in the free troposphere, the air is quite dry with dew point depressions of about 20°C and RH about 15%. The sharp inversion and moisture discontinuity at 3500 m suggest that this is the top of the boundary layer. Another moist layer observed near 600 m was separated from the higher moist layer by a relatively dry layer. (In other cases where this dry layer was also observed, the temperature frequently became nearly isothermal through much of the layer.) The layer below 600 m has high relative humidity of more than 70%. At 16 g/m³, the absolute humidity (not shown) within the layer below 600 m is much greater than that near Iceland. Winds were lighter than those near Iceland, but fairly steady with height during this sounding: the u-component is about 6 m/s (Fig. 3-17) and the v-component is about -3 m/s (Fig. 3-18). These result in generally west to northwest winds. The potential temperature profile (Fig. 3-19) shows a stable atmosphere for the entire sounding from the surface to 8000 m. A strong stable layer is present at 3500 m, the top of the boundary layer. Note the equivalent potential temperature profile has a more pronounced discontinuity at 3500 m. The virtual temperature, mixing ratio and saturation mixing ratio, and vapor pressure and saturation vapor pressure (Figs. 3-20, 3-21 and 3-22) also show this discontinuity. In the layer below 600 m, mixing ratio (14 g/kg) and vapor pressure (22 hPa) are about three times greater than the near-surface values in the sounding near Iceland 12 GMT August 10 because of the higher ambient temperature..

Most of the other soundings under the Bermuda/Azores High show the double moist layer phenomenon. Table 3-1 lists the boundary layer depths and cloud layers for each sounding. Sometimes the moist layer below the boundary layer may not be as humid and the boundary layer may not be as well defined as that shown in Fig. 3-15. Stull (1988) states that decoupled multiple mixed layers

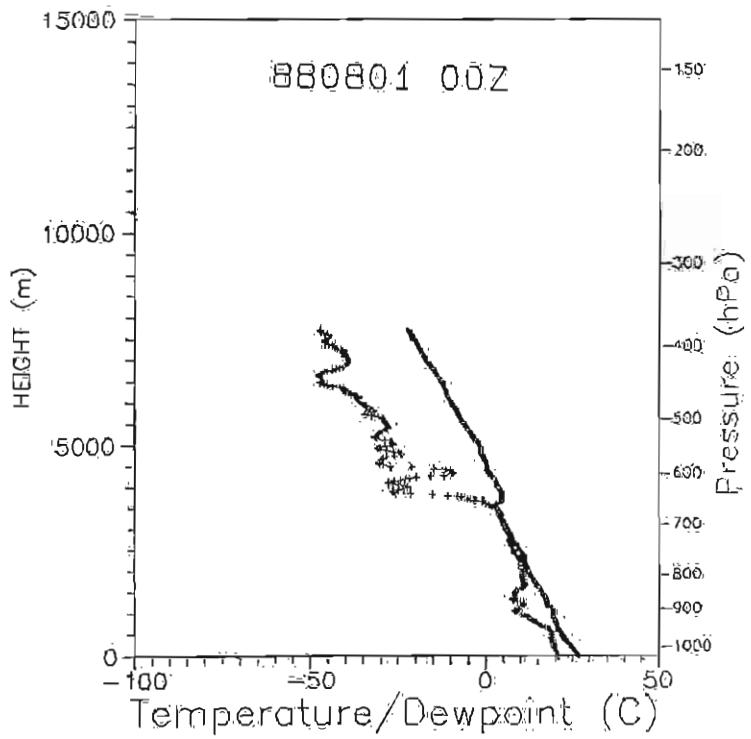


Figure 3-15. Temperature and dew point vertical profiles from the 00 GMT 1 August 1988 sounding.

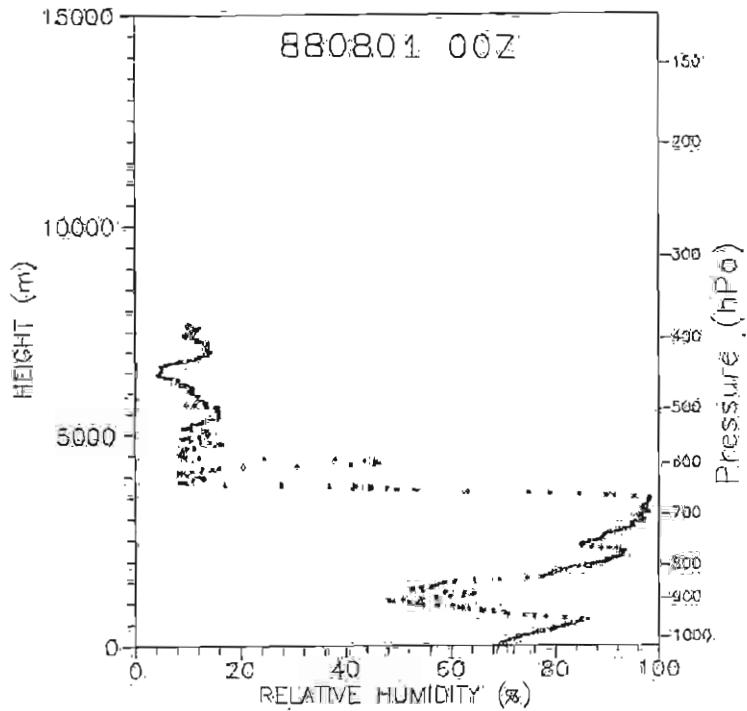


Figure 3-16. Relative humidity vertical profile from the 00 GMT 1 August 1988 sounding.

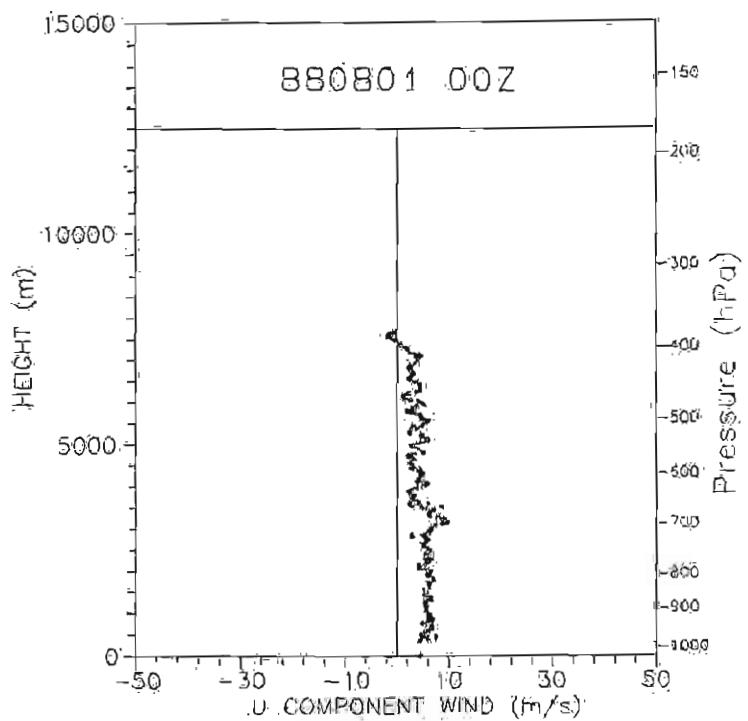


Figure 3-17. U wind component vertical profile from the 00 GMT 1 August 1988 sounding.

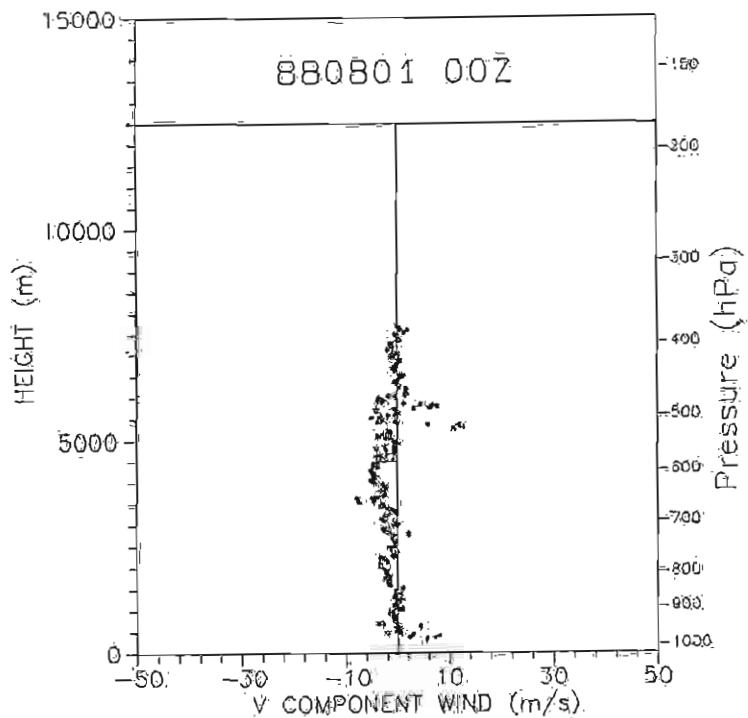


Figure 3-18. V wind component vertical profile from the 00 GMT 1 August 1988 sounding.

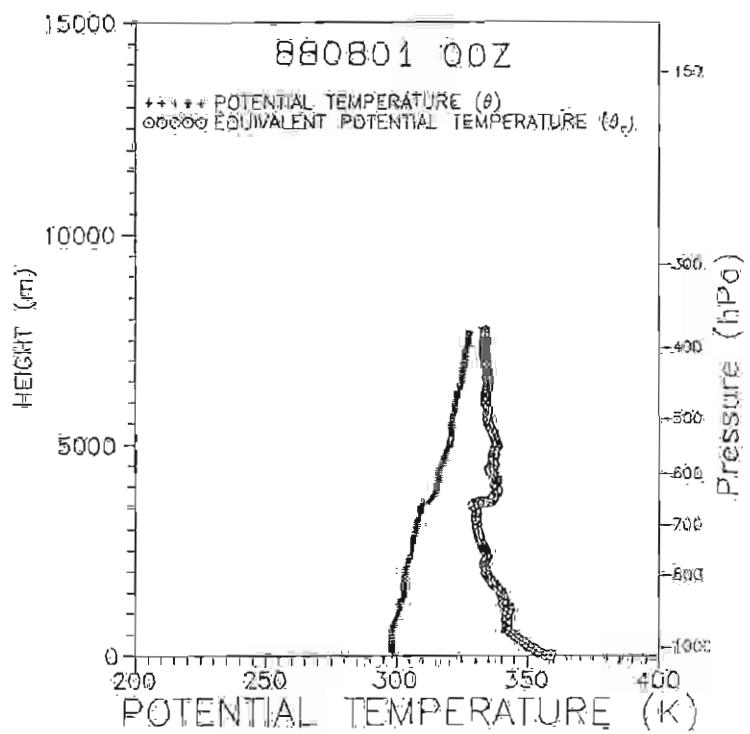


Figure 3-19. Potential temperature and equivalent potential temperature vertical profiles from the 00 GMT 1 August 1988 sounding.

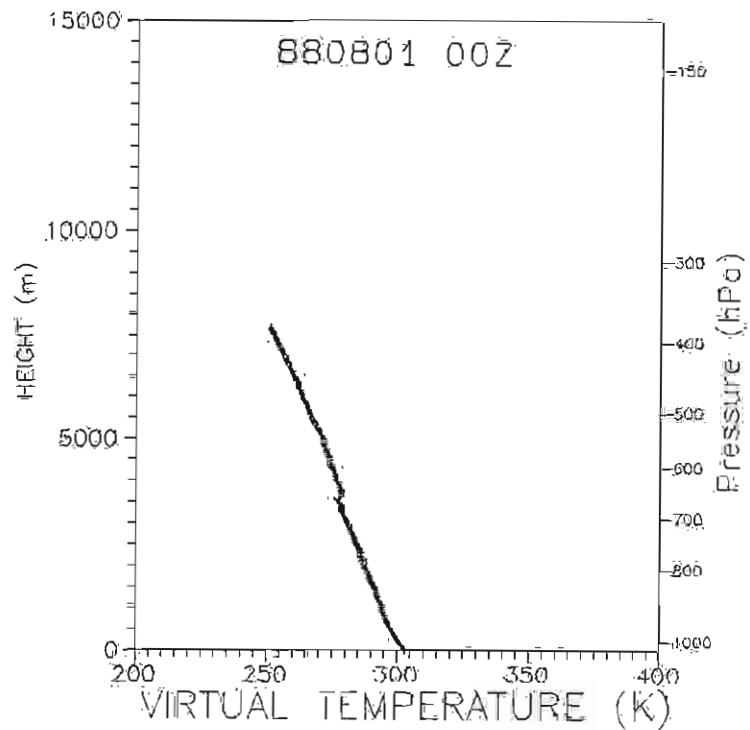


Figure 3-20. Virtual temperature vertical profile from the 00 GMT 1 August 1988 sounding.

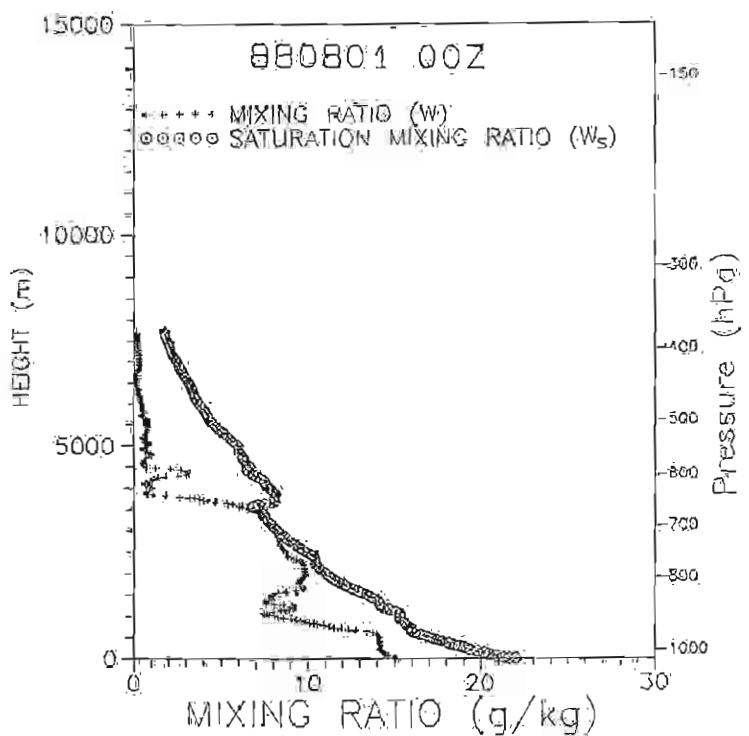


Figure 3-21. Mixing ratio and saturation mixing ratio vertical profiles from the 00 GMT 1 August 1988 sounding.

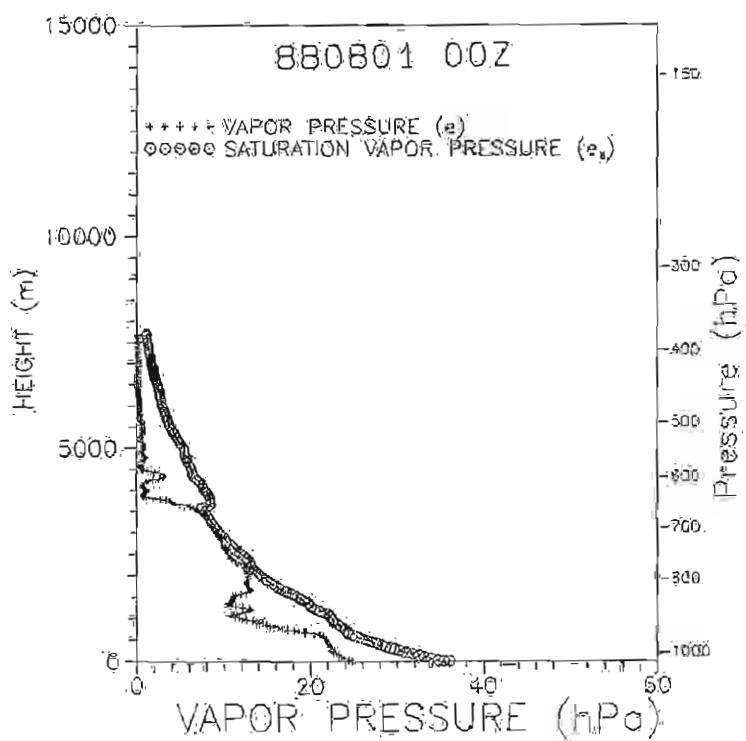


Figure 3-22. Vapor pressure and saturation vapor pressure vertical profiles from the 00 GMT 1 August 1988 sounding.

may result from differences in solar heating, wind shear, or entrainment above and below clouds. Differences in solar heating do not apply here because the multiple layer phenomenon was present during the day and night. At the present we cannot fully explain this phenomenon, but clouds may play an important role because some of the soundings show only one mixed layer when no clouds were observed (i.e., 12 GMT and 18 GMT July 19). During leg 2, deep cloud layers with tops at 6500 m and 8000 m were observed 12 GMT July 21 and 00 GMT July 22, respectively, but generally clouds did not extend above 3000 to 4000 m. Immediately south of the polar front on both sides of the Atlantic (12 GMT August 3, 12 GMT August 20 - 12 GMT August 21) more clouds were observed than for most of the other soundings classified as under the high. The clouds extended here from near the surface to about 2000 to 3000 m.

On August 31, 1988 the Mt. Mitchell was about 2300 km south of the Azores and within the ITCZ (approximately 19°N). Sounding data are shown in Figs. 3-23 through 3-28. The 00 GMT temperature/dew point vertical profiles (Fig. 3-23) show a surface temperature of 27°C, similar to that observed 00 GMT August 1 near Bermuda. The prominent feature of the August 31 sounding is the relatively moist air from the surface up to 6300 m; relative humidity (Fig. 3-24) was generally at least 60% throughout the layer and absolute humidity (not shown) was 20 g/m³ at the surface, gradually decreasing to less than 1 g/m³ at 6500 m. The temperature and dew point discontinuities at 400 m mark the top of the boundary layer. The potential temperature profile (Fig. 3-25) shows a stable atmosphere. Potential temperature and equivalent potential temperature (Fig. 3-25), and virtual temperature (Fig. 3-26) show a discontinuity at 6300 m, the top of the moist layer. The mixing ratio (Fig. 3-27) and vapor pressure (Fig. 3-28), about 17 g/kg and 27 g/m³ in the boundary layer, respectively, are greater than that observed 00 GMT August 1 under the Bermuda/Azores High because of the higher absolute humidity observed here within the ITCZ.

Low dew point depressions and high relative and absolute humidities are typical of soundings within the ITCZ. The soundings after 12 GMT September 1 have dew point depressions of less than approximately 3 degrees and RH generally 70 to 80% up to about 5000 m; the boundary layers are generally shallow, about 500 m. As in the 00 GMT August 31 sounding, the soundings within the ITCZ before 00 GMT September 2 show a moist layer in approximately the lowest 1500 m, then a somewhat drier layer above.

3.3 Trajectories

The source regions of air reaching the ship during the cruise were assigned a category based on the isentropic back-trajectories. Isentropic rather than isobaric trajectories were used for the categorization because they are better at accounting for vertical motions in the atmosphere; however, the 850 hPa isobaric trajectories shown later in this section also tend to give the same categories. Typically three or four isentropic trajectories were computed for each 12-h period (00 and 12 GMT) on the available potential temperature surfaces. Categories refer to back-trajectories calculated from the lowest level available for the layer of the atmosphere best representing the sampling height of the ship. The categories are:

- 1 -- Heavily populated North America
- 2 -- Lightly populated North America
- 3 -- Oceanic tropical

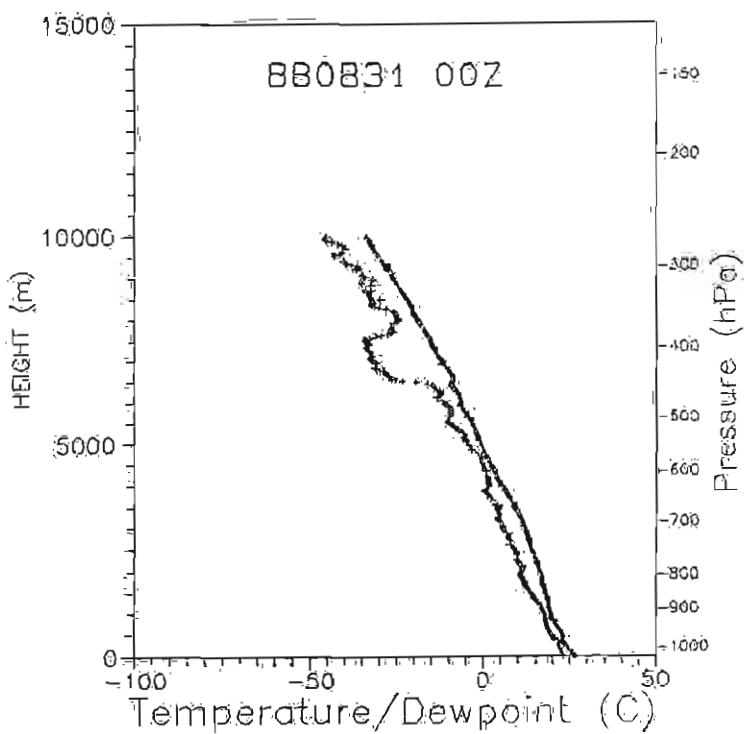


Figure 3-23. Temperature and dew point vertical profiles from the 00 GMT 31 August 1988 sounding.

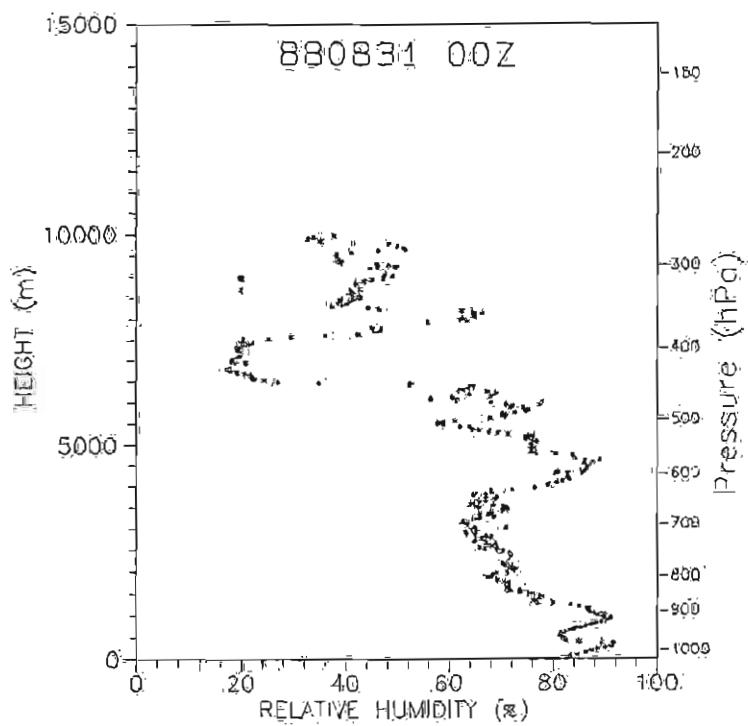


Figure 3-24. Relative humidity vertical profile from the 00 GMT 31 August 1988 sounding.

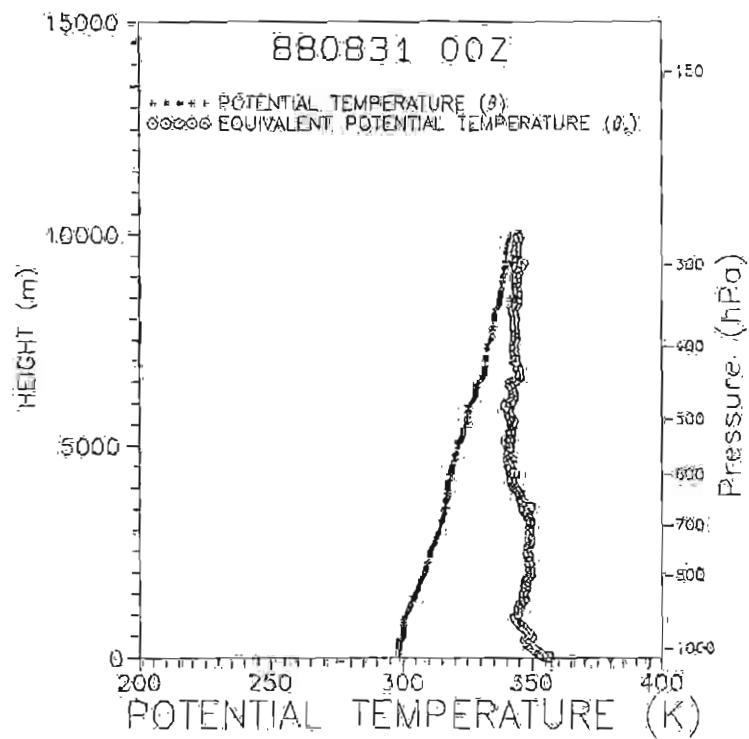


Figure 3-25. Potential temperature and equivalent potential temperature vertical profiles from the 00 GMT 31 August 1988 sounding.

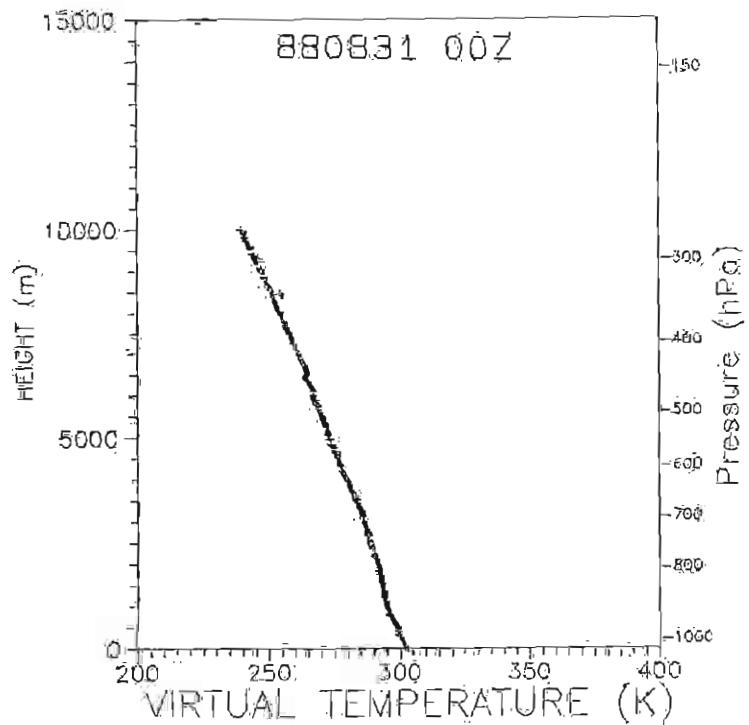


Figure 3-26. Virtual temperature vertical profile from the 00 GMT 31 August 1988 sounding.

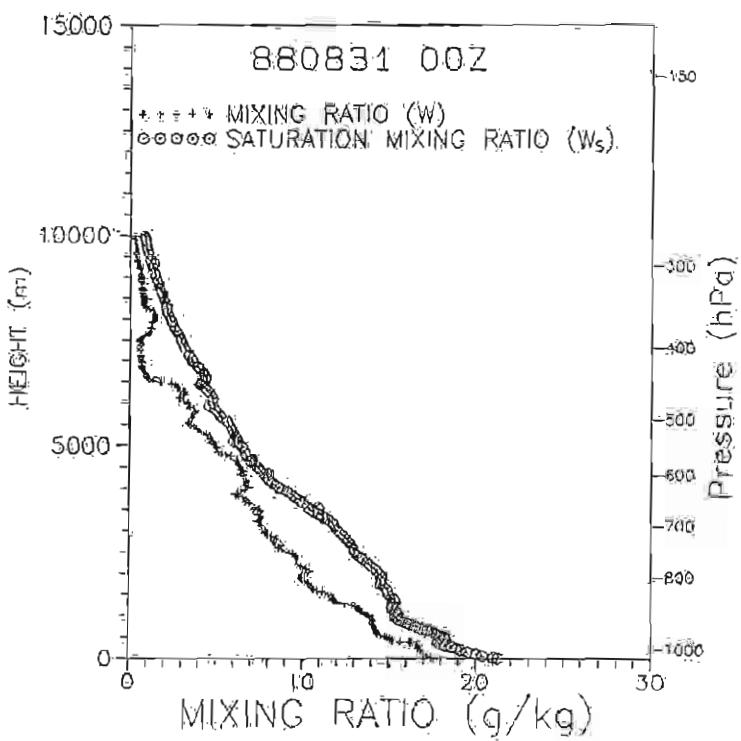


Figure 3-27. Mixing ratio and saturation mixing ratio vertical profiles from the 00 GMT 31 August 1988 sounding.

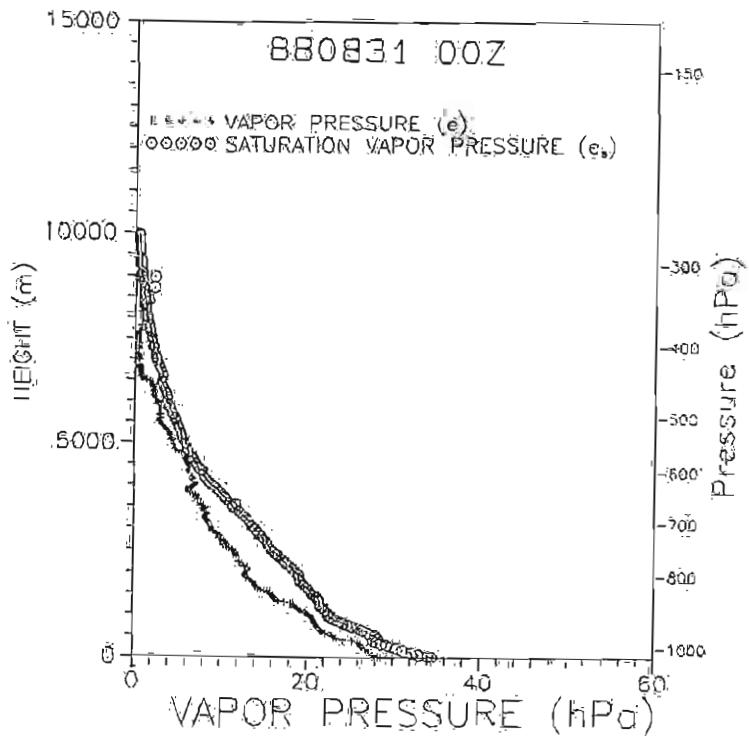


Figure 3-28. Vapor pressure and saturation vapor pressure vertical profiles from the 00 GMT 31 August 1988 sounding.

- 4 -- Oceanic polar
- 5 -- European
- 6 -- African
- 7 -- Iceland or Greenland

Subcategories are assigned for categories in which the trajectories reached land in (a) 1 day or less, (b) 1 to 2 days, and (c) 2 to 3 days. Trajectories that reached land in more than 3 days are categorized as oceanic (3 or 4) due to compounding uncertainties in trajectory computations.

Figure 3-29 shows the trajectory category of air reaching the ship twice-a-day during the cruise based on isentropic back-trajectories and Fig. 2-1 shows the corresponding back-trajectory start date/time (DDHH). Table 3-1 (Section 3.2) also lists the source categories. Land source regions are: heavily populated North America for part of the time the ship was near Norfolk and Bermuda, lightly populated North America for part of leg 2 north of the polar front, Iceland or Greenland when the ship was near Iceland, and Africa for 1 day during leg 4. No trajectories were categorized as European, although both August 9 trajectories categorized as oceanic polar (southwest of Iceland) could have been categorized as Icelandic or European (see comment in Table 3-1). Other comments in Table 3-1 also pertain to the classification scheme such as: another 2 days of African influence may have been observed; inter-hemispheric flow was apparent for the period from September 3 through 6, except for 12 GMT on September 4; and September 5-6 exhibited flow from South America.

Figures 3-30, 3-31, 3-32, and 3-33 show 3-day isobaric back trajectories at 1000, 850, 700 and 500 hPa, respectively. These arrive 12 GMT daily at the ship's location during the entire cruise from July 17 through September 6. In the figures a dot indicates the starting position of a back-trajectory and a date indicates the end. The three meteorological synoptic regimes identified earlier are apparent from the trajectories on all four pressure levels. North of the polar front (approximately 45°N), the air flow is generally either from Canada or circulates with the Icelandic low and has higher wind speeds as indicated by longer 3-day trajectories compared to the trajectories south of the front. The anticyclonic flow associated with the Bermuda/Azores High is apparent from the curvature of the trajectories on both sides of the Atlantic. Within the ITCZ, the trajectories tend to approach the ship from the east or south. Trajectories from the south suggest flow from the Southern Hemisphere. At 850 hPa (representative of flow near the top of the boundary layer), the 30 August trajectory reaches Africa and those from September 5 and 6 reach South America.

3.4 Mt. Mitchell Deck Log Data

The NOAA ship Mt. Mitchell deck log data are included in Appendix B. This data log includes an hourly summary of ship position, observed weather, ambient and dew point temperature, surface wind speed and direction, barometric pressure, and sea surface characteristics.

4. DISCUSSION OF METEOROLOGY BY CRUISE LEG

A more detailed discussion of the meteorology is given here by showing 10-day isobaric back-trajectories, vertical cross-sections of various

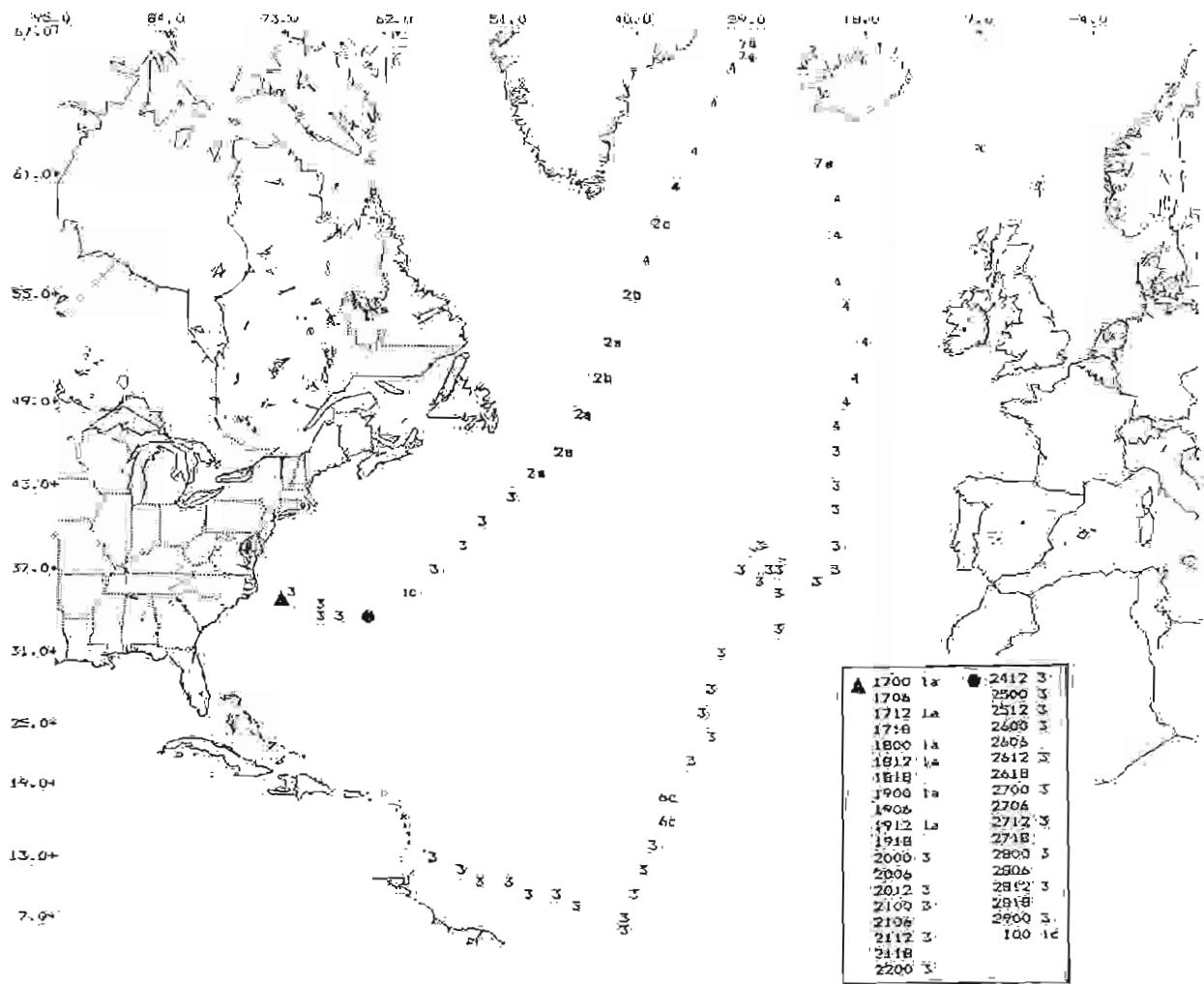


Figure 3-29. Isentropic back-trajectory category:
 1=heavily populated North America
 2=lightly populated North America
 3=oceanic tropical
 4=oceanic polar
 5=European
 6=African
 7=Iceland or Greenland.
 Trajectory reaches land in:
 (a) 1 day or less
 (b) 1 to 2 days
 (c) 2 to 3 days.

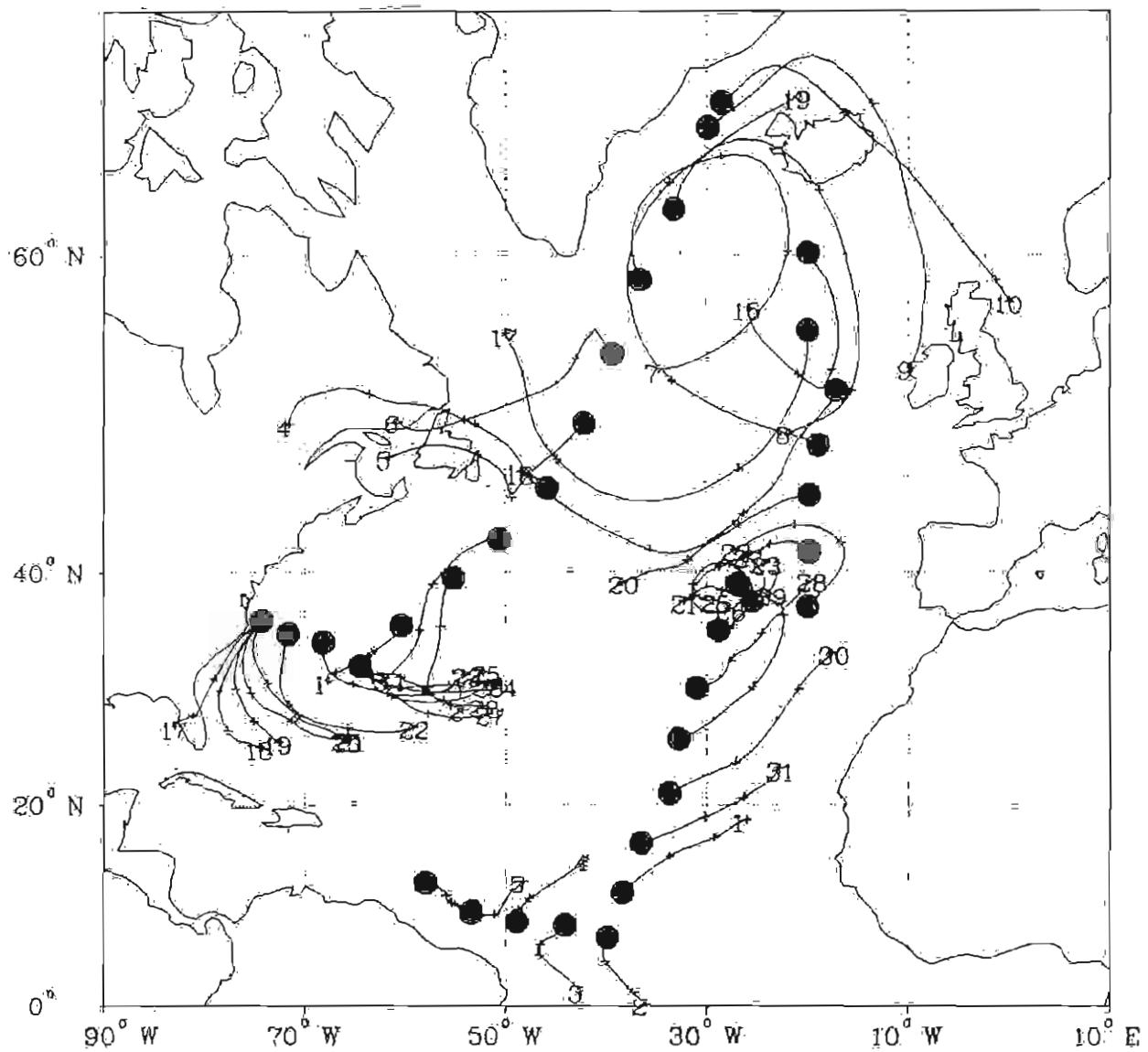


Figure 3-30. Daily 12 GMT 1000 hPa 3-day back-trajectories beginning at the ship's position during the cruise from 17 July through 6 September 1988. A dot is at the beginning and the date is at the end of each back-trajectory. + symbols are at 24-h intervals.

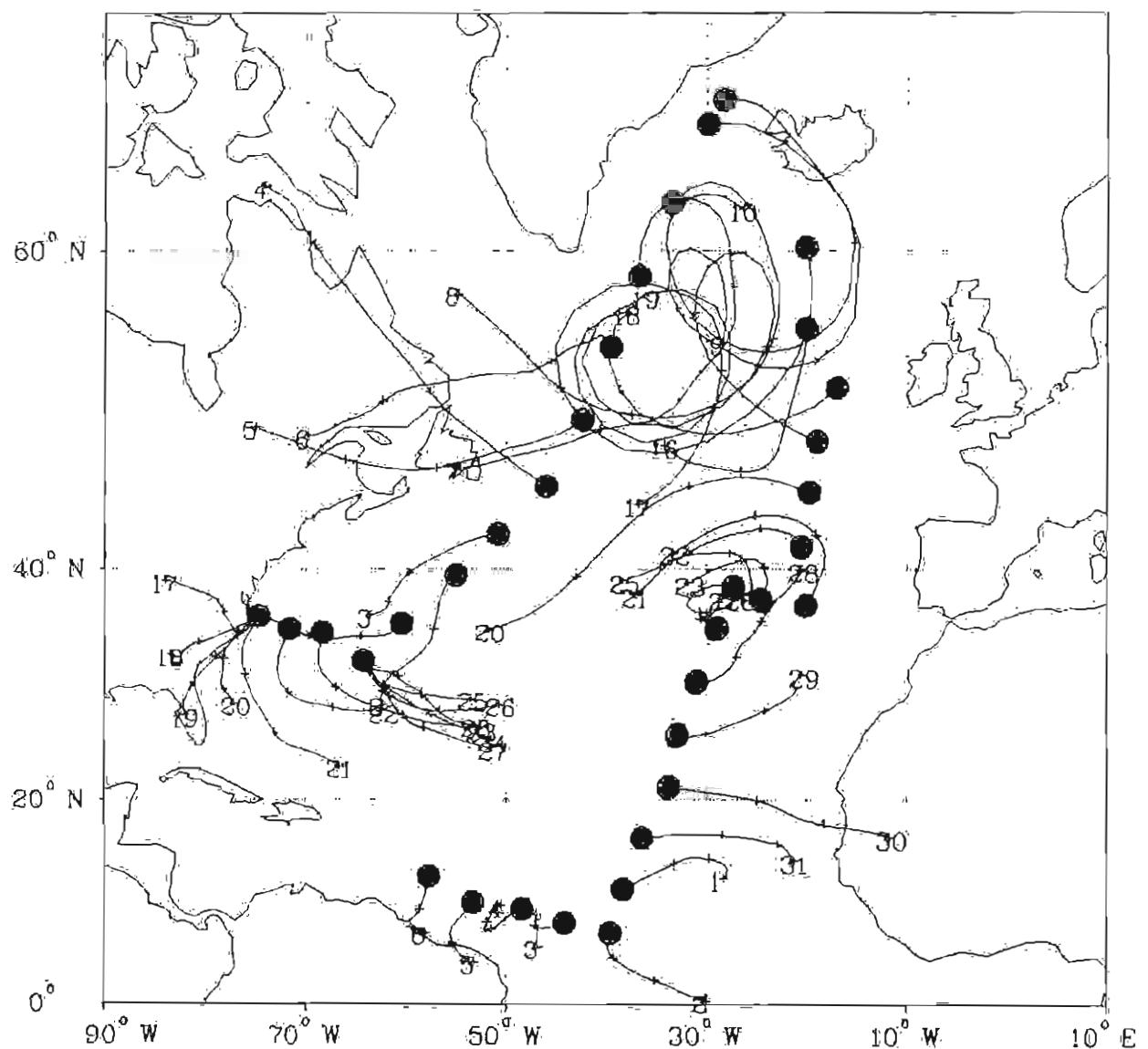


Figure 3-31. As Fig. 3-30, but for 850 hPa.

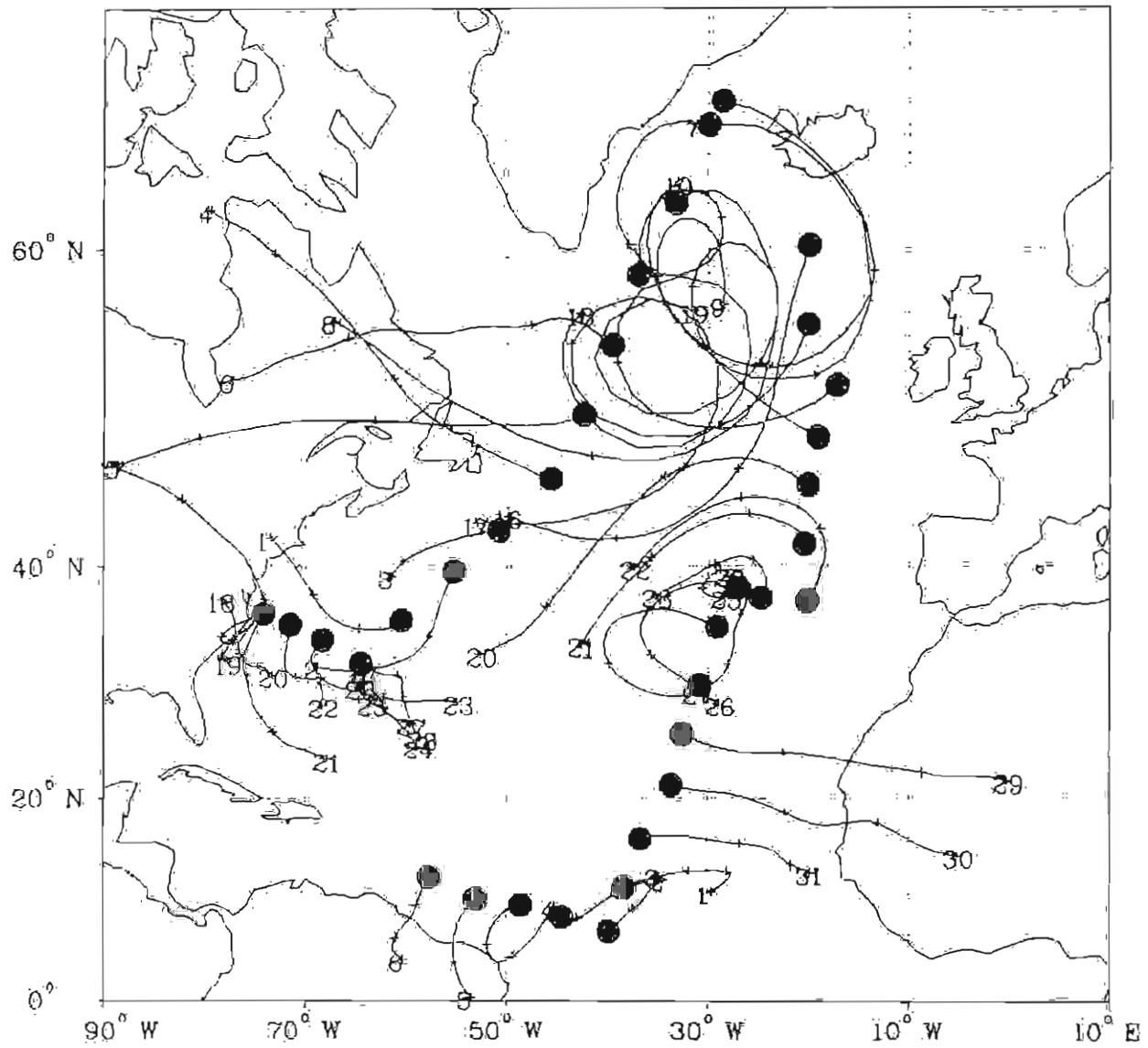


Figure 3-32. As Fig. 3-30, but for 700 hPa.

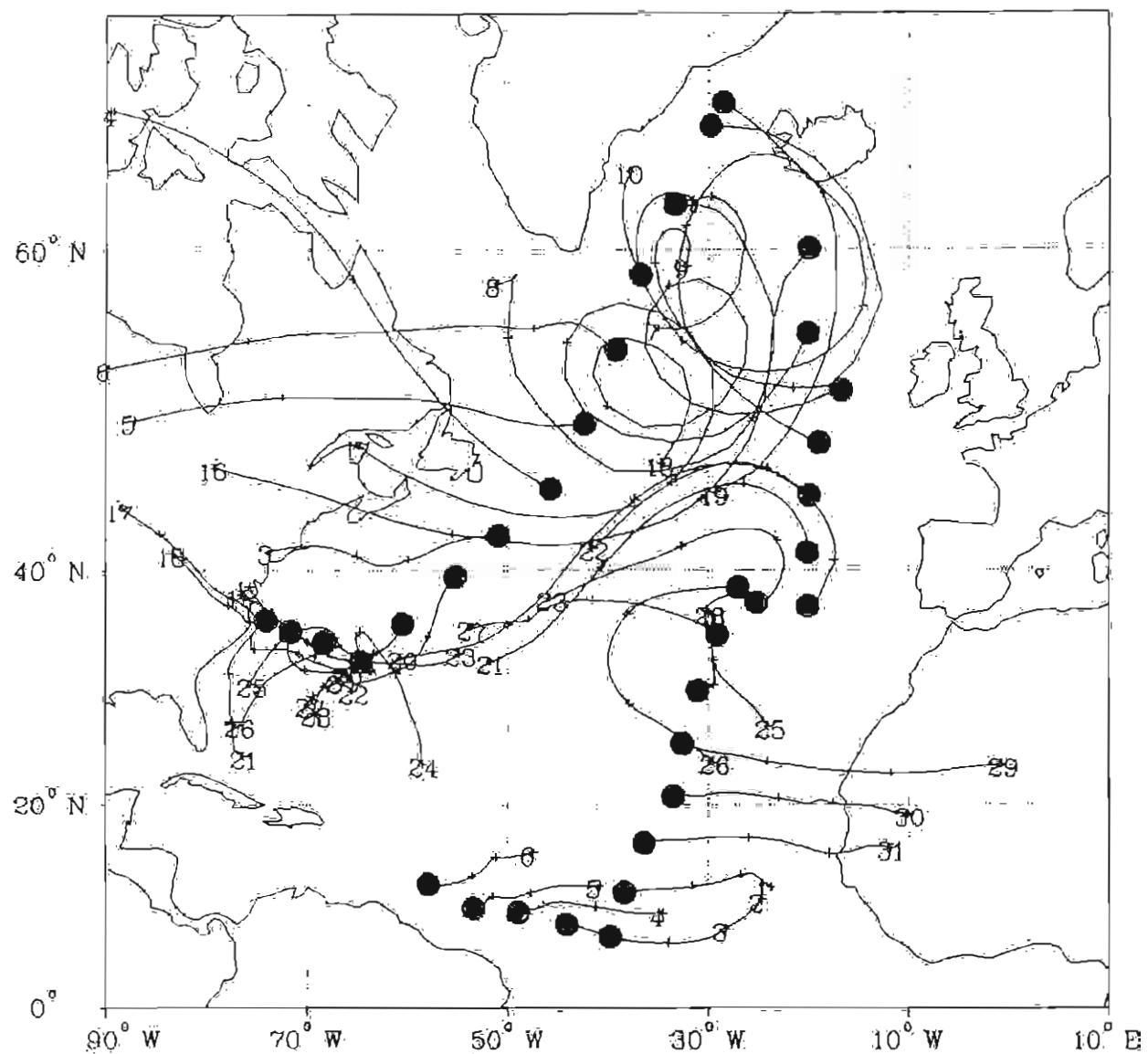


Figure 3-33. As Fig. 3-30, but for 500 hPa.

meteorological parameters, and meteorological data measured from the King Air. Isobaric trajectories on four pressure levels (1000, 850, 700, and 500 hPa) and up to six cross-sections of meteorological parameters measured from the soundings and derived products are presented for seven segments of the cruise. Cross-sections display temperature and wind vectors, relative humidity, potential temperature, mixing ratio, and the rotated u- and v-component (u' and v') air fluxes. Discussion of transport winds emphasizes the 850 hPa level because that level most closely represents the boundary layer. As discussed in Section 2.3, the cross-sections graphically depict the vertical structure of the atmosphere in the vicinity of the ship. During the periods the ship was relatively stationary off Norfolk, VA, and Bermuda, the abscissa of the cross-section is time. When the ship was cruising, the abscissa is both distance and time.

4.1 Leg 1: Norfolk to Bermuda

Leg 1 is divided into three segments: (1) the Norfolk area, (2) Norfolk to Bermuda, and (3) the Bermuda area. The NOAA King Air aircraft flew near the Mt. Mitchell off Norfolk and Bermuda. Additional details on the King Air flights are found in Gunter and Boatman (1989). King Air data are available from R. L. Gunter, NOAA/ERL/ARL/Aerosol Research Section, 325 Broadway, Boulder, CO 80303.

4.1.1 Norfolk area - Mt. Mitchell data and general overview

Figures 4-1 through 4-4 show daily 10-day back-trajectories beginning at 12 GMT for the period July 17 through July 21 on the 1000, 850, 700, and 500 hPa levels, respectively. At 850 hPa, the July 17 and 18 trajectories are over the Eastern US with transport generally from the west. For July 19-21, transport is generally from the south for at least 2 days, then from the east. The July 19 trajectory is over parts of Florida and Cuba. The July 20 and 21 trajectories are completely over the Atlantic Ocean. Note the differences in the trajectories among the four pressure levels; different levels may best be used in different applications. For all the 1000 hPa trajectories during this period, transport is from the east across the western Atlantic, then from the south. The 500 hPa trajectories, however, show transport from the northwest for three of the trajectories (July 17-19), transport from the south approaching the ship on July 21, and the July 20 trajectory ends over the US but passes over the Atlantic for at least 6 days.

Figures 4-5(a-d) and 4-6(a-b) are the cross-sections for the period 00 GMT July 17 through 00 GMT July 22. Figure 4-5(a) shows that the temperature was constant over the 5-day period (approximately 28°C at the surface) and decreased uniformly with height at a rate of about 6°C/km. This is close to the rate of 6.5°C/km for the US Standard Atmosphere (e.g., Dutton, 1976). Winds were southwesterly over much of the period as expected because of the Bermuda/Azores High. At 850 hPa (approximately 1500 m), wind speeds were about 10 m/s. Southerly and east to northeasterly winds were observed above 5000 m during July 19 and 20. The relative humidity (RH) cross-section (Fig. 4-5(b)) showed RH generally greater than 70% near the surface (i.e., in the boundary layer) and RH less than 40% above 4000 m. The potential temperature surfaces (Fig. 4-5(c)) gradually slope with time. Although surface potential temperatures were near 300 K during this period, at about 500 m, the potential temperature was between 300 K and 305 K on July 17 and near 300 K on July 21. The mixing ratio (Fig. 4-5(d)) was near 17 g/kg at the surface decreasing to

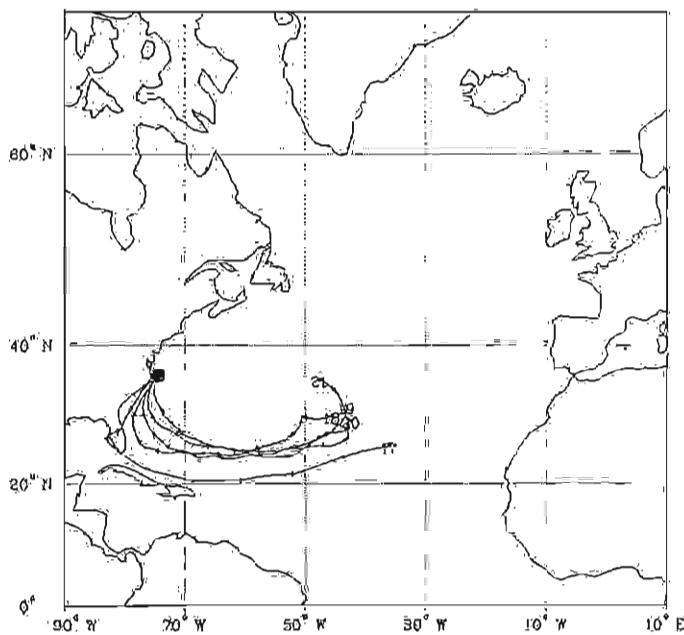


Figure 4-1. Daily 12 GMT 1000 hPa 10-day back-trajectories beginning at the ship's position from 17 July through 21 July 1988. A dot is at the beginning and the date is at the end of each back-trajectory. + symbols are at 24-h intervals.

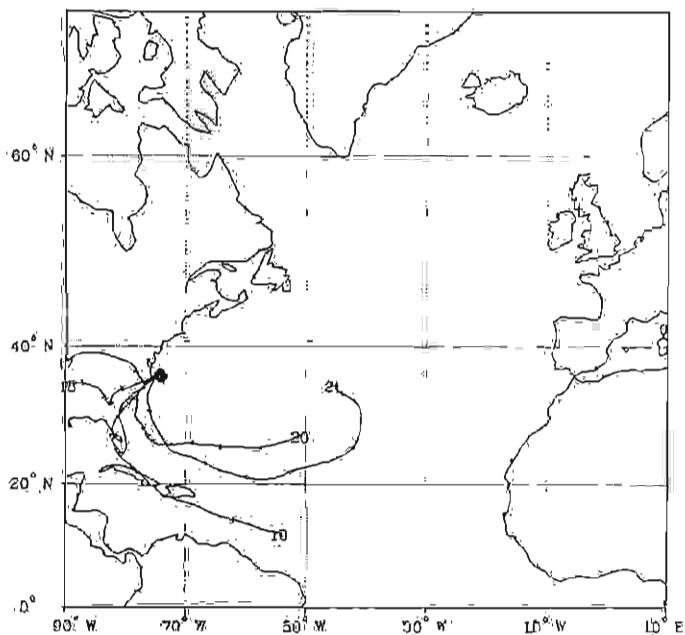


Figure 4-2. As Fig. 4-1, but for 850 hPa.

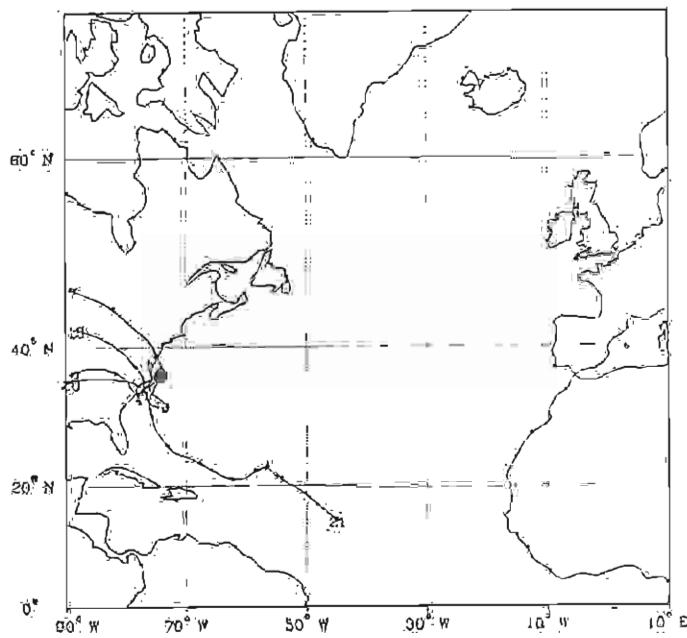


Figure 4-3. As Fig. 4-1, but for 700 hPa.

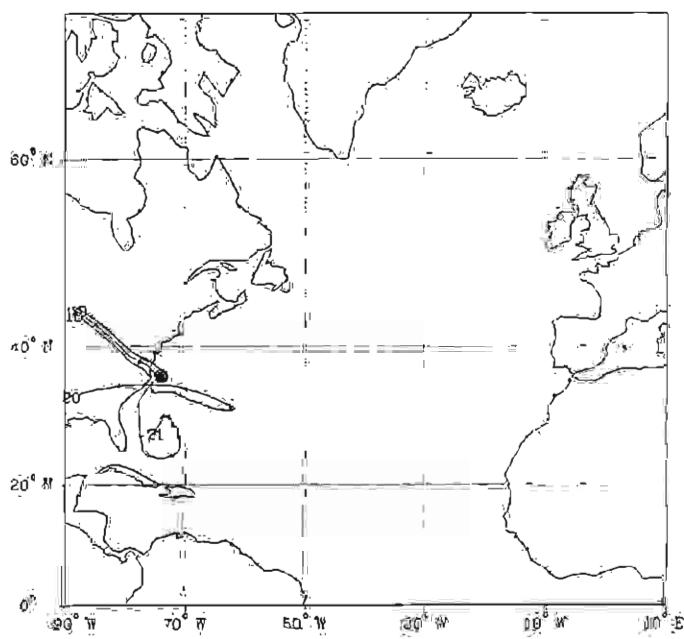


Figure 4-4. As Fig. 4-1, but for 500 hPa.

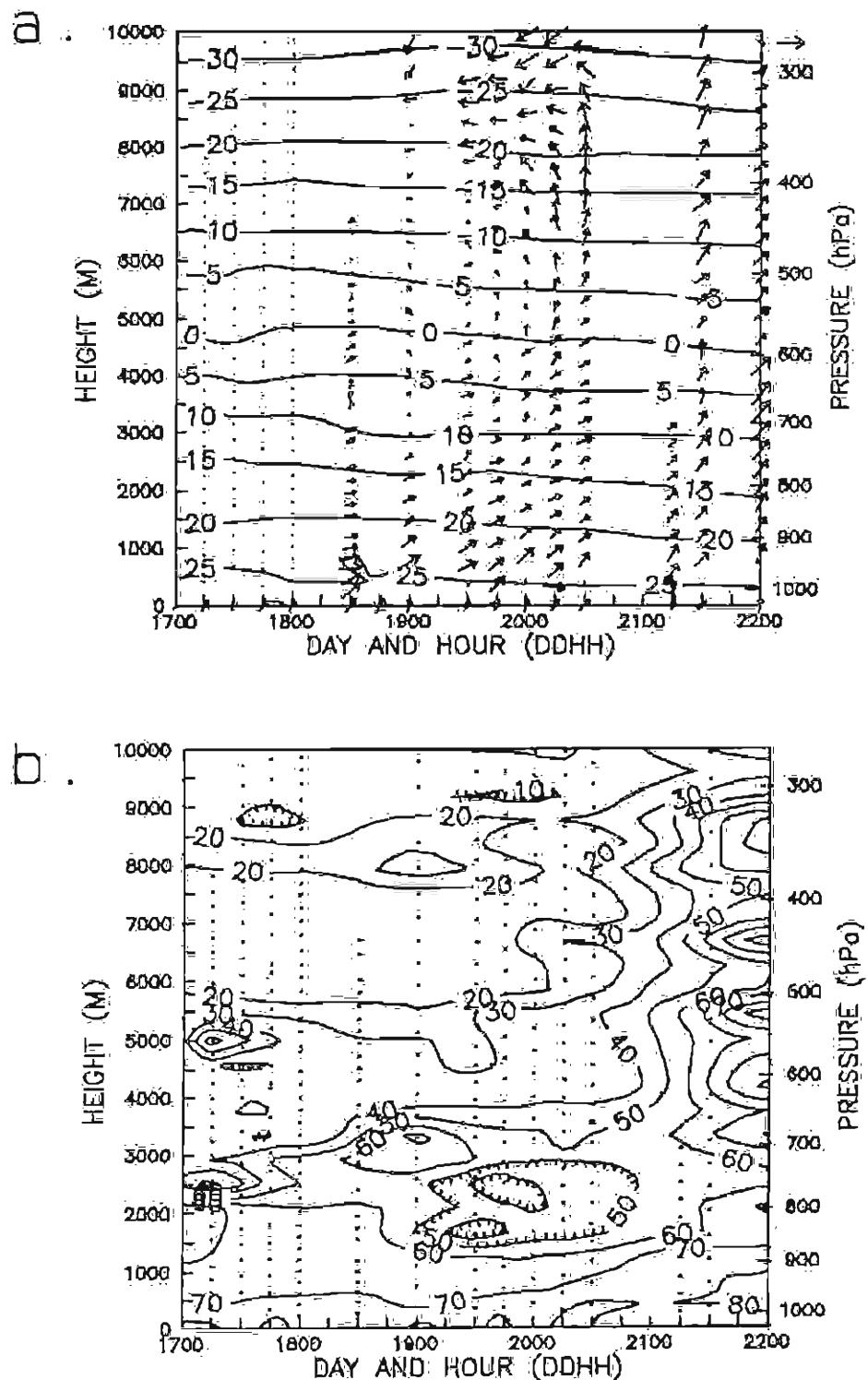


Figure 4-5. Time-section of (a) temperature ($^{\circ}$ C) and wind vectors (wind vector scale at upper-right corner is 20 m/s) and (b) relative humidity (%) approximately 200 km southeast of Norfolk, VA, beginning 00 GMT 17 July 1988 (1700 in figure) and ending 00 GMT 22 July 1988 (2200 in figure). Dots or wind vectors indicate the locations of sounding values at 100 s intervals.

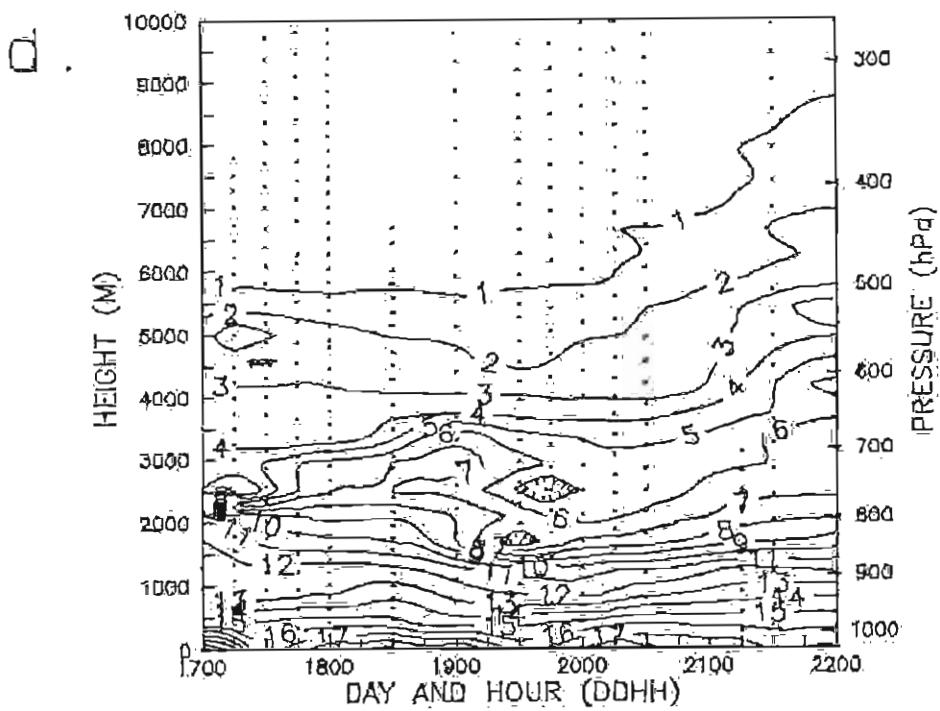
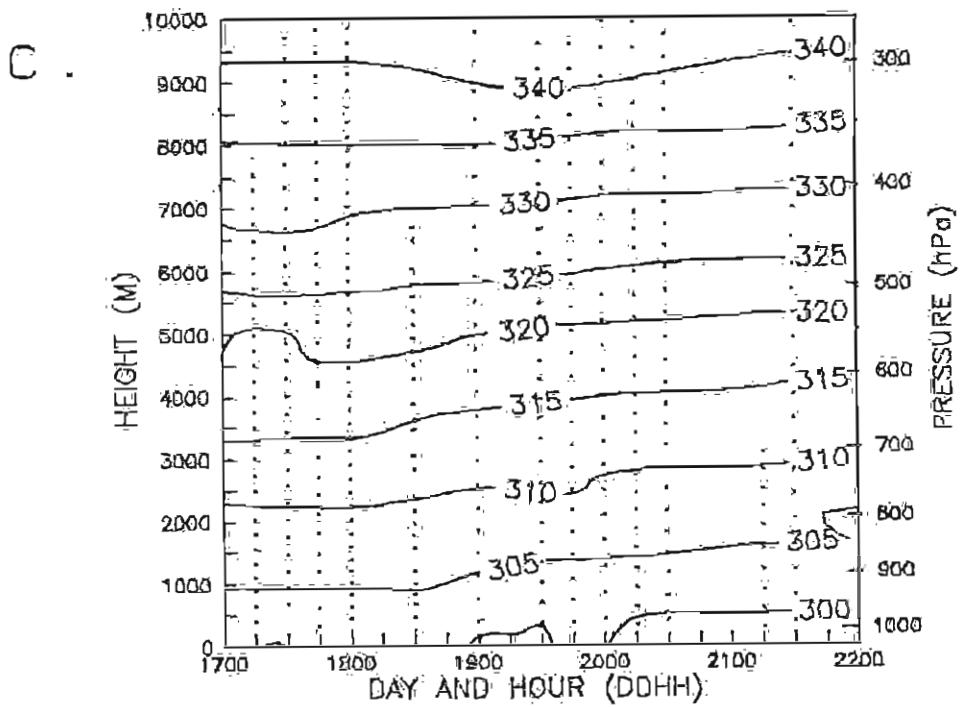


Figure 4-5 continued. Time-section of (c) potential temperature (K), and (d) mixing ratio (g/kg) approximately 200 km southeast of Norfolk, VA, beginning 00 GMT 17 July 1988 (1700 in figure) and ending 00 GMT 22 July 1988 (2200 in figure). Dots or wind vectors indicate the locations of sounding values at 100 s intervals.

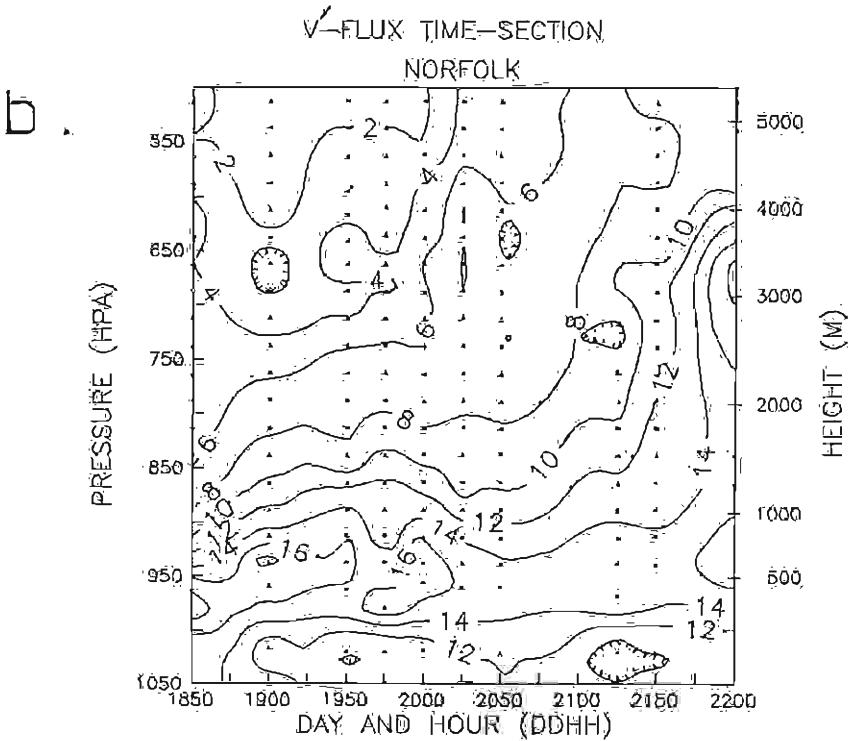
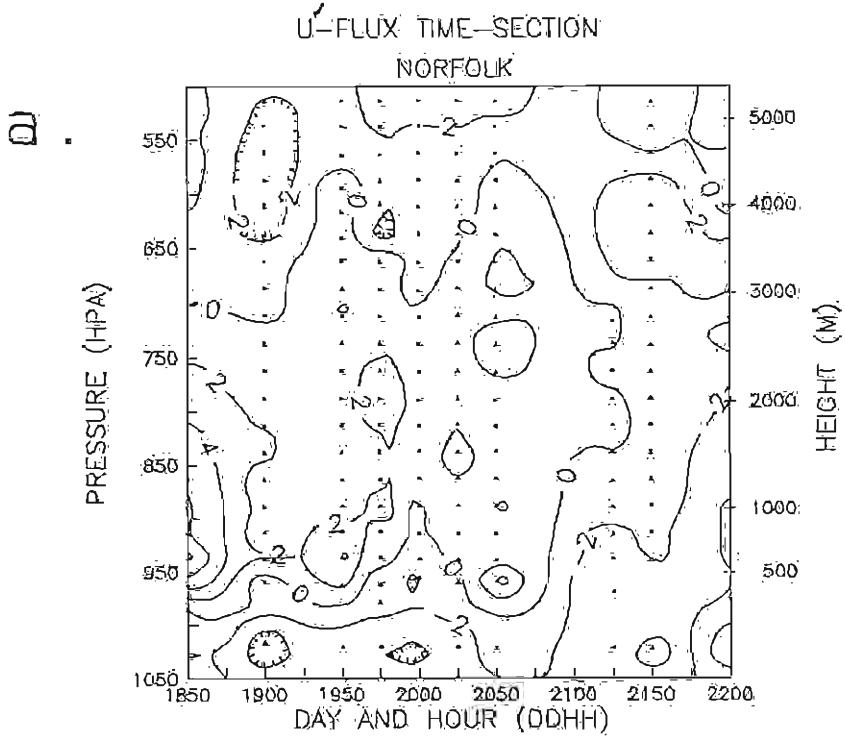


Figure 4-6. Time-section of mean (a) u' -component and (b) v' -component air flux ($\text{kg/m}^2/\text{s}$) approximately 200 km southeast of Norfolk, VA, beginning 12 GMT 18 July 1988 (1850 in figure) and ending 00 GMT 22 July 1988 (2200 in figure). Dots indicate level of mean flux.

about 10 g/kg at 1500 m. The u' -flux component (positive to the southeast, Fig. 4-6(a)) was small, generally in the range -2 to 2 kg/m²/s, but the v' -flux component (positive to the northeast, Fig. 4-6(b)) was much greater, generally 10 to 16 kg/m²/s below 1500 m. As discussed in Section 2.4, the flux is the product of air density and wind speed. Wind speed has a greater effect on flux because it varies more with height than does density. The greater v' -flux results because of the generally southwest winds during this period.

4.1.2 Norfolk area - King Air intensives

Flights of approximately four hour duration were flown offshore in the vicinity of the Mt. Mitchell. There were four flights for this intensive: 17, 18, 19, and 21 July 1988. Each flight departed Patrick Henry Field (PHF), Newport News, VA, at approximately 1300 GMT. The first two hours of each flight (en route to the ship and then back and forth over the ship) were in the free troposphere at approximately 2590 m (743 hPa) for about 1 and 1/2 hours, then at 2285 m (828 hPa) for 15 minutes, then at 760 m (927 hPa) for 15 minutes. The last part of the flight was at 150 m (998 hPa) for approximately one hour, to include a 30-m (1015 hPa) flyby of the Mt. Mitchell, then approximately one hour back to PHF at 150 m. See Figure 4-7 for in-flight pressures.

The data taken with the instruments aboard the King Air substantiate the meteorological data taken aboard the Mt. Mitchell. To give a better representation of the values, parameters were graphed vs. time. When graphed vs. altitude, the variances are not apparent because the aircraft was at each level for an extended time. Surface temperatures at PHF and during the in-flight 150 m level were approximately 28°C, and temperatures at 2590 m were approximately 12°C. This agrees with the lapse rate of 6°C/km determined by the soundings from the Mt. Mitchell. Figure 4-8 shows the temperature and dew point data vs. time for each flight. The RH at PHF was approximately 75% and over the ocean at 150 m, values were near 85%. At the highest level (2590 m), values were generally less than 40%, except for the 21st, where the RH was approximately 70% and the 18th where values were approximately 50%. On the ascent to 2590 m, moist layers were evident on two days (17 and 19 July). Figure 4-9 shows relative humidity vs. time for each flight. Wind data from the flights indicated moderate southwest flow. The U-component (positive for westerly flow) and the V-component (positive for southerly flow) indicate a fairly constant 10 m/s each. (See Figures 4-10 and 4-11.) Again, these data are in agreement with Mt. Mitchell sounding information.

4.1.3 Norfolk to Bermuda

Figures 4-12 through 4-15 show daily 10-day back-trajectories beginning at 12 GMT for the period July 22 through July 28 on the 1000, 850, 700, and 500 hPa levels, respectively. During the Norfolk to Bermuda period, July 22 through 24, the 850 hPa trajectories showed transport over the ocean generally from the east.

Figures 4-16(a-d) and 4-17(a-b) are the cross-sections for the period 00 GMT July 22 through 00 GMT July 25. Figure 4-16(a) shows that the temperature was constant over the 3-day period (approximately 26°C at the surface) and decreased with height. Winds were relatively strong and southwesterly for the sounding nearest Norfolk, then decreased in strength approaching Bermuda

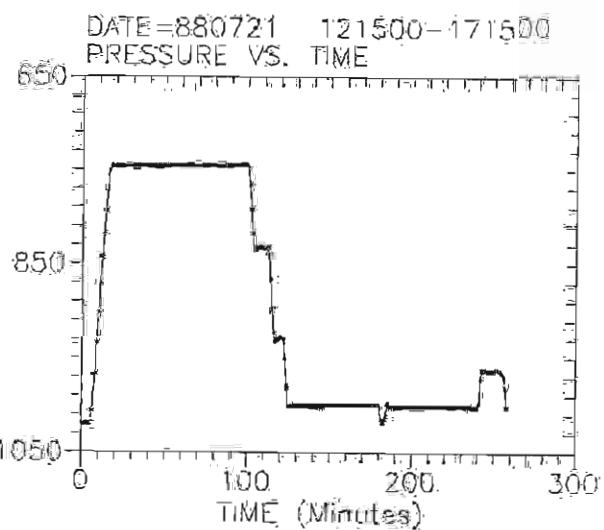
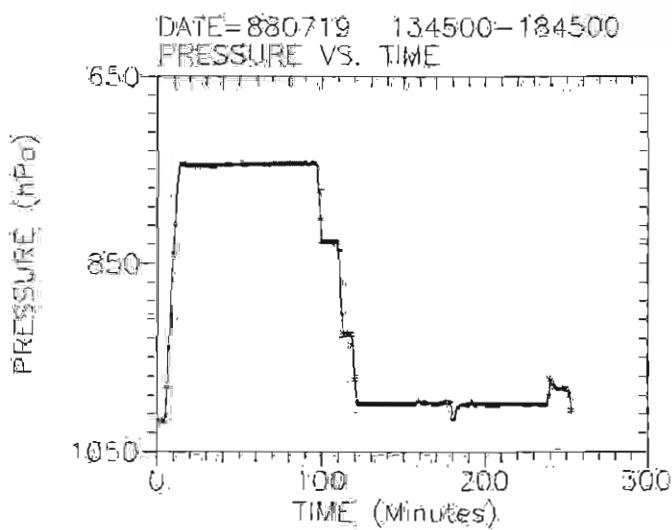
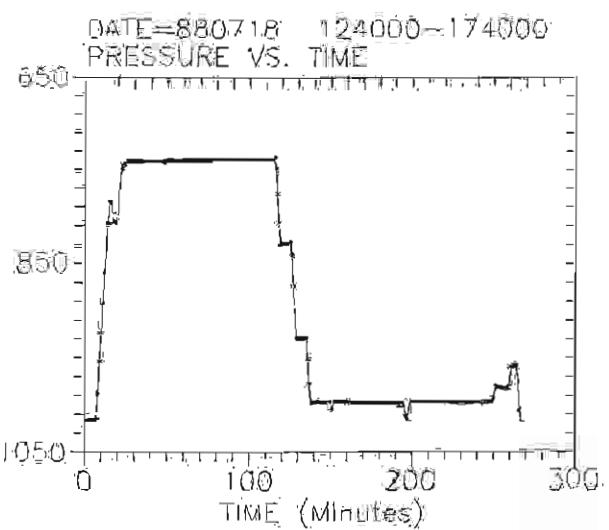
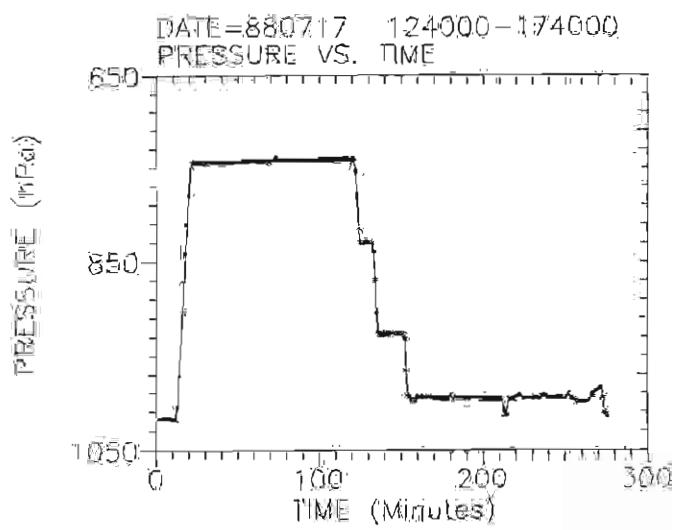


Figure 4-7. Pressure as a function of time for Norfolk-area King Air flights.

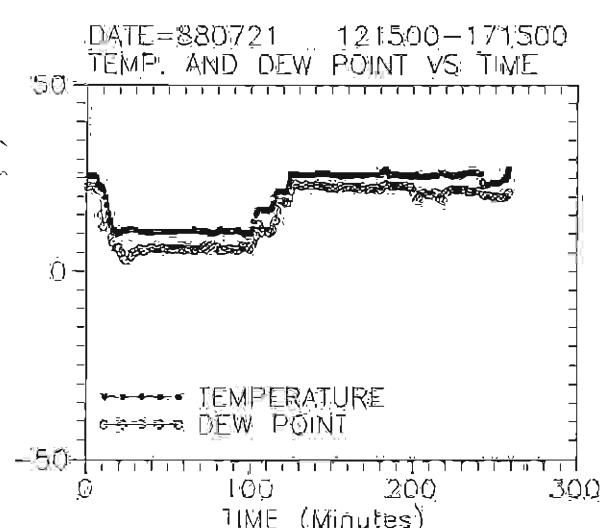
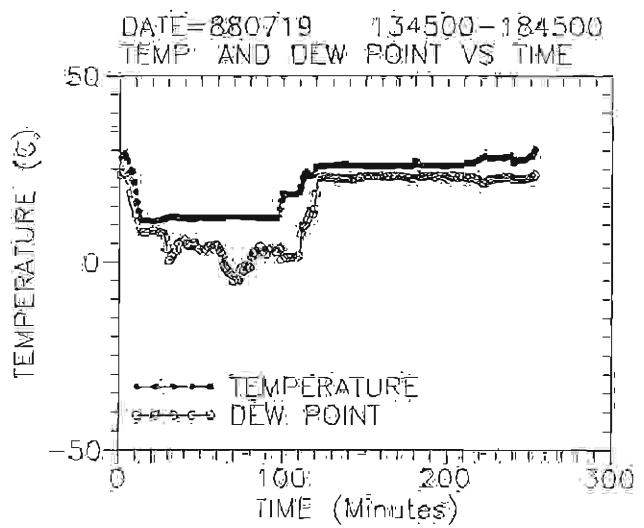
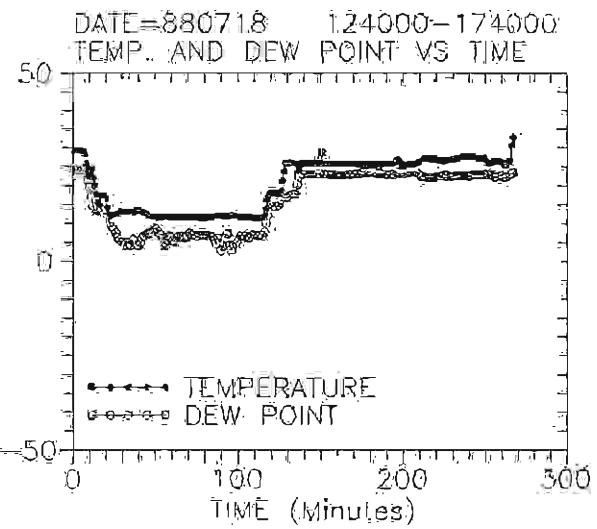
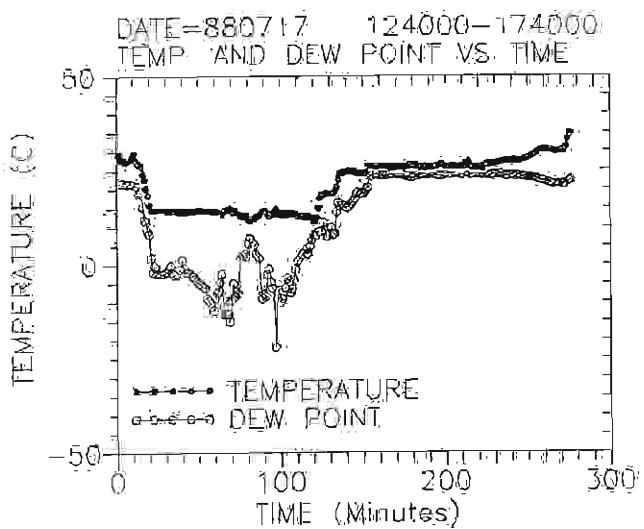


Figure 4-8. Temperature and dewpoint as a function of time for Norfolk-area King Air flights.

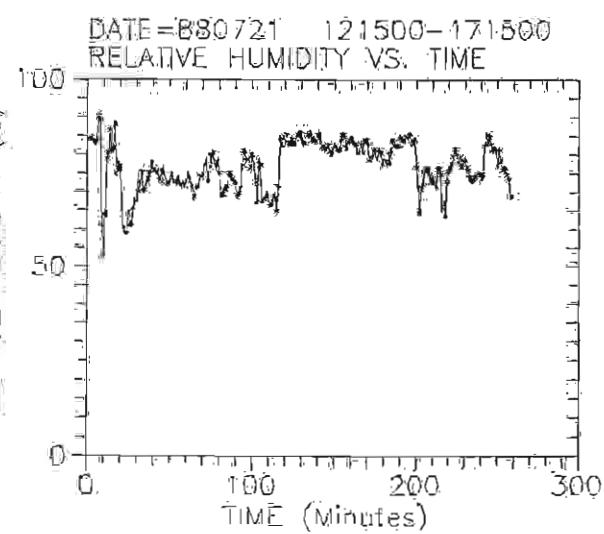
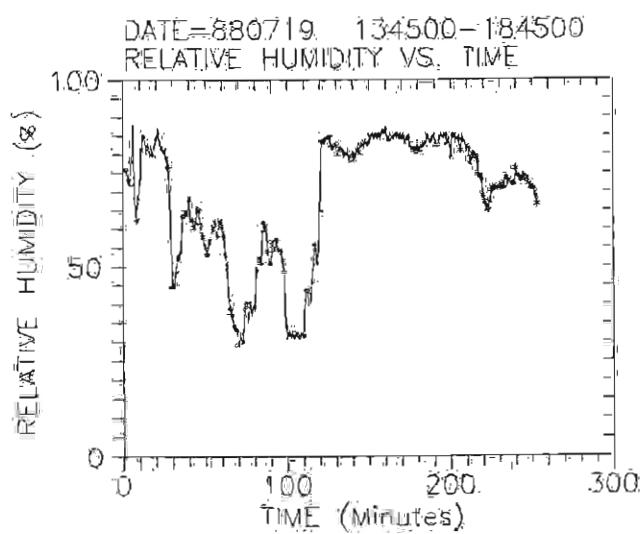
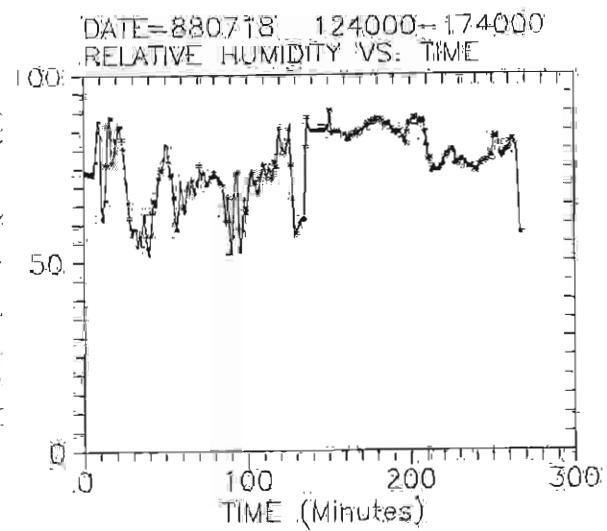
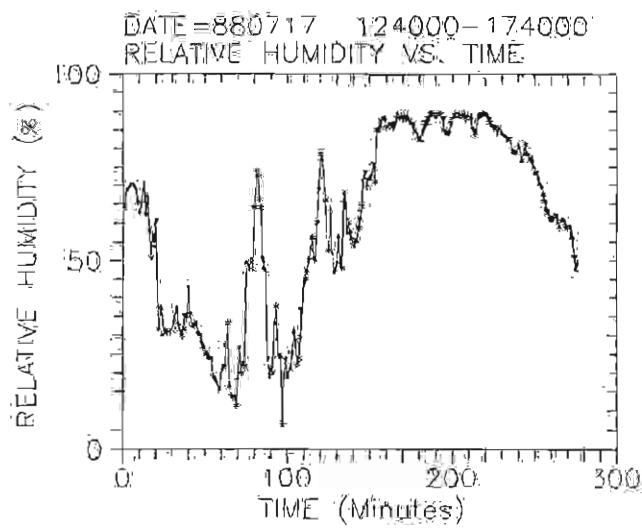


Figure 4-9. Relative humidity as a function of time for Norfolk-area King Air flights.

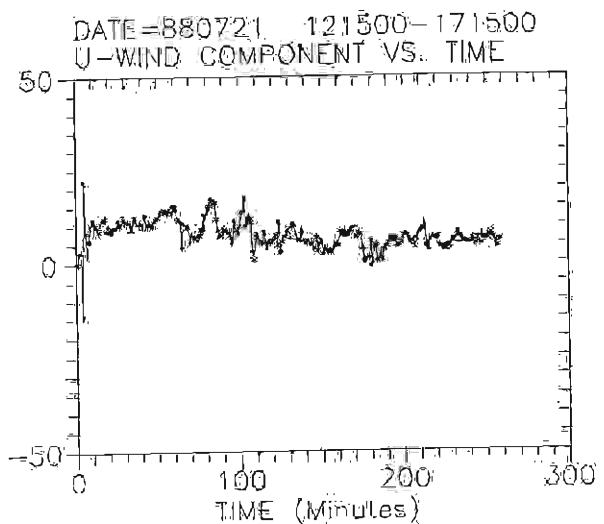
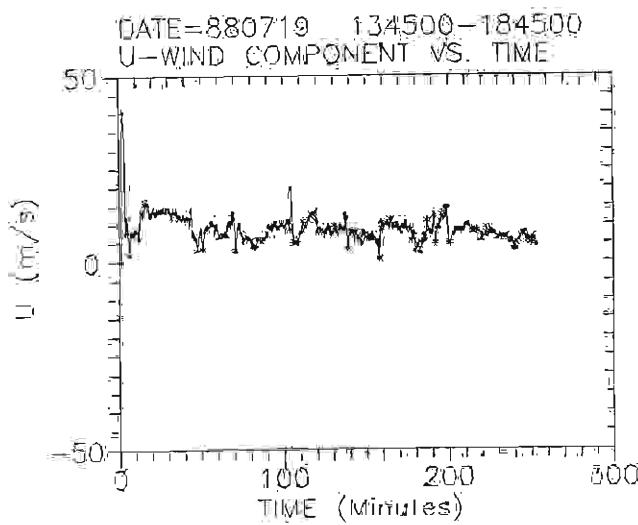
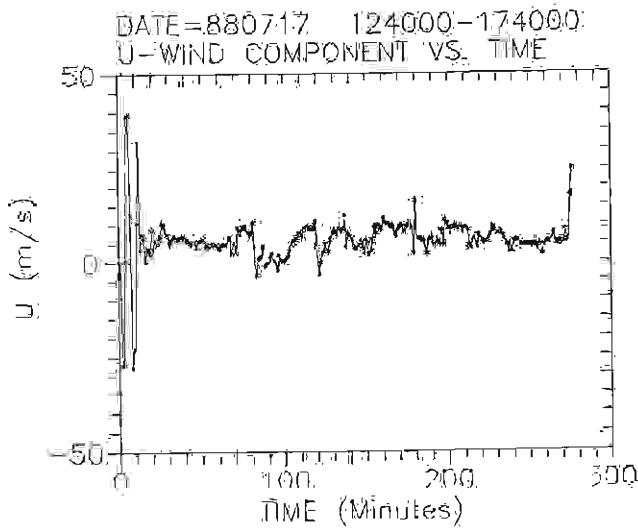


Figure 4-10. U-component wind (positive for westerly flow) as a function of time for Norfolk-area King Air flights.

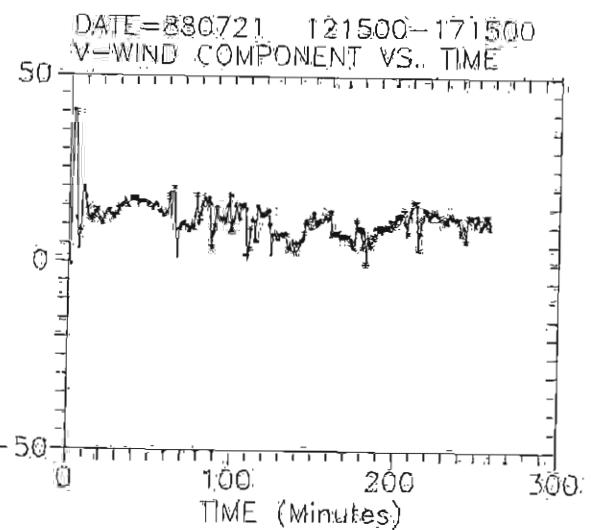
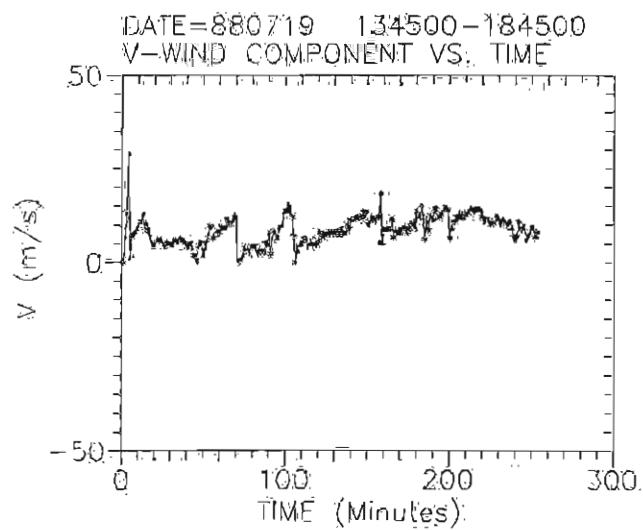
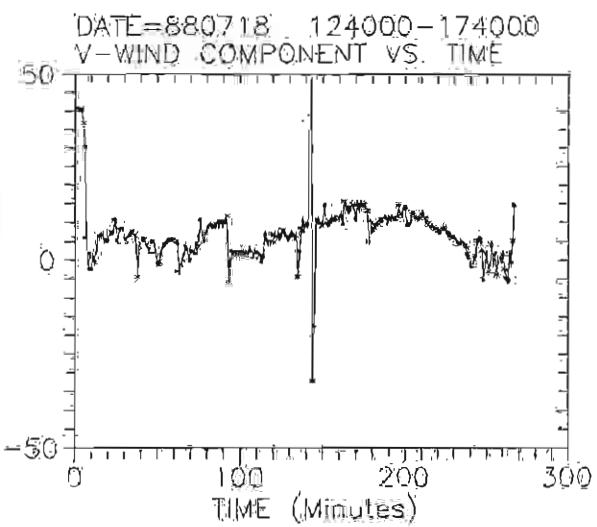
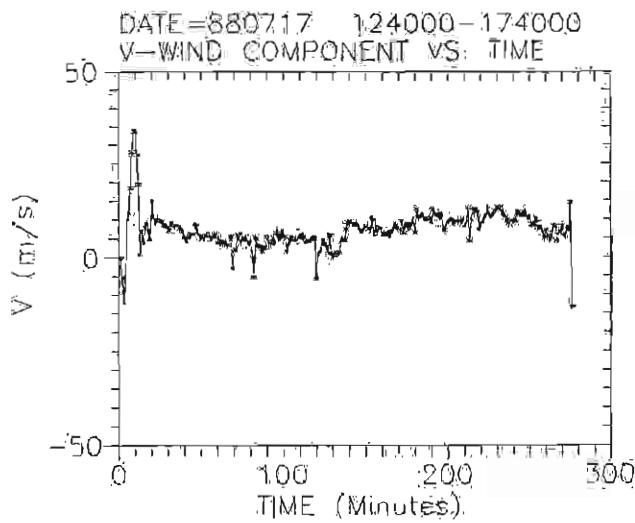


Figure 4-11. V-component wind (positive for southerly flow) as a function of time for Norfolk-area King Air flights.

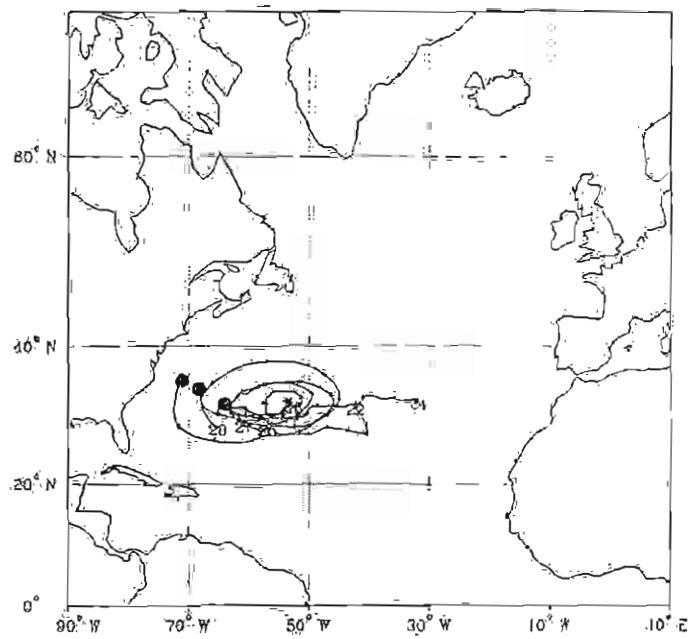


Figure 4-12. Daily 12 GMT 1000 hPa 10-day back-trajectories beginning at the ship's position from 22 July through 28 July 1988. A dot is at the beginning and the date is at the end of each back-trajectory. + symbols are at 24-h intervals.

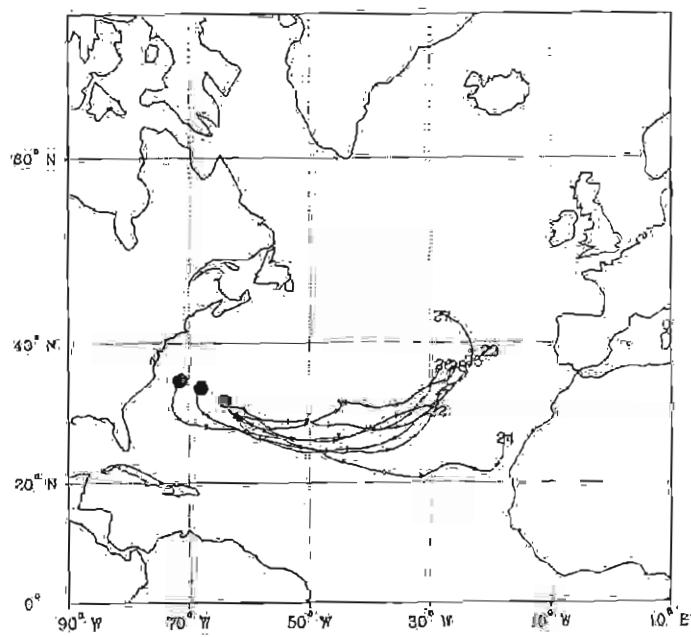


Figure 4-13. As Fig. 4-12, but for 850 hPa.

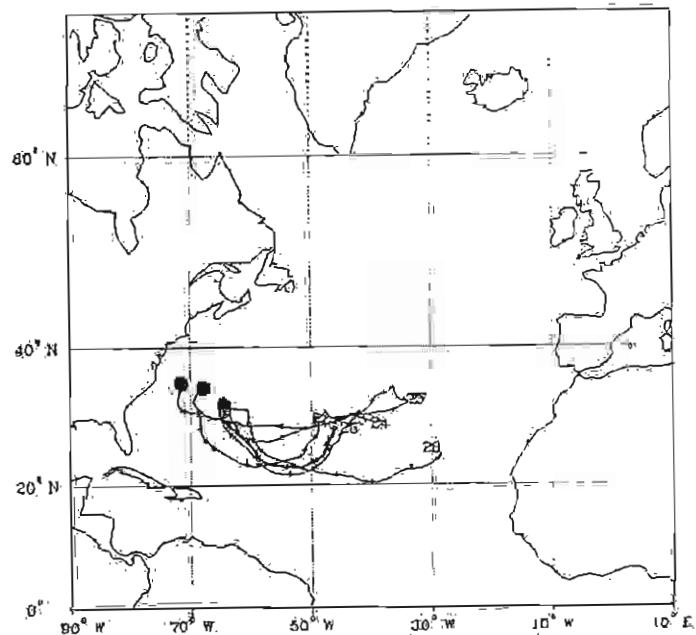


Figure 4-14. As Fig. 4-12, but for 700 hPa.

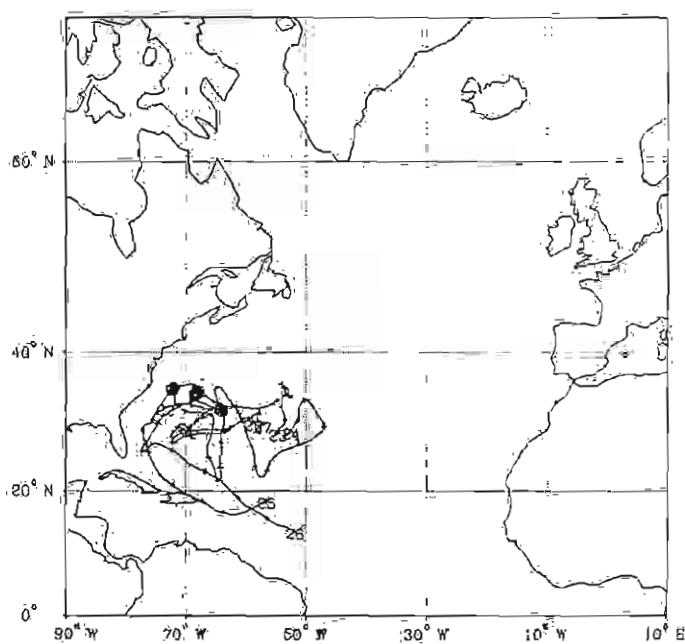


Figure 4-15. As Fig. 4-12, but for 500 hPa.

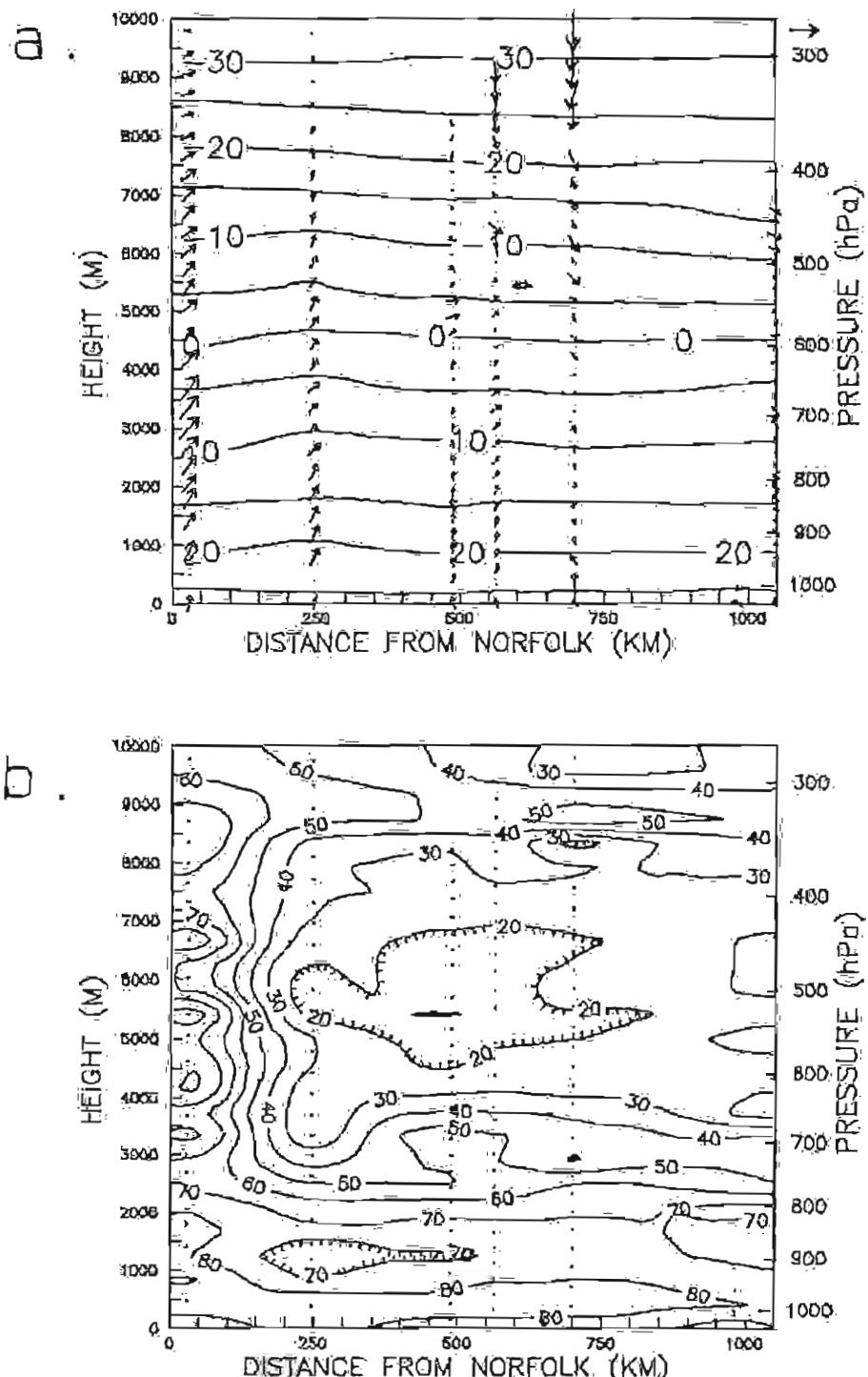


Figure 4-16. Space/time-section of (a) temperature ($^{\circ}$ C) and wind vectors (wind vector scale at upper-right corner is 20 m/s), and (b) relative humidity (%) on a scale from 36N, 74W to 32N, 64W (Norfolk to Bermuda). Data are from soundings beginning 00 GMT 22 July (30 km from Norfolk) and ending 00 GMT 25 July (1050 km from Norfolk). Dots or wind vectors indicate the locations of sounding values at 100 s intervals.

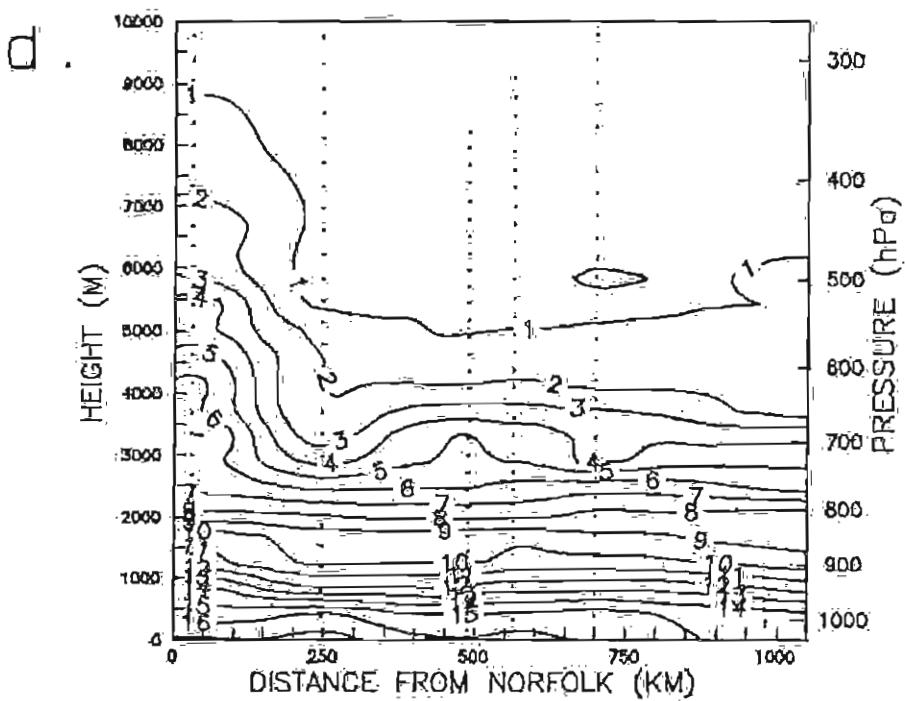
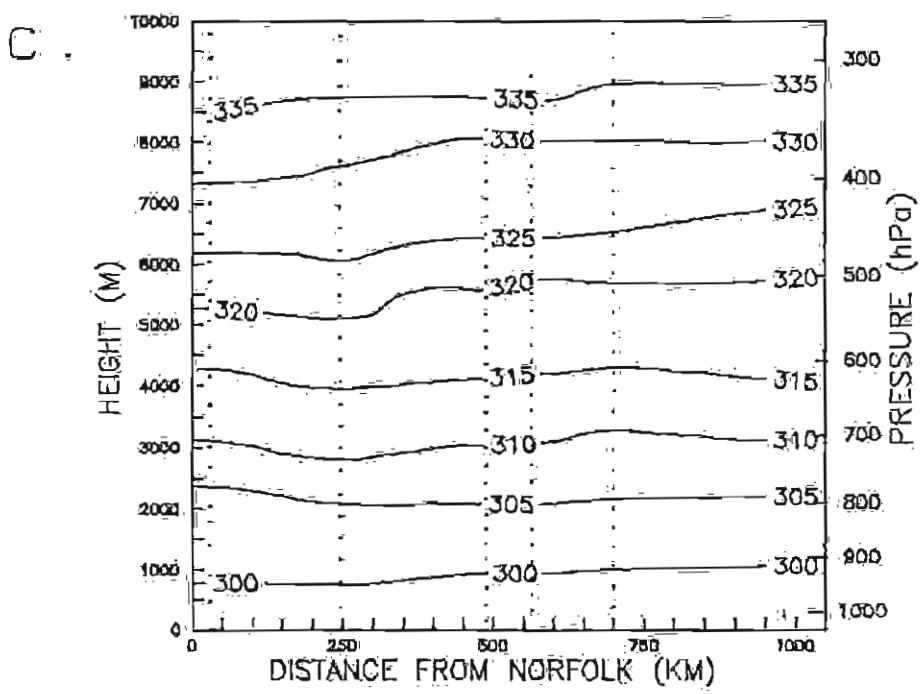


Figure 4-16 continued. Space/time-section of (c) potential temperature (K), and (d) mixing ratio (g/kg) on a scale from 36N, 74W to 32N, 64W (Norfolk to Bermuda). Data are from soundings beginning 00 GMT 22 July (30 km from Norfolk) and ending 00 GMT 25 July (1050 km from Norfolk). Dots or wind vectors indicate the locations of sounding values at 100 s intervals.

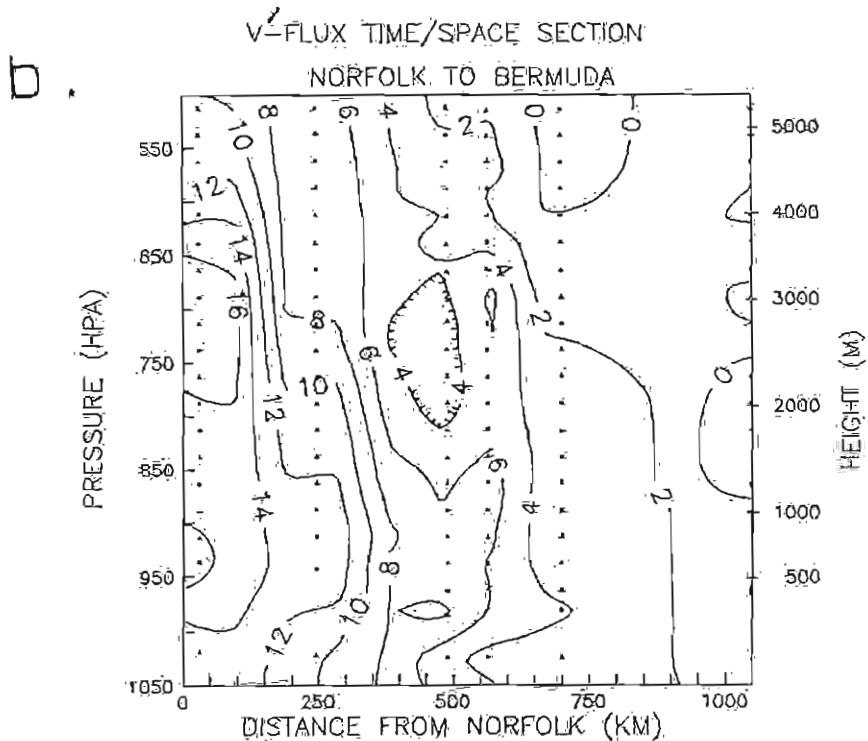
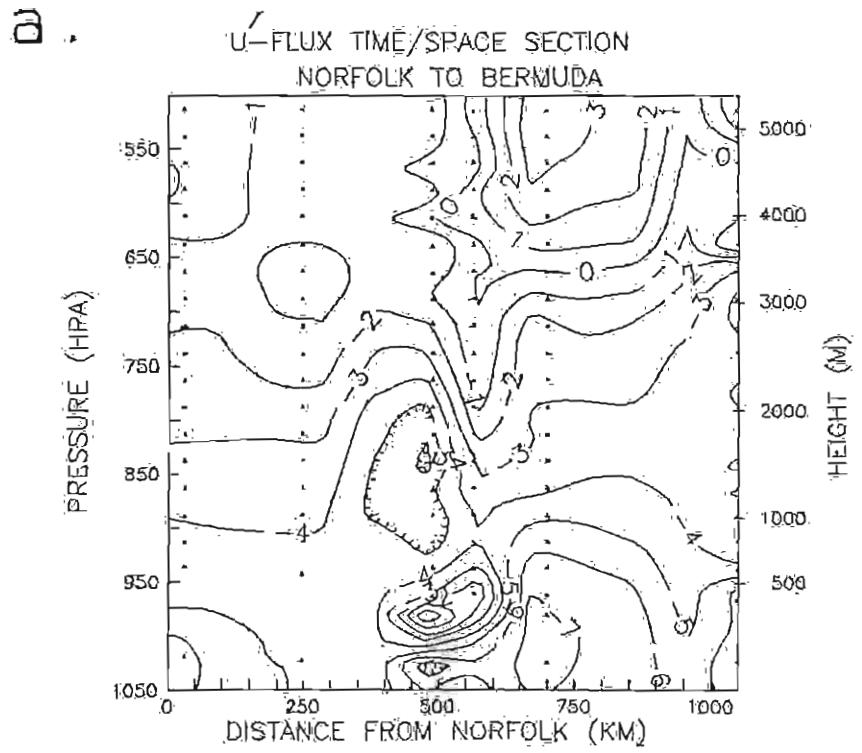


Figure 4-17. As Fig. 4-16, but mean (a) u' -component and (b) v' -component air flux ($\text{kg/m}^2/\text{s}$). Dots indicate level of mean flux.

because of the location of the Bermuda/Azores High. At 850 hPa (approximately 1500 m), wind speeds were about 10 m/s close to Norfolk, decreasing to 2 m/s near Bermuda. The relative humidity cross-section (Fig. 4-16(b)) showed RH generally greater than 70% below 2000 m. The potential temperature surfaces (Fig. 4-16(c)) are generally constant with time. Near the surface, the potential temperature was approximately 297 K. The mixing ratio (Fig. 4-16(d)) was 17 g/kg at the surface near Norfolk decreasing to about 15 g/kg near Bermuda. Mixing ratio was less than 10 g/kg above 1200 m. u' -flux ranged from -7 to 3 kg/m²/s (Fig. 4-17(a)). Negative u' -flux (southeasterly wind component) occurred over much of the cross-section except above 3200 m at distances greater than 500 km from Norfolk. v' -flux (southwest component, Fig. 4-17(b)) was greater than 10 kg/m²/s for much of the first two soundings (00 and 12 GMT July 22) decreasing to near zero nearest Bermuda.

4.1.4 Bermuda area - Mt. Mitchell data and general overview

During the Bermuda period, July 25 through 28, the 850 hPa trajectories showed transport over the ocean generally from the east in a similar pattern as during the Norfolk to Bermuda period (Fig. 4-13).

Figures 4-18(a-d) and 4-19(a-b) are the cross-sections for the period 00 GMT July 25 through 00 GMT July 29. As near Norfolk, temperature was constant with time (approximately 27°C at the surface) and decreased uniformly with height at a rate of about 6°C/km. The winds were lighter than earlier in the cruise, but tended to have a southerly component for heights below about 5000 m and a northerly component above 5000 m. At 850 hPa, wind speeds were about 3 m/s. The depth of the layer having RH greater than 70% (Fig. 4-18(b)) was about 2000 m, or about three times as deep as that near Norfolk. The potential temperature surfaces (Fig. 4-18(c)) are constant with time. Near the surface, the potential temperature was approximately 297 K. The mixing ratio (Fig. 4-18(d)) was near 15 g/kg at the surface decreasing to about 10 g/kg at 1300 m. Both the u' - and v' -flux components (Figs. 4-19(a and b)) were small with magnitudes less than 6 kg/m²/s.

4.1.5 Bermuda area - King Air intensives

Flights of approximately four hour duration were flown upwind of Bermuda. Dates for these flights were: 26, 27 (2 flights), and 28 July 1988. The flight plans were identical to those flown off the east coast of the U.S. (see Section 4.1.2). Figure 4-20 shows in-flight pressures for these flights.

The meteorological data from the King Air once again substantiate the Mt. Mitchell findings. As for the first four flights, the parameters are graphed vs. time. Surface temperatures at Bermuda, and at 150 m (1004 mb) were approximately 27°C. Temperatures at 2590 m (747 mb) were approximately 11°C, once again indicating a lapse rate of 6°C/km (see Figure 4-21 for temperature and dew point vs. time). The surface RH at Bermuda averaged 75%. Values at 2590 m were less than 25% for the first three flights, with relatively moist layers (up to 50% RH) on the 26th, and values at 150 m were approximately 75%. On the 28th, RH on the ground was 80%, and on ascent, a layer at 90% was evident. At 2590 m, RH values remained on the average at 60%, with values of 80% at the 150 m level. See Figure 4-22 for RH vs time. Winds were light and variable (about 5 m/s or less) during this time, and the U and V components (Figs. 4-23 and 4-24) indicate a general southeasterly flow, which is in agreement with the Mt. Mitchell soundings.

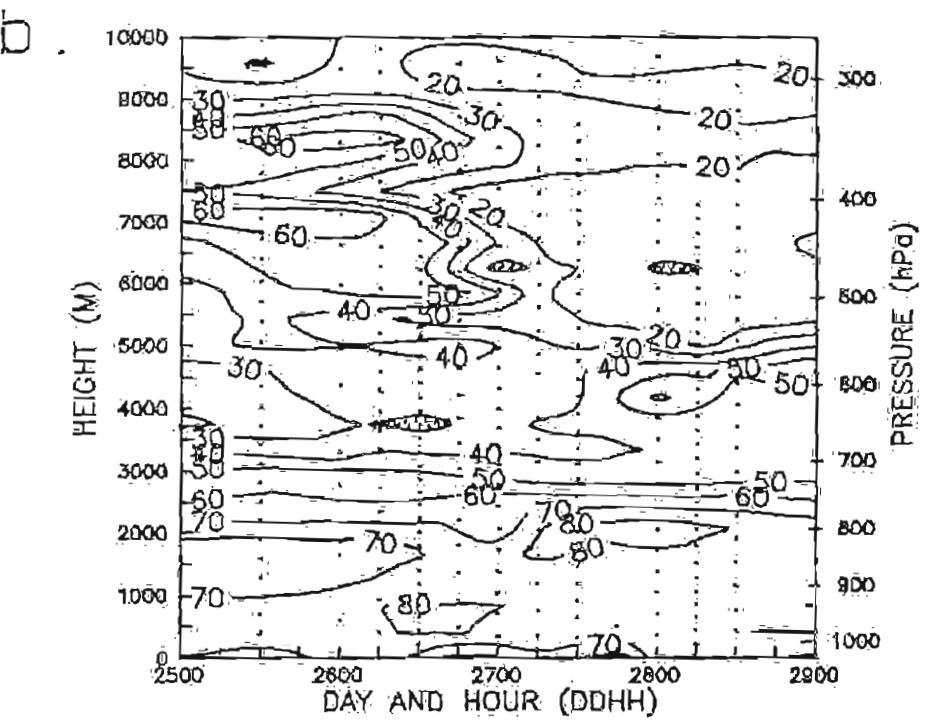
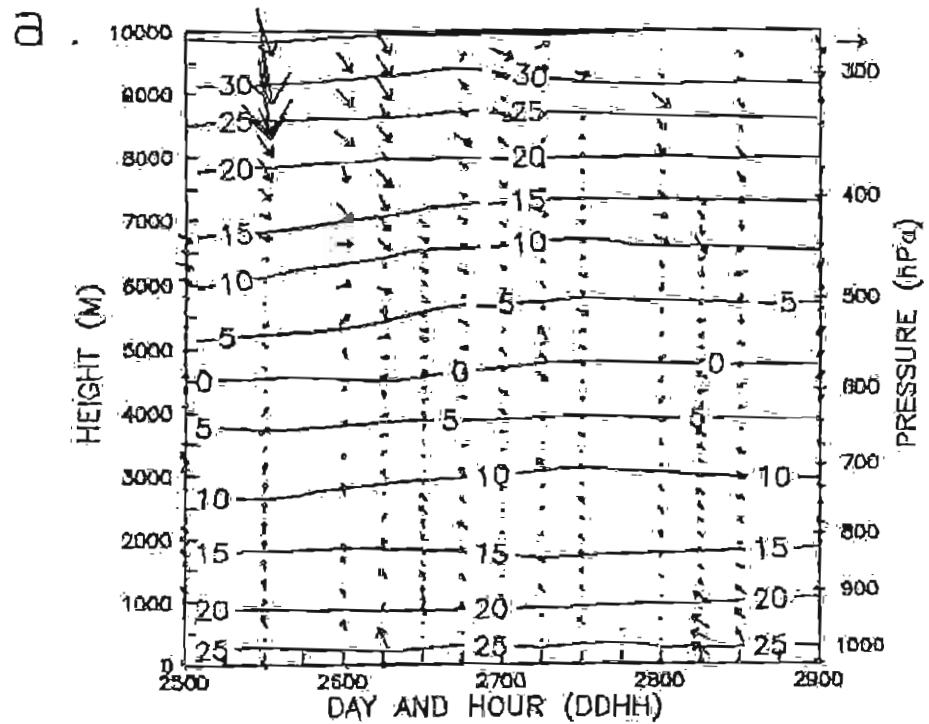


Figure 4-18. Time-section of (a) temperature (C) and wind vectors (wind vector scale at upper-right corner is 20 m/s) and (b) relative humidity (%) from soundings near Bermuda beginning 00 GMT 25 July 1988 (2500 in figure) and ending 00 GMT 29 July 1988 (2900 in figure). Dots or wind vectors indicate the locations of sounding values at 100 s intervals.

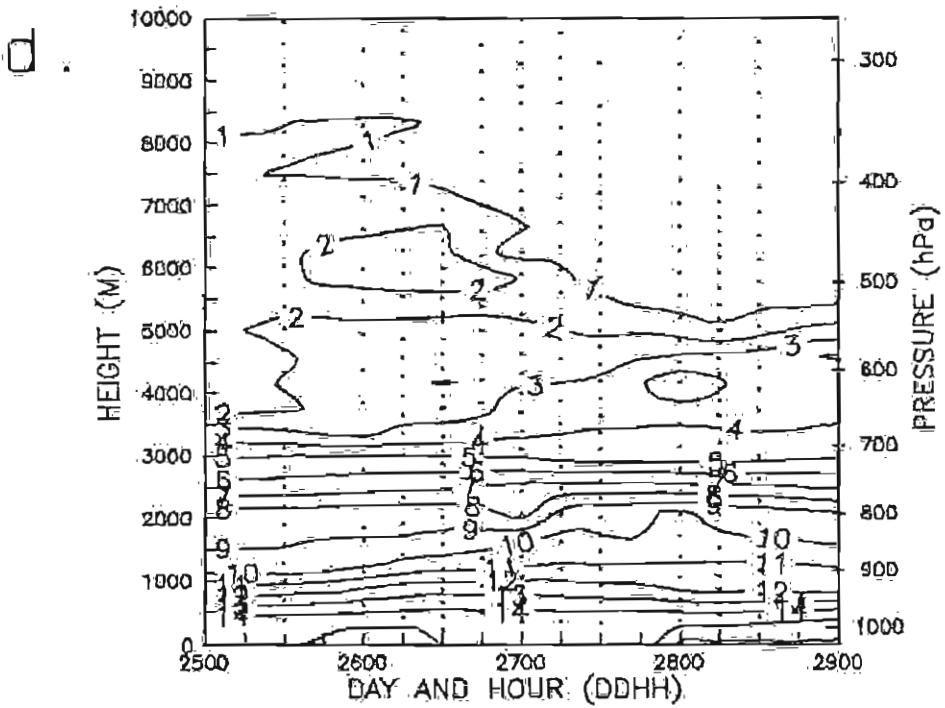
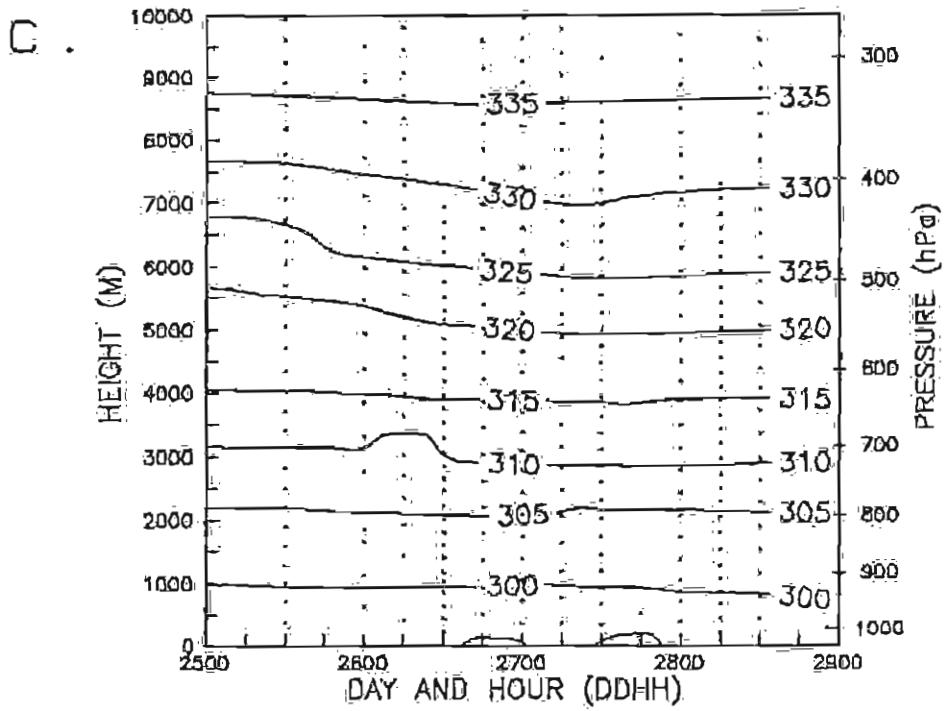


Figure 4-18 continued. Time-section of (c) potential temperature (K), and (d) mixing ratio (g/kg) from soundings near Bermuda beginning 00 GMT 25 July 1988 (2500 in figure) and ending 00 GMT 29 July 1988 (2900 in figure). Dots or wind vectors indicate the locations of sounding values at 100 s intervals.

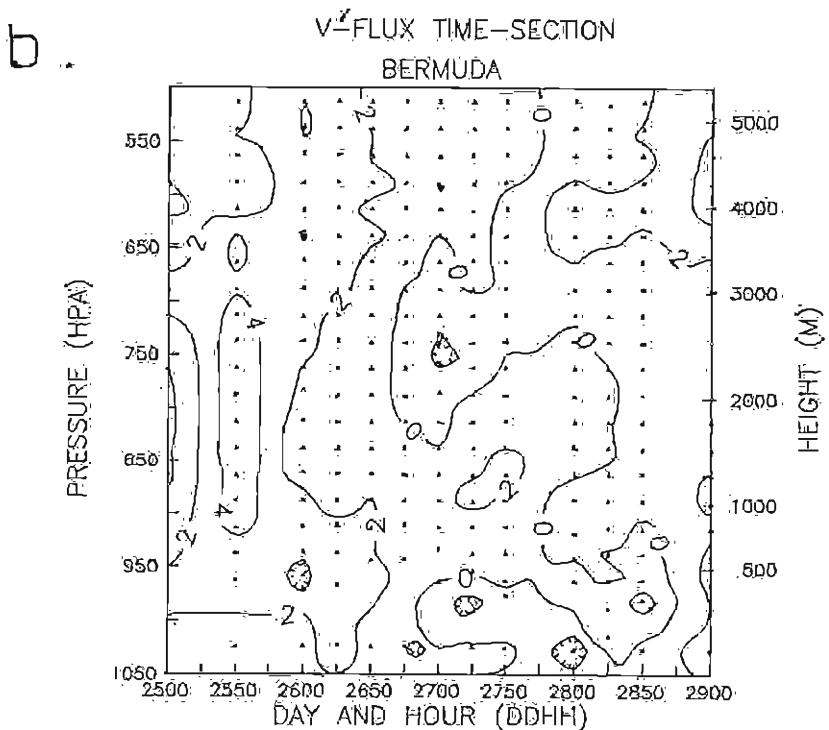
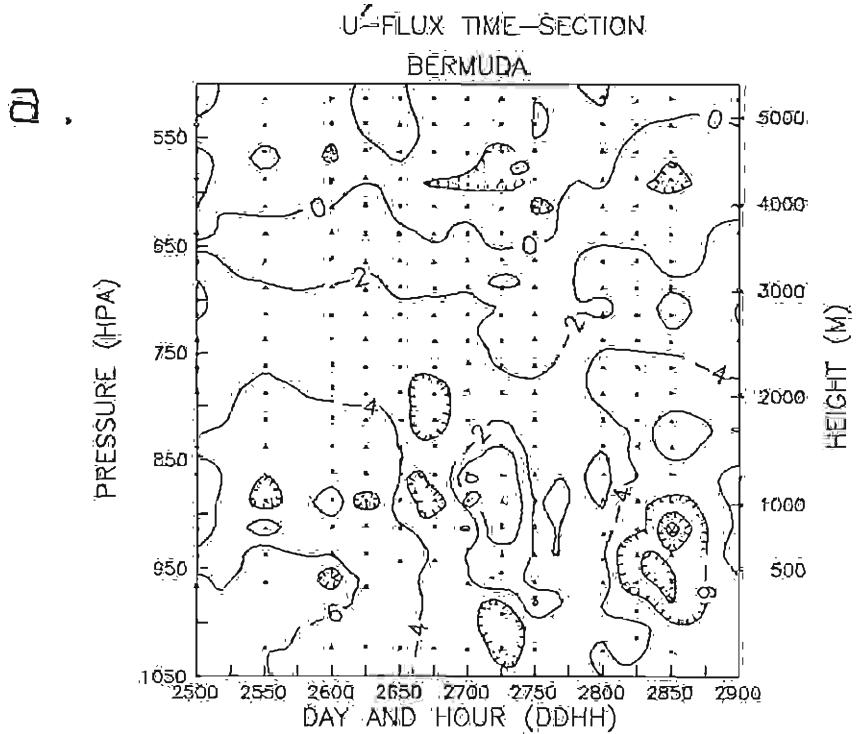


Figure 4-19. As Fig. 4-18, but mean (a) u' -component and (b) v' -component air flux ($\text{kg}/\text{m}^2/\text{s}$). Dots indicate level of mean flux.

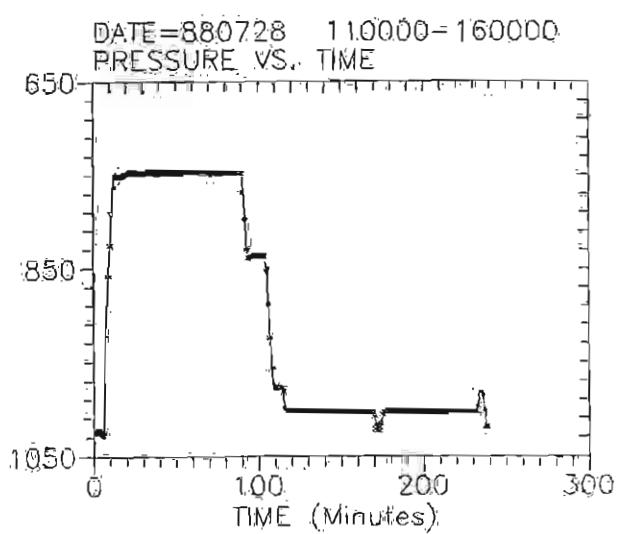
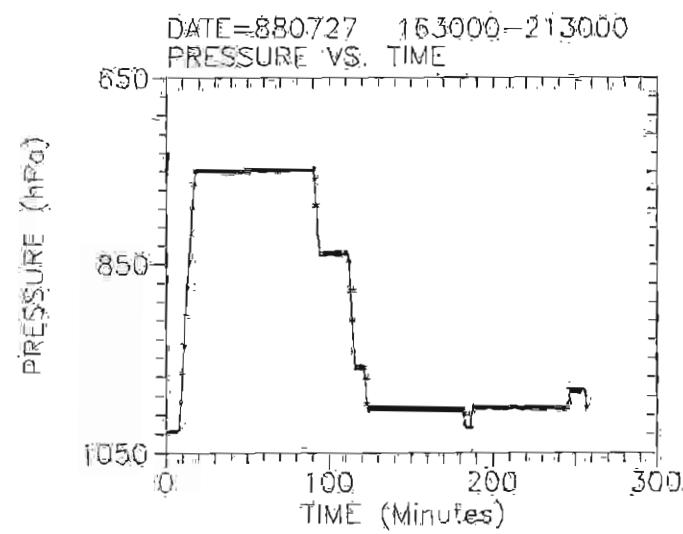
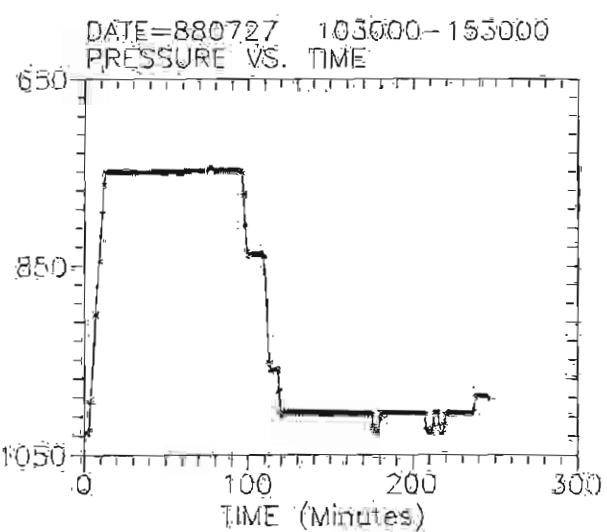
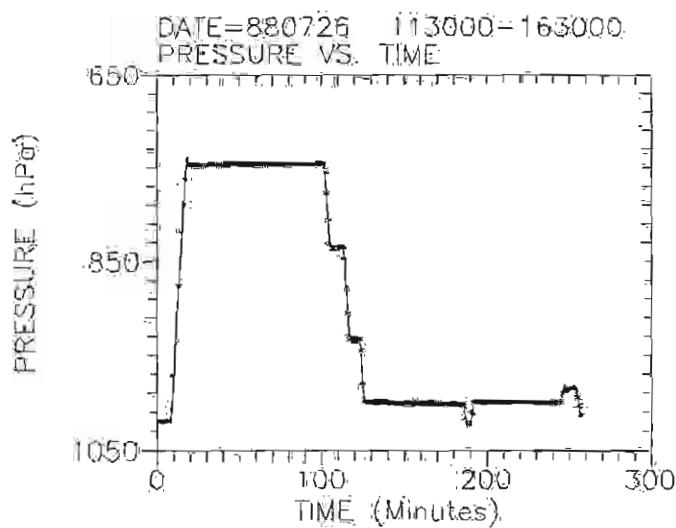


Figure 4-20. Pressure as a function of time for Bermuda-area King Air flights.

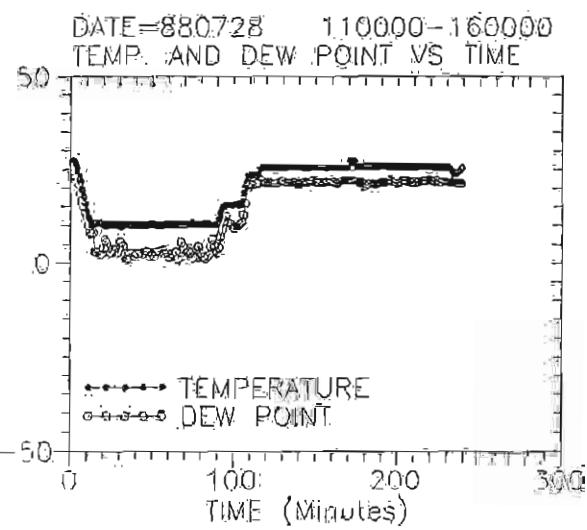
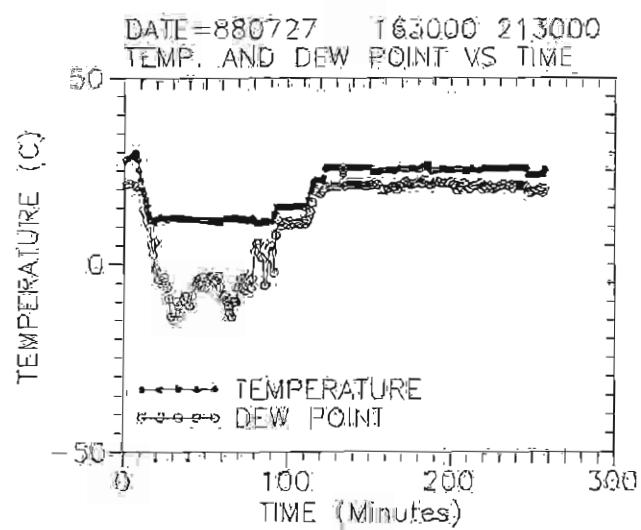
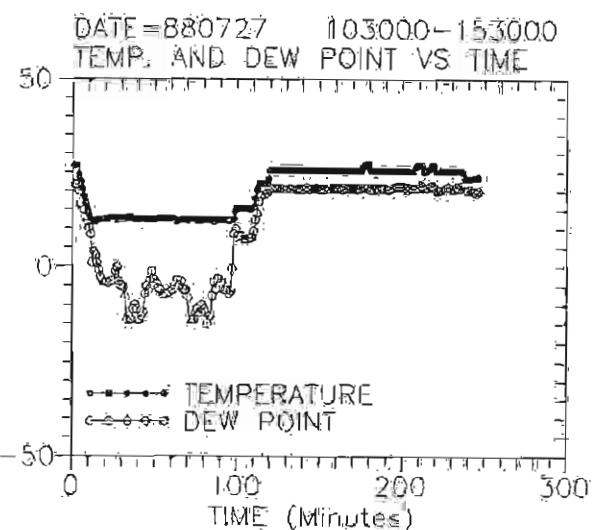
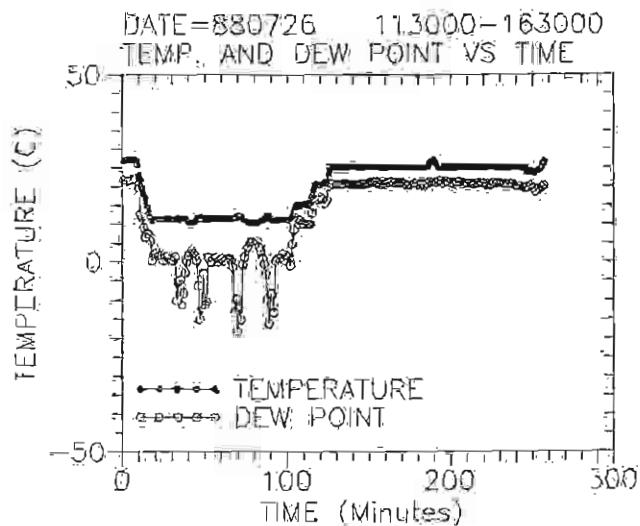


Figure 4-21. Temperature and dewpoint as a function of time for Bermuda-area King Air flights.

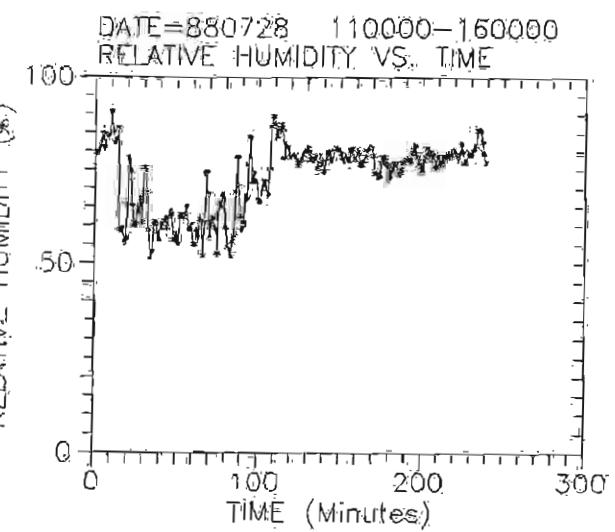
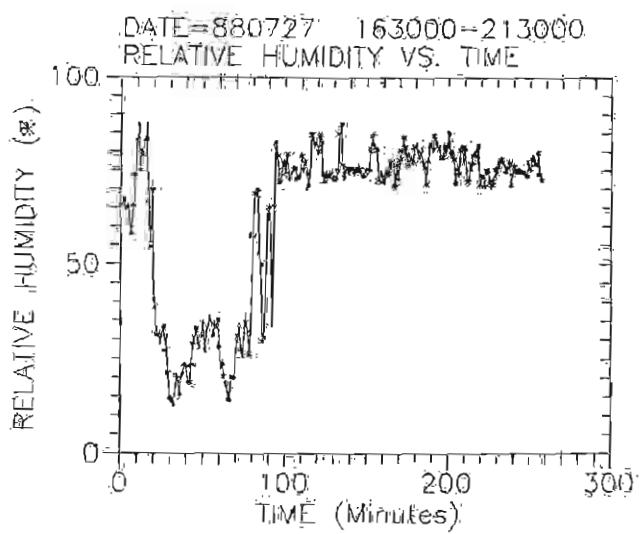
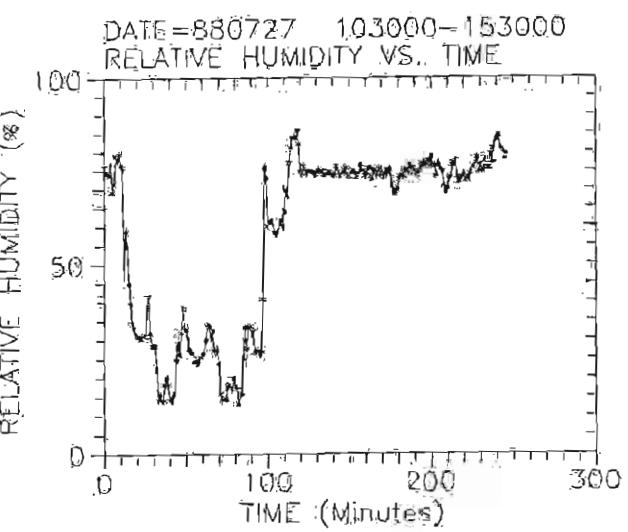
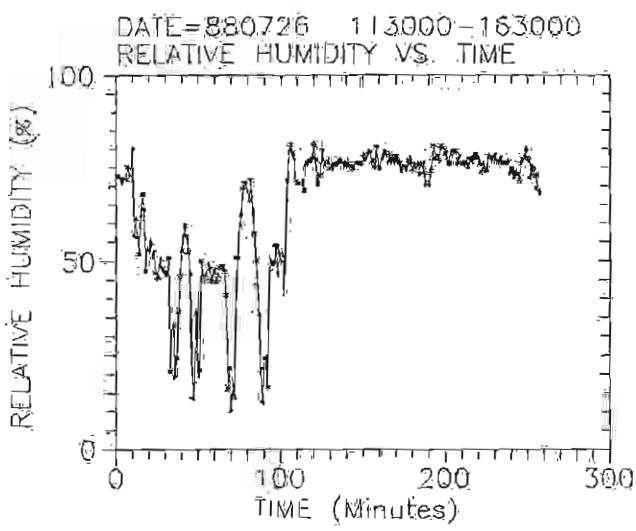


Figure 4-22. Relative humidity as a function of time for Bermuda-area King Air flights.

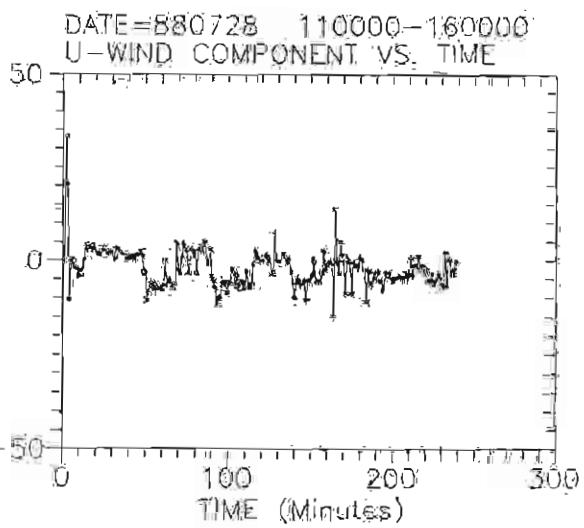
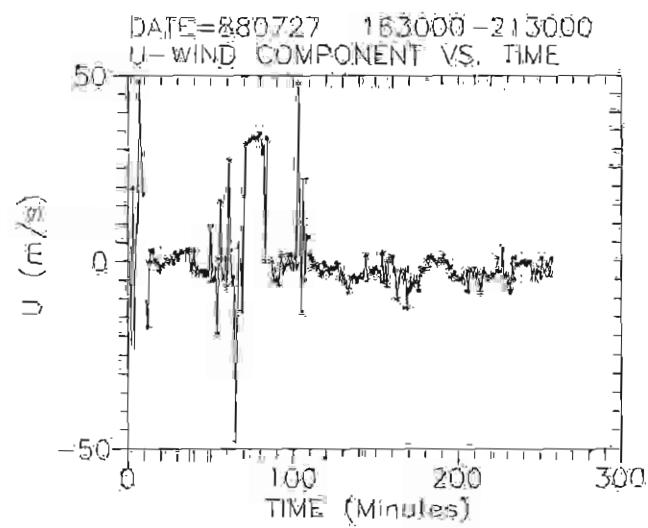
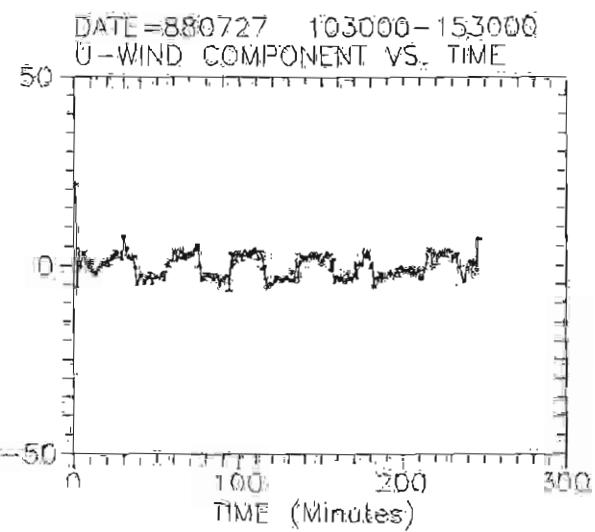
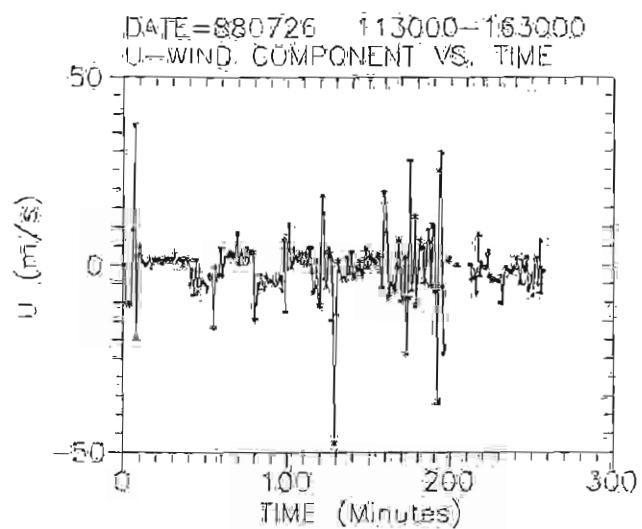


Figure 4-23. U-component wind (positive for westerly flow) as a function of time for Bermuda-area King Air flights.

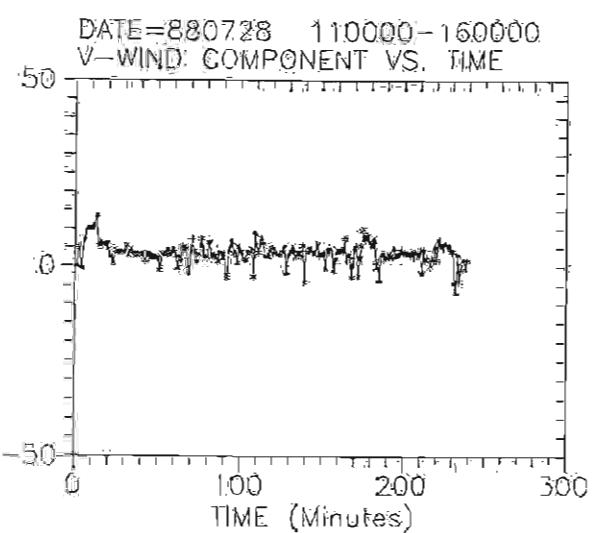
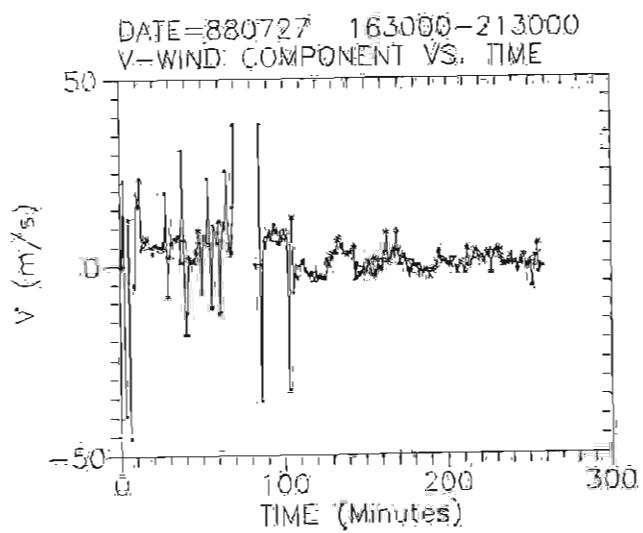
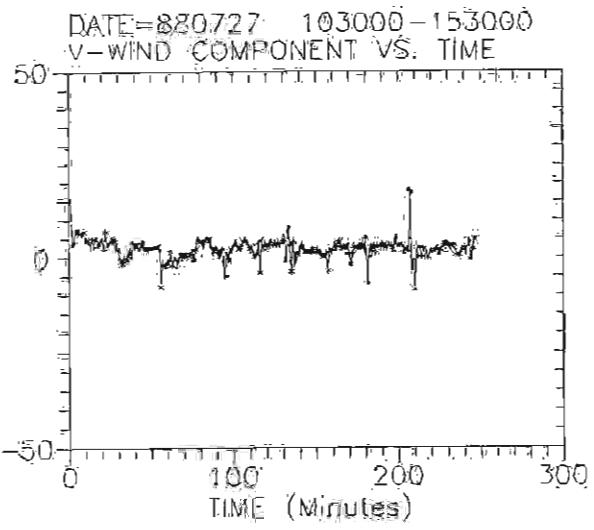
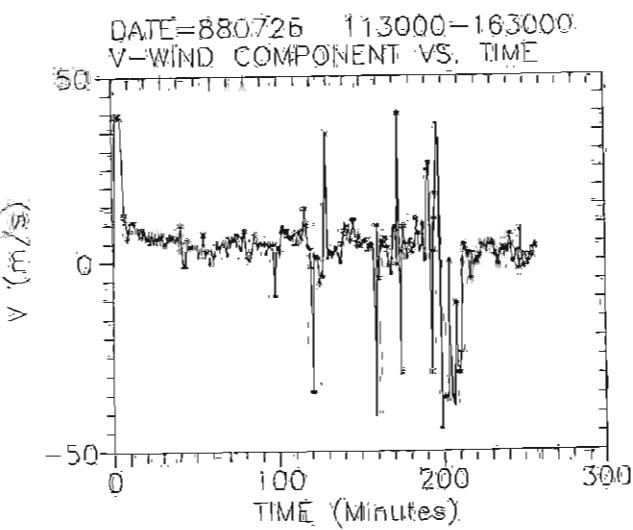


Figure 4-24. V-component wind (positive for southerly flow) as a function of time for Bermuda-area King Air flights.

4.2 Leg 2: Bermuda to Iceland

Figures 4-25 through 4-28 show daily 10-day back-trajectories beginning at 12 GMT for the period August 1 through August 10 on the 1000, 850, 700, and 500 hPa levels, respectively. The 850 hPa trajectories show three transport zones for transport about a day before reaching the ship. South of the polar front (August 1 through 3), transport was from the west or south. North of the front (August 4 through 6), transport was from the west or northwest, with the trajectories crossing the Northern Canada/Atlantic Ocean border within a few days of the trajectory origination at the ship. When the influence of the Icelandic low was apparent (August 7 through 10), transport was from the north or east with the northernmost trajectories crossing Iceland.

Figures 4-29(a-d) and 4-30(a-b) are the cross-sections for the period 00 GMT August 1 through 12 GMT August 10. The polar front is clearly evident because of the temperature and wind discontinuities about 2000 km from Bermuda (45°N). Surface temperatures were over 25°C and winds were comparatively weak south of the front (6 m/s at 850 hPa), while temperatures were about 10°C and winds were stronger near Iceland (14 m/s). Winds were strongest (18 m/s) during this 10-day period in the vicinity of the front 1700 to 2700 km from Bermuda (43 to 50°N). Wind direction varied over this 10-day period because of the ship's position with respect to the front and the Icelandic low. As the ship approached Iceland (distances greater than 3500 km from Bermuda), winds veered from northerly to northeasterly to easterly. Relative humidity (Fig. 4-29(b)) was lower (less than 60%) just north of the front (2000 to 3000 km from Bermuda) compared to the 80% region farther north, closer to the low, as shown in the August 10 sounding (Fig. 3-8). The potential temperature surfaces (Fig. 4-29(c)) also show the front. Near the ocean surface, the potential temperature was approximately 297 K south of the front and 287 K north of the front. South of the front the mixing ratio (Fig. 4-29(d)) was near 15 g/kg at the surface, but only about 7 g/kg north of the front. The u' - and v' -flux components (Figs. 4-30(a and b)) show generally constant flux with height, but change with time as the ship travelled north. u' -flux ranged from about -5 to 15 $\text{kg}/\text{m}^2/\text{s}$, with the strongest flux in the vicinity of the front. v' -flux ranged from about -10 to 10 $\text{kg}/\text{m}^2/\text{s}$. The strongest positive v' -flux was on either side of the front, and the strongest negative v' -flux was near Iceland.

4.3 Leg 3: Iceland to the Azores

Figures 4-31 through 4-34 show daily 10-day back-trajectories beginning at 12 GMT for the period August 16 through August 23 on the 1000, 850, 700, and 500 hPa levels, respectively. During August 16 through 19, the ship was north of the polar front and 850 hPa transport with and through the Icelandic low occurred. During this period the low was farther south than that shown in Fig. 3-2 on July 27. During August 20 through 23, the ship was south of the front, and 850 hPa transport within the Bermuda/Azores High occurred. For all the 850 hPa trajectories, transport was over the ocean for at least 5 days before reaching the ship.

Figures 4-35(a-d) and 4-36(a-b) are the cross-sections for the period 00 GMT August 16 through 12 GMT August 23. These are similar to the Leg 2 cross-sections because the ship crosses the polar front again (Fig. 4-35(a)), here about 1750 km south of Iceland (approximately 46°N). Temperatures at the surface were about 15°C north of the front and 25°C south of the front.

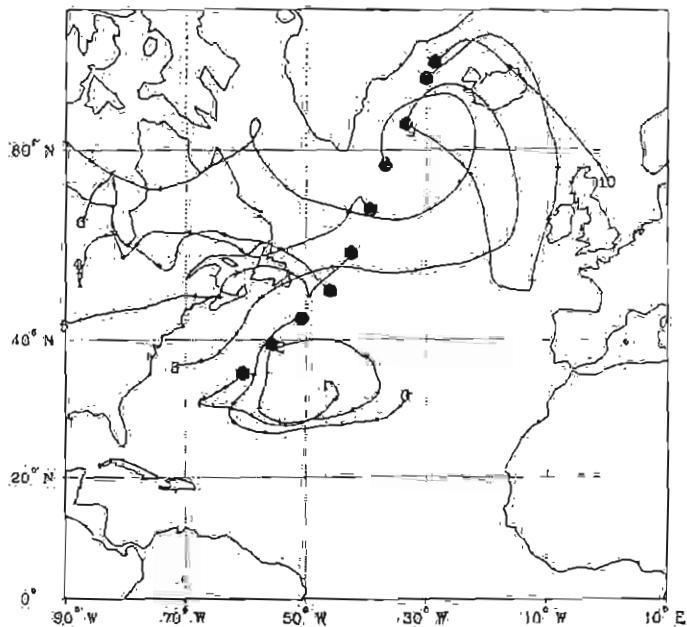


Figure 4-25. Daily 12 GMT 1000 hPa 10-day back-trajectories beginning at the ship's position from 1 August 1988 through 10 August 1988. A dot is at the beginning and the date is at the end of each back-trajectory. + symbols are at 24-h intervals.

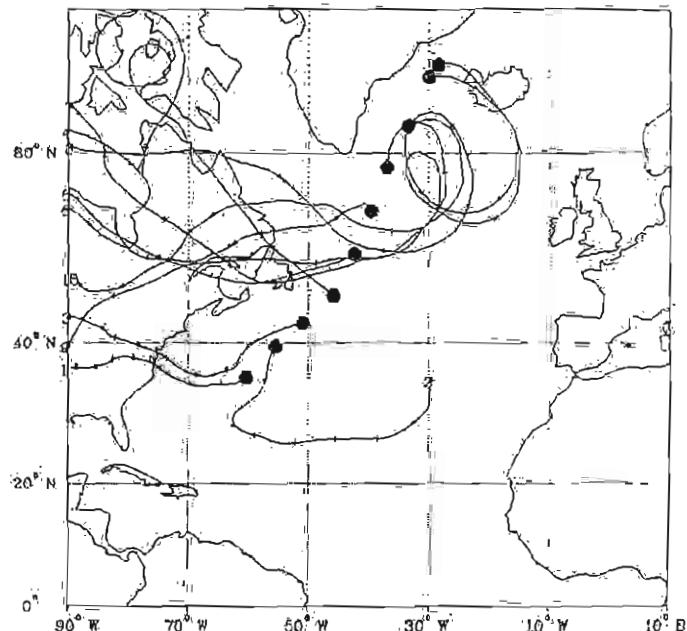


Figure 4-26.. As Fig. 4-25, but for 850 hPa.

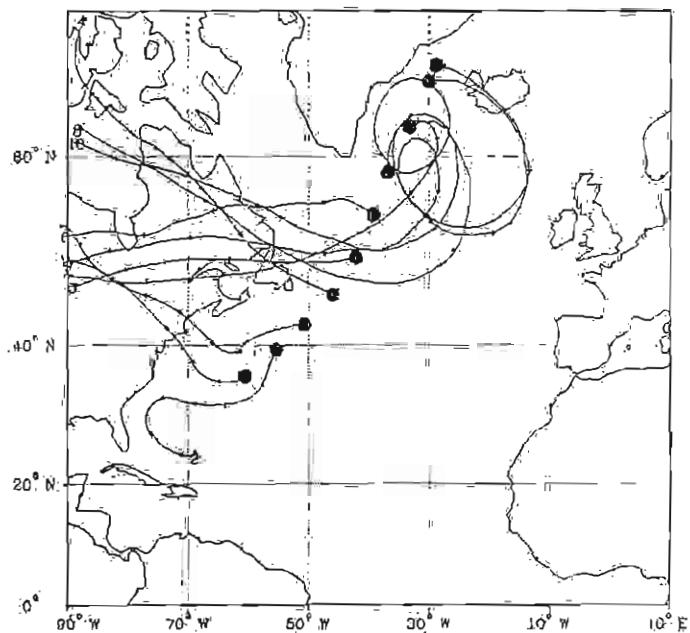


Figure 4-27. As Fig. 4-25, but for 700 hPa.

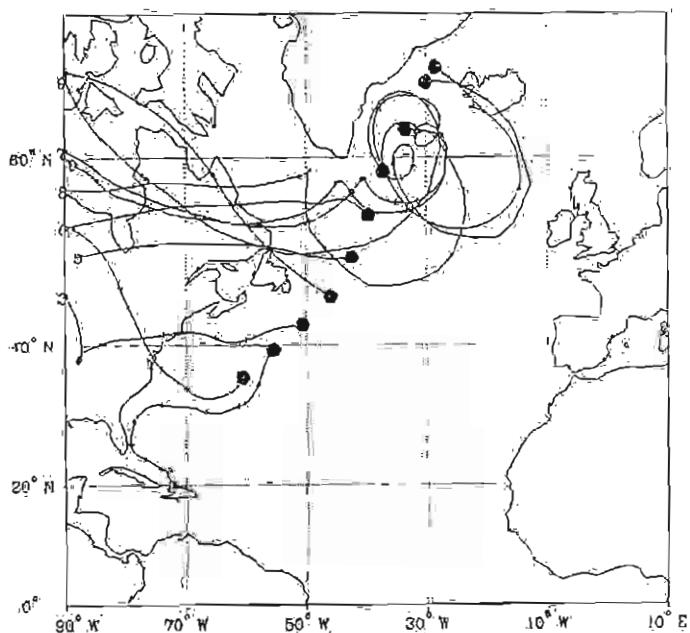


Figure 4-28. As Fig. 4-25, but for 500 hPa.

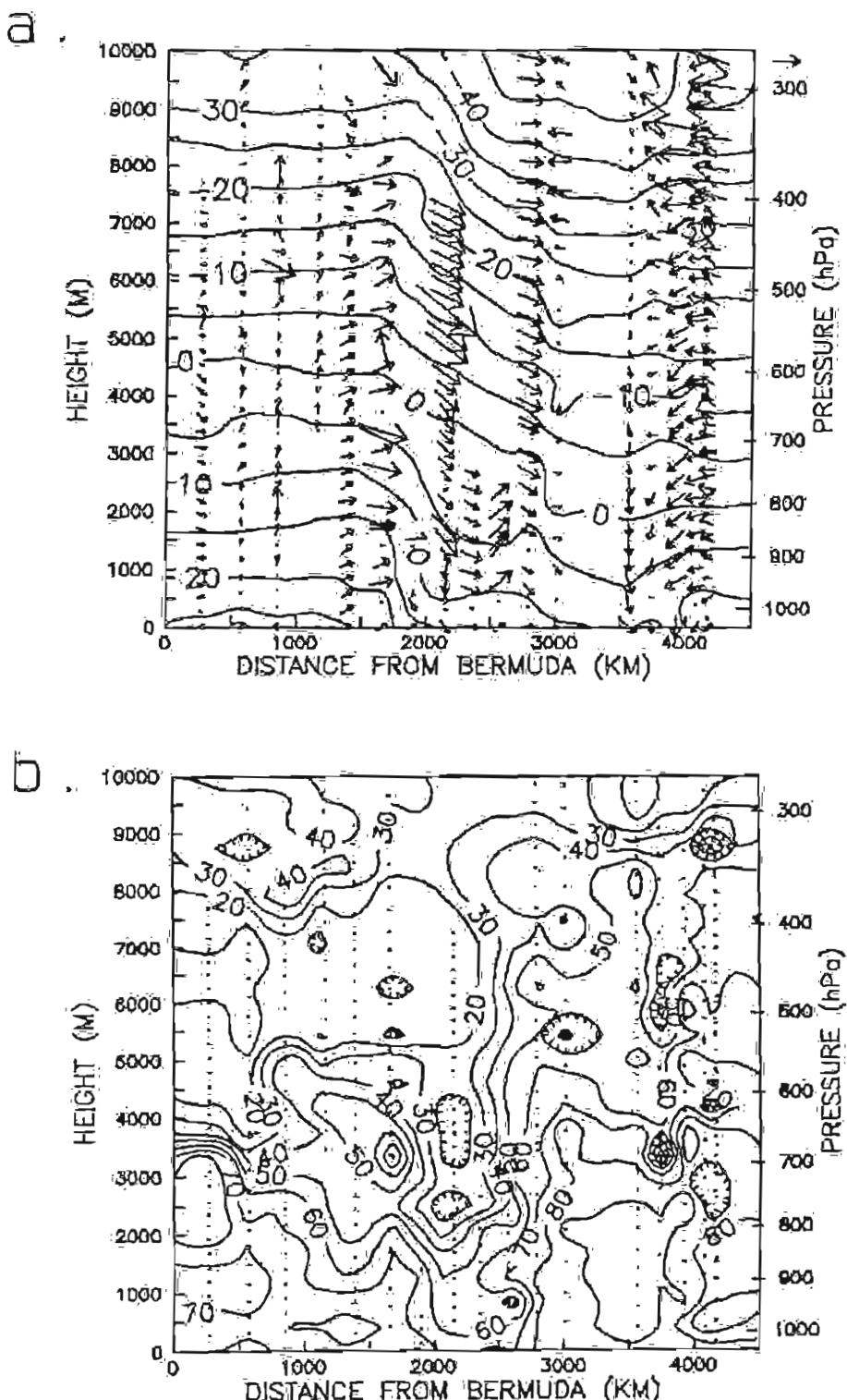


Figure 4-29. Space/time-section of (a) temperature ($^{\circ}$ C) and wind vectors (wind vector scale at upper-right corner is 20 m/s) and (b) relative humidity (%) on a scale from 32N, 65W to 64N, 28.5W (Bermuda to Iceland). Data are from soundings beginning 00 GMT 1 August 1988 (270 km from Bermuda) and ending 12 GMT 10 August 1988 (4170 km from Bermuda). Dots or wind vectors indicate the locations of sounding values at 100 s intervals.

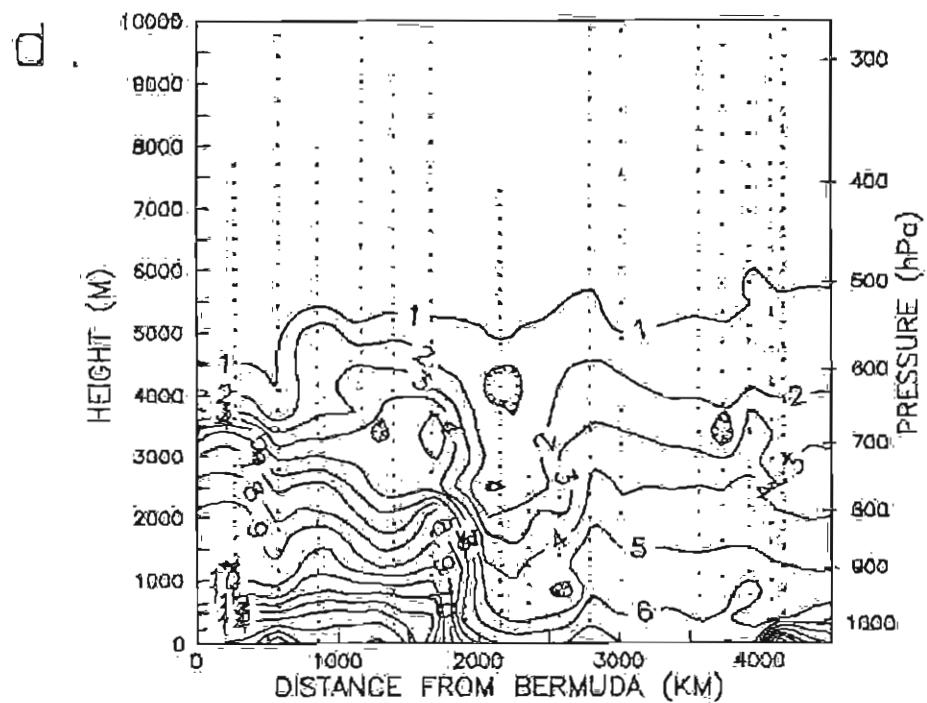
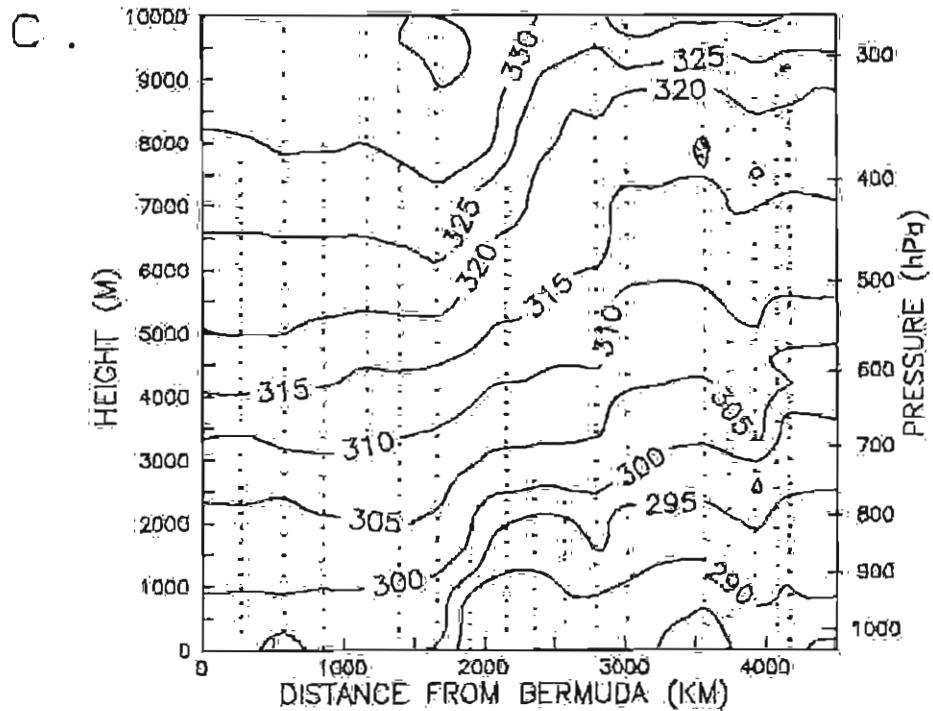


Figure 4-29 continued. Space/time-section of (c) potential temperature (K) and (d) mixing ratio (g/kg) on a scale from 32N, 65W to 64N, 28.5W (Bermuda to Iceland). Data are from soundings beginning 00 GMT 1 August 1988 (270 km from Bermuda) and ending 12 GMT 10 August 1988 (4170 km from Bermuda). Dots or wind vectors indicate the locations of sounding values at 100 s intervals.

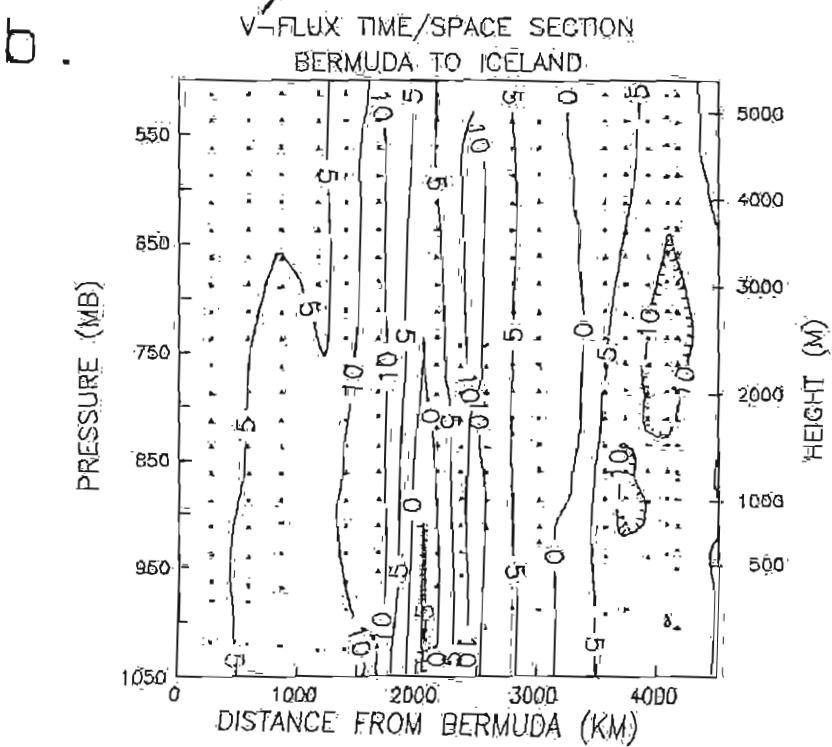
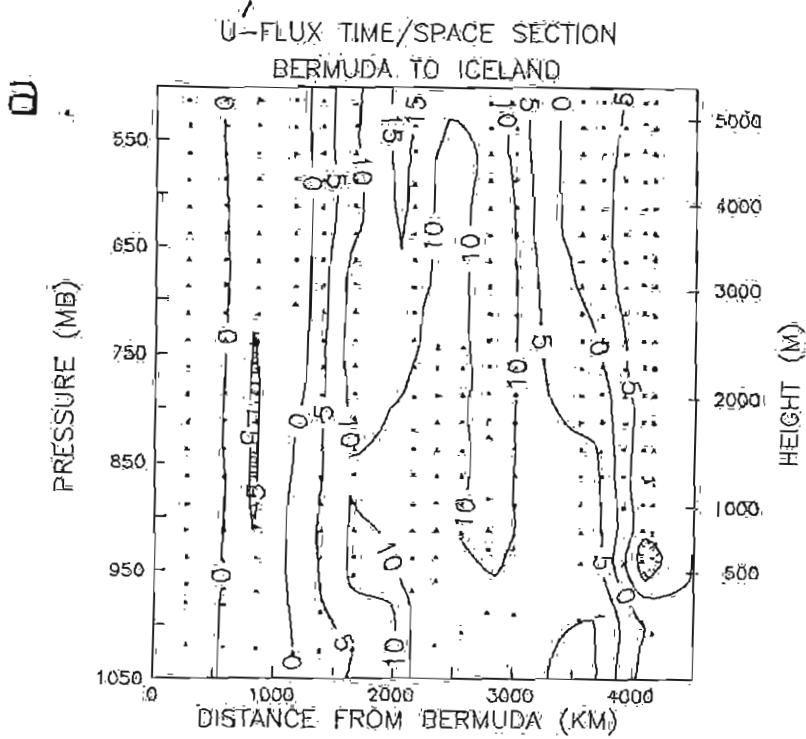


Figure 4-30. As Fig. 4-29, but mean (a) u' -component and (b) v' -component air flux ($\text{kg}/\text{m}^2/\text{s}$). Dots indicate level of mean flux.

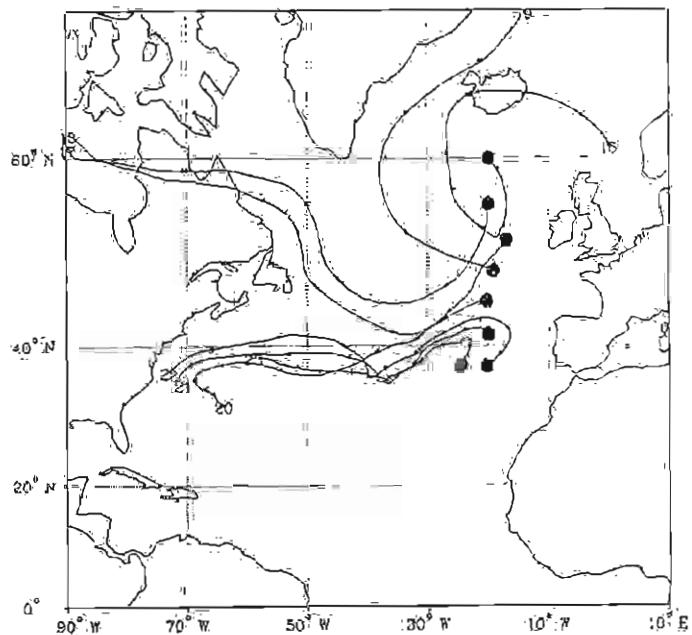


Figure 4-31. Daily 12 GMT 1000 hPa 10-day back-trajectories beginning at the ship's position from 16 August 1988 through 23 August 1988. A dot is at the beginning and the date is at the end of each back-trajectory. + symbols are at 24-h intervals.

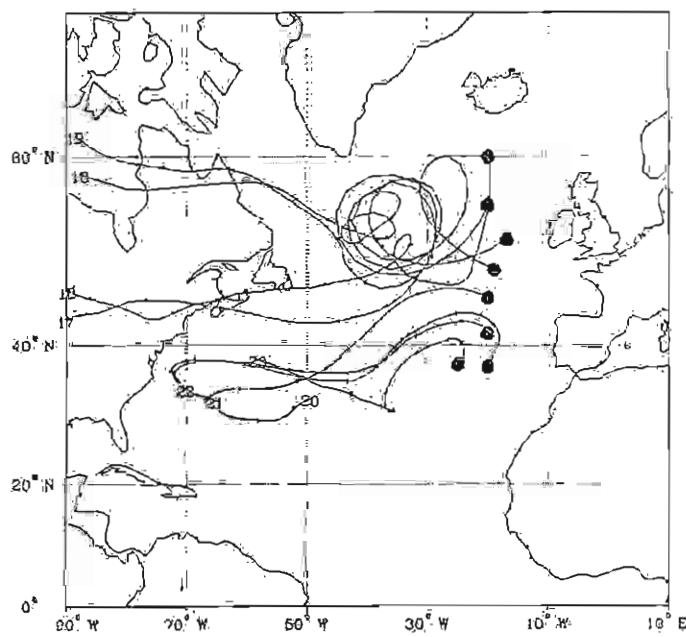


Figure 4-32. As Fig. 4-31, but for 850 hPa.

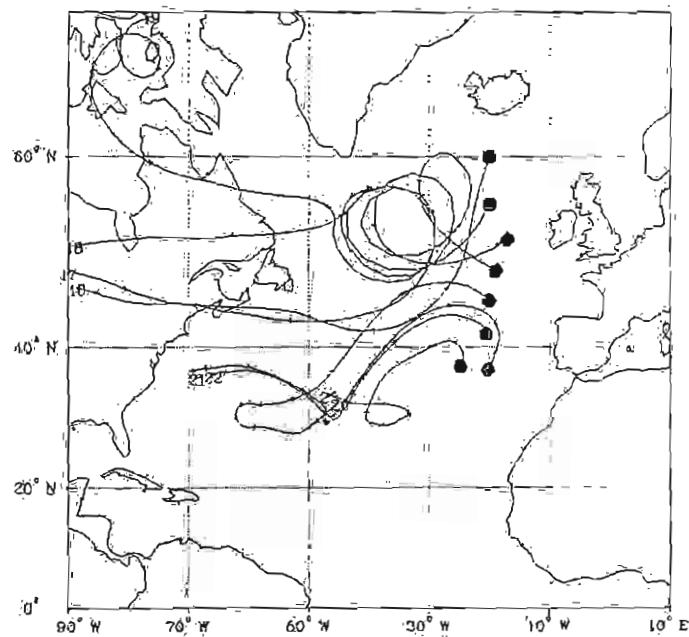


Figure 4-33. As Fig. 4-31, but for 700 hPa.

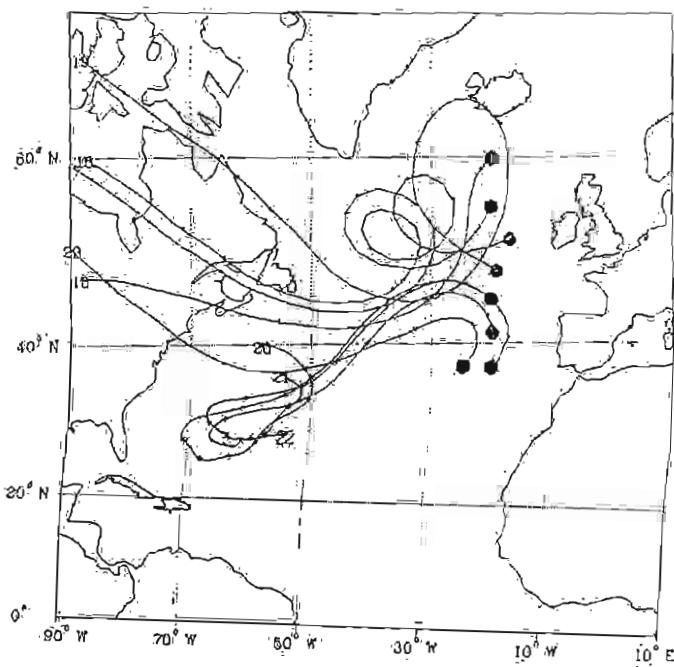


Figure 4-34. As Fig. 4-31, but for 500 hPa.

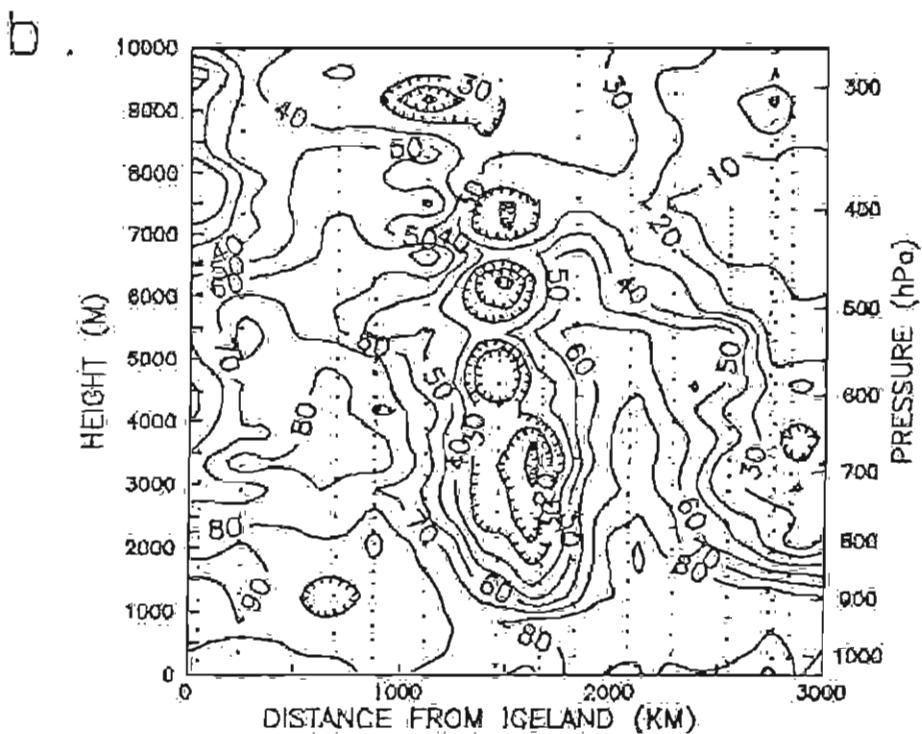
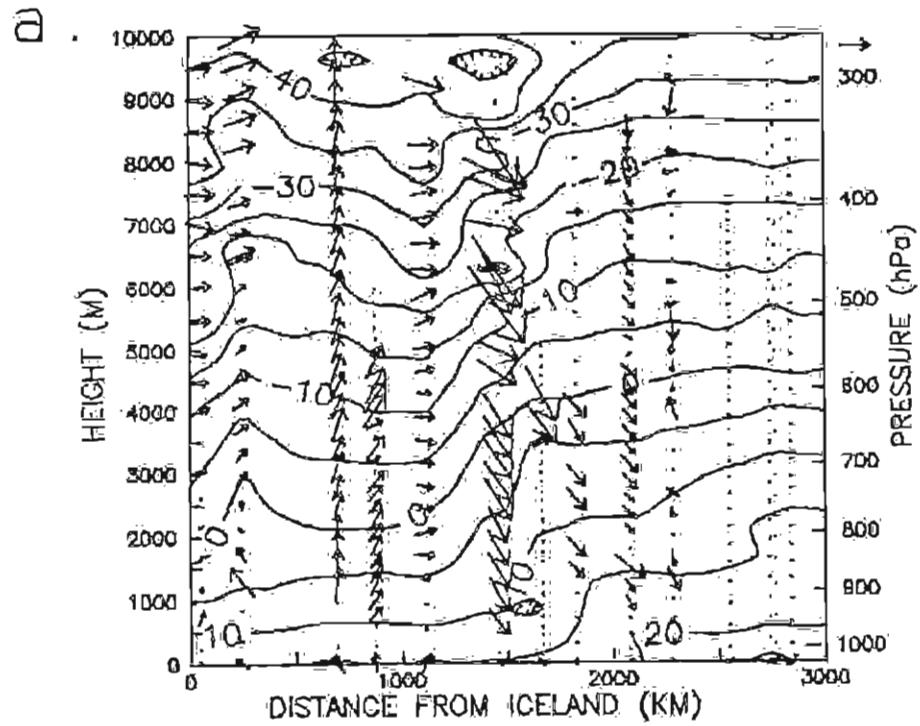


Figure 4-35. Space/time-section of (a) temperature (C) and wind vectors (wind vector scale at upper-right corner is 20 m/s) and (b) relative humidity (%) on a scale from 62N, 22W to 37N, 25W (Iceland to the Azores). Data are from soundings beginning 00 GMT 16 August 1988 (50 km from Iceland) and ending 12 GMT 23 August 1988 (2740 km from Iceland). Dots or wind vectors indicate the locations of sounding values.

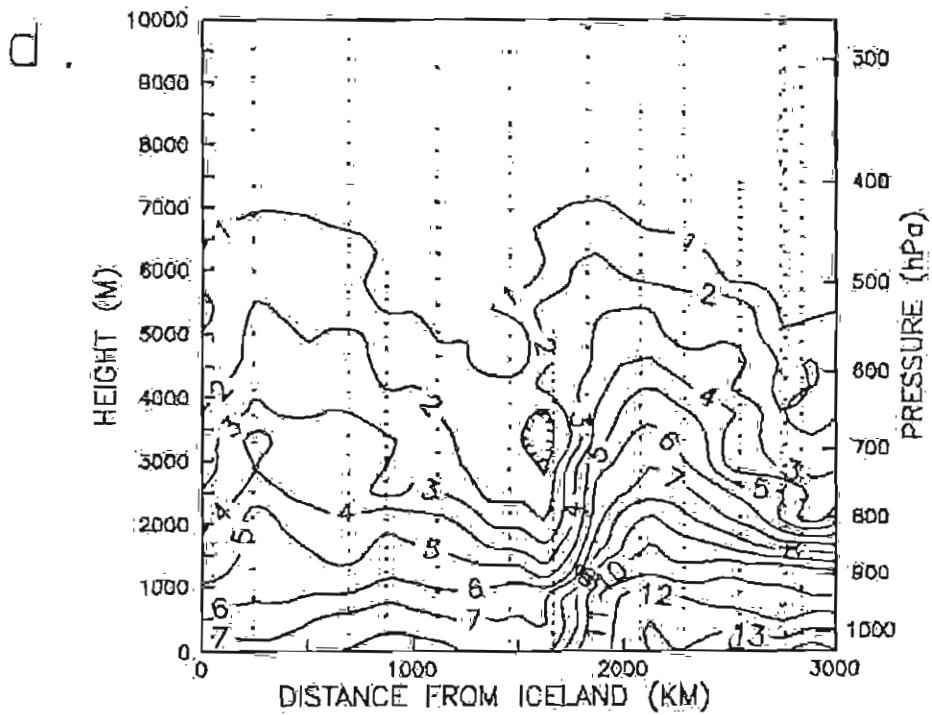
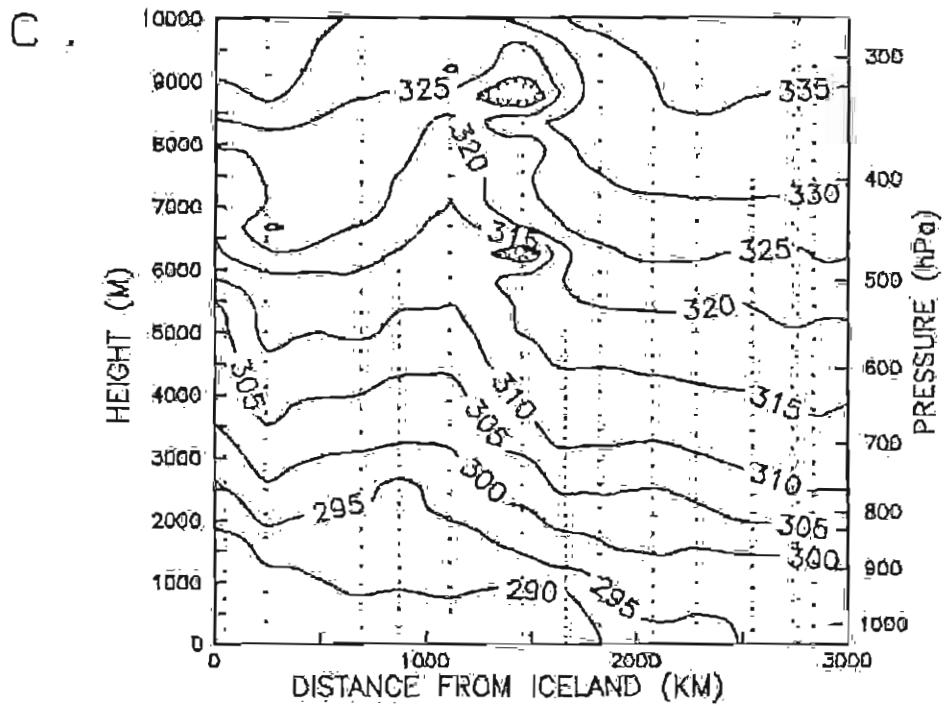


Figure 4-35 continued. Space/time-section of (c) potential temperature (K) and (d) mixing ratio (g/kg) on a scale from 62N, 22W to 37N, 25W (Iceland to the Azores). Data are from soundings beginning 00 GMT 16 August 1988 (50 km from Iceland) and ending 12 GMT 23 August 1988 (2740 km from Iceland). Dots or wind vectors indicate the locations of sounding values at 100 s intervals.

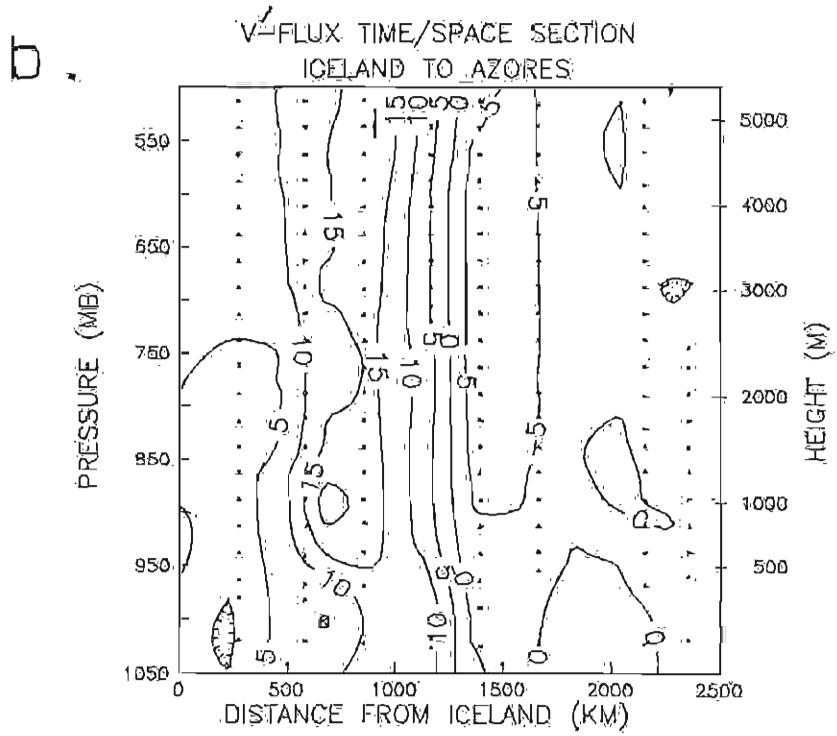
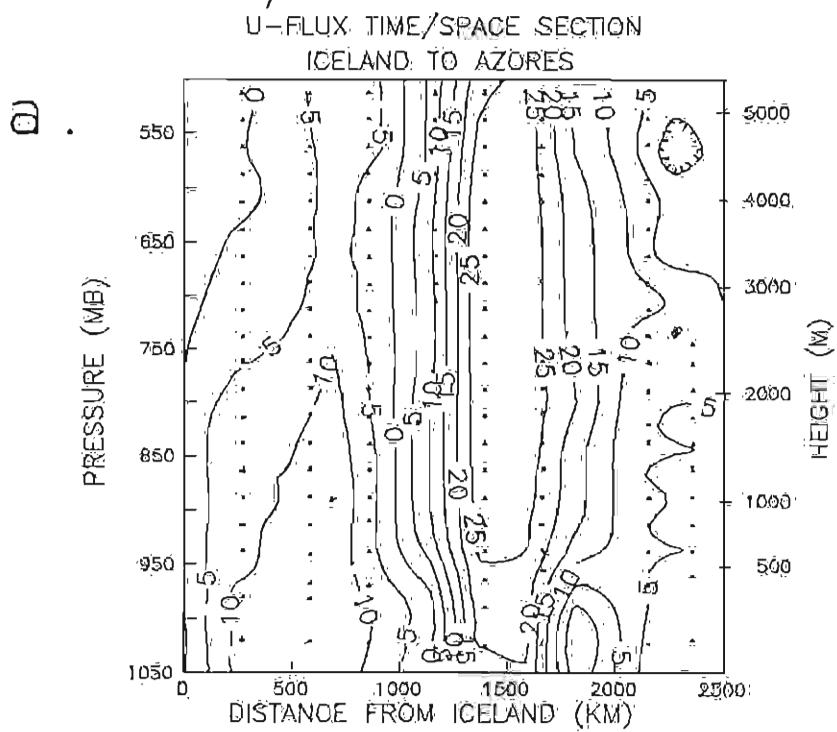


Figure 4-36. As Fig. 4-35, but mean (a) u' -component and (b) v' -component air flux ($\text{kg}/\text{m}^2/\text{s}$). Last sounding for flux data is 12 GMT 21 August 1988 (2280 km from Iceland). Dots indicate level of mean flux.

During this period, winds were strongest just north of the front (25 m/s at 850 hPa, 1500 km from Iceland, or approximately 49°N) and weakest south of the front (5 m/s). A dry region (low RH, Fig. 4-35(b)) was also apparent just north of the front as was observed in Leg 2. As discussed in Section 2.2 no winds were obtained from the soundings near the end of this leg and for the remainder of the cruise because of insufficient LORAN signals. The potential temperature surfaces (Fig. 4-35(c)) also show the front. Near the surface, the potential temperature was approximately 287 K north of the front and 295 K south of the front. Mixing ratio (Fig. 4-35(d)) was near 8 and 13 g/kg at the surface north and south of the front. The u' - and v' -flux components (Figs. 4-36(a and b)) again show generally constant flux with height, but change with time as the ship travelled south. U' -flux ranged from about -10 to 25 kg/m²/s. The strongest positive flux was just north of the front where the winds were northwesterly; v' -flux was weaker, ranging from about -5 to 15 kg/m²/s. The strongest positive v' -flux was about 850 km from Iceland (north of the front), where strong southwesterlies occurred.

4.4 Leg 4: The Azores to Barbados

The trajectory and cross-section figures for leg 4 are divided into two sections at the southernmost point on the cruise ("South Station").

4.4.1 The Azores to South Station

Figures 4-37 through 4-40 show daily 10-day back-trajectories beginning at 12 GMT for the period August 25 through September 1 on the 1000, 850, 700, and 500 hPa levels, respectively. The influence of the Bermuda/Azores high is apparent because of the curvature of the trajectories on August 26 and 27 when 850 hPa transport winds were weak and on August 25, 28, and 29 when the winds were stronger as implied by the longer distances of the trajectories. The August 30, 31, and September 1 850 hPa trajectories show transport from Africa after at least 2 days..

Figures 4-41(a-d) are the cross-sections for the period 12 GMT August 25 through 12 GMT September 2. Discontinuities near 2000 km from the Azores (about 22°N) indicate the boundary of the ITCZ. Day-to-day temperature variability (Fig. 4-41(a)) was generally small, although surface temperatures of 30°C were warmer at the southern end of this cross-section within the ITCZ (3000 km (approximately 13°N) to 4000 km from the Azores) compared to the rest of the cross-section (25°C). Relative humidity (Fig. 4-41(b)) was also higher in the southern third of this cross-section as suggested from the representative ITCZ sounding shown in Fig. 3-24. Note that the region of RH greater than 70% extended only up to 1000 m within 2000 km of the Azores, but extended up to 5000 m between 3500 and 4000 km from the Azores. The potential temperature surfaces (Fig. 4-41(c)) also show the ITCZ; near the surface, the potential temperature was approximately 295 K north of the ITCZ and 300 K within the ITCZ. North of the ITCZ the mixing ratio (Fig. 4-41(d)) at the surface was near 13 g/kg and mixing ratios greater than 10 g/kg occurred for altitudes up to 1000 m. Within the ITCZ, the mixing ratio at the surface was near 17 g/kg and mixing ratio greater than 10 g/kg occurred up to 2000 m.

4.4.2 South Station to Barbados

Figures 4-42 through 4-45 show daily 10-day back-trajectories beginning at 12 GMT for the period September 2 through September 6 on the 1000, 850,

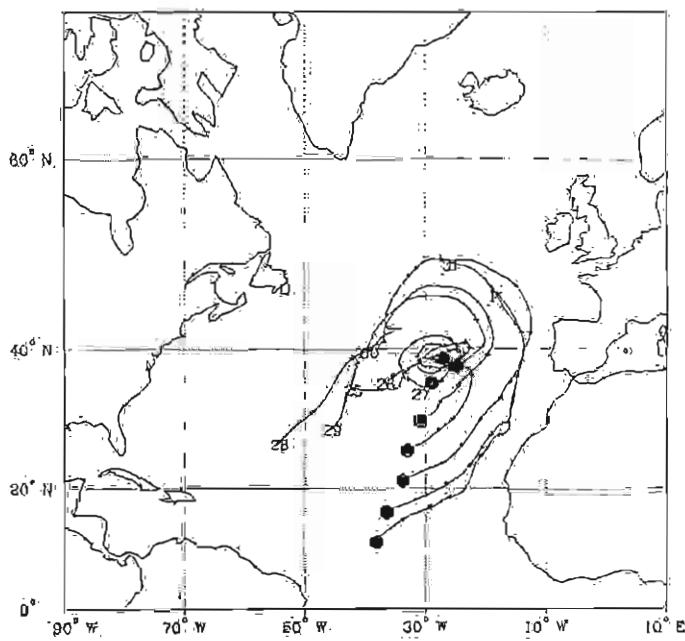


Figure 4-37. Daily 12 GMT 1000 hPa 10-day back-trajectories beginning at the ship's position from 25 August 1988 through 1 September 1988. A dot is at the beginning and the date is at the end of each back-trajectory. + symbols are at 24-h intervals.

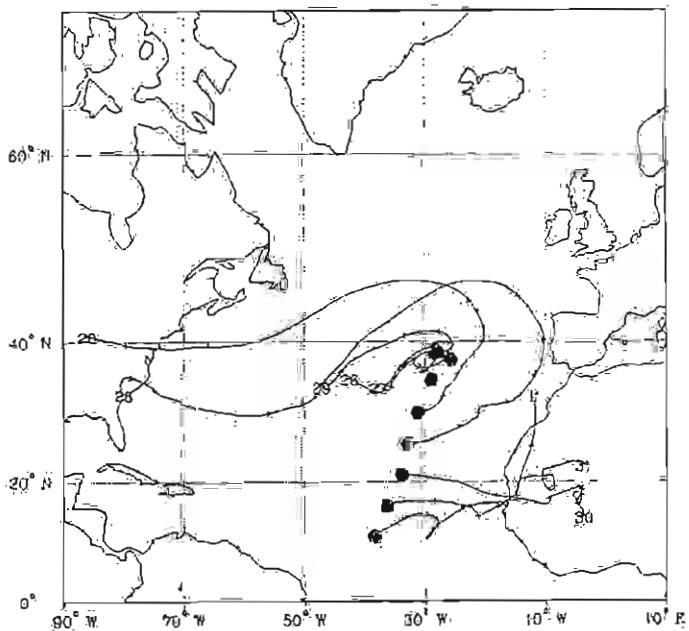


Figure 4-38. As Fig. 4-37, but for 850 hPa.

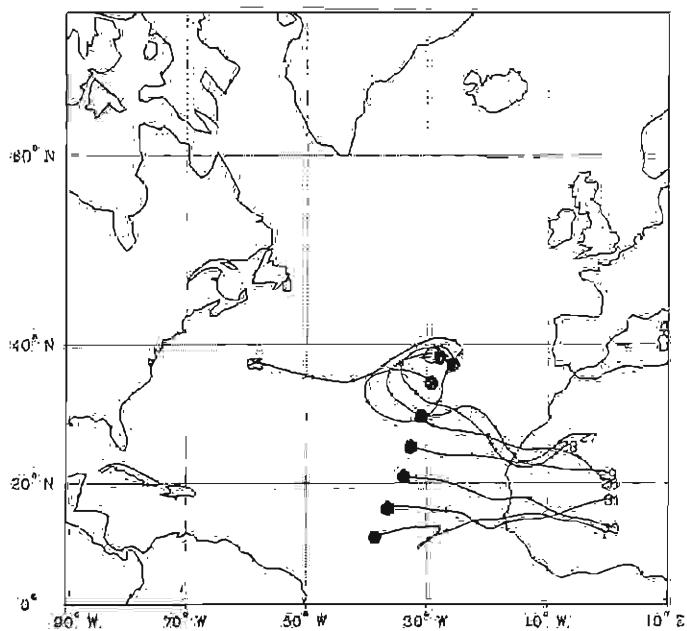


Figure 4-39. As Fig. 4-37, but for 700 hPa.

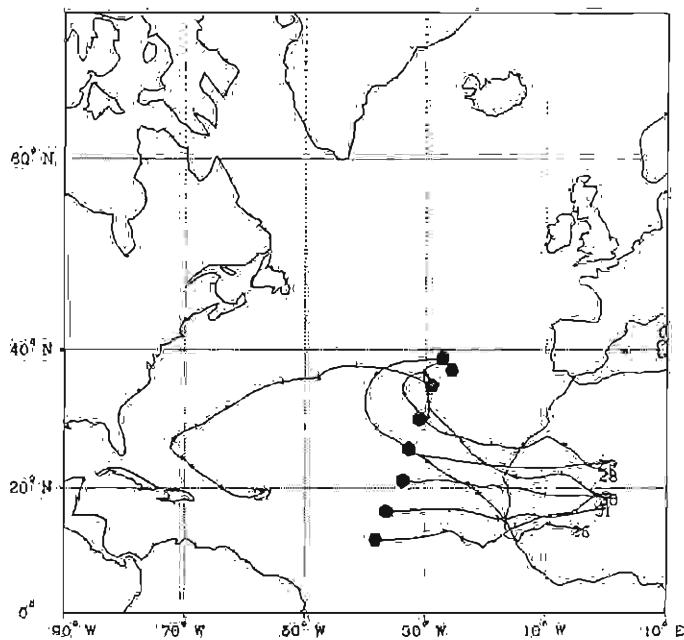


Figure 4-40. As Fig. 4-37, but for 500 hPa.

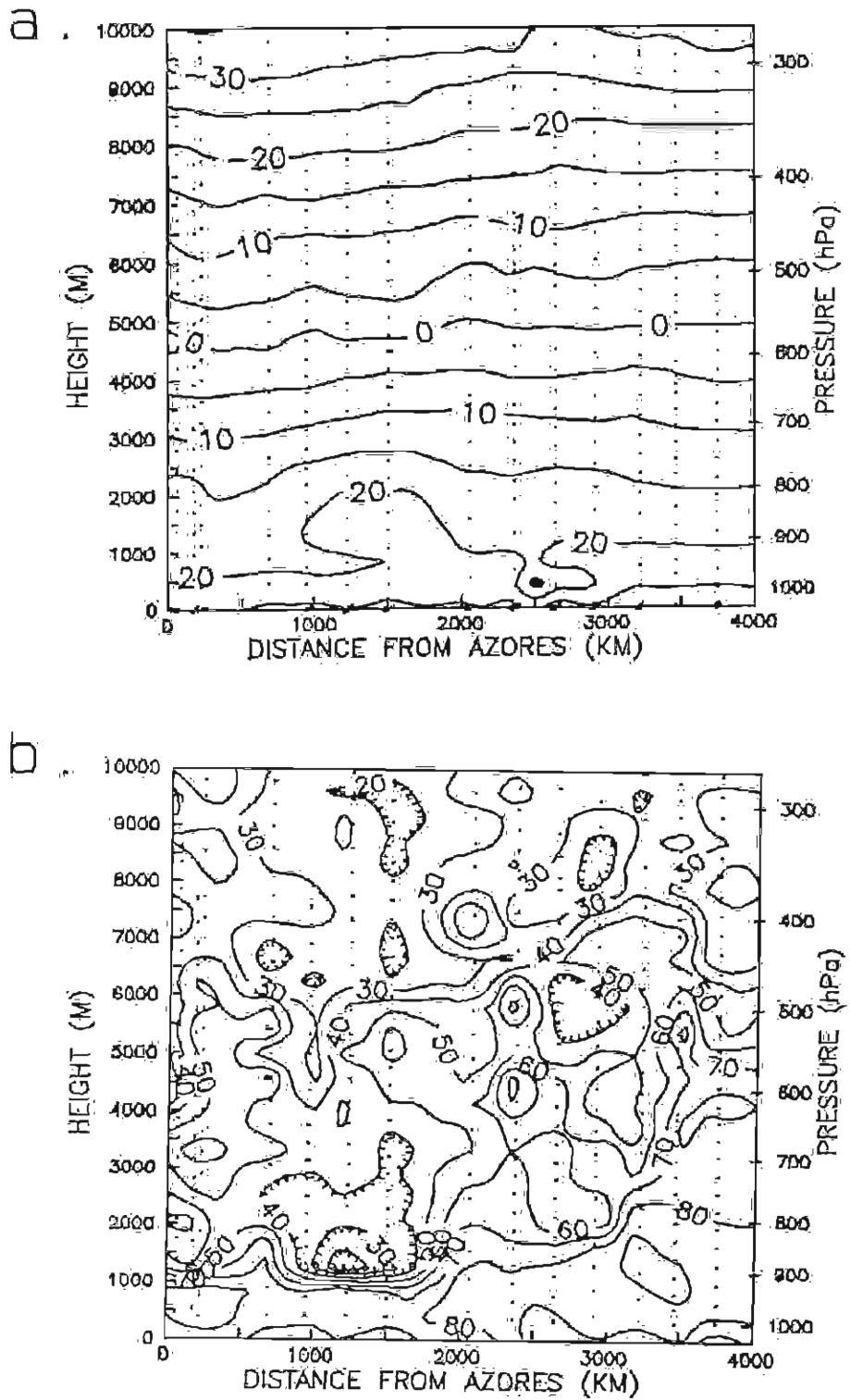


Figure 4-41. Space/time-section of (a) temperature ($^{\circ}$ C) and (b) relative humidity (%) on a scale from 37.5N, 25W to 7N, 40W (Azores to South Station). Data are from soundings beginning 12 GMT 25 August 1988 (70 km from Azores) and ending 12 GMT 2 September 1988 (3750 km from Azores). Dots indicate the locations of sounding values at 100 s intervals.

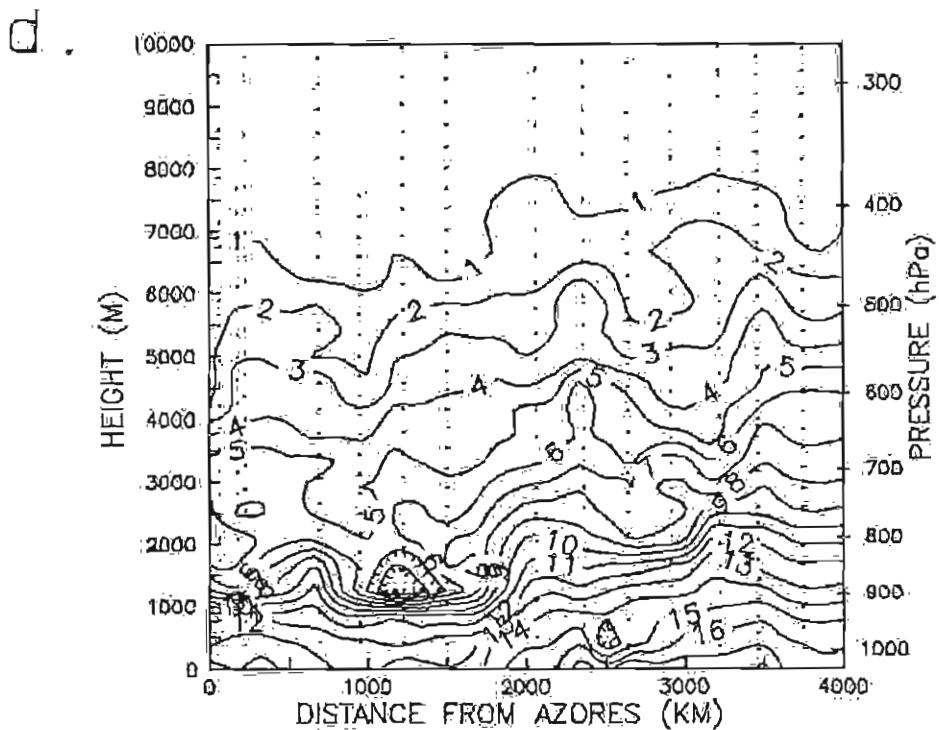
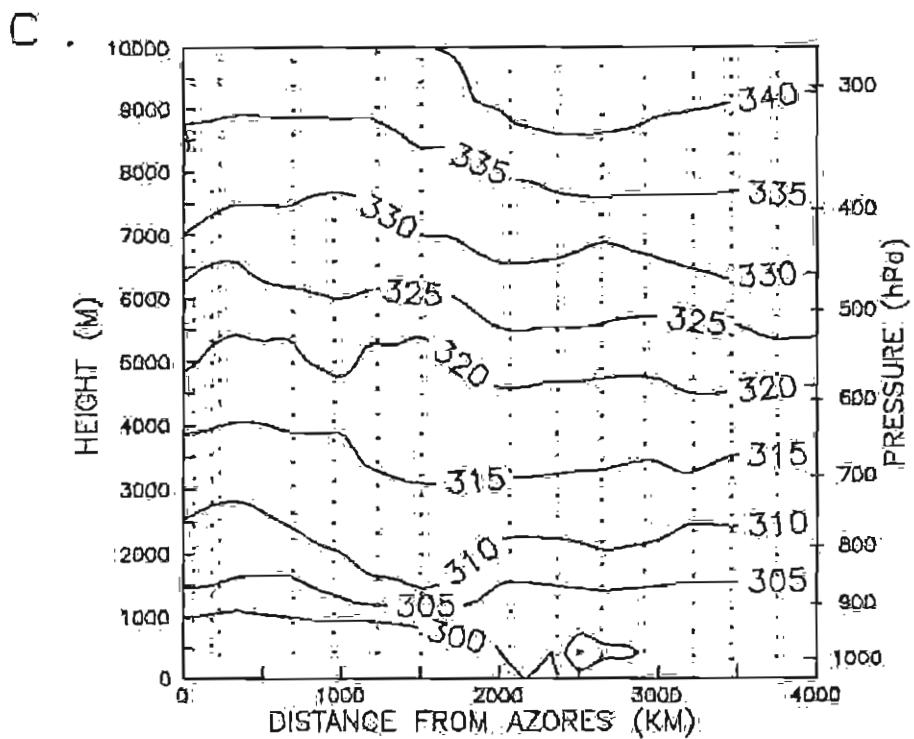


Figure 4-41 continued. Space/time-section of (c) potential temperature and (d) mixing ratio (g/kg) on a scale from 37.5°N , 25°W to 7°N , 40°W (Azores to South Station). Data are from soundings beginning 12 GMT 25 August 1988 (70 km from Azores) and ending 12 GMT 2 September 1988 (3750 km from Azores). Dots indicate the locations of sounding values at 100 s intervals.

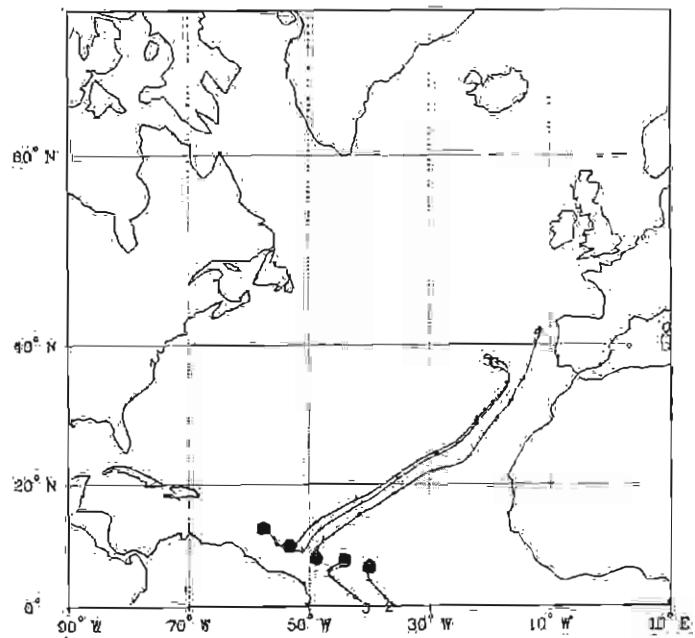


Figure 4-42. Daily 12 GMT 1000 hPa 10-day back-trajectories beginning at the ship's position from 2 September 1988 through 6 September 1988. A dot is at the beginning and the date is at the end of each back-trajectory. + symbols are at 24-h intervals.

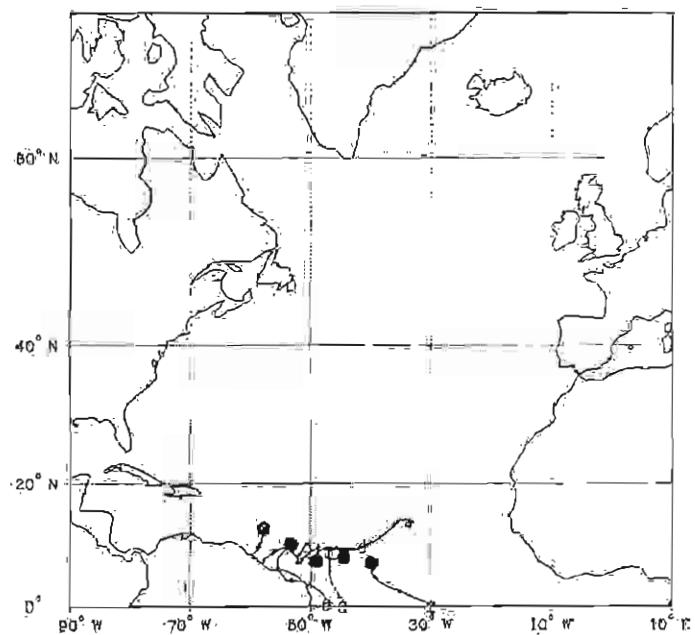


Figure 4-43. As Fig. 4-42, but for 850 hPa.

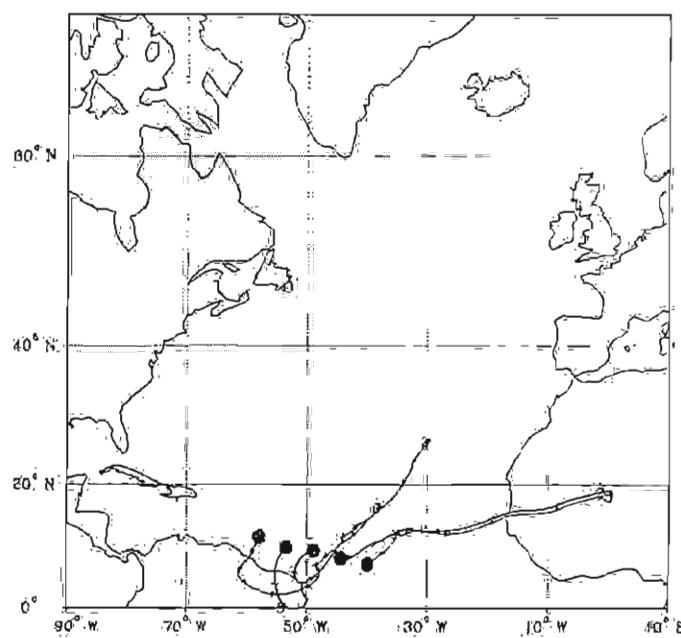


Figure 4-44. As Fig. 4-42, but for 700 hPa.

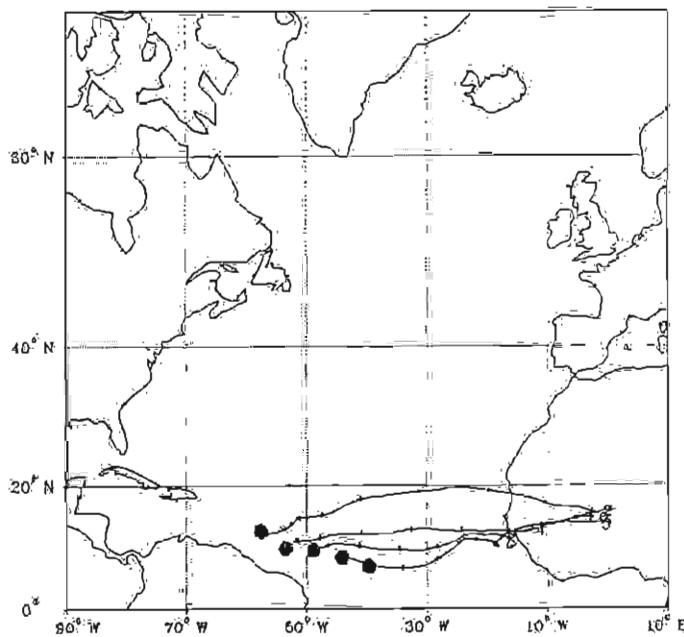


Figure 4-45. As Fig. 4-42, but for 500 hPa.

700, and 500 hPa levels, respectively. At 850 hPa the trajectories indicate transport from the east or south. On September 5 and 6, the trajectories cross the South American coast.

Figures 4-46(a-d) are the cross-sections for the period 00 GMT September 3 through 12 GMT September 6. These are quite similar to the ITCZ portion of the Azores-to-South Station cross-sections. The temperature structure (Fig. 4-36(a)) was constant over this time period. As in Fig. 4-41(b) within the ITCZ, high RH of at least 70% extended up to about 4000 to 5000 m for most of this period (Fig. 4-46(b)). As with the temperature cross-section, the potential temperature surfaces (Fig. 4-46(c)) were uniform with a value near the ocean surface of about 300 K. The mixing ratio (Fig. 4-46(d)) at the surface was near 16 g/kg. Mixing ratio greater than 10 g/kg occurred up to approximately 2000 m.

5. SUMMARY

A description of the meteorological conditions over the North Atlantic ocean during GCE/CASE/WATOX was given. Synoptic maps, soundings, and cross-sections of temperature, wind, relative humidity, potential temperature, mixing ratio, and air flux were shown to illustrate the typical overall synoptic situation and the three meteorological regimes encountered during the cruise: north of the polar front, under the Bermuda/Azores High, and under the ITCZ. The cross-sections typically showed overall day-to-day uniformity except in the vicinity of the polar front and when the Mt. Mitchell crossed into the ITCZ. South of the front under the Bermuda/Azores High and the ITCZ, winds were relatively light; north of the front, winds were stronger. Temperatures were coldest north of the front and warmest within the ITCZ. Similarly, mixing ratios were lowest north of the front and highest within the ITCZ. Daily isobaric back-trajectories showed general air flow features for the entire cruise. Landmass source regions of atmospheric constituents reaching the ship within 3 days were determined from twice-daily isentropic back-trajectories. Meteorological data from the King Air intensives (U.S. east coast, and near Bermuda) were presented, and compared to Mt. Mitchell data over the same time frame.

6. ACKNOWLEDGEMENTS

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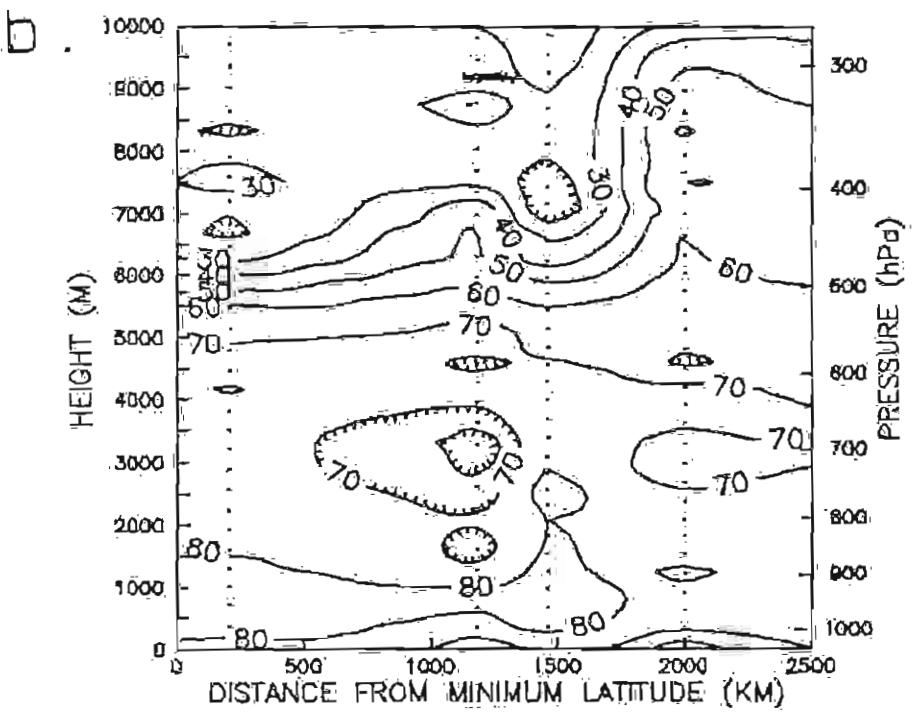
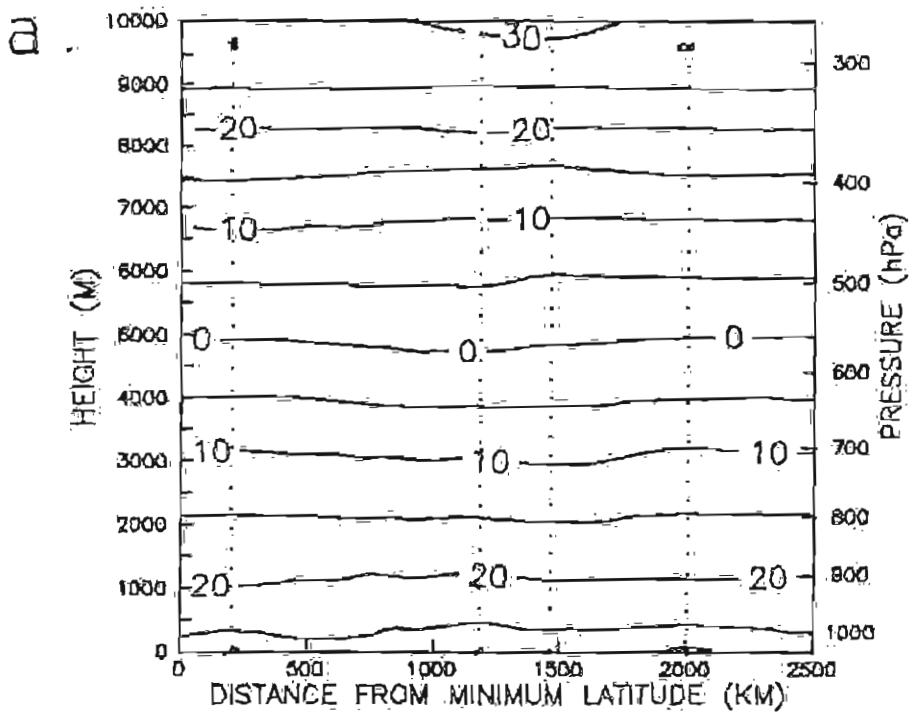


Figure 4-46. Space/time-section of (a) temperature (C) and (b) relative humidity (%) on a scale from 8N, 40W to 12.5N, 58W (South Station to Barbados). Data are from soundings beginning 00 GMT 3 September 1988 (200 km from minimum latitude) and ending 12 GMT 6 September 1988 (2000 km from minimum latitude). Dots indicate the locations of sounding values at 100 s intervals.

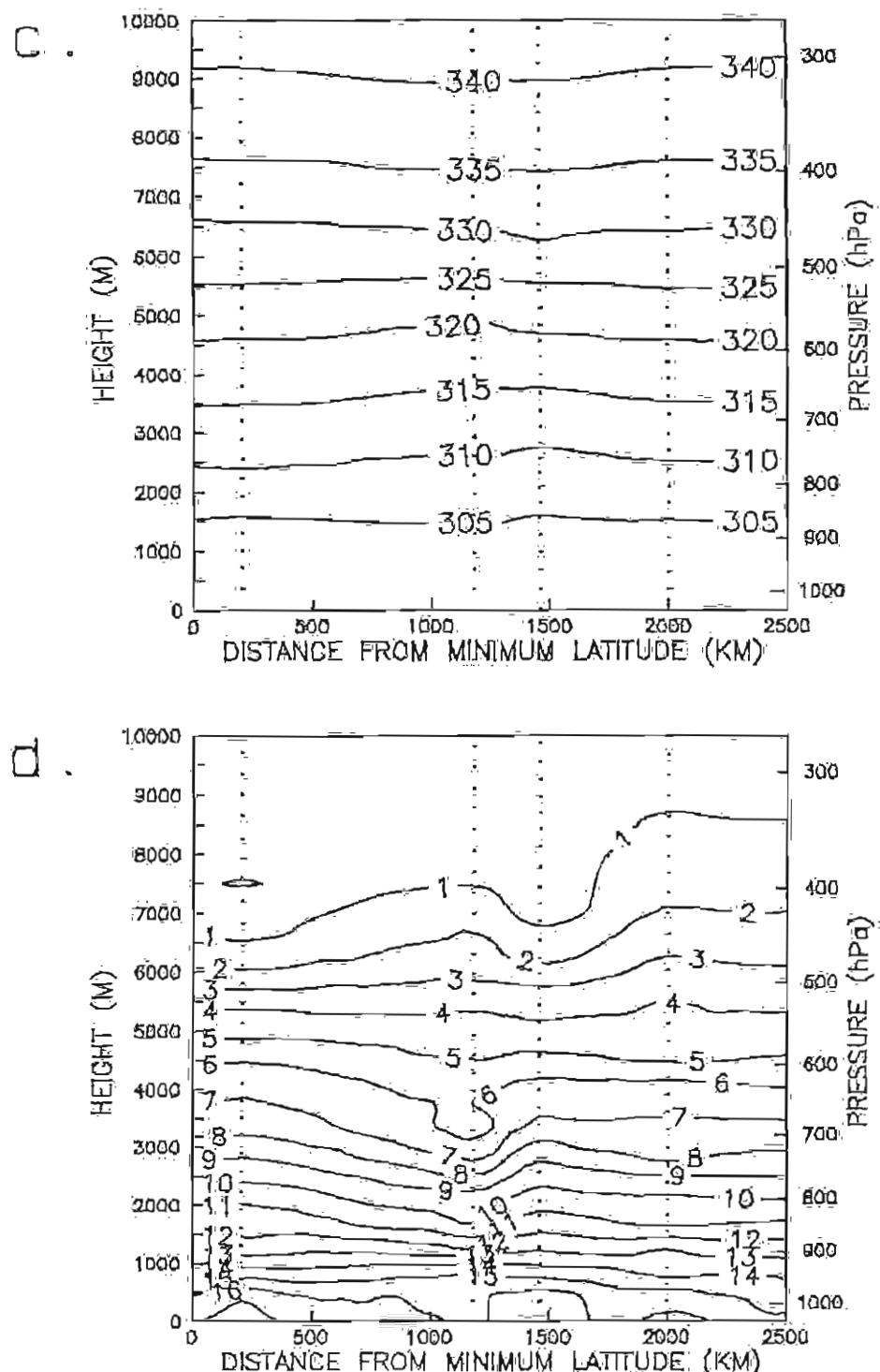


Figure 4-46 continued. Space/time-section of (c) potential temperature and (d) mixing ratio on a scale from 8N, 40W to 12.5N, 58W (South Station to Barbados). Data are from soundings beginning 00 GMT 3 September 1988 (200 km from minimum latitude) and ending 12 GMT 6 September 1988 (2000 km from minimum latitude). Dots indicate the locations of sounding values at 100 s intervals.

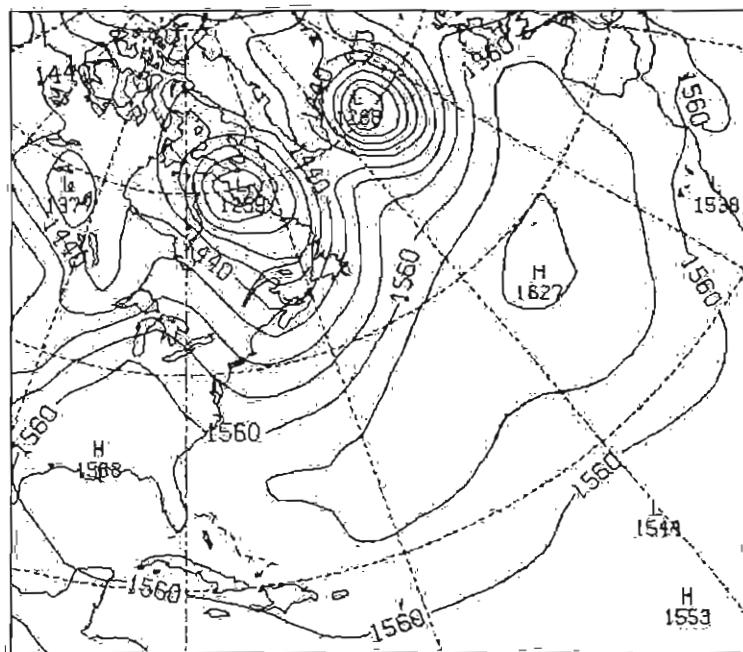
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Appendix A - 850-hPa synoptic analyses

This appendix contains 12 GMT 850-hPa synoptic analyses (geopotential height, m) for the period July 15, 1988 through September 7, 1988.

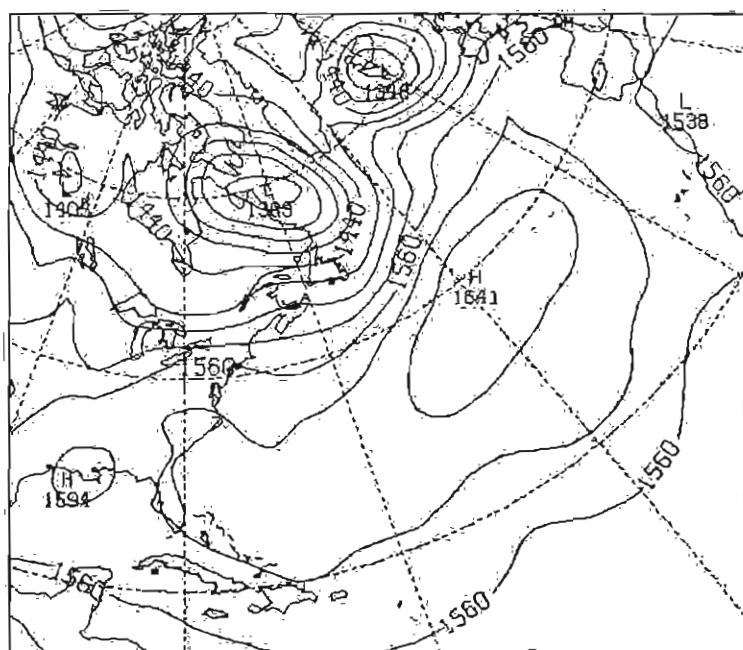
MRF(AVN) MODEL



850.00 MB HGT ANALYSIS VALID AT 88-07-15 12Z

CENTER FROM 1280.0 TO 1620.0 CONTOUR INTERVAL OF 50.000 PT(SL1)= 1550.0

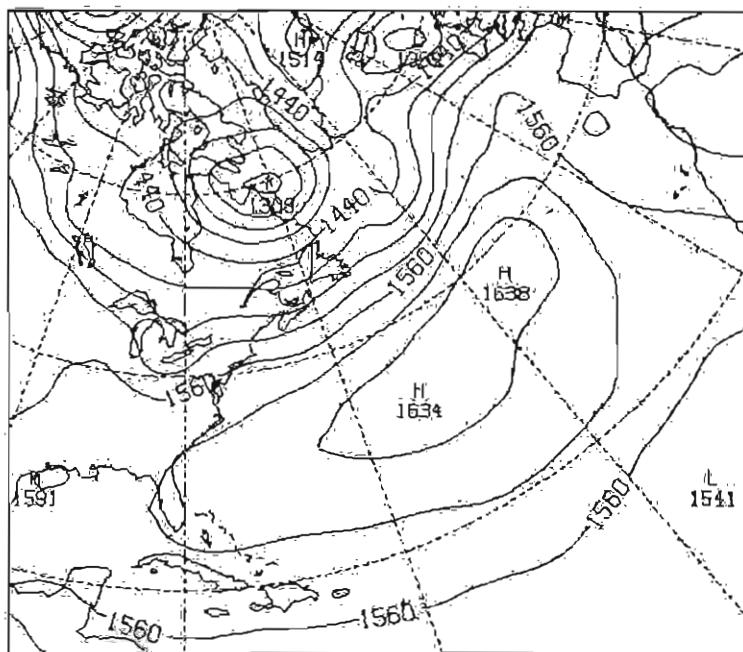
MRF(AVN) MODEL



850.00 MB HGT ANALYSIS VALID AT 88-07-16 12Z

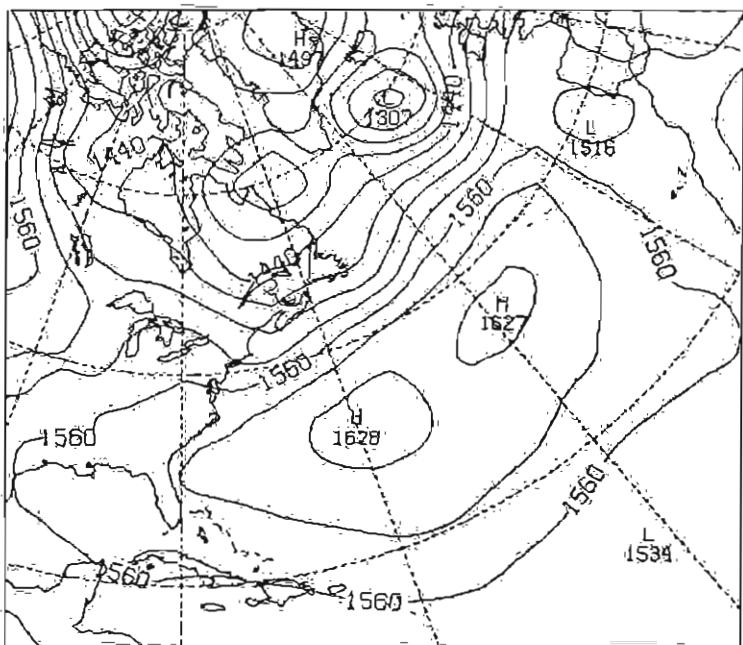
CENTER FROM 1280.0 TO 1620.0 CONTOUR INTERVAL OF 50.000 PT(SL1)= 1550.0

MRF(AVN) MODEL



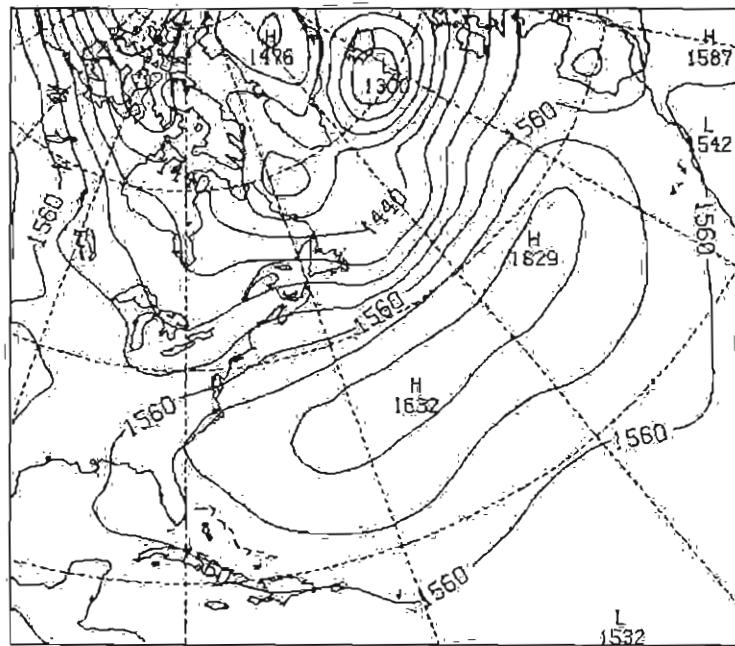
850.00 MB HGT ANALYSIS VALID AT 88-07-17 12Z
CENTRUS FIRM 12004.0 TS 1620.0 CENTRUM INTERVAL OF 30.000 FT (L3) 1620.2

MRF(AVN) MODEL



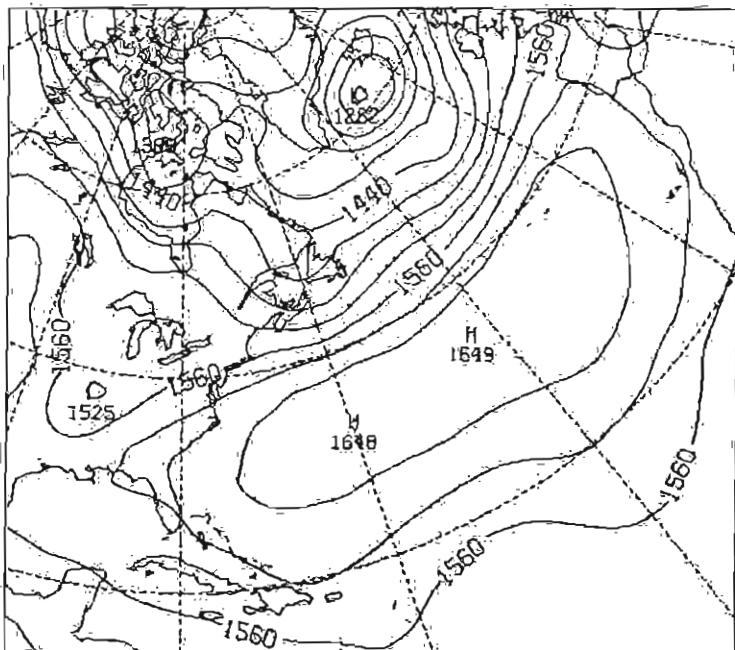
850.00 MB HGT ANALYSIS VALID AT 88-07-18 12Z
CONTINUE FROM 1200.0 TH 1200.0 CONTINUE INTERVAL AT 30.000 FT CLS 10-1842.5

MRF(AVN) MODEL



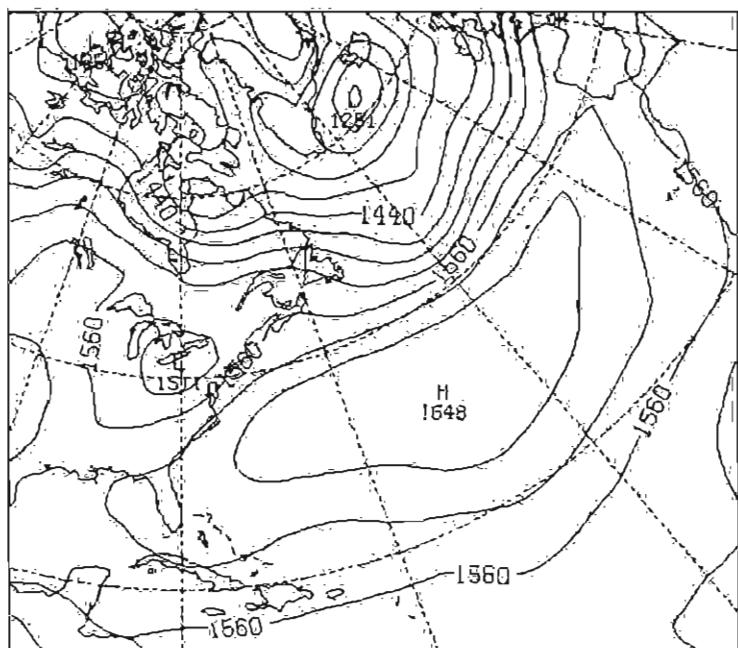
850.00 MB HGT ANALYSIS VALID AT 88-07-19 12Z
CONTINUATION 1200.0 TO 1220.0 CENTER INTERVAL 15 50.000 PT 01-01= 1560.0

MRF(AVN) MODEL



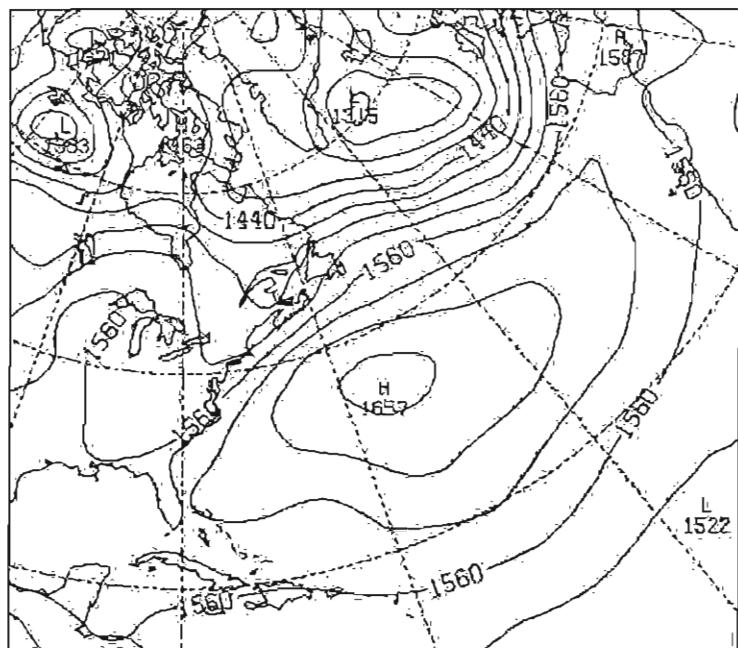
850.00 MB HGT ANALYSIS VALID AT 88-07-20 12Z
CONTINUATION 1200.0 TO 1220.0 CENTER INTERVAL 15 50.000 PT 01-01= 1560.0

MRF(AVN) MODEL



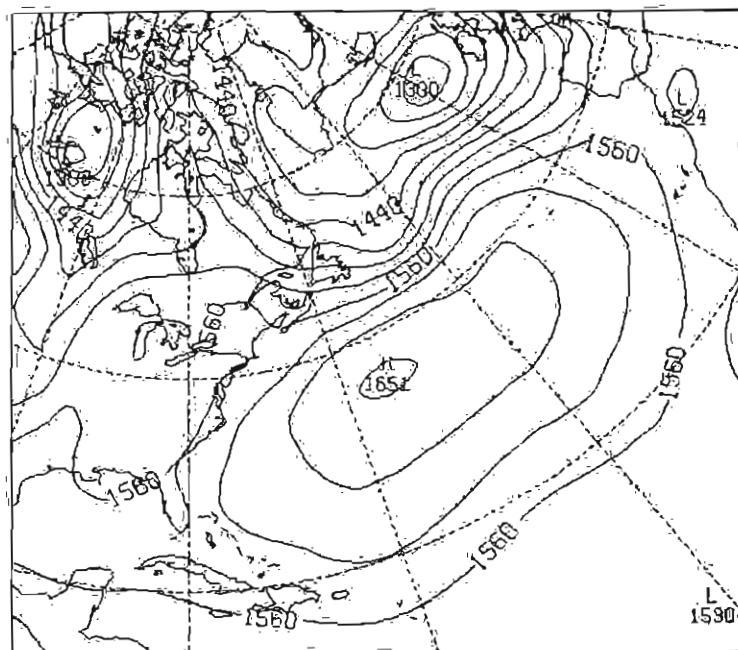
850.00 MB HGT ANALYSIS VALID AT 88-07-21 12Z
CENTRAL POINT 1560.0 IN 1620.0 CENTER INTERVAL 50.000 PT 0.3W 160.0

MRF(AVN) MODEL



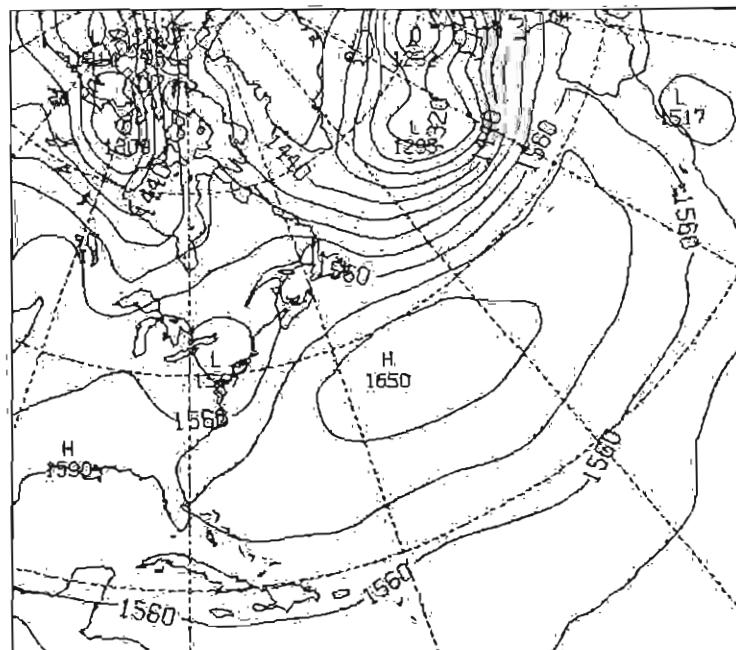
850.00 MB HGT ANALYSIS VALID AT 88-07-22 12Z
CENTRAL POINT 1560.0 IN 1620.0 CENTER INTERVAL 50.000 PT 0.3W 160.0

MRF(AVN) MODEL



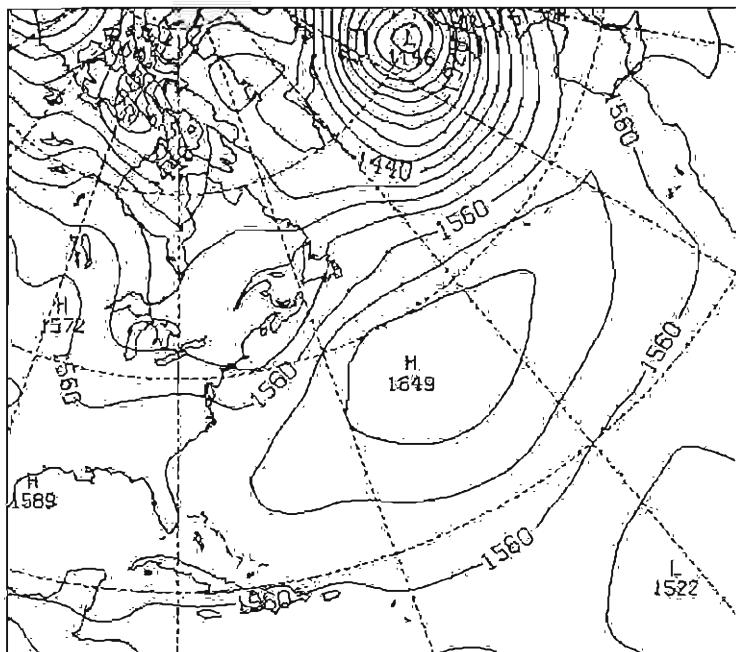
850.00 MB HGT ANALYSIS VALID AT 88-07-23 12Z
CONTOUR FROM 1200.0 TO 1650.0 CONTOUR INTERVAL IS 50.000 FT (2.8) = 1500.0

MRF(AVN) MODEL



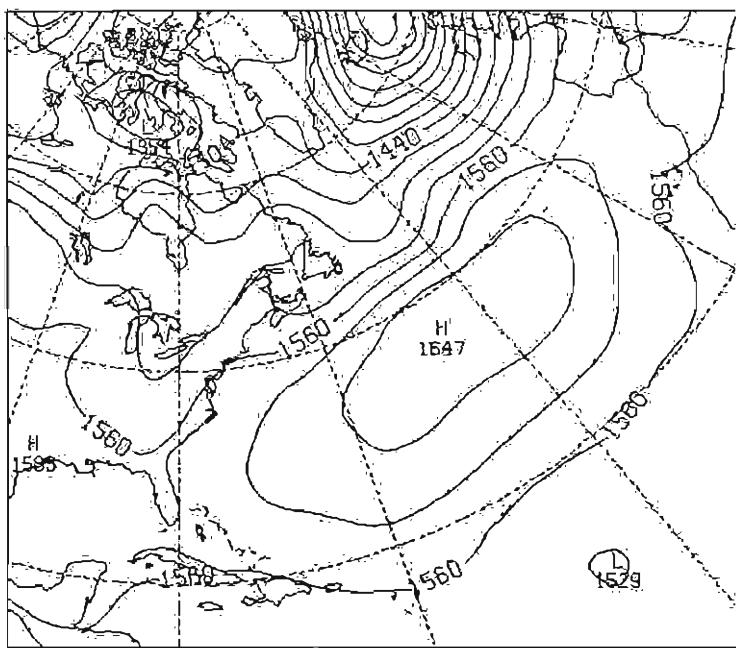
850.00 MB HGT ANALYSIS VALID AT 88-07-24 12Z
CONTOUR FROM 1200.0 TO 1650.0 CONTOUR INTERVAL IS 50.000 FT (2.8) = 1500.0

MRF(AVN) MODEL



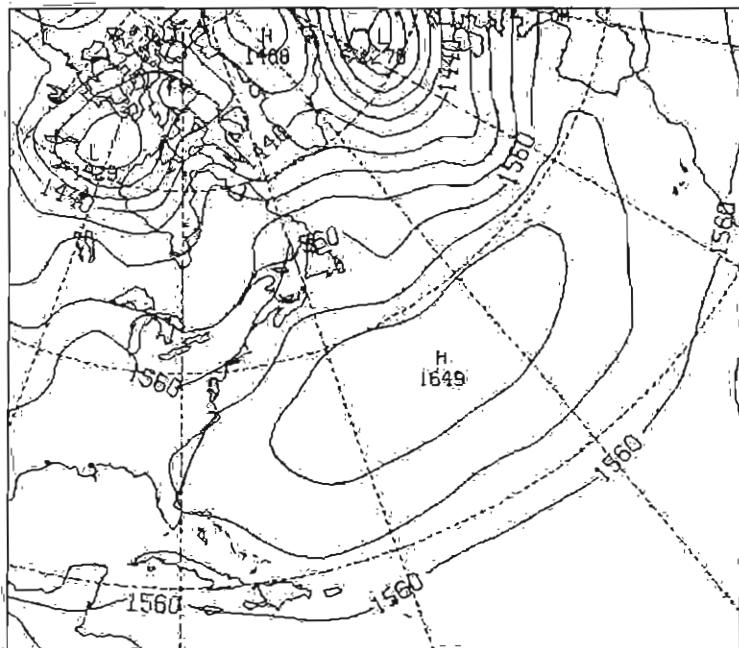
850.00 MB HGT ANALYSIS VALID AT 88-07-25 12Z
SFC 1000 FT 0.00 D 1000.0 CIRCUIT BREAKER 30.000 P 0.00 L 1000.0

MRF(AVN) MODEL



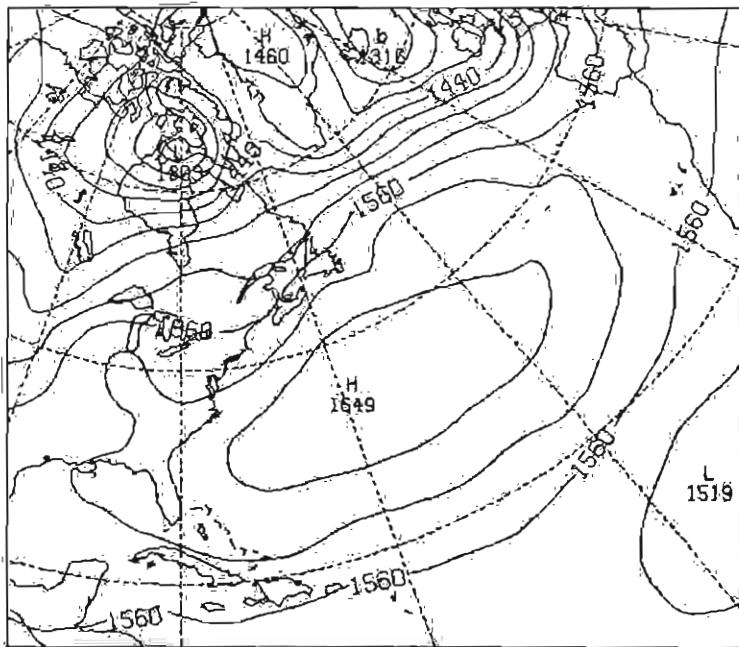
850.00 MB HGT ANALYSIS VALID AT 00-07-26 12Z
DISTANCE FROM 1200.0 TO 1800.0 CIRCULAR INTERVAL OF 30.000 FT (0.001) 1867.2

MRF(AVN) MODEL



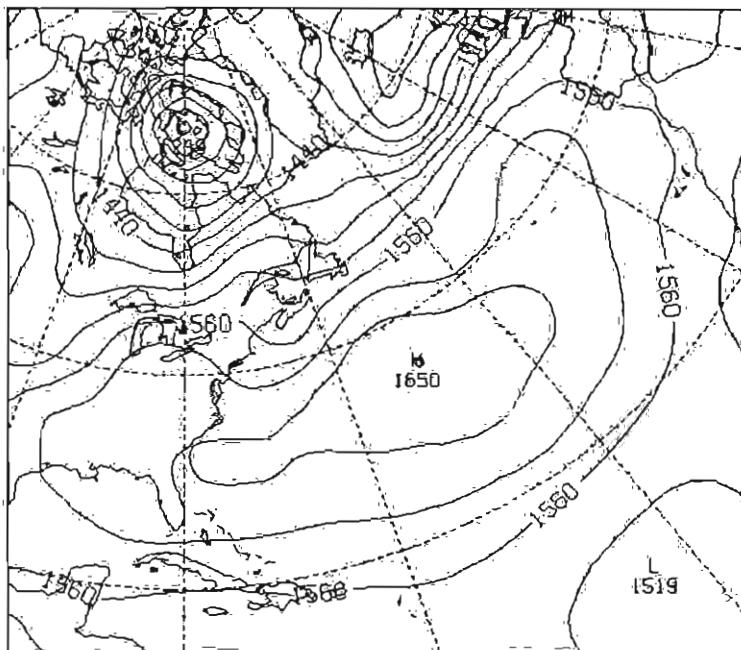
850.00 MB HGT ANALYSIS VALID AT 88-07-27 12Z
CONTOUR FROM 1020.0 TO 1020.0 CONTOUR INTERVAL OF 30.000 PT(0.5)= 1501.1

MRF(AVN) MODEL



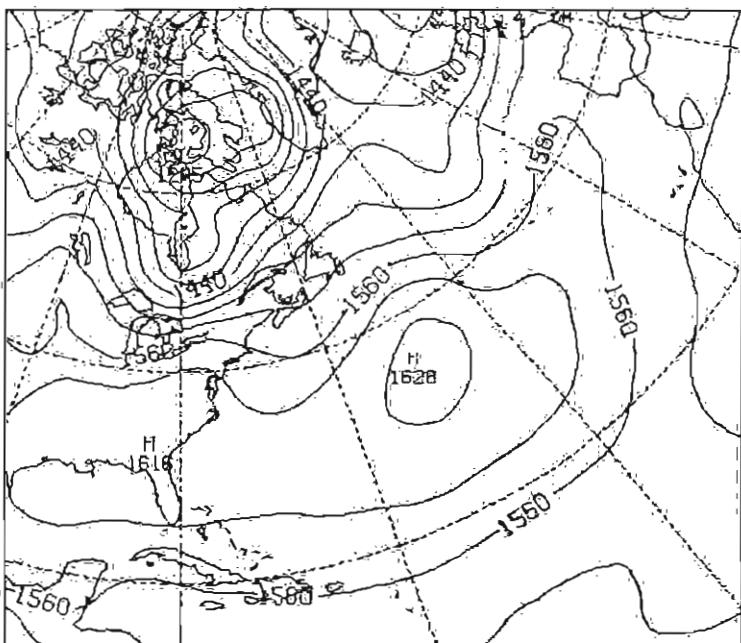
850.00 MB HGT ANALYSIS VALID AT 88-07-28 12Z
CONTOUR FROM 1020.0 TO 1020.0 CONTOUR INTERVAL OF 30.000 PT(0.5)= 1501.1

MRF(AVN) MODEL



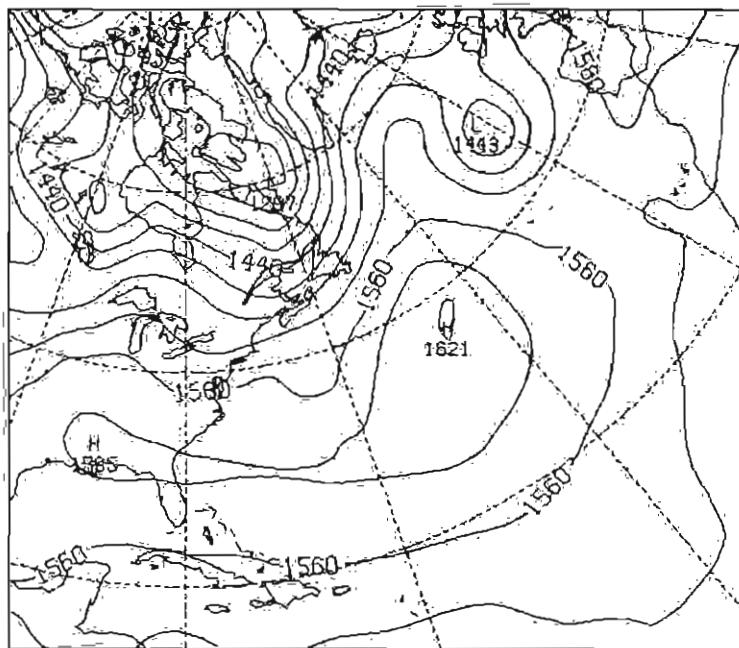
850.00 MB HGT ANALYSIS VALID AT 88-07-29 12Z
CONTINUE FROM 1520.0 THRU 1560.0 CENTER INTERVAL OF 30.000 FTG.SHA 1520.0

MRF(AVN) MODEL



850.00 MB HGT ANALYSIS VALID AT 88-07-30 12Z
CONTINUE FROM 1520.0 THRU 1560.0 CENTER INTERVAL OF 30.000 FTG.SHA 1520.0

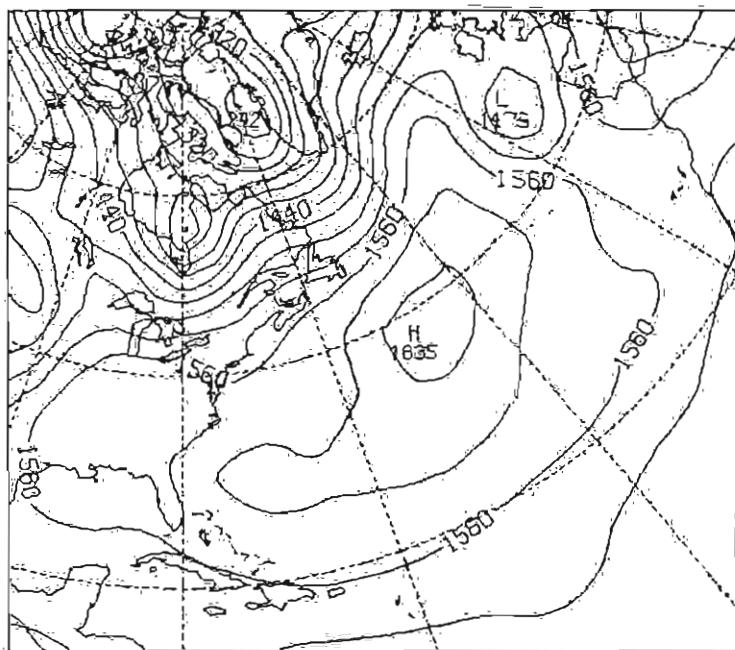
MRF(AVN) MODEL



850.00 MB HGT ANALYSIS VALID AT 88-07-31 12Z

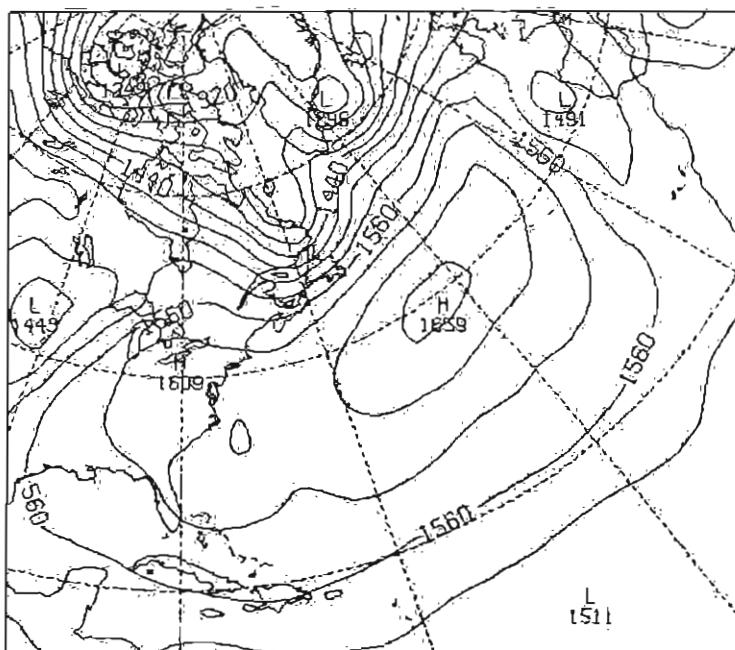
CONTINUOUS FROM 1200.0 TO 1620.0 CONTOUR INTERVAL OF 30.000 FT (3.333) = 1560.0

MRF(AVN) MODEL



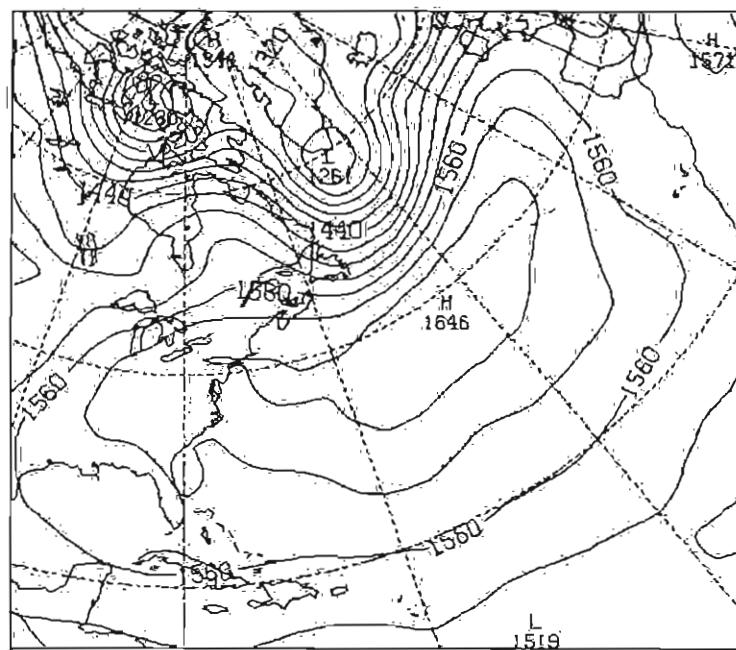
850.00 MB HGT ANALYSIS VALID AT 88-08-01 12Z
CONTOUR FLD: 1200.0 ■ 1650.0 CONTOUR INTERVAL: 30.000 FT (9.81) 1622.7

MRF(AVN) MODEL



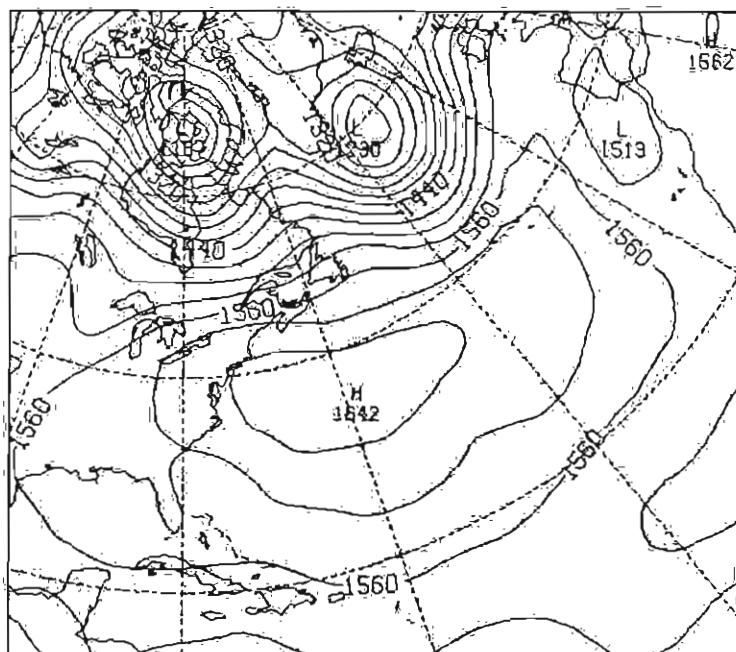
850.00 MB HGT ANALYSIS VALID AT 88-08-02 12Z
CONTOUR FLD: 1200.0 ■ 1650.0 CONTOUR INTERVAL: 30.000 FT (9.81) 1622.7

MRF(AVN) MODEL



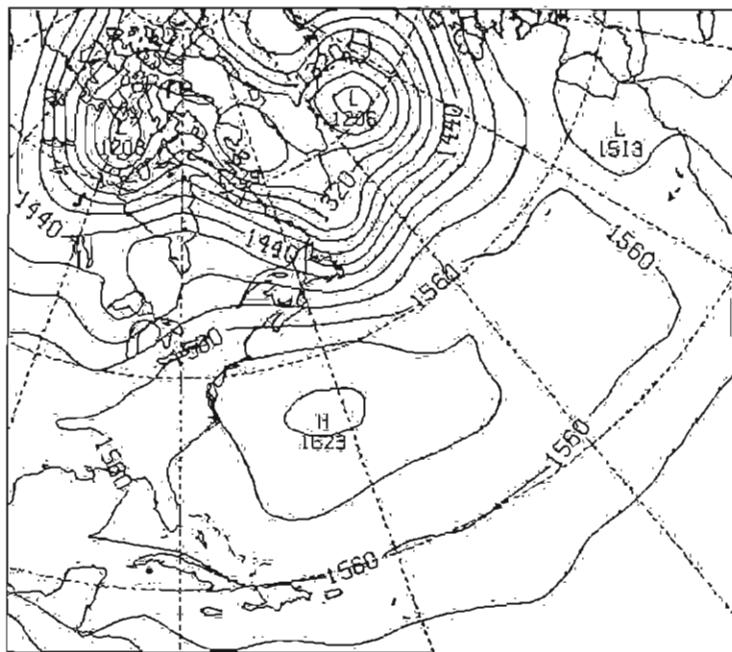
850.00 MB HGT ANALYSIS VALID AT 88-08-03 12Z
CONTOUR FROM 1120.0 TO 1620.0 CONTOUR INTERVAL OF 20.000 P(1.3)= 1822.2

MRF(AVN) MODEL



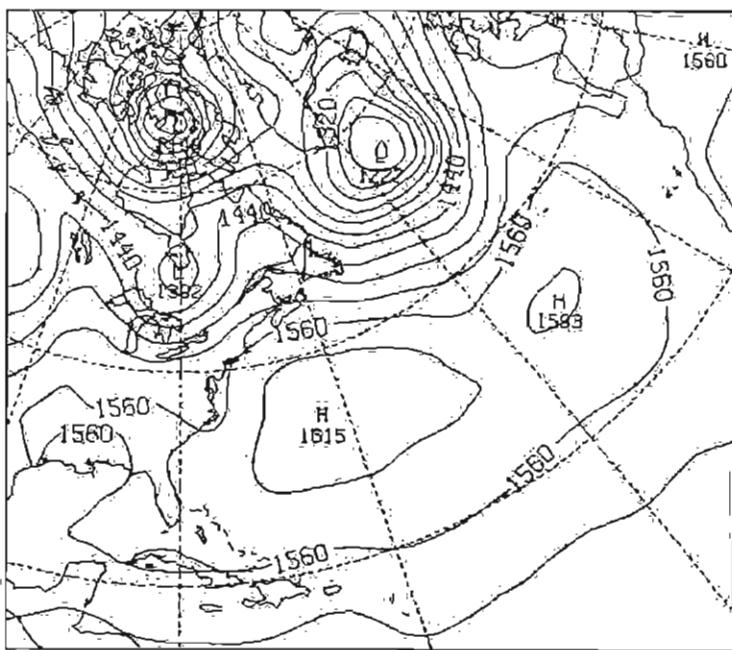
850.00 MB HGT ANALYSIS VALID AT 88-08-04 12Z
CONTOUR FROM 1120.0 TO 1620.0 CONTOUR INTERVAL OF 20.000 P(1.3)= 1822.2

MRF(AVN) MODEL



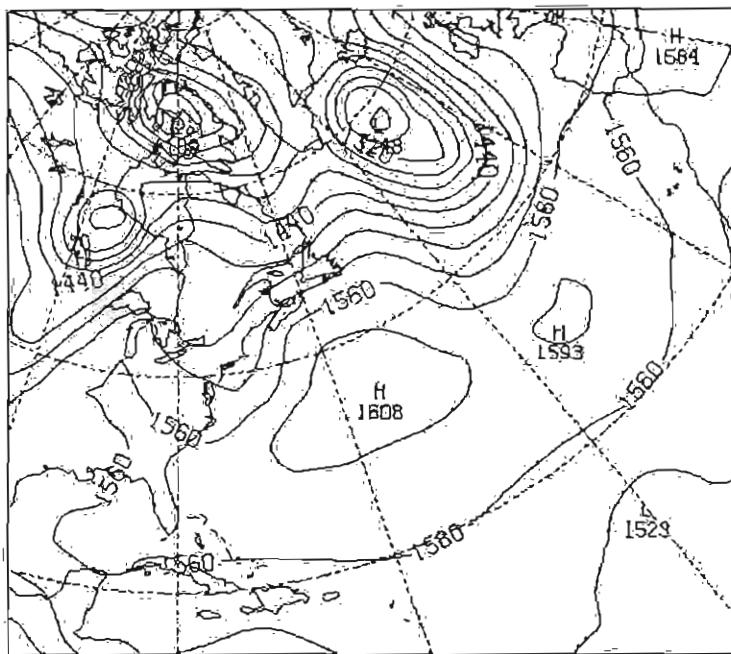
850.00 MB HGT ANALYSIS VALID AT 88-08-05 12Z
CUTTING TIME 2000.0 1000.0 CENTER INTERVAL OF 30.000 P(1.3) 1538.0

MRF(AVN) MODEL



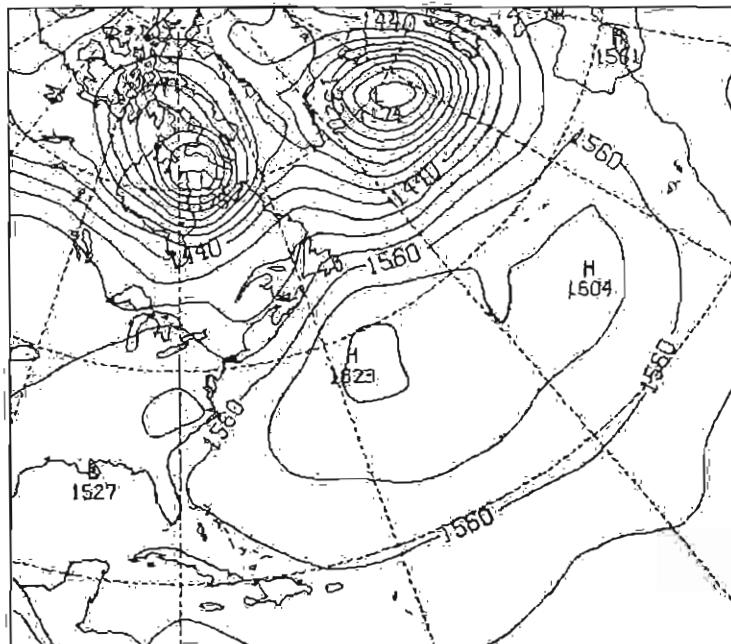
850.00 MB HGT ANALYSIS VALID AT 88-08-06 12Z
CENTER FROM LMH01 RT 1590.0 (CONTINUOUS INTERVAL WF 30.000 PTD(3) (1590.0)

MRF(AVN) MODEL



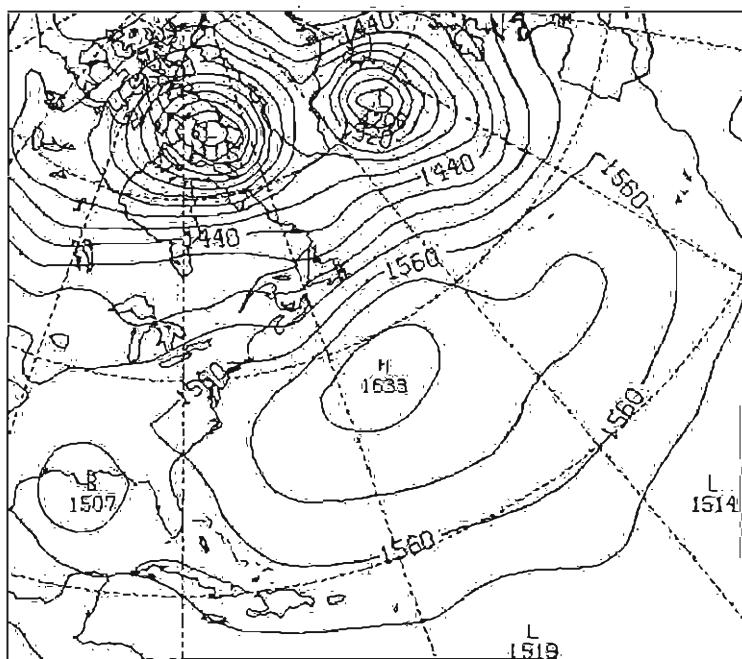
850.00 MB HGT ANALYSIS VALID AT 88-08-07 12Z
CONTUR FROM 1420.0 TO 1580.0 CONTOUR INTERVAL IS 50.000 FT G.31 - 1590.2

MRF(AVN) MODEL



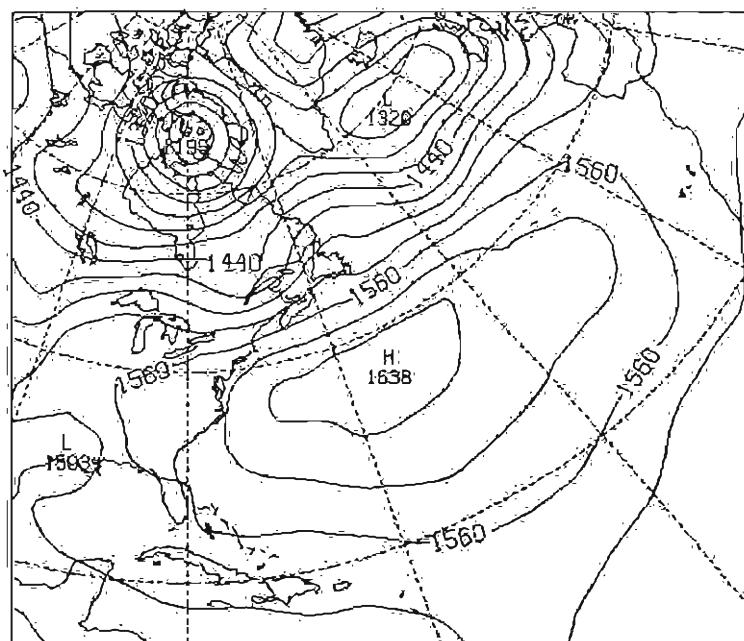
850.00 MB HGT ANALYSIS VALID AT 88-08-08 12Z
CONTUR FROM 1420.0 TO 1580.0 CONTOUR INTERVAL IS 50.000 FT G.31 - 1590.2

MRF(AVN) MODEL



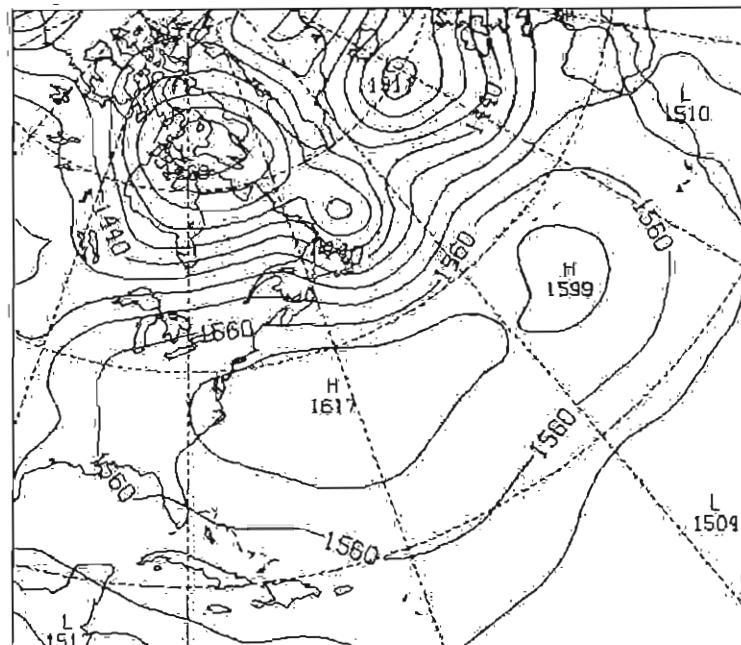
850.00 MB HGT ANALYSIS VALID AT 88-08-09 12Z
CIRCLE PERIOD 1120.0 DEG 1620.0 CENTER INTERVAL 80.000 PT(3.3)= 1622.7

MRF(AVN) MODEL



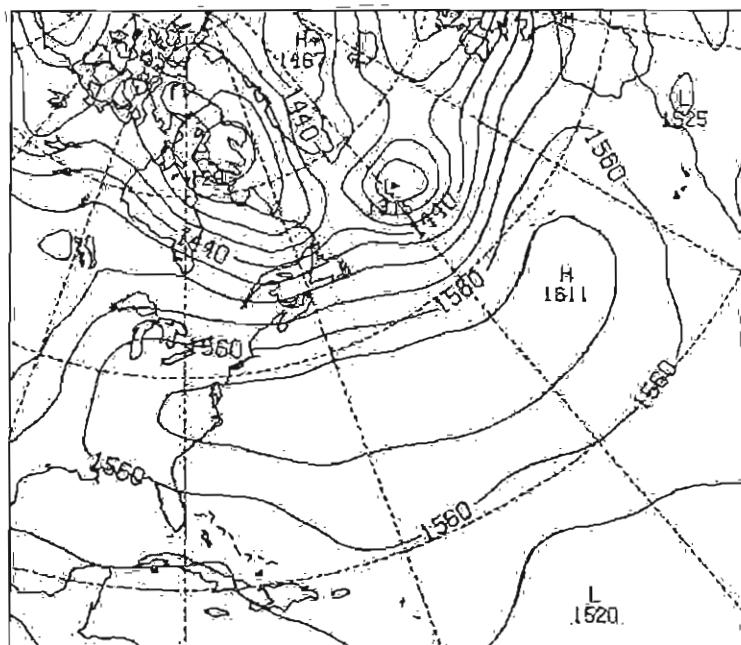
850.00 MB HGT ANALYSIS VALID AT 88-08-10 12Z
CIRCLE PERIOD 1120.0 DEG 1620.0 CENTER INTERVAL 80.000 PT(3.3)= 1620.8

MRF(AVN) MODEL



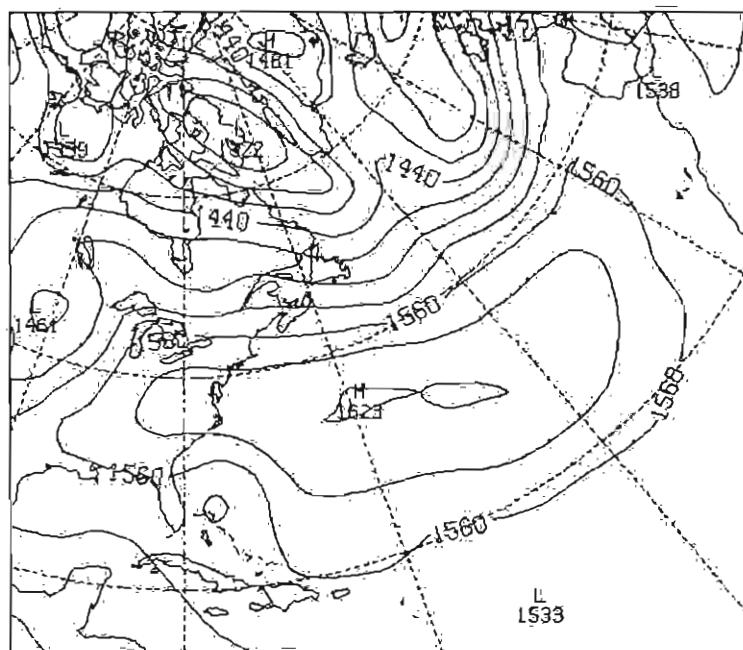
850.00 MB HGT ANALYSIS VALID AT 88-08-11 12Z
CONTUR FREQ 1280.0 TB 1580.0 CONTOUR INTERVAL OF 10.000 FT (3.048 M) 1610.0

MRF(AVN) MODEL



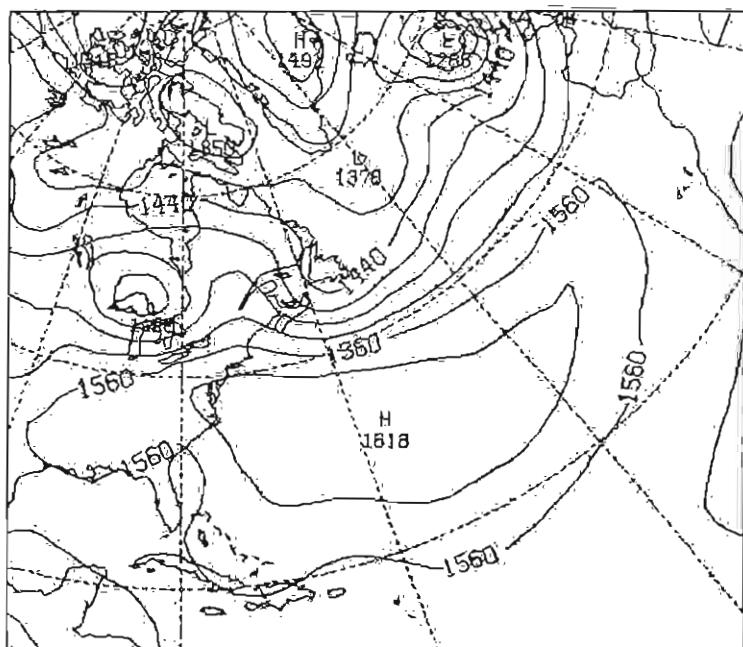
850.00 MB HGT ANALYSIS VALID AT 88-08-12 12Z
CONTUR FREQ 1280.0 TB 1580.0 CONTOUR INTERVAL OF 10.000 FT (3.048 M) 1610.0

MRF(AVN) MODEL



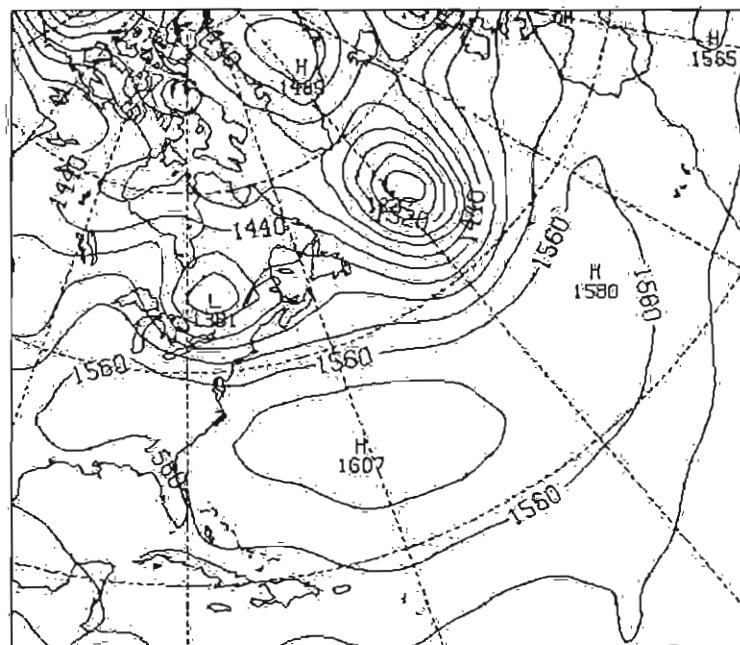
850.00 MB HGT ANALYSIS VALID AT 88-08-13 12Z
CONTINUOUS 1200.0 10 1200.0 CONTOUR INTERVAL 30.000 PERT. SPC 11512.5

MRF(AVN) MODEL



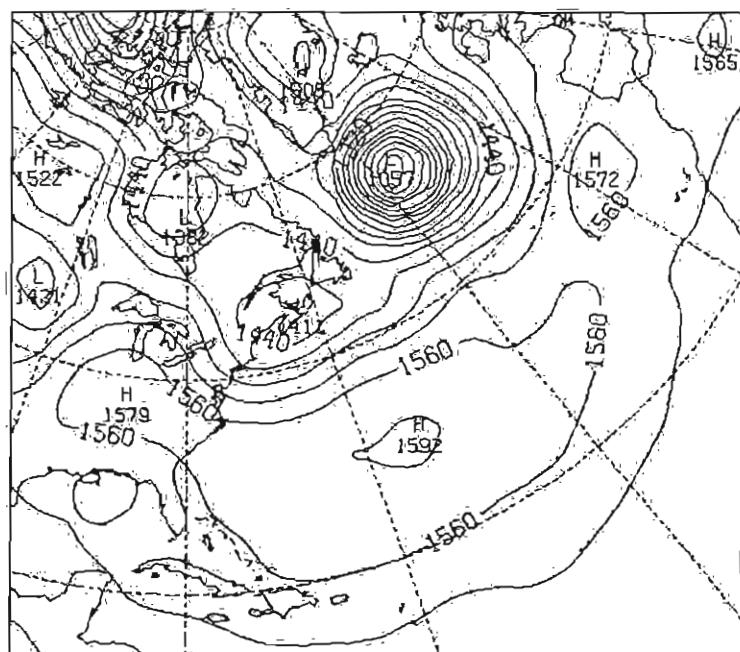
850.00 MB HGT ANALYSIS VALID AT 88-08-14 12Z
CONTINUOUS 1200.0 10 1200.0 CONTOUR INTERVAL 30.000 PERT. SPC 11512.5

MRF(AVN) MODEL

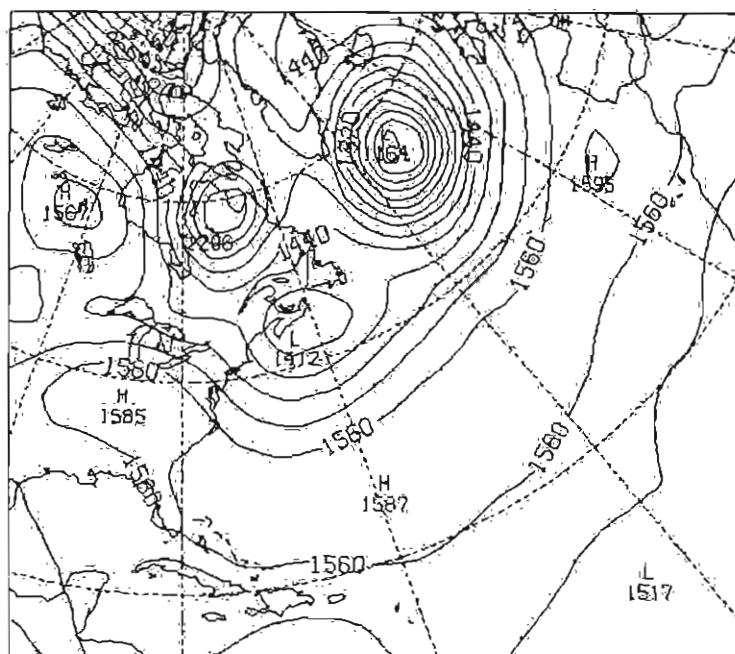


850.00 MB HGT ANALYSIS VALID AT 88-08-15 12Z
CONTOUR FINE 1200.0 ■ 680.0 CONTOUR INTERVAL OF 30.000 FT(G.O.) 1526.0

MRF(AVN) MODEL

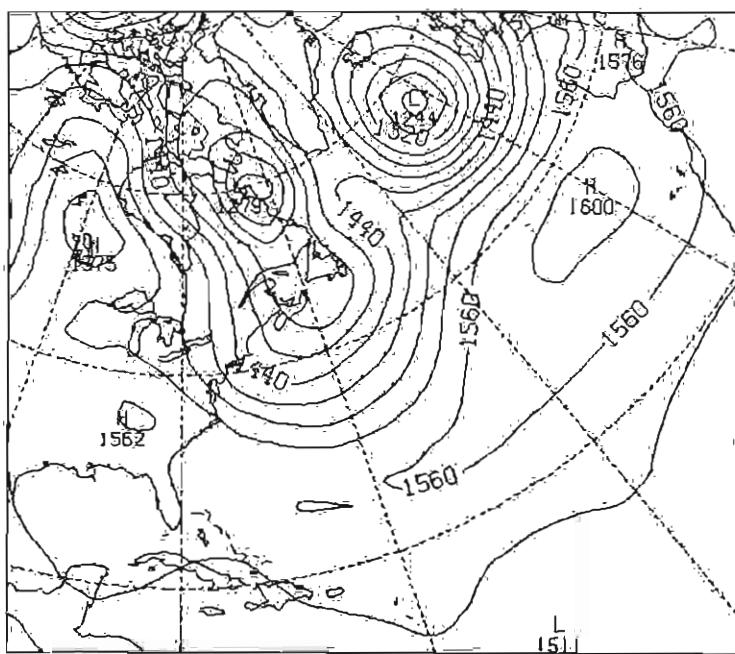


MRF(AVN) MODEL



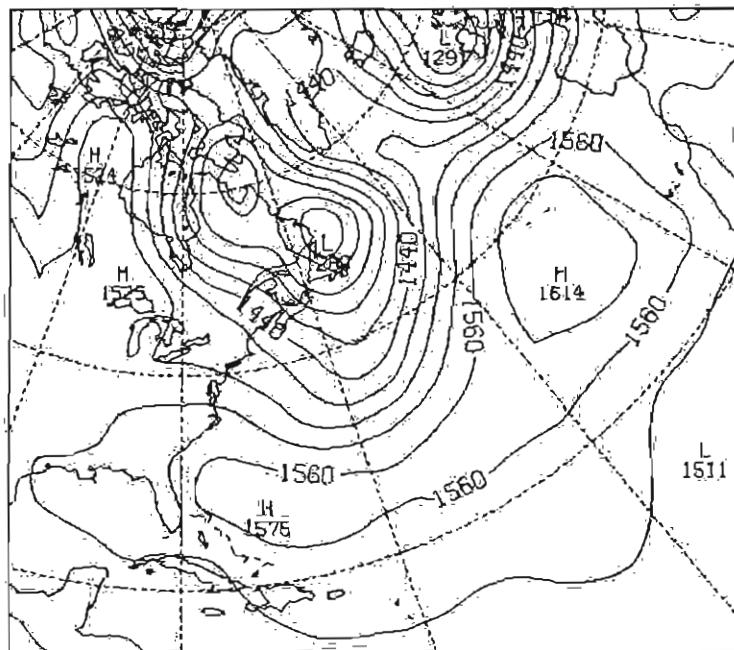
850.00 MB HGT ANALYSIS VALID AT 88-08-17 12Z
CENTRE FROM 110.0 10 1560.0 CENTRE INTENSTY OF 80.000 013:30= 1521.1

MRF(AVN) MODEL



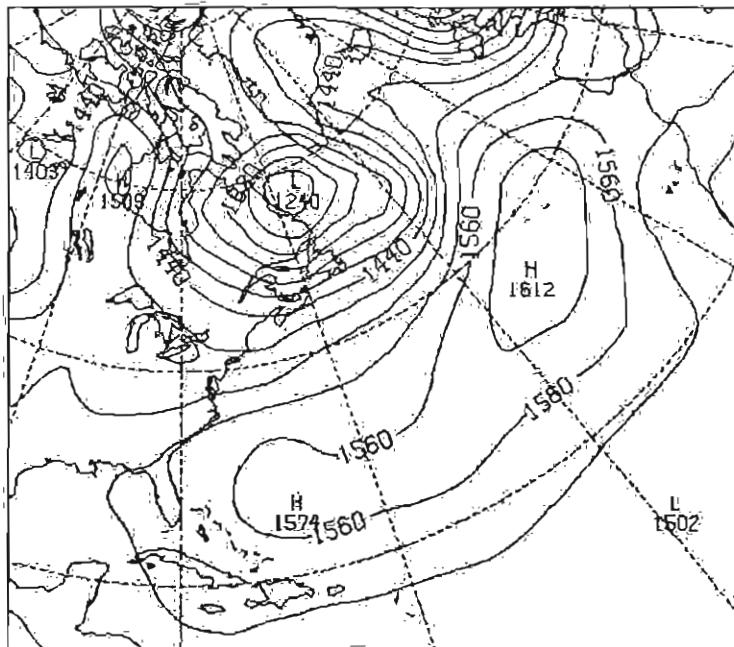
850.00 MB HGT ANALYSIS VALID AT 88-08-18 12Z
CENTRE FROM 120.0 10 1560.0 CENTRE INTENSTY OF 80.000 013:30= 1521.1

MRF(AVN) MODEL



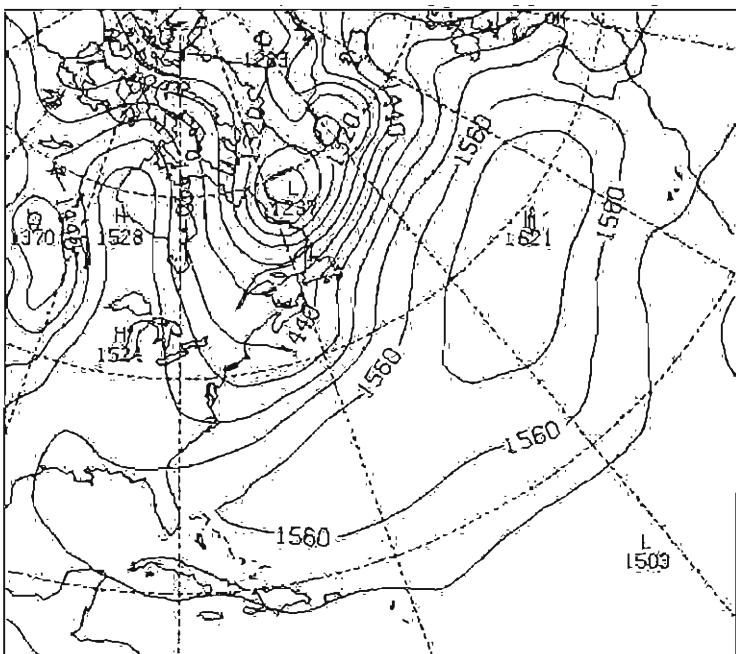
850.00 MB HGT ANALYSIS VALID AT 88-08-19 12Z
CENTRAL PRESSURE 1280.0 FT 1580.0 CENTRAL INTERVAL OF 30.000 FT (3.3) 1580.0

MRF(AVN) MODEL



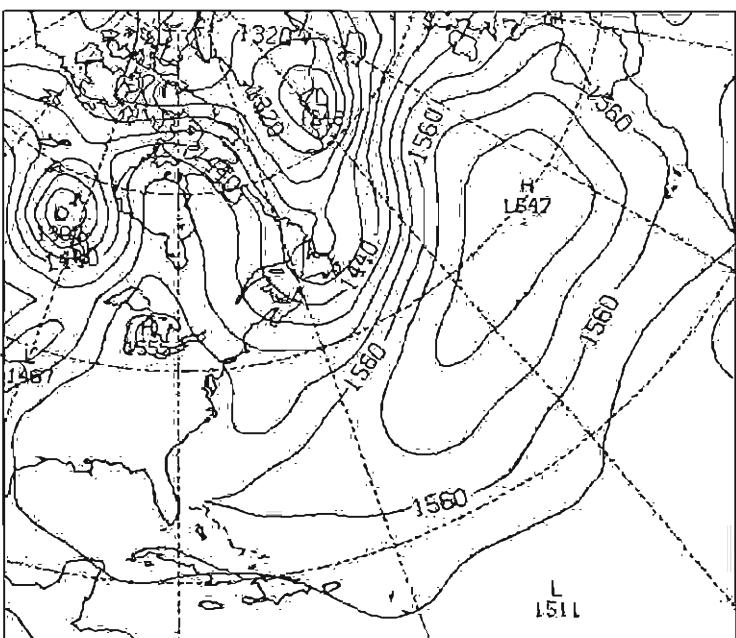
850.00 MB HGT ANALYSIS VALID AT 88-08-20 12Z
CENTRAL PRESSURE 1280.0 FT 1580.0 CENTRAL INTERVAL OF 30.000 FT (3.3) 1580.0

MRF(AVN) MODEL



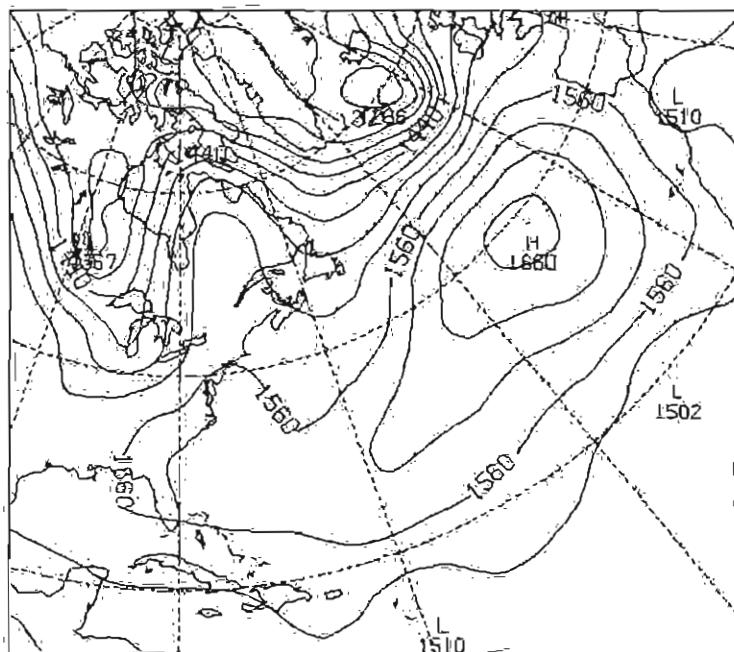
850.00 MB HGT ANALYSIS VALID AT 88-08-21 12Z
CENTRAL-FROM 1250.0 TO 1260.0 CENTER INTERVAL IS 10.000 FTLS 31H 1021.2

MRF(AVN) MODEL



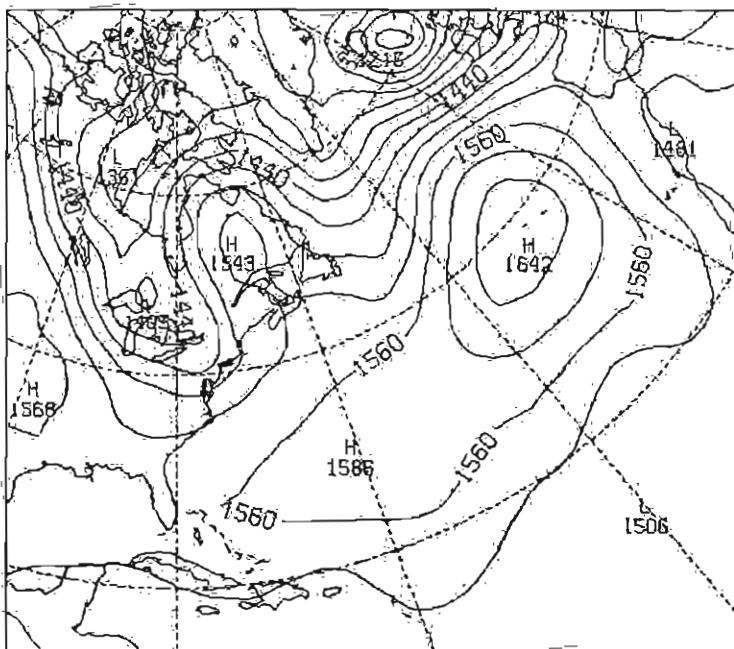
850.00 MB HGT ANALYSIS VALID AT 08-06-22 12Z

MRF(AVN) MODEL



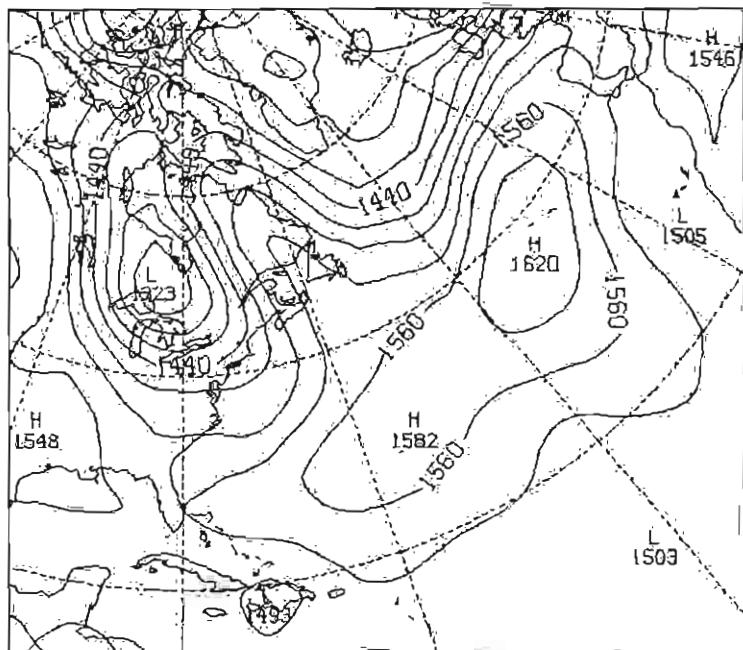
850.00 MB HGT ANALYSIS VALID AT 88-08-23 12Z
CONTOUR FROM 1200.0 TO 1620.0 CONTOUR INTERVAL IS 30.000 PT(G,3)= 1E4.2

MRF(AVN) MODEL



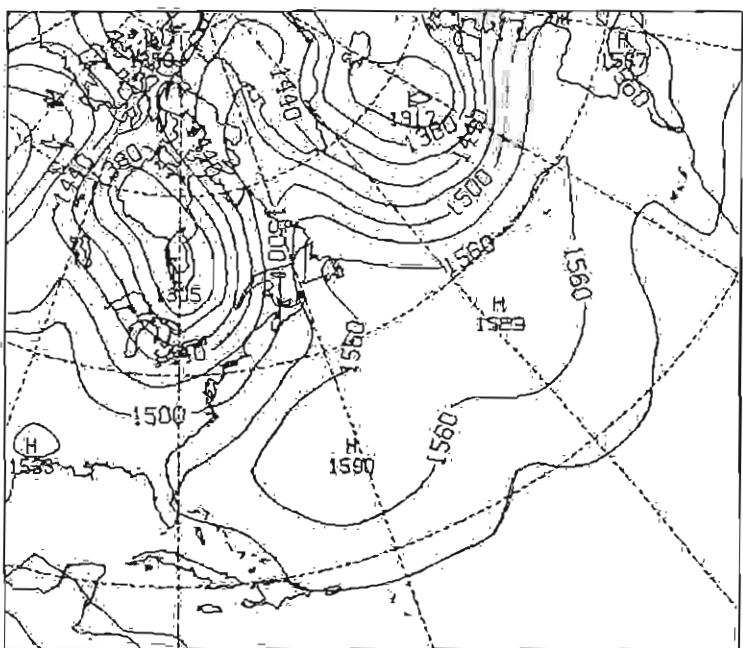
850.00 MB HGT ANALYSIS VALID AT 88-08-24 12Z
CONTOUR FROM 1200.0 TO 1620.0 CONTOUR INTERVAL IS 30.000 PT(G,3)= 1E4.2

MRF(AVN) MODEL



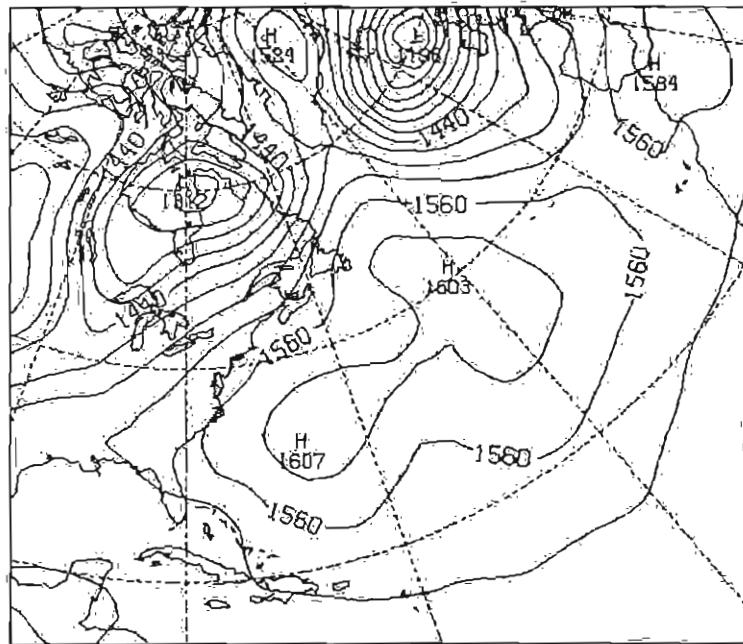
850.00 MB HGT ANALYSIS VALID AT 88-08-25 12Z
CENTRAL FREQ 1290.0 TH 1020.0 CENTER INTERVAL OF 80.000 FT (0.3) 1000.0

MRF(AVN) MODEL



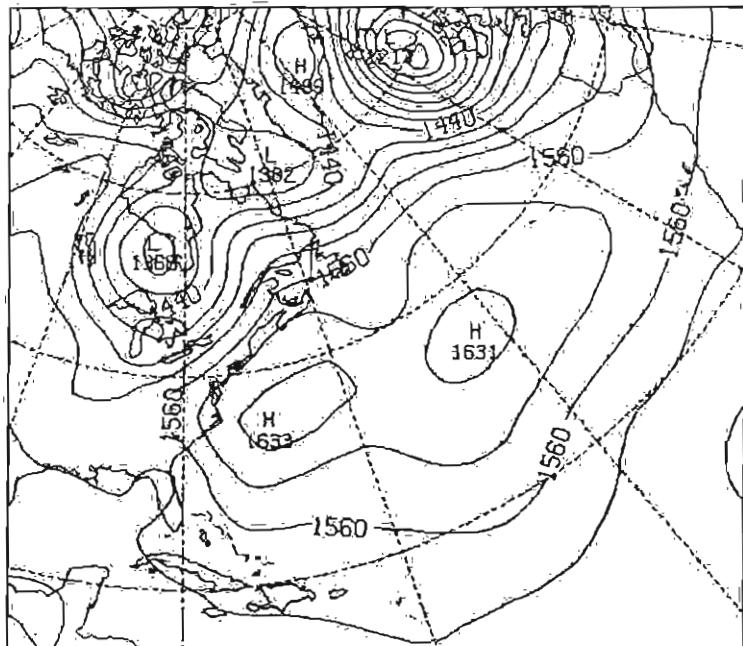
850.00 MB HGT ANALYSIS VALID AT 88-08-26 12Z
CENTRAL FREQ 1290.0 TH 1020.0 CENTER INTERVAL OF 80.000 FT (0.3) 1000.0

MRF(AVN) MODEL



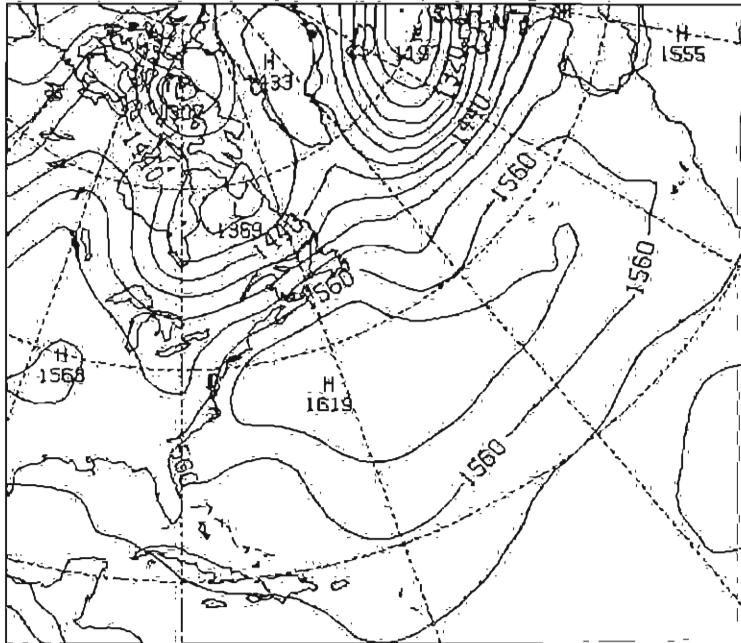
850.00 MB HGT ANALYSIS VALID AT 88-08-27 12Z
CONTOUR FREQ: 120.00 FT 1560.0 CONTOUR INTERVAL: 30.000 FT 0.01 160.0

MRF(AVN) MODEL



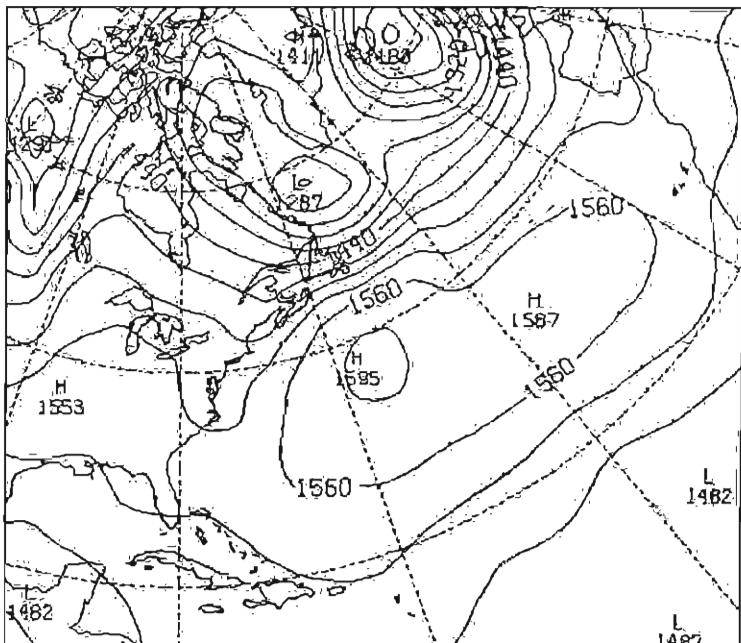
850.00 MB HGT ANALYSIS VALID AT 88-08-28 12Z
CONTOUR FREQ: 120.00 FT 1560.0 CONTOUR INTERVAL: 30.000 FT 0.01 160.0

MRF(AVN) MODEL



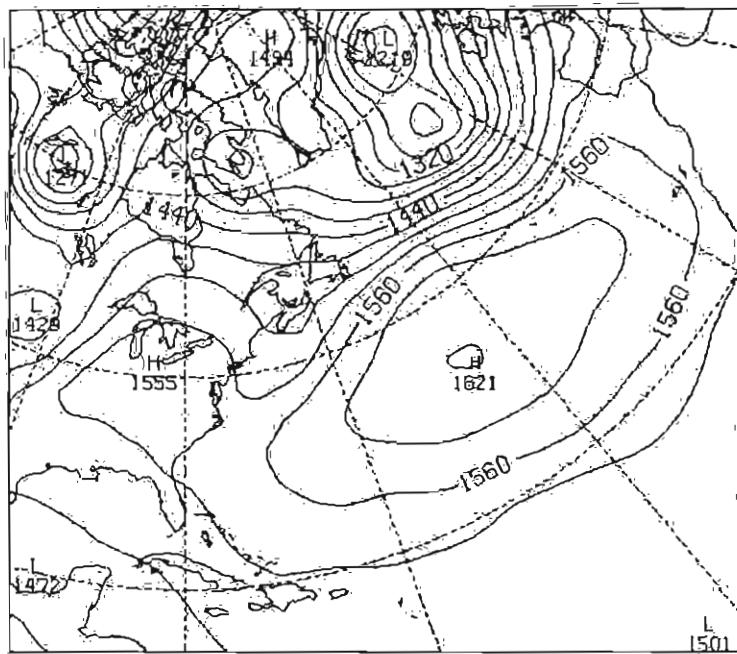
850.00 MB HGT ANALYSIS VALID AT 88-08-29 12Z
CONTINUE FROM 1120-0 TM 1800-0 CENTER INTERVAL OF 30.000 FT 15-31° 1500-1

MRF(AVN) MODEL



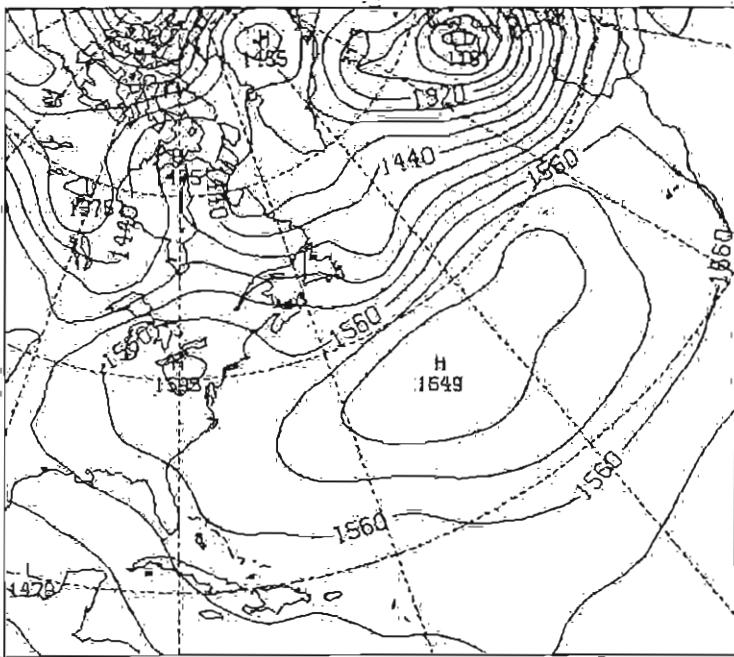
850.00 MB HGT ANALYSIS VALID AT 08-06-30 12Z
DISTANCE FROM 100.0 DEGREES LATITUDE 100.0 DEGREES LONGITUDE 100.0 DEGREES

MRF(AVN) MODEL



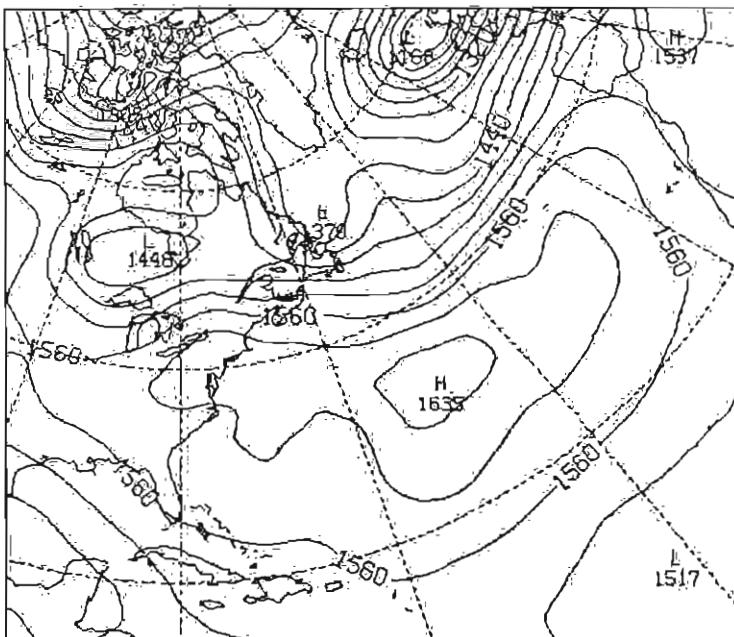
850.00 MB HGT ANALYSIS VALID AT 88-08-31 12Z
CONTURS FROM 1200.0 130 1620.0 CONTUR INTERVAL OF 20.000 FT GLD 120 1620.0

MRF(AVN) MODEL



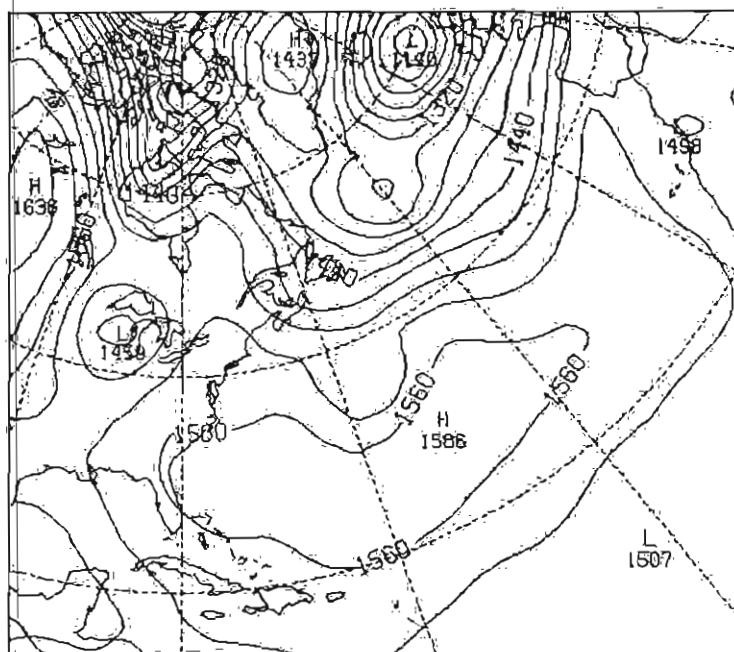
850.00 MB HGT ANALYSIS VALID AT 88-09-01 12Z
CENTER PTM 110.0 10 100.0 CENTER INTERVAL OF 30.00 PTG 110.0 100.0

MRF(AVN) MODEL



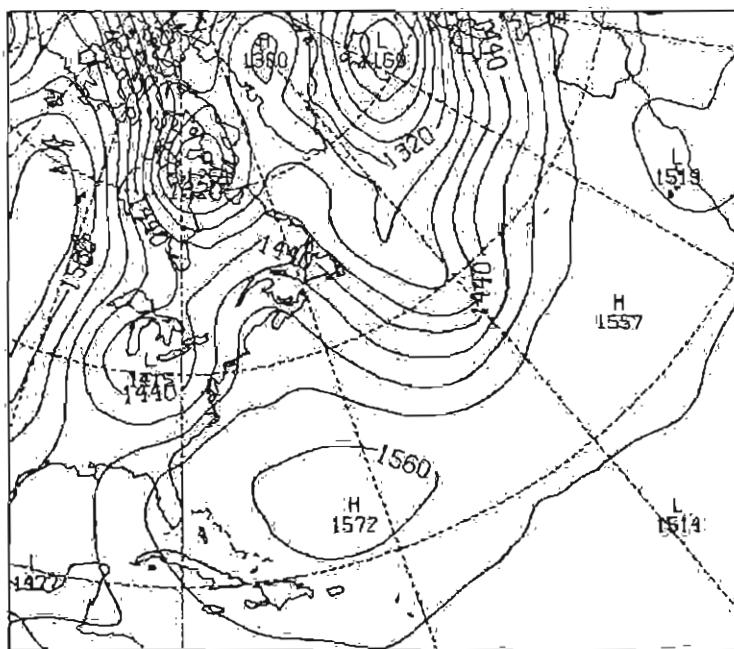
850.00 MB HGT ANALYSIS VALID AT 88-09-02 12Z
CENTER PTM 110.0 10 100.0 CENTER INTERVAL OF 30.00 PTG 110.0 100.0

MRF(AVN) MODEL



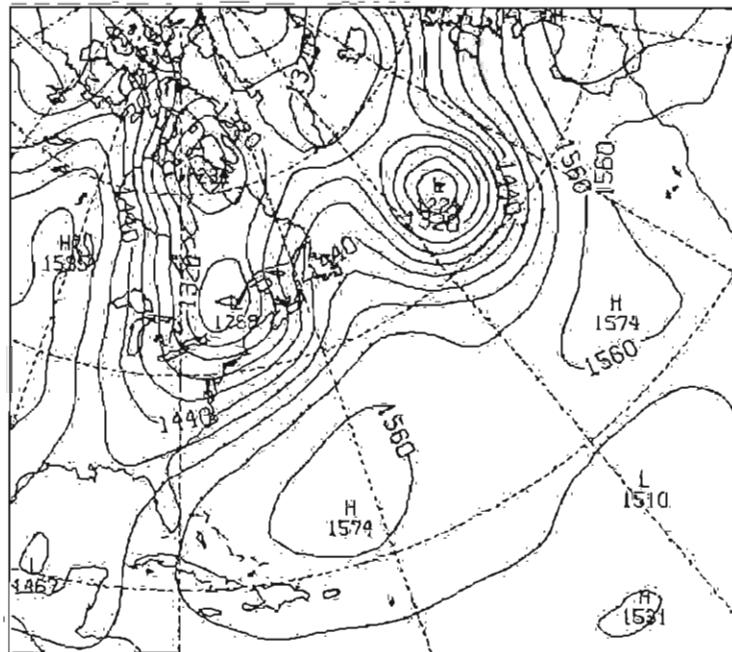
850.00 MB HGT ANALYSIS VALID AT 88-09-03 12Z.
CENTERS FROM 1140.0 TO 1620.0 CENTER INTERVAL OF 20.000 P1343= 1487.1

MRF(AVN) MODEL



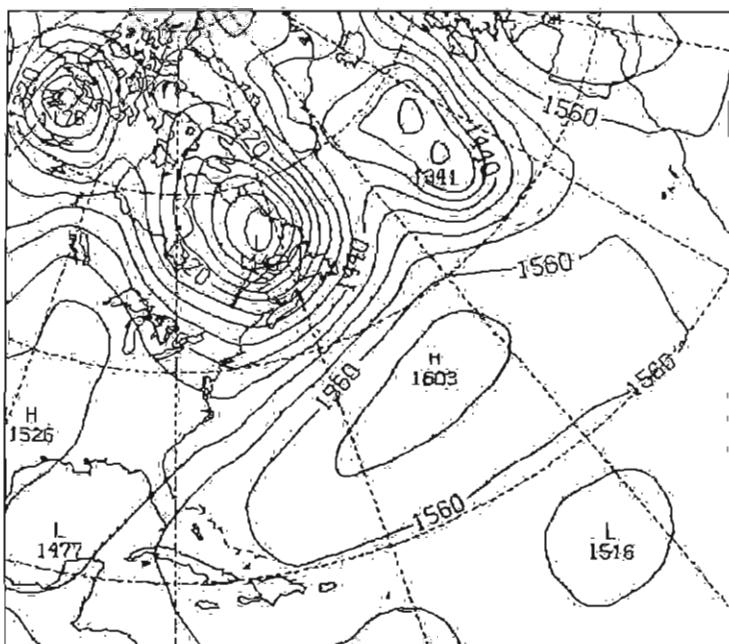
850.00 MB HGT ANALYSIS VALID AT 88-09-04 12Z
CENTERS FROM 1140.0 TO 1620.0 CENTER INTERVAL OF 20.000 P1343= 1488.7

MRF(AVN) MODEL



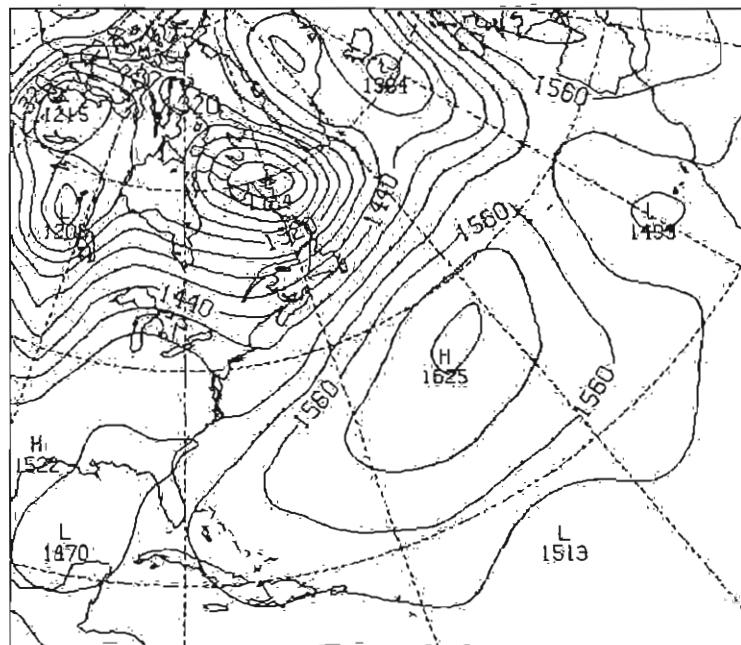
850.00 MB HGT ANALYSIS VALID AT 88-09-05 12Z
CONTOUR FREQ 1200.0 TB 1500.0 CONTOUR INTERVAL 1F 3000.0 PT 10.01-1500.0

MRF(AVN) MODEL



850.00 MB HGT ANALYSIS VALID AT 88-09-06 12Z
CONTOUR FREQ 1200.0 TB 1500.0 CONTOUR INTERVAL 1F 3000.0 PT 10.01-1500.0

MRF(AVN) MODEL



850.00 MB HGT ANALYSIS VALID AT 88-09-07 12Z
CONTINUOUS FROM 110000 TO 162010 CENTER INTERVAL IS 300000 PT CNTD = 11000 Q

Appendix B - Mt. Mitchell deck log data

The Mt. Mitchell deck log contains the following hourly ship position, weather, and oceanic data:

- date
- time
- time zone with respect to GMT
- latitude
- longitude
- present weather
- visibility
- wind direction and speed
- wave height minimum and maximum
- swell direction
- swell height minimum and maximum
- sea temperature
- barometric pressure
- dry and wet bulb temperature.

1988 GLOBAL CHANGE CRUISE
SHIP WT. MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESNT WEATHER	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE (FEET) (TRUE)	WAVE (FEET) (MIN)	WAVE (FEET) (MAX)	SWELL DIR.	SWELL HEIGHT (FEET) (TRUE)	SWELL HEIGHT (FEET) (MIN)	SWELL HEIGHT (FEET) (MAX)	SEA TEMP (C)	DRY TEMP (C)	WET TEMP (C)
15-JUL-88	16:00	+04	37 00.0 N	76 17.0 W	HAZE	6	220	7	0	0	0	#	0	0	28.3	1015.2	32.7	31.7
	17:00	+04			HAZE	6	W	0	0	0	0	#	0	0	28.3	1015.2	32.1	31.1
	18:00	+04			HAZE	6	230	5	0	0	0	#	0	0	28.3	1015.2	32.1	31.1
	19:00	+04			HAZE	6	340	5	0	0	0	#	0	0	28.3	1015.2	31.7	31.1
	20:00	+04	36 55.5 N	76 05.0 W	HAZE	5	10	7	#	#	#	#	#	#	28.3	1015.8	30.0	29.4
	21:00	+04	36 57.7 N	75 53.7 W	HAZE	5	60	11	#	#	#	#	#	#	28.3	1016.0	30.0	29.4
	22:00	+04	36 43.0 N	75 42.1 W	HAZE	5	63	11	#	#	#	#	#	#	26.1	1015.5	28.5	28.4
	23:00	+04	36 35.0 N	75 33.0 W	HAZE	5	65	12	#	#	#	#	#	#	26.1	1015.5	27.2	27.0
N	B	B	B	B		8	8	7	0	4	4	4	4	4	8	8	8	8

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP M.V. MITCHELL DECK LOG DATA

DATE	TIME	PRESENT WEATHER	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE HEIGHT MIN (FEET)	WAVE HEIGHT MAX (FEET)	SWELL DIR. (TRUE)	SWELL HEIGHT MIN (FEET)	SWELL HEIGHT MAX (FEET)	SEA TEMP (C)	BAROM. (HPA)	DRY TEMP (C)	WET TEMP (C)
16-JUL-88	0:00	+04 36 27.8 N 75 26.3 W HAZE	4	70.	13	0	0	150	1	1	26.1	1017.0	26.7	26.5
	1:00	+04 35 52.6 N 74 36.9 W HAZE	4	70.	13	0	0	150	1	1	26.1	1017.0	26.7	26.5
	2:00	+04 35 52.6 N 74 36.9 W HAZE	3	70.	13	0	0	160	1	1	27.8	1017.3	26.7	26.4
	3:00	+04 36 01.8 N 74 48.0 W HAZE	4	80.	13	0	0	160	1	1	27.8	1018.0	26.7	26.1
	4:00	+04 35 52.6 N 74 36.9 W HAZE	5	100	5	0	0	150	1	1	28.3	1018.2	27.2	26.7
	5:00	+04 35 52.6 N 74 36.9 W HAZE	5	170	5	0	0	150	1	1	28.3	1018.2	27.2	26.7
	6:00	+04 35 35.5 N 74 12.0 W HAZE	5	8	0	0	0	150	1	1	28.3	1018.0	27.2	26.7
	7:00	+04 35 18.0 N 73 54.4 W HAZE	5	240	8	#	#	160	1	1	28.3	1017.2	27.2	26.7
	8:00	+04 35 21.5 N 74 04.0 W HAZE	6	225	12	#	#	#	#	#	30.0	1018.0	27.0	26.7
	9:00	+04 35 30.1 N 74 12.8 W HAZE	6	228	9	#	#	#	#	#	30.0	1018.0	27.2	26.7
	10:00	+04 35 40.7 N 74 22.0 W HAZE	7	230	6	#	#	#	#	#	28.9	1018.9	27.2	26.7
	11:00	+04 35 44.5 N 74 32.6 W HAZE	4	240	5	0	1	160	0	1	28.9	1019.2	26.8	26.8
	12:00	+04 35 49.0 N 74 31.8 W HAZE	3	130	6	0	1	#	#	#	28.8	1019.3	28.0	27.5
	13:00	+04 35 49.0 N 74 31.8 W HAZE	3	140	6	0	1	#	#	#	28.8	1019.9	28.8	28.3
	14:00	+04 35 56.0 N 74 40.3 W HAZE	3	160	6	0	1	#	#	#	29.9	1020.1	30.0	29.4
	15:00	+04 35 56.0 N 74 40.3 W HAZE	3	150	5	0	0	180	2	2	28.8	1020.0	28.9	28.9
	16:00	+04 35 49.0 N 74 31.8 W HAZE	3	140	4	0	0	180	2	2	28.8	1020.0	28.9	27.8
	17:00	+04 35 32.8 N 74 10.0 W HAZE	3	160	4	0	0	180	2	2	28.8	1020.0	28.9	27.8
	18:00	+04 35 32.8 N 74 10.0 W HAZE	8	260	4	0	0	180	2	2	28.8	1020.0	28.9	27.8
	19:00	+04 35 24.0 N 73 58.2 W HAZE	8	226	7	#	#	200	2	2	28.8	1020.0	28.9	27.8
	20:00	+04 35 24.0 N 73 58.2 W HAZE	8	226	7	#	#	200	2	2	28.8	1020.0	29.4	29.2
	21:00	+04 35 26.8 N 73 55.6 W HAZE	8	260	10	#	#	200	2	2	28.8	1020.0	30.0	30.0
	22:00	+04 35 27.8 N 73 53.2 W HAZE	8	250	9	#	#	200	1	2	30.6	1020.0	29.4	29.4
	23:00	+04 35 29.7 N 73 52.0 W HAZE	8	235	9	#	#	200	2	2	30.6	1020.1	29.4	29.4
	N	24 24 24	24	24	24	16	16	18	18	18	24	24	24	24

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (MT)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE HEIGHT (FEET) (TRUE)	SWELL DIR. (TRUE)	SWELL HEIGHT (FEET) (TRUE)	SEA STATE	WET TEMP (C)	DRY TEMP (C)	BAROM. (HPA)	TEMP (C)
17-JUL-88	1:00	+04	35 24.1 N	73 50.6 W	HAZE	.5	210	10	3	3	3	#	30.6	28.3	1020.0	27.3
	+04	+04			HAZE	6	210	16	3	4	4	#	31.2	28.3	1020.2	27.7
	2:00	+04			HAZE	6	230	20	4	5	5	#	31.2	28.3	1020.0	27.7
3:00	+04	35 30.6 N	74 07.5 W	HAZE	8	230	21	4	5	5	5	#	31.2	28.3	1020.1	27.7
4:00	+04	35 38.5 N	74 15.3 W	HAZE	8	220	20	5	5	5	5	#	28.3	28.4	1019.0	25.0
5:00	+04	+04			HAZE	8	210	20	5	5	5	#	28.3	28.4	1019.8	27.8
6:00	+04	35 56.4 N	74 34.0 W	HAZE	8	210	18	5	5	5	5	#	28.3	28.3	1019.5	27.8
7:00	+04	+04			HAZE	8	220	17	5	5	5	#	28.3	28.3	1019.0	26.7
8:00	+04	35 56.9 N	74 48.0 W	HAZE	8	195	18	4	5	5	5	#	28.3	28.3	1019.0	27.2
9:00	+04	35 55.2 N	74 40.3 W	HAZE	6	220	15	3	3	3	3	#	27.8	27.8	1019.0	27.2
10:00	+04	35 55.2 N	74 40.3 W	HAZE	6	200	17	3	3	3	3	#	27.8	27.8	1019.2	26.7
11:00	+04	35 54.9 N	74 39.6 W	HAZE	6	208	18	3	3	3	3	#	27.8	27.8	1019.5	26.7
12:00	+04	35 55.0 N	74 40.2 W	HAZE	6	210	18	3	3	3	3	#	27.8	27.8	1019.6	26.7
13:00	+04	+04			HAZE	6	215	17	3	3	3	#	28.8	28.8	1020.0	26.7
14:00	+04				HAZE	6	210	16	3	3	3	#	28.8	28.8	1020.0	26.7
15:00	+04	35 54.1 N	74 38.2 W	HAZE	6	210	22	3	5	5	5	#	28.8	28.8	1020.0	27.8
16:00	+04	35 53.0 N	74 41.5 W	HAZE	4	210	23	5	5	5	5	#	27.8	27.8	1019.8	27.3
17:00	+04	+04			HAZE	4	220	19	5	5	5	#	27.8	27.8	1019.5	27.2
18:00	+04	35 51.5 N	74 45.0 W	HAZE	4	210	20	5	5	5	5	#	27.8	27.8	1019.0	27.8
19:00	+04	+04			HAZE	4	200	21	5	5	5	#	27.8	27.8	1018.8	27.2
20:00	+04	35 50.8 N	74 45.3 W	HAZE	6	200	18	5	5	5	5	#	27.8	27.8	1018.5	27.2
21:00	+04	35 51.6 N	74 46.0 W	HAZE	6	200	20	5	5	5	5	#	27.8	27.8	1017.5	27.7
22:00	+04	35 52.6 N	74 45.8 W	HAZE	8	195	22	5	5	5	5	#	27.8	27.8	1016.8	27.2
23:00	+04	35 52.5 N	74 44.0 W	HAZE	8	200	24	5	5	5	5	#	27.8	27.8	1016.2	27.7
N	24	24	24	24		24	24	24	24	24	24	7	24	24	24	24

4

= MISSING DATUM

NOAA SHIP MT. MITCHELL DECK LOG DATA
1968 GLOBAL CHANGE CRUISE

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN (FEET)	WAVE MAX (FEET)	SWELL MAX (FEET)	SWELL DIR. (TRUE)	SWELL HEIGHT (FEET)	SEA SWELL (FEET)	MAX GUST (FEET)	TEMP (C)	TEMP (F)	DRY TEMP (C)	DRY TEMP (F)	WET TEMP (C)	WET TEMP (F)
18-JUL-68	00:00	+04	35 48.0 N	74 28.3 W	HAZE	6	200	24	5	6	6	#	#	0	21.7	1016.8	27.6	27.3	26.8	27.3	
	1:00	+04	35 48.0 N	74 28.3 W	HAZE	6	210	22	5	6	6	#	#	0	31.2	1017.2	27.4	27.3	27.6	27.3	
	2:00	+04	35 48.0 N	74 28.3 W	HAZE	8	210	24	5	6	6	#	#	0	31.2	1017.8	27.6	27.3	27.6	27.3	
	3:00	+04	35 48.0 N	74 28.3 W	HAZE	8	210	24	5	6	6	#	#	0	31.2	1018.4	27.0	26.5	26.7	26.7	
	4:00	+04	35 48.0 N	74 28.3 W	HAZE	8	200	23	6	6	6	#	#	0	28.3	1018.2	27.2	26.7	26.7	26.7	
	5:00	+04	35 48.0 N	74 28.3 W	HAZE	8	200	25	6	6	6	#	#	0	28.3	1018.2	27.2	26.7	26.7	26.7	
	6:00	+04	35 46.9 N	74 30.0 W	HAZE	8	200	25	6	6	6	#	#	0	28.3	1018.5	27.2	26.7	26.7	26.7	
	7:00	+04	35 46.9 N	74 30.0 W	HAZE	8	210	27	7	7	7	#	#	0	28.3	1017.8	27.2	26.7	26.7	26.7	
	8:00	+04	35 46.9 N	74 29.0 W	CLEAR	10	210	24	7	7	7	#	#	0	28.3	1018.0	26.2	25.5	25.5	25.5	
	9:00	+04	35 48.0 N	74 28.3 W	CLEAR	10	210	25	7	7	7	#	#	0	28.7	1018.0	26.7	25.5	25.5	25.5	
	10:00	+04	35 48.8 N	74 29.2 W	PTLY CLOUD	10	216	26	5	7	7	#	#	0	28.7	1018.0	26.7	25.5	25.5	25.5	
	11:00	+04	35 50.2 N	74 34.2 W	HAZE	10	205	23	5	7	7	#	#	0	28.7	1018.2	26.7	26.7	26.7	26.7	
	12:00	+04	35 55.6 N	74 39.6 W	HAZE	4	205	24	5	7	7	#	#	0	27.8	1019.0	26.7	25.5	25.5	25.5	
	13:00	+04	35 55.6 N	74 39.6 W	HAZE	4	210	26	5	7	7	#	#	0	27.8	1019.2	26.0	25.6	25.6	25.6	
	14:00	+04	35 53.6 N	74 43.9 W	HAZE	4	205	22	5	7	7	#	#	0	27.8	1019.8	26.7	25.7	25.7	25.7	
	15:00	+04	35 53.3 N	74 42.0 W	HAZE	4	205	20	4	6	6	#	#	0	27.8	1019.0	26.7	26.5	26.5	26.5	
	16:00	+04	35 53.6 N	74 43.9 W	HAZE	4	210	23	6	7	7	#	#	0	27.2	1019.2	27.2	26.4	26.4	26.4	
	17:00	+04	35 55.0 N	74 47.0 W	HAZE	4	200	20	6	6	6	#	#	0	27.2	1019.2	27.8	26.7	26.7	26.7	
	18:00	+04	35 55.0 N	74 47.0 W	HAZE	4	200	19	6	6	6	#	#	0	27.2	1019.2	26.3	26.7	26.7	26.7	
	19:00	+04	35 56.3 N	74 51.2 W	HAZE	8	200	20	6	6	6	#	#	0	27.2	1019.2	27.8	26.7	26.7	26.7	
	20:00	+04	35 57.0 N	74 46.0 W	HAZE	8	195	20	5	6	6	#	#	0	27.2	1017.8	27.7	26.7	26.7	26.7	
	21:00	+04	35 57.2 N	74 50.0 W	HAZE	8	195	18	5	6	6	#	#	0	27.2	1017.2	27.7	26.7	26.7	26.7	
	22:00	+04	35 57.7 N	74 57.0 W	HAZE	8	200	21	5	6	6	#	#	0	27.2	1016.8	27.7	26.7	26.7	26.7	
	23:00	+04	35 57.0 N	74 46.0 W	HAZE	8	195	20	5	6	6	#	#	0	27.2	1017.0	27.7	26.7	26.7	26.7	
	N		24	24		24	24	24	24	24	24	24	24	0	24	24	24	24	24	24	

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP M/T MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (NM)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN (FEET)	WAVE MAX (FEET)	HEIGHT MIN (FEET)	HEIGHT MAX (FEET)	SWELL DIR. (TRUE)	SWELL HEIGHT (FEET)	SEA STATE	TEMP (C)	BAROM. (HPA)	DRY TEMP (C)	WET TEMP (C)
19-JUL-88	00:00	+04	35 56.8 N	74 42.0 W	HAZE	6	205	22	5	5	#	#	#	#	27.7	1019.7	27.0	26.0	
	1:00	+04			HAZE	6	200	18	4	4	#	#	#	#	27.7	1019.2	27.2	26.1	
	2:00	+04			HAZE	9	210	20	4	4	#	#	#	#	27.7	1020.0	26.4	25.7	
	3:00	+04	35 59.0 N	74 35.5 W	PTLY CLDY	10	200	16	4	4	0	0	0	0	27.7	1020.0	26.5	25.7	
	4:00	+04			PTLY CLDY	10	210	17	4	4	0	0	0	0	27.7	1020.0	26.7	26.1	
	5:00	+04			PTLY CLDY	10	210	17	4	4	0	0	0	0	27.8	1020.2	26.7	26.1	
	6:00	+04	35 48.5 N	74 38.0 W	PTLY CLDY	10	210	18	4	4	0	0	0	0	27.8	1020.0	26.7	26.1	
	7:00	+04			PTLY CLDY	10	200	18	4	4	0	0	0	0	27.8	1020.0	26.7	26.1	
	8:00	+04	35 50.0 N	74 31.8 W	CLEAR	10	217	18	4	4	0	0	0	0	27.8	1020.0	26.7	26.2	
	9:00	+04			CLEAR	10	215	19	4	4	0	0	0	0	27.8	1020.0	25.5	24.5	
	10:00	+04	35 50.0 N	74 33.0 W	CLEAR	10	215	20	3	3	0	0	0	0	27.8	1020.0	25.5	24.5	
	11:00	+04	35 51.3 N	74 34.3 W	PTLY CLDY	10	220	16	3	3	0	0	0	0	27.8	1021.0	26.7	26.2	
	12:00	+04	35 52.6 N	74 37.0 W	PTLY CLDY	10	210	16	3	3	0	0	0	0	27.8	1021.0	26.7	26.2	
	13:00	+04			PTLY CLDY	10	210	18	3	3	0	0	0	0	27.8	1021.0	26.7	25.3	
	14:00	+04			CLEAR	10	215	20	3	3	0	0	0	0	27.8	1021.0	26.7	25.3	
	15:00	+04	35 54.7 N	74 40.7 W	CLEAR	10	220	20	3	3	0	0	0	0	27.8	1021.3	26.8	26.1	
	16:00	+04	35 53.9 N	74 39.7 W	PTLY CLDY	10	200	17	4	4	0	0	0	0	27.8	1021.0	26.7	26.1	
	17:00	+04			PTLY CLDY	10	200	16	4	4	0	0	0	0	27.8	1021.0	26.7	26.1	
	18:00	+04	35 54.0 N	74 39.0 W	PTLY CLDY	10	210	18	4	4	0	0	0	0	27.8	1021.0	27.2	26.1	
	19:00	+04			PTLY CLDY	10	200	20	4	4	0	0	0	0	27.8	1021.0	27.0	26.7	
	20:00	+04	35 55.0 N	74 37.0 W	PTLY CLDY	10	195	19	4	4	0	0	0	0	27.8	1020.8	28.4	26.7	
	21:00	+04	35 55.0 N	74 36.2 W	PTLY CLDY	10	200	20	4	4	0	0	0	0	27.8	1020.2	28.4	26.7	
	22:00	+04	35 54.6 N	74 35.1 W	CLEAR	10	200	20	4	4	0	0	0	0	27.8	1020.5	28.4	26.7	
	23:00	+04	35 55.7 N	74 32.0 W	CLEAR	10	197	20	4	4	0	0	0	0	27.8	1020.5	28.4	26.7	
	N	24	24	24		24	24	24	0	0	0	0	0	0	24	24	24	24	

or
or

= MISSING DATA

1980 GLOBAL CHANGE CRUISE
NOAA SHIP: MT. MITCHELL DECK LOG DATA.

DATE:	TIME:	ZONE:	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE HEIGHT (FEET)	WAVE MAX. (FEET)	SWELL DIR. (TRUE)	SWELL MIN. (FEET)	SWELL MAX. (FEET)	SEA HEIGHT (FEET)	SEAS MAX. (FEET)	DRY TEMP. (C.)	WET TEMP. (C.)
20-JUL-80	00:00	+04	35 54.2 N	74 33.0 W	CLEAR	10	200	24	4	4	#	#	#	27.8	1020.9	27.4	26.4
	1:00	+04	35 54.2 N	74 33.0 W	CLEAR	10	200	20	4	5	#	#	#	27.8	1021.0	27.4	26.4
	2:00	+04	35 54.2 N	74 33.0 W	CLEAR	10	200	21	4	5	#	#	#	27.8	1022.5	27.9	26.3
	3:00	+04	35 55.4 N	74 31.0 W	CLEAR	10	200	20	4	4	#	#	#	27.8	1022.0	26.3	25.6
	4:00	+04	35 56.1 N	74 31.0 W	CLEAR	10	210	20	4	4	#	#	#	27.8	1022.0	26.7	26.1
	5:00	+04	35 56.1 N	74 31.0 W	CLEAR	10	210	19	4	4	#	#	#	27.8	1022.0	26.7	26.1
	6:00	+04	35 58.0 N	74 31.5 W	CLEAR	10	200	18	4	4	#	#	#	27.8	1021.8	26.7	26.1
	7:00	+04	35 58.0 N	74 31.5 W	CLEAR	10	200	17	4	4	#	#	#	27.8	1021.2	26.7	26.1
	8:00	+04	35 57.6 N	74 27.5 W	CLEAR	10	220	14	4	4	#	#	#	27.8	1021.8	25.6	24.4
	9:00	+04	35 59.0 N	74 28.6 W	PFTY CLDY	10	215	12	4	4	#	#	#	27.8	1022.0	25.5	24.4
	10:00	+04	35 58.4 N	74 27.7 W	PFTY CLDY	10	210	15	4	4	#	#	#	27.8	1022.2	26.2	25.6
	11:00	+04	35 59.9 N	74 26.7 W	PFTY CLDY	10	220	16	3	5	#	#	#	27.8	1022.2	26.2	25.6
	12:00	+04	35 59.9 N	74 26.7 W	PFTY CLDY	10	220	20	3	3	#	#	#	27.8	1022.0	26.3	25.7
	13:00	+04	36 01.0 N	74 24.3 W	CLEAR	10	225	20	3	3	#	#	#	27.8	1023.5	26.3	25.8
	14:00	+04	36 01.0 N	74 24.3 W	CLEAR	10	220	20	3	3	#	#	#	27.8	1023.8	26.8	25.8
	15:00	+04	36 02.5 N	74 21.0 W	PFTY CLDY	10	210	18	3	3	#	#	#	28.4	1024.2	27.4	26.3
	16:00	+04	36 02.5 N	74 21.0 W	PFTY CLDY	10	220	17	4	4	#	#	#	27.8	1024.0	27.2	26.1
	17:00	+04	36 03.1 N	74 21.6 W	PFTY CLDY	10	230	15	4	4	#	#	#	27.8	1024.0	27.8	26.7
	18:00	+04	36 02.5 N	74 20.9 W	PFTY CLDY	10	210	19	4	4	#	#	#	27.8	1023.5	27.8	26.7
	19:00	+04	36 03.1 N	74 20.5 W	PFTY CLDY	10	200	15	3	5	#	#	#	27.8	1023.2	27.8	26.3
	20:00	+04	36 03.1 N	74 20.5 W	PFTY CLDY	10	200	20	3	5	#	#	#	27.8	1022.5	27.8	26.3
	21:00	+04	36 03.1 N	74 20.5 W	PFTY CLDY	10	200	19	3	5	#	#	#	27.8	1022.2	27.8	26.7
	22:00	+04	36 04.2 N	74 20.5 W	PFTY CLDY	10	198	17	3	5	#	#	#	27.8	1022.0	27.8	26.7
	23:00	+04	36 04.2 N	74 20.5 W	PFTY CLDY	10	205	16	3	5	#	#	#	27.8	1022.0	27.8	26.7
	24	24	24	24	24	24	24	24	24	24	0	0	0	24	24	24	24

= MISSING DATA

1988 GLOBAL CHANGE CRUISE
NOAA SHIP R/V MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESNT WEATHER	VIS. (ME)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN (FEET)	WAVE MAX (FEET)	WAVE HEIGHT (FEET)	SWELL DIR. (TRUE)	SWELL MIN (FEET)	SWELL MAX (FEET)	SEA TEMP (C)	DRY TEMP (C)	WET TEMP (C)
21-JUL-88	0:00	+04	36 05.8 N	74 14.0 W	FRTY CLDY	10	200	16	4	4	#	#	#	27.2	1022.4	27.4	26.4
	1:00	+04			CLEAR	10	210	18	3	3	#	#	#	27.2	1023.1	27.4	26.2
	2:00	+04			CLEAR	10	205	16	3	3	#	#	#	27.2	1023.2	26.4	25.6
	3:00	+04	36 08.1 N	74 16.8 W	CLEAR	10	210	20	3	3	#	#	#	27.2	1023.5	26.4	25.8
	4:00	+04	36 08.3 N	74 14.7 W	FRTY CLDY	10	200	15	4	4	#	0	0	27.8	1023.0	26.7	26.1
	5:00	+04			FRTY CLDY	10	200	14	4	4	#	0	0	27.8	1022.8	26.7	26.1
	6:00	+04	36 09.0 N	74 12.0 W	FRTY CLDY	10	200	16	4	4	#	0	0	27.8	1022.2	26.7	26.1
	7:00	+04			FRTY CLDY	10	200	18	4	4	#	0	0	27.8	1022.0	26.7	26.1
	8:00	+04			FRTY CLDY	10	210	16	4	4	#	0	0	27.8	1022.0	26.7	25.6
	9:00	+04	36 12.0 N	74 13.7 W	FRTY CLDY	10	215	18	4	4	#	#	#	27.8	1022.0	26.2	25.6
	10:00	+04	36 11.5 N	74 13.0 W	FRTY CLDY	10	195	15	3	5	#	#	#	27.8	1022.0	26.7	26.1
	11:00	+04			FRTY CLDY	10	205	12	3	5	#	#	#	27.8	1022.0	26.7	26.2
	12:00	+04	36 12.4 N	74 11.6 W	HAZE	8	200	16	3	3	#	#	#	27.8	1022.6	26.2	25.6
	13:00	+04			RAIN-LTNG	8	200	12	3	3	#	#	#	27.8	1022.6	26.2	25.6
	14:00	+04			RAIN-LTNG	6	190	16	3	3	#	#	#	27.8	1022.5	26.8	25.8
	15:00	+04	36 14.8 N	74 08.9 W	DRZL-LTNG	10	190	9	3	3	#	#	#	27.8	1022.4	25.8	25.0
	16:00	+04	36 16.0 N	74 08.1 W	CLDGY	10	180	9	3	3	#	0	0	27.8	1022.2	26.7	25.6
	17:00	+04			CLDGY	8	190	14	3	3	#	0	0	28.3	1022.0	27.2	26.1
	18:00	+04			CLDGY	10	190	14	4	4	#	0	0	28.3	1021.2	27.8	26.7
	19:00	+04	36 16.8 N	74 06.3 W	CLDGY	10	190	14	4	4	#	0	0	28.8	1021.0	27.8	26.7
	20:00	+04			CLDGY	10	200	20	3	4	#	0	0	28.8	1020.5	27.8	26.7
	21:00	+04	36 17.3 N	74 10.9 W	CLDGY	10	190	20	3	4	#	#	#	28.8	1020.2	27.3	26.7
	22:00	+04	36 16.0 N	74 08.2 W	CLDGY	10	198	20	3	5	#	#	#	28.8	1019.9	27.6	26.7
	23:00	+04			CLDGY	10	200	22	3	5	#	#	#	28.8	1019.0	27.8	26.7
N	24	24				24	24	24	24	24	0	0	0	24	24	24	24

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= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (M)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN (FOOT)	WAVE MAX (FOOT)	HEIGHT (FEET)	SWELL DIR. (TRUE)	SWELL MAX (FEET)	SEA STATE	BAROM. (HPA)	DRY TEMP (C)	WET TEMP (C)
22-JUL-88	00:00	+04	36 08 N	73 39.0 W	CLOUDY	10	190	22	5	5	4	#	#	28.8	1020.0	27.8	26.9
	1:00	+04	36 08 N	73 39.0 W	CLOUDY	9	180	25	6	6	4	#	#	30.0	1020.2	26.7	25.7
	2:00	+04	36 08 N	73 39.0 W	RAIN-LTDG	8	180	30	6	6	4	#	#	30.0	1020.0	26.7	25.7
	3:00	+04	35 54.4 N	72 57.5 W		10	190	26	6	6	4	#	#	30.0	1021.1	26.7	25.7
	4:00	+04	35 54.4 N	72 57.5 W		10	180	25	6	6	4	#	#	30.0	1021.0	26.7	25.6
	5:00	+04	35 45.5 N	72 30.0 W		8	190	23	6	6	4	#	#	30.0	1020.8	26.1	25.0
	6:00	+04	35 33.4 N	72 12.8 W	PRTLY	10	190	22	6	6	4	#	#	30.0	1021.0	26.1	25.0
	7:00	+04	35 27.4 N	72 00.1 W	PRTLY	10	175	18	5	7	4	#	#	27.8	1022.5	25.6	25.4
	8:00	+04	35 20.4 N	71 48.3 W	PRTLY	10	180	17	4	6	4	#	#	27.6	1022.8	25.6	25.4
	9:00	+04	35 12.0 N	71 24.1 W	HAZE	8	180	16	5	5	4	#	#	27.8	1022.9	25.6	25.4
	10:00	+04	34 51.4 N	70 23.6 W	HAZE	8	170	16	5	5	4	#	#	27.8	1023.0	25.7	25.6
	11:00	+04	34 46.0 N	70 05.9 W	HAZE	8	170	17	5	5	4	#	#	27.8	1023.4	25.0	25.0
	12:00	+04	34 29.0 N	69 33.5 W	PRTLY	10	190	16	4	6	4	#	#	28.3	1023.3	25.6	25.6
	13:00	+04	34 24.5 N	69 19.0 W	PRTLY	10	160	13	4	4	4	#	#	27.8	1024.0	25.7	24.6
	14:00	+04	34 20.0 N	69 05.8 W	PRTLY	10	165	13	4	4	4	#	#	27.8	1024.2	26.1	24.4
	15:00	+04	34 16.0 N	69 12.0 W	PRTLY	10	170	17	5	5	5	#	#	27.8	1024.2	26.1	25.0
	16:00	+04	34 12.0 N	69 08.0 W	HAZE	8	180	15	5	5	4	#	#	27.8	1024.2	26.1	25.0
	17:00	+04	34 08.0 N	69 04.0 W	HAZE	8	170	16	5	5	4	#	#	27.8	1024.2	26.1	25.0
	18:00	+04	34 04.0 N	68 59.0 W	HAZE	8	180	17	5	5	4	#	#	27.8	1024.0	26.1	25.0
	19:00	+04	34 00.0 N	68 55.0 W	HAZE	8	170	15	5	5	4	#	#	27.8	1024.2	26.1	25.0
	20:00	+04	33 56.0 N	68 51.5 W	PRTLY	10	170	14	5	5	4	#	#	27.8	1024.2	26.1	25.0
	21:00	+04	33 54.0 N	68 49.0 W	PRTLY	10	160	13	4	4	4	#	#	27.8	1024.2	26.7	25.6
	22:00	+04	33 54.0 N	68 47.0 W	PRTLY	10	165	13	4	4	4	#	#	27.8	1024.4	26.7	25.6
	23:00	+04	33 54.0 N	68 45.0 W	PRTLY	10	170	12	3	3	3	#	#	27.8	1024.9	26.7	25.6
	N	24	24	24		24	24	24	24	24	24	4	4	4	24	24	24

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MICHIGAN DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS: (MI.)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE (FEET)	WAVE MIN (FEET)	WAVE MAX (FEET)	HEIGHT (TRUE)	SWELL DTR.	SWELL MIN (FEET)	SWELL MAX (FEET)	SEA TEMP (C)	DRY TEMP (C)	WET TEMP (C)
23-JUL-88	00:00	+04	34 19.4 N	69 09.9 W	PTLY CLDY	10	160	12	3	3	3	#	#	#	27.8	1025.0	25.7	24.7
	1:00	+04			CLODY	10	160	16	3	3	3	#	#	#	27.8	1026.0	25.6	24.7
	2:00	+04			CLODY	10	170	14	3	3	3	#	#	#	27.8	1026.2	25.6	24.7
	3:00	+04			CLODY	10	170	14	3	3	3	#	#	#	27.8	1026.5	25.2	24.5
	4:00	+04	34 15.3 N	68 53.8 W	PTLY CLDY	10	160	13	3	3	3	#	0	0	27.8	1025.8	26.1	25.0
	5:00	+04			PTLY	10	160	15	3	3	3	#	0	0	27.2	1025.8	26.1	25.0
	6:00	+04	34 15.0 N	68 50.8 W		10	160	14	3	3	3	#	0	0	27.2	1025.8	26.1	25.0
	7:00	+04			PTLY	10	160	12	3	3	3	#	0	0	27.2	1025.2	26.1	25.0
	8:00	+04			PTLY	10	165	12	3	3	3	#	0	0	27.2	1025.0	25.8	25.0
	9:00	+04	34 14.6 N	68 45.4 W	PTLY CLDY	10	162	12	3	3	3	#	0	0	27.2	1025.0	25.8	25.0
	10:00	+04	34 14.8 N	68 45.2 W	PTLY CLDY	10	165	12	3	3	3	#	0	0	27.2	1025.2	25.9	25.0
	11:00	+04			PTLY CLDY	10	165	11	2	3	3	#	3	3	27.2	1025.5	25.8	25.0
	12:00	+04	34 15.4 N	68 41.0 W	CLEAR	10	160	12	3	3	3	#	#	#	27.2	1025.0	25.8	25.0
	13:00	+04			CLEAR	10	160	12	3	3	3	#	#	#	27.2	1025.2	25.9	25.0
	14:00	+04			CLEAR	10	155	12	3	3	3	#	#	#	27.2	1025.3	25.7	24.5
	15:00	+04			CLEAR	10	150	12	3	3	3	#	#	#	27.2	1026.4	25.9	25.0
	16:00	+04	34 18.8 N	68 35.1 W	PTLY CLDY	10	170	13	3	3	3	#	0	0	27.2	1026.3	25.7	24.5
	17:00	+04			PTLY CLDY	10	170	13	3	3	3	#	0	0	27.2	1025.7	26.1	25.0
	18:00	+04	34 10.0 N	68 15.0 W	PTLY CLDY	10	170	13	3	3	3	#	0	0	27.2	1025.2	26.7	25.0
	19:00	+04			PTLY CLDY	10	170	14	3	3	3	#	0	0	27.2	1025.2	26.7	25.0
	20:00	+04	33 58.0 N	67 44.5 W	PTLY CLDY	10	160	12	3	3	3	#	0	0	27.2	1025.2	26.7	25.0
	21:00	+04	33 54.0 N	67 29.9 W	PTLY CLDY	10	165	12	3	3	3	#	0	0	27.2	1025.0	26.7	25.0
	22:00	+04	33 49.6 N	67 16.5 W	PTLY CLDY	10	150	13	3	3	3	#	0	0	28.4	1025.0	26.7	25.0
	23:00	+04			PTLY CLDY	10	140	13	3	3	3	#	0	0	28.4	1025.0	26.7	25.0
	N												13	13	24	24	24	24

B10

= MISSING DATA

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	TIME ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE HEIGHT .MIN (FEET)	WAVE HEIGHT .MAX (FEET)	SWELL DIR. (TRUE)	SWELL .MIN (FEET)	SWELL .MAX (FEET)	SEA HEIGHT	BAROM. (HPA)	DRY TEMP (°F)	WET TEMP (°C)
24-JUL-88	0 1:00 2:00	+04 +04 +04	33 38.5 N	66 49.1 W	CLEAR CLEAR	10 10 10	130 120 140	14 14 12	3 3 3	3 3 3	# # #	# # #	28.4 28.4 28.4	1026.7 1026.5 1026.5	25.9 25.8 25.8	24.9 24.7 24.7	
	3:00 4:00 5:00	+04 +04 +04	33 25.4 N	66 51.4 W	CLEAR PTLY CLDY	10 10 10	140 140 140	12 12 12	3 3 3	3 3 3	# # #	# # #	28.4 28.3 27.8	1026.9 1026.2 1026.2	25.7 25.1 26.1	24.6 25.0 25.0	
	6:00 7:00 8:00	+04 +04 +04	33 12.0 N	65 24.6 W	CLDY CLDY CLDY	10 10 10	130 130 135	12 12 9	3 3 3	3 3 3	# # #	# # #	27.8 27.8 27.8	1026.0 1025.8 1025.2	26.1 25.6 25.6	24.4 24.4 24.4	
	9:00 10:00 11:00	+04 +04 +04	32 56.9 N	64 41.8 W	CLDY CLDY PTLY CEDY	10 10 10	130 135 120	8 9 12	3 2 2	3 2 2	# # #	# # #	27.8 27.8 27.8	1025.5 1026.8 1026.0	25.6 25.6 25.6	24.4 24.4 24.4	
	12:00 13:00 14:00	+04 +04 +04	32 25.0 N	64 16.5 W	PTLY CLDY CLDY	10 10 10	120 110 120	16 16 16	2 2 2	195 140 145	2 2 2	2 2 2	27.8 27.5 28.3	1026.2 1026.0 1026.4	25.7 25.3 26.2	24.5 24.5 25.0	
	15:00 16:00 17:00	+04 +04 +04	32 00.0 N	64 00.0 W	CLDY PTLY CLDY	10 10 10	120 140 140	14 15 15	1 3 3	1 3 3	145 140 145	2 0 2	2 0 2	28.3 28.3 28.3	1026.4 1025.2 1026.2	26.3 26.3 27.8	24.5 24.5 26.1
	18:00 19:00 20:00	+04 +04 +04	31 54.0 N	63 57.6 W	PTLY CLDY PTLY CLDY PTLY CLDY	10 10 10	140 140 150	15 15 9	3 3 2	3 3 2	# # #	0 0 #	28.3 28.3 28.3	1026.0 1026.0 1025.6	26.4 26.4 28.4	24.4 24.4 27.0	
	21:00 22:00 23:00	+04 +04 +04	31 59.2 N	63 54.1 W	PTLY CLDY PTLY CLDY PTLY CLDY	10 10 10	150 140 145	9 10 10	2 2 2	2 2 2	# # #	# # #	28.3 28.3 28.3	1025.2 1025.2 1025.2	26.4 26.6 27.3	24.4 26.6 26.1	
	N		24	24		24		24	3	3			14	14	24	24	24

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESNT WEATHER	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE HTN (FEET)	WTHT MAX (FEET)	SWELL DIR (TRUE)	SWELL HTN (FEET)	SEA TEMP (C)	DRY TEMP (C)	WET TEMP (C)
		GMT											BAROM. (HPA)		
25-JUL-88	00:00	+04	32 00.0 N	63 53.9 W	PTLY CLDY	1.0	150	12	2	2	2	2	26.8	25.7	
	1:00	+04	32 00.0 N	63 52.1 W	PTLY CLOUDY	1.0	140	10	2	2	2	2	28.3 1021.2	25.8	25.9
	2:00	+04			CLOUDY	1.0	145	10	2	2	2	2	28.3 1026.6	25.7	24.6
	3:00	+04			CLOUDY	1.0	150	10	2	2	2	2	28.3 1026.5	25.6	24.5
	4:00	+04	32 00.0 N	63 53.5 W	PTLY CLDY	1.0	130	12	2	2	2	2	28.3 1026.0	26.1	25.0
	5:00	+04			CLDY	1.0	140	12	2	2	2	2	28.3 1026.0	26.1	25.0
	6:00	+04	31 58.9 N	63 53.5 W	PTLY CLDY	1.0	140	10	2	2	2	2	28.3 1025.8	26.1	24.4
	7:00	+04			CLDY	1.0	140	11	2	2	2	2	28.3 1025.0	25.1	24.4
	8:00	+04	31 59.8 N	63 53.1 W	PTLY CLDY	1.0	135	10	2	2	2	2	28.3 1024.9	25.6	
	9:00	+04	32 00.1 N	63 53.4 W	PTLY CLDY	1.0	130	10	2	2	2	2	28.3 1024.0	25.6	24.4
	10:00	+04	32 00.2 N	63 51.5 W	PTLY CLDY	1.0	130	11	2	2	2	2	28.3 1025.0	26.2	25.0
	11:00	+04			CLDY	1.0	150	10	2	2	2	2	28.3 1025.2	26.2	25.0
	12:00	+04	32 01.3 N	63 51.0 W	PTLY CLDY	1.0	140	10	1	2	2	2	28.3 1025.5	25.6	24.4
	13:00	+04			CLDY	1.0	150	10	1	2	2	2	28.3 1025.7	26.2	25.0
	14:00	+04			CLDY	1.0	150	10	1	2	2	2	28.3 1025.8	27.7	26.6
	15:00	+04	32 00.5 N	63 50.3 W	PTLY CLDY	1.0	140	10	1	2	2	2	28.3 1026.0	27.4	26.4
	16:00	+04	32 00.4 N	63 50.0 W	PTLY CLDY	1.0	130	10	2	2	2	2	28.3 1025.8	27.8	26.1
	17:00	+04			CLDY	1.0	130	10	2	2	2	2	28.3 1025.5	27.8	26.1
	18:00	+04	32 01.8 N	63 46.5 W	CLOUDY	1.0	140	10	2	2	2	2	28.3 1025.2	28.4	26.7
	19:00	+04			CLOUDY	1.0	130	10	2	2	2	2	28.3 1025.0	28.4	26.7
	20:00	+04			CLOUDY	1.0	145	10	2	2	2	2	28.3 1024.8	28.4	26.7
	21:00	+04	32 02.1 N	63 44.7 W	CLOUDY	1.0	150	10	2	2	2	2	28.3 1024.3	27.8	26.4
	22:00	+04	32 02.2 N	63 43.9 W	CLOUDY	1.0	135	8	2	2	2	2	28.3 1024.2	27.8	26.7
	23:00	+04			CLOUDY	1.0	140	9	2	2	2	2	28.3 1024.5	27.4	26.2
N	24	24				2.4	2.4	2.4	1	9	9	9	24	24	24

= MISSING DATUM

NOAA SHIP MT. MITCHELL DECK LOG DATA
1980 GLOBAL CHANGE CRUISE

DATE	TIME	GMT	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (M.)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE HEIGHT (FEET)	SWELL DLR. (TRUE)	SWELL DLR. (MIN. (TRUE))	SWELL DLR. (MAX. (FEET))	SEA STATE (EPA)	TEMP. (C)	TEMP. (F)	DRY TEMP. (C)	DRY TEMP. (F)	WET TEMP. (C)	WET TEMP. (F)
26-JUL-80	0	00:04	32 02.2 N	63 45.7 W		CLOUDY	10	150	10	2	#	#	#	28.3	1024.5	27.4	26.4	28.3	1026.2	26.6
	1:00	+04	32 02.1 N	63 45.7 W		CLOUDY	10	140	12	1	#	#	#	28.3	1026.7	26.4	25.5	28.3	1026.7	26.4
	2:00	+04	32 02.1 N	63 45.7 W		RAIN	8	140	12	1	#	#	#	28.3	1026.7	26.4	25.2	28.3	1026.7	26.4
	3:00	+04	32 02.1 N	63 45.7 W		NO REPORT	8	140	12	2	#	#	#	28.3	1026.7	26.4	26.4	28.3	1025.9	25.6
	4:00	+04	32 02.1 N	63 45.7 W		CLOUDY	10	180	10	0	140	0	0	28.3	1025.2	25.1	25.0	28.3	1025.2	25.1
	5:00	+04	32 01.1 N	63 45.5 W		CLOUDY	10	160	11	2	#	#	#	28.3	1025.0	25.0	25.0	28.3	1025.0	25.0
	6:00	+04	32 01.1 N	63 45.5 W		PFTLY CLDY	10	160	10	2	#	#	#	28.3	1025.0	25.0	25.0	28.3	1024.2	25.6
	7:00	+04	32 01.0 N	63 45.5 W		PFTLY CNDY	10	160	11	2	#	#	#	28.3	1024.0	24.5	24.4	28.3	1024.0	24.5
	8:00	+04	32 00.9 N	63 44.9 W		CLOUDY	10	160	11	2	#	#	#	28.3	1024.0	24.5	24.4	28.3	1024.0	24.5
	9:00	+04	32 00.9 N	63 44.9 W		CLOUDY	10	155	7	2	#	#	#	28.3	1024.0	24.5	24.4	28.3	1024.5	25.6
	10:00	+04	32 01.1 N	63 45.2 W		PFTLY CLDY	10	160	7	1	#	#	#	28.3	1024.5	25.6	24.4	28.3	1024.5	25.6
	11:00	+04	32 01.1 N	63 45.2 W		PFTLY CLDY	10	140	8	1	#	#	#	28.3	1024.5	25.6	24.4	28.3	1024.5	25.6
	12:00	+04	32 01.0 N	63 44.2 W		PFTLY CLDY	10	140	8	1	#	#	#	28.3	1025.7	25.7	25.7	28.3	1025.7	25.7
	13:00	+04	32 01.0 N	63 44.2 W		PFTLY CLDY	10	130	8	0	1	1	1	28.3	1025.9	26.4	25.4	28.3	1025.9	26.4
	14:00	+04	32 01.0 N	63 44.2 W		PFTLY CLDY	10	125	8	0	1	1	1	28.3	1025.2	26.7	25.6	28.3	1025.2	26.7
	15:00	+04	31 59.5 N	63 42.7 W		PFTLY CLDY	10	130	8	0	1	1	1	28.3	1025.7	25.7	25.7	28.3	1026.2	27.8
	16:00	+04	31 59.5 N	63 42.7 W		PFTLY CLDY	10	130	7	0	0	0	0	28.3	1026.2	27.8	26.2	28.3	1026.2	27.8
	17:00	+04	31 58.6 N	63 42.5 W		PFTLY CLDY	10	130	7	0	0	0	0	28.3	1026.2	27.8	27.2	28.3	1026.2	27.8
	18:00	+04	31 58.6 N	63 42.5 W		PFTLY CLDY	10	130	5	0	0	0	0	28.3	1026.2	28.9	27.2	28.3	1026.2	28.9
	19:00	+04	31 58.8 N	63 40.3 W		PFTLY CLDY	10	120	5	0	0	0	0	28.3	1025.2	29.4	28.3	28.3	1025.2	29.4
	20:00	+04	31 58.8 N	63 40.3 W		PFTLY CLDY	10	130	3	0	0	0	0	28.3	1025.5	29.4	28.3	28.3	1025.5	29.4
	21:00	+04	31 58.0 N	63 40.3 W		PFTLY CLDY	10	140	5	0	0	0	0	28.3	1025.3	28.9	27.2	28.3	1025.1	28.9
	22:00	+04	31 59.4 N	63 42.3 W		PFTLY CLDY	10	154	6	0	0	0	0	28.3	1025.1	27.2	27.2	28.3	1025.9	27.8
	23:00	+04	31 59.4 N	63 42.3 W		PFTLY CLDY	10	140	3	0	0	0	0	28.3	1025.9	27.8	26.2	28.3	1025.9	27.8
	N													18	24	24	24	18	24	24

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VTS. (MIF)	WIND (TRUE)	DIR.	WIND SPEED (KNOTS)	WAVE HEIGHT MIN (FEET)	WAVE HEIGHT MAX (FEET)	SWELL DIR. (TRUE)	SWELL MAX (FEET) (FETT)	SEA TEMP (C)	SEA TEMP (F)	DRY TEMP (C)	WET TEMP (C)
27-JUL-88	0:00	+04	32 00.5 N	63 47.3 W	PFTLY CLDY	10	110	8	0	0	150	1	1	25.3	1026.2	26.7	26.2
	1:00	+04	31 57.3 N	63 39.2 W	PFTLY CLDY	10	120	2	0	0	150	1	1	24.6	1026.3	26.7	24.5
	2:00	+04	31 58.2 N	63 39.7 W	PFTLY CLDY	10	170	4	0	0	150	1	1	28.9	1027.1	26.7	24.5
	3:00	+04	31 58.2 N	63 39.7 W	PFTLY CLDY	10	130	7	0	0	150	0	0	28.9	1027.1	26.7	24.5
	4:00	+04	31 58.2 N	63 39.7 W	PFTLY CLDY	10	130	7	0	0	160	2	2	28.8	1026.8	26.7	25.0
	5:00	+04	31 58.2 N	63 39.7 W	PFTLY CLDY	10	90	3	0	0	160	2	2	28.9	1026.5	26.1	25.0
	6:00	+04	32 02.0 N	63 45.5 W	RAIN	8	150	8	2	2	#	0	0	28.9	1026.2	25.6	24.4
	7:00	+03	31 57.3 N	63 39.2 W	PFTLY CLDY	10	145	8	2	2	#	#	#	28.9	1025.9	25.6	24.4
	8:00	+03	31 57.3 N	63 39.2 W	PFTLY CLDY	10	142	6	0	0	150	2	2	28.9	1025.9	25.6	24.4
	9:00	+03	31 51.3 N	63 37.4 W	PFTLY CLDY	10	140	4	0	0	150	2	2	28.9	1025.4	25.0	24.0
	10:00	+03	31 51.3 N	63 37.4 W	PFTLY CLDY	10	145	4	0	0	150	2	2	28.4	1026.2	25.6	24.4
	11:00	+03	31 51.3 N	63 37.4 W	PFTLY CLDY	10	140	6	0	0	160	2	2	28.4	1027.0	25.7	24.5
	12:00	+03	31 54.6 N	63 37.4 W	CLOUDY	10	140	6	0	0	130	2	2	28.4	1027.7	25.7	24.5
	13:00	+03	31 54.6 N	63 37.4 W	CLOUDY	10	110	6	0	0	130	2	2	28.4	1027.8	26.3	25.2
	14:00	+03	31 51.9 N	63 36.4 W	CLOUDY	10	190	6	0	0	140	2	2	28.9	1025.0	26.4	25.2
	15:00	+03	31 51.9 N	63 36.4 W	PFTLY CLDY	10	130	5	2	2	#	0	0	28.3	1027.8	28.3	26.7
	16:00	+03	31 48.7 N	63 35.9 W	PFTLY CLDY	10	100	5	2	2	#	0	0	28.9	1027.8	28.3	26.7
	17:00	+03	31 48.7 N	63 35.9 W	PFTLY CLDY	10	50	4	0	0	140	2	2	28.9	1027.8	29.4	27.2
	18:00	+03	31 53.1 N	63 37.6 W	PFTLY CLDY	10	40	4	0	0	140	2	2	28.9	1027.5	29.4	27.8
	19:00	+03	31 48.7 N	63 35.9 W	RAIN	10	60	4	0	0	140	2	2	28.9	1027.5	26.3	26.7
	20:00	+03	31 48.7 N	63 35.9 W	CLOUDY	10	90	5	0	0	130	2	2	28.9	1027.4	27.3	25.7
	21:00	+03	31 47.4 N	63 33.0 W	PFTLY CLDY	10	80	6	0	0	#	#	#	28.9	1027.2	27.8	25.7
	22:00	+03	31 47.4 N	63 33.0 W	PFTLY CLDY	10	90	9	0	0	140	2	2	28.9	1027.0	27.8	25.7
	23:00	+03	31 47.4 N	63 33.0 W	PFTLY CLDY	10	90	10	0	1	140	2	2	28.9	1027.2	27.6	25.8
N	24	24	24	24		24	24	24	24	17	17	18	21	21	24	24	24

14

= MISSING DATUM

NOAA SHIP MV. MITCHELL DECK LOG DATA.

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (M)	DUR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN. (FEET)	WAVE MAX. (FEET)	SWELL DIR. (TRUE)	SWELL MIN. (FEET)	SWELL MAX. (FEET)	SEAS (FEET)	TEMP. (RAY.)	TEMP. (C)	DRY TEMP. (C)	WET TEMP. (C)
28-JULY-88	0:00	+03	31 51.0 N	63 37.4 W	PTRY CLDY	10	80	10	0	1	140	2	2	28.5	1027.2	26.6	25.0	
	1:00	+03			PTRY CLDY	10	130	10	0	1	140	1	1	28.5	1028.0	26.6	25.2	
	2:00	+03			PTRY CLDY	10	140	10	0	0	140	1	1	28.4	1028.0	26.6	25.2	
	3:00	+03	31 48.2 N	63 37.2 W	PTRY CLDY	10	120	10	2	2	#	0	0	28.3	1027.8	26.7	25.6	
	4:00	+03			PTRY CLDY	10	130	10	2	2	#	0	0	28.9	1027.5	26.7	25.6	
	5:00	+03			PTRY CLDY	10	130	10	2	2	#	0	0	28.9	1027.5	26.7	25.6	
	6:00	+03	31 50.5 N	63 40.7 W	PTRY CLDY	10	120	11	2	2	#	0	0	28.9	1027.0	26.7	25.6	
	7:00	+03	31 50.7 N	63 40.7 W	PTRY CLDY	10	120	10	2	2	#	0	0	28.9	1026.9	26.4	24.7	
	8:00	+03			PTRY CLDY	10	130	9	#	4	#	#	#	28.9	1026.7	26.4	24.7	
	9:00	+03	31 49.2 N	63 39.1 W	PTRY CLDY	10	130	9	#	1	#	#	#	28.9	1026.7	25.6	24.4	
	10:00	+03			PTRY CLDY	10	130	10	1	1	#	#	#	28.9	1027.4	25.6	24.4	
	11:00	+03			PTRY CLDY	10	130	10	1	1	#	#	#	28.9	1028.0	25.7	24.5	
	12:00	+03	31 45.2 N	63 39.2 W	PTRY CLDY	10	120	12	1	1	1	1	1	28.8	1028.0	25.7	24.4	
	13:00	+03			PTRY CLDY	10	120	10	1	1	1	1	1	28.8	1028.0	25.8	25.2	
	14:00	+03			PTRY CLDY	10	130	9	1	1	1	1	1	28.8	1028.2	25.7	24.5	
	15:00	+03	31 45.8 N	63 38.4 W	PTRY CLDY	10	130	9	2	2	2	0	0	28.9	1028.0	27.8	26.1	
	16:00	+03			PTRY CLDY	10	120	8	2	2	2	0	0	28.9	1028.0	28.3	26.7	
	17:00	+03			PTRY CLDY	10	130	9	2	2	2	0	0	28.9	1028.0	29.4	27.8	
	18:00	+03	31 47.7 N	63 41.5 W	PTRY CLDY	10	130	9	2	2	2	0	0	28.9	1028.0	29.4	27.8	
	19:00	+03			PTRY CLDY	10	100	10	1	1	1	1	1	28.9	1027.8	30.0	28.4	
	20:00	+03	31 42.5 N	63 39.3 W	PTRY CLDY	10	105	9	2	2	2	1	1	28.9	1027.4	30.0	28.4	
	21:00	+03	31 42.2 N	63 39.1 W	PTRY CLDY	10	95	9	2	2	2	1	1	28.9	1027.1	27.5	27.0	
	22:00	+03			PTRY CLDY	10	80	7	2	2	2	1	1	28.9	1027.0	26.7	25.6	
	23:00	+03			PTRY CLDY	10	90	10	0	1	140	1	1	28.9	1027.0	27.8	26.7	
	24	24	24	24		24	24	24	21	21	21	12	12	24	24	24	24	

F = MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (NM)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE HEIGHT (FEET) (TRUE)	WAVE HEIGHT (FEET) (MAX)	SWELL DTR. (FEET)	SWELL MAX (FEET)	SEA TEMP (C)	SEA TEMP (F)	DRY TEMP (C)	WET TEMP (C)	
29-JUL-88	0	+03	31 35.6 N	63 39.0 W	PFTLY CLOUDY	10	CLOUDY	90	10	0	1	140	1	28.9	1027.4	27.4	25.8
	1:00	+03			PFTLY CLOUDY	10	CLOUDY	90	10	0	1	140	1	28.9	1023.0	27.4	25.7
	2:00	+03			CLOUDY	10	CLOUDY	80	10	0	1	130	0	28.9	1028.0	27.2	25.4
	3:00	+03	31 35.3 N	63 38.9 W	PFTLY CLOUDY	10	CLOUDY	80	10	1	1	140	1	28.9	1027.5	27.2	26.1
	4:00	+03			PFTLY CLOUDY	10	CLOUDY	80	10	1	1	140	2	28.9	1027.2	26.7	26.1
	5:00	+03			PFTLY CLOUDY	10	CLOUDY	80	10	1	1	140	2	28.9	1027.0	26.7	26.1
	6:00	+03	31 43.0 N	63 40.0 W	PFTLY CLOUDY	10	CLOUDY	80	10	1	1	140	1	28.9	1026.5	26.7	26.1
	7:00	+03			PFTLY CLOUDY	10	CLOUDY	102	8	1	1	130	1	28.9	1026.0	25.5	24.4
	8:00	+03			PFTLY CLOUDY	10	CLOUDY	90	7	1	1	130	1	28.9	1025.9	25.6	24.4
	9:00	+03	32 05.0 N	64 17.7 W	PFTLY CLOUDY	10	CLOUDY	115	6	1	1	130	1	28.9	1025.9	25.6	24.4
	10:00	+03			PFTLY CLOUDY	10	CLOUDY	110	4	1	1	130	1	28.9	1026.0	25.6	24.4
	11:00	+03	32 23.0 N	64 35.4 W	PFTLY CLOUDY	10	CLOUDY	110	8	0	0	8	#	28.9	1026.0	28.0	26.2
N	12	12	12	12		12		11	11	12	11	11	11	12	12	12	12

= MISSING DATA

NOAA SHIP MT. MITCHELL DECK LOG DATA
1988 GLOBAL CHANGE CRUISE

DATE	TIME	TIME ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN (FEET)	WAVE MAX (FEET)	HEIGHT MIN (FEET)	HEIGHT MAX (FEET)	SWELL MIN (FEET)	SWELL MAX (FEET)	SEA TEMP (C)	BAROM. (HGA)	DRY TEMP (C)	NET TEMP (C)
31-JUL-88	14:00	+03	32° 27.9' N	64° 29.3' W	PTLY CLOUD	1.0	N	0	0	0	140	2	28.3	1022.0	27.2	26.7		
15:00	+03	32° 27.9' N	64° 29.3' W	HAZE	1.0	300	6	#	140	1	2	28.3	1022.0	27.2	26.6			
16:00	+03	32° 27.9' N	64° 29.3' W	HAZE	1.0	300	7	#	140	1	2	28.3	1021.8	28.4	27.3			
17:00	+03	33° 05.0' N	63° 45.0' W	HAZE	1.0	285	7	#	#	1	2	28.3	1021.7	28.4	27.3			
18:00	+03	33° 05.1' N	63° 36.4' W	HAZE	1.0	280	4	#	150	1	2	28.3	1021.5	28.4	27.3			
19:00	+03	33° 05.1' N	63° 36.4' W	HAZE	1.0	260	4	#	150	1	2	28.3	1021.2	28.8	27.7			
20:00	+03	33° 23.0' N	63° 15.6' W	HAZE	1.0	280	8	#	150	1	0	28.8	1021.0	27.7	26.4			
21:00	+03	33° 23.0' N	63° 15.6' W	HAZE	1.0	260	10	1	150	1	0	28.8	1020.5	26.8	25.8			
22:00	+03	33° 23.0' N	63° 15.6' W	HAZE	1.0	260	10	0	150	0	5	28.8	1020.4	26.4	25.5			
23:00	+03	34° 44.7' N	62° 54.7' W	HAZE	1.0	270	9	1	130	2	2	28.9	1020.2	26.7	26.1			
N	10	1.0	10	10	1.0	9	10	4	4	10	10	10	10	10	10	10		

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MICHIGAN DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESNT WEATHER	VIS. (MT)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN (FEET)	WAVE MAX (FEET)	SWELL DIR. (TRUE)	SWELL MIN (FEET)	SWELL MAX (FEET)	SEA TEMP (C.)	DRY TEMP (C.)	WET TEMP (C.)
01-AUG-88	00:00	*D3	33 53.2 N	62 42.6 W	HAZE	5	260	12	1	130	2	2	28.9	1020.2	26.7	25.6
	+03				HAZE	5	260	12	1	130	2	2	28.9	1020.5	26.7	25.6
	+03				HAZE	5	260	12	1	130	2	2	28.9	1021.0	26.7	25.6
	2:00															
	3:00															
	4:00															
	5:00															
	6:00															
	7:00															
	8:00															
	9:00															
	10:00															
	11:00															
	12:00															
	13:00															
	14:00															
	15:00															
	16:00															
	17:00															
	18:00															
	19:00															
	20:00															
	21:00															
	22:00															
	23:00															
	24															

10-18

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP NR. MITCHELL DECK LOG DATA

DATE:	TIME:	TIME ZONE:	LATITUDE	LONGITUDE	PRESNT WEATHER	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE HEIGHT MAX (FEET)	WAVE HEIGHT MIN (FEET)	SWELL DIR. (TRUE)	SWELL MIN (FEET)	SWELL MAX (FEET)	SEA TEMP (C)	DRY TEMP (C)	WET TEMP (C)
02-ADG-88																
1:00	+03	37 33.5 N	57 40.0 W	PRTY CLDY	10	180	11	3	3	0	#	0	28.3	1024.0	26.1	25.5
2:00	+03			CLOUDY	10	176	12	3	3	0	#	0	28.3	1024.0	26.1	25.5
3:00	+03	38 00.0 N	57 16.0 W	PRTY CLDY	10	170	13	3	3	0	#	0	28.3	1024.0	26.1	25.5
4:00	+03	38 12.5 N	56 58.5 W	PRTY CLDY	10	170	12	3	3	0	#	0	28.3	1024.0	26.1	25.5
5:00	+03			PRTY CLDY	10	180	15	3	3	0	#	0	28.3	1024.0	26.1	25.5
6:00	+03	38 32.5 N	56 31.0 W	PRTY CLDY	10	195	15	3	3	0	#	0	28.8	1025.5	25.6	24.5
7:00	+03	38 42.4 N	56 14.5 W	PRTY CLDY	10	180	10	3	3	0	#	0	28.8	1025.8	25.4	24.5
8:00	+03			PRTY CLDY	10	200	10	3	3	0	#	0	28.8	1026.2	25.6	24.6
9:00	+03	39 00.2 N	55 51.5 W	PRTY CLDY	10	190	12	2	2	0	#	0	28.8	1026.9	25.4	25.0
10:00	+03			PRTY CLDY	10	190	10	2	2	0	#	0	28.8	1027.1	25.7	25.2
11:00	+03	39 16.8 N	55 26.7 W	PRTY CLDY	10	190	13	3	3	0	#	0	27.8	1027.2	26.1	25.6
12:00	+03	39 20.1 N	55 27.0 W	PRTY CLDY	10	200	13	3	3	0	#	0	27.8	1027.8	26.7	26.7
13:00	+03			PRTY CLDY	10	200	10	1	1	0	#	0	27.8	1027.8	26.7	26.7
14:00	+03			PRTY CLDY	10	190	8	1	1	0	#	0	27.8	1027.8	26.7	26.7
15:00	+03	39 48.0 N	54 42.0 W	PRTY CLDY	10	195	8	2	2	0	#	0	26.2	1028.0	27.3	26.7
16:00	+03	39 51.4 N	54 39.8 W	PRTY CLDY	10	190	10	2	2	0	#	0	27.3	1028.0	27.8	26.7
17:00	+03			PRTY CLDY	10	195	14	2	2	0	#	0	27.3	1028.0	28.7	27.7
18:00	+03	40 09.0 N	54 20.0 W	PRTY CLDY	10	210	14	2	2	0	#	0	27.3	1018.0	28.9	28.0
19:00	+03			CLOUDY	10	210	10	1	1	0	#	0	27.3	1027.9	28.8	28.3
20:00	+03			CLOUDY	10	210	10	0	1	0	#	0	27.3	1027.9	26.7	26.5
21:00	+03	40 36.5 N	53 42.0 W	CLOUDY	10	210	12	1	1	0	#	0	27.7	1027.5	26.4	25.8
22:00	+03			CLOUDY	10	240	10	1	1	0	#	0	27.7	1027.9	26.4	25.6
23:00	+03	40 54.9 N	53 16.1 W	PRTY CLDY	10	240	12	1	1	0	#	0	26.7	1027.5	26.1	25.6
N	24	24	24		24	24	24	24	24	16	16	16	24	24	24	24

* = MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NORA SHIP M/T MITCHELL DECK LOG DATA

DATE:	TIME:	ZONE:	LATITUDE	LONGITUDE	PRESENT WEATHER:	VTS. (ML)	WIND DIR. (TRUE)	WIND SPEED. (KNOTS)	WAVE MIN (FEET)	WAVE MAX (FEET)	HEIGHT MAX (FEET)	SWELL DIR. (TRUE)	SWELL MIN (FEET)	SWELL MAX (FEET)	SEA TEMP. (C)	DRY TEMP. (C)	WET TEMP. (C)	BAROM. (HPA)
03-AUG-88	0	+03	41 08.0 N	53 05.0 W	PTLY	CLOUDY	10	210	14	3	3	#	0	0	26.7	1027.2	26.1	25.6
	1:00	+03	41 37.0 N	52 11.0 W	PTLY	CLOUDY	10	210	16	3	3	#	0	0	26.7	1027.2	25.6	25.0
	2:00	+03	41 30.0 N	52 11.0 W	PTLY	CLOUDY	10	210	16	3	3	#	0	0	26.7	1027.2	25.6	25.0
	3:00	+03	41 29.5 N	52 23.0 W	PTLY	CLOUDY	10	230	18	3	3	#	#	#	26.7	1027.0	25.0	24.4
	4:00	+03	41 29.0 N	52 11.0 W	PTLY	CLOUDY	10	230	17	4	4	#	#	#	26.7	1026.5	25.0	24.4
	5:00	+03	41 28.5 N	52 11.0 W	PTLY	CLOUDY	10	240	18	4	5	#	#	#	26.7	1026.0	25.0	24.4
	6:00	+03	41 28.0 N	51 46.0 W	PTLY	CLOUDY	10	235	15	4	5	#	#	#	26.9	1026.0	23.5	22.7
	7:00	+03	42 05.7 N	51 33.1 W	HAZE	CLOUDY	20	250	13	3	3	#	#	#	24.0	1025.1	23.4	22.8
	8:00	+03	42 05.0 N	51 33.1 W	HAZE	CLOUDY	8	250	14	2	2	#	#	#	22.0	1024.5	22.4	22.2
	9:00	+03	42 24.3 N	51 05.0 W	FOG	3	230	17	2	2	2	#	#	#	16.8	1024.6	20.0	20.0
	10:00	+03	42 41.9 N	50 42.7 W	HAZE	FOG	5	230	14	2	2	#	0	0	16.8	1024.4	20.6	20.6
	11:00	+03	42 48.0 N	50 30.0 W	HAZE	FOG	5	240	16	5	5	#	0	0	20.6	1024.0	21.7	20.6
	12:00	+03	42 48.0 N	50 30.0 W	HAZE	FOG	5	240	18	4	4	#	0	0	20.6	1024.0	22.8	20.8
	13:00	+03	42 48.0 N	50 30.0 W	HAZE	FOG	5	240	17	4	4	#	0	0	20.6	1023.8	22.8	21.4
	14:00	+03	43 14.8 N	52.5 W	HAZE	FOG	5	230	19	4	4	#	0	0	20.6	1023.2	25.0	21.4
	15:00	+03	43 14.8 N	52.5 W	HAZE	FOG	5	235	18	4	4	#	#	#	21.1	1023.0	23.8	21.4
	16:00	+03	43 14.8 N	52.5 W	HAZE	FOG	4	238	18	3	3	#	#	#	21.1	1022.5	23.8	21.4
	17:00	+03	43 14.8 N	52.5 W	HAZE	FOG	4	255	17	3	4	#	#	#	21.1	1023.0	23.8	20.6
	18:00	+03	43 38.2 N	49.0 W	FOG	1	265	17	3	3	3	#	#	#	18.9	1022.0	22.2	20.6
	19:00	+03	43 38.2 N	49.0 W	FOG	0	270	16	2	2	2	#	#	#	13.8	1022.0	17.7	15.7
	20:00	+03	43 38.2 N	49.0 W	FOG	0	270	16	2	2	2	#	#	#	13.8	1022.1	16.6	15.0
	21:00	+03	44 05.0 N	48.32.5 W	FOG	0	270	16	2	2	2	#	#	#	13.8	1022.1	16.2	15.0
	22:00	+03	44 05.0 N	48.32.5 W	FOG	0	270	16	1	2	1	#	#	#	14.5	1022.2	15.5	14.5
	23:00	+03	44 28.5 N	47.55.0 W	HAZE	FOG	6	280	14	2	2	1	1	1	15.6	1022.0	15.0	14.4
N	24	24	24	24	24	24	24	24	24	24	24	2	10	10	10	24	24	24

= MISSING DATA

1988' GLOBAL CHANGE CRUISE
NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN. (FEET)	WAVE MAX. (FEET)	WEIGHT SWELL DIR. (TRUE)	SWELL MIN. (FEET)	SWELL MAX. (FEET)	SEA TEMP. (C)	DRY TEMP. (C)	WET TEMP. (C)
04-AUG-88	00:00	+03	44 38.5 N	47 42.5 W	HAZE	6	310	17	2	200	3	3	3	15.6	1022.5	15.6
	1:00	+03			HAZE	8	310	18	3	200	2	2	2	15.6	1023.0	15.6
	2:00	+03			HAZE	8	310	18	3	200	1	1	1	15.6	1023.0	14.4
	3:00	+03	44 53.1 N	47 27.0 W	PRTLY CLOUDY	10	330	17	3	200	2	2	2	15.6	1023.0	14.0
	4:00	+03	45 43.0 N	47 10.8 W	PRTLY CLOUDY	10	330	18	3	330	3	3	3	15.6	1023.0	12.3
	5:00	+03	45 35.8 N	46 20.1 W	CLOUDY	10	235	19	3	330	3	3	3	15.6	1023.0	12.3
	6:00	+03	45 19.2 N	46 46.6 W	CLOUDY	10	330	20	3	3	#	#	#	15.6	1023.4	12.3
	7:00	+03			CLOUDY	10	320	20	3	3	#	#	#	17.3	1023.3	11.3
	8:00	+03			CLOUDY	10	310	20	3	3	#	#	#	17.3	1023.6	11.2
	9:00	+03	45 20.0 N	45 37.5 W	CLOUDY	10	310	21	3	190	2	2	2	17.3	1024.0	12.3
	10:00	+03	45 51.2 N	45 53.7 W	PRTLY CLOUDY	10	320	19	5	5	#	#	#	14.4	1024.0	10.3
	11:00	+03			PRTLY CLOUDY	10	320	19	5	5	#	#	#	14.4	1024.0	10.8
	12:00	+03	46 21.0 N	45 41.5 W	PRTLY CLOUDY	10	310	15	5	5	#	#	#	14.4	1024.5	11.2
	13:00	+03			CLOUDY	10	310	16	5	5	#	#	#	14.4	1024.5	11.7
	14:00	+03	46 24.2 N	45 10.0 W	CLOUDY	10	295	20	5	330	2	2	2	14.4	1024.5	10.0
	15:00	+03	46 25.2 N	45 02.6 W	CLOUDY	10	298	17	3	4	330	3	4	14.4	1024.0	13.4
	16:00	+03			CLOUDY	10	295	17	5	330	3	4	4	14.4	1023.2	10.0
	17:00	+03			CLOUDY	10	285	19	5	320	4	5	5	14.4	1022.5	10.0
	18:00	+03	46 55.2 N	44 31.9 W	CLOUDY	10	280	20	3	320	5	5	5	14.4	1022.6	14.2
	19:00	+03			CLOUDY	10	275	22	3	320	6	6	6	15.7	1022.0	11.2
	20:00	+03	47 15.7 N	44 17.2 W	CLOUDY	10	260	24	4	320	6	6	6	15.7	1021.9	11.2
	21:00	+03	47 27.1 N	44 08.3 W	CLOUDY	10	260	22	4	320	6	6	6	15.3	1021.2	11.2
	22:00	+03	47 47.0 N	43 59.0 W	CLOUDY	10	270	18	5	320	7	8	8	12.8	1021.2	10.6
	23:00	+03			PRTLY CLOUDY	10	270	18	5	320	8	8	8	12.8	1020.8	10.6
	N		24	24		24	24	24	24	24	16	17	17	24	24	24

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (MI.)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN (FEET)	WAVE MAX (FEET)	HEI.GHT MAX (FEET)	SWELL DIR. (TRUE)	SWELL MIN (FEET)	SWELL MAX (FEET)	SEA TEMP. (C)	TEMP. (C)	DRY TEMP. (C)	WET TEMP. (C)
05-AUG-88	00:00	+02	47° 58.2' N	49° 53.0' W	PRTLY	CLDY	10	260	18	5	5	320	8	8	12.8	1020.5	12.2	10.3
	1:00	+02	48° 21.7' N	49° 34.2' W	PRTLY	CLDY	10	260	18	5	5	320	8	8	12.8	1020.0	12.2	10.8
	2:00	+02	48° 21.7' N	49° 34.2' W	PRTLY	CLDY	10	245	18	5	5	320	8	8	12.6	1019.0	12.7	10.6
	3:00	+02	48° 27.2' N	49° 39.5' W	PRTLY	CLDY	10	250	18	5	5	320	7	8	12.8	1018.5	12.7	10.6
	4:00	+02	48° 23.0' N	49° 23.5' W	PRTLY	CLDY	10	230	20	5	5	320	7	9	14.4	1016.5	13.4	11.2
	5:00	+02	48° 23.5' N	49° 23.5' W	PRTLY	CLDY	10	235	19	5	5	320	7	8	14.4	1016.0	13.4	11.2
	6:00	+02	49° 07.9' N	49° 07.1' W	PRTLY	CLDY	10	240	26	4	4	320	7	7	14.4	1015.1	13.4	11.2
	7:00	+02	49° 25.0' N	49° 23.0' W	HAZE	PRTLY	10	250	23	4	4	320	5	5	15.7	1013.9	14.4	11.2
	8:00	+02	49° 31.4' N	49° 42.5' W	HAZE	PRTLY	7	240	26	4	4	320	6	6	15.7	1013.1	14.3	11.5
	9:00	+02	49° 56.1' N	49° 42.9' W	HAZE	PRTLY	7	240	26	4	4	320	5	5	15.7	1012.4	14.3	11.5
	10:00	+02	49° 56.1' N	49° 42.9' W	HAZE	PRTLY	7	220	21	7	7	320	6	6	17.2	1011.0	14.7	11.7
	11:00	+02	50° 23.1' N	49° 42.0' W	HAZE	PRTLY	7	230	20	7	7	320	6	6	17.2	1009.2	15.6	12.2
	12:00	+02	50° 41.0' N	49° 42.0' W	HAZE	PRTLY	7	210	28	8	8	320	6	6	17.2	1007.5	16.1	12.2
	13:00	+02	50° 41.0' N	49° 42.0' W	FOG	PRTLY	1	210	30	9	9	320	5	5	17.2	1006.2	15.6	12.2
	14:00	+02	50° 41.0' N	49° 42.0' W	FOG	PRTLY	1	295	30	8	8	320	5	5	17.7	1004.9	12.8	11.7
	15:00	+02	50° 50.5' N	49° 42.0' W	FOG	PRTLY	1	190	30	8	9	320	5	5	17.7	1002.0	12.8	11.7
	16:00	+02	50° 50.4' N	49° 41.8' W	FOG	PRTLY	0	175	22	8	9	320	5	5	14.0	998.5	12.3	10.6
	17:00	+02	50° 50.4' N	49° 41.8' W	FOG	PRTLY	0	195	23	8	9	320	5	5	14.0	997.1	12.3	11.0
	18:00	+02	51° 25.0' N	49° 35.0' W	FOG	PRTLY	0	200	22	9	9	320	5	5	14.0	994.8	12.5	12.3
	19:00	+02	51° 52.5' N	49° 22.7' W	FOG	PRTLY	0	210	20	9	9	320	5	5	13.3	991.5	12.7	12.3
	20:00	+02	51° 52.5' N	49° 22.7' W	FOG	PRTLY	1	200	18	9	8	320	5	5	13.3	990.7	12.3	12.3
	21:00	+02	52° 04.0' N	49° 22.7' W	FOG	PRTLY	1	200	18	6	6	320	5	5	13.3	990.0	12.6	12.3
	22:00	+02	52° 12.8' N	49° 09.0' W	HAZE	PRTLY	4	260	16	3	3	200	7	7	12.2	989.8	12.8	11.7
	23:00	+02	52° 12.8' N	49° 09.0' W	HAZE	PRTLY	6	260	20	4	4	200	7	7	12.2	990.0	12.0	10.9
	N		24	24		24		24		24		24		16	16	23	24	24

= MISSING DATUM

NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (MI.)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE HEIGHT (FEET)	WAVE HEIGHT (FEET) (TRUE)	SWELL DIR. (TRUE)	SWELL MAX (FEET)	SWELL MIN (FEET)	SWELL HEIGHT (FEET)	SEA STATE	TEMP (C)	TEMP (F)	DRY TEMP (C)	DRY TEMP (F)	WET TEMP (C)	WET TEMP (F)
06-AUG-88	0:00	+02	52 37.0 N	40 51.0 W	HAZE	8	280	22	4	4	200	7	7	12.2	989.9	12.0	10.9				
	1:00	+02	52 37.0 N	40 51.0 W	FOG	10	280	18	4	4	200	6	6	12.2	990.9	11.7	10.3				
	2:00	+02	53 00.0 N	40 35.0 W	FOG	10	280	21	4	4	200	6	6	12.2	990.0	11.7	10.0				
	3:00	+02	53 10.0 N	40 30.0 W	CLOUDY	6	278	20	4	5	200	6	6	12.2	990.2	11.7	10.0				
	4:00	+02	53 10.0 N	40 30.0 W	CLOUDY	2	283	18	4	5	200	5	6	12.2	990.0	10.0	9.6				
	5:00	+02	53 10.0 N	40 30.0 W	FOG	2	285	18	4	5	200	5	6	12.2	989.9	10.0	9.6				
	6:00	+02	53 43.7 N	40 05.6 W	FOG	4	286	12	3	3	200	4	4	11.7	989.9	10.4	9.5				
	7:00	+02	54 06.2 N	39 47.4 W	FOG & RAIN	4	280	20	3	3	200	4	4	11.2	990.0	10.2	9.2				
	8:00	+02	54 06.2 N	39 47.4 W	FOG & RAIN	1	280	15	4	4	200	5	5	11.2	989.9	10.5	9.5				
	9:00	+02	54 28.8 N	39 29.8 W	FOG & RAIN	5	280	16	3	3	200	4	4	11.2	990.2	10.5	9.5				
	10:00	+02	54 28.8 N	39 29.8 W	FOG	0	320	10	1	1	200	5	5	10.6	990.5	10.0	9.2				
	11:00	+02	54 28.8 N	39 29.8 W	FOG	1	300	11	1	1	200	5	5	10.6	990.5	10.0	9.2				
	12:00	+02	54 45.3 N	39 15.9 W	HAZE	4	310	9	1	1	200	5	5	10.6	990.1	10.3	9.5				
	13:00	+02	55 05.0 N	39 02.0 W	FOG & RAIN	0	310	9	1	1	200	4	4	10.6	991.2	10.3	9.2				
	14:00	+02	55 05.0 N	39 02.0 W	FOG & RAIN	0	25	3	1	1	200	4	4	10.6	991.5	10.0	9.5				
	15:00	+02	55 17.0 N	38 55.0 W	FOG	0	53	12	1	1	200	4	4	10.6	992.0	9.5	9.0				
	16:00	+02	55 17.0 N	38 55.0 W	FOG	1	25	14	3	3	200	5	5	10.6	993.1	9.5	9.0				
	17:00	+02	55 17.0 N	38 55.0 W	FOG	1	25	13	3	3	210	5	5	11.1	994.0	9.5	9.0				
	18:00	+02	55 51.3 N	38 32.2 W	CLOUDY	10	0	20	4	4	200	4	4	11.1	994.8	10.3	8.8				
	19:00	+02	56 13.0 N	38 15.5 W	FOG	10	0	18	4	4	200	4	4	11.1	995.8	10.0	7.9				
	20:00	+02	56 13.0 N	38 15.5 W	FOG	5	340	20	4	4	200	3	3	10.7	996.1	10.0	7.5				
	21:00	+02	56 22.4 N	38 08.2 W	FOG	0	0	20	4	4	200	3	3	10.7	996.5	9.8	7.4				
	22:00	+02	56 33.2 N	37 59.0 W	HAZE	2	330	18	4	4	200	3	3	10.0	996.8	8.9	7.8				
	23:00	+02	56 33.2 N	37 59.0 W	HAZE	4	330	22	5	5	200	3	3	10.0	997.7	10.0	7.8				
	N		24	24	24	24	24	24	23	23	24	24	24	24	24	24	24	24	24	24	

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. KETCHUM DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (M)	WIND DIR. (LRDE)	WIND SPEED (KNOTS)	WAVE HEIGHT MIN (FEET)	WAVE HEIGHT MAX (FEET)	SWELL DIR. (TRUE)	SWELL HEIGHT MIN (FEET)	SWELL HEIGHT MAX (FEET)	SEA TEMP. (C)	BAROM. (hPa)	DRY TEMP. (C)	WET TEMP. (C)
07-AUG-88	00:00	+02	56 55.8 N	37 41.0 W	HAZE	6	320	20	5	200	6	3	3	10.0	997.7	10.0	7.8
	1:00	+02	56 55.8 N	37 41.0 W	HAZE	6	310	25	6	200	4	3	3	10.0	997.2	9.0	7.8
	2:00	+02	57 12.2 N	37 25.0 W	HAZE	6	310	24	4	200	3	3	3	10.0	997.1	8.6	7.8
	3:00	+02	57 26.5 N	37 16.0 W	FOG	6	310	26	6	8	#	#	#	10.6	997.0	8.6	8.3
	4:00	+02	57 26.5 N	37 16.0 W	FOG	6	325	28	7	9	#	#	#	10.6	997.5	8.4	7.8
	5:00	+02	57 26.5 N	37 16.0 W	CLOUDY	6	325	24	7	7	#	#	#	10.6	998.0	8.0	7.5
	6:00	+02	57 54.0 N	36 55.0 W	CLOUDY	10	330	22	7	7	#	#	#	10.0	997.0	8.2	7.2
	7:00	+02	57 54.0 N	36 40.0 W	FOG	7	330	24	7	7	#	#	#	10.0	998.5	9.0	8.3
	8:00	+02	58 12.7 N	36 40.0 W	FOG	7	320	24	7	7	#	#	#	11.0	999.0	9.8	8.5
	9:00	+02	58 33.8 N	36 23.2 W	FOG	7	320	22	7	7	#	#	#	11.0	999.5	11.5	9.5
	10:00	+02	58 33.8 N	36 23.2 W	HAZE	8	310	25	7	7	#	#	#	10.0	999.5	9.4	7.5
	11:00	+02	58 33.8 N	36 23.2 W	HAZE	8	320	25	7	7	#	#	#	10.0	999.8	9.7	8.1
	12:00	+02	58 43.0 N	36 17.2 W	HAZE	6	310	23	7	7	#	#	#	10.0	1000.6	10.0	5.8
	13:00	+02	58 43.0 N	36 17.2 W	HAZE	6	310	25	7	7	#	#	#	10.0	999.5	10.0	8.1
	14:00	+02	58 58.2 N	36 08.1 W	HAZE	8	308	24	7	7	#	#	#	10.0	1000.1	9.5	9.0
	15:00	+02	59 08.0 N	35 54.5 W	CLOUDY	8	310	23	7	7	#	#	#	10.0	1000.0	9.5	8.8
	16:00	+02	59 08.0 N	35 54.5 W	CLOUDY	8	308	23	6	6	#	#	#	10.0	999.4	9.5	8.8
	17:00	+02	59 08.0 N	35 54.5 W	CLOUDY	10	310	23	6	6	#	#	#	10.0	999.1	9.5	8.8
	18:00	+02	59 39.0 N	35 30.0 W	FOG	8	310	24	7	7	#	#	#	10.0	998.8	10.0	8.8
	19:00	+02	59 39.0 N	35 30.0 W	FOG	8	310	25	7	7	#	#	#	10.0	998.0	9.2	8.5
	20:00	+02	59 57.8 N	35 27.2 W	FOG	8	310	24	7	7	#	#	#	10.0	997.8	9.8	8.2
	21:00	+02	60 15.5 N	34 57.1 W	HAZE	8	310	24	7	7	#	#	#	10.0	997.6	9.9	6.7
	22:00	+02	60 15.5 N	34 57.1 W	HAZE	6	310	27	8	8	#	#	#	10.0	997.0	10.0	8.3
	23:00	+02	60 15.5 N	34 57.1 W	HAZE	6	310	28	8	8	#	#	#	10.0	996.8	10.8	6.3
	24	24	24	24		24	24	24	3	3	9	9	9	24	24	24	24

24

= MISSING DATA

NOMA SHIP MT; MITCHELL DECK LOG DATA
1968 GLOBAL CHANGE CRUISE

DATE	TIME	TIME GMT	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (ML)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN (FEET)	WAVE MAX (FEET)	SWELL MIN (FEET)	SWELL MAX (FEET)	SEA TEMP. (C.)	WET TEMP. (C.)	DRY TEMP. (C.)	WET TEMP. (C.)	DRY TEMP. (C.)	BAROM. (HPA)
08 AUG-86	0	+02	60° 34.5' N	34° 44.0' W		HAZE	4	310	29	9	9	4	0	0	10.0	996.8	9.4	8.3	
	1:00	+02	60° 51.0' N	34° 36.0' W		HAZE	4	310	30	9	9	4	0	0	10.0	997.0	8.9	7.5	
	2:00	+02	61° 02.0' N	34° 20.0' W		HAZE	3	205	24	8	8	4	0	0	10.0	995.5	8.4	8.0	
	3:00	+02	61° 32.0' N	33° 50.0' W		HAZE	3	218	21	8	8	4	0	0	10.0	995.0	8.4	8.0	
	4:00	+02	61° 32.0' N	33° 50.0' W		HAZE	1	320	18	4	4	3	0	0	10.0	994.2	8.4	8.0	
	5:00	+02	61° 32.0' N	33° 50.0' W		HAZE	0	340	29	8	8	4	0	0	11.0	993.7	9.1	8.2	
	6:00	+02	61° 32.4' N	33° 52.4' W		FOG	0	320	26	8	8	4	0	0	10.0	992.0	9.1	8.2	
	7:00	+01	61° 32.0' N	33° 50.0' W		FOG	0	330	28	6	8	4	0	0	10.0	992.8	9.5	8.5	
	8:00	+01	61° 58.6' N	33° 30.9' W		FOG	0	320	26	8	8	4	0	0	10.0	992.5	10.0	9.9	
	9:00	+01	61° 58.6' N	33° 30.9' W		FOG	0	330	23	8	8	4	0	0	12.2	991.8	10.0	9.9	
	10:00	+01	62° 26.0' N	32° 59.0' W		CLOUDY	0	350	20	7	7	4	0	0	12.2	991.8	10.0	9.9	
	11:00	+01	62° 26.0' N	32° 59.0' W		CLOUDY	0	350	22	7	7	4	0	0	12.2	991.8	10.0	9.9	
	12:00	+01	62° 09.2' N	33° 23.8' W		FOG	0	350	19	7	7	4	0	0	12.2	991.8	10.0	9.9	
	13:00	+01	62° 26.0' N	32° 59.0' W		CLOUDY	0	350	22	7	7	4	0	0	16.0	991.2	10.0	9.9	
	14:00	+01	62° 32.0' N	32° 37.2' W		FOG	1	60	22	7	7	4	0	0	10.0	990.5	10.0	9.9	
	15:00	+01	62° 50.0' N	32° 37.2' W		FOG	0	45	24	7	7	4	0	0	10.0	990.6	10.0	9.9	
	16:00	+01	63° 24.8' N	32° 05.0' W		FOG & RAIN	0	25	28	7	7	4	0	0	10.0	991.2	10.0	9.9	
	17:00	+01	63° 35.6' N	31° 56.5' W		FOG & RAIN	0	20	34	8	8	4	0	0	10.0	991.0	9.8	8.8	
	18:00	+01	63° 44.7' N	31° 56.1' W		HAZE	2	350	33	10	10	4	0	0	11.0	990.5	11.0	8.9	
	19:00	+01	63° 44.7' N	31° 56.1' W		FOG	0	350	28	10	10	4	0	0	10.0	991.2	11.1	8.9	
	20:00	+01	63° 44.7' N	31° 56.1' W		HAZE	1	25	29	10	10	4	0	0	10.0	991.2	11.1	8.9	
	21:00																		
	22:00	+01	63° 24.8' N	32° 05.0' W		HAZE	2	350	33	10	10	4	0	0	10.0	990.5	11.0	8.9	
	23:00	+01	63° 24.8' N	32° 05.0' W		HAZE	1	25	29	10	10	4	0	0	10.0	991.2	11.1	8.9	
	24	24	24	24			24	24	24	24	24	24	24	24	24	24	24	24	24

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVES MIN (FEET)	WAVES MAX (TRUE) (FEET)	HEIGHT (FEET)	SWELL DUR. (TRUE)	SWELL MAX (FEET)	SEA TEMP (C)	BAROM. (HPA)	DRY TEMP (C)	WET TEMP (C)	
09-AUG-88	0:00	+01	64 12.5 N	31 20.5 W	HAZE	1	0	29	10	10	0	0	0	10.0	991.2	11.1	8.9	
	1:00	+01	64 22.0 N	31 10.0 W	FOG & RAIN	1	7	28	10	10	0	0	0	10.0	990.9	7.7	7.3	
	2:00	+01			FOG & RAIN	2	0	31	10	14	0	0	0	10.0	990.5	7.7	7.3	
	3:00	+01	64 35.0 N	30 40.0 W	FOG & RAIN	1	0	32	10	14	#	#	#	10.0	990.5	7.7	7.3	
	4:00	+01			FOG & RAIN	1	26	27	10	12	#	#	#	10.0	990.5	8.4	7.7	
	5:00	+01			FOG & RAIN	6	25	26	8	B	#	#	#	10.0	990.2	9.3	8.3	
	6:00	+01	64 57.0 N	30 38.0 W	FOG & RAIN	5	40	26	8	8	#	#	#	10.0	993.1	9.3	8.3	
	7:00	+01	65 03.8 N	30 10.0 W	FOG & RAIN	5	50	24	8	8	#	#	#	10.0	994.5	9.5	8.5	
	8:00	+01			FOG & RAIN	4	40	20	7	7	#	#	#	10.0	995.0	9.7	8.7	
	9:00	+01	65 16.0 N	30 10.0 W	HAZE	8	30	18	7	7	#	#	#	10.0	995.2	11.1	7.8	
	10:00	+01			HAZE	4	20	22	7	7	#	#	#	8.9	995.5	10.0	6.1	
	11:00	+01			HAZE	4	30	20	7	7	#	#	#	8.9	997.0	8.9	6.6	
	12:00	+01	65 39.6 N	29 51.9 W	HAZE	4	30	28	8	8	#	#	#	8.9	997.2	7.8	6.1	
	13:00	+01	65 44.0 N	29 54.0 W	HAZE	3	40	16	8	8	#	#	#	8.9	998.5	6.1	5.6	
	14:00	+01			HAZE	3	52	12	8	8	#	#	#	8.9	999.5	4.9	3.5	
	15:00	+01	66 04.0 N	29 34.0 W	FOG	0	50	14	8	8	#	#	#	8.9	1000.5	4.0	3.5	
	16:00	+01			FOG	1	59	14	8	8	#	#	#	8.9	1002.2	3.9	3.4	
	17:00	+01	66 20.8 N	29 20.8 W	FOG & RAIN	3	40	20	8	8	#	#	#	8.9	1003.2	3.8	3.4	
	18:00	+01	66 34.7 N	29 07.8 W	FOG & RAIN	4	40	20	8	8	#	#	#	3.3	1005.0	3.8	3.4	
	19:00	+01			FOG & RAIN	4	50	20	8	8	#	#	#	3.3	1006.0	3.7	3.3	
	20:00	+01			FOG & RAIN	4	60	16	7	7	#	#	#	3.3	1006.4	3.3	3.0	
	21:00	+01	66 36.4 N	29 04.6 W	HAZE	2	60	18	7	7	#	#	#	0	3.4	1007.0	4.4	3.2
	22:00	+01			HAZE	2	60	19	7	7	150	150	150	0	3.4	1007.2	4.4	3.4
	23:00	+01			HAZE	2	60	18	7	7	150	150	150	0	3.4	1007.2	4.4	3.4
	N.						24	24	24	24	1	9	9	24	24	24	24	

= MISSING DATA

NOAA SHIP MT. MITCHELL DECK LOG DATA
1988 GLOBAL CHANGE CRUISE

DATE	TIME	TIME ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN (FEET)	WAVE MAX (FEET)	HEIGHT SWELL (TRUE)	SWELL DIR. (TRUE)	SWELL MIN (FEET)	SWELL MAX (FEET)	SEA TEMP. (°C)	DRY TEMP. (°C)	WET TEMP. (°C)
10-AUG-88	0:00	+00	66 38.4 N	28 58.6 W	HAZE	2	65	16	7	7	#	#	6	6	3.4	1008.5	2.5
	1:00	+00	66 40.3 N	28 56.4 W	FOG	5	66	14	6	6	155	6	8	8	3.4	1009.0	2.5
	2:00	+00			FOG	3	53	14	6	6	155	8	8	8	3.6	1010.0	2.2
	3:00	+00	66 40.6 N	29 00.0 W	FOG	0	55	16	6	6	155	8	8	8	3.8	1009.5	1.5
	4:00	+00	66 42.0 N	29 00.3 W	FOG	0	50	18	4	4	140	6	6	6	3.8	1009.5	1.4
	5:00	+00	66 42.0 N	29 00.3 W	FOG	2	20	16	4	4	120	4	4	4	3.8	1009.6	1.4
	6:00	+00	66 41.1 N	28 56.2 W	FOG & RAIN	4	20	16	4	4	110	4	4	4	4.4	1010.2	1.0
	7:00	+00	66 39.0 N	28 43.6 W	FOG	0	10.	20.	4	4	110	4	4	4	4.4	1010.0	1.2
	8:00	+00	66 39.0 N	28 43.6 W	FOG	0	40	22	5	5	110	4	4	4	4.4	1010.0	1.2
	9:00	+00	66 38.5 N	28 41.6 W	FOG	0	50	15	5	5	110	4	4	4	4.4	1010.0	1.2
	10:00	+00			FOG	0	40	19	5	4	110	4	4	4	4.4	1009.5	1.2
	11:00	+00			FOG	2	40	15	4	4	110	4	4	4	4.4	1009.5	1.2
	12:00	+00	66 39.0 N	28 30.9 W	FOG	3	40	11	4	4	110	4	4	4	4.4	1009.1	1.2
	13:00	+00			HAZE	7	40	14	4	4	110	4	4	4	3.6	1008.9	2.0
	14:00	+00			CLOUDY	10	35	14	4	4	120	4	4	4	3.9	1008.2	2.0
	15:00	+00	66 10.3 N	27 28.0 W	CLOUDY	10	30	8	3	4	120	4	4	4	3.4	1007.5	3.9
	16:00	+00			CLOUDY	10	50	10	2	2	140	4	4	4	3.4	1007.4	3.8
	17:00	+00			HAZE	8	60	8	2	2	140	4	4	4	3.6	1007.6	6.4
	18:00	+00	65 43.5 N	26 30.0 W	HAZE	8	30	8	2	2	150	4	4	4	4.4	1007.0	6.6
	19:00	+00			HAZE	8	310	5	5	2	150	4	4	4	4.2	1007.8	11.7
	20:00	+00	65 26.2 N	25 52.6 W	HAZE	8	350	6	6	0	150	4	4	4	4.2	1006.8	11.1
	21:00	+00	65 16.0 N	25 33.5 W	HAZE	8	350	12	1	1	150	4	4	4	4.6	1006.2	14.1
	22:00	+00			CLOUDY	10	0	14	1	1	150	4	4	4	4.6	1006.0	10.8
	23:00	+00			CLOUDY	10	0	15	1	1	150	3	3	3	4.6	1005.5	10.0
N	24	24				24	24	24	24	23	23	23	23	24	24	24	24

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP M. MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN (FEET)	WAVE MAX (FEET)	REIGHT (FEET)	SWELL DIR (TRUE)	SWELL MAX (FEET)	SEA SWELL HEIGHT (FEET)	MAX (FEET)	MIN (FEET)	DRY TEMP. (C)	WET TEMP. (C)	DRY BAROM. (HPA)	WET BAROM. (HPA)
11-AUG-88	0:00	+00	64 46.0 N	24 36.0 W	CLOUDY	10	0	15	1	1	150	3	3	11.6	1005.0	10.0	9.5			
	1:00	+00			CLOUDY	10	0	15	1	1	150	2	2	11.6	1004.8	10.0	9.5			
	2:00	+00			CLOUDY	10	B	7	#	#	150	2	2	11.6	1004.1	10.6	10.0			
	3:00	+00	64 29.5 N	23 27.5 W	CLOUDY	10	10	10	#	#	160	2	2	11.6	1004.0	11.2	10.0			
	4:00	+00			FOG	8	30	10	0	0	160	1	1	11.6	1003.5	10.7	10.0			
	5:00	+00			FOG	8	40	12	0	0	160	1	1	12.2	1003.0	10.7	10.0			
	6:00	+00	64 15.3 N	24 52.0 W	FOG	8	40	11	0	0	190	1	1	12.2	1003.2	10.0	9.8			
	7:00	+00			FOG	8	40	6	0	0	190	1	1	12.2	1003.4	10.2	9.8			
	8:00	+00	64 14.2 N	24 59.0 W	HAZE	8	10	6	0	0	190	1	1	11.6	1003.0	11.1	10.6			
	9:00	+00			HAZE	8	20	7	0	0	190	1	1	11.6	1003.2	12.8	11.1			
	N	10	10	10		10	10	10	8	8	17	7	7	10	10	10	10	10	10	

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	TIME ZONE	LATITUDE	LONGITUDE	PRES. WEATHER	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE HEIGHT (FEET)	WAVE HEIGHT (TRUE) (FEET)	SWELL DIR. (TRUE)	SWELL MIN MAX (FEET)	SWELL DIR. (TRUE)	SWELL MIN MAX (FEET)	SEA TEMP. (C)	DRY TEMP. (C)	WET TEMP. (C)
15-AUG-88	8:00	+00:			CLOUDY	10	80	5	#	#	#	#	#	#	1008.0	12.2	10.0
	9:00	+00:			CLOUDY	10	60	3	#	#	#	#	#	#	1008.5	12.2	10.6
	10:00	+00:	64 10.0 N	21 56.3 W	CLOUDY	10	33	4	#	#	#	#	#	#	1009.0	11.1	10.0
	11:00	+00:	64 09.1 N	22 33.4 W	CLOUDY	10	53	4	#	#	#	#	#	#	1000.2	11.7	10.6
	12:00	+00:	64 02.3 N	22 50.0 W	CLOUDY	10	0	0	#	#	#	#	#	#	1010.0	11.5	10.5
	13:00	+00:	64 00.0 N	22 47.9 W	LIGHT RAIN	10	100	10	#	#	#	#	#	#	1010.2	11.2	10.4
	14:00	+00:	63 23.7 N	22 31.5 W	LIGHT RAIN	10	100	10	#	1	100	0	1	1	1010.2	11.2	10.4
	15:00	+00:	63 12.7 N	22 22.9 W	CLOUDY	10	90	0	#	1	100	0	1	1	1010.6	11.4	10.4
	16:00	+00:	63 12.2 N	22 22.9 W	CLOUDY	10	50	12	#	1	100	1	1	1	1010.0	13.1	10.6
	17:00	+00:	62 47.0 N	22 05.2 W	Partly Cldy	10	70	14	#	1	100	1	1	1	1010.0	14.4	11.1
	18:00	+00:	62 47.0 N	22 05.2 W	Partly Cldy	10	60	13	#	1	100	1	1	1	1009.8	14.4	11.1
	19:00	+00:			CLOUDY	10	70	14	#	1	100	1	1	1	1009.8	12.8	10.3
	20:00	+00:			CLOUDY	10	70	14	#	1	100	1	1	1	1010.0	12.2	10.0
	21:00	+00:	62 13.2 N	21 36.5 W	CLOUDY	10	70	14	#	1	100	1	1	1	1010.0	11.7	11.0
	22:00	+00:			CLOUDY	10	80	14	#	1	100	1	1	1	1010.0	11.7	10.6
	23:00	+00:			CLOUDY	10	135	7	#	#	#	#	#	#	1010.9	11.7	10.6
N	16	16	16	16		16	15	16	7	7	9	9	9	9	11	16	16

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRES ^{ENT} WEATHER	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE HTN. (FEET)	WAVE HTN. MAX (FEET)	SWELL HTN. MAX (FEET)	SWELL HTN. MIN (FEET)	SEA TEMP. (°C)	DRY TEMP. (°C)	WET TEMP. (°C)	BAROM. (H.P.A.)			
16-AUG-88	00:00	61	37.0 N	21 10.9 W	CLOUDY	10	160	8	9	1	4	4	4	12.2	1011.2	11.2	10.0		
	1:00	400	60	37.0 N	CLOUDY	10	160	12	1	1	4	4	4	12.2	1011.5	11.0	9.9		
	2:00	+00	130	HAZE	8	110	12	1	1	4	4	4	4	12.2	1011.2	11.2	9.9		
	3:00	+00	60	59.0 N	20 43.0 W	HAZE	8	110	12	1	2	2	2	4	12.2	1011.0	11.2	9.9	
	4:00	+00	60	49.9 N	20 37.0 W	RAIN	9	70	16	1	6	6	0	4	13.3	1010.8	11.7	10.3	
	5:00	+00	130	RAZEN	9	130	8	1	1	6	6	1	1	4	13.3	1010.5	11.7	10.2	
	6:00	+00	60	25.2 N	20 21.1 W	RAIN	6	120	12	1	1	60	1	1	13.2	1010.2	12.8	11.1	
	7:00	+00	130	RAZEN	6	130	14	1	1	1	6	0	0	4	13.3	1010.2	12.8	11.1	
	8:00	+00	60	06.5 N	20 05.0 W	FOG	5	115	15	1	1	6	0	4	13.3	1010.2	11.7	11.1	
	9:00	+00	60	00.0 N	20 00.0 W	FOG	6	147	14	1	1	6	0	4	13.3	1010.2	12.2	11.7	
	10:00	+00	60	19.5 N	19 59.6 W	HAZE	6	140	18	1	3	3	3	4	13.3	1010.0	12.2	11.7	
	11:00	+00	60	01.0 N	19 59.6 W	HAZE	6	120	15	1	3	3	3	4	13.3	1010.0	12.0	12.8	
	12:00	+00	59	47.7 N	20 02.9 W	FOG	10	130	20	3	3	3	3	4	13.3	1009.5	12.3	11.8	
	13:00	+00	130	FOG	8	120	22	3	3	3	3	3	3	4	13.3	1009.0	12.8	12.3	
	14:00	+00	130	FOG	4	120	24	3	3	3	3	3	3	4	13.3	1008.0	13.1	12.3	
	15:00	+00	59	01.6 N	20 01.8 W	CLOUDY	10	115	24	4	4	4	4	4	13.3	1007.1	13.4	12.3	
	16:00	+00	130	HAZE	6	110	26	6	6	6	6	6	6	4	13.9	1005.5	14.4	12.2	
	17:00	+00	130	HAZE	6	100	25	6	6	6	6	6	6	4	13.9	1004.8	14.2	11.9	
	18:00	+00	58	38.2 N	20 00.0 W	HAZE	6	110	27	7	7	7	7	0	0	13.9	1004.0	14.2	11.9
	19:00	+00	58	25.0 N	20 06.0 W	HAZE	4	110	26	8	8	8	8	0	0	13.9	1002.5	13.9	11.1
	20:00	+00	58	15.0 N	20 00.0 W	FOG & RAIN	4	160	28	7	8	8	8	0	0	13.9	1001.0	12.3	11.1
	21:00	+00	58	15.0 N	20 00.0 W	FOG & RAIN	1	95	32	12	14	14	14	4	13.9	999.0	13.3	11.1	
	22:00	+00	105	FOG & RAIN	1	100	33	13	15	17	17	17	17	4	13.9	997.0	12.3	11.1	
	23:00	+00	105	FOG & RAIN	2	105	28	14	17	17	17	17	17	4	14.0	996.5	12.3	11.1	
N	24	24	24	24	24	24	24	24	24	24	24	24	24	8	8	24	24	24	

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	TIME ZONE	LATITUDE	LONGITUDE	PRES.	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE HEIHT SEIN (FEET)	WAVE HEIHT MAX (FEET)	SWELL DIR. (TRUE)	SWELL MAX (FEET)	SWELL HEIHT MAX (FEET)	SEA TEMP (C)	DRY TEMP (H&A) (C)	WEST TEMP (C)
17-AUG-88	00:00	+00	57 57.7 N	20 00.0 W	CLOUDY	8	190	26	10	10	#	#	#	13.9	997.0	12.1
	1:00	+00			CLOUDY	10	180	20	6	8	#	#	#	13.8	997.3	12.2
	2:00	+00			CLOUDY	8	190	20	8	8	#	#	#	13.8	997.8	12.2
	3:00	+00	57 20.0 N	20 02.0 W	CLOUDY	8	170	22	8	8	#	#	#	13.9	997.5	12.2
	4:00	+00	57 08.9 N	20 01.9 W	CLOUDY	10	160	25	8	8	#	#	#	13.9	997.5	12.2
	5:00	+00			CLOUDY	10	160	23	8	8	#	#	#	13.9	997.5	12.2
	6:00	+00	56 46.5 N	20 00.0 W	CLOUDY	10	160	22	8	8	#	#	#	13.9	997.5	12.2
	7:00	+00	56 28.0 N	20 00.0 W	CLOUDY	10	160	22	8	8	#	#	#	13.9	998.0	12.6
	8:00	+00	56 28.0 N	20 00.0 W	CLOUDY	10	147	23	8	10	#	#	#	13.0	998.0	13.6
	9:00	+00	56 16.5 N	20 00.0 W	HAZE	10	150	22	8	10	#	#	#	14.0	999.0	13.0
	10:00	+00			HAZE	10	150	23	8	10	#	#	#	14.5	997.5	13.0
	11:00	+00			HAZE	10	150	24	8	10	#	#	#	14.5	997.7	13.0
	12:00	+00	55 47.5 N	20 00.3 W	HAZE	8	150	25	8	10	#	#	#	14.5	997.2	12.5
	13:00	+00			HAZE	6	160	29	8	10	#	#	#	14.5	997.2	12.5
	14:00	+00			HAZE	6	160	26	8	10	#	#	#	14.5	997.1	12.7
	15:00	+00	55 24.5 N	19 52.0 W	HAZE	6	170	32	8	10	#	#	#	14.5	997.2	12.8
	16:00	+00	55 14.3 N	19 42.5 W	HAZE	6	170	28	10	10	#	#	#	14.4	997.5	12.4
	17:00	+00			HAZE	6	170	28	10	10	#	#	#	14.4	997.2	12.8
	18:00	+00	55 00.9 N	19 29.6 W	HAZE	6	170	28	10	10	#	#	#	14.4	997.0	12.8
	19:00	+00			HAZE	6	170	28	11	11	#	#	#	14.4	997.5	12.8
	20:00	+00	54 46.0 N	19 09.5 W	HAZE	6	175	25	11	14	#	#	#	14.0	997.4	12.8
	21:00	+00	54 39.0 N	19 00.0 W	HAZE	6	178	27	12	15	#	#	#	14.4	997.5	12.8
	22:00	+00			HAZE	6	175	25	12	14	#	#	#	14.0	998.5	12.8
	23:00	+00			HAZE	6	175	25	12	14	#	#	#	12	24	24
	N															

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (M)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE HEIGHT (FEET) (TRUE)	WAVE HEIGHT MIN (FEET) (TRUE)	WAVE HEIGHT MAX (FEET) (TRUE)	SWELL DRY (FEET)	SWELL HEIGHT MAX (FEET) (TRUE)	SEA TEMP (C)	DRY TEMP (C)	WET TEMP (C)	BAROM. (HPA)
18-AUG-88	00:00	54 16.0 N	10 32.6 W	CLOUDY	8	180	2.6	12	12	8	8	#	#	14.4	998.0	14.0	12.6
	1:00	+0.5	54 16.0 N	10 32.6 W	CLOUDY	10	170	2.6	10	10	8	#	#	14.4	997.5	14.2	13.5
	2:00	+0.0	54 16.0 N	10 32.6 W	CLOUDY	12	170	2.6	10	10	8	#	#	14.4	998.0	14.2	13.6
	3:00	+0.0	53 51.2 N	10 02.0 W	HAZE	10	170	2.6	8	10	8	#	#	14.4	997.5	14.2	13.5
	4:00	+0.0	53 41.6 N	10 53.6 W	HAZE	10	180	2.1	10	10	8	0	0	15.0	997.0	15.0	12.8
	5:00	+0.0	53 41.6 N	10 53.6 W	HAZE	10	170	1.6	10	10	8	0	0	15.0	997.0	15.0	12.8
	6:00	+0.0	53 25.3 N	11 28.5 W	HAZE	8	190	2.4	10	10	8	0	0	15.0	996.0	13.3	11.3
	7:00	+0.0	53 08.0 N	11 11.0 W	HAZE	8	190	1.9	9	9	8	0	0	15.0	996.5	13.9	12.2
	8:00	+0.0	53 08.0 N	11 11.0 W	CLOUDY	8	190	2.0	9	10	8	0	0	15.0	996.0	14.0	12.9
	9:00	+0.0	52 52.0 N	11 00.0 W	RAIN	6	185	2.1	9	10	8	#	#	15.0	996.4	14.0	12.7
	10:00	+0.0	52 52.0 N	11 00.0 W	RAIN	6	203	2.0	9	10	8	#	#	15.0	997.0	14.0	12.7
	11:00	+0.0	52 52.0 N	11 00.0 W	RAIN	10	214	2.2	8	10	8	#	#	15.0	997.0	14.0	12.7
	12:00	+0.0	52 23.0 N	11 59.6 W	HAZE	7	210	2.6	8	10	8	#	#	15.0	997.2	13.8	13.3
	13:00	+0.0	51 48.2 N	11 00.0 W	HAZE	7	210	2.4	8	10	8	#	#	15.0	997.6	13.8	13.3
	14:00	+0.0	51 36.5 N	11 00.0 W	HAZE	8	220	2.4	8	10	8	#	#	15.0	997.8	14.3	13.5
	15:00	+0.0	51 48.2 N	11 00.0 W	HAZE	8	215	2.4	8	8	8	#	#	15.6	998.1	14.4	13.4
	16:00	+0.0	51 36.5 N	11 00.0 W	PTLY CLOUDY	8	220	2.3	8	8	8	#	#	16.1	997.8	15.0	12.8
	17:00	+0.0	51 36.5 N	11 00.0 W	RAIN	10	226	2.3	9	9	9	0	0	16.1	998.2	15.0	12.8
	18:00	+0.0	51 15.5 N	11 02.2 W	HAZE	8	240	2.6	10	10	8	#	#	16.1	998.2	15.0	12.5
	19:00	+0.0	50 57.2 N	11 13.0 W	HAZE	8	240	2.5	10	10	8	#	#	16.1	998.2	15.0	12.8
	20:00	+0.0	50 57.2 N	11 13.0 W	CLOUDY	8	250	2.7	10	10	12	#	#	16.1	998.9	14.0	12.8
	21:00	+0.0	50 57.2 N	11 13.0 W	CLOUDY	8	250	2.2	10	12	8	#	#	16.1	999.9	14.0	12.8
	22:00	+0.0	50 57.2 N	11 13.0 W	CLOUDY	8	250	2.3	10	12	8	#	#	16.1	1000.1	13.5	12.8
	23:00	+0.0	50 57.2 N	11 13.0 W	CLOUDY	8	250	2.8	10	12	8	#	#	15.6	1002.0	13.5	12.8
	N	24	24	24		24	24	24	24	24	24	0	0	9	24	24	24

B-32

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (M.)	DTR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN (FEET)	WAVE MAX (FEET)	WAVE HEIGHT (FEET)	SWELL DIR. (TRUE)	SWELL MAX (FEET)	SEA STATE	HEIGHT (FEET)	DRY TEMP (°C)	WET TEMP (°C)
19-AUG-88	00:00	+00	50 27.0 N	17 31.1 W	CLOUDY	8	250	28	10	12	#	#	#	15.6	1003.0	13.5	
	1:00	+00			CLOUDY	10	270	30	8	12	#	#	#	16.2	1004.1	14.3	
	2:00	+00			CLOUDY	10	270	32	8	12	#	#	#	16.2	1004.4	14.3	
	3:00	+00	49 53.5 N	17 58.5 W	CLOUDY	10	270	36	8	12	#	#	#	16.2	1005.3	14.5	
	4:00	+00	49 53.5 N	17 58.5 W	FILY CLDY	10	280	28	15	15	#	#	#	16.7	1006.2	14.4	
	5:00	+00			FILY CLDY	10	280	27	15	15	#	#	#	16.7	1007.0	14.4	
	6:00	+00	49 37.8 N	18 14.2 W	FILY CLDY	8	260	27	15	15	#	#	#	16.7	1007.8	15.0	
	7:00	+00	49 28.0 N	18 30.0 W	FILY CLDY	10	280	26	15	15	#	#	#	16.7	1008.5	15.0	
	8:00	+00	49 28.0 N	18 30.0 W	CLOUDY	10	280	22	10	14	#	#	#	16.7	1010.0	15.0	
	9:00	+00	49 15.0 N	18 38.5 W	CLOUDY	10	287	22	10	14	#	#	#	16.2	1011.1	15.0	
	10:00	+00			CLOUDY	10	288	23	10	14	#	#	#	16.2	1012.6	15.6	
	11:00	+00			CLOUDY	10	277	20	10	12	#	#	#	16.2	1012.5	14.4	
	12:00	+00	48 56.1 N	18 59.6 W	CLOUDY	10	270	22	10	10	#	#	#	16.2	1013.8	15.0	
	13:00	+00			FILY CLDY	10	270	20	8	10	#	#	#	16.2	1013.8	15.0	
	14:00	+00			FILY CLDY	10	280	24	8	8	#	#	#	16.8	1015.4	15.6	
	15:00	+00	48 26.5 N	19 30.6 W	FILY CLDY	10	270	20	6	8	#	#	#	16.2	1016.2	15.6	
	16:00	+00	48 16.8 N	19 42.7 W	CLOUDY	10	290	20	6	8	#	#	#	17.2	1016.5	17.2	
	17:00	+00			CLOUDY	10	290	20	6	8	#	#	#	17.2	1017.5	17.2	
	18:00	+00	48 00.0 N	20 00.0 W	CLOUDY	10	290	20	7	7	#	#	#	17.2	1018.0	17.2	
	19:00	+00			CLOUDY	10	280	20	7	7	#	#	#	17.2	1019.0	17.2	
	20:00	+00			CLOUDY	10	290	16	7	8	#	#	#	17.2	1019.2	15.6	
	21:00	+00	47 33.0 N	20 00.0 W	CLOUDY	10	290	15	7	8	#	#	#	17.2	1020.0	15.6	
	22:00	+00			CLOUDY	10	310	13	7	8	#	#	#	17.2	1020.5	15.6	
	23:00	+00			CLOUDY	10	315	13	7	8	#	#	#	17.2	1021.0	14.0	
	24	24			24	24	24	24	24	24	0	0	0	24	24	24	

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MARYCELLA DECK LOG DATA

DATE	TIME	TIME ZONE	LATITUDE	LONGITUDE	PRESSTEST	WEATHER	WIND DIR:	WIND SPEED (KNOTS)	WAVE MIN (FEET)	WAVE MAX (FEET)	SWELL DIR:	SWELL HEIGHT (FEET)	SEA STATE	WIND DRY TEMP (°C)	WIND WET TEMP (°C)	BAROM: (HPA)
					(MI)	(TRUE)	(TRUE)	(TRUE)	(FEET)	(FEET)	(TRUE)	(FEET)				
20-AUG-88	0	+00	47° 00'.0 N	20° 00'.0 W	CLOUDY	CLOUDY	10	310	12	5	5	5	#	17.2	1021.4	13.9
	17:00	+00			CLOUDY	CLOUDY	10	310	12	9	4	4	#	#	1021.4	14.9
	21:00	+00					10	290	10	4			#	#	1021.8	14.1
																13.2
	3:00	+00	46° 21'.0 N	20° 00'.0 W	CLOUDY	CLOUDY	10	295	6	3	3	3	#	18.3	1021.9	16.1
	4:00	+00	46° 09'.1 N	19° 59'.8 W	CLOUDY	CLOUDY	10	230	8	0	0	0	#	18.3	1021.6	16.7
	5:00	+00														16.7
	6:00	+00	46° 00'.0 N	20° 01'.0 W	CLOUDY	CLOUDY	10	210	6	0	0	0	#	18.3	1021.2	14.4
	7:00	+00					10	210	6							
	8:00	+00	45° 57'.9 N	20° 00'.0 W	HAZE	HAZE	8	205	6							
	9:00	+00	45° 57.6 N	20° 00'.0 W	FOG	FOG	4	180	6							
	10:00	+00			FOG	FOG	1	190	7							
	11:00	+00			FOG	FOG	3	145	12							
	12:00	+00	45° 32'.9 N	20° 00'.0 W	FOG	FOG	2	170	10	0	11	310	3	18.6	1022.1	17.7
	13:00	+00			FOG	FOG	0	210	10	0	11	310	3	18.3	1022.1	17.7
	14:00	+00			FOG	FOG	0	230	14	1	1	300	3	18.3	1022.1	17.5
	15:00	+00	45° 53'.5 N	20° 01'.0 W	FOG	FOG	9	230	14	1	2	300	2	18.3	1022.2	18.3
	16:00	+00	44° 38'.2 N	20° 00'.7 W	FOG	FOG	0	250	13	1	1	300	2	19.4	1022.2	17.8
	17:00	+00			FOG	FOG	0	250	13	1	1	300	2	19.4	1022.2	17.9
	18:00	+00	44° 13.0 N	20° 00'.0 W	FOG	FOG	0	260	12	1	1	300	2	19.4	1022.8	21.1
	19:00	+00			FOG	FOG	0	260	13	1	1	300	2	19.4	1022.8	20.0
	20:00	+00	43° 59.8 N	20° 01'.4 W	FOG	FOG	0	259	12	1	1	300	2	19.4	1023.2	18.8
	21:00	+00	43° 50.9 N	20° 02'.0 W	FOG	FOG	0	266	12	1	1	300	2	19.4	1023.9	18.4
	22:00	+00			FOG	FOG	0	265	12	1	1	295	2	19.4	1024.0	18.4
	23:00	+00			FOG	FOG	0	290	12	1	1	295	2	19.4	1024.5	17.8
N	24	24			24	24	23	24	19	19	19	19	22	24	24	24

* = MISSING DATUM

1988 GLOBAL ORANGE CRUISE
NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	TIME ZONE	LATITUDE	LONGITUDE	PRESNT WEATHER	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN. (FEET)	WAVE MAX. (FEET)	SWELL DIR. (TRUE)	SWELL MIN. (FEET)	SWELL MAX. (FEET)	SEA STATE	DRY TEMP. (°C)	WET TEMP. (°C)	BAROM. (HPA)
21-AUG-88	00:00	+00	43 16.0 N	20 01.0 W	FOG	0	270	6	1	1	#	#	#	19.4	18.6	1024.6
	1:00	+00			FOG	0	260	10	2	2	#	#	#	21.2	18.5	1025.4
	2:00	+00			FOG	0	250	10	2	2	#	#	#	21.6	18.4	1025.5
	3:00	+00	42 41.0 N	20 00.0 W	FOG	0	250	8	2	1	1	1	1	21.6	18.8	1025.4
	4:00	+00	42 30.5 N	20 00.0 W	FOG	0	290	11	1	1	1	1	1	22.2	18.0	1025.0
	5:00	+00			FOG	0	290	12	1	1	1	1	1	22.2	18.0	1025.0
	6:00	+00	42 07.8 N	20 00.0 W	HAZE	1	300	12	1	1	1	1	1	22.2	18.0	1025.2
	7:00	+00			HAZE	1	300	12	1	1	1	1	1	22.2	18.0	1025.2
	8:00	+00	42 00.0 N	20 00.0 W	HAZE	6	305	14	2	2	1	1	1	22.0	18.0	1025.5
	9:00	+00	41 57.0 N	20 01.7 W	HAZE	10	315	9	1	2	1	1	1	22.0	18.0	1025.5
	10:00	+00			HAZE	10	320	8	1	2	1	1	1	22.7	18.0	1027.0
	11:00	+00			HAZE	10	320	8	1	2	1	1	1	22.7	18.0	1027.2
	12:00	+00	41 20.2 N	19 59.6 W	PTLY CLDY	10	330	6	1	1	1	1	1	22.7	18.6	1027.9
	13:00	+00			CLODY	10	350	6	1	1	1	1	1	22.7	18.6	1028.0
	14:00	+00			CLODY	10	330	10	1	1	1	1	1	24.4	20.6	1028.0
	15:00	+00	40 38.0 N	20 00.0 W	CLOUDY	10	30	8	1	1	1	1	1	24.4	20.6	1027.9
	16:00	+00	40 18.7 N	20 00.2 W	CLOUDY	10	30	9	1	1	1	1	1	24.4	20.6	1027.9
	17:00	+00			PTLY CLDY	10	20	10	1	1	1	1	1	24.4	20.6	1027.9
	18:00	+00	40 00.0 N	20 00.0 W	PTLY CLDY	10	30	8	1	1	1	1	1	24.4	20.6	1027.8
	19:00	+00			PTLY CLDY	10	10	14	2	2	2	2	2	24.4	20.6	1027.8
	20:00	+00	39 54.0 N	20 00.0 W	CLOUDY	10	25	11	1	1	1	1	1	24.4	20.6	1027.9
	21:00	+00	39 42.0 N	20 00.0 W	CLOUDY	10	37	12	1	2	2	2	2	25.0	21.1	1028.6
	22:00	+00			CLOUDY	10	37	12	1	2	2	2	2	25.0	21.0	1028.6
	23:00	+00			CLOUDY	10	46	12	1	2	2	2	2	25.0	21.0	1028.6
	24	24				24	24	24	24	24	14	14	14	24	24	24

= MISSING DATUM

NOAA SHEP ME, MITCHELL, DECK LOG DATA
1988 GLICELA CHANGING CRUISE

MISSING DATA

1988 GLOBAL CHANGE CRUISE
NOAA SHIP R/V MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESNT WEATHER	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN (FEET)	WAVE MAX (FEET)	SWELL DIR. (TRUE)	SWELL MIN (FEET)	SWELL MAX (FEET)	SEA STATE	SWELL HEIGHT (FEET)	SEA TEMP (C)	DRY TEMP (C)	NET TEMP (C)
23-AUG-88	0:00	36 36.0 N	21 32.0 W	CLOUDY	10	50	12	3	3	3	#	#	#	25.0	1028.7	23.4	21.6	
	1:00	+00 36 36.0 N	21 32.0 W	CLOUDY	10	50	12	1	2	2	#	#	#	25.0	1028.4	23.6	21.4	
	2:00	+00 36 36.0 N	21 32.0 W	CLOUDY	10	50	12	1	2	2	#	#	#	26.1	1028.1	23.1	21.4	
	3:00	+00 36 36.0 N	21 32.0 W	CLOUDY	10	50	12	1	2	2	#	0	0	26.1	1027.8	25.0	21.0	
	4:00	+00 36 36.0 N	21 32.0 W	CLOUDY	10	50	11	2	2	2	#	0	0	26.1	1027.8	25.0	21.0	
	5:00	+00 36 36.0 N	21 32.0 W	CLOUDY	10	40	10	2	2	2	#	0	0	26.1	1027.8	25.0	21.0	
	6:00	+00 37 02.9 N	23 23.9 W	CLOUDY	10	40	11	2	2	2	#	0	0	26.1	1028.2	25.6	21.6	
	7:00	+00 37 07.0 N	23 39.0 W	CLOUDY	10	35	11	2	2	2	#	0	0	26.1	1028.5	24.4	21.1	
	8:00	+00 37 07.0 N	23 39.0 W	CLOUDY	10	35	12	3	3	3	#	0	0	26.1	1028.9	24.4	21.6	
	9:00	+00 37 11.5 N	23 55.0 W	CLOUDY	10	38	12	3	3	3	#	#	#	26.1	1029.5	24.2	22.0	
	10:00	+00 37 26.7 N	24 44.7 W	PTLY CLDY	10	55	11	3	3	3	#	#	#	26.1	1030.0	25.0	22.7	
	11:00	+00 37 44.2 N	25 39.5 W	PTLY CLDY	10	55	10	3	3	3	#	#	#	26.1	1030.0	25.0	22.7	
	12:00	+00 37 30.9 N	24 59.9 W	PTLY CLDY	10	53	7	3	3	3	#	#	#	26.1	1030.4	25.5	22.7	
	13:00	+00 37 44.2 N	25 39.5 W	PTLY CLDY	10	55	8	4	4	4	#	#	#	26.1	1030.2	25.5	22.7	
	14:00	+00 37 44.2 N	25 39.5 W	PTLY CLDY	10	60	6	6	6	6	#	#	#	26.1	1030.2	25.5	22.7	
N	15 15 15	15:	15:			15	15	15	13	13	0	0	0	4	4	15	15	15

= MISSING DATUM

1986 GLOBAL CHANGE CRUISE
NOAA SHIP M/T. MITCHELL DECK LOG DATA

DATE	TIME	GMT ZONE	LATITUDE	LONGITUDE	PRESNT WEATHER	VIS. (M)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN. (FEET)	WAVE MAX. (FEET)	SWELL DIR. (TRUE)	SWELL MIN. (FEET)	SWELL MAX. (FEET)	SEA TEMP (C)	DRY TEMP (C)	WET TEMP (C)
25-AUG-88	11:00	+01	37 44.2 N	25 39.5 W	PTLY	CLOUDY	10	80	12	0	#	#	#	25.6	1024.2	23.8
	12:00	+01	37 22.0 N	25 52.0 W	PTLY	CLOUDY	10	70	12	1	#	#	0	25.6	1024.0	24.4
	13:00	+01	37 09.7 N	25 57.1 W	PTLY	CLOUDY	10	70	12	1	#	0	0	26.7	1023.8	26.1
	14:00	+01	36 47.4 N	26 09.1 W	PTLY	CLOUDY	10	60	13	1	#	0	0	26.7	1023.8	25.8
	15:00	+01	36 09.0 N	26 30.0 W	PTLY	CLOUDY	10	70	14	1	#	0	0	26.7	1023.5	25.8
	16:00	+01	35 58.0 N	26 36.0 W	PTLY	CLOUDY	10	60	13	2	#	0	0	26.7	1023.0	25.8
	17:00	+01	36 24.0 N	26 25.0 W	PTLY	CLOUDY	10	58	13	2	#	#	0	26.7	1023.0	27.7
	18:00	+01	36 06.8 N	26 41.0 W	PTLY	CLOUDY	10	60	10	2	#	#	0	26.7	1022.1	27.7
	19:00	+01	35 45.0 N	26 42.0 W	PTLY	CLOUDY	10	55	13	2	#	#	0	26.7	1021.9	26.7
	20:00	+01	36 06.8 N	26 41.0 W	PTLY	CLOUDY	10	58	13	2	#	#	0	26.7	1021.9	26.7
	21:00	+01	36 06.8 N	26 41.0 W	CLOUDY	CLOUDY	10	40	13	3	#	#	0	26.7	1021.9	26.7
	22:00	+01	36 06.8 N	26 41.0 W	CLOUDY	CLOUDY	10	40	13	3	#	#	0	26.7	1022.1	26.4
	23:00	+01			CLOUDY	CLOUDY	10	40	13	3	#	#	0	26.7	1022.2	26.4
	N	13 13	13	13			13	13	13	0	4	4	4	23	13	13

= MISSING DATA

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (MI)	WIND DIR., (TRUE)	WIND SPEED (KNOTS)	WAVE HEIGHT (FEET)	SWELL DIREC. (TRUE)	SWELL HEIGHT (FEET)	SEA MAX. (FEET)	DRY TEMP. (C)	WET TEMP. (C)
		GMT												
26-MNG-68.	0	+01	36° 46.3' N	26° 45.0' W	CLOUDY	10	40	14	3	#	#	2.5	22.3	21.1
	1:00	+01	37° 00.8' N	26° 47.4' W	CLOUDY	10	60	10	3	3	3	2.5	21.5	20.6
	2:00	+01			CLOUDY	10	60	10	3	3	3	2.5	21.5	20.6
	3:00	+01	37° 19.5' N	26° 48.0' W	PTLY CLDY	10	40	11	3	3	3	2.5	21.5	20.6
	4:00	+01			PTLY CLDY	10	60	9	2	3	3	2.5	21.5	20.6
	5:00	+01			PTLY CLDY	10	60	4	2	3	3	2.5	21.5	20.6
	6:00	+01	38° 09.0' N	26° 53.0' W	PTLY CLDY	10	50	3	3	3	3	2.5	21.5	20.6
	7:00	+01	38° 22.0' N	26° 53.0' W	PTLY CLDY	10	50	3	3	3	3	2.5	21.5	20.6
	8:00	+01			PTLY CLDY	10	220	10	4	4	4	2.5	21.5	20.6
	9:00	+01			PTLY CLDY	10	160	6	4	4	4	2.5	21.5	20.6
	10:00	+01			PTLY CLDY	10	170	4	4	4	4	2.5	21.5	20.6
	11:00	+01			PTLY CLDY	10	170	4	4	4	4	2.5	21.5	20.6
	12:00	+01	38° 42.9' N	27° 00.7' W	CLOUDY	10	180	14	0	1	1	2.5	22.3	21.4
	13:00	+01	38° 42.2' N	27° 00.0' W	PTLY CLDY	10	200	14	1	1	1	2.5	22.3	21.4
	14:00	+01			PTLY CLDY	10	220	17	2	2	2	2.5	22.3	21.4
	15:00	+01	38° 40.0' N	26° 59.0' W	PTLY CLDY	10	220	16	2	2	2	2.5	22.3	21.4
	16:00	+01			PTLY CLDY	10	130	10	6	6	6	2.5	22.3	21.4
	17:00	+01	38° 41.5' N	27° 00.2' W	PTLY CLDY	10	10	6	6	6	6	2.5	22.3	21.4
	18:00	+01	38° 27.0' N	27° 04.0' W	PTLY CLDY	10	260	19	3	3	3	2.5	22.3	21.4
	19:00	+01	38° 14.0' N	27° 10.0' W	PTLY CLDY	10	230	14	3	3	3	2.5	22.3	21.4
	20:00	+01			PTLY CLDY	10	230	13	3	3	3	2.5	22.3	21.4
	21:00	+01	37° 47.2' N	27° 19.2' W	PTLY CLDY	10	250	12	3	3	3	2.5	22.3	21.4
	22:00	+01			CLDY PTLY	10	250	12	3	3	3	2.5	22.3	21.4
	23:00	+01			CLDY PTLY	10	250	12	3	3	3	2.5	22.3	21.4
	24:00	+01			CLDY PTLY	10	24	24	3	3	3	2.5	22.3	21.4
	24	+01										10	24	24

= MISSING DATUM

**1988 GLOBAL CHANGE CRUISE
NOAA SITE MT. MITCHELL DECK LOG DATA**

DATE	TIME	TIME		PRESENT WEATHER		VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE HEIGHT (FEET)	SWELL DIR. (TRUE)	SWELL HEIGHT (FEET)	SEA STATE (O)	DRY TEMP. (°C)	WET TEMP. (°C)
		ZONE	LATITUDE	LONGITUDE	WEATHER									
27-AUG-88	00:00	402	37 42.2 N	27 39.0 W	PFTLY CLOUDY	10	250	10	2	5	6	6	23.8	22.6
	00:02	402	37 00.2 N	27 43.2 W	PFTLY CLOUDY	10	260	8	2	2	0	0	26.2	21.4
	02:00	402	36 38.0 N	27 56.0 W	PFTLY CLOUDY	10	240	7	2	2	0	0	26.7	21.4
	04:00	402	36 00.0 N	27 40.0 W	PFTLY RAIN	8	250	8	2	2	0	0	26.7	21.4
	05:00	402	36 01.8 N	28 09.5 W	CLOUDY	10	220	9	2	2	0	0	26.7	21.7
	06:00	402	36 02.0 N	28 18.0 W	CLOUDY	10	230	6	2	2	0	0	26.7	21.7
	07:00	402	36 39.0 N	28 18.0 W	CLOUDY	10	255	8	2	2	0	0	26.7	22.5
	08:00	402	36 27.0 N	28 28.5 W	CLOUDY	10	240	8	1	2	0	0	26.7	22.5
	09:00	402	36 12.0 N	28 35.0 W	CLOUDY	10	230	9	1	1	0	0	26.7	22.5
	10:00	402	36 00.0 N	28 40.7 W	PFTLY CLOUDY	10	240	10	1	1	0	0	26.7	22.5
	11:00	402	35 01.0 N	28 40.7 W	PFTLY CLOUDY	10	220	8	0	0	0	0	26.7	22.5
	12:00	402	35 01.0 N	28 40.7 W	PFTLY CLOUDY	10	230	7	0	0	0	0	26.7	22.5
	13:00	402	34 39.0 N	28 50.5 W	PFTLY CLOUDY	10	250	7	0	0	0	0	27.8	22.2
	14:00	402	34 17.0 N	28 37.0 W	PFTLY CLOUDY	10	230	6	0	0	0	0	27.8	22.2
	15:00	402	34 00.0 N	28 37.0 W	PFTLY CLOUDY	10	230	7	0	0	0	0	27.8	22.2
	16:00	402	33 46.0 N	29 15.0 W	CLOUDY	10	205	2	0	0	0	0	27.8	22.2
	17:00	402	33 25.0 N	29 23.0 W	CLOUDY	10	205	1	0	0	0	0	27.8	22.2
	18:00	402	33 19.0 N	29 30.0 W	PFTLY CLOUDY	10	210	0	0	0	0	0	27.8	22.2
	19:00	402	33 00.0 N	29 36.5 W	PFTLY HAZE	8	210	0	0	0	0	0	27.8	22.4
	20:00	402	33 00.0 N	29 40.0 W	HAZE	8	200	0	0	0	0	0	27.8	22.4
	21:00	402	33 00.0 N	29 44.0 W	HAZE	8	190	0	0	0	0	0	27.8	22.4
	22:00	402	33 00.0 N	29 48.0 W	HAZE	8	180	0	0	0	0	0	27.8	22.4
	23:00	402	33 00.0 N	29 52.0 W	HAZE	8	170	0	0	0	0	0	27.8	22.4
	24	24	24	24		24	24	24	21	18	18	14	19	24

MISSING DATA

1988 - GLOBAL CHANGE CRUISE
NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	GMT ZONE	LATITUDE	LONGITUDE	PRESNT WEATHER	VIS. (MI.)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN. (FEET)	WAVE MAX. (FEET)	WAVE HEIGHT (FEET)	SWELL DIR. (TRUE)	SWELL MIN. (FEET)	SWELL MAX. (FEET)	SEA TEMP (C)	BAROM. (HPA)	DRY TEMP (C)	WET TEMP (C)
28-AUG-88	0	+02	32 36.5 N	29 50.7 W	RAZE CLOUDY	8	190	3	#	#	80	1	1	1	27.3	1022.9	23.8	22.4
	1:00	+02	32 11.9 N	30 01.6 W	CLOUDY	10	20	4	0	0	90	1	1	1	27.3	1022.9	23.8	22.4
	2:00	+02	31 59.0 N	30 05.5 W	CLOUDY	10	40	5	0	0	90	1	1	1	26.7	1022.2	24.8	21.1
	3:00	+02	31 59.0 N	30 05.5 W	CLOUDY	10	50	6	0	0	90	1	1	1	26.7	1021.5	25.0	21.1
	4:00	+02	31 59.0 N	30 05.5 W	CLOUDY	10	70	7	0	0	90	1	1	1	26.7	1021.0	24.9	21.1
	5:00	+02	31 22.0 N	30 19.0 W	PTLY CLDY	10	70	13	#	#	90	1	1	1	26.7	1020.9	24.0	22.0
	6:00	+02	31 22.0 N	30 19.0 W	PTLY CLDY	10	65	15	2	2	90	1	1	1	26.7	1021.0	23.4	22.2
	7:00	+02	30 56.5 N	30 20.8 W	PTLY CLDY	10	70	14	2	2	90	1	1	1	26.7	1021.2	23.4	22.2
	8:00	+02	30 56.5 N	30 20.8 W	PTLY CLDY	10	70	10	2	2	90	1	1	1	26.7	1021.2	23.4	22.2
	9:00	+02	30 44.1 N	30 35.0 W	PTLY CLDY	10	60	14	2	2	90	1	1	1	26.7	1021.9	23.4	22.2
	10:00	+02	30 33.3 N	30 41.0 W	PTLY CLDY	10	80	16	2	2	90	1	1	1	26.7	1022.1	23.8	22.3
	11:00	+02	30 29.0 N	30 42.0 W	PTLY CLDY	10	60	12	1	2	90	1	1	1	26.7	1022.6	25.4	23.3
	12:00	+02	30 29.0 N	30 42.0 W	PTLY CLDY	10	60	12	1	2	90	1	1	1	26.2	1022.2	26.7	23.3
	13:00	+02	30 08.9 N	30 52.0 W	PTLY CLDY	10	80	15	2	2	90	1	1	1	26.1	1022.2	26.7	23.3
	14:00	+02	29 58.5 N	30 56.0 W	PTLY CLDY	10	80	13	2	2	90	1	1	1	26.1	1022.9	26.1	21.1
	15:00	+02	29 58.5 N	30 56.0 W	PTLY CLDY	10	70	14	3	3	90	1	1	1	26.1	1022.9	26.1	21.1
	16:00	+02	29 58.5 N	30 56.0 W	PTLY CLDY	10	60	13	3	3	90	1	1	1	26.1	1021.2	26.7	21.4
	17:00	+02	29 17.5 N	31 17.0 W	PTLY CLDY	10	50	15	3	3	90	1	1	1	26.1	1021.0	27.2	21.4
	18:00	+02	28 39.0 N	31 33.0 W	PTLY CLOUDY	10	50	14	3	3	90	1	1	1	26.1	1021.2	26.4	25.0
	19:00	+02	28 27.9 N	31 33.0 W	PTLY CLOUDY	10	50	15	3	3	90	1	1	1	26.1	1021.2	28.4	25.0
	20:00	+02	28 09.1 N	31 43.6 W	PTLY CLOUDY	10	50	17	2	2	90	1	1	1	26.1	1021.4	24.4	22.0
	N																	
	24	24																

D-14

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP M/T MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRES.	VIS. (M)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN (FEET)	WAVE MAX (FEET)	SWELL DIR. (TRUE)	SWELL MAX (FEET)	SEA TEMP (C)	DRY TEMP (C)	WET TEMP (C)
28-AUG-88	00:00	+02			PTLY	CLDY	10	50	17	2	#	#	26.6	10121.2	23.6
	1:00	+02	33.6 N	54.1 W	PTLY	CLDY	10	50	16	2	#	#	26.6	10220.7	25.6
	2:00	+02	32	03.2 W	PTLY	CLDY	10	60	18	3	#	0	26.7	10220.0	25.6
	3:00	+02	32	03.2 W	PTLY	CLDY	10	60	19	3	3	0	26.7	10119.9	25.0
	4:00	+02			PTLY	CLDY	10	60	18	4	4	0	26.7	10118.8	25.0
	5:00	+02			PTLY	CLDY	10	60	18	4	4	0	26.7	10118.2	25.0
	6:00	+02	43.0 N	32 17.0 W	CLOUDY	CLOUDY	10	70	19	4	4	0	26.7	10118.2	24.5
	7:00	+02	32	31.5 W	CLOUDY	CLOUDY	10	60	18	4	4	0	26.7	10118.0	24.5
	8:00	+02	22.0 N	32 31.5 W	CLOUDY	CLOUDY	10	60	16	4	4	2	26.7	10118.0	24.5
	9:00	+02	26 09.0 N	32 38.0 W	CLOUDY	CLOUDY	10	60	16	4	4	0	26.7	10118.0	24.5
	10:00	+02	32 38.0 W	HAZE	HAZE	8	70	16	4	4	4	2	26.7	10118.1	24.4
	11:00	+02	32 43.4 W	HAZE	HAZE	8	60	18	4	4	4	2	26.7	10118.0	24.4
	12:00	+02			HAZE	HAZE	6	60	18	4	4	2	26.7	10117.9	24.5
	13:00	+02	25 27.7 N	32 56.9 W	HAZE	HAZE	8	60	16	3	3	0	26.2	10117.9	24.5
	14:00	+02	15.5 N	33 02.0 W	HAZE	HAZE	8	60	19	4	4	0	26.1	10117.2	24.7
	15:00	+02	32	00.0 W	HAZE	HAZE	8	50	17	4	4	0	26.1	10116.5	24.7
	16:00	+02			HAZE	HAZE	8	60	18	4	4	0	26.1	10116.0	24.7
	17:00	+02			HAZE	HAZE	8	50	18	4	4	0	26.1	10115.8	24.7
	18:00	+02	24 36.0 N	33 15.0 W	HAZE	HAZE	8	50	17	4	4	0	26.7	10115.8	25.6
	19:00	+02			CLOUDY	CLOUDY	8	60	18	4	4	0	26.7	10114.9	25.6
	20:00	+02	24 11.0 N	33 25.0 W	CLOUDY	CLOUDY	8	50	18	4	4	0	26.7	10114.9	25.6
	21:00	+02	23 58.5 N	33 30.0 W	CLOUDY	CLOUDY	8	50	18	5	5	3	26.7	10115.2	25.3
	22:00	+02			HAZE	HAZE	9	60	16	5	5	3	26.7	10115.1	25.3
	23:00	+02			HAZE	HAZE	8	60	16	4	4	4	26.7	10116.0	25.6
N	24	24	24	24			24	24	24	9	18	18	24	24	24

= MISSING DATA

1988 GLOBAL CHANGE CRUISE DATA
NOAA SHIP MT. MITCHELL DECK LOG

DATE	TIME	TIME ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN (FEET)	WAVE MAX (FEET)	HEIGHT (FEET)	SWELL DIR. (TRUE)	SWELL MIN (FEET)	SWELL MAX (FEET)	SEA TEMP (C)	DRY TEMP. (C)	WET TEMP. (C)
30-AUG-88	0	+02	23 23.6 N	33 44.1 W	HAZE	8	60	16	4	4	#	#	#	26.2	1016.0	25.6	22.8
	1:00	+02	22 55.0 N	33 54.0 W	HAZE	8	60	16	4	4	#	#	#	26.2	1015.8	25.6	22.8
	2:00	+02	22 55.0 N	33 54.0 W	HAZE	8	60	18	4	4	#	#	#	26.1	1015.2	25.6	22.8
	3:00	+02	22 43.2 N	33 59.0 W	HAZE	8	60	20	5	5	#	#	#	26.7	1014.5	25.6	22.8
	4:00	+02	22 43.2 N	33 59.0 W	HAZE	8	70	22	5	5	#	#	#	26.7	1014.0	25.6	22.8
	5:00	+02	22 43.2 N	33 59.0 W	HAZE	8	70	20	5	5	#	#	#	26.7	1013.8	25.6	22.8
	6:00	+02	22 06.5 N	34 14.5 W	HAZE	8	55	19	5	5	#	#	#	26.7	1013.0	25.0	22.8
	7:00	+02	21 59.0 N	34 14.5 W	CLOUDY	8	60	18	5	5	#	#	#	26.7	1013.0	25.0	22.8
	8:00	+02	21 28.5 N	34 30.0 W	HAZE	8	55	18	5	5	#	#	#	26.7	1013.0	25.5	24.0
	9:00	+02	21 28.5 N	34 30.0 W	HAZE	8	55	28	5	5	#	#	#	26.7	1013.2	25.5	24.0
	10:00	+02	20 40.4 N	34 49.7 W	HAZE	6	70	16	4	4	#	#	#	26.7	1014.0	25.6	24.4
	11:00	+02	20 40.4 N	34 49.7 W	HAZE	6	70	18	4	4	#	#	#	26.7	1014.2	25.6	24.4
	12:00	+02	21 10.3 N	34 36.8 W	HAZE	6	80	18	4	4	#	#	#	26.7	1014.2	25.6	24.4
	13:00	+02	20 40.4 N	34 49.7 W	HAZE	6	80	24	4	4	#	#	#	26.7	1014.1	26.6	23.9
	14:00	+02	20 40.4 N	34 49.7 W	HAZE	6	70	28	4	4	#	#	#	27.2	1014.0	27.5	23.9
	15:00	+02	20 27.0 N	34 54.0 W	HAZE	6	70	18	4	4	#	#	#	27.2	1013.5	27.2	23.9
	16:00	+02	20 27.0 N	34 54.0 W	HAZE	6	80	16	4	4	#	#	#	27.2	1012.8	27.2	23.9
	17:00	+02	20 27.0 N	34 54.0 W	HAZE	6	70	20	4	4	#	#	#	27.2	1012.5	27.2	23.9
	18:00	+02	19 47.0 N	35 10.0 W	HAZE	6	65	18	4	4	#	#	#	27.2	1012.2	26.0	24.0
	19:00	+02	19 47.0 N	35 10.0 W	HAZE	6	70	19	4	4	#	#	#	27.2	1012.2	26.0	24.0
	20:00	+02	19 22.0 N	35 10.5 W	HAZE	6	70	29	4	4	#	#	#	27.2	1012.5	26.0	24.0
	21:00	+02	19 10.0 N	35 25.0 W	HAZE	6	70	18	4	4	#	#	#	27.2	1012.5	26.0	24.5
	22:00	+02	19 10.0 N	35 25.0 W	HAZE	6	70	20	4	4	#	#	#	27.2	1013.0	25.7	24.4
	23:00	+02	19 10.0 N	35 25.0 W	HAZE	10	70	19	4	4	#	#	#	26.7	1014.0	25.7	24.4
	N		24	24		24	24	24	24	24	0	1	1	23	24	24	24

= MISSING DATA

NOAA SHIP MT. MITCHELL DECK LOG DATA

1986 GLOBAL CHANGE CRUISE

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRES.	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE MTN (FEET)	WAVE MTR (FEET)	WAVE MIN (FEET)	SWELL MTR (FEET)	SWELL MTR (FEET)	SEA TEMP (C)	TEMP (RBA)	DRY TEMP (C)	WET TEMP (C)
31-AUG-86	00:00	+02	18 38.8 N	35 37.1 W	CLEAR	10	70	18	4	4	4	#	#	26.7	1013.9	25.7	24.4
	1:00	+03	18 38.8 N	35 37.1 W	NO REPORT	8	70	17	4	4	4	#	#	26.7	1013.8	25.7	24.4
	2:00	+03	18 38.8 N	35 37.1 W	PTLY	10	70	17	4	4	4	#	#	26.7	1013.8	25.7	24.4
	3:00	+03	18 03.5 N	35 52.2 W	HAZE	8	60	20	4	4	4	#	#	26.7	1013.2	26.0	23.8
	4:00	+03	18 03.5 N	35 52.2 W		8	60	20	4	4	4	#	#	27.8	1013.0	26.7	23.9
	5:00	+03	18 03.5 N	35 52.2 W	HAZE	8	70	19	4	4	4	#	#	27.8	1012.5	25.6	23.9
	6:00	+03	17 26.8 N	36 06.0 W	HAZE	8	60	10	4	5	5	#	#	27.8	1012.5	25.6	24.0
	7:00	+03	17 26.8 N	36 06.0 W	HAZE	8	55	20	5	5	5	#	#	27.8	1012.9	25.6	24.0
	8:00	+03	17 26.8 N	36 06.0 W	HAZE	8	60	19	5	5	5	#	#	27.8	1012.9	25.6	24.0
	9:00	+03	16 49.0 N	36 17.0 W	HAZE	8	60	19	5	5	5	#	#	27.4	1012.9	26.5	24.8
	10:00	+03	16 49.0 N	36 17.0 W	HAZE	8	60	18	4	4	4	#	#	27.4	1013.9	27.0	25.0
	11:00	+03	16 49.0 N	36 17.0 W	HAZE	6	60	16	4	4	4	#	#	27.4	1014.0	26.7	25.6
	12:00	+03	16 18.0 N	36 28.3 W	HAZE	6	60	15	4	4	4	#	#	27.4	1014.0	26.6	24.8
	13:00	+03	16 18.0 N	36 28.3 W	HAZE	6	60	15	4	4	4	#	#	27.7	1014.7	28.3	25.6
	14:00	+03	15 55.8 N	36 37.0 W	HAZE	8	50	18	4	4	4	#	#	27.7	1014.8	27.8	26.6
	15:00	+03	15 55.8 N	36 37.0 W	HAZE	8	60	17	5	5	5	#	#	27.2	1013.8	27.7	24.7
	16:00	+03	15 55.8 N	36 37.0 W	HAZE	8	50	18	5	5	5	#	#	28.3	1013.5	28.3	25.9
	17:00	+03	15 55.8 N	36 37.0 W	HAZE	8	50	18	5	5	5	#	#	28.3	1013.2	27.7	24.7
	18:00	+03	15 18.2 N	36 52.0 W	HAZE	8	50	18	5	5	5	#	#	28.3	1013.0	27.7	24.7
	19:00	+03	15 18.2 N	36 52.0 W	HAZE	8	50	17	5	5	5	#	#	28.3	1013.0	27.0	25.0
	20:00	+03	15 18.2 N	36 52.0 W	HAZE	8	50	15	5	5	5	#	#	28.3	1013.3	27.0	25.0
	21:00	+03	14 39.0 N	37.08.0 W	HAZE	8	55	16	5	5	5	#	#	28.4	1013.2	27.0	25.0
	22:00	+03	14 39.0 N	37.08.0 W	HAZE	8	55	16	4	4	4	#	#	28.4	1013.5	27.0	25.0
	23:00	+03	14 39.0 N	37.08.0 W	CLOUDY	10	60	16	4	4	4	#	#	28.4	1014.0	26.8	25.6
	N.	24	24	24		24	23	23	23	23	23	0	0	0	23	23	23

D-44

= MISSING DATUM

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE MIN (FEET)	WAVE MAX (FEET)	SWELL DIR. (TRUE)	SWELL MIN (FEET)	SWELL MAX (FEET)	SEA TEMP (C)	BAROM. (HPA)	TEMP (C)	WET TEMP (C)		
01-SEP-88	0:00	+03	14° 03' 4 N	37° 19' 9 W	CLOUDY	10	S0	18	4	4	#	#	#	28.4	1014.0	26.8	25.3		
	1:00	+03	14° 03' 4 N	37° 19' 9 W	CLOUDY	10	S0	18	4	4	#	#	#	28.8	1014.4	26.8	25.3		
	2:00	+03	13° 23' 0 N	37° 36' 0 W	HAZE	8	SD	18	5	5	#	#	#	28.8	1014.1	26.7	25.0		
	3:00	+03	13° 23' 0 N	37° 36' 0 W	HAZE	8	SD	16	5	5	#	#	#	28.3	1014.0	27.5	24.4		
	4:00	+03	13° 23' 0 N	37° 36' 0 W	HAZE	8	SD	15	5	5	#	#	#	28.9	1013.2	27.5	24.4		
	5:00	+03	13° 23' 0 N	37° 36' 0 W	HAZE	8	SD	15	5	5	#	#	#	28.9	1013.0	27.2	24.4		
	6:00	+03	12° 44' 0 N	37° 51' 0 W	HAZE	8	S0	16	4	5	#	#	#	28.9	1013.0	26.7	24.4		
	7:00	+03	12° 35' 4 N	37° 53' 3 W	HAZE	8	S0	16	4	5	#	#	#	28.9	1012.5	26.5	24.4		
	8:00	+03	12° 35' 4 N	37° 53' 3 W	HAZE	8	S0	17	4	5	#	#	#	28.9	1012.2	26.5	24.4		
	9:00	+03	12° 16' 0 N	38° 01' 5 W	HAZE	8	SD	17	9	9	#	#	#	28.9	1012.5	27.8	25.5		
	10:00	+03	12° 16' 0 N	38° 01' 5 W	PTLY CLDY	8	SD	18	3	3	#	#	#	28.9	1012.5	27.8	25.5		
	11:00	+03	12° 16' 0 N	38° 01' 5 W	CLDY	6	SD	14	4	4	#	#	#	28.9	1012.2	27.3	26.0		
	12:00	+03	11° 44' 0 N	38° 13' 0 W	LIGHT RAIN	6	SD	20	4	5	#	#	#	28.9	1012.5	27.8	25.5		
	13:00	+03	11° 44' 0 N	38° 13' 0 W	CLOUDY	10	SD	18	3	3	70	4	4	28.9	1013.6	27.1	26.3		
	14:00	+03	11° 44' 0 N	38° 13' 0 W	HAZE	8	SD	17	3	3	70	4	4	28.9	1013.2	29.1	26.3		
	15:00	+03	11° 15' 0 N	38° 25' 5 W	HAZE	8	SD	15	2	2	90	4	4	28.9	1013.0	27.8	26.0		
	16:00	+03	11° 15' 0 N	38° 25' 5 W	RAIN	8	SD	10	3	3	4	4	4	28.9	1012.2	26.7	24.2		
	17:00	+03	10° 35' 0 N	38° 40' 8 W	HAZE	8	SD	80	6	6	80	4	4	28.9	1012.2	26.7	24.2		
	18:00	+03	10° 35' 0 N	38° 40' 8 W	CLOUDY	10	SD	60	11	11	1	90	3	3	28.9	1012.0	27.8	24.2	
	19:00	+03	10° 35' 0 N	38° 40' 8 W	PTLY CLDY	10	SD	55	6	6	80	4	4	3	28.9	1011.9	27.8	25.0	
	20:00	+03	10° 35' 0 N	38° 40' 8 W	CLOUDY	10	SD	30	5	5	4	4	4	3	28.9	1012.0	27.8	25.0	
	21:00	+03	10° 00' 0 N	38° 54' 0 W	CLOUDY	10	SD	35	7	7	4	4	4	3	29.4	1012.0	27.5	25.5	
	22:00	+03	09° 36' 8 N	39° 03' 1 W	CLOUDY	8	SD	20	4	4	4	4	4	3	29.4	1012.5	26.5	24.5	
	23:00	+03	09° 36' 8 N	39° 03' 1 W	HAZE	8	SD	24	24	24	20	20	20	7	9	9	24	24	24
	N																		

0-45

= MISSING DATUM

1968 GLOBAL CHANGE CRUISE
NOAA SHIP M.L. MITCHELL, DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESNT WEATHER	VTS. (WT)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE HEIGHT (FEET)	SWELL DIR. (TRUE)	SWELL HEIGHT (FEET)	SEA TEMP (C)	DRY TEMP (C)	WET TEMP (C)
02-SEP-68	0 0	+03			CLOUDY	S	20	4	3	#	#	30.0	1013.9	25.6
	1:00	+03			CLOUDY	S	20	4	3	#	#	30.0	1014.0	25.1
	2:00	+03			CLOUDY	S	20	6	2	#	#	30.0	1013.9	25.2
	3:00	+03	08 47.1 N	39 20.9 W	PTLY CLDY	10	50	5	#	70	2	29.4	1013.0	26.7
	4:00	+03			PTLY CLDY	10	240	5	#	160	2	30.0	1012.0	26.7
	5:00	+03			PTLY CLDY	10	200	6	#	160	3	30.0	1012.2	23.9
	6:00	+03	08 10.8 N	39 34.2 W	PTLY CLDY	10	220	6	#	160	2	30.0	1011.8	27.2
	7:00	+03	07 58.0 N	39 38.0 W	PTLY CLDY	10	200	8	#	160	3	30.0	1012.0	27.2
	8:00	+03			PTLY CLDY	10	230	9	#	160	3	30.0	1012.5	27.0
	9:00	+03	07 34.0 N	39 47.5 W	PTLY CLDY	10	200	5	#	170	3	30.0	1012.5	27.0
	10:00	+03			PTLY CLDY	10	200	9	#	170	3	30.0	1012.9	27.0
	11:00	+03	07 11.5 N	39 54.3 W	PTLY CLDY	10	210	12	#	170	2	30.0	1013.8	26.7
	12:00	+03	07 20.0 N	40 00.0 W	PTLY CLDY	10	210	12	#	170	2	30.0	1013.9	27.0
	13:00	+03			SHOWERS	10	210	12	#	170	1	30.0	1014.0	27.7
	14:00	+03			PTLY CLDY	10	220	12	#	170	1	30.0	1013.6	26.3
	15:00	+03	07 07.0 N	40 20.0 W	PTLY CLDY	10	190	15	3	#	#	30.0	1013.2	29.4
	16:00	+03			SHOWERS	8	200	16	2	50	1	30.0	1012.5	29.4
	17:00	+03			PTLY CLDY	10	210	17	2	50	1	30.0	1011.8	27.8
	18:00	+03	07 20.5 N	40 51.0 W	PTLY CLDY	10	200	18	2	50	1	30.0	1011.2	28.6
	19:00	+03			PTLY CLDY	10	195	17	5	60	2	30.0	1011.2	28.9
	20:00	+03			CLDY	10	200	20	3	60	2	30.0	1011.5	28.6
	21:00	+03	07 32.0 N	41 25.0 W	CLOUDY	10	195	20	3	60	2	30.5	1011.9	27.8
	22:00	+03			CLOUDY	10	195	20	3	60	2	30.5	1011.9	27.5
	23:00	+03	07 37.7 N	41 46.4 W	CLOUDY	10	240	20	3	60	2	30.5	1012.1	25.0
	N											20	24	24
		24	24	24		24						20	24	24

1986 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MITCHELL: DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE HEIGHT (FEET)	WIND MAX (FEET)	WAVE MAX (FEET)	SWELL DIR. (TRUE)	SWELL MIN (FEET)	SWELL MAX (FEET)	SEA STATE	BAROM. (HPA)	TEMP (C)	TEMP (F)	DRY TEMP (C)	DRY TEMP (F)
03-SEP-98	0 0:03	1:00	48.8	35.0 W	CLOUDY	10	240	20	3	3	3	#	#	#	30.5	1012.6	26.2	25.0		
	+0:03	2:00			CLOUDY	10	230	18	4	4	3	#	#	#	30.5	1013.4	26.5	25.0		
	+0:03	3:00			CLOUDY	10	220	16	3	3	3	#	#	#	30.5	1013.0	26.5	25.0		
	+0:03	4:00			CLOUDY	10	240	15	3	3	3	#	#	#	30.0	1012.0	27.0	23.9		
	+0:03	5:00			CLOUDY	10	220	14	4	4	3	#	#	#	30.0	1011.5	27.2	23.9		
	+0:03	6:00			CLOUDY	10	220	14	4	4	3	#	#	#	30.0	1011.5	27.2	23.9		
	+0:03	7:00			CLOUDY	10	220	14	4	4	3	#	#	#	30.0	1011.2	26.7	25.3		
	+0:03	8:00			CLOUDY	10	230	16	3	3	3	#	#	#	30.0	1011.4	26.7	25.3		
	+0:03	9:00			CLOUDY	10	240	12	1	2	1	#	#	#	30.0	1012.9	29.0	26.2		
	+0:03	10:00			CLOUDY	10	230	16	3	3	3	#	#	#	30.0	1012.9	29.0	26.2		
	+0:03	11:00			CLOUDY	10	230	16	3	3	3	#	#	#	30.0	1012.9	29.0	26.2		
	+0:03	12:00			CLOUDY	10	240	12	1	2	1	#	#	#	30.0	1012.8	29.2	26.2		
	+0:03	13:00			CLOUDY	10	240	12	1	2	1	#	#	#	30.5	1012.8	28.7	26.8		
	+0:03	14:00			CLOUDY	10	230	16	1	2	1	#	#	#	30.5	1012.6	28.7	26.8		
	+0:03	15:00			CLOUDY	10	240	12	1	2	1	#	#	#	30.0	1012.0	29.4	25.0		
	+0:03	16:00			CLOUDY	10	240	12	1	2	1	#	#	#	30.6	1011.2	28.9	24.4		
	+0:03	17:00			CLOUDY	10	240	13	1	1	1	#	#	#	30.6	1011.2	28.9	24.4		
	+0:03	18:00			CLOUDY	10	240	14	2	2	1	#	#	#	30.6	1011.0	28.9	25.0		
	+0:03	19:00			CLOUDY	10	240	13	1	1	1	#	#	#	30.6	1010.9	29.0	25.0		
	+0:03	20:00			CLOUDY	10	240	10	1	1	1	#	#	#	30.6	1010.9	29.0	25.0		
	+0:03	21:00			CLOUDY	10	230	14	1	1	1	#	#	#	30.6	1010.9	28.5	26.0		
	+0:03	22:00			CLOUDY	10	270	10	1	1	1	#	#	#	30.6	1011.0	28.5	26.0		
	+0:03	23:00			CLOUDY	10	240	10	1	1	1	#	#	#	30.6	1012.0	27.8	25.8		
	24	24				24	24	24	24	24	16	16	16	16	24	24	24	24	24	

= MISSING DATA

1988 GLOBAL CHANGE CRUISE
 NOAA SHIP MT. MCGEE DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRES.	VIS.	WIND DIR.	WIND SPEED (KNOTS)	WAVE MIN (FEET)	WAVE MAX (FEET)	SWELL DIR.	SWELL MAX (FEET)	SEA TEMP (C)	DRY TEMP (C)	WET TEMP (C)
04-SEP-88	00:00	+03	08 56.7 N	46 26.0 W	CLOUDY	10	240	10	1	1	30	1	30.6	1012.9	25.8
	1:00	+03			CLOUDY	10	270	10	1	1	30	1	30.6	1013.0	25.8
	2:00	+03			CLOUDY	10	260	10	1	1	30	1	30.6	1013.0	25.6
	3:00	+03	09 41.1 N	47 04.5 W	PTLY CLDY	10	240	8	1	1	40	2	30.6	1013.0	24.2
	4:00	+03			CLOUDY	10	240	6	1	1	40	2	30.6	1013.0	23.9
	5:00	+03			CLOUDY	10	240	6	1	1	40	2	30.6	1012.2	23.9
	6:00	+03	09 20.0 N	47 41.0 W	CLOUDY	10	240	6	1	1	40	2	30.6	1012.0	23.9
	7:00	+03			CLOUDY	10	240	6	1	1	40	1	30.6	1011.9	24.0
	8:00	+03			PTLY CLDY	10	240	7	#	#	40	2	30.6	1012.0	24.0
	9:00	+03	09 32.0 N	48 13.0 W	PTLY CLDY	10	245	6	#	#	20	2	30.6	1012.0	24.5
	10:00	+03			PTLY CLDY	10	245	6	#	#	20	3	30.6	1012.2	24.0
	11:00	+03	09 36.6 N	48 36.9 W	CLOUDY	10	260	6	#	#	10	3	30.6	1013.2	27.0
	12:00	+03	09 38.8 N	48 46.8 W	CLOUDY	10	260	6	#	#	10	2	30.6	1013.9	24.8
	13:00	+03			CLOUDY	10	220	6	#	#	10	3	30.6	1014.2	26.8
	14:00	+03			CLOUDY	10	230	5	#	#	30	3	30.6	1014.2	26.8
	15:00	+03	09 41.0 N	48 51.0 W	PTLY CLDY	10	200	9	#	#	40	3	30.6	1014.0	24.4
	16:00	+03			PTLY CLDY	10	230	9	#	#	40	3	30.6	1013.2	24.7
	17:00	+03			PTLY CLDY	10	210	8	#	#	40	3	30.6	1013.0	25.0
	18:00	+03	09 55.0 N	49 31.5 W	CLOUDY	10	240	8	1	1	40	3	30.6	1012.2	24.4
	19:00	+03			PTLY CLDY	10	210	9	#	#	40	3	30.6	1012.2	25.2
	20:00	+03			PTLY CLDY	10	190	10	#	#	20	3	30.6	1012.0	25.5
	21:00	+03	10 06.0 N	50 04.0 W	PTLY CLDY	10	195	12	#	#	10	3	30.6	1012.0	25.5
	22:00	+03			PTLY CLDY	10	180	12	#	#	10	3	30.6	1012.0	25.9
	23:00	+03			PTLY CLDY	10	220	10	2	2	20	2	30.6	1012.7	25.2
	N												24	24	24

0-48

= MISSING DATA

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESENT WEATHER	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE HEIGHT (FEET)	SWELL HEIGHT (FEET)	SWELL DIR. (TRUE)	MIN. (FEET)	MAX. (FEET)	SEA TEMP. (C)	BAROM. (BPA)	TEMP. (C)	WET TEMP. (C)
05-SEP-88	0:00	+03	10° 20'.5 N	50° 37'.4 W	PTLY CLDY	10	230	10	2	2	2	2	2	30.6	1013.4	27.6	25.2
	1:00	+03			CLDLY	10	220	12	1	1	2	2	2	30.6	1013.0	27.6	25.4
	2:00	+03			CLDLY	10	220	12	1	2	1	1	2	30.6	1013.9	27.7	25.4
	3:00	+03	10° 29'.0 N	51° 17'.0 W	PTLY CLDY	10	220	7	1	1	20	2	2	30.6	1013.8	28.4	24.2
	4:00	+03			CLDY	10	230	10	1	1	20	2	2	30.6	1013.2	28.4	23.9
	5:00	+03			CLDY	10	230	10	1	1	20	2	2	30.6	1013.2	28.4	23.9
	6:00	+03	10° 20'.5 N	51° 32'.5 W	PTLY CLDY	10	220	10	1	1	20	2	2	30.6	1012.2	28.4	23.9
	7:00	+03			CLDY	10	230	10	1	1	20	2	2	30.6	1012.0	27.3	25.0
	8:00	+03			CLDY	10	230	11	1	1	20	2	2	30.6	1012.0	27.3	25.0
	9:00	+04	10° 54'.4 N	52° 33'.5 W	PTLY CLDY	10	245	7	1	1	20	2	2	30.6	1012.5	27.3	25.0
	10:00	+04	10° 56'.0 N	52° 43'.5 W	PTLY CLDY	10	220	7	1	1	20	2	2	31.1	1013.2	26.0	23.8
	11:00	+04			PTLY CLDY	10	220	7	2	2	20	2	2	31.1	1013.4	26.0	23.8
	12:00	+04	11° 02'.0 N	53° 13'.8 W	PTLY CLDY	10	280	6	1	1	50	3	3	31.1	1014.7	27.3	25.6
	13:00	+04			PTLY CLDY	10	290	4	1	1	40	2	2	31.1	1015.2	29.3	26.2
	14:00	+04			CLDLY	10	230	8	#	30	2	5	5	30.6	1014.9	28.3	26.2
	15:00	+04	11° 15'.3 N	53° 50'.1 W	CLDLY	10	250	10	#	30	3	3	3	30.6	1015.0	28.3	26.2
	16:00	+04			PTLY CLDY	10	230	6	1	1	30	2	2	30.6	1014.8	29.2	24.2
	17:00	+04			PTLY CLDY	10	#	0	0	0	30	2	2	30.6	1014.0	28.9	24.2
	18:00	+04	11° 22'.5 N	54° 08'.0 W	PTLY CLDY	10	180	3	0	0	30	2	2	30.6	1013.0	28.4	23.8
	19:00	+04			PTLY CLDY	10	175	2	4	#	230	2	2	30.6	1012.5	28.9	23.9
	20:00	+04			PTLY CLDY	10	#	#	#	230	2	2	30.6	1012.5	29.0	25.0	
	21:00	+04	11° 35'.0 N	54° 52'.0 W	SQUALLS	10	160	6	#	270	2	2	30.6	1013.0	29.0	25.0	
	22:00	+04			RAIN	13	235	20	#	30	2	2	30.6	1013.0	28.0	25.0	
	23:00	+04			RAIN	15	205	14	#	30	2	2	30.6	1013.9	24.5	23.4	
N		24	24	24		24	22	24	10	18	24	24	24	24	24	24	

= MISSING DATA

1988 GLOBAL CHANGE CRUISE
NOAA SHIP MT. MITCHELL DECK LOG DATA

DATE	TIME	ZONE	LATITUDE	LONGITUDE	PRESSENT WEATHER	VIS. (MI)	WIND DIR. (TRUE)	WIND SPEED (KNOTS)	WAVE (FOOT)	WAVE MIN (FOOT)	WAVE MAX (FOOT)	SWELL (FOOT)	SWELL MIN (FOOT)	SWELL MAX (FOOT)	SEA TEMP (C)	DRY TEMP (C)	WET TEMP (C)
06-SEP-88	00:00	+04	11 48.7 N	25.0 W	CLOUDY	8	170	12	2	2	6	#	#	#	30.6	1014.0	25.0
	1:00	+04	11 48.7 N	25.0 W	CLOUDY	9	190	18	2	2	6	#	#	#	30.6	1014.2	25.4
	2:00	+04	11 48.7 N	25.0 W	CLOUDY	8	190	18	3	3	6	#	#	#	30.6	1015.1	25.8
	3:00	+04	11 56.1 N	56 00.4 W	RAIN-LING	8	190	18	3	1	3	#	#	#	30.6	1015.0	26.6
	4:00	+04	12 02.2 N	56 16.6 W	RAIN	10	180	13	1	1	3	#	#	#	30.6	1014.2	26.7
	5:00	+04	12 04.0 N	56 16.6 W	RAIN-LING	10	170	11	1	1	3	#	#	#	30.6	1013.8	26.7
	6:00	+04	12 09.0 N	56 43.0 W	RAIN	10	180	14	2	2	2	230	2	2	30.0	1013.0	26.7
	7:00	+04	12 25.0 N	57 35.0 W	PTLY	10	170	6	#	#	#	230	2	2	30.0	1012.8	27.2
	8:00	+04	12 32.0 N	57 59.6 W	PTLY	10	180	8	#	#	#	230	2	2	30.0	1012.4	25.0
	9:00	+04	12 32.0 N	57 59.6 W	PTLY	10	170	6	#	#	#	230	2	2	30.0	1013.0	25.0
	10:00	+04	12 32.0 N	57 59.6 W	PTLY	10	180	8	#	#	#	230	2	2	30.0	1013.0	25.0
	11:00	+04	12 32.0 N	57 59.6 W	PTLY	10	170	6	#	#	#	230	2	2	30.0	1013.5	25.0
	12:00	+04	12 32.0 N	57 59.6 W	CLOUDY	10	180	6	1	1	1	20	1	1	30.0	1014.2	28.7
	13:00	+04	12 32.0 N	57 59.6 W	CLOUDY	10	160	6	1	1	1	30	2	2	30.5	1014.4	29.4
	14:00	+04	12 32.0 N	57 59.6 W	CLOUDY	10	180	6	1	1	1	30	2	2	30.5	1014.5	29.4
	15:00	+04	12 45.0 N	58 42.0 W	CLOUDY	10	160	4	0	1	1	30	2	2	30.5	1014.5	29.4
	16:00	+04	12 45.0 N	58 42.0 W	PTLY	10	135	8	1	1	1	30	2	2	30.5	1014.5	29.4
	17:00	+04	12 45.0 N	58 42.0 W	PTLY	10	140	10	1	1	1	30	2	2	30.5	1014.5	29.4
	18:00	+04	12 55.5 N	59 27.8 W	RAIN	10	130	12	1	1	1	#	#	#	30.5	1012.4	28.9
	19:00	+04	13 06.1 N	59 39.2 W	CLUDY	10	150	10	1	1	1	#	#	#	30.0	1012.5	28.9
	20:00	+04	13 06.1 N	59 39.2 W	RAIN	10	130	12	1	1	1	#	#	#	30.0	1012.0	29.2
	21:00	+04			CLUDY	10	150	15	2	2	2	#	#	#	30.0	1011.8	29.4
N	22	22	22	22		22	22	18	10	13	13	22	22	22	22	22	22

= MISSING DATUM

* U.S. GOVERNMENT PRINTING OFFICE: 1960-773-002/11449