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SWADE Data Guide

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Preface

The Surface Wave Dynamics Experiment (SWADE) could not have happened if it had not been for the cooperation of many people in many agencies. It was planned at the Office of Naval Research, ONR, with the help of people from the National Aeronautics and Space Administration, NASA, the National Oceanic and Atmospheric Administration, NOAA, The Canada Centre for Inland Waters, CCIW, the U. S. Army Corps of Engineers, and participants from universities and other groups world-wide. The data collected has been put in the public domain and this is meant as a guide to that data.

The investigators in SWADE are listed in an appendix to this Guide; however, there are many other people who worked diligently to make this project a success. Among those we would like to thank for their immediate contributions are Kay Goodwill from CCIW, Helen Shirk and Karen Stewart at NASAWallops, also Will Drennan of CCIW who found and corrected many errors in early versions of the Guide.

Mark Donelan, CCIW
David Oberholtzer, NASA

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SUMMARY OF SWADE GOALS, OBJECTIVES AND PLAN

The Surface Wave Dynamics Experiment was carried out over the winter of '90/'91 near the edge of the Continental Shelf off Virginia. The goals as set forth in the planning document (Weller *et al.*,1991) are as follows:

a. Scientific goals

SWADE's scientific goals are:

1) To understand the dynamics of the evolution of the wave field in the open ocean.
2) To determine the effect of waves on the air-sea transfers of momentum, heat, and mass.
3) To explore the response of the upper mixed layer to atmospheric forcing.
4) To investigate the effect of waves on the data obtained from altimeters, scatterometers and synthetic aperture radars.
5) To improve numerical wave modelling.

b. Experimental objectives

In order to achieve these scientific goals, the design of the field program focused on the following specific objectives:

1) To determine the evolution of the wave spectrum and the source functions, especially in unsteady or inhomogeneous wind conditions, in order to investigate the characteristics of the source functions and their role in establishing a spectral balance.
2) To measure the directional distribution of waves in considerable detail over large areas using airborne instrumentation on several occasions.
3) To measure the directional distribution of waves at several points, over the entire experiment. In particular, a high resolution wave array at a central location will observe the adjustment of the spectrum to changing conditions.
4) To measure the acoustic signature of wave breaking at the central wave station and to attempt to quantify the dissipation source function.
5) To measure the pressure-slope correlation of the long waves at the outer stations and to attempt to quantify the wind input function to the longer (>20m) waves.
6) To measure the fluxes of momentum and heat at each of three wave stations over the full experiment.
7) To measure the fluxes of momentum, heat, and moisture in considerable spatial detail over the experimental domain on several occasions, using the NRL airship.
8) To measure the radar signal in various microwave bands from active and passive airborne sensors to explore the effect of waves on the response of the instruments to the desired parameter(s).
9) To measure the surface meteorology (wind velocity, air temperature, and water temperature) with sufficient accuracy and spatial coverage that the wind input to numerical models will not be the source of overwhelming uncertainty that it has been in most field experiments to date.
10) To determine breaking distributions as a function of sea state, wind, and boundary stability.
11) To use numerical modelling as an interpolation and analysis tool and to test various hypotheses regarding modelling of wave physics.

c. Experimental plan

The Surface Wave Dynamics Experiment (SWADE), sponsored by the Office of Naval Research (ONR) and the National Aeronautics and Space Administration (NASA), was nominally conducted in the 6 month period October 1, 1990 through March 31, 1991. Aircraft remote sensing, buoy, and ship environmental measuring systems from several organizations participated in the experiment. To achieve the objectives an experimental plan using moored buoys and aircraft was developed (Weller et al., 1991). Generally speaking the plan was carried out as intended, see Figs. 1, 2 and 3 and Appendix M for maps of the SWADE area, but there were some important differences. These are listed here for quick reference, and exact times and locations of useful data are given in the data summary (pp. 17—21).

The best laid plans...

Untoward movement of moored buoys:

1) SPAR

During the storm of October 26 the Brookhaven spar buoy was moved a few kilometers and sank in 250m of water. It was recovered with U.S. Navy salvage barge USN GRASP in May 1992. It gathered data for about 10 days during one of the most interesting periods of SWADE. Most of these data were recorded on board on optical disk. The likelihood of significant data recovery from this medium is vanishingly small. The spar also carried an internal recording Anderra thermistor chain (PI, Flagg) and a Marsh McBirney electromagnetic current meter (PI, Melville). These data are probably recoverable.

To make up for this loss a SWATH ship as described below was outfitted with a wave staff array and other systems and collected a large amount of data in the SWADE area.

2) 3 meter discus

The NDBC/SWADE 3m discus at position "Discus-E" was moved (probably by the Gulf Stream) about January 18, 1991 and came to rest at a new location several kilometers away, where it remained until the end of SWADE. It was decided not to attempt to return it to its original position.

3) MiniMet buoys

The four Coastal Climate "MiniMet" buoys were installed as planned. Their name is usually shortened to "met buoy." Three of them moved from their original locations; one took up a new position and remained there until the end of SWADE; two drifted outside of the SWADE area; of these, one was recovered and one was lost. A coding error in programming for ARGOS transmission introduced an ambiguity in the time that data was recorded. Much of this ambiguity has been removed. The unambiguous data has been stored in the database in the subdirectory "metbuoy."

4) Wavescan 3m discus

Power failure led to the early removal of Wavescan in early February. There were no reports from Wavescan after January 1, 1991.

Intensive Operational Periods

Three periods were planned during which aircraft and other platforms would be available to cooperate in data gathering. Designated Intensive Operational Periods (IOP), the first was a learning period in October 1990; the second extended from January 13 to 25, 1991; only the SWATH ship and the Wallops aircraft were active during this IOP. The third and most active period was from February 25 to March 9, 1991. The SWATH ship and all of the aircraft that took part in SWADE were active during this IOP.

SUMMARY OF SWADE DATA SYSTEMS

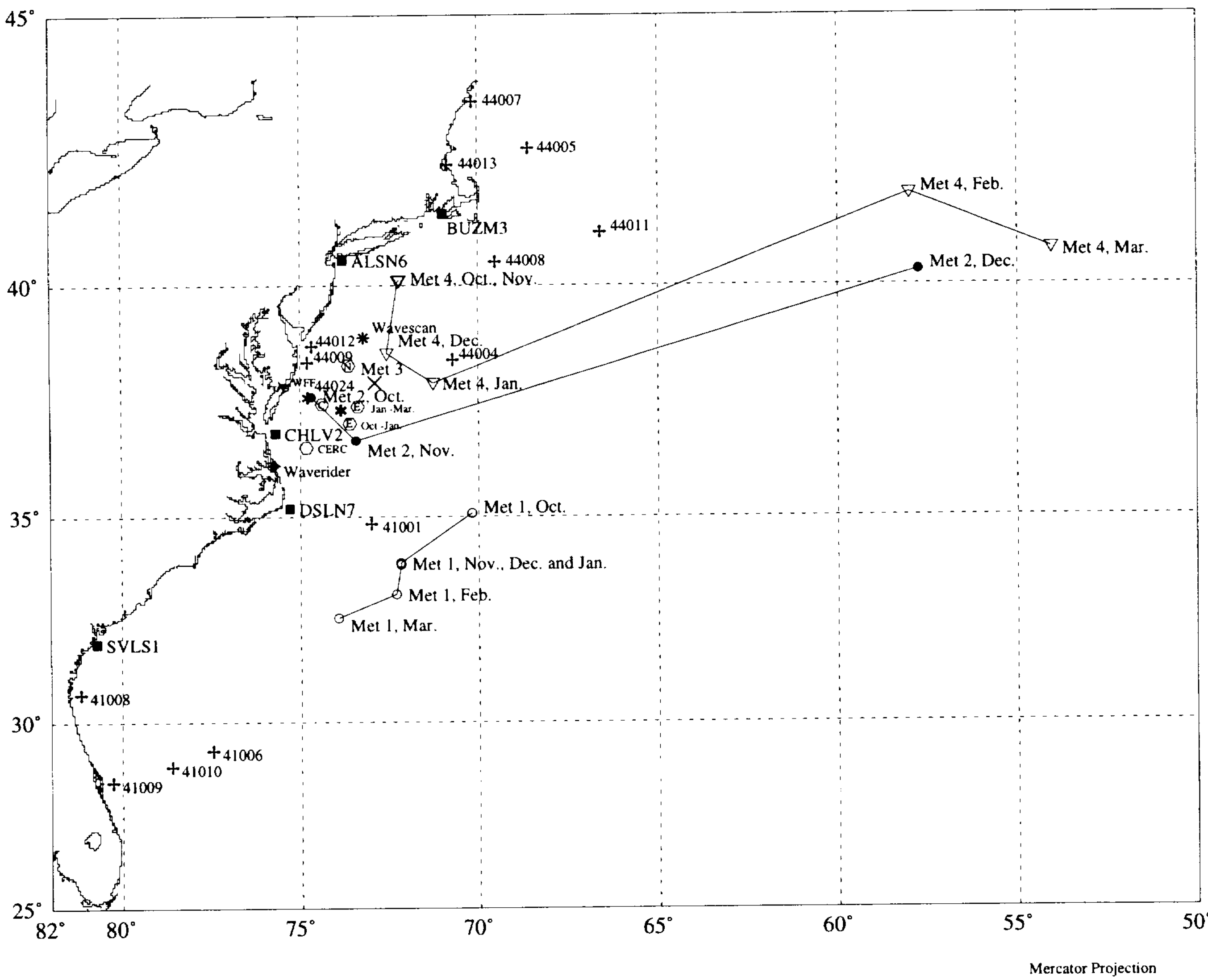
Addresses and phone numbers of contact persons mentioned are given in Appendix B.

BUOYS

NDBC 3m discus buoys

Directional wave and meteorological measurements from pre-existing NDBC buoys in the area of the SWADE, acquired during the experiment, were transferred to the SWADE data base. In addition, through funding by ONR, NDBC prepared three buoys of special design for the experiment. The first

Buoy and Station Positions during SWADE



*The WHOI Buoy. This buoy was in place from October to January

*The Wavescan Buoy was in place from late November through December.

○ These hexagons represent the SWADE 3-meter discus buoys.

Note that Coastal Buoy 2, ID 44024, (symbol ✲) was placed near the Met 2 buoy original site.

Discus C, ID 44023, was moored at the Spar buoy site.

Both Coastal Buoy 2 and Discus C were activated in the middle of January.

⭑Wallops Flight Facility (WFF)

Figure 1

Buoys and Stations in the SWADE Area for October and November 1990

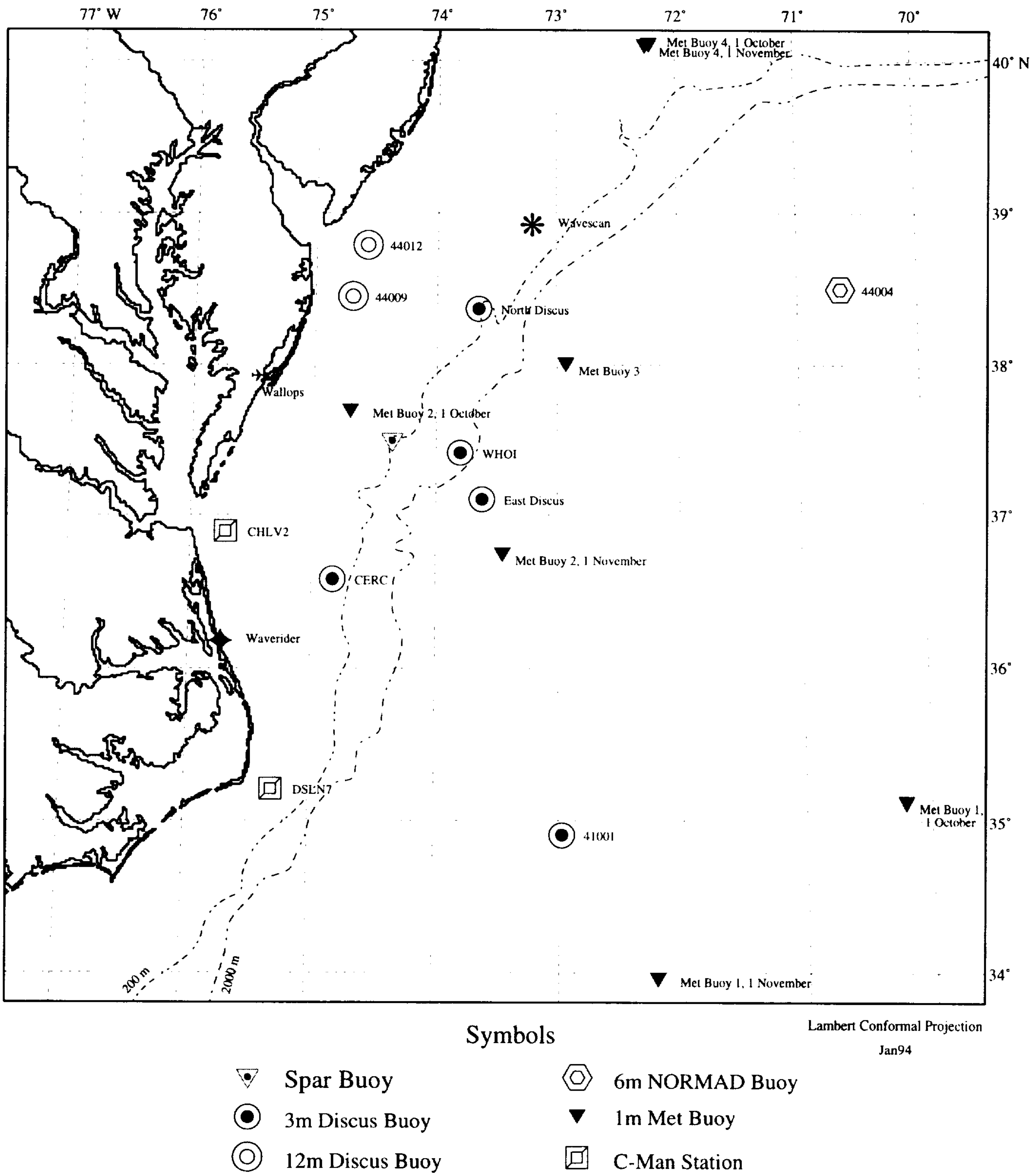


Figure 2

SWADE Area
February and March 1991

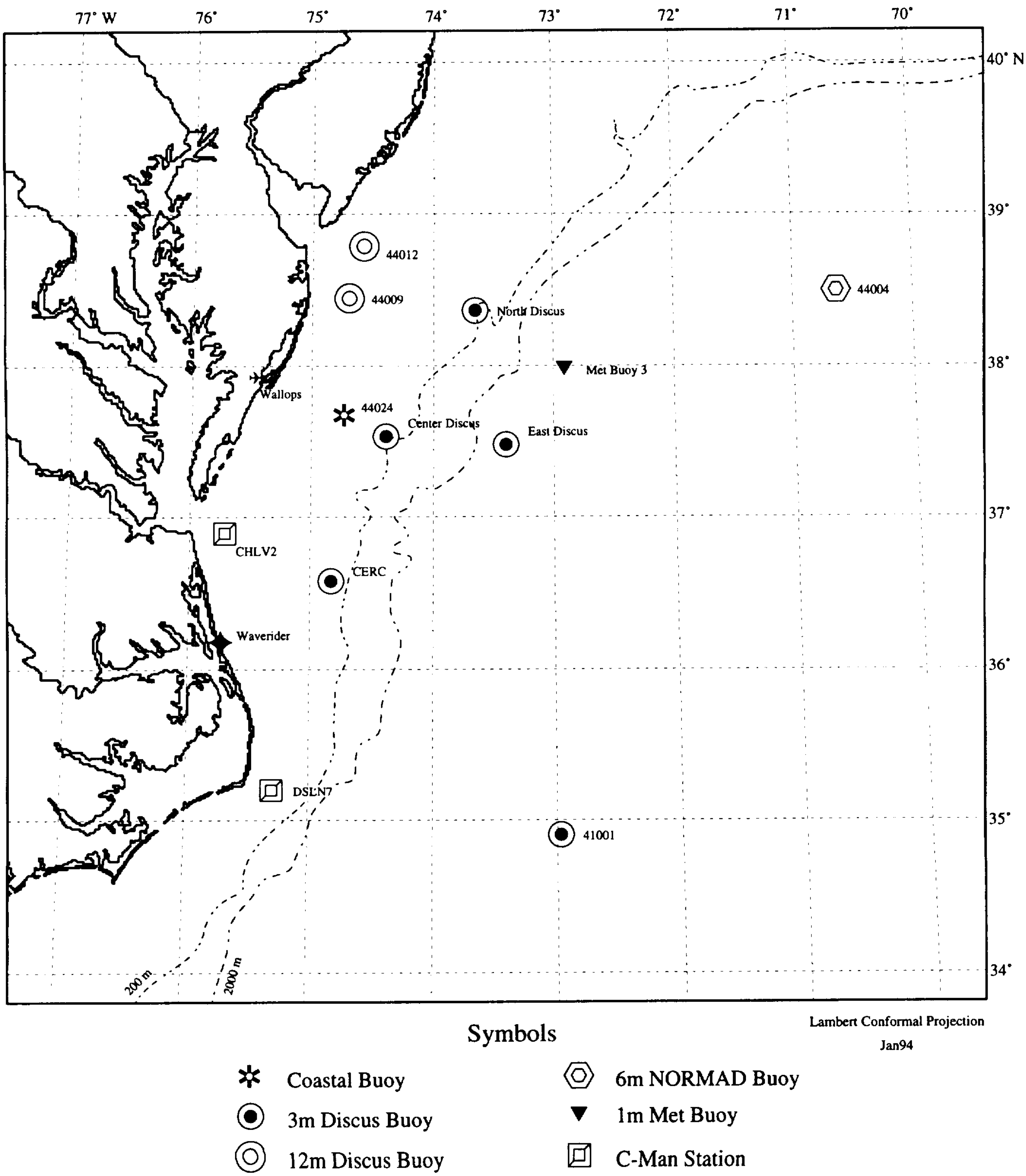


Figure 3

two were deployed at ocean stations 44001 (at 38°22'06"N, 73°38'56"W, called Discus-North) and 44015 (at 37°06'46"N, 73°36'56"W, called Discus-East) in September 1990, at the beginning of the experiment. A third buoy was deployed at station 44023 (at 37°32'07"N, 73°23'28"N, called Discus-Central) in January 1991.

Each of these three buoys, discus shaped and 3 meters in diameter, was designed to accommodate two payloads. In addition to a standard NDBC payload with its suites of meteorological and directional wave sensors, each buoy was designed to accommodate measurement equipment provided by the Canada Centre for Inland Waters (CCIW). The CCIW payload was housed in a cylindrical package mounted over the buoy hatch, had its own sensors, and recorded time series data at 1 Hz continuously from these, and some NDBC sensors. CCIW equipment integrated into the mooring line measured currents and mooring line forces.

The standard NDBC environmental measurement system aboard the buoy comprised two each of wind speed, wind direction, air temperature, water temperature, and barometric pressure sensors. It also included a directional wave measuring system consisting of the Datawell HIPPY 40 pitch, roll and heave sensor, heave acceleration being used in the SWADE application. NDBC meteorological and directional wave data from the standard payload were reported to shore via the GOES satellite each hour. Directional wave data were further processed to correct for hull mooring effects, and distributed in the WAVEOB format on WMO circuits within minutes. All GOES-reported data were reviewed in the weeks following acquisition, and archival tapes of all good data were placed in the SWADE data base at the NASA Wallops Flight Facility. The data recorded for these variables are available from the database in two places. It is in the subdirectory "/pub/ndbc" where the wave data have been reduced by NDBC and "/pub/ndbc.um" where the wave data have been reduced by University of Miami personnel.

The CCIW payload was designed to measure the linear and rotational motion of the buoy (heave, surge, sway, pitch, roll and yaw) and two components of the wind velocity for computation of the wind stress on the surface. In addition the payload included a very sensitive pressure probe for investigating the atmospheric input to the long waves and a sensitive rain gauge. There were two payloads which were moved among the three buoys. The relatively large data sets from this system were recorded on banks of five optical (WORM) drives. The total amount of data recovered amounts to 67 days distributed among Discus-East, -North and -Central.

On October 26, 1990, a storm, nominally a "50 year" storm, developed in the vicinity of the SWADE area. High winds and waves exceeding 8 meters significant wave height occurred. Solar panels on one NDBC buoy were damaged, and at the peak of the storm the tilt of one buoy had a maximum deviation from the vertical of about 34°. This storm was quite interesting for purposes of the experiment and is being studied in depth.

The NDBC buoy at station 44015, Discus East, apparently was caught up in the Gulf Stream in mid-January 1991. Strong currents dragged the buoy and its mooring into deeper water where the buoy began drifting. The U.S. Coast Guard located and retrieved it and moored it again at 37°29'00"N, 73°23'54"W on January 22, 1991. All three NDBC buoys with CCIW equipment aboard were retrieved in early April 1991. Data from the CCIW and NDBC sensors have been evaluated and placed in the SWADE archives at the anonymous ftp site, osb2.wff.nasa.gov.

NDBC BUOY DATA PRODUCTS

Copies of the NDBC records from the six months of the SWADE are at Wallops. They are available to the general public through the "anonymous ftp" site at osb2.wff.nasa.gov. Three records from the reporting buoys have been made public in this way. Record 2 contains wind data and significant wave height information for most of the buoys along the Atlantic coast. Record 3 contains non-directional wave data. Record 8 has directional wave information from the few buoys with the sensors to report this.

If you wish to use the directional wave data from NDBC you should talk with someone knowledgeable at NDBC about this data such as Kenneth Steele or David Wang.

A FORTRAN program has been developed by Hans Graber (RSMAS) that extracts selected data and data records from the NDBC buoy archive data files archived at Wallops. The program NDBC_191.F queries the user for which data records should be extracted and writes the data to separate files identified by the buoy name and the record type. For example, if record types 2 and 9 are selected from the input file of buoy 44001 (N41001.OCT), the output files are N41001.D2 and N41001.D9. For a description of the record types and output parameters see the text file *read.me2* in the ndbc.um directory. In general the data is written to a file in such a way that it can be loaded either into MATLAB or a spreadsheet type program such as LOTUS 123 or EXCEL.

Each output line for any record type consists of the station or buoy of interest, the date and time. Data available for extraction are: descriptive header (e.g., latitude and longitude, bottom depth and magnetic variation); environmental parameters (e.g., wind speed, wind direction, air temperature, water temperature, atmospheric pressure, significant wave height, dominant wave period, average wave period and wind gust), power spectra, and directional spectra as well as continuous wind measurements for non-directional buoys only. Wave directional spectral values can be expressed either as coefficients of the first two harmonics in the Fourier series representation of the directional wave spectrum, or in terms of spectral density as a function of direction and frequency obtained from the Fourier coefficients of the Longuet-Higgins, Cartwright, Smith (Longuet-Higgins *et al.*, 1963) formulation, or as the uncorrected co- and quad-spectra of the heave, pitch and roll.

The latter is used as input to a modified maximum-likelihood method (MLM) technique based on Capon (Capon, 1969). Among the modifications used by Drennan, Graber and Donelan (Drennan *et al*, 1996) is a substitution of the MLM estimate with the Longuet-Higgins *et al.* (1963) estimate for the case when the matrix becomes singular. These directional energy spectral densities are also archived in the anonymous ftp site at Wallops in subdirectories under /pub/ndbc.um/dir_spec. They are identified by the buoy name and the month. Each hourly spectrum is stored as a MATLAB *.mat file. The file name specifies the buoy (DN = Discus North (44001); DE = Discus East (44015); DC = Discus Central (44023); CE = Discus CERC (44014)) and the date and time. So DE102815.MAT contains the directional spectrum from Discus East for October 28, 1990 at 15:00 GMT, while DC030609.MAT contains the directional spectrum from Discus Center for March 6, 1991 at 09:00 GMT. The directional spectra are given in terms of a (40, 72) matrix of spectral energy densities [m^2/Hz/rad] for 40 frequency bins from 0.01 to 0.4 Hz in 0.01 Hz increments and 0 to 355 degrees clockwise from north in 5 degree intervals. Note also that the actual measurements of heave, pitch and roll occurred at minutes 28 to 48 during the previous hour. In other words, the spectrum for 12:00 (noon) was measured from 11:28 to 11:48.

Examples of these spectra are given in the two SWADE reports from the U.S. Army Corps of Engineers for IOP-1 (Caruso *et al.*, 1993) and IOP-3 (Caruso *et al.*, 1994), respectively.

Copies are available from Robert E. Jensen.

Meteorological Buoy Measurements:

Four modified MiniMet buoys from Coastal Climate were deployed in late September 1990 in the SWADE area. All buoys were equipped with two R.M. Young wind anemometers, one located on top of the center mast at approximately 2.8 m above the water surface and a second on a horizontal arm about 0.3 m below and 0.5 m away from the center mast. In addition, all buoys measured air and sea temperature. Two buoys, MET-1 and MET-3, were also equipped with a pressure sensor to record atmospheric pressure. Each buoy had two ARGOS transmitters to relay data messages of wind speed and direction, air and sea surface temperature, atmospheric pressure and its location in real time. These buoys were also equipped with a separate internal data storage system. The sampling frequency was 20 minutes consisting of data records 20 minutes long. The following variables were stored internally for both wind sensors:

1. Vector average wind speed (m/s)
2. Vector average wind direction (deg)
3. Scalar average wind speed (m/s)
4. Maximum wind speed of record (m/s)
5. Time of maximum wind speed (%)
6. Unit vector average direction (deg)
7. Last instantaneous direction (deg)

8. Standard deviation of direction (deg)
9. Standard deviation of speed (m/s)

In addition the following other variables were also recorded:

10. First compass reading (deg)
11. Last compass reading (deg)
12. Air temperature (deg-C)
13. Water temperature (deg-C)
14. Barometric Pressure (hPa)
15. Battery Voltage (volts)

Of these 15 variables, only data from 3, 6, 11, 12, 13, 14, and 15 were transmitted in real time via ARGOS.

Three of the buoys began to drift at different times during the experiments—a result of severe storms over the SWADE area. Eventually two of the met buoys (MET-2 and MET-4) were captured by the Gulf Stream and drifted outside of the SWADE area. A third buoy (MET-1) re-anchored twice in slow and steady drifts southwestward, but still within the large SWADE area. (See Fig. 1, the Large Area SWADE Map, and page 19).

Several buoys suffered damage to sensors, especially the wind anemometers,from fishing vessels and storm related forces. Some of these wind sensors were repaired during the experiment, but at least one wind sensor was functional on each buoy. An ARGOS programming error gave ambiguous times for the data records. Hans Graber was able to correctly register much of this data; it is in the database under the directory "pub/metbuoy."

Other Directional Wave Buoy Measurements:

A WAVESCAN directional buoy from SEATEX in Trondheim, Norway was deployed in late October 1990 in the SWADE area. The buoy was equipped with a Hippy 120 wave sensor, a Brooks and Gatehouse cup anemometer and vane, air and sea temperature and atmospheric pressure sensors. Processed data is transmitted in real time via GOES and the raw data is stored internally on disks.

Presently the following variables are available:

1. Wave processor results
   a. Significant wave height
   b. Significant wave height of swell
   c. Maximum wave height
   d. Period of spectral peak
   e. Mean wave direction of spectral peak
   f. Mean wave direction of windsea (for bands 0.4 - 0.44 Hz)
   g. Mean wave direction of swell (for bands 0.05 - 0.07 Hz)
   h. Main wave direction
   i. Unidirectivity index
   j. Energy density of spectral peak
   k. Width of spectral peak
   l. Zero-crossing period
   m. Heave or energy density spectrum
   n. Mean wave direction
   o. Circular standard deviation or spread

2. Environmental data results
a. Atmospheric pressure
b. Vector mean wind speed
c. Vector mean wind direction
d. Air temperature
e. Sea temperature
f. Compass heading
g. Heave (max, min, mean, variance, standard deviation)
h. Roll (max, min, mean, variance, standard deviation)
i. Pitch (max, min, mean, variance, standard deviation)
j. Compass (max, min, mean, variance, standard deviation)
k. Mean internal and lid temperatures
l. Battery levels (max, min, mean, variance, standard deviation)

Additional data such as covariance spectra for heave, pitch and roll can be derived. Contact Peter Kjeldsen for more information.

Woods Hole Oceanographic Institute 3 m Discus Buoy

The WHOI buoy was in place from October 1990 through the middle of January 1990. It collected meteorological and wave data for that period. The data are stored in the database in the directory "/pub/whoi." Further information may be obtained from Robert Weller of WHOI.

Waverider Buoy

This buoy is maintained by the Corps of Engineers about 7 miles off shore of their Coastal Engineering Research Center Field Research Facility at Duck, N. C. The buoy measures non-directional wave variables. This includes the significant wave height, the wave period and the wave energy. The data from the buoy during SWADE are in files named for the month in which they were acquired; that is, they have the form *mmmyy*.630. Thus dec90.630, contains the data for December 1990; the 630 is the identification number of the device. There is a file for each of the 6 months of the experiment. Readings are recorded every three hours. The buoy was located at 36° 12'.0 N Lat., 75° 41'.3 W Long. before October 28 and after December 1990. During November and December it was at 36° 11'.7 N latitude, 75° 40'.1 W longitude. Further information may be obtained from Robert Jensen at the Waterways Experiment Station.

AIRCRAFT

Canada Centre For Remote Sensing Convair 580

C-Band Synthetic Aperture Radar (SAR)

The C-band (5.3 GHz) SAR mounted in the Convair 580 consists of dual polarized antennas, dual receivers, seven-look real-time SAR processor, a sensitivity time control (STC) for range dependent gain control, a real-time motion compensation system for dynamic antenna steering in azimuth and elevation, and baseband I and Q signal phase rotation. The system is able to look to either side of the aircraft with high or low resolution.

During SWADE the radar was generally configured to optimize the imaging of ocean waves. The platform height-to-velocity ratio was minimized, and H H polarization was used to maximize the contribution of tilt modulation in the ocean wave image. The product is a SAR ocean wave spectrum. The contact to obtain more information about these data is Paris Vachon at CCRS.

Météo-France Merlin-IV

The RESSAC system

The RESSAC system consists of a C-band FM/CW radar, whose characteristics are summarized in Table 1. The radar was developed at CRPE (CNET/CNRS, France), and its characteristics have been chosen so as to optimise the ability of the instrument to measure ocean wave two-dimensional spectra. The radar can be mounted on two airplanes, either the Dornier 228 of DLR (Germany), or the Merlin-IV of Météo-France (France). During SWADE, the carrier was the Merlin-IV, which is a twin-engine turbo-prop pressurized aircraft. It has 3 to 5 hours endurance, depending on the flight profile. The maximum flight altitude is 9 500 km (31 000 ft), and the minimum operating speed is 99 m s^{-1} at 6 000 m (20 000 ft.) Additional information concerning this data set may be obtained from Danièle Hauser or Gérard Caudal at CRPE.

The transmitting and receiving antennas of the radar look at an angle of 14° from the nadir, and perform one rotation per minute around a vertical axis. The optimal use of RESSAC corresponds to flight altitudes of about 6 000 m. In this condition, the lobes of the transmitting and receiving antennas are such that the beam spot on the sea surface has a half-power width of the order of 1 566 m in the direction of the incidence plane (or elevation direction), and 375 m in the perpendicular direction (or azimuthal direction). During SWADE, due to flight constraints, the flight altitude chosen for the Merlin-IV varied between 3 000 and 6 000 m.

Following the principle of the FM/CW radar, a signal with linear frequency modulation is transmitted continuously with constant amplitude during a sweep time T(= 5.71 ms). Assuming a scattering object at distance R, the received signal is delayed by a time interval Δt proportional to R. The simultaneously transmitted and received signals (at frequencies f_t and f_r, respectively) are passed through a mixer and a low-pass filter, thus producing a beat signal, whose frequency is the difference frequency f_t-f_r (or beat frequency), and is proportional to distance R. A spectrum analyzer performs an FFT on the beat signal received from each modulation ramp (every 6.5 ms), yielding a power spectrum. A time integration is performed on the power spectra, The number of integrated samples can be chosen as N=4, 8, 16, or 32. During SWADE, N=16 was usually chosen. This yields one integrated radar spectrum every 0.1 s, which is recorded on a digital tape for further processing. The time, as well as the aircraft flight parameters (pitch,roll, heading, velocity, drift, latitude, longitude,...) are included within each record containing a radar spectrum.

The distance resolution, dR, is related to the frequency resolution of the radar spectrum df (= 250 Hz) through: dR= (c/2m)df, where m (=2.4 x 10^{10} Hz/s) is the frequency sweep rate of the frequency modulation ramp, and c is the velocity of light. This yields: dR = 1.56 m. In fact, due to the FFT analysis procedure used, contiguous frequency points are not independent. The width of the impulse response of the analyzer is of the order of 1.74 dR. Only 400 frequency points are recorded on tape, which thus correspond to a total analyzed band of 100 kHz, and cover a distance of 624 m. Through an adjustable local oscillator, the analyzed band is chosen so that the first recorded sample will be at a distance slightly less than the aircraft altitude, so as to get the useful part of the power profile. The total dynamic range of the received signal is about 40 dB. A set of attenuators (from 5 to 25 dB with 5 dB steps) can be used to adjust the level of the signal within the dynamic range of the receiver.

The antenna lobe characteristics given in Table 1 are those deduced from measurements performed at the CNET facility at La Turbie (France). The measurements have shown that the transmitting and receiving gain functions can be approximated as Gaussian functions. Test flights of RESSAC over a set of corner reflectors performed in France in 1990, have shown that the Gaussian lobe model inferred from La Turbie is also well-suited in flight conditions. The additional test flights performed over the set of corner reflectors during SWADE will be analyzed in order to confirm this conclusion, and in order to obtain an absolute calibration of the total gain of the system in flight conditions.

Table 1: RESSAC Radar Characteristics

Type FM-CW

Mean frequency	5.35 GHz (C-band)
Transmitted power	32 mW (15 dBm) or 3400 mW (35.3 dBm)

Receiver	Total gain 93.5 dBv	
Modulation	Upward linear frequency modulation	
	Duration	5.71 ms
	Bandwidth	137 MHz
	Repetition period	6.5 ms
Antennas		
	Polarization	HH
	Mean incidence angle	14°
	Beam width (at 3 dB)	16.5° in elevation
		11.7° in azimuth
	Two-way gain	36 dB
	Rotation in azimuth	360°/minute
Signal processing	FFT analyzer, 512 points (400 retained)	
	Adjustable analyzed band of 100 kHz width	
	Resolution	250 Hz in frequency
		1.56 m in range
	Number of integrations	4, 8, 16, or 32
	Digitized output with a 0.1 dB sensitivity	
Ancillary data		
	Clock, antennas rotation angle	
	Flight parameters (pitch, roll, heading, speed) from the NIS through ARINC output protocol.	

NASA C-130

C-SCAT

C-SCAT is a vertically polarized C-band pulsed scatterometer developed by the Microwave Remote Sensing Laboratory (MIRSL) at the University of Massachusetts. The antenna is a microstrip planar array made up of 16 series fed columns with 27 elements each. The 27 elements are weighted to give sidelobe levels that are approximantely 20 dB down from the main lobe. The main lobe can be frequency steered from 20° to 50° off boresight by changing the transmit frequency from 5.7 to 4.98 GHz. Over this frequency range the antenna gain varies from 26.4 to 29.1 dB. The E-plane 2-way equivalent beam width varies from 4.2° to 6.3°, and the H plane 2-way equivalent beam width is 4.5°. The antenna is laminated to an aluminum disk with a shaft mounted on the other side. The shaft is mounted on bearings and can be rotated up to 30 rev/min. providing azimuthal rotation of the antenna. A 10-bit shaft encoder monitors the rotation. The transmitter is temperature controlled. The signal is pulse modulated and amplified to either 100 mW or 2 W. The pulse duration and signal level are programmable. The return signal is down-converted and passed through one of five bandpass filters ranging from 50 kHz to 10MHz. This filter bank is designed to maintain a minimum signal-to-noise ratio with altitude. As the altitude increases the transmit pulse length is increased so that a narrower bandpass filter can be selected to compensate for the decrease in the received power. Following the filter bank an 85 dB dynamic range log detector converts the input power to a voltage that is sampled by a 12-bit A/D converter and stored on disk along with the shaft encoder position and navigation data such as pitch, yaw, roll, altitude, latitude and longitude. Fluctuations in the gain of the transmitter and receiver are monitored through a calibration loop. During a flight the gain typically varies by only 0.1 dB. During a flight the antenna is rotated in azimuth and the incidence angle is varied by changing the frequency of the local oscillator. C-SCAT provides a complete 360° scan approximately every 2 s. For each scan the measurements are converted from a log scale to a linear scale and are averaged into seventy-two 5° bins with each bin containing about 30 samples. Several scans may be averaged together to reduce the statistical variation of the backscattered power. Robert McIntosh of the University of Massachusetts can provide more information concerning this instrument.

Table 2. C-SCAT Instrument Characteristics

Frequency	4.97–5.70 GHz
Polarization	VV
Pulsewidth	0.2–120 μs
Peak Power	0.1 or 2 W
PRF	0.1–2 kHz
Azimuth	0–360°
Incidence Angle	20–50°
Antenna Gain	26.4–29.1 dB
Beam Width	4.2–6.3°
Detection	Logarithmic

NUSCAT

NUSCAT is a Ku-band pulsed scatterometer developed at JPL. It transmits either a horizontally or vertically polarized pulse at 13.9 GHz at a power level of either 10 or 250 W. The pulse repetition frequency (PRF) is between 1 and 10 kHz, and pulse width is between 2 and 65 μsec. The receiver has both a vertical and horizontal receive capablility. Each sampled signal is integrated over a 0.5 s interval and the result is stored on magnetic tape. Typically the antenna is positioned at a selected incidence angle, 4 s of data are collected and then the antenna is rotated 10° in azimuth and the process is repeated. This produces a cycloid scan pattern on the ocean surface. The antenna is a dual-polarized parabolic dish 46 cm (18 in) in diameter with a 2-way equivalent beamwidth of 4°. The estimated calibration error has a root mean square error of ±0.23 dB. Fluctuations in the gain of the transmitter and receiver are monitored through a calibration loop. During SWADE data were gathered at incidence angles from 0° to 60°and NUSCAT was operated between altitudes of 1 500 m (4 000 ft) and 3 700 m (12 000 ft). Fuk Li of the Jet Propulsion Laboratory can provide more information about this instrument and the data.

Table 3. NUSCAT Instrument Characteristics

Frequency	13.995–13.999 GHz
Polarization	HH, VV, HV, VH
Pulsewidth	2–75 μs
Peak Power	10 or 250 W
PRF	1–10 kHz
Azimuth	0–360°
Incidence Angle	0–60°
Antenna Gain	32 dB
Beam Width	4°
Detection	Square Law

NASA P-3

The Scanning Radar Altimeter (SRA)

The Multimode Airborne Radar Altimeter (MARA) was developed in 1988 to advance the state of the art of microwave altimetry. MARA has two distinct sensor configurations. One is a fixed, multiple-beam altimeter mode. In its other configuration it is the Scanning Radar Altimeter. The SRA is the successor instrument to the Surface Contour Radar (SCR). Like its predecessor it is a high spatial resolution radar operating at 36 GHz. Mounted in the NASA Wallops P-3, it transmits a 6 ns pulse in a pencil beam (1° two-way width) that is scanned perpendicular to the aircraft ground track. Data are recorded for sixty-four evenly spaced points along the scan line; the width of the scan line is 0.8 times the altitude of the aircraft. Corrections are made for the off nadir geometry to generate an elevation map of the surface scanned. Postflight data processing produces sea surface directional wave height variance spectra that typically have much higher angular resolution than pitch-and-roll buoys. Because the SRA uses direct range measurements the data analysis is more straightforward than instruments such as synthetic aperture radars or ROWS that require an understanding of the ocean scattering mechanisms to produce their spectra. Edward Walsh of GSFC may be contacted for further information.

Table 4. MARA/SRA System Characteristics

Transmitter	
Center Frequency	36 GHz
Peak Power	1.7 kW
Pulsewidth	6.4 ns
PRF (Multibeam)	200 Hz maximum
PRF (SRA)	10 cross-track scans/sec, 64 pulses/scan
Max. Duty cycle	0.01
Receiver(s)	
Noise Figure	6 dB DSB
IF frequency	600 MHz
Bandwidth	220 MHz
Detector	square law
Dynamic Range	80 dB
Multibeam Mode Antenna	
Lens aperture	85 cm diameter
3 dB beamwidth	0.62° one-way
Gain	47 dB
Feed Configuration	5 separate feeds, pointing angles adjustable to any point within 15°
from vertical	
SRA Mode Antenna	
Lens aperture	45.7 m diameter
3 dB beamwidth	1° two-way
Scan swath	± 22° from vertical, cross-track (64 pixels)
Gain	41 dB
Feed configuration	single horn feed scanning pattern generated using reflector

Nadir Pointing Video

The NASA P-3 contained a nadir pointing black and white camcorder that ran continuously during the flight missions. Copies of the video tapes are available from Wallops Flight Facility.

Airborne Expendable Current Profilers (AXCP)

For the 5 March Mission of the NASA P-3 Nick Shay of the University of Miami successfully released a number of AXCP's as the aircraft flew a star-like pattern in the southern SWADE area. For more information contact Nick Shay.

NASA T-39

Radar Ocean Wave Spectrometer (ROWS)

The ROWS is a Ku band real aperture radar. It was developed at the Goddard Space Flight Center primarily to prove the feasability of using such a system to measure the two dimensional gravity wave spectra of the ocean; in addition, it also has an altimeter mode by which the sea surface roughness can be measured. Spectrometer mode data are generated with a near-vertically-pointing, pencil-beam antenna which rotates in azimuth. Concurrent pulse-limited altimeter mode radar returns are derived using a vertically-pointed horn antenna. Fred Jackson formerly of GSFC may be contacted for more information about these data.

In the spectrometer mode it radiates a pulse compressed rotating beam operating at 13.9 GHz (about 2 cm wavelength). The width of the beam was measured to be 9.1° at the one-way 3 dB points. The rotational speed of the antenna is 6 rpm; it points nominally 13° off nadir. The pulse repetition rate is 100 Hz; however, because the ROWS cycles between the spectrometer and altimeter mode each of those gets 50 pulses/s. During SWADE the system was mounted in the NASA Wallops T-39 which flew typically at an altitude between 5 000 and 9 000 m (approximately 15 000 and 30 000 ft.). The minimum wavelength detectable by the ROWS is set theoretically by the projected range resolution which is a function of the radar pulse width and the incidence angle of the radar beam on the sea surface. For a 12.5 ns pulse width and an incidence angle of 13° the minimum wavelength is about 17 m.

Spectrometer mode processing begins by grouping 25 pulses together (18° sectors) and averaging the return. After a motion correction is applied the power data is transformed to the log domain and a low pass filter generates a return containing only the antenna pattern and radar cross-section component of the signal applied. This smoothed return is subtracted from the original waveform to create a surface range modulation series and a 256 point Fast Fourier Transform is taken. A noise floor is subtracted and this output becomes the ROWS directional wavenumber spectrum for this azimuth look direction. The total two dimensional spectrum is formed by repeating this process for each 18° sector in a complete rotation. Eight rotations, nominally, are grouped to give a spectrum. Often several spectra are averaged to give the published spectra. At a ground speed of 200 m/s (400 knots) eight rotations cover 16 km; Thus two-spectra averages represent data from a 32 km ground track at this speed.

The altimeter mode of the ROWS provides a measure of the mean-square-slope of the sea surface and of the sea surface height distribution or significant wave height (SWH). The processing for these measurements begins by averaging ten return waveforms and computing the location in time of the leading-edge half-power point. This is then repeated 200 times, and the results are stored as an array. A low pass filter is applied to smooth the data to represent the aircraft vertical motion. The vertical motion is removed from the 200 composite waveforms, and a least squares regression is performed to give four variables: the peak power, the trailing edge slope, the leading edge standard deviation, σ and the time of the peak power. The SWH is then computed using the equation:

$$SWH = 4c\sqrt{\sigma^2 - \sigma_{pt}^2}$$

where σ is the computed standard deviation and σ_{pt} is the one sigma pulse width and c is the speed of light. Table 5 provides the radar system's characteristics.

Table 5. ROWS Instrument Characteristics

Frequency	13.9 Ghz
Pulse Type	linear FM, 100 MHz bandwidth, 1.2 μs chirp
Pulse Length	12.5 ns, compressed
Peak Power	2 kW
PRF	100 Hz
Dynamic Range	70 dB
Detection	noncoherent, square law
Antennas	Spectrometer: 10 by 4° (elevation by azimuth) printed circuit array, vertical polarization, 16° boresight angle, 6 rpm rotation rate Altimeter: vertically-pointing 29° pyramidal horn
Data System	PC-based with full waveform capture using a 100 or 500 MHz digitization rate

Naval Research Laboratory P-3

Aircraft Sensor System

A P-3 aircraft has been instrumented by NRL to provide oceanographic information. The sensors include two real aperture radars operating at X-band and C-band providing horizontal-horizontal and vertical-vertical polarization mapping. A Ku band scatterometer and a thermal infrared radiometer also acquire data. The cognizant persons for further information regarding this system are William Keller at the University of Washington or Mark Peterson at NRL.

Office of Naval Research/Environmental Research Institute of Michigan P-3

Three Frequency SAR

The Environmental Research Institute of Michigan (ERIM) has built and operates for the Office of Naval Research (ONR) a three frequency synthetic aperture radar. The three frequencies are in the X, C and L bands. The system is mounted in a P-3 operated by ONR. The aircraft flies at a nominal altitude of 3 km. (10 000 ft.) At this altitude the recorded swath is 9.83 km. with 4 096 samples and a pixel size of 2.4 m. The images in the three frequencies are coincident; thus responses of ocean targets to these three frequencies may be studied; studies of multi-frequency image analysis may also be conducted with these data sets. James Lyden may be contacted at ERIM for more information about these data.

SHIP

SWATH SHIP

Following the loss of the SPAR on October 26, 1990, in order to meet the objectives of SWADE, it was necessary to replace the measuring capabilities of the SPAR. Its place in the array was taken by a new Discus buoy, Discus-Central. In addition, the SWATH (Small Water Plane Area - Twin Hull) ship Frederick G. Creed, operated by the Canadian Department of Fisheries and Oceans, was chartered and equipped to perform the high resolution measurements. The ship, 20 m long by 10 m wide, was designed to produce minimal flow disturbance at the water surface and, because of its high design cruising speed, is much better streamlined than typical ships. It is thus an excellent air-sea interaction research platform. Buoyancy is provided by two hulls/pontoons located below the surface which are attached to the upper deck by two narrow struts running the length of the ship. Engines located in each pontoon allow for ship speeds of up to 26 knots, although for the purposes of SWADE, speeds of 3-15 knots were typical.

The Creed operated in the SWADE area during IOP's 2 (January 14-25, 1991) and 3 (February 25, - March 9, 1991). Although the opportunity for six months of continuous high resolution data collection was lost with the SPAR, the mobility of the ship allowed for several innovations. For instance, it became possible to study the effects of currents and fetch on wave spectra. Also, cross calibration of the various Discus buoy wave measurements was feasible. For more information please contact Mark Donelan.

SWATH SHIP DATA

The transformation of the SWATH ship into a mobile research platform required the addition of a variety of special equipment. A global positioning system (GPS) receiver and two magnetic compasses (digicourse and fluxgate) were installed to allow the ship's position and heading to be recorded. A motion package, consisting of 3 linear accelerometers (heave, surge and sway) and a vertical gyroscope for pitch and roll measured the instantaneous translation and rotation of the ship. These signals were used to transform the wave elevation and fluid velocities, measured with respect to the ship, to an earth-referenced frame. Mounted on a sprit two meters fore of the bow, and well ahead of the pontoons, was the principal wave sensing apparatus which initially included an array of wave staffs, an acoustic current meter and an Elliot pressure probe. Six 4.5 m long capacitance wave gauges arranged in a centered pentagon of 75 cm radius made up the wave staff array employed to estimate the directional properties of the wave field. The high resolution array functioned very well and yielded 12 hours of detailed wave directional information during IOP 2 and the first half of IOP 3. In the 2nd half of IOP 3 a 3-gauge (isosceles triangle) wave array was used yielding an additional 17 hours of data.

Meteorological instrumentation on the SWATH ship included a K-Gill vane anemometer, Lyman-alpha humidiometer and thermocouples, all sampled at 20 Hz to give the "fast" data set. Two wet/dry bulb thermometer pairs, a second anemometer, Rotronics humidiometer and several radiometers were sampled every ten seconds; these data form the "slow" data set. Sea surface temperatures at 1 m depth were obtained from an ADCP located at the stern of the ship (see below). The K-Gill wind velocities were first corrected for the motion of the ship (all six degrees of motion were recorded at 20 Hz), and then the "fast" data used to calculate the surface fluxes of momentum, heat and moisture using the eddy-correlation method. The data are in the database in Matlab format in the directory "swath." Additional information regarding this data set may be obtained from Mark Donelan or Will Drennan at CCIW; queries regarding the "slow" data set should be directed to Kristina Katsaros of IFREMER and the University of Washington.

Several balloon launches were carried out from the stern of the ship duing IOP 3. These yielded temperature and humidity profiles in the atmospheric boundary layer.

During the second cruise aboard the F.G.Creed 39 Expendable Bathy-Thermographs (XBT's) were launched along several cross isobath sections. The XBT's were model 10T's capable of profiling to a depth of 200 m with a nominal accuracy of $\pm$ 0.1°C. In general, the XBT's were launched during periods when wave and/or acoustic Doppler current profiler data were also being collected. The data files containing position and time data together with depth/temperature series are in ASCII format in the database in the directory "/pub/depth/xbt." The data is also contained in the hydrographic data base at Brookhaven from which profiles and sections are being generated. Please contact Charles Flagg of Brookhaven for more information.

The last data item is the Acoustic Doppler Current Profiler (ADCP) records obtained during the second F.G.Creed cruise in late February, early March. During data collection, the ADCP emits short acoustic pings and records the Doppler shifted returns as a function of distance from the four transducers. The ping rate is typically about 1 Hz and the data is collected and averaged over five minute intervals to form ensembles. The instrument can also measure the Doppler shifted return from the ocean bottom when the bottom is within range. Using this bottom return data together with navigation data it is possible to determine the variations of the ship track accurately. The ADCP thus collects water velocity profiles relative to the ship which can be combined with navigation data from the ship's compass and Loran-C or GPS to calculate the absolute velocity profile. For the SWADE cruise GPS was used throughout. The maximum range of the ADCP on a ship mount is 150 to 200 m. On the Creed the ADCP transducers were mounted about 1 meter below the surface with 4 m vertical bins. Thus, the first good bin starts about seven meters below the surface. Because of side-lobe interference the ADCP's range is limited near the bottom and cannot measure currents within a distance from the bottom given by D $*(1-\cos(30°))$, where D is the water depth. In 100 meters of water the ADCP velocity data spans the depths between 7 and 87 m with 4 m resolution in the vertical.

The five minute ensemble averaging used on the Creed results in rms velocity errors from the ADCP itself of approximately $\pm$ 0.25 cm/sec. In addition to this, one has to add the uncertainty of the ship's velocity from the ship's navigation which is generally much greater. For instance, during the data acquisition on the Creed, the ship cruised at about 9 km/hr (5 knots) covering a distance of some 750 m for each ensemble. The standard error of position, SEP, for GPS with selective availability, SA, code is about 25 m (as compared to 10 m without SA) which yields a velocity error for a five minute run of about $\pm$ 8 cm/sec if only the positions at either end of the run are used. This large error is usually dealt with by combining five minute ensembles to reduce this error by a factor of two to four. Alternatively, since the GPS data was recorded on the Creed at one second intervals, we can run a filter on the position data and substantially reduce the 25 m position error. We will try the latter approach to retain the horizontal resolution inherent in the data.

A total of 13 transects were made with the ADCP deployed between February 25 and March 8, 1991. The data are available in the SWADE anonymous ftp database at Wallops in the directory "pub/depth/adcp" and from a VAX based database at Brookhaven in the form of vertical profiles of relative and absolute water velocities. Charles Flagg of Brookhaven is the principal investigator for the ADCP.

OTHER METEOROLOGICAL DATA

AVHRR Surface Temperature Imagery:

High-resolution infrared satellite imagery of surface temperature from the Advanced Very-High Resolution Radiometer on board the polar-orbiting NOAA 11 are routinely collected and processed at the Remote Sensing Facility at RSMAS/University of Miami. The images have been corrected for geometric distortion and use a multichannel algorithm for converting to temperature. The IR images are specified in a binary format and are readily displayed for further processing with suitable graphical software (for example, Satellite Data Processing System (SDPS), Woods Hole Oceanographic Institution). The image is specified on a Mercator projection and the size is 1024 x 1024 pixels with an approximate spatial resolution of 2.8 km. The geometrical coverage is limited to the Western North Atlantic and the Gulf Stream. The frequency interval of the surface temperature images is about two per day. Contact Hans Graber of RSMAS for further information.

Wallops Island Meteorological Data

The Wallops windtower is a 300 foot tower on Wallops Island with wind sensors starting at 50 ft above ground level and every 50 ft above that up to the top (six levels). The wind speed was measured in miles per hour, and this has not been converted to m/s as the NDBC wind data are. The time recorded is UTC, so that 5 hours must be subtracted from this to get local time. The data is a ten minute average, tagged at the start of the interval. An "I" after the date in the file name indicates that not all of the day's data has been transmitted; you can tell by the file size whether a significant amount has been left out. Each file has a header and a footer. The data is in the database under the directory "windtower."

MODEL INFORMATION

1a. Meteorological Information: Stress and Neutrally Stable Wind Fields at 19.5 m

Analyzed and forecast wind stress and 19.5 m neutrally stable wind fields derived from Fleet Numerical Oceanographic Center (FNOC) NOGAPS (Navy Operational Global Atmospheric System) model are given in terms of their components Tau(x) and Tau(y) for wind stress in units of Pa and u and v for 19.5m winds in units of m/s. The 19.5m neutrally stable winds are directly computed from the wind stress fields at each local grid point. The model system (T80) uses 80 Fourier coefficients and spectrally interpolates the fields to 1.5 degrees. A final, linear interpolation is made onto a spherical grid with a spatial resolution of 1.25 degrees in latitude and longitude. The time interval of wind and wind stress fields is every 6 hours beginning at 00:00.

Contact Robert Jensen for access to this data.

1b. Meteorological Information: 10 m Wind Fields

Analyzed 10 m wind fields from the European Centre for Medium-Range Forecasts(ECMWF) generated by their operational atmospheric general circulation model. The winds are provided in terms of the u and v components in units of m/s.These analyses are from the so-called ECMWF/TOGA advanced operational analysis surface and diagnostic fields data set. The geometrical coverage is specified on a spherical grid with a spatial resolution of 1.125 degrees in latitude and longitude. The time interval of wind fields is every 6 hours beginning at 00:00.

Analyzed surface pressure fields [mbar] and surface temperature fields [deg-C]are also available with the same spatial and temporal resolution.

> **NOTE** All work with ECMWF data products must be performed on computers at the Waterways Experiment Station, US Army Corps of Engineers in Vicksburg, Mississippi.

Contact Robert Jensen for access to this data.

1c. Surface Current Information:

Analyzed surface current fields from Fleet Numerical Oceanographic Center (FNOC) generated from their regional-scale circulation model DART (Data Assimilation Research and Transition) which uses two active layers for the Gulf Stream region. DART is initialized from the dynamic height field derived from daily Gulf Stream temperature (IR imagery) and salinity products. The currents are given in terms of the U and V components (cm/s). The geometrical coverage is specified on a spherical grid domain with a spatial resolution of 0.20 degrees in latitude and longitude and is limited to the Western North Atlantic and the Gulf Stream. The time interval of the surface current fields is every 6 hours beginning at 00:00.

Contact Robert Jensen for access to this data.

1d. Surface Current Information:

A special data set of surface currents was generated from Harvard's quasi-geostrophic (QG) model. The currents were generated using a "feature model" for the Gulf Stream and imbedding rings in the nowcast locations. Input data of the locations of the Gulf Stream North Wall and warm and cold core rings were provided by NAVOCEANO (Naval Oceanographic Office). The computations were kindly performed by Scott Glenn, at Rutgers University and made available to SWADE. The grid domain is roughly parallel to the coastline between Cape Hatteras and Nova Scotia. There are daily maps of surface velocity fields consisting of nowcast and forecast fields. The spatial resolution is 15 km.

Contact Robert Jensen for access to this data.

1e. Wave Model Simulation Data Sets:

The principal ocean wave prediction model used for these simulations is the third-generation WAM model, which computes the directional wave spectrum by integration of the energy transport equation without prior specification of the spectral shape. There are 26 frequency bands from 0.0418 to 0.4526 Hz in logarithmic equally-spaced increments and 24 directional bins at 15 degree intervals. The WAM model has been implemented in spherical coordinates on three nested grids:

1. Basin-scale North and South Atlantic model:	1.00 degree resolution
2. Regional-scale Western North Atlantic model:	0.25 degree resolution
3. Fine Mesh SWADE Array model:	0.10 degree resolution

Forecast and hindcast studies have been carried out with the Cycle-2 release, while the currently implemented Cycle-3 release will include options for nested grids to account for incoming swell and time and spatially varying currents for studying wave-current interactions.

Model output fields include maps of significant wave height, mean wave period, mean wave direction, swell wave height, swell period and swell direction. In addition, two-dimensional wave spectra are produced at selected output points near buoy stations and within the SWADE experimental area.

Contact Robert Jensen for access to this data.

SWADE
Summary of Data Acquisition Platforms

Aircraft

Platform	Location	Instrumentation	Nominal Dates of Operation	Data Accessability
				Digital data *via* anonymous ftp to osb2.wff.nasa.gov
CCRS Convair 580	See Maps M-1 to M-4	C-band Synthetic Aperture Radar (SAR)	3rd IOP* 4 Flights	Contact: Paris Vachon Canada Centre for Remote Sensing Ottawa, Canada Data in: /pub/syn_radr (Matlab graphics)
Météo-France Merlin	See Maps M-5 to M-10	fm/cw radar (RESSAC)	3rd IOP 6 Flights	Contact: Danièle Hauser or Gérard Caudal Centre de Recherches en Physique de l'Environement Terrestre et Planétaire Report: Participation of RESSAC *to SWADE*
NASA C-130	See Maps M-11 to M-20	Ku-band Scatterometer (Nu-Scat),	3rd IOP	Contact: Fuk Li Jet Propulsion Laboratory Pasadena CA
	See Maps M-11 to M-20	C-band Scatterometer (C-Scat)	3rd IOP 10 Flights	Contact: Robert McIntosh University of Massachusetts
NASA P-3	See Maps M-21 to M-32	Airborne Expendable Current Profilers (AXCP),	March 5, 1991 Map M-31	Contacts: (AXCP)Nick Shay Univ. of Miami
		Airborne Oceanographic Lidar (AOL),	2nd and 3rd IOP	(AOL/Video) Frank Hoge
		Scanning Radar Altimeter (SRA)	2nd and 3rd IOP	(SRA) Edward Walsh NASA/GSFC/Wallops Flight Facility
		(New SCR), Nadir Video	2nd and 3rd IOP 13 Flights	
NASA T-39	See Maps M-33 to M-39	Radar Ocean Wave Spectrometer (ROWS)	3rd IOP 7 Flights	Contact: Fred Jackson (See his name under Investigators) Data in: /pub/rows
NRL P-3	No Maps available	Real Aperture Radar	3rd IOP	Contact: William Keller APL of Univ. of Washington or Mark Peterson, NRL
		Infrared Radiometer (PRT-5)	3rd IOP	
ONR/ERIM P-3	See Maps M-40 to M-44	Three Frequency SAR	3rd IOP 5 Flights	Contact: James Lyden Environmental Research Institute of Michigan (ERIM) Images from SAR available at WFF

* IOP, Intensive Operational Period. There were three times of intensive data gathering during SWADE. The first was a learning period in October 1990; the second period extended from January 13 to 25, 1991 and the third period was from February 25, to March 9, 1991.

SWATH Ship

Platform	Location	Instrumentation	Nominal Dates of Operation	Data Accessability
Frederick G. Creed	See Maps M-45 to M-46	Acoustic Doppler Current Profiler (ADCP),	2^{nd} and 3^{rd} IOP	Contact: Charles Flagg Brookhaven National Lab.
		Expendable Bathythermographs (XBT),	2^{nd} and 3^{rd} IOP	
		Global Positioning System (GPS)	2^{nd} and 3^{rd} IOP	Data in: Anonymous ftp @osb2.wff.nasa.gov /pub/swath/loc
		Meteorological Measurements,	2^{nd} and 3^{rd} IOP	/pub/swath/metavg
		Solar Radiation,	3^{rd} IOP	/pub/swath/metavg
		Wave Staffs	2^{nd} and 3^{rd} IOP	/pub/swath/wave Contact: Mark Donelan Canada Centre for Inland Waters Burlington, Canada
		Balloon soundings	3^{rd} IOP	Contact: Kristina Katsaros IFREMER/Univ. of Washington
		Marine Radar	3^{rd} IOP	Contact: Dennis Trizna Naval Research Laboratory

Buoys

Platform	Location	Data Recorded	Nominal Dates of Operation	Data Accessability
Meteorological Buoys		Winds at 2.4 m, Pressure, Sea and Air Temp.		Anonymous ftp osb2.wff.nasa.gov 128.154.1.2
Met 1 ID's 1602, 1606	35.25°N 70.0°W 34°N 72°W 33°N 72.5°W 33°N 72-74°W 33°N 74°W		October 1990 Nov.–Dec. '90 Jan. '91 Feb. '91 Mar. '91	/pub/metbuoy
Met 2 ID's 1603, 1607	37.7°N 74.72°W 36.2°N 74.5°W to 38°N 61°W		Oct '90 Nov. '90 to Dec. 9, '90	/pub/metbuoy
Met 3 ID's 1605, 1609	37.99°N 72.9°W		SWADE Period	/pub/metbuoy
Met 4 ID's 1604, 1608	40.1°N 72.24°W 39°N 72.5°W 38°N 70°W to 41°N 59°W		Oct. '90 Nov.' 90 Dec. '90	/pub/metbuoy
NDBC Buoys				Data:
SWADE Buoys		Winds at 5 m, Air Pressure, Sea and Air Temp. Dir. Wave Spectra unless noted		Anonymous ftp to osb2.wff.nasa.gov *in* /pub/ndbc and /pub/;ndbc/um
44023, Discus-C	37.535°N 74.39°W		Jan. 15, '91 through Mar., '91	Contact: Ken Steele at NDBC
44015, Discus-E	37.13°N 73.63°W then		Oct. '90 to Jan. 18, '91	
(Broke mooring ~1/18/91)	37.483°N 73.398°W		Jan. 23, '91 through Mar. '91	
44001, Discus-N	38.37°N 73.65°W		Oct. '90 through Mar. '91	
44014, CERC	36.58°N 74.83°W		Oct. '90 through Mar. '91	
44024/CB-2, Coastal Buoy, 2.3m discus (Experimental)	37.69N 74.72W	No Directional Wave Data	15 Jan. '91 through Mar. '91	

Buoys

Platform	Location	Instrumentation	Nominal Dates of Operation	Data Accessability
Other NDBC Buoys		Winds at 5 m, Air Pressure, Sea and Air Temp. Non-Dir. Wave Meas. unless noted		anonymous ftp to osb2.wff.nasa.gov 128.154.1.2 *in* /pub/ndbc
41001	34.90°N 72.97°W		SWADE Period to 7 Feb. '91	
41006	29.30°N 77.38°W		SWADE Period	
41008	30.73°N 81.08°W	+ Dir. Wave Spectra	SWADE Period	
41009	28.50°N 80.18°W		SWADE Period	
41010	28.88°N 78.53°W		SWADE Period	
44004	38.50°N 70.64°W		SWADE Period	
44005	42.65°N 68.56°W		SWADE Period	
44007	43.53°N 70.09°W		SWADE Period	
44008	40.50°N 69.43°W		SWADE Period	
44009	38.45°N 74.70°W		SWADE Period	
44011	41.06°N 66.56°W		SWADE Period	
44012	38.79°N 74.58°W		SWADE Period	
44013	42.38°N 70.78°W		SWADE Period	
Other Buoys				
Waverider	36.201°N 75.688°W	Wave Motion only	October 1 to October 26	/pub/waverider
	36.195°N 75.669°W		Nov.'90 through Dec. '90	
	36.201°N 75.688°W		Jan. '91 through Mar. '91	
WaveScan	38.95°N 73.18°W	Wave Motion, Air Pressure, Winds, Air and Sea Temperature	Nov. '90 through Dec. '90	
WHOI	37.42°N 73.80°W	Wave Motion, Air Pressure, Winds, Air and Sea Temperature	Oct. '90 to Jan. 16, '91	/pub/whoi

SWADE
Summary of Data Acquisition Platforms

Stations

Platform	Location	Instrumention	Nominal Dates of Operation	Data Accessability
		Air Pressure, Winds, Air and Sea Temperature		anonymous ftp to osb2.wff.nasa.gov 128.154.1.2 *in* /pub/ndbc
ALSN6	40.5°N 73.8°W		SWADE Period	
BUZM3	41.6°N 71.0°W		SWADE Period	
CHLV2	36.9°N 75.7°W		SWADE Period	
DSLN7	35.2°N 75.3°W		SWADE Period	
SVLS1	32.0°N 80.7°W		SWADE Period	

APPENDIX A

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APPENDIX B
Investigators

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APPENDIX C

THE SWADE DATABASE AVAILABLE THROUGH ftp

The following pages summarize the SWADE data available at Wallops Flight Facility through the Internet. All the digital data reside in a public file system available through anonymous ftp. The address is osb2.wff.nasa.gov; the IP number is 128.154.1.2

The database is arranged in the standard anonymous ftp style. That is, the data are in directories under /pub with names that indicate the kind of data contained. Following are lists of files available under the various directories. When the structure among the directories is similar not all directories' files are shown here.

The data are stored in Sun workstations operating under UNIX; therefore, file names follow the naming conventions of UNIX. Any of these files may be copied to your computer using ftp commands such as "get" to download them. Because there is more latitude in naming files here than in the PC world, if you are copying them for use with a DOS based PC you must change some names to be compatible with the eight character limit on MSDOS filenames. For example, *swade_large_area.ps* might be downloaded with the command:

get swade_large_area.ps swad_lg.ps

The newly downloaded file will be named *swad_lg.ps*, an acceptable MSDOS name.

Most of the files are in text format. Thus they can be downloaded to a computer using the text file transfer. Exceptions are the graphics files from the synthetic aperture radar from the Canada Centre for Remote Sensing (CCRS), the motion files from the WHOI buoy, the directional wave files from the University of Miami, the windwave files from the SWATH ship and the scanning radar altimeter (sra). The CCRS files, the University of Miami and the SWATH data are in Matlab format. The motion data from WHOI is in compressed "cdf" format; the sra files are in compressed unix format. Binary downloads must be used to get any of these exceptions.

Several text files are under /pub; the *readme.pub* describes the file system. There are also three files ending in *.ps*. These are PostScript files and will print out maps of the SWADE area when sent to a PostScript printer. They are reproduced as the three figures in the front of this guide.

Directories available using anonymous ftp to osb2.wff.nasa.gov

dr-xr-xr-x	2 root	512	May 7 1993	**bin**
dr-xr-xr-x	2 root	512	May 7 1993	**dev**
dr-xr-xr-x	2 root	512	May 7 1993	**etc**
drwx-wx-wx	2 root	512	Jul 6 10:13	**incoming**
drwxr-xr-x	8 root	512	May 25 10:10	**pub**
dr-xr-xr-x	4 root	512	May 7 1993	**usr**

The only directories that are useful to a user are **pub** and possibly **incoming**. The purpose of the **incoming** directory is a location in which to leave files for the osb2 system administrator. No one else has permission to see file names in this directory. The contents of **pub** are below. Note that each line above begins with a "d." This indicates that each entry is a directory; names of directories are printed here in bold text to separate them from text files.

Directory for *pub*

drwxr-xr-x	2 root512 May 19 14:41	**bathy**
-rw-r—r—	1 root1399 Nov 26 1991	buoy_sta.loc

drwxr-xr-x 5 root512 May 19 13:35	**depth**
drwxr-xr-x 2 root1536 May 25 08:55	**metbuoy**
drwxr-xr-x 11 root512 Feb 7 13:31	**ndbc**
dr-xr-xr-x 3 root512 Sep 18 1995	**ndbc.um**
-rw-r—r— 1 root4336 Sep 18 1995	readme.pub
drwxr-xr-x 5 root 512 May 25 11:26	**rows**
dr-xr-xr-x 2 root3072 Sep 27 15:08	**sra**
-r—r—r— 1 root134008 Feb 8 1994	swade_3iop.ps
-r—r—r— 1 root95865 Feb 8 1994	swade_large_area.ps
-r—r—r— 1 root137381 Feb 8 1994	swade_octnov.ps
dr-xr-xr-x 5 root512 Jun 20 1995	**swath**
drwxr-xr-x 2 root512 Jan 25 1994	**syn_radr**
drwxr-xr-x 2 root512 Jan 25 1994	**waverider**
drwxr-xr-x 4 root512 May 25 10:13	**whoi**
drwxr-xr-x 2 root2560 Jun 3 16:29	**windtower**

Directories again are in bold. Other entries are text files. The readme.pub file is a text file that describes this database. There are text or *readme* files in each of these subdirectories describing the data and files to be found there. They will tell you whether a binary download must be done. Note that these UNIX files are case sensitive; thus you must refer to the file name exactly using upper and lower case appropriately.

The directories' names indicate the kinds of data to be found under them.

bathy contains a file with bathymetric data in the SWADE area listed in a grid.

depth contains data from an acoustic doppler current profiler (adcp), a thermistor chain (t-chain) and expendable bathythermographs (xbt).

metbuoy contains the meteorological records from the meteorological buoys.

ndbc contains the hourly records for the NDBC buoys. The National Data Buoy Center (NDBC) set out several three meter discus buoys for the SWADE project. These were Discus East-Id#44015, Discus North-Id#44001, the CERC discus-Id#44014, and, in January 1991, Discus Center-Id#44023. An experimental buoy, CB 2-Id#44024 was also set out by NDBC in January. The data from these buoys and other NDBC buoys and stations along the coast is in this database. The list of buoys and stations reporting is in the "pub" subdirectory as "buoy_sta.loc." The data is arranged by month then by NDBC record and then by manageable file size. The files do not contain headers; these can be found under ndbc as "rec*n*head.txt" where *n* is 2, 3 or 8 or B and C. These correspond to NDBC's records 2, 3 and 8, as well as the new NDBC records B and C.

ndbc.um contains directional wave spectra derived from the NDBC buoy data that have been analyzed at the University of Miami using algorithms different from those NDBC used. The data files are in Matlab format.

rows contains the data analyzed from the Radar Ocean Wave Spectrometer flown during the third intensive data period.

sra contains wave data derived from the Scanning Radar Altimeter. These files are in compressed UNIX format.

swath contains data from the SWATH ship, the Frederick G. Creed. Data are from the 2nd and 3rd Intensive Operational Periods (IOP). Wave data are in Matlab format; meteorological data are in ASCII format.

syn_radr contains an analysis of data taken by the Canada Centre for Remote Sensing Synthetic Aperture Radar during the SWADE third Intensive Operational Period. The files are in Matlab format.

waverider contains data from the buoy set out near Duck, NC. The file buoy_sta.loc gives the location of this and all the other buoys that have contributed data to the SWADE database. The files give wave energies as a function of wave frequency. No directional information is available.

whoi contains the data from the Woods Hole Oceanographic Institute buoy set out from October through December 1990.

windtower contains the data from the met tower on Wallops Island. Winds at 6 levels to just under 100 m (300 ft) are recorded and presented here with the results given as ten minute averages.

While these directories are expected to remain other directories may be added if new information comes into the database.

Following are more details of the file structure:

/pub/bathy

-rw-r—r—	1 root	997	May 19	1994	readme.bathy
-rw-r—r—	1 root	81845	May 19	1994	swade_bathy.txt

/pub/depth

drwxr-xr-x	2 root	512	May 19	1993	**adcp**

Files are named velabs.*ddr* or velabs.s*dd*, where *dd* is the day the data were taken and *r* differentiates data taken on the same day.

-rw-r—r—	1 root	2009	Dec 11	1992	chkpro.swd
-rw-r—r—	1 root	2639	Dec 11	1992	readme.asc
-rw-r—r—	1 root	28338	Dec 11	1992	velabs.21a
-rw-r—r—	1 root	71268	Dec 11	1992	velabs.21b
-rw-r—r—	1 root	10285	Dec 11	1992	velabs.s22
-rw-r—r—	1 root	53099	Dec 11	1992	velabs.s24
-rw-r—r—	1 root	101981	Dec 11	1992	velabs.s4
-rw-r—r—	1 root	8254	Dec 11	1992	velabs.s5
-rw-r—r—	1 root	17081	Dec 11	1992	velabs.s6x
-rw-r—r—	1 root	40489	Dec 11	1992	velabs.s7
-rw-r—r—	1 root	54680	Dec 11	1992	velabs.s8

drwxr-xr-x	2 root	512	May 19	1993	**t-chain**
-rw-r—r—	1 root	55395	Dec 11	1992	677_t_av.dat
-rw-r—r—	1 root	1092	Dec 11	1992	readme.asc

drwxr-xr-x	2 root	2048	May 19	1993	**xbt**
-rw-r—r—	1 root	3830	Dec 11	1992	101.lis
-rw-r—r—	1 root	12076	Dec 11	1992	1010.lis
-rw-r—r—	1 root	12076	Dec 11	1992	1011.lis
...					
-rw-r—r—	1 root	5493	Dec 11	1992	1021.lis
...					
-rw-r—r—	1 root	4953	Dec 11	1992	1028.lis
-rw-r—r—	1 root	3477	Dec 11	1992	1029.lis

-rw-r—r—	1 root	4298	Dec 11 1992	103.lis
-rw-r—r—	1 root	3765	Dec 11 1992	1030.lis
...				
-rw-r—r—	1 root	8121	Dec 11 1992	1039.lis
-rw-r—r—	1 root	5846	Dec 11 1992	104.lis
...				
-rw-r—r—	1 root	12110	Dec 11 1992	109.lis
-rw-r—r—	1 root	7995	Dec 11 1992	swadehdr.lis

/pub/metbuoy

Files are named *myy_bbbb*.data, where *m* is the month, *yy* is the year the data was taken and *bbbb* is the identification number of the buoy.

-rw-r—r—	2 root	39056	May 22 1992	d90_1602.data
-rw-r—r—	2 root	1768	May 22 1992	d90_1603.data
-rw-r—r—	2 root	28672	May 22 1992	d90_1604.data
-rw-r—r—	2 root	41180	May 22 1992	d90_1605.data
-rw-r—r—	2 root	42075	May 22 1992	d90_1606.data
-rw-r—r—	2 root	1473	May 22 1992	d90_1607.data
-rw-r—r—	2 root	29077	May 22 1992	d90_1608.data
-rw-r—r—	2 root	43013	May 22 1992	d90_1609.data
-rw-r—r—	2 root	33510	May 22 1992	f91_1602.data
-rw-r—r—	2 root	1178	May 22 1992	f91_1603.data
-rw-r—r—	2 root	33038	May 22 1992	f91_1604.data
-rw-r—r—	2 root	35870	May 22 1992	f91_1605.data
-rw-r—r—	2 root	37653	May 22 1992	f91_1606.data
-rw-r—r—	2 root	35241	May 22 1992	f91_1608.data
-rw-r—r—	2 root	39127	May 22 1992	f91_1609.data
-rw-r—r—	2 root	38112	May 22 1992	j91_1602.data
-rw-r—r—	2 root	29970	May 22 1992	j91_1604.data
-rw-r—r—	2 root	40000	May 22 1992	j91_1605.data
-rw-r—r—	2 root	41539	May 22 1992	j91_1606.data
-rw-r—r—	2 root	32963	May 22 1992	j91_1608.data
-rw-r—r—	2 root	44085	May 22 1992	j91_1609.data
-rw-r—r—	2 root	1296	May 22 1992	m91_1602.data
-rw-r—r—	2 root	1414	May 22 1992	m91_1604.data
-rw-r—r—	2 root	1414	May 22 1992	m91_1605.data
-rw-r—r—	2 root	1473	May 22 1992	m91_1606.data
-rw-r—r—	2 root	1473	May 22 1992	m91_1608.data
-rw-r—r—	2 root	1607	May 22 1992	m91_1609.data
-rw-r—r—	2 root	37050	May 22 1992	n90_1602.data
...				
-rw-r—r—	2 root	41271	May 22 1992	n90_1609.data
-rw-r—r—	2 root	38702	May 22 1992	o90_1602.data
...				
-rw-r—r—	2 root	42344	May 22 1992	o90_1609.data

/pub/ndbc

drwxr-xr-x	2 root	512	May 13 1993	**123.files**
drwxr-xr-x	5 root	512	Jun 11 1991	**april**

See below for file structure. Each month repeats this structure

drwxr-xr-x	5 root	512	Apr 24 1991	**dec**
drwxr-xr-x	5 root	512	May 23 1991	**feb**
drwxr-xr-x	5 root	512	May 1 1991	**jan**
-rw-r—r—	1 root	562	Apr 30 1993	length
drwxr-xr-x	5 root	512	May 23 1991	**mar**

drwxr-xr-x	5 root	512	Apr 19 1991	**nov**
drwxr-xr-x	5 root	512	Apr 25 1991	**oct**
-rw-r—r—	1 root	3872	Mar 26 1993	rec2head.txt
-rw-r—r—	1 root	3996	Mar 26 1993	rec3head.txt
-rw-r—r—	1 root	5271	Mar 26 1993	rec8head.txt
-rw-r—r—	1 root	3940	Mar 26 1993	recBhead.txt
-rw-r—r—	1 root	3402	Mar 26 1993	recChead.txt

The directories have the following structures:

drwxr-xr-x 2 root 512 May 13 1993 **123.files**

Files are named wave*mmdd*.wk1, where *mm* is the month and *dd* is the day on which the data was taken. These are Lotus 123 files; this is an early product that was not continued, and only 12 days data are included here.

-rw-r—r—	1 root	696	May 13 1993	readme.123
-rwxr-xr-x	1 root	133868	Dec 20 1990	wave1020.wk1
-rwxr-xr-x	1 root	134251	Dec 20 1990	wave1021.wk1
...				
-rwxr-xr-x	1 root	136469	Dec 20 1990	wave1031.wk1
-rwxr-xr-x	1 root	97350	Dec 20 1990	windndbc.wk1

drwxr-xr-x 5 root 512 Jun 11 1991 **april**

drwxr-xr-x 2 root 512 Jun 13 1991 **record2**

Files are named rec2.all.mmdd.yy, where *mm* is the month, *dd* is the day of the month and *yy* is the year the data was taken. *all* in the name indicates that data from all of the buoys recorded are contained in this record.

-rwxr-xr-x	1 root	71786	Jun 13 1991	rec2.all.0401.91
-rwxr-xr-x	1 root	71929	Jun 13 1991	rec2.all.0402.91
-rwxr-xr-x	1 root	71929	Jun 13 1991	rec2.all.0403.91
-rwxr-xr-x	1 root	71071	Jun 13 199	rec2.all.0404.91
-rwxr-xr-x	1 root	68354	Jun 13 1991	rec2.all.0405.91
-rwxr-xr-x	1 root	63206	Jun 13 1991	rec2.all.0406.91
-rwxr-xr-x	1 root	60346	Jun 13 1991	rec2.all.0407.91

drwxr-xr-x 2 root 1024 Jun 12 1991 **record3**

Files are named rec3.*bbbbb.mmyy.d1_d2*, where *bbbbb* is the name of the buoy or station whose data is recorded, *mm* is the month, *yy* is the year, *d1* is the first day on which data were taken and *d2* is the last day on which data were taken for the file.

-rwxr-xr-x	1 root	157248	Jun 12 1991	rec3.41008.0491.01_07
-rwxr-xr-x	1 root	311688	Jun 12 1991	rec3.41009.0491.01_07
-rwxr-xr-x	1 root	313560	Jun 12 1991	rec3.41010.0491.01_07
-rwxr-xr-x	1 root	156312	Jun 12 1991	rec3.44004.0491.01_07
-rwxr-xr-x	1 root	156312	Jun 12 1991	rec3.44005.0491.01_07
-rwxr-xr-x	1 root	155376	Jun 12 1991	rec3.44007.0491.01_07
-rwxr-xr-x	1 root	155376	Jun 12 1991	rec3.44008.0491.01_07
-rwxr-xr-x	1 root	155376	Jun 12 1991	rec3.44009.0491.01_07
-rwxr-xr-x	1 root	156312	Jun 12 1991	rec3.44011.0491.01_07
-rwxr-xr-x	1 root	156312	Jun 12 1991	rec3.44012.0491.01_07
-rwxr-xr-x	1 root	157248	Jun 12 1991	rec3.44013.0491.01_07
-rwxr-xr-x	1 root	134784	Jun 12 1991	rec3.ALSN6.0491.01_07
-rwxr-xr-x	1 root	155376	Jun 11 1991	rec3.CERC.0491.01_07
-rwxr-xr-x	1 root	150696	Jun 12 1991	rec3.CHLV2.0491.01_07
-rwxr-xr-x	1 root	113256	Jun 12 1991	rec3.Cdisc.0491.01_06
-rwxr-xr-x	1 root	145080	Jun 12 1991	rec3.DSLN7.0491.01_07
-rwxr-xr-x	1 root	79560	Jun 11 1991	rec3.Edisc.0491.01_07

-rwxr-xr-x	1 root	121680	Jun 11 1991	rec3.Ndisc.0491.01_07
-rwxr-xr-x	1 root	134784	Jun 12 1991	rec3.SVLS1.0491.01_07

drwxr-xr-x 2 root 512 Jun 12 1991 **record8**

Files are named rec8.*bbbbb.mmyy.d1_d2*, where *bbbbb* is the name of the buoy whose data is recorded, *mm* is the month, *yy* is the year, *d1* is the first day on which data were taken and *d2* is the last day on which data were taken for the file.

-rwxr-xr-x	1 root	247632	Jun 12 1991	rec8.41008.0491.01_07
-rwxr-xr-x	1 root	244684	Jun 12 1991	rec8.CERC.0491.01_07
-rwxr-xr-x	1 root	178354	Jun 12 1991	rec8.Cdisc.0491.01_06
-rwxr-xr-x	1 root	125290	Jun 12 1991	rec8.Edisc.0491.01_04
-rwxr-xr-x	1 root	191620	Jun 12 1991	rec8.Ndisc.0491.01_06

drwxr-xr-x 2 root 2048 May 13 1993 **buoy44024**

Files are named recn.44024.*mmyy.d1_d2*, where *n* is the record type, *mm* is the month, *yy* is the year, *d1* is the first day on which data were taken and *d2* is the last day on which data were taken for the file.

-rwxr-xr-x	1 root	930	May 13 1993	readme.pc
-rwxr-xr-x	1 root	1009	May 13 1993	readme.unix
-rwxr-xr-x	1 root	10780	Dec 10 1991	recB.44024.0191.14_17
-rwxr-xr-x	1 root	13300	Dec 10 1991	recB.44024.0191.18_21
-rwxr-xr-x	1 root	13440	Dec 10 1991	recB.44024.0191.22_25
-rwxr-xr-x	1 root	13440	Dec 10 1991	recB.44024.0191.26_29
-rwxr-xr-x	1 root	6720	Dec 10 1991	recB.44024.0191.30_31
-rwxr-xr-x	1 root	13440	Dec 10 1991	recB.44024.0291.01_04
...				
-rwxr-xr-x	1 root	13300	Dec 10 1991	recB.44024.0291.25_28
-rwxr-xr-x	1 root	13300	Dec 10 1991	recB.44024.0391.01_04
...				
-rwxr-xr-x	1 root	10080	Dec 10 1991	recB.44024.0391.29_31
-rwxr-xr-x	1 root	13440	Dec 10 1991	recB.44024.0491.01_04
...				
-rwxr-xr-x	1 root	13440	Dec 10 1991	recB.44024.0491.13_17
-rwxr-xr-x	1 root	64800	Dec 10 1991	recC.44024.0191.14_17
...				
-rwxr-xr-x	1 root	41472	Dec 10 1991	recC.44024.0191.30_31
-rwxr-xr-x	1 root	82944	Dec 10 1991	recC.44024.0291.01_04
-rwxr-xr-x	1 root	82944	Dec 10 1991	recC.44024.0291.05_08
...				
-rwxr-xr-x	1 root	82080	Dec 10 1991	recC.44024.0291.25_28
-rwxr-xr-x	1 root	82080	Dec 10 1991	recC.44024.0391.01_04
...				
-rwxr-xr-x	1 root	62208	Dec 10 1991	recC.44024.0391.29_31
-rwxr-xr-x	1 root	82944	Dec 10 1991	recC.44024.0491.01_04
...				
-rwxr-xr-x	1 root	82944	Dec 10 1991	recC.44024.0491.13_17

/pub/ndbc.um

drwxr-xr-x 8 root512 Jun 28 1995 **dir_spec**
-rw-r—r— 1 root9129 Aug 29 1995 read.me2
-rw-r—r— 1 root1720 Sep 18 1995 readme

drwxr-xr-x 8 root512 Jun 28 1995 **dir_spec**
drwxr-xr-x 6 root512 Jun 28 1995 **dec90**
drwxr-xr-x 6 root512 Jun 28 1995 **feb91**

drwxr-xr-x	6 root512	Jun 28	1995	**jan91**		
drwxr-xr-x	6 root512	Jun 28	1995	**mar91**		
drwxr-xr-x	6 root512	Jun 28	1995	**nov90**		
drwxr-xr-x	6 root512	Jun 28	1995	**oct90**		

Each of the directories named for a month has the following structure:

drwxr-xr-x	6 root512	Jun 28	1995	**dec90**
drwxr-xr-x	2 root18432	Aug 4	1995	**cr**
drwxr-xr-x	2 root512	Jun 28	1995	**dc**
drwxr-xr-x	2 root17920	Aug 4	1995	**de**
drwxr-xr-x	2 root16384	Aug 4	1995	**dn**

Note that the directories cr, dc, de and dn refer to the SWADE/NDBC buoys for which directional wave spectra were analyzed; that is, the CERC discus buoy, discus center, discus east and discus north.. Each of these directories has the same convention for naming files in it; only cr is shown:

drwxr-xr-x	2 root18432	Aug 4	1995	**cr**

Files are named *bbmmddhh*.mat, where *bb* is the buoy identification, *mm* the month, *dd* the day and *hh* the hour at which the data were taken.

-rw-r—r—	1 ftp23063	Aug 4	1995	cr120100.mat
-rw-r—r—	1 ftp23063	Aug 4	1995	cr120101.mat
...				
-rw-r—r—	1 ftp23063	Aug 4	1995	cr120123.mat
...				
-rw-r—r—	1 ftp23063	Aug 4	1995	cr121512.mat
...				
-rw-r—r—	1 ftp23063	Aug 4	1995	cr123123.mat

/pub/rows

drwxr-xr-x	2 root	1536	May 25	1993	**altdata**
drwxr-xr-x	2 root	512	May 25	1993	**navdat**
-rw-r—r—	2 jackson	4693	Mar 3	1993	readme.row
drwxr-xr-x	2 root	2048	May 25	1993	**spectra**

The directories have the following structures:

drwxr-xr-x	2 root	1536	May 25	1993	**altdata**

Files are named a*mmdd_pp*.out, where *mm* is the month, *dd* is the day and *pp* is the point at which the data were taken.

-r—r—r—	2 jackson	583	Feb 11	1993	a0227_01.out
-r—r—r—	2 jackson	583	Feb 11	1993	a0227_02.out
...					
-r—r—r—	2 jackson	583	Feb 11	1993	a0227_06.out
-r—r—r—	2 jackson	583	Feb 11	1993	a0227_07.out
-r—r—r—	2 jackson	583	Feb 11	1993	a0228_01.out
...					
-r—r—r—	2 jackson	583	Feb 11	1993	a0228_07.out
-r—r—r—	2 jackson	583	Feb 11	1993	a0228_08.out
-r—r—r—	2 jackson	583	Dec 21	1992	a0302_01.out
...					
-r—r—r—	2 jackson	587	Feb 9	1993	a0302_09.out
-r—r—r—	2 jackson	583	Dec 14	1992	a0304_01.out
-r—r—r—	2 jackson	583	Dec 14	1992	a0304_02.out
...					
-r—r—r—	2 jackson	585	Dec 14	1992	a0304_05.out
-r—r—r—	2 jackson	583	Nov 19	1992	a0305_01.out
...					
-r—r—r—	2 jackson	583	Nov 19	1992	a0305_06.out
-r—r—r—	2 jackson	583	Feb 11	1993	a0306_01.out

...

-r—r—r—	2 jackson	585	Feb 11 1993	a0306_05.out
-r—r—r—	2 jackson	583	Dec 4 1992	a0307a01.out

...

-r—r—r—	2 jackson	583	Dec 4 1992	a0307a08.out
-r—r—r—	2 jackson	1120	Dec 4 1992	a0307a09.out

drwxr-xr-x 2 root 512 May 25 1993 navdat

Files are named n*mmdd*.asc, where *mm* is the month, *dd* is the day on which the data were taken.

-r—r—r—	2 jackson	2214	Feb 11 1993	n0227.asc
-r—r—r—	2 jackson	3950	Feb 11 1993	n0228.asc
-r—r—r—	2 jackson	3256	Feb 11 1993	n0302.asc
-r—r—r—	2 jackson	3891	Feb 11 1993	n0304.asc
-r—r—r—	2 jackson	3008	Feb 11 1993	n0305.asc
-r—r—r—	2 jackson	2310	Feb 11 1993	n0306.asc
-r—r—r—	2 jackson	3534	Feb 11 1993	n0307a.asc
-r—r—r—	2 jackson	443	Feb 5 1993	navmask.asc

drwxr-xr-x 2 root 2048 May 25 1993 spectra

Files are named s*mmdd_pp*.srf, where *mm* is the month, *dd* is the day and *pp* is the point at which the data were taken.

-r—r—r—	2 jackson	16228	Feb 9 1993	s0227_01.srf
-r—r—r—	2 jackson	16228	Feb 9 1993	s0227_02.srf
-r—r—r—	2 jackson	16228	Feb 9 1993	s0227_03.srf
-r—r—r—	2 jackson	16228	Feb 9 1993	s0227_04.srf
-r—r—r—	2 jackson	16228	Feb 9 1993	s0227_05.srf
-r—r—r—	2 jackson	16228	Feb 9 1993	s0227_06.srf
-r—r—r—	2 jackson	16228	Feb 9 1993	s0227_07.srf
-r—r—r—	2 jackson	16227	Feb 9 1993	s0227_08.srf
-r—r—r—	2 jackson	16228	Jan 28 1993	s0228_01.srf
-r—r—r—	2 jackson	16228	Jan 28 1993	s0228_02.srf

...

-r—r—r—	2 jackson	16229	Jan 20 1993	s0228_08.srf

...

-r—r—r—	2 jackson	16228	Jan 20 1993	s0228_16.srf
-r—r—r—	2 jackson	16229	Feb 4 1993	s0302_01.srf

...

-r—r—r—	2 jackson	16228	Jan 13 1993	s0302_09.srf
-r—r—r—	2 jackson	16228	Dec 10 1992	s0304_01.srf

...

-r—r—r—	2 jackson	16229	Feb 4 1993	s0304_09.srf
-r—r—r—	2 jackson	14901	Nov 20 1992	s0305_01.srf

...

-r—r—r—	2 jackson	14902	Nov 21 1992	s0305_11.srf
-r—r—r—	2 jackson	16227	Dec 7 1992	s0306_01.srf

...

-r—r—r—	2 jackson	16228	Dec 7 1992	s0306_07.srf
-r—r—r—	2 jackson	16228	Dec 2 1992	s0307a01.srf

...

-r—r—r—	2 jackson	16228	Dec 2 1992	s0307a10.srf
-r—r—r—	2 jackson	16229	Feb 5 1993	s0307a11.srf

/pub/sra

Files are named *mdd.fnn*.Z, where *m* is the month, *dd* is the day, *f* is the flight line and *nn* is the point at which the data were taken. The Z indicates that the files are compressed.

-rw-r—r— 1 ftp866 Sep 30 1994 f27.100.Z
-rw-r—r— 1 ftp756 Sep 30 1994 f27.101.Z

-rw-r—r— 1 ftp721 Sep 30 1994 f27.109.Z
-rw-r—r— 1 ftp37509 Sep 30 1994 f27.240.Z

rw-r—r— 1 ftp29628 Sep 30 1994 f27.249.Z
-rw-r—r— 1 ftp903 Oct 4 1994 f28.100.Z

rw-r—r— 1 ftp601 Oct 4 1994 f28.107.Z
-rw-r—r— 1 ftp40871 Oct 4 1994 f28.240.Z

-rw-r—r— 1 ftp23532 Oct 4 1994 f28.247.Z
-rw-r—r— 1 root7861 Jun 14 1995 files.sra
-rw-r—r— 1 root7398 Jun 14 1995 files_old.sra
-rw-r—r— 1 root658 Sep 22 1994 m01.100.Z

rw-r—r— 1 root489 Sep 22 1994 m01.107.Z
-rw-r—r— 1 root30780 Sep 22 1994m01.240.Z

w-r—r— 1 root3259 Sep 22 1994 m01.247.Z
-rw-r—r— 1 root780 Sep 22 1994 m02.100.Z

-rw-r—r— 1 root913 Sep 22 1994 m02.108.Z
-rw-r—r— 1 root27573 Sep 22 1994m02.240.Z

-rw-r—r— 1 root25551 Sep 22 1994m02.248.Z
-rw-r—r— 1 root861 Sep 22 1994 m02a.109.Z
-rw-r—r— 1 root25688 Sep 22 1994m02a.249.Z
-rw-r—r— 1 root716 Sep 22 1994 m02b.109.Z
-rw-r—r— 1 root9974 Sep 22 1994 m02b.249.Z
-rw-r—r— 1 root596 Sep 26 1994 m04.100.Z

-rw-r—r— 1 root496 Sep 26 1994 m04.108.Z
-rw-r—r— 1 root20942 Sep 26 1994m04.240.Z

-rw-r—r— 1 root11837 Sep 26 1994m04.248.Z
-rw-r—r— 1 root495 Sep 26 1994 m04a.109.Z
-rw-r—r— 1 root10839 Sep 26 1994m04a.249.Z
-rw-r—r— 1 root565 Sep 26 1994 m04b.109.Z
-rw-r—r— 1 root12865 Sep 26 1994m04b.249.Z
-rw-r—r— 1 root1928 Sep 22 1994 m05.101.Z

-rw-r—r— 1 root1270 Sep 22 1994 m05.107.Z
-rw-r—r— 1 root78979 Sep 22 1994m05.241.Z

-rw-r—r— 1 root50225 Sep 22 1994m05.247.Z
-rw-r—r— 1 root1634 Sep 22 1994 m05a.100.Z

-rw-r—r— 1 root291 Sep 22 1994 m05a.109.Z
-rw-r—r— 1 root72205 Sep 22 1994m05a.240.Z
-rw-r—r— 1 root6206 Sep 22 1994 m05a.243.Z

```
-rw-r—r— 1 root1264 Sep 22 1994 m05a.249.Z
-rw-r—r— 1 root426 Sep 22 1994 m05b.100.Z

-rw-r—r— 1 root610 Sep 22 1994 m05b.109.Z

-rw-r—r— 1 root26422 Sep 22 1994m05b.246
-rw-r—r— 1 root6419 Sep 22 1994 m05b.246.Z
-rw-r—r— 1 root19367 Sep 22 1994m05b.249.Z
-rw-r—r— 1 root499 Sep 22 1994 m05c.106.Z
-rw-r—r— 1 root11926 Sep 22 1994m05c.246.Z
-rw-r—r— 1 root759 Sep 27 1994 m07.102.Z

-rw-r—r— 1 root434 Sep 27 1994 m07.109.Z
-rw-r—r— 1 root28029 Sep 27 1994m07.242.Z
-rw-r—r— 1 root37682 Sep 27 1994m07.243.Z
-rw-r—r— 1 root11031 Sep 27 1994m07.249.Z
-rw-r—r— 1 root554 Sep 27 1994 m07a.100.Z
-rw-r—r— 1 root551 Sep 27 1994 m07a.101.Z
-rw-r—r— 1 root19298 Sep 27 1994m07a.240.Z
-rw-r—r— 1 root19703 Sep 27 1994m07a.241.Z
-rw-r—r— 1 root299 Sep 27 1994 m07b.100.Z
-rw-r—r— 1 root298 Sep 27 1994 m07b.101.Z
-rw-r—r— 1 root4331 Sep 27 1994 m07b.240.Z
-rw-r—r— 1 root4573 Sep 27 1994 m07b.241.Z
-rw-r—r— 1 root2732 Jun 6 1995 readme.sra
```

/pub/swath

```
-r—r—r— 1 root3651 Jun 6 1995 README
dr-xr-xr-x 2 root512 Jun 6 1995 loc
dr-xr-xr-x 2 root512 Jun 19 1995 met
-r—r—r— 1 root3663 Jun 6 1995 readme.swath
dr-xr-xr-x 2 root2048 Jun 19 1995 windwave
```

The directories have the following structures:

```
dr-xr-xr-x 2 root512 Jun 6 1995 loc
    -rw-r—r— 1 root 2710 Jun 6 1995     gpsfeb25.asc
    -rw-r—r— 1 root 15011 Jun 6 1995    gpsfeb26.asc
    -rw-r—r— 1 root 17826 Jun 6 1995    gpsfeb27.asc
    -rw-r—r— 1 root 32477 Jun 6 1995    gpsmar3.asc
    ...
    -rw-r—r— 1 root 15751 Jun 6 1995    gpsmar9.asc

dr-xr-xr-x 2 root512 Jun 19 1995 met
    -rw-r—r— 1 root 4699 Jun 19 1995    metmar3.asc
    ...
    -rw-r—r— 1 root 2997 Jun 19 1995    metmar9.asc

dr-xr-xr-x 2 root2048 Jun 19 1995 windwave
```

Files are named f*ddtttt*.mat, where *dd* is the Julian day and *tttt* is the UTC start time at which the data was recorded; for example, f631947.mat is data for day 63 (4 March 1991) starting at 19:47 UTC. The data is in Matlab format. A file contains 17 minutes of data.

```
    -rw-r—r— 1 root 16661 Jun 19 1995   f192201.mat
    -rw-r—r— 1 root 16661 Jun 19 1995   f192218.mat
    -rw-r—r— 1 root 16661 Jun 19 1995   f192235.mat
    -rw-r—r— 1 root 16661 Jun 19 1995   f200015.mat
```

```
...
-rw-r—r—  1 root   16661 Jun 19  1995            f200551.mat
-rw-r—r—  1 root   16661 Jun 19  1995            f212148.mat
-rw-r—r—  1 root   16661 Jun 19  1995            f220007.mat
...
-rw-r—r—  1 root   16661 Jun 19  1995            f222050.mat
-rw-r—r—  1 root   16661 Jun 19  1995            f230308.mat
...
-rw-r—r—  1 root   16661 Jun 19  1995            f230615.mat
-rw-r—r—  1 root   16661 Jun 19  1995            f631913.mat
-rw-r—r—  1 root   16661 Jun 19  1995            f631930.mat
-rw-r—r—  1 root   16661 Jun 19  1995            f631947.mat
-rw-r—r—  1 root   16661 Jun 19  1995            f640100.mat
...
-rw-r—r—  1 root   16661 Jun 19  1995            f642343.mat
-rw-r—r—  1 root   16661 Jun 19  1995            f650000.mat
...
-rw-r—r—  1 root   16661 Jun 19  1995            f651808.mat
-rw-r—r—  1 root   16661 Jun 19  1995            f661908.mat
...
-rw-r—r—  1 root   16661 Jun 19  1995            f662246.mat
-rw-r—r—  1 root   16661 Jun 19  1995            f670033.mat
...
-rw-r—r—  1 root   16661 Jun 19  1995            f672344.mat
-rw-r—r—  1 root   16661 Jun 19  1995            f680006.mat
-rw-r—r—  1 root   16661 Jun 19  1995            f680033.mat
-rw-r—r—  1 root   16661 Jun 19  1995            f680100.mat
```

/pub/syn_radr

File names contain the mission and leg on which the synthetic aperture radar data were taken: s*x*l*y*p*za*.mat where *x* is the mission number, *y* is the flight leg, *z* is the point on the leg, and *a* is a radar image parameter. Note that a lower case L, l, and the number one, 1, must be distinguished to correctly copy these files.

```
-r—r—r—  1 root868 Jan 25  1994    radar.txt
-r—r—r—  1 root52516 Jan 25  1994 s1l1p1c.mat
-r—r—r—  1 root52516 Jan 25  1994 s1l1p1e.mat
-r—r—r—  1 root52516 Jan 25  1994 s1l2p2e.mat
-r—r—r—  1 roo t52516 Jan 25  1994s1l2p2x.mat
-r—r—r—  1 roo t52516 Jan 25  1994s1l3p3c.mat
-r—r—r—  1 roo t52516 Jan 25  1994s1l3p3n.mat
-r—r—r—  1 roo t52516 Jan 25  1994s1l3p3x.mat
-r—r—r—  1 roo t52516 Jan 25  1994s2l1p3c.mat
-r—r—r—  1 roo t52516 Jan 25  1994s2l1p3e.mat
-r—r—r—  1 roo t52516 Jan 25  1994s2l2p1e.mat
-r—r—r—  1 roo t52516 Jan 25  1994s2l3p2c.mat
-r—r—r—  1 roo t52516 Jan 25  1994s2l3p2n.mat
-r—r—r—  1 roo t52516 Jan 25  1994s3l1p1c.mat
-r—r—r—  1 roo t52516 Jan 25  1994s3l1p1e.mat
-r—r—r—  1 roo t52516 Jan 25  1994s3l2p2e.mat
-r—r—r—  1 roo t52516 Jan 25  1994s3l2p2x.mat
-r—r—r—  1 roo t52516 Jan 25  1994s3l3p3c.mat
-r—r—r—  1 roo t52516 Jan 25  1994s3l3p3n.mat
-r—r—r—  1 roo t52516 Jan 25  1994s3l3p3x.mat
-r—r—r—  1 roo t52516 Jan 25  1994s4l1p1n.mat
-r—r—r—  1 roo t52516 Jan 25  1994s4l2p2x.mat
```

/pub/waverider

```
-r—r—r— 1 root17650 Jan 25 1994 dec90.630
-r—r—r— 1 root7276 Jan 25 1994 feb91.630
-r—r—r— 1 root11000 Jan 25 1994 jan91.630
-r—r—r— 1 root22438 Jan 25 1994 mar91.630
-r—r—r— 1 root19113 Jan 25 1994 nov90.630
-r—r—r— 1 root31216 Jan 25 1994 oct90.630
-r—r—r— 1 root1385 Jan 25 1994 wavrider.txt
```

/pub/whoi

drwxr-xr-x	2 root	2560	May 25 1993	**met**
drwxr-xr-x	2 root	5632	May 25 1993	**motion**
-rw-r—r—	2 root	670	Apr 30 1993	readme.whoi

The directories contain the following files:

drwxr-xr-x	2 root	2560	May 25 1993	**met**

Files are named whoi.*ddd*, where *ddd* is the Julian day on which the data were taken. Jan 1 is day 000 in this directory only.

-rwxr-xr-x	2 root	189214	Jun 2 1992	whoi.000
-rwxr-xr-x	2 root	189214	Jun 2 1992	whoi.001
...				
-rwxr-xr-x	2 root	190662	Jun 2 1992	whoi.007
-rwxr-xr-x	2 root	190662	Jun 2 1992	whoi.008
-rwxr-xr-x	2 root	190662	Jun 2 1992	whoi.009
-rwxr-xr-x	2 root	190663	Jun 2 1992	whoi.010
...				
-rwxr-xr-x	2 root	190663	Jun 2 1992	whoi.015
-rwxr-xr-x	2 root	189216	Jun 2 1992	whoi.267
-rwxr-xr-x	2 root	189216	Jun 2 1992	whoi.268
...				
-rwxr-xr-x	2 root	189216	Jun 2 1992	whoi.360
...				
-rwxr-xr-x	2 root	189216	Jun 2 1992	whoi.364

drwxr-xr-x	2 root	5632	May 25 1993	**motion**

Files are named *yymmddhh*.mot, where *yy* is the year, *mm* is the month, *dd* is the day and *hh* is the middle hour for the time interval over which the data were taken. Each file records 8 hours of data.

-rw-r—r—	2 root	191488	Apr30 1993	90092504.mot
-rw-r—r—	2 root	191488	Apr30 1993	90092512.mot
-rw-r—r—	2 root	191488	Apr30 1993	90092520.mot
-rw-r—r—	2 root	191488	Apr30 1993	90092604.mot
-rw-r—r—	2 root	191488	Apr30 1993	90092612.mot
-rw-r—r—	2 root	191488	Apr30 1993	90092620.mot
...				
-rw-r—r—	2 root	191488	Apr30 1993	90093004.mot
-rw-r—r—	2 root	191488	Apr30 1993	90093012.mot
-rw-r—r—	2 root	191488	Apr30 1993	90093020.mot
-rw-r—r—	2 root	191488	Apr30 1993	90100104.mot
-rw-r—r—	2 root	191488	Apr30 1993	90100112.mot
-rw-r—r—	2 root	191488	Apr30 1993	90100120.mot
...				
-rw-r—r—	2 root	191488	Apr30 1993	90103104.mot
-rw-r—r—	2 root	191488	Apr30 1993	90103112.mot
-rw-r—r—	2 root	191488	Apr30 1993	90103120.mot
-rw-r—r—	2 root	191488	Apr30 1993	90110104.mot

```
-rw-r—r— 2 root   191488   Apr30 1993   90110112.mot
-rw-r—r— 2 root   191488   Apr30 1993   90110120.mot
...
-rw-r—r— 2 root   191488   Apr30 1993   90111504.mot
-rw-r—r— 2 root   191488   Apr30 1993   90111512.mot
-rw-r—r— 2 root   191488   Apr30 1993   90111520.mot
...
-rw-r—r— 2 root   191488   Apr30 1993   90111904.mot
-rw-r—r— 2 root   191488   Apr30 1993   90111912.mot
-rw-r—r— 2 root   191488   Apr30 1993   90111920.mot
-rw-r—r— 2 root   191488   Apr30 1993   90120104.mot
-rw-r—r— 2 root   191488   Apr30 1993   90120112.mot
-rw-r—r— 2 root   191488   Apr30 1993   90120120.mot
...
-rw-r—r— 2 root   191488   Apr30 1993   90120504.mot
-rw-r—r— 2 root   191488   Apr30 1993   90120512.mot
-rw-r—r— 2 root   191488   Apr30 1993   90120520.mot
-rw-r—r— 2 root   191488   Apr30 1993   90120604.mot
-rw-r—r— 2 root   191488   Apr30 1993   90120612.mot
-rw-r—r— 2 root   191488   Apr30 1993   91010104.mot
-rw-r—r— 2 root   191488   Apr30 1993   91010112.mot
...
-rw-r—r— 2 root   191488   Apr30 1993   91011004.mot
-rw-r—r— 2 root   191488   Apr30 1993   91011012.mot
-rw-r—r— 2 root   191488   Apr30 1993   91011020.mot
...
-rw-r—r— 2 root   191488   Apr30 1993   91011604.mot
-rw-r—r— 2 root   191488   Apr30 1993   91011612.mot
-rw-r—r— 2 root   191488   Apr30 1993   91011620.mot
```

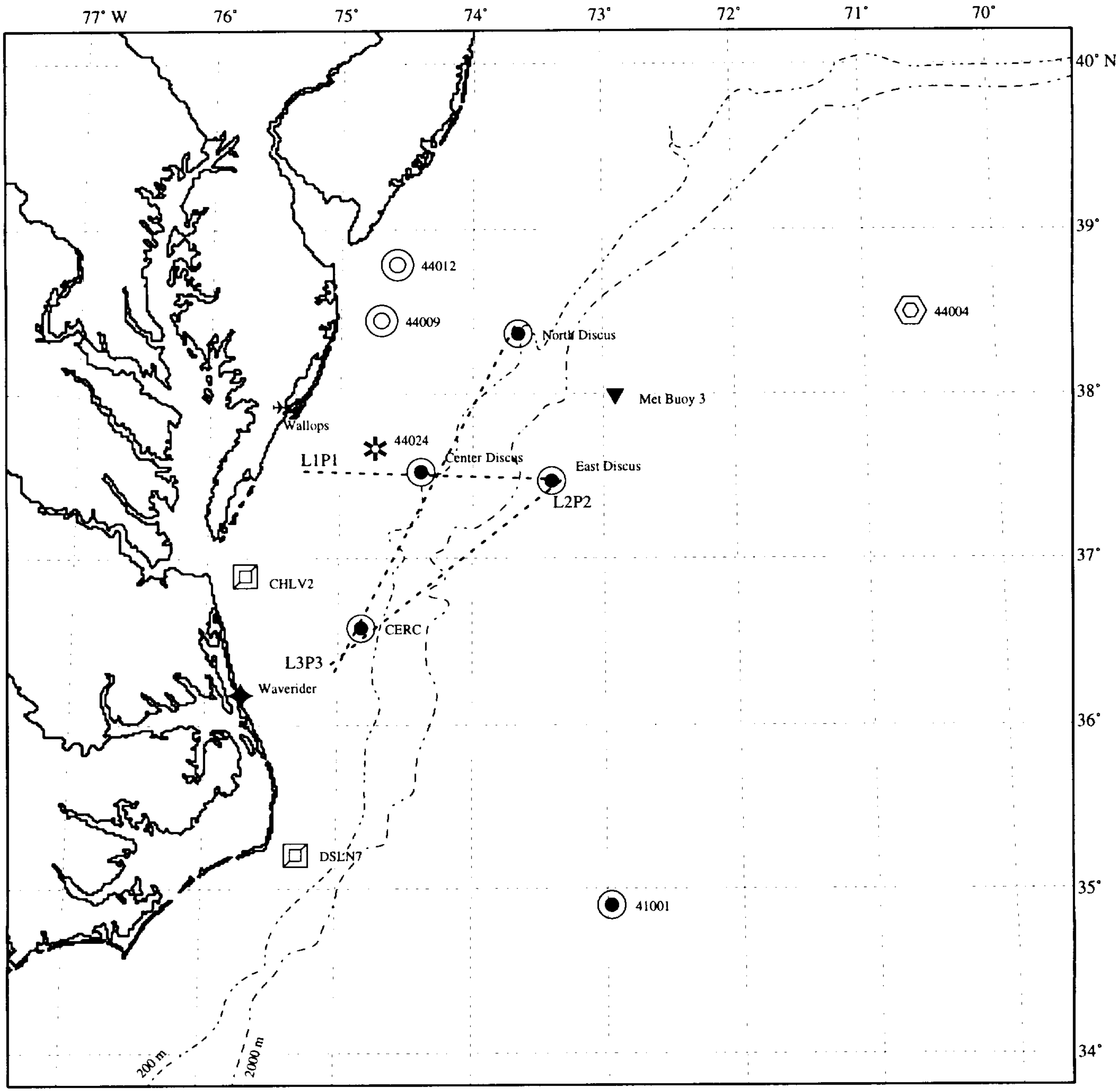
/pub/windtower

Files are named *ddd.x*, where *ddd* is the Julian day on which the data were taken, and *x* is an indication of the data completeness for that day. *x* may have the value *c* for complete, *inc* for incomplete and *0* for no data that day.

```
-rw-r—r— 2 daveo   13921   Jun 3  1993   001.c
-rw-r—r— 2 daveo    8065   May 26 1993   002.inc
-rw-r—r— 2 daveo    4993   May 26 1993   003.inc
-rw-r—r— 2 daveo       0   May 26 1993   004.0
-rw-r—r— 2 daveo       0   May 26 1993   005.0
-rw-r—r— 2 daveo       0   May 26 1993   006.0
-rw-r—r— 2 daveo    1441   May 26 1993   007.inc
-rw-r—r— 2 daveo    7585   May 26 1993   008.inc
-rw-r—r— 2 daveo       0   May 26 1993   009.0
-rw-r—r— 2 daveo       0   May 26 1993   010.0
-rw-r—r— 2 daveo       0   May 26 1993   011.0
-rw-r—r— 2 daveo       0   May 26 1993   012.0
-rw-r—r— 2 daveo       0   May 26 1993   013.0
-rw-r—r— 2 daveo    5089   May 26 1993   014.inc
-rw-r—r— 2 daveo       0   May 26 1993   015.0
-rw-r—r— 2 daveo    4993   Jun 3  1993   017.inc
-rw-r—r— 2 daveo   14238   Jun 3  1993   018.c
-rw-r—r— 2 daveo   13921   Jun 3  1993   019.c
-rw-r—r— 2 daveo   13921   Jun 3  1993   020.c
-rw-r—r— 2 daveo   13921   Jun 3  1993   021.c
-rw-r—r— 2 daveo   14018   Jun 3  1993   022.c
```

-rw-r—r—	2 daveo	12099	Jun 3 1993	023.inc
-rw-r—r—	2 daveo	6049	Jun 3 1993	024.inc
-rw-r—r—	2 daveo	3009	Jun 3 1993	025.inc
-rw-r—r—	2 daveo	6529	Jun 3 1993	028.inc
-rw-r—r—	2 daveo	13456	Jun 3 1993	029.inc
-rw-r—r—	2 daveo	14113	Jun 3 1993	030.c
-rw-r—r—	2 daveo	14287	Jun 3 1993	031.c
-rw-r—r—	2 daveo	12466	Jun 3 1993	032.inc
-rw-r—r—	2 daveo	14095	Jun 3 1993	033.c
-rw-r—r—	2 daveo	14094	Jun 3 1993	034.c
-rw-r—r—	2 daveo	9219	Jun 3 1993	035.inc
-rw-r—r—	2 daveo	7759	Jun 3 1993	036.inc
-rw-r—r—	2 daveo	14192	Jun 3 1993	059.c
-rw-r—r—	2 daveo	14289	Jun 3 1993	060.c
...				
-rw-r—r—	2 daveo	6529	Jun 3 1993	067.inc
-rw-r—r—	2 daveo	6529	Jun 3 1993	070.inc
...				
-rw-r—r—	2 daveo	13921	Jun 3 1993	086.c
-rw-r—r—	2 daveo	13921	Jun 3 1993	087.c
-rw-r—r—	2 daveo	14017	Jun 3 1993	088.c
-rw-r—r—	2 daveo	13921	Jun 3 1993	089.c
-rw-r—r—	2 daveo	13921	Jun 3 1993	090.c
-rw-r—r—	2 daveo	0	Aug 3 1992	274.0
-rw-r—r—	2 daveo	0	Aug 3 1992	275.0
-rw-r—r—	2 daveo	0	Aug 3 1992	276.0
-rw-r—r—	2 daveo	4609	Aug 3 1992	277.inc
-rw-r—r—	2 daveo	9026	Aug 3 1992	278.inc
-rw-r—r—	2 daveo	13058	Aug 3 1992	282.inc
-rw-r—r—	2 daveo	14017	Aug 3 1992	283.c
-rw-r—r—	2 daveo	9123	Aug 3 1992	284.inc
-rw-r—r—	2 daveo	6049	Aug 3 1992	285.inc
-rw-r—r—	2 daveo	13922	Aug 3 1992	289.c
-rw-r—r—	2 daveo	13153	Aug 3 1992	290.c
-rw-r—r—	2 daveo	4706	Aug 3 1992	292.inc
-rw-r—r—	2 daveo	13922	Aug 3 1992	295.c
...				
-rw-r—r—	2 daveo	13921	Aug 3 1992	305.c
...				
-rw-r—r—	2 daveo	0	Aug 3 1992	315.0
...				
-rw-r—r—	2 daveo	9603	Aug 3 1992	325.inc
...				
-rw-r—r—	2 daveo	13921	Aug 3 1992	335.c
...				
-rw-r—r—	2 daveo	13922	Aug 4 1992	345.c
...				
-rw-r—r—	2 daveo	12578	Aug 4 1992	355.inc
...				
-rw-r—r—	2 daveo	0	Aug 4 1992	364.0
-rw-r—r—	2 daveo	2113	Aug 4 1992	365.inc
-rw-r—r—	1 root	1317	Jun 3 1993	readme.tower

CCRS SAR Flight 1
February 27, 1991



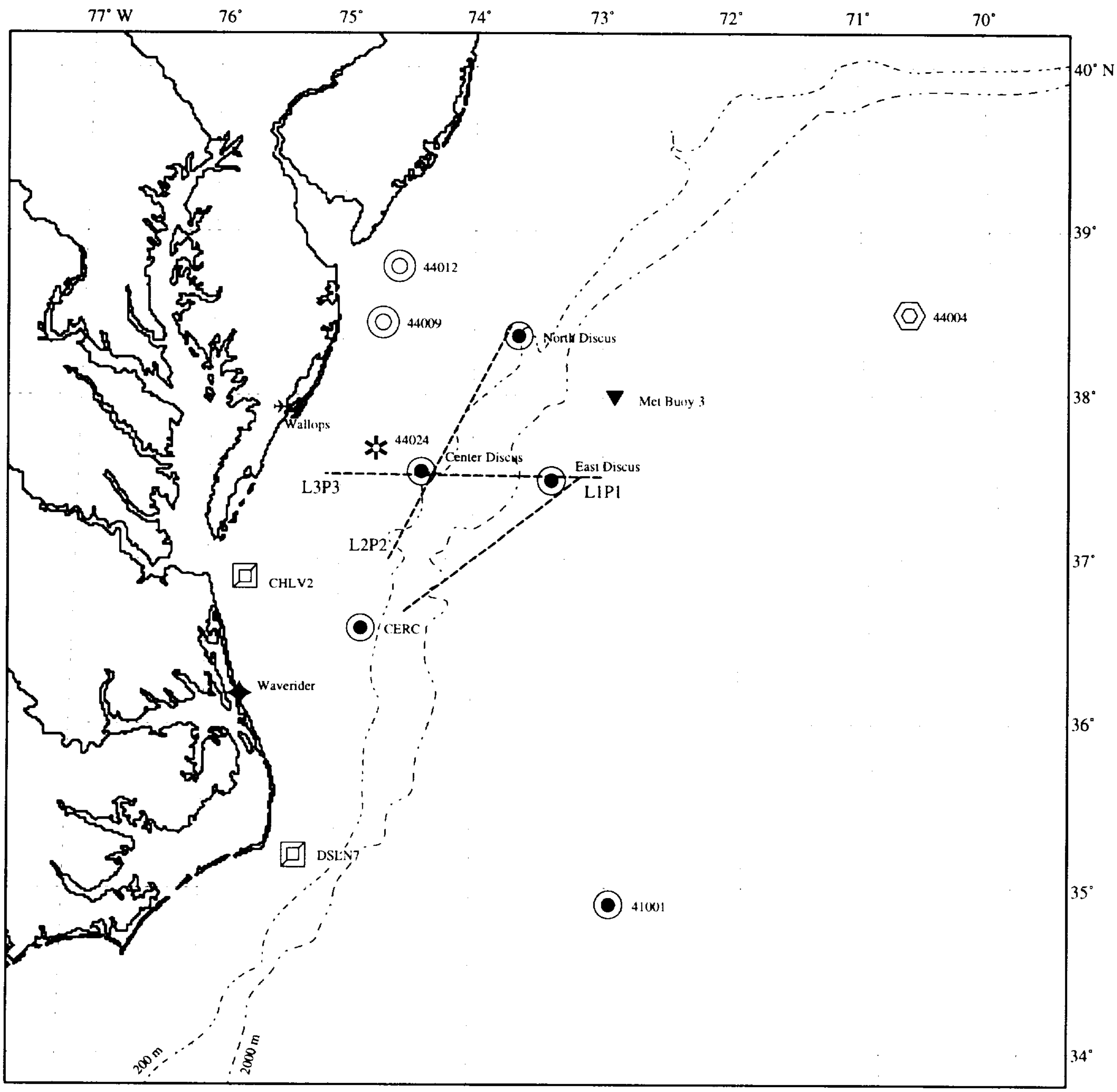
Lambert Conformal Projection
Feb96

Symbols

Coastal Buoy	6m NORMAD Buoy
3m Discus Buoy	1m Met Buoy
12m Discus Buoy	C-Man Station

LnPn are flight line labels.

CCRS SAR Flight 2
March 1, 1991



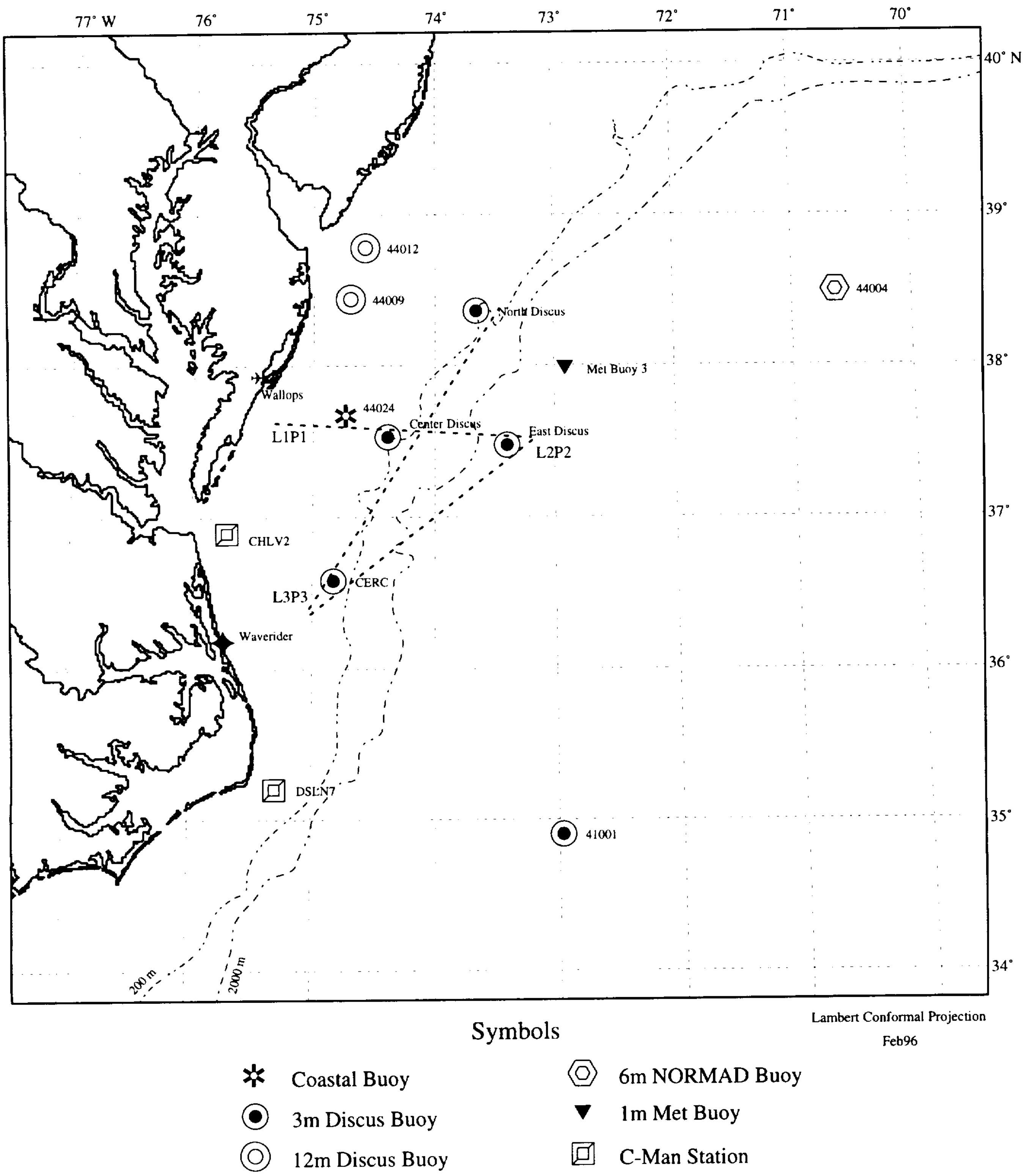
Lambert Conformal Projection
Feb96

Symbols

Coastal Buoy	6m NORMAD Buoy
3m Discus Buoy	1m Met Buoy
12m Discus Buoy	C-Man Station

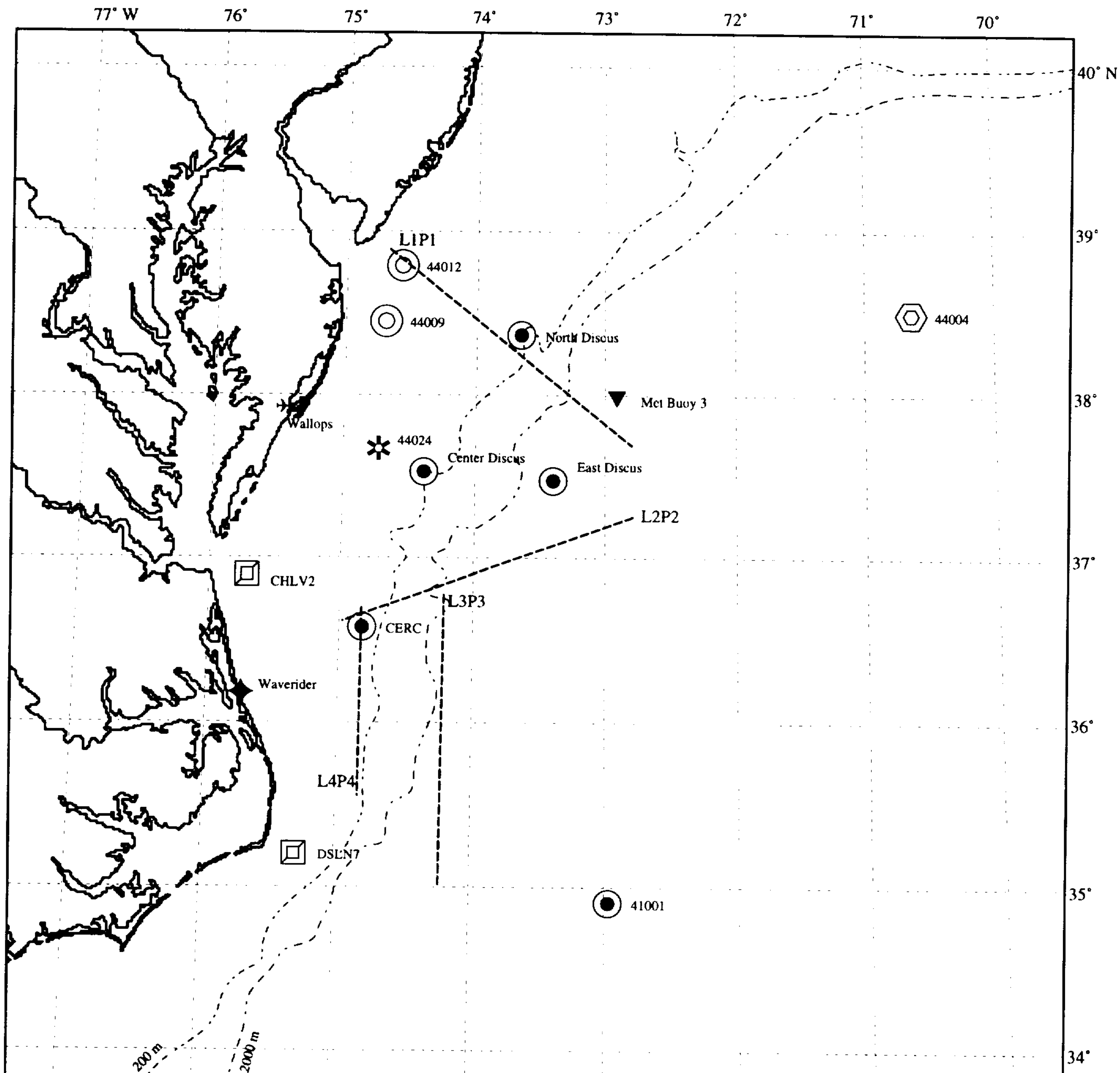
LnPn are flight line labels.

CCRS SAR Flight 3
March 2, 1991



L*n*P*n* are flight line labels.

CCRS SAR Flight 4
March 5, 1991



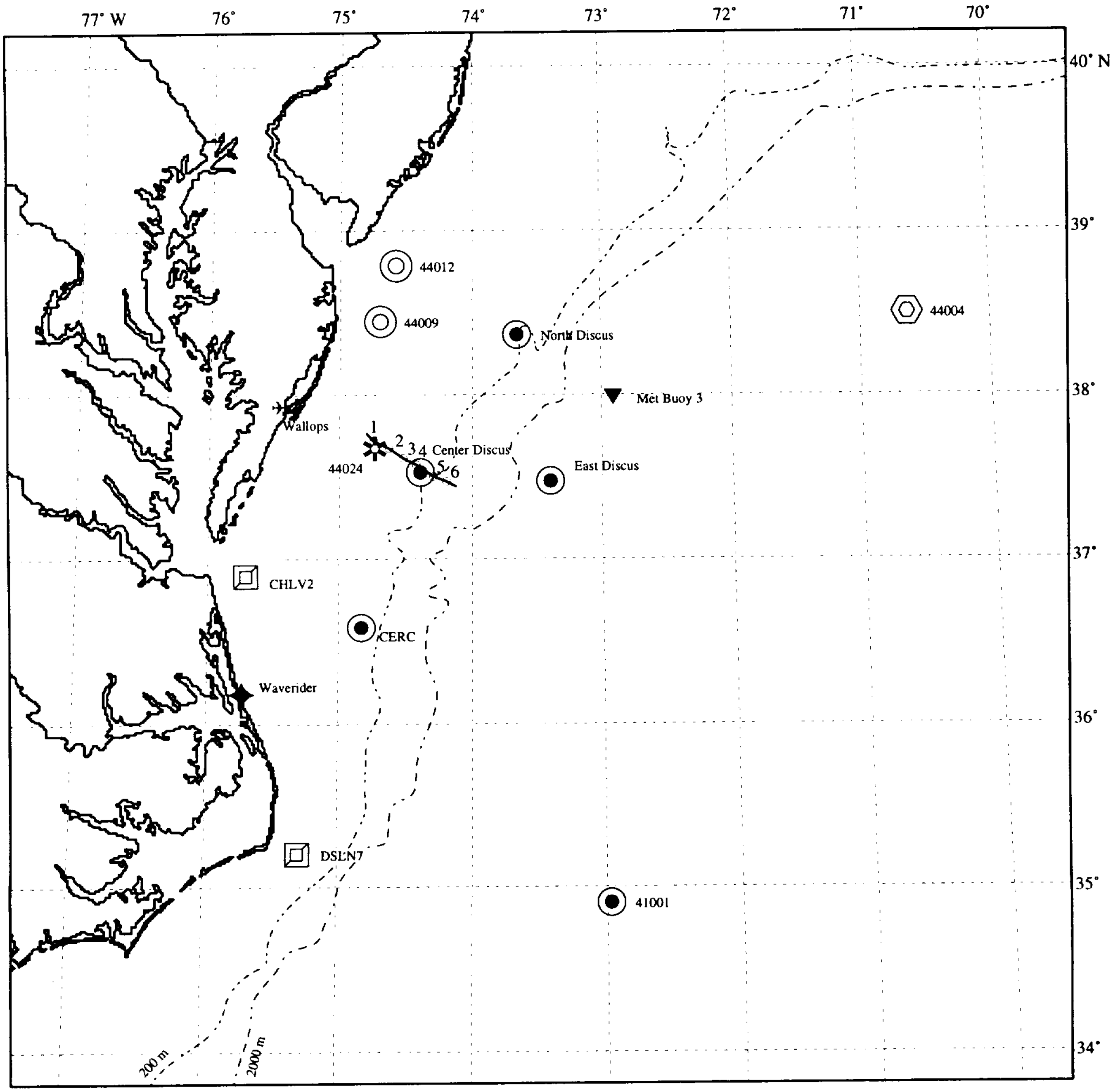
Lambert Conformal Projection
Feb96

Symbols

Coastal Buoy	6m NORMAD Buoy
3m Discus Buoy	1m Met Buoy
12m Discus Buoy	C-Man Station

LnPn are flight line labels.

Meteo-France RESSAC Flight
February 27, 1991



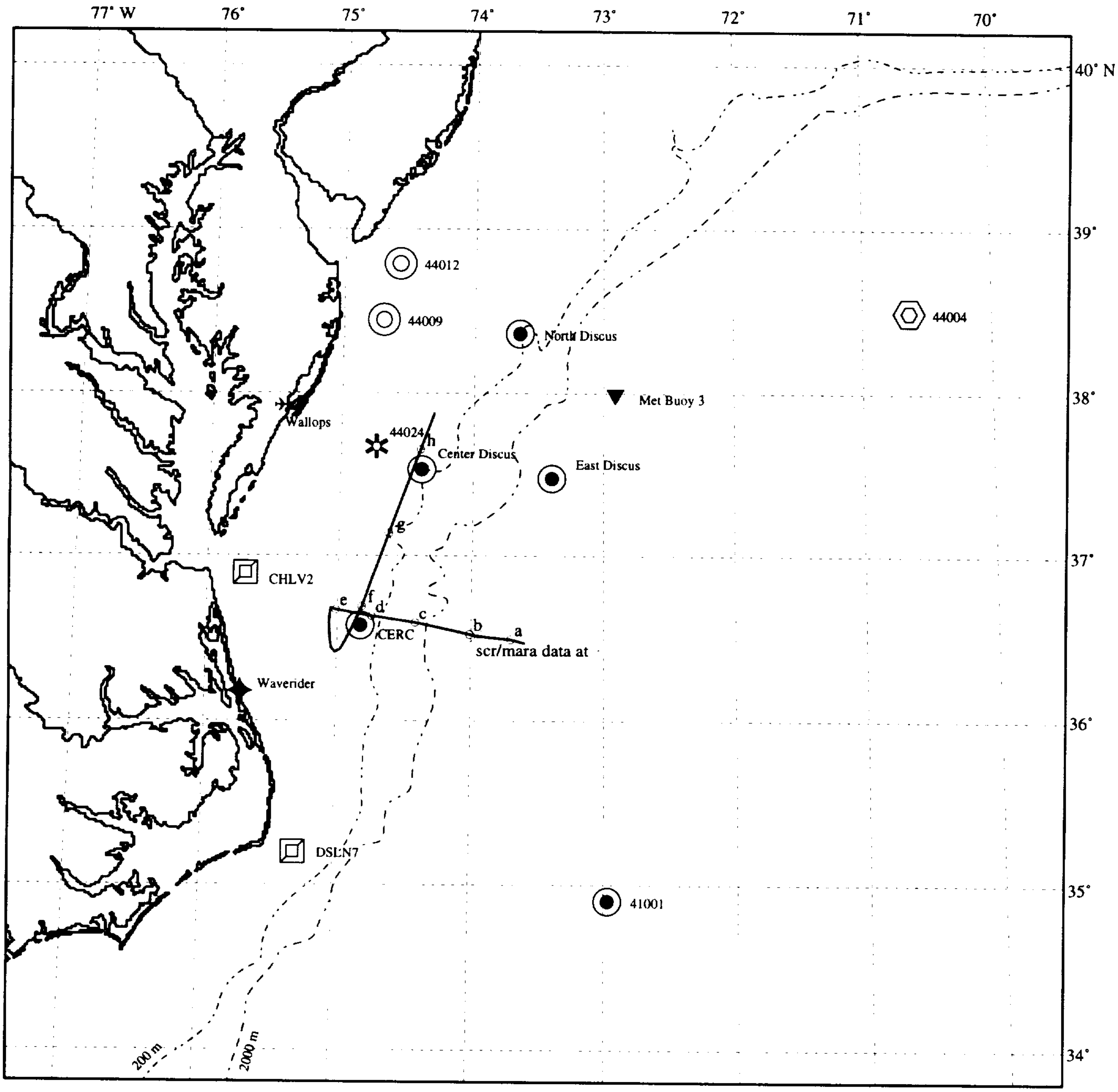
Lambert Conformal Projection
Feb96

Symbols

Coastal Buoy	6m NORMAD Buoy
3m Discus Buoy	1m Met Buoy
12m Discus Buoy	C-Man Station

The circles with numbers identify locations for which analyses were done.

Meteo-France RESSAC Flight
March 2, 1991



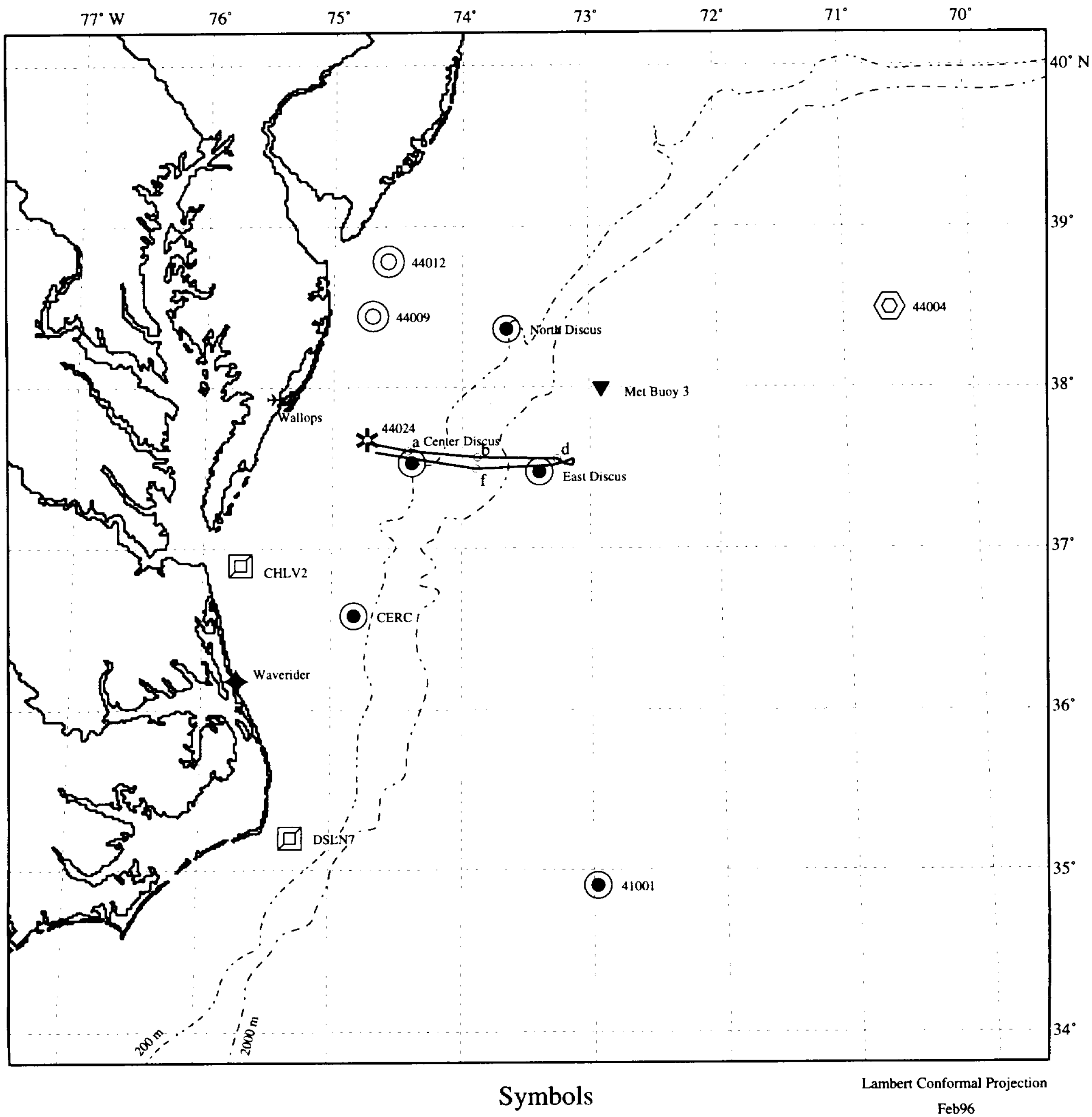
Lambert Conformal Projection
Feb96

Symbols

Coastal Buoy
3m Discus Buoy
12m Discus Buoy
6m NORMAD Buoy
1m Met Buoy
C-Man Station

The circles with lower case letters identify locations for which analyses were done.

Meteo-France RESSAC Flight
March 4-5, 1991

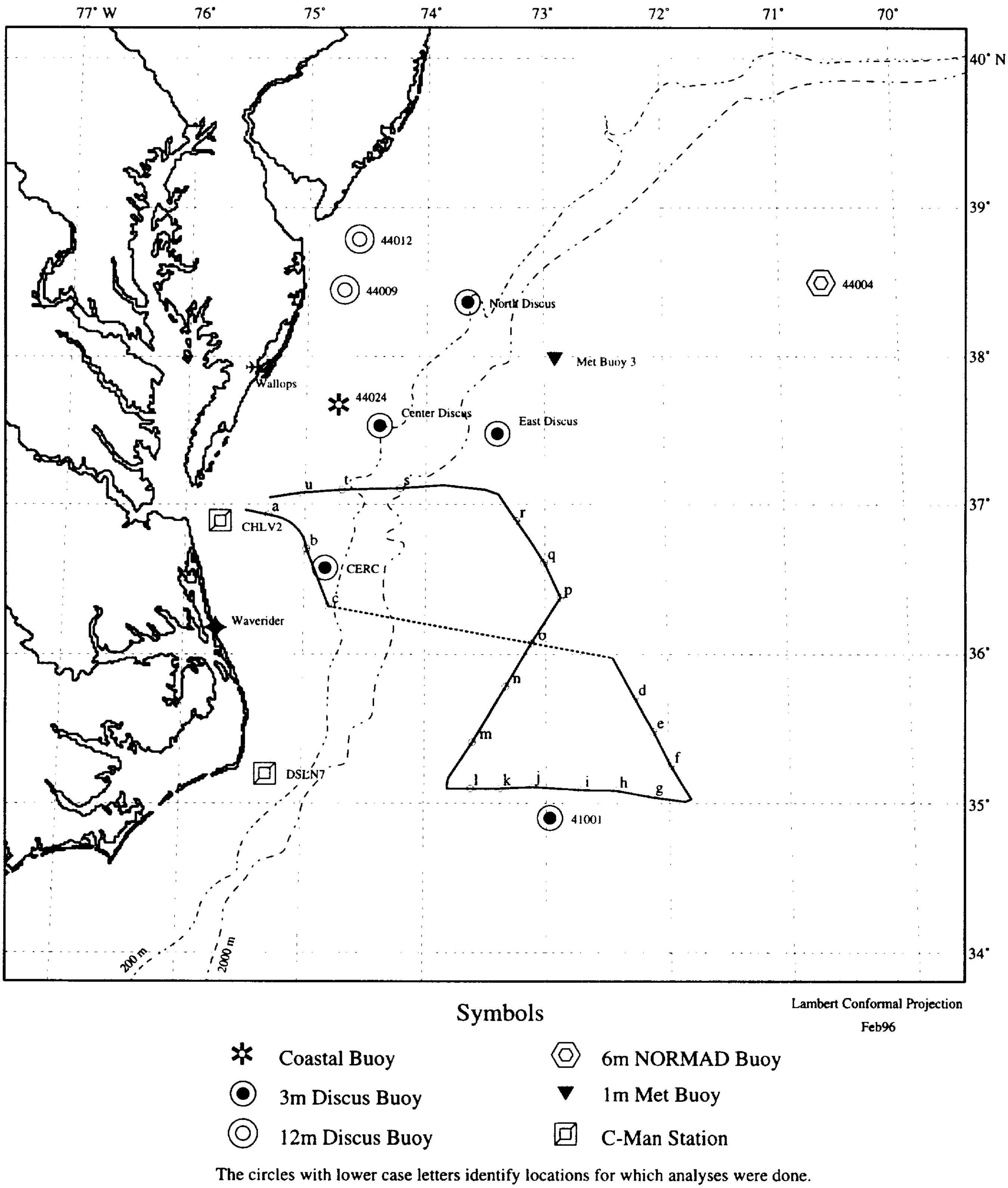


Symbols

Coastal Buoy
3m Discus Buoy
12m Discus Buoy
6m NORMAD Buoy
1m Met Buoy
C-Man Station

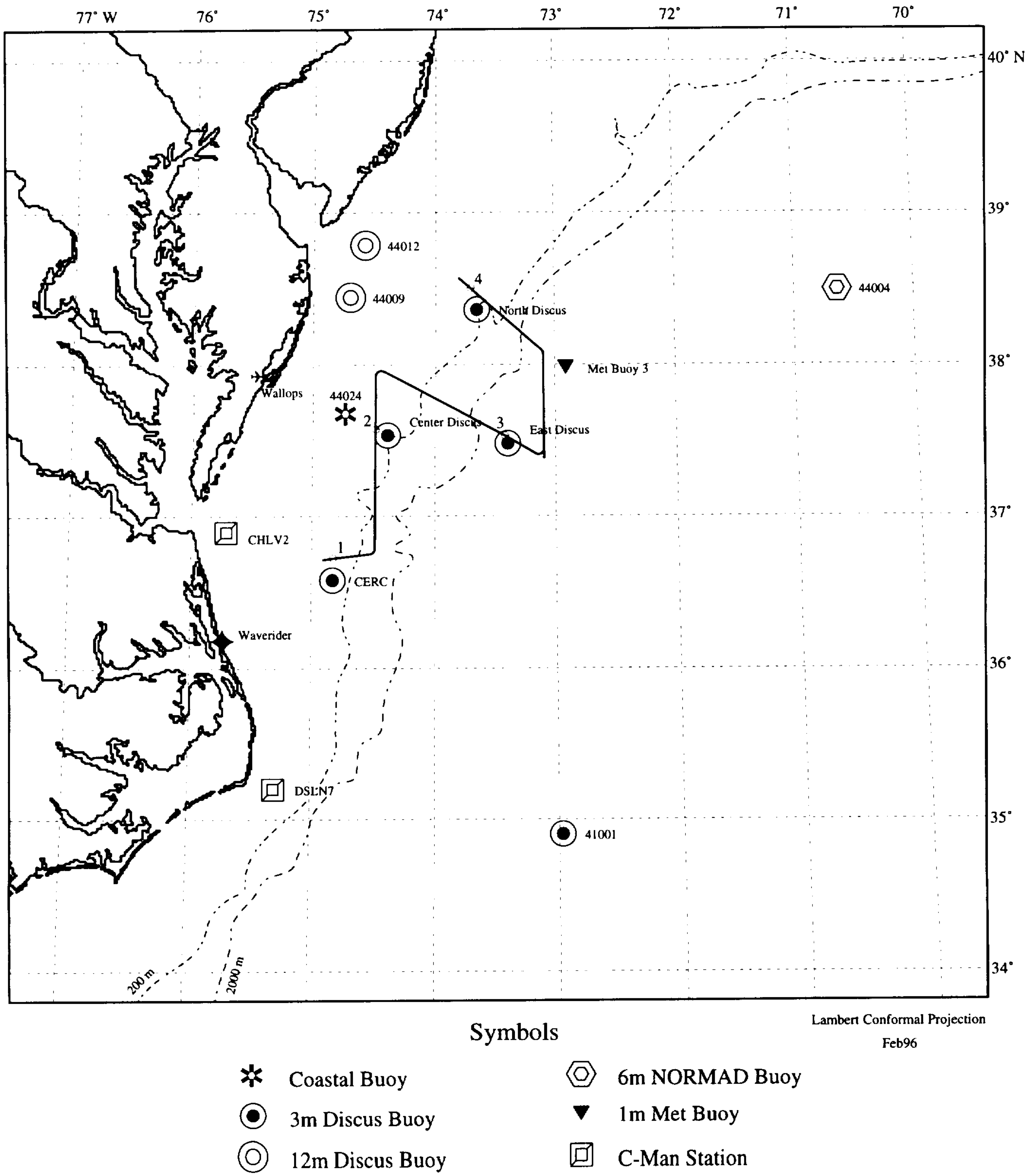
The circles with lower case letters identify locations for which analyses were done.

Meteo-France RESSAC Flight
March 5, 1991



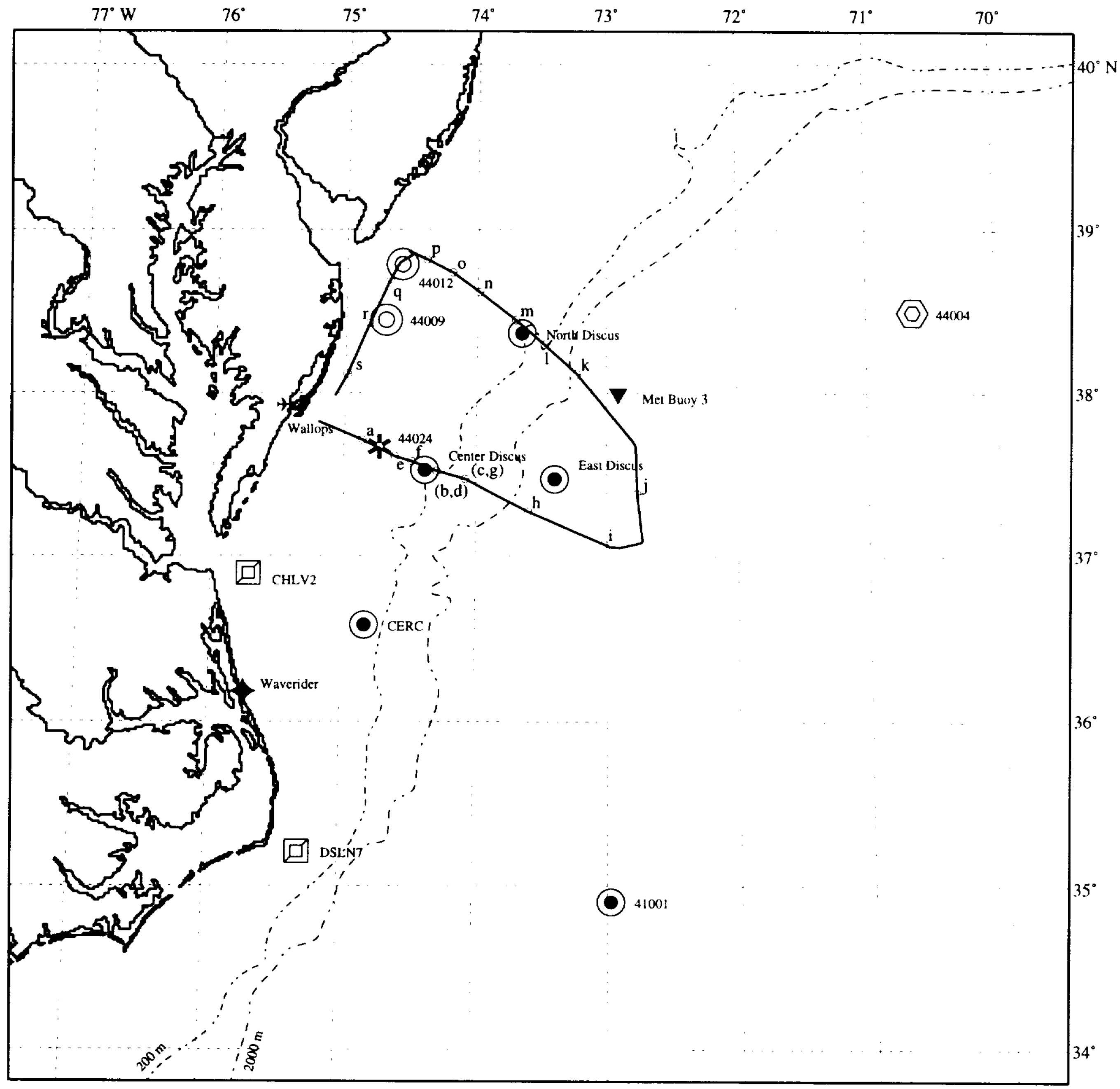
The circles with lower case letters identify locations for which analyses were done.

Meteo-France RESSAC Flight
March 6, 1991



The circles with numbers identify locations for which analyses were done.

Meteo-France RESSAC Flight
March 7, 1991



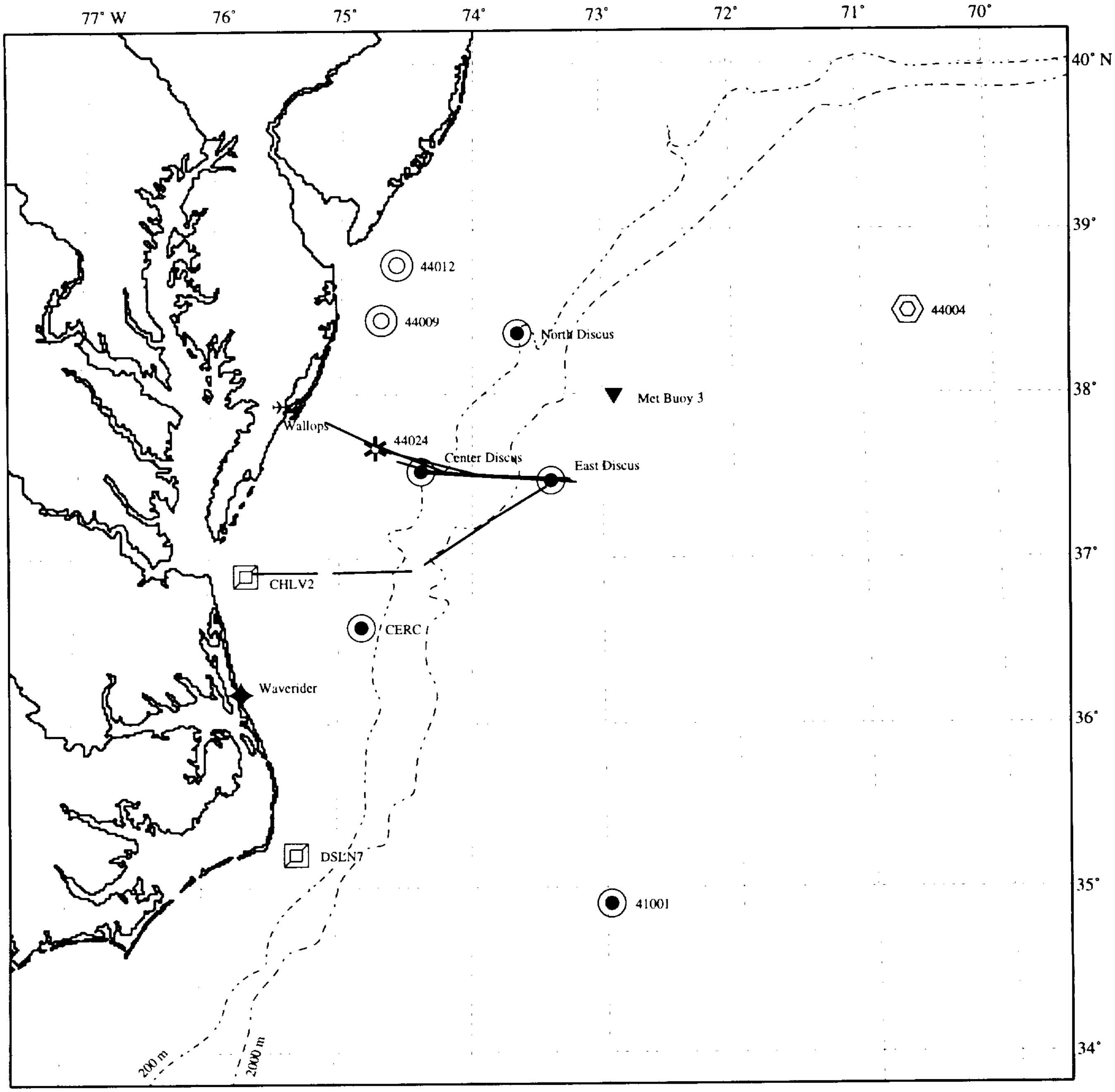
Lambert Conformal Projection
Feb96

Symbols

Coastal Buoy	6m NORMAD Buoy
3m Discus Buoy	1m Met Buoy
12m Discus Buoy	C-Man Station

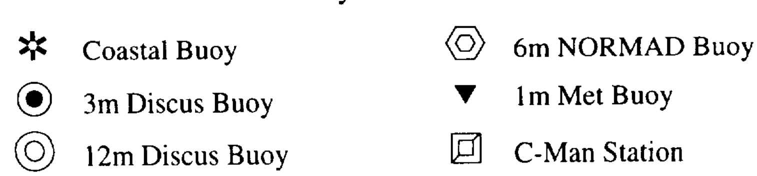
The circles with lower case letters identify locations for which analyses were done.

NASA C-130 Scatterometers Flight 1
February 27, 1991

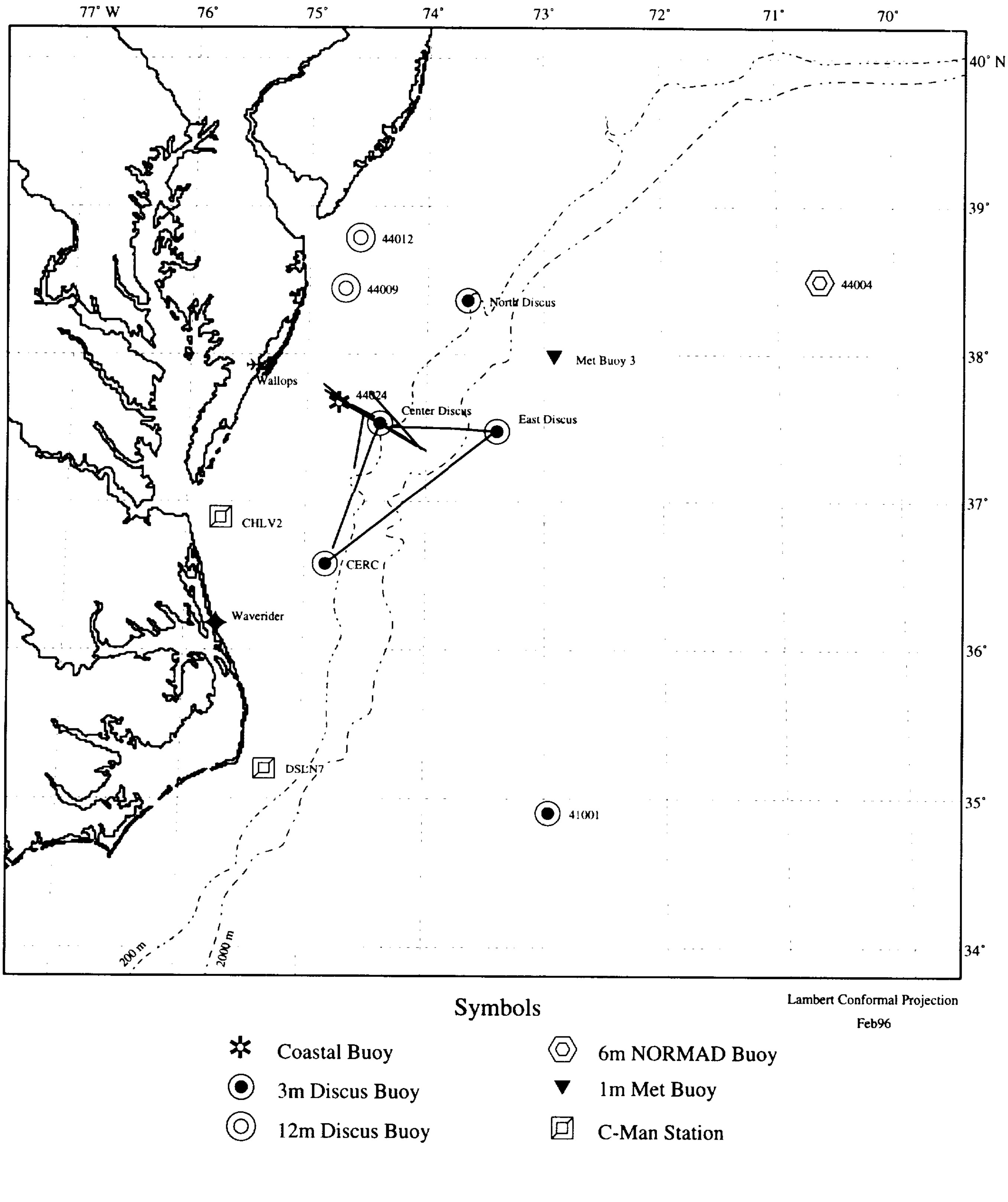


Lambert Conformal Projection
Feb96

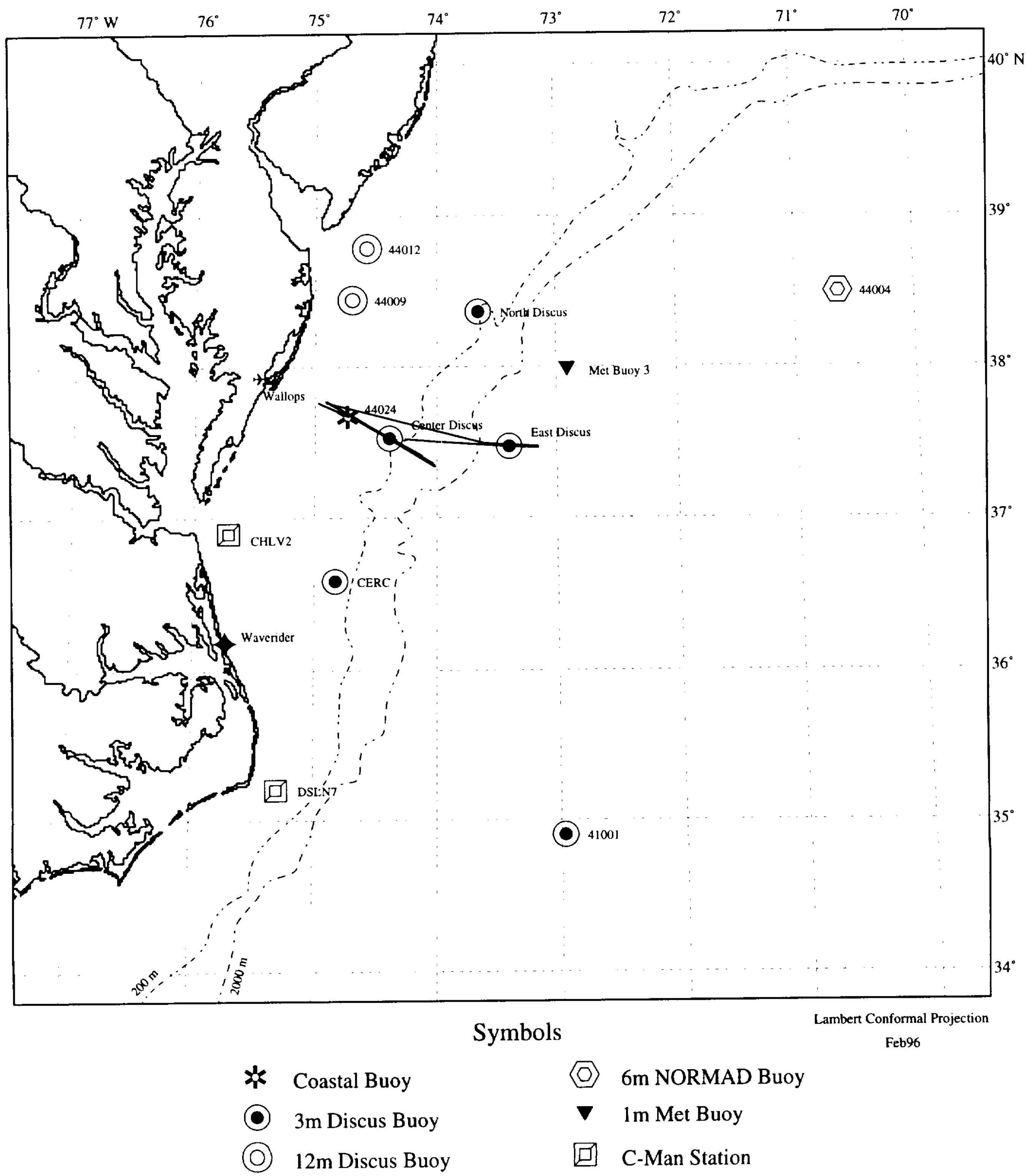
Symbols



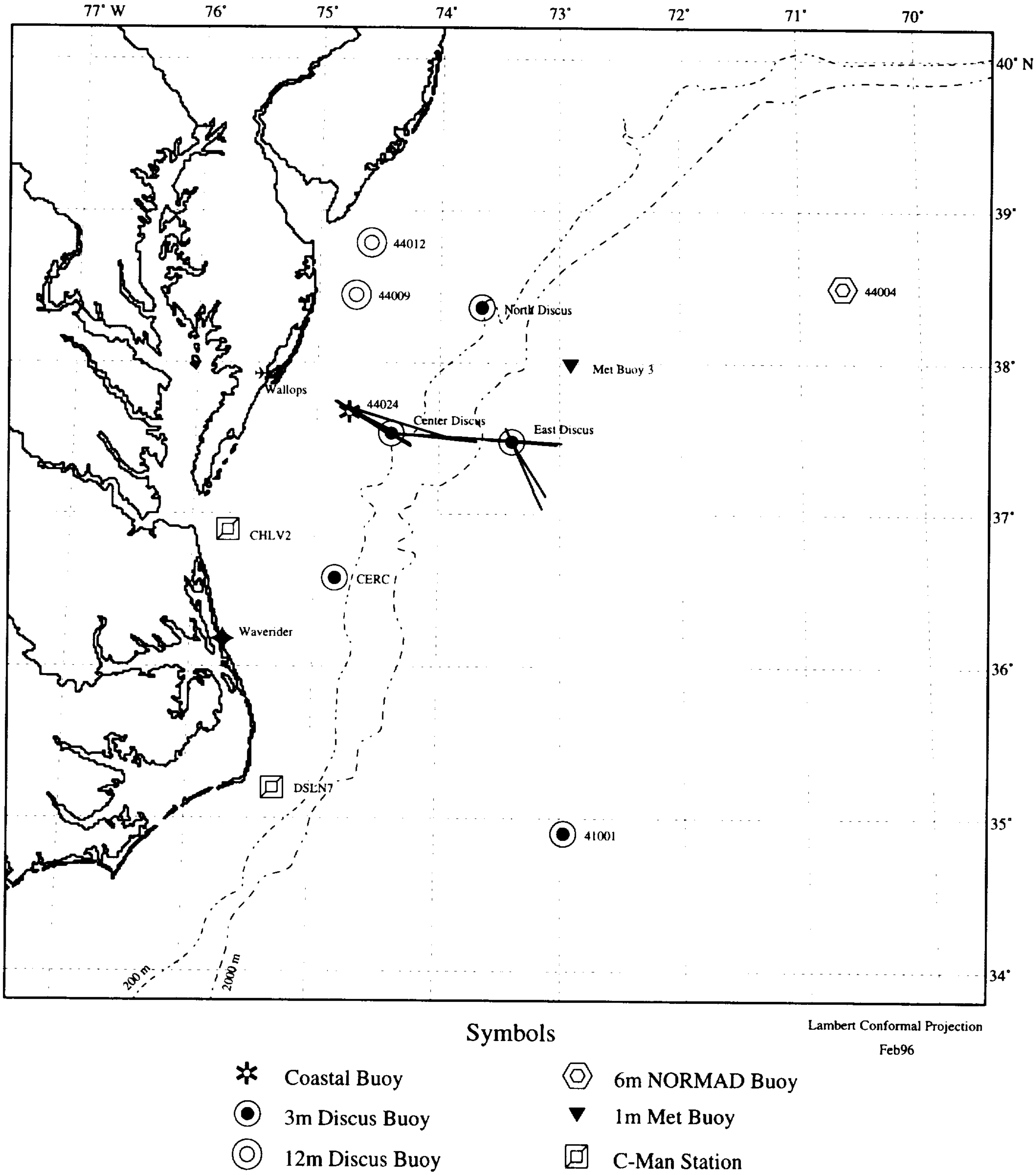
NASA C-130 Scatterometers Flight 2
February 28, 1991



NASA C-130 Scatterometers Flight 3
March 1, 1991

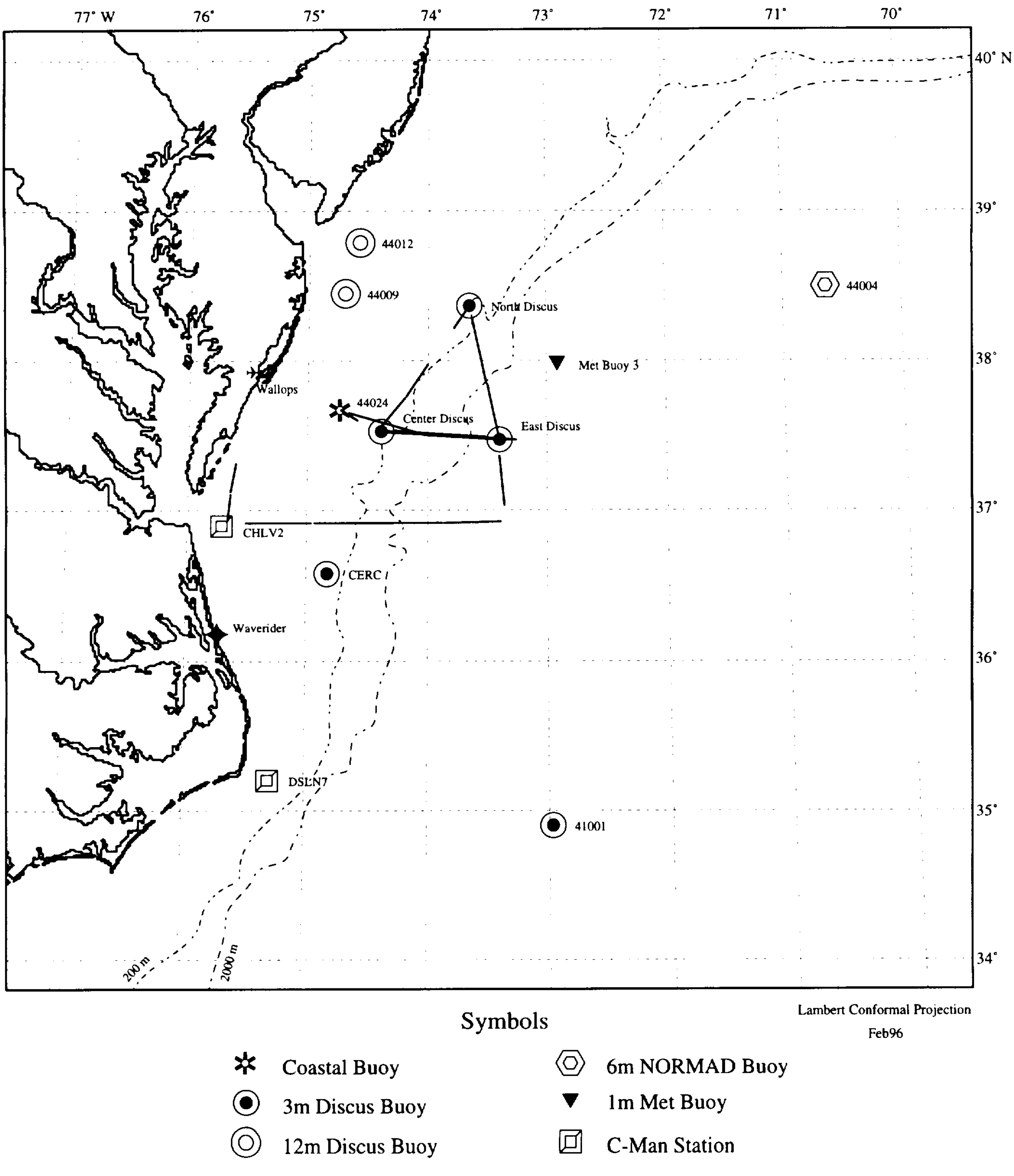


NASA C-130 Scatterometers Flight 4
March 2, 1991

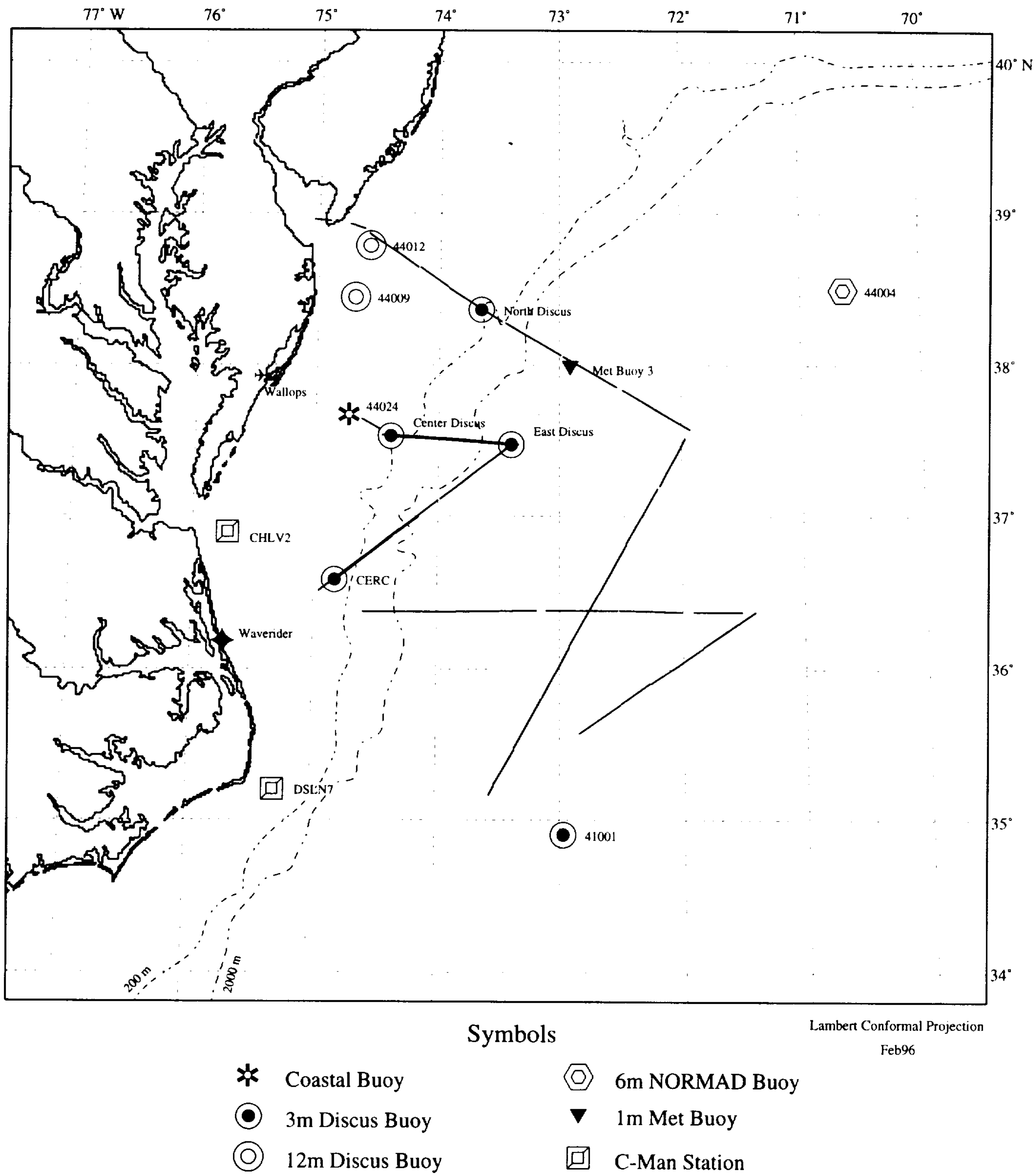


Lambert Conformal Projection
Feb96

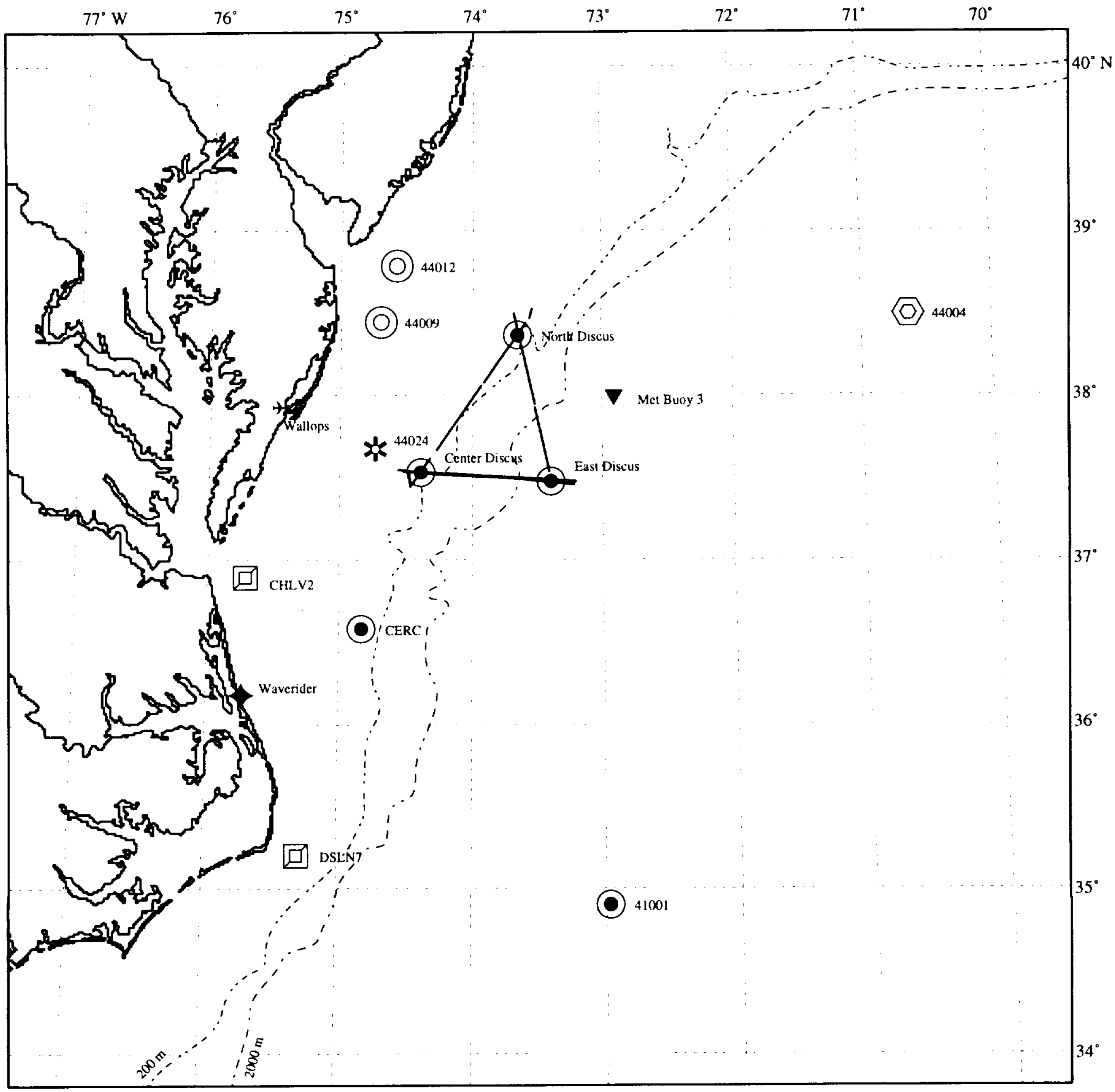
NASA C-130 Scatterometers Flight 5
March 3, 1991



NASA C-130 Scatterometers Flight 6
March 5, 1991



NASA C-130 Scatterometers Flight 7
March 6, 1991

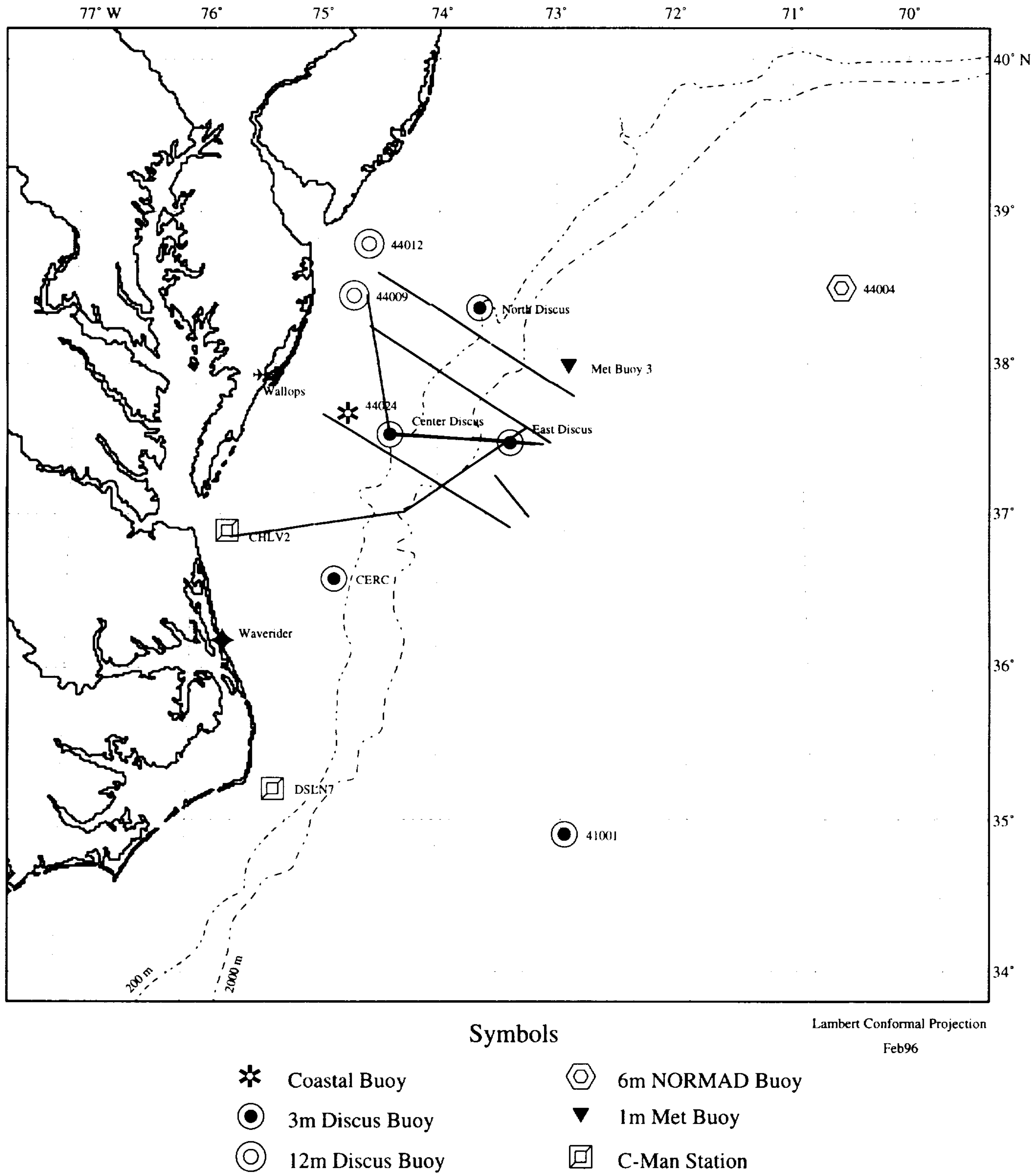


Lambert Conformal Projection
Feb96

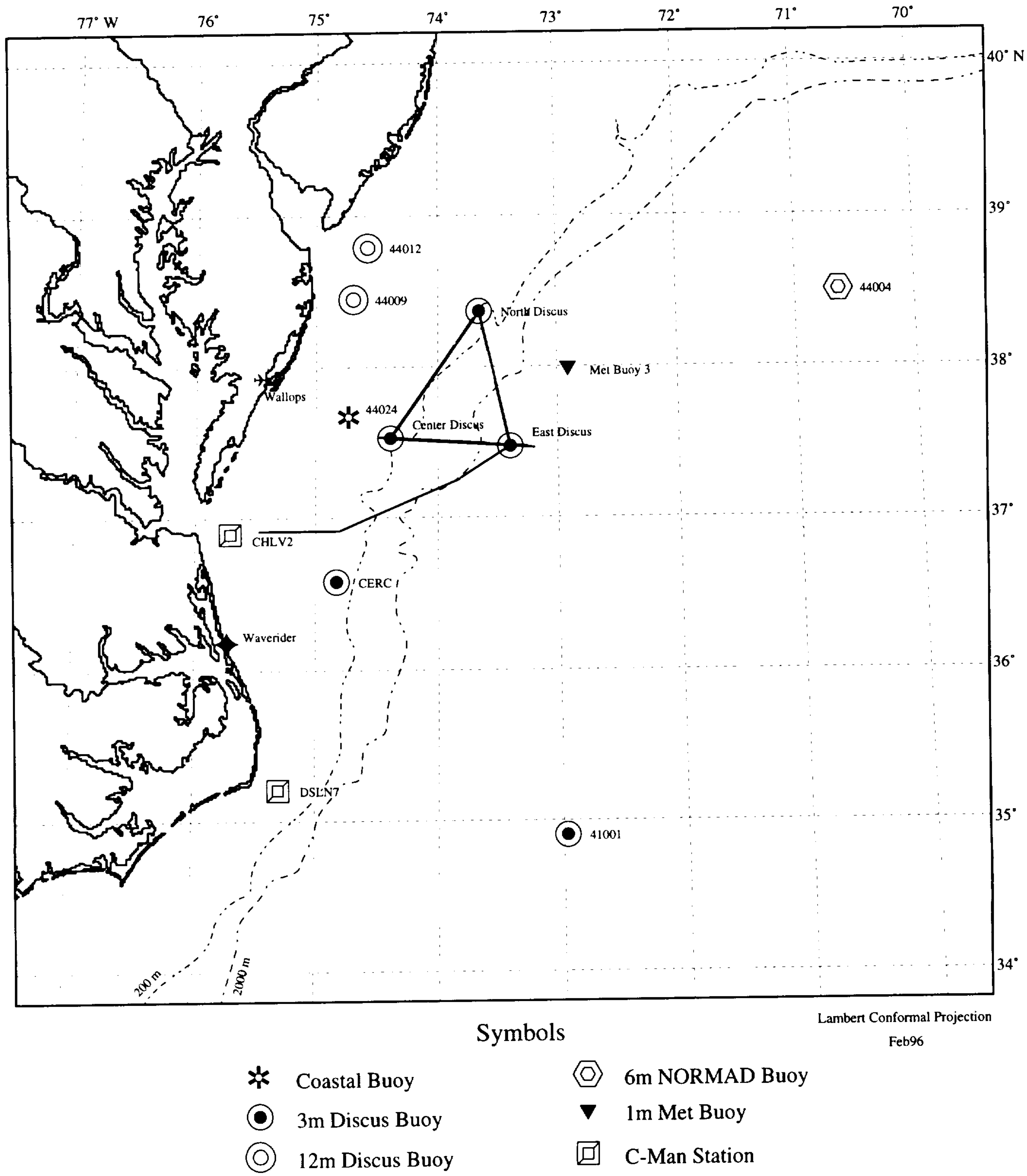
Symbols

- Coastal Buoy
- 3m Discus Buoy
- 12m Discus Buoy
- 6m NORMAD Buoy
- 1m Met Buoy
- C-Man Station

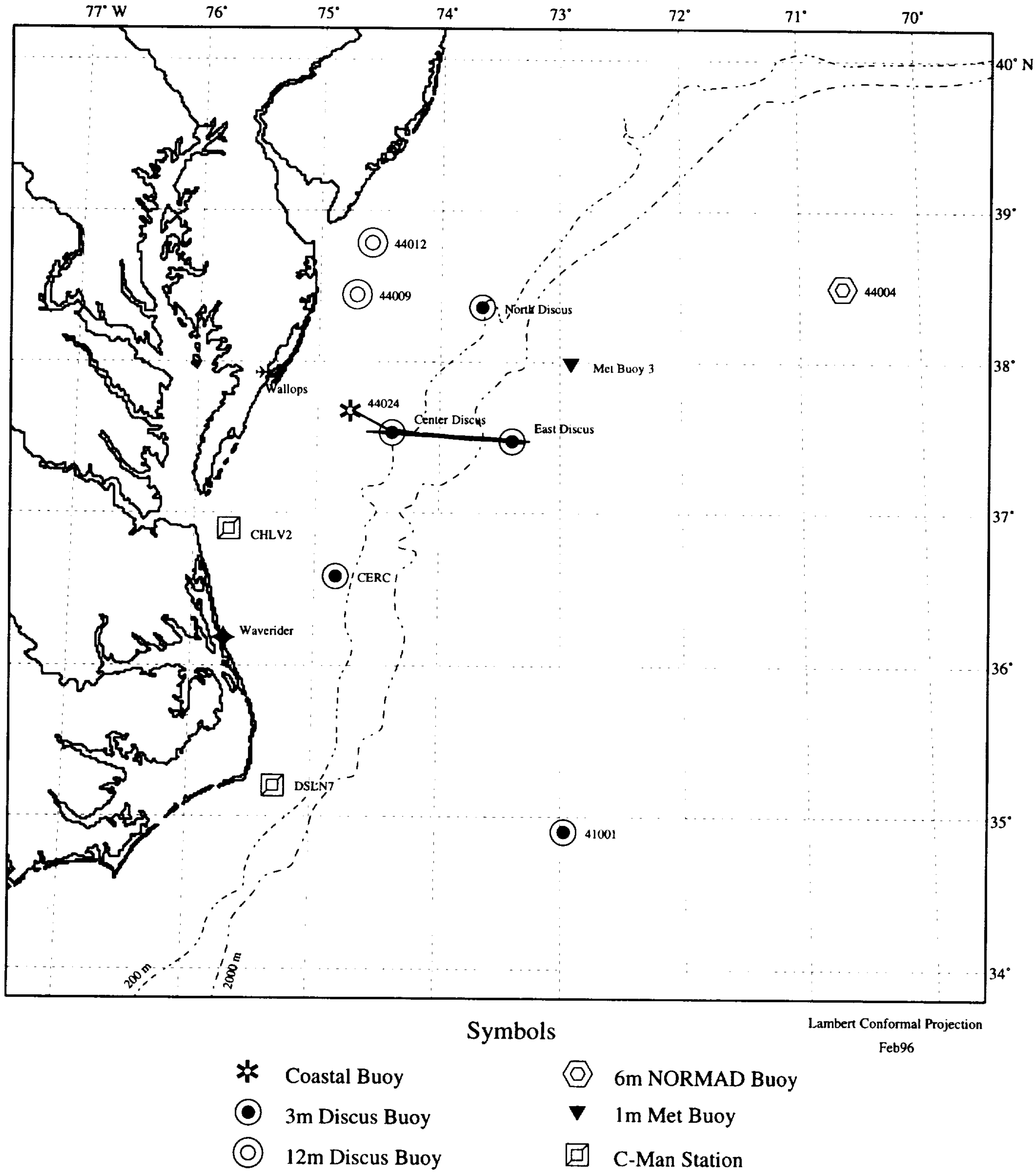
NASA C-130 Scatterometers Flight 8
March 7, 1991



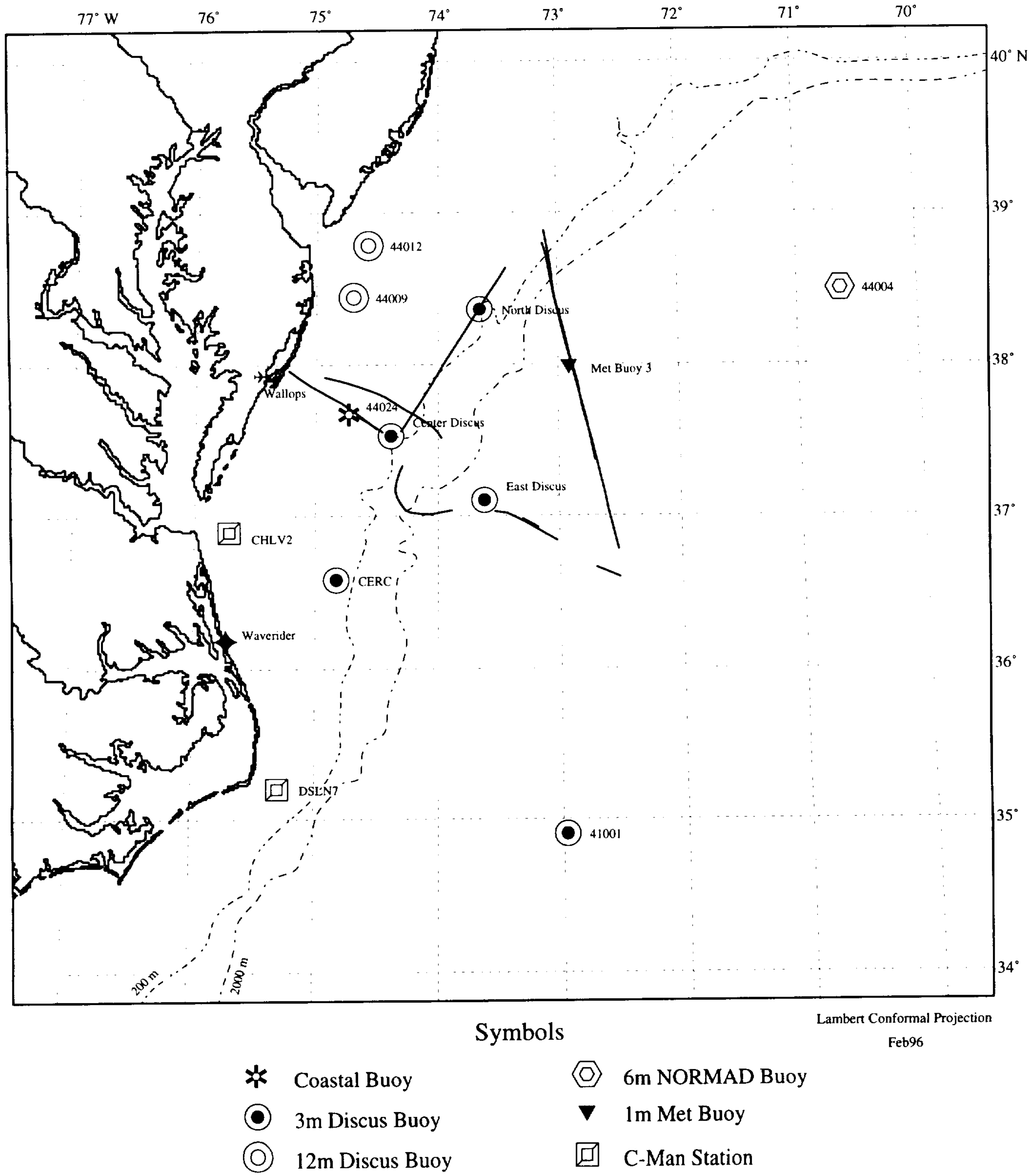
NASA C-130 Scatterometers Flight 9
March 8, 1991



NASA C-130 Scatterometers Flight 10
March 9, 1991

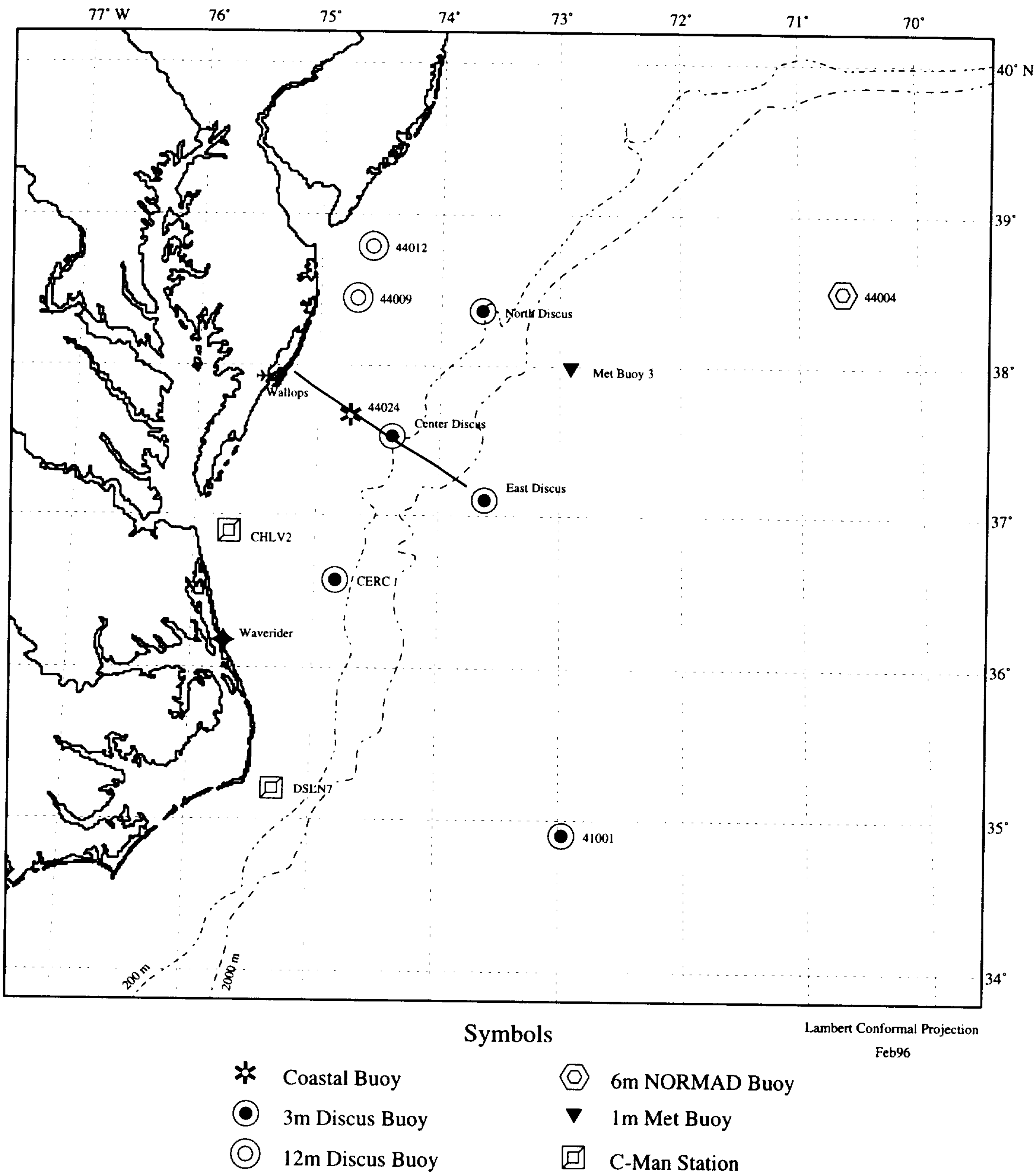


NASA P-3 Flights 1 and 2
January 17, 1991

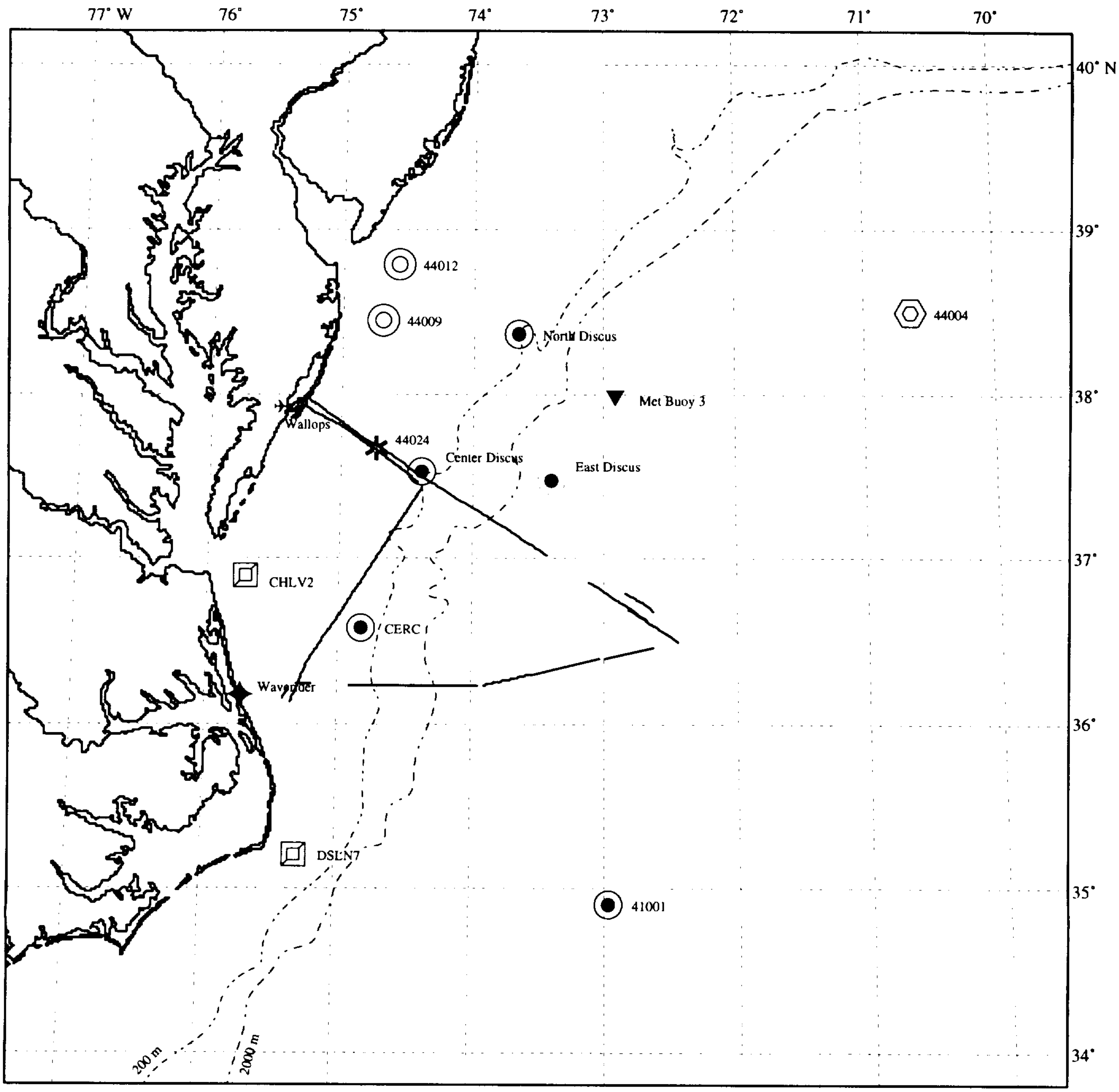


Lambert Conformal Projection
Feb96

NASA P-3 Flight 3
January 18, 1991



NASA P-3 Flight 4
January 19, 1991

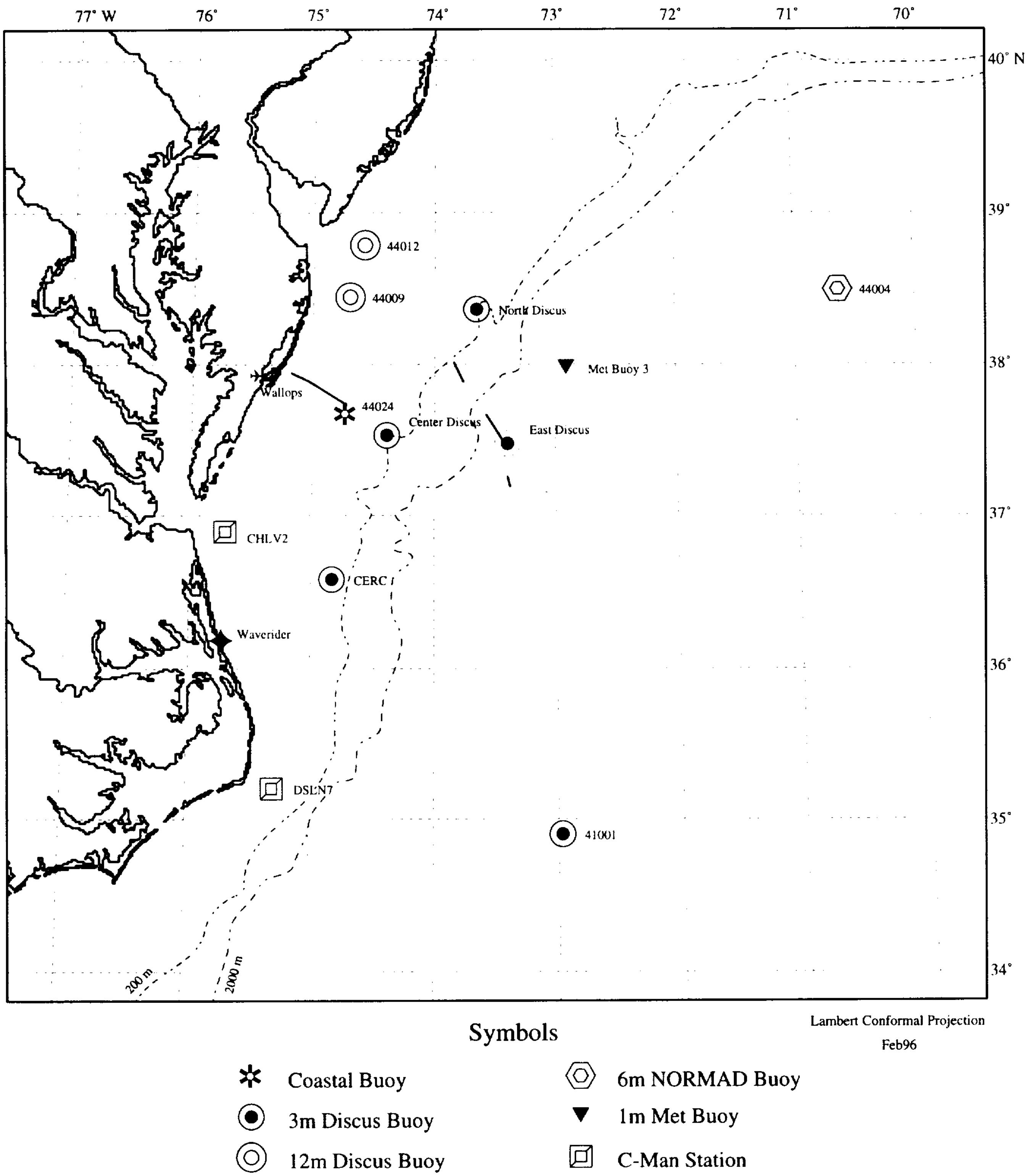


Lambert Conformal Projection
Feb96

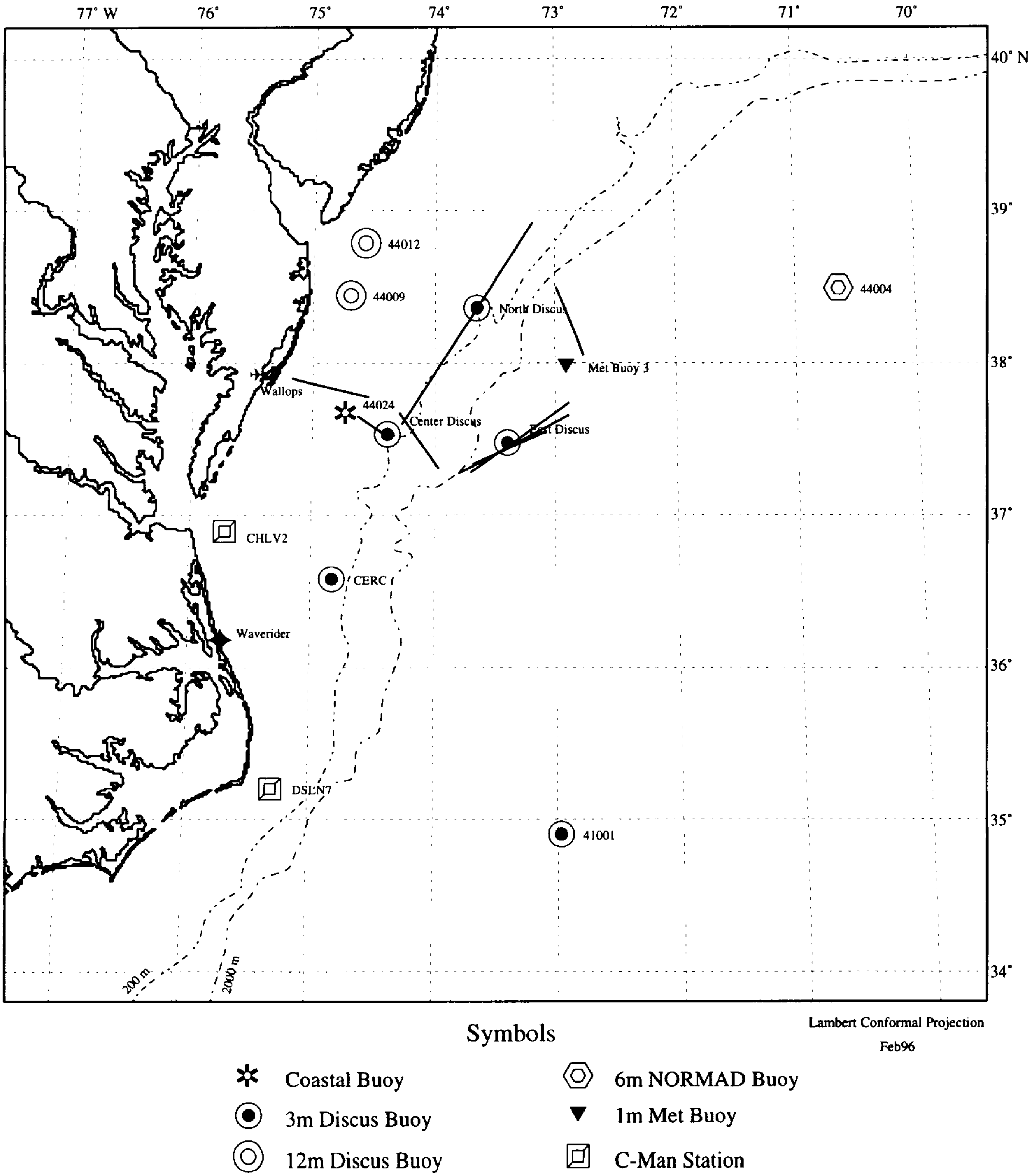
Symbols

Coastal Buoy	6m NORMAD Buoy
3m Discus Buoy	1m Met Buoy
12m Discus Buoy	C-Man Station

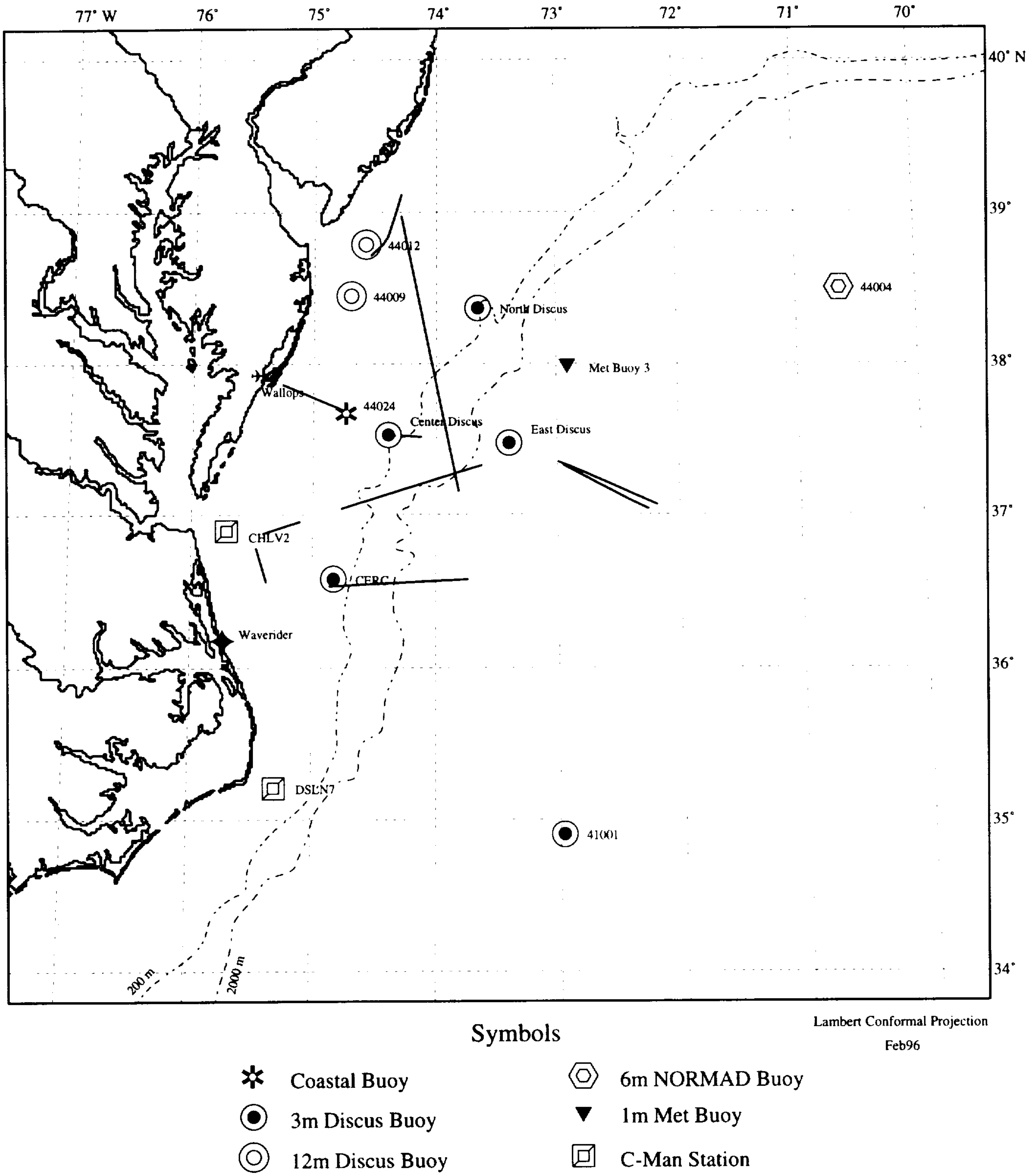
NASA P-3 Flight 5
January 22, 1991



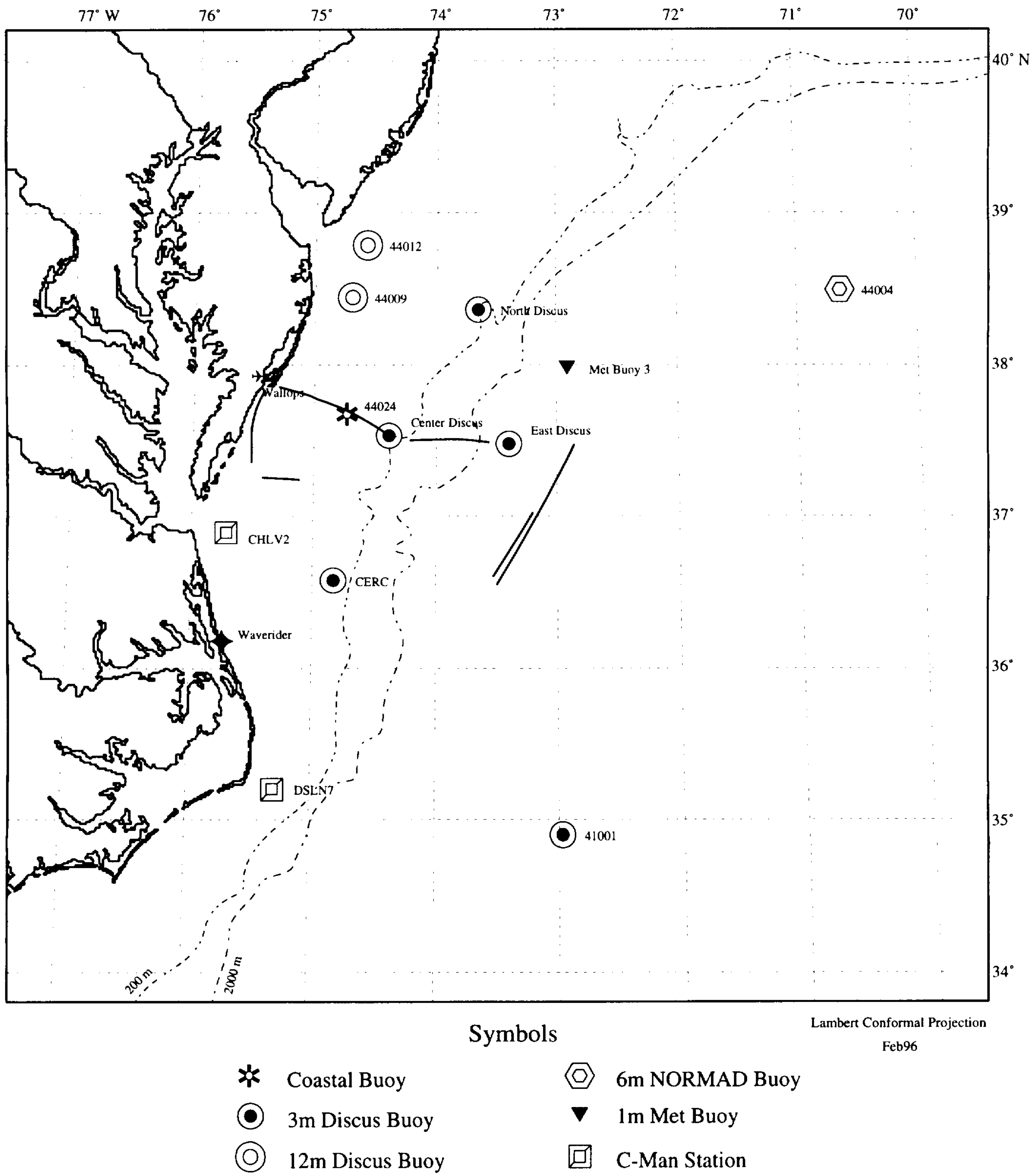
NASA P-3 Flight 6
January 24, 1991



NASA P-3 Flight 7
February 22, 1991



NASA P-3 Flight 8
February 28, 1991



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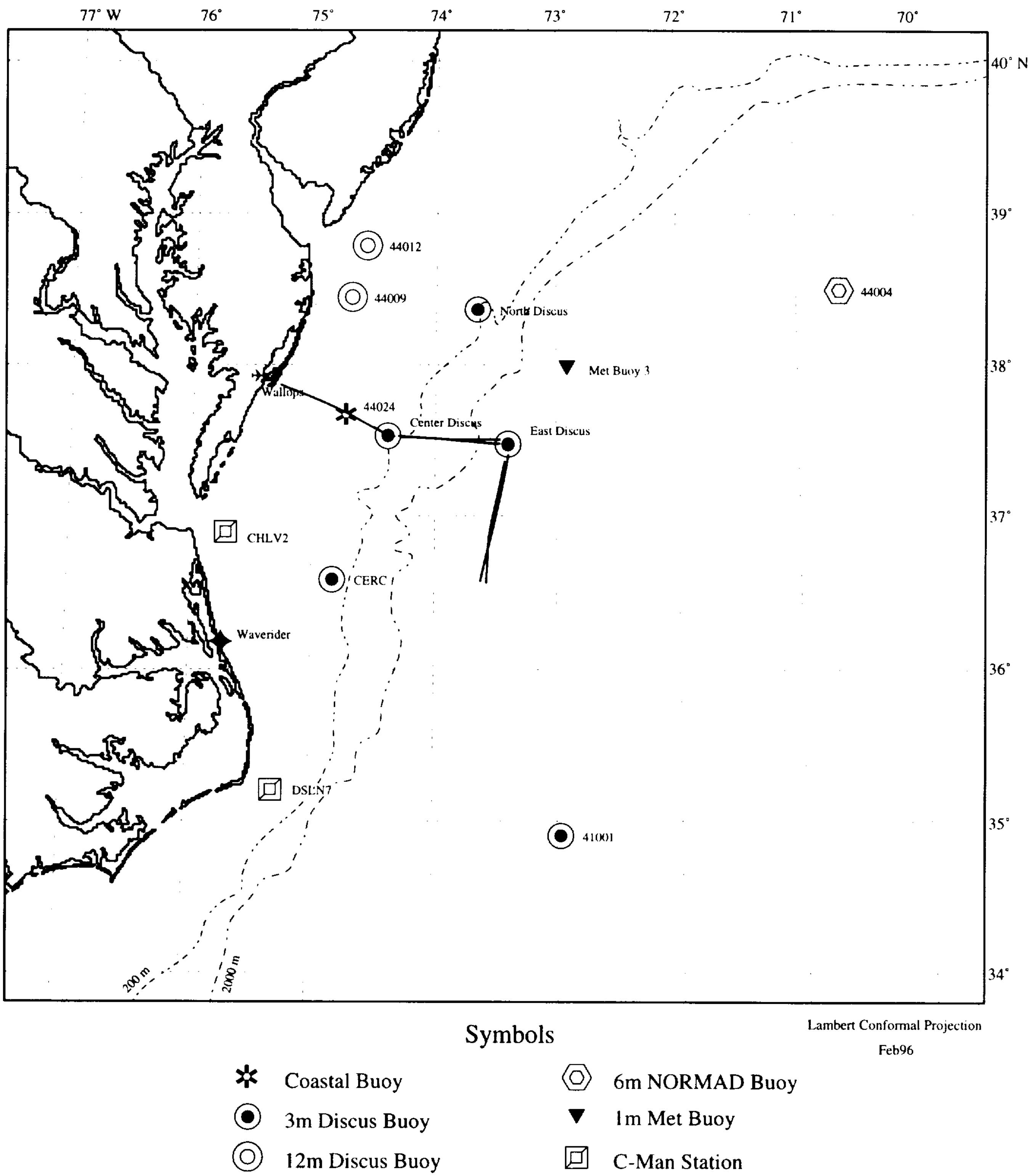
March 1, 1991



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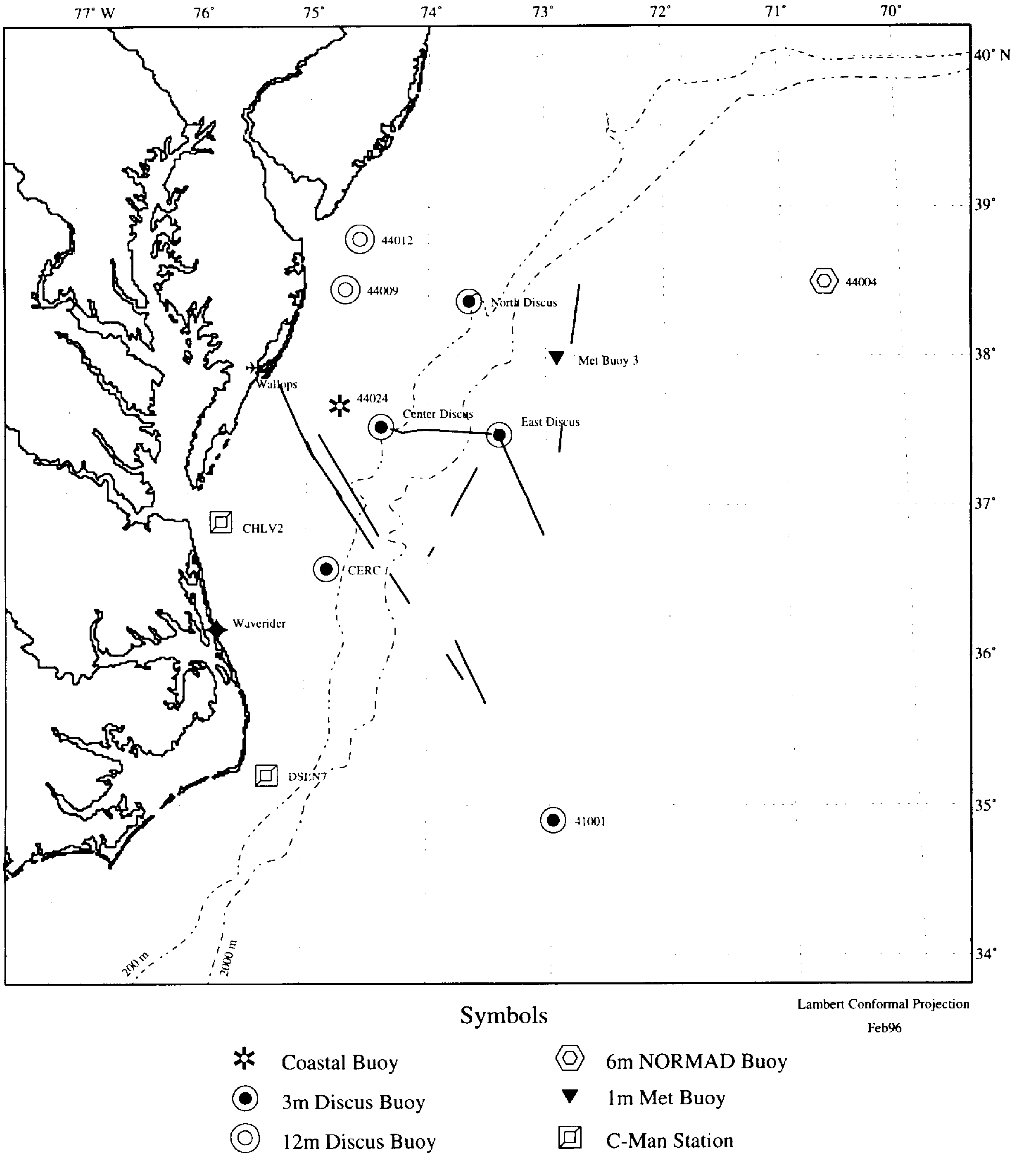

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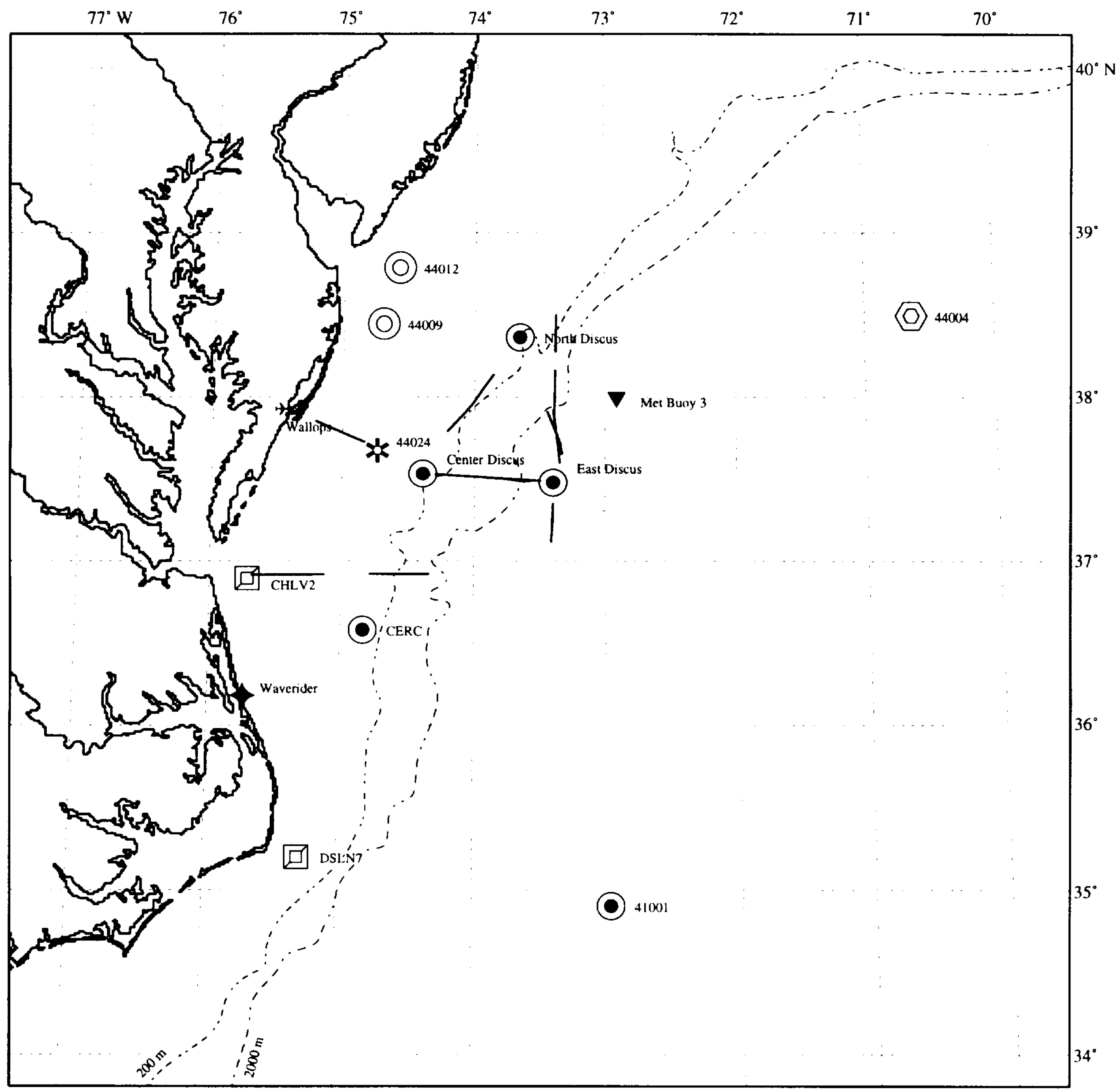
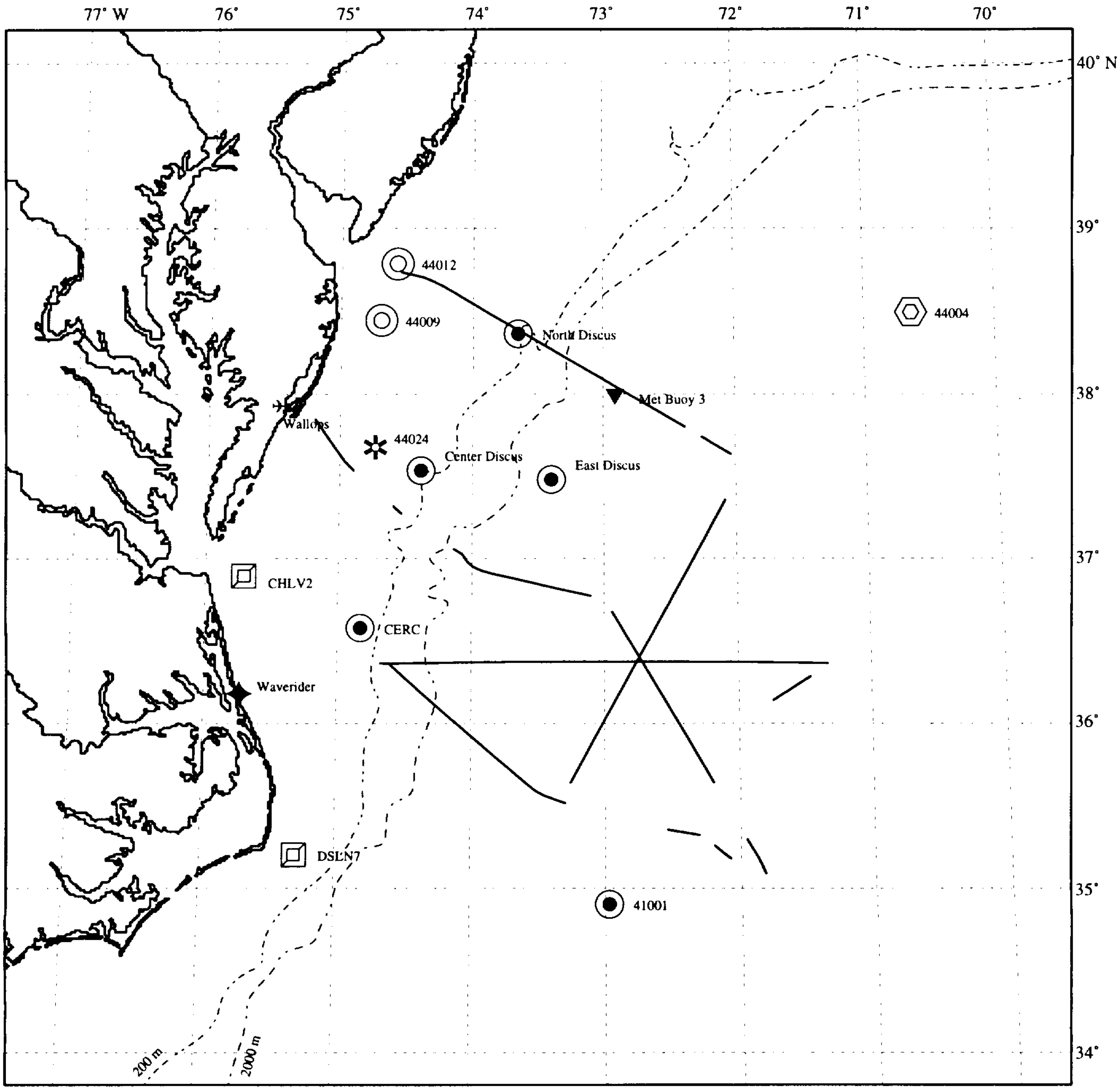


Symbols

Lambert Conformal Projection
Feb96

Coastal Buoy	6m NORMAD Buoy
3m Discus Buoy	1m Met Buoy
12m Discus Buoy	C-Man Station

NASA P-3 Flight 12
March 5, 1991

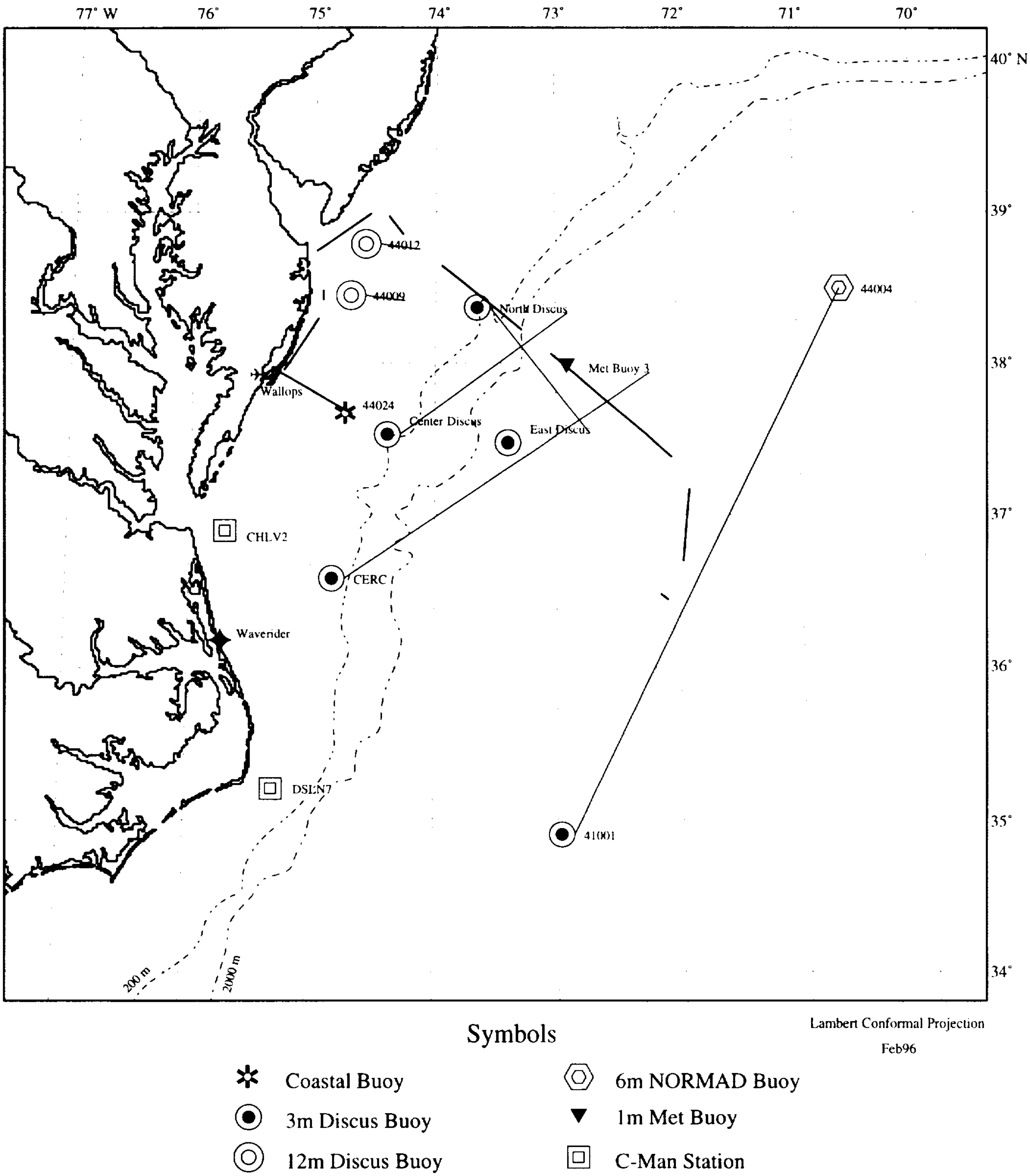


Lambert Conformal Projection
Feb96

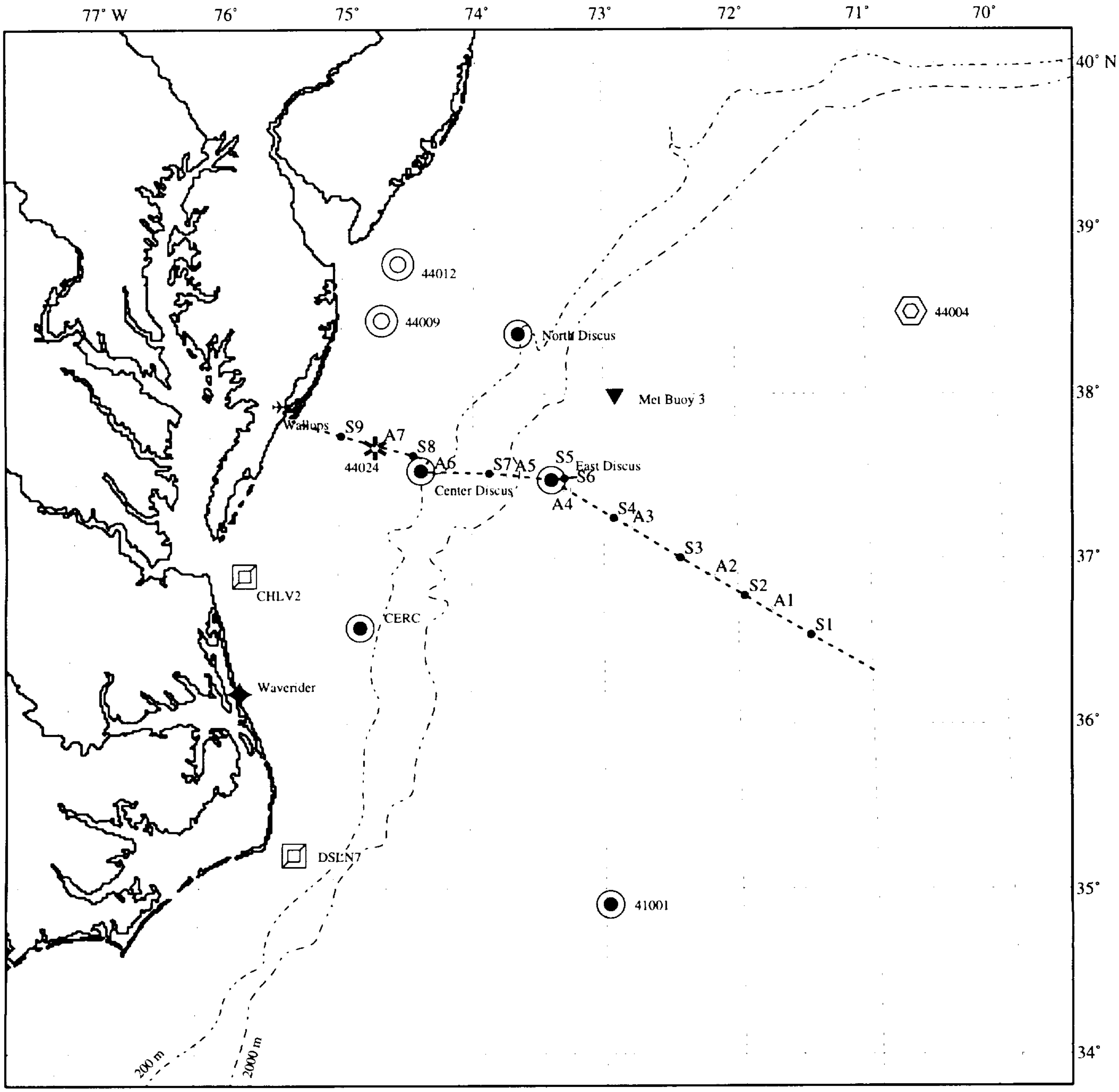
Symbols

Coastal Buoy	6m NORMAD Buoy
3m Discus Buoy	1m Met Buoy
12m Discus Buoy	C-Man Station

NASA P-3 Flight 13
March 7, 1991



NASA T-39 ROWS Flight
February 27, 1991



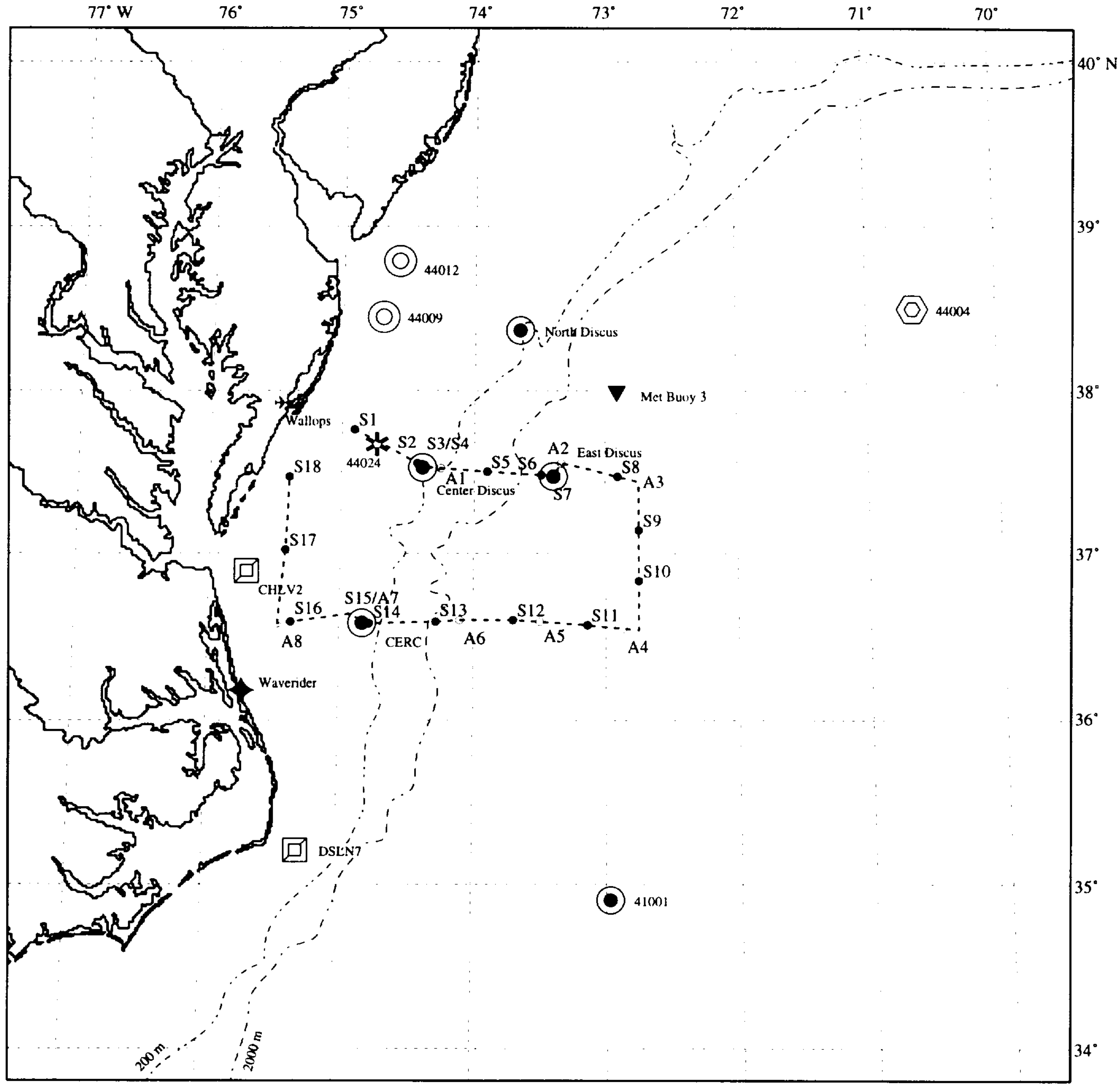
Lambert Conformal Projection
Feb96

Symbols

Coastal Buoy	6m NORMAD Buoy
3m Discus Buoy	1m Met Buoy
12m Discus Buoy	C-Man Station

The notations A*n* and S*n* mark locations where altimeter or spectral data were taken that are in the public archive.

NASA T-39 ROWS Flight
February 28, 1991



Lambert Conformal Projection
Feb96

Symbols

Coastal Buoy	6m NORMAD Buoy
3m Discus Buoy	1m Met Buoy
12m Discus Buoy	C-Man Station

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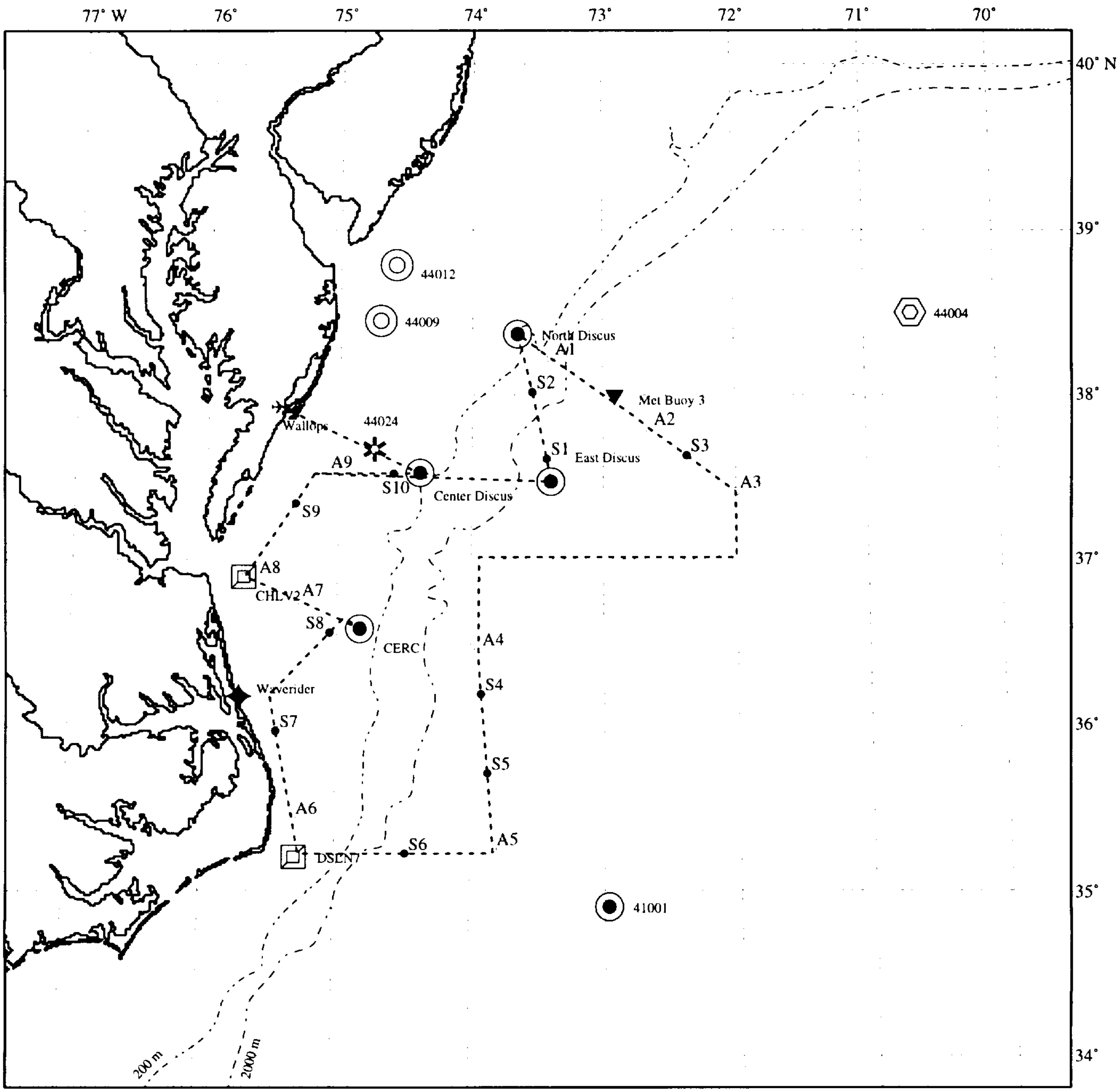
NASA T-39 ROWS Flight
March 2, 1991



Lambert Conformal Projection

Feb96

Symbols

Coastal Buoy	6m NORMAD Buoy
3m Discus Buoy	1m Met Buoy
12m Discus Buoy	C-Man Station

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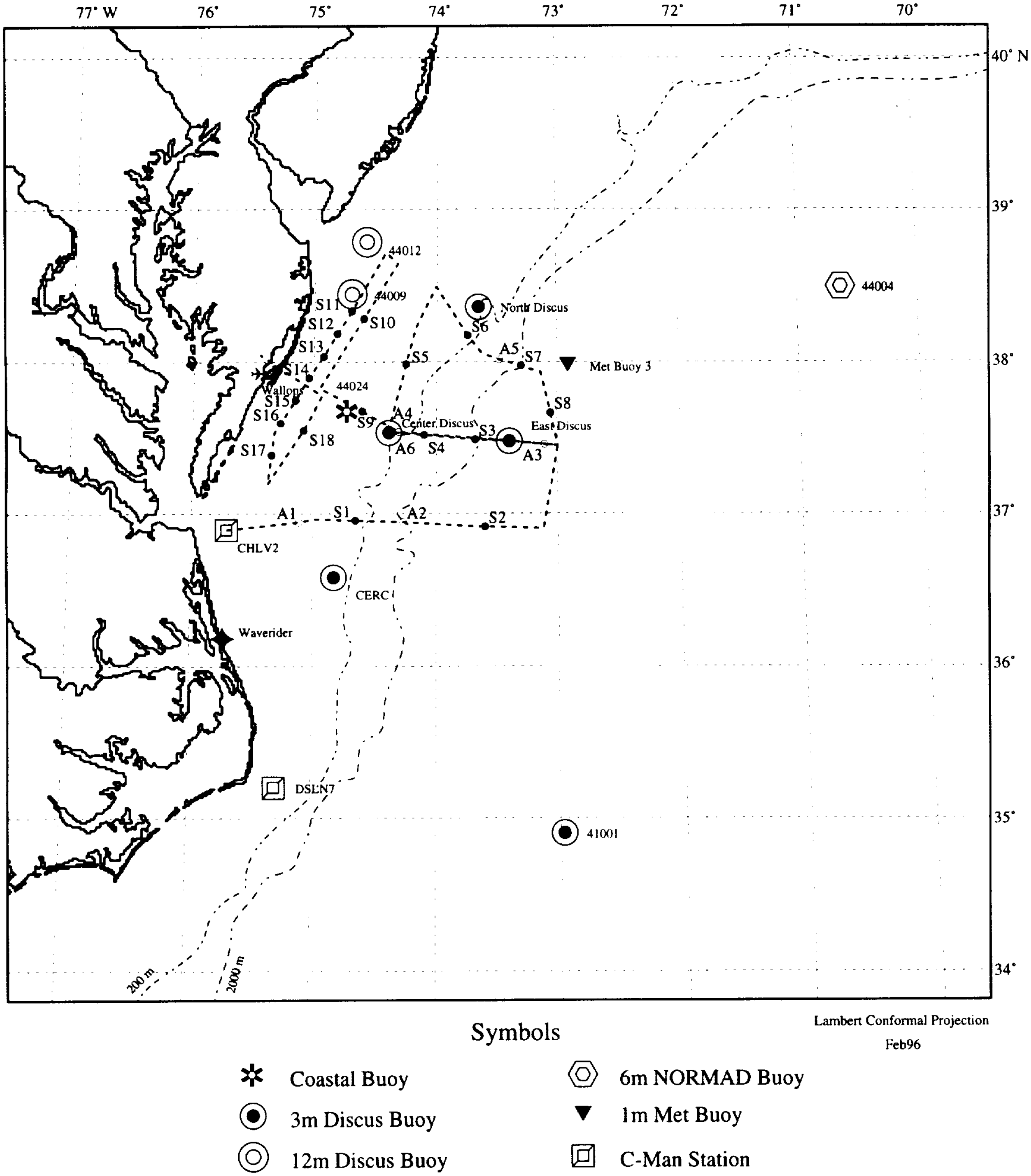
NASA T-39 ROWS Flight
March 4, 1991



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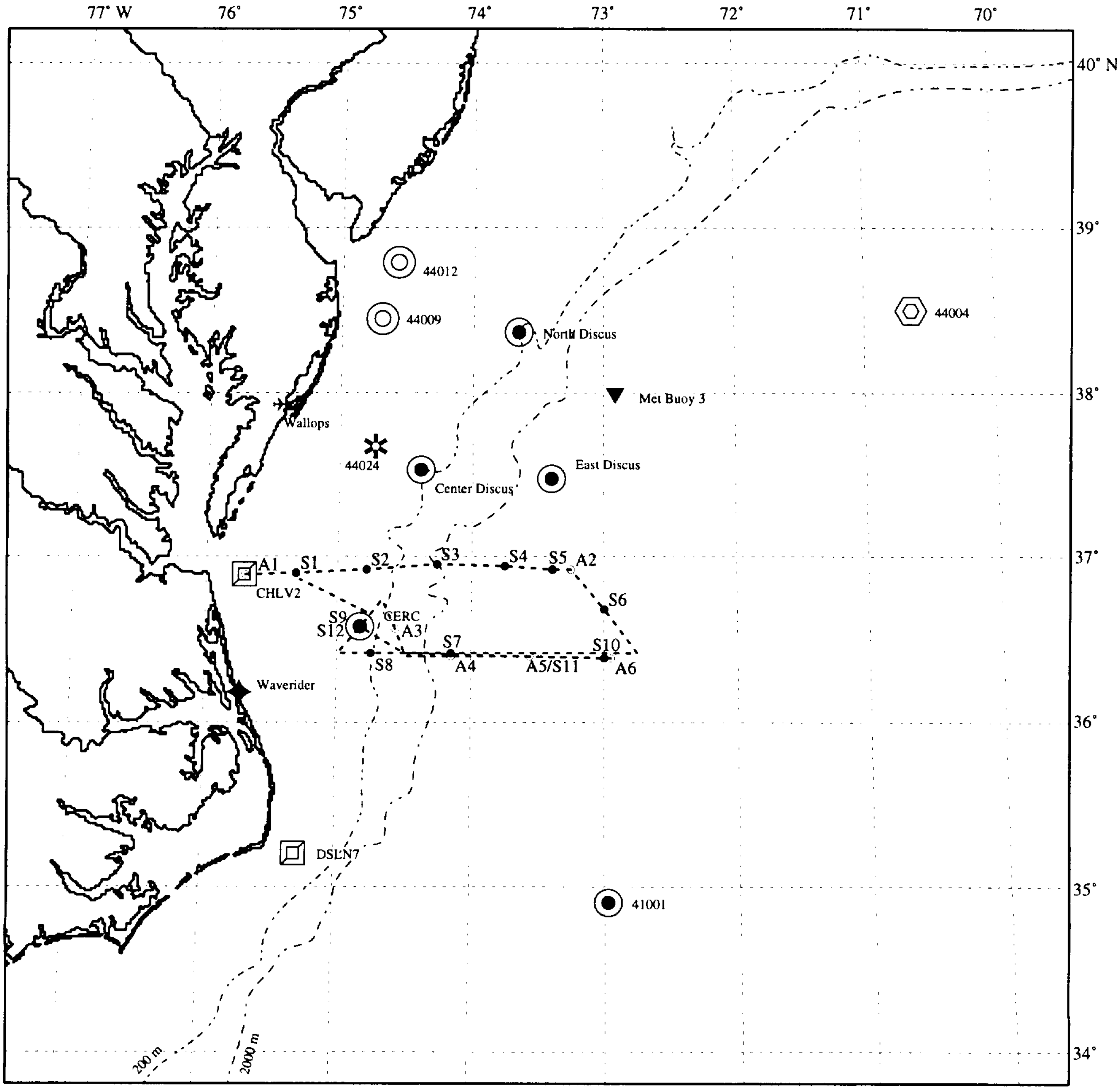
March 5, 1991

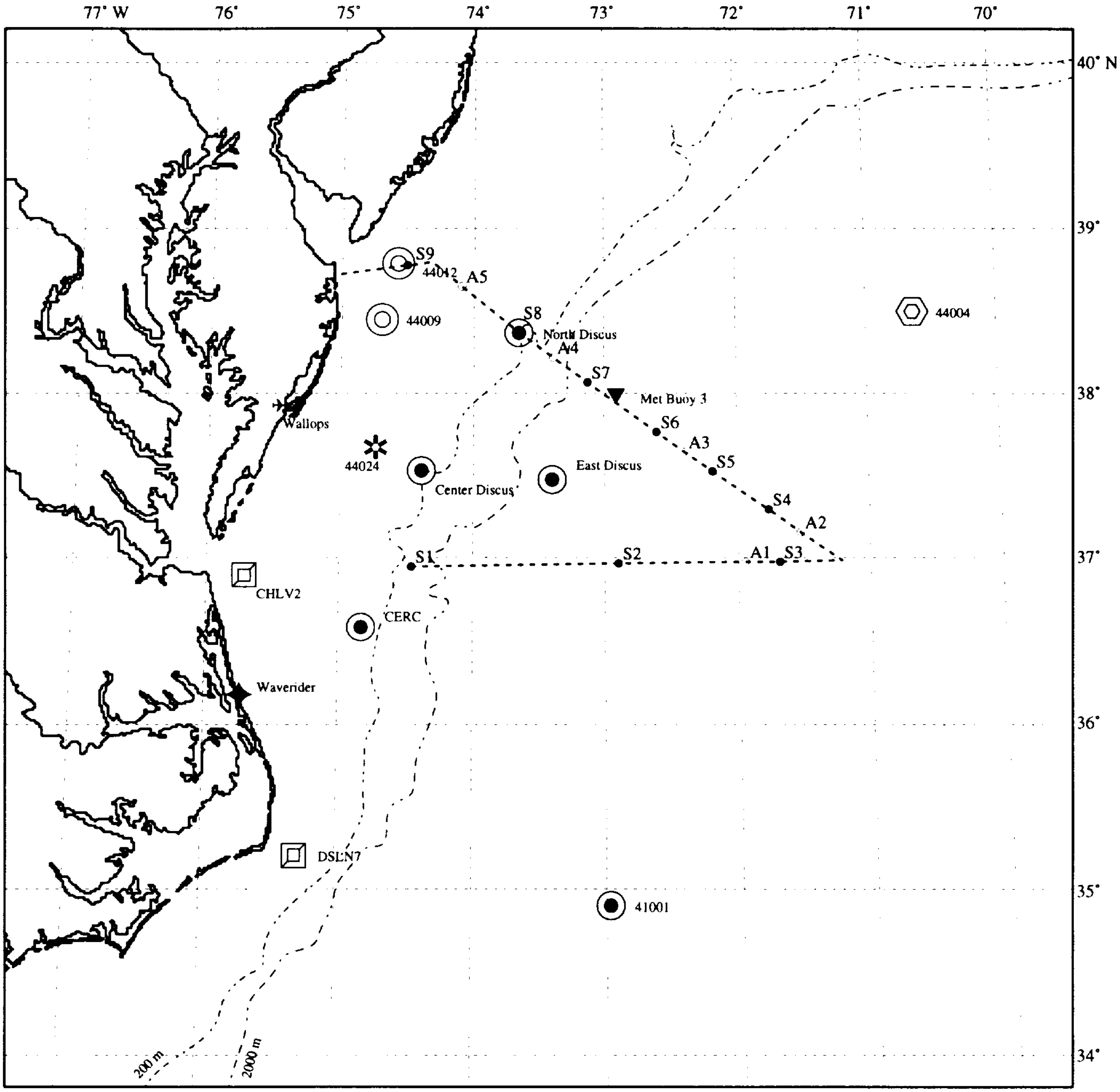


Symbols

Coastal Buoy	6m NORMAD Buoy
3m Discus Buoy	1m Met Buoy
12m Discus Buoy	C-Man Station

The notations A*n* and S*n* mark locations where altimeter or spectral data were taken that are in the public archive.

NASA T-39 ROWS Flight
March 6, 1991



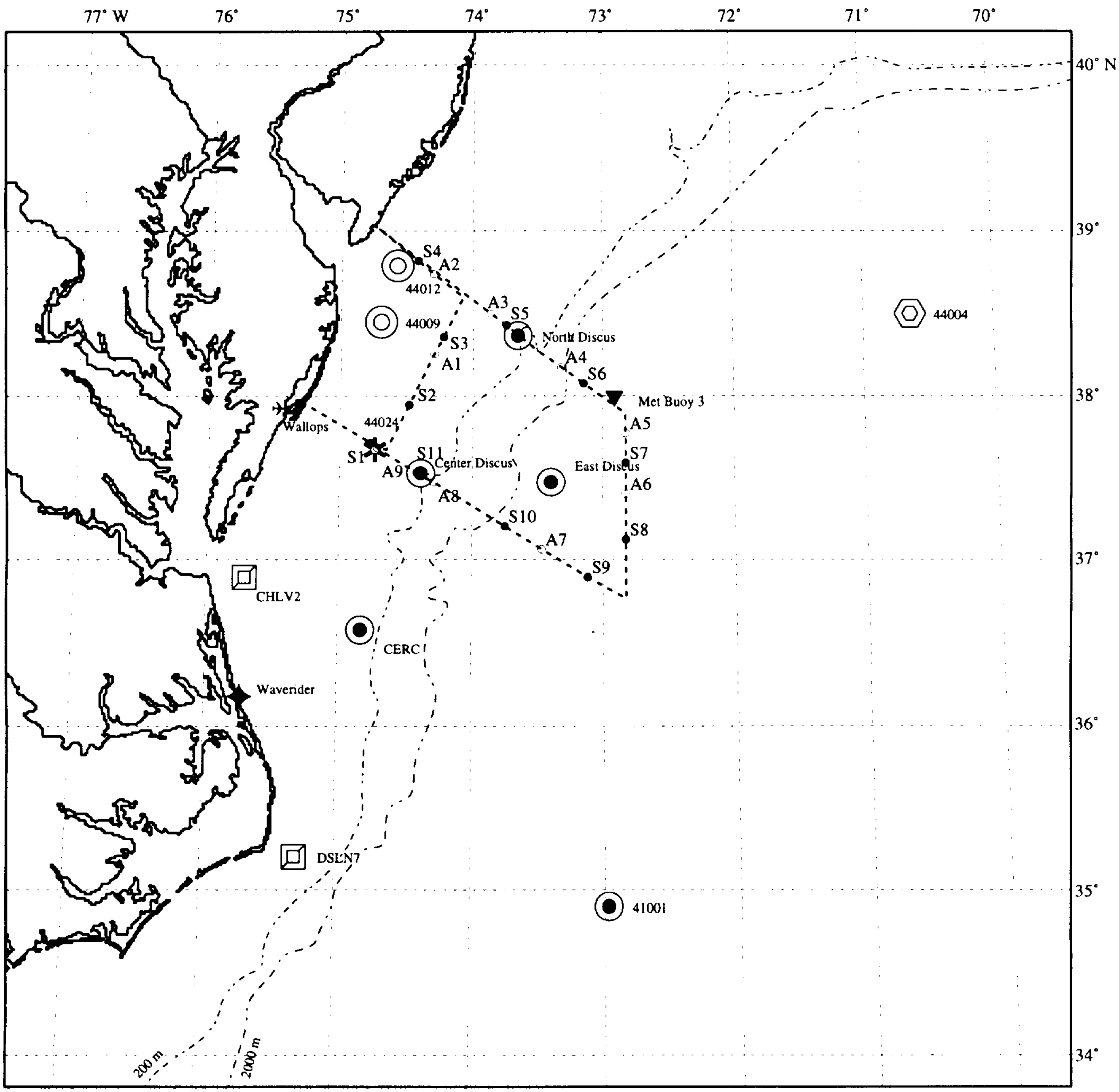
Lambert Conformal Projection
Feb96

Symbols

✲	Coastal Buoy	⬡	6m NORMAD Buoy
◉	3m Discus Buoy	▼	1m Met Buoy
◎	12m Discus Buoy	◰	C-Man Station

The notations A*n* and S*n* mark locations where altimeter or spectral data were taken that are in the public archive.

NASA T-39 ROWS Flight
March 7, 1991



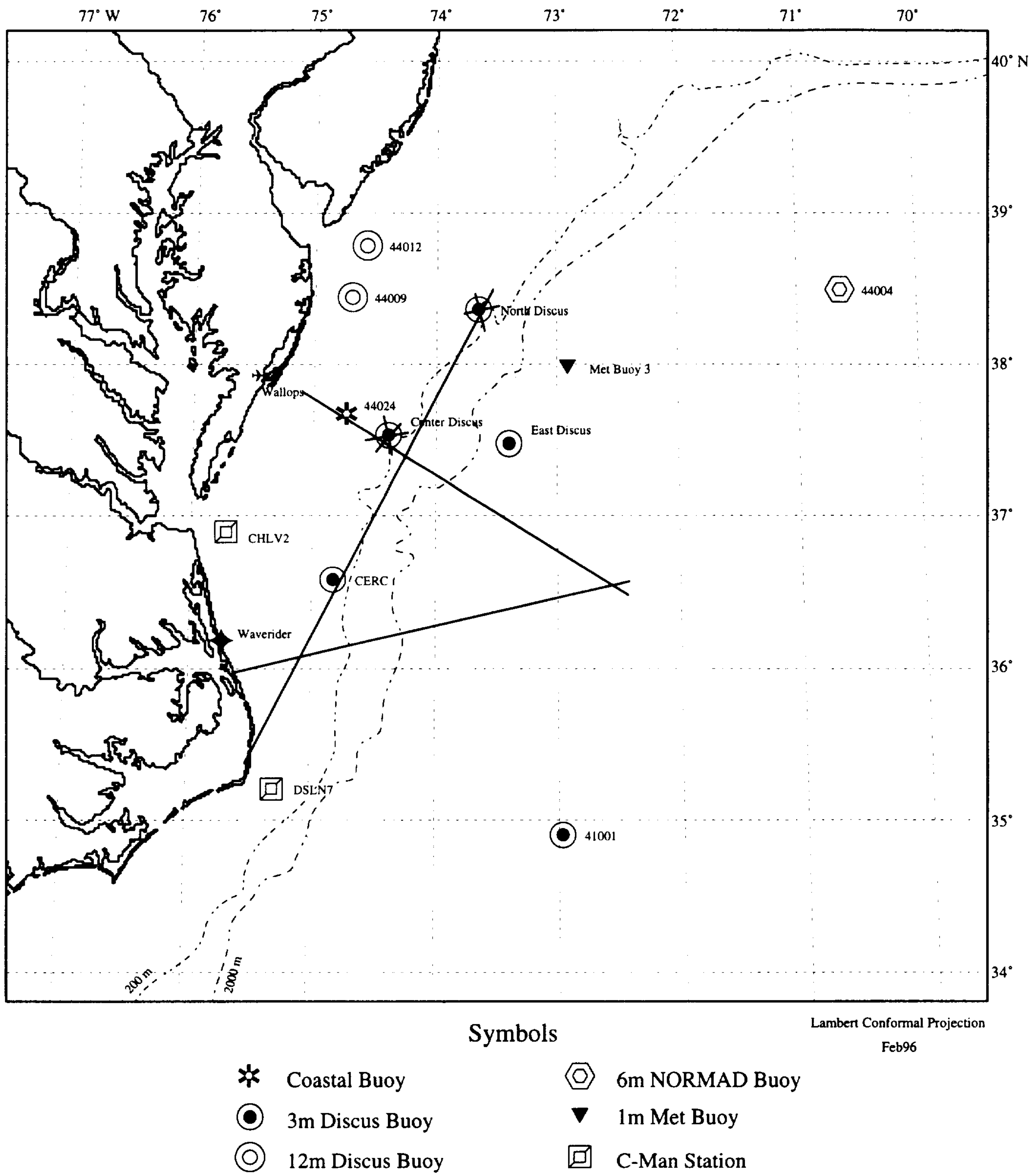
Lambert Conformal Projection
Feb96

Symbols

Coastal Buoy	6m NORMAD Buoy
3m Discus Buoy	1m Met Buoy
12m Discus Buoy	C-Man Station

The notations A*n* and S*n* mark locations where altimeter or spectral data were taken that are in the public archive.

ONR/ERIM P-3 SAR Flight
February 27, 1991



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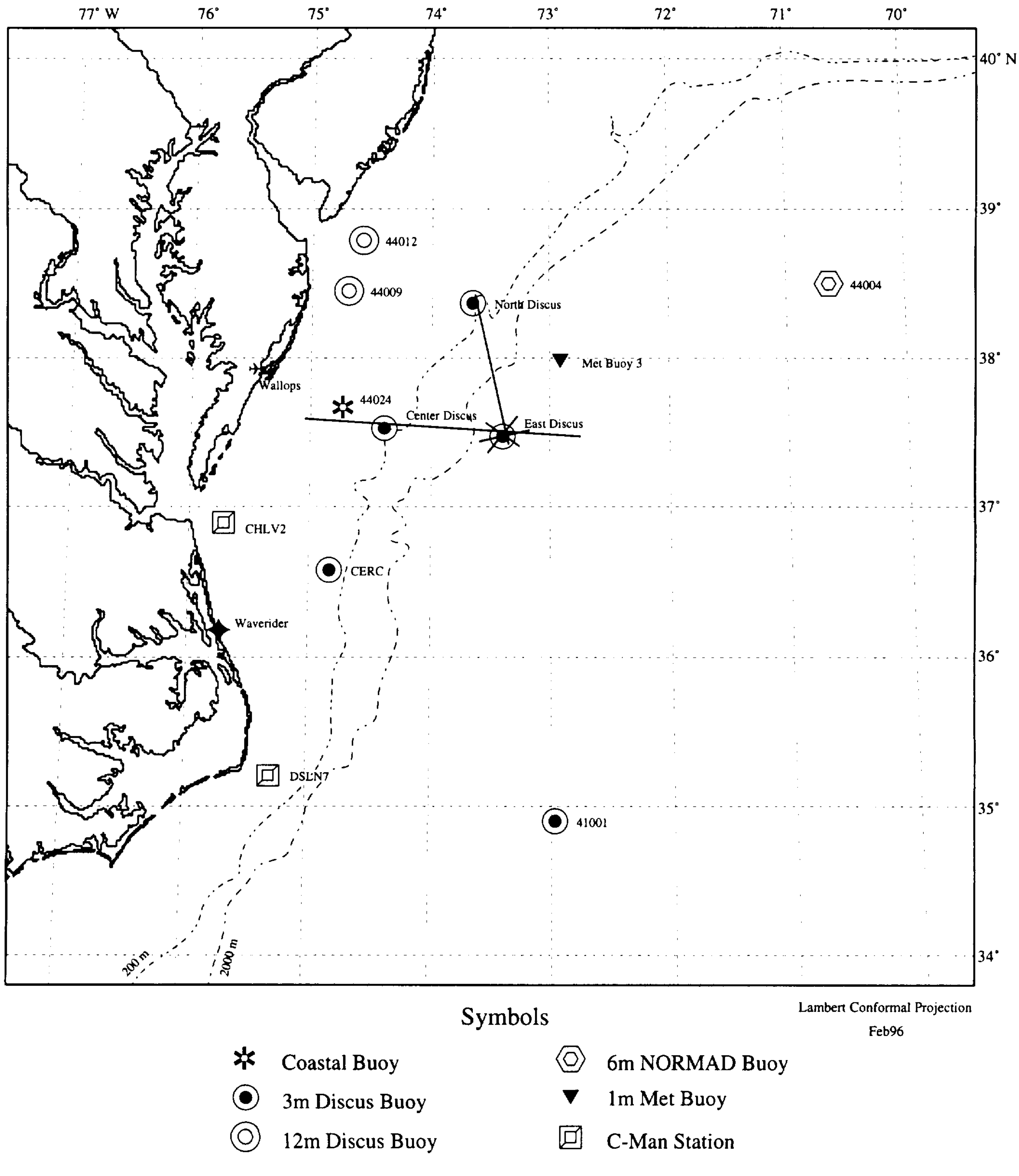
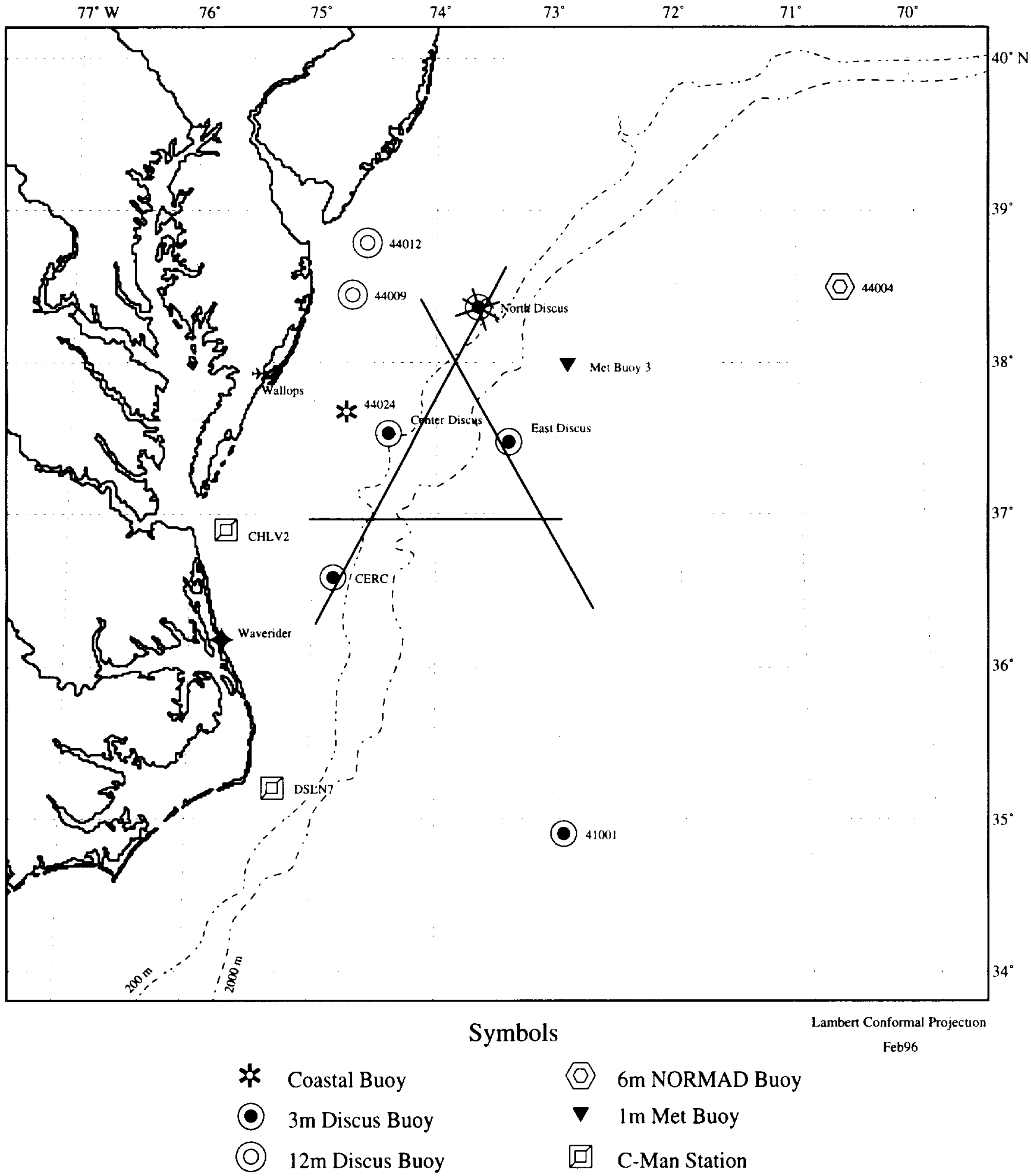
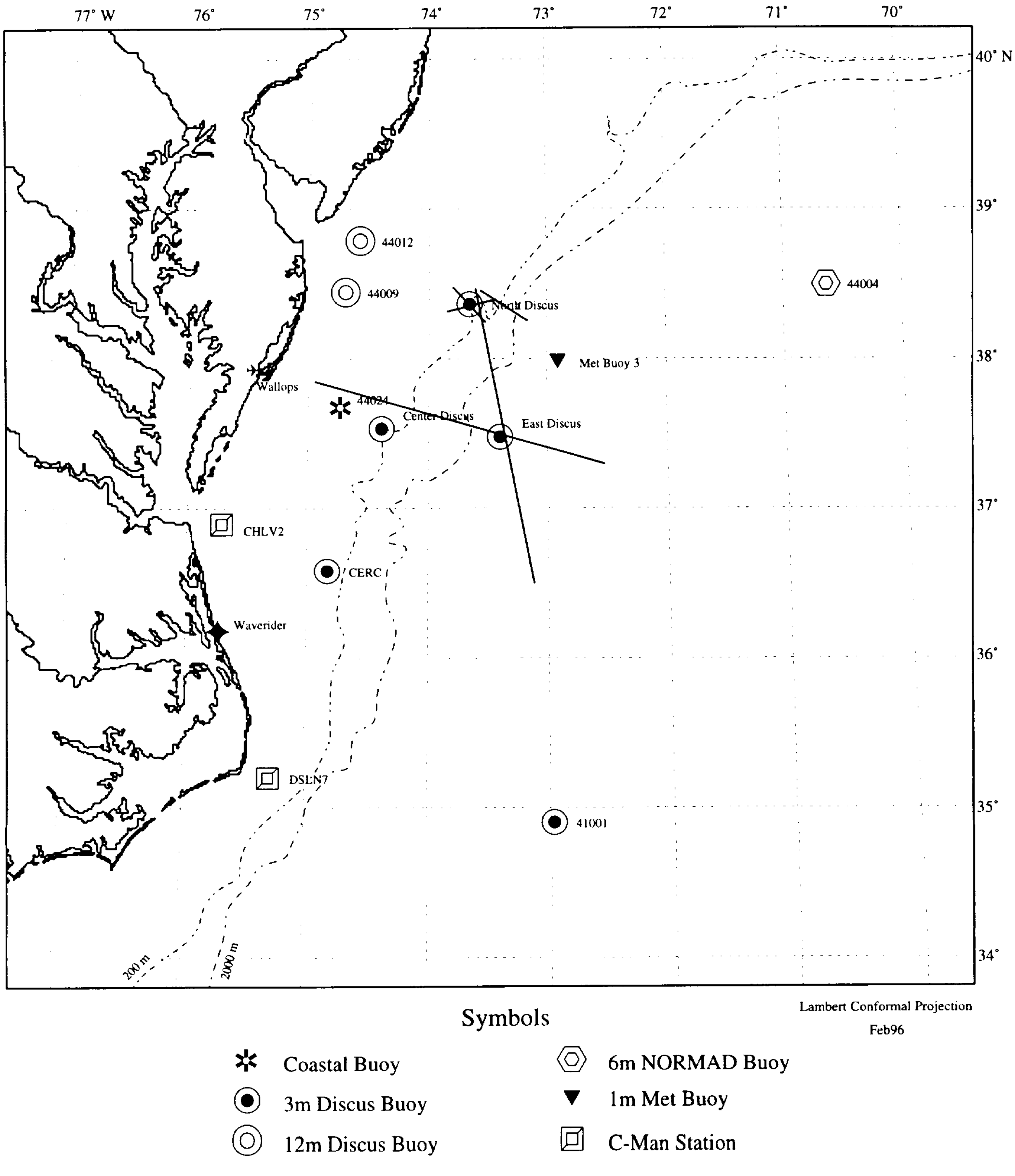


ONR/ERIM P-3 SAR Flights
March 5, 1991



ONR/ERIM P-3 SAR Flights
March 6, 1991



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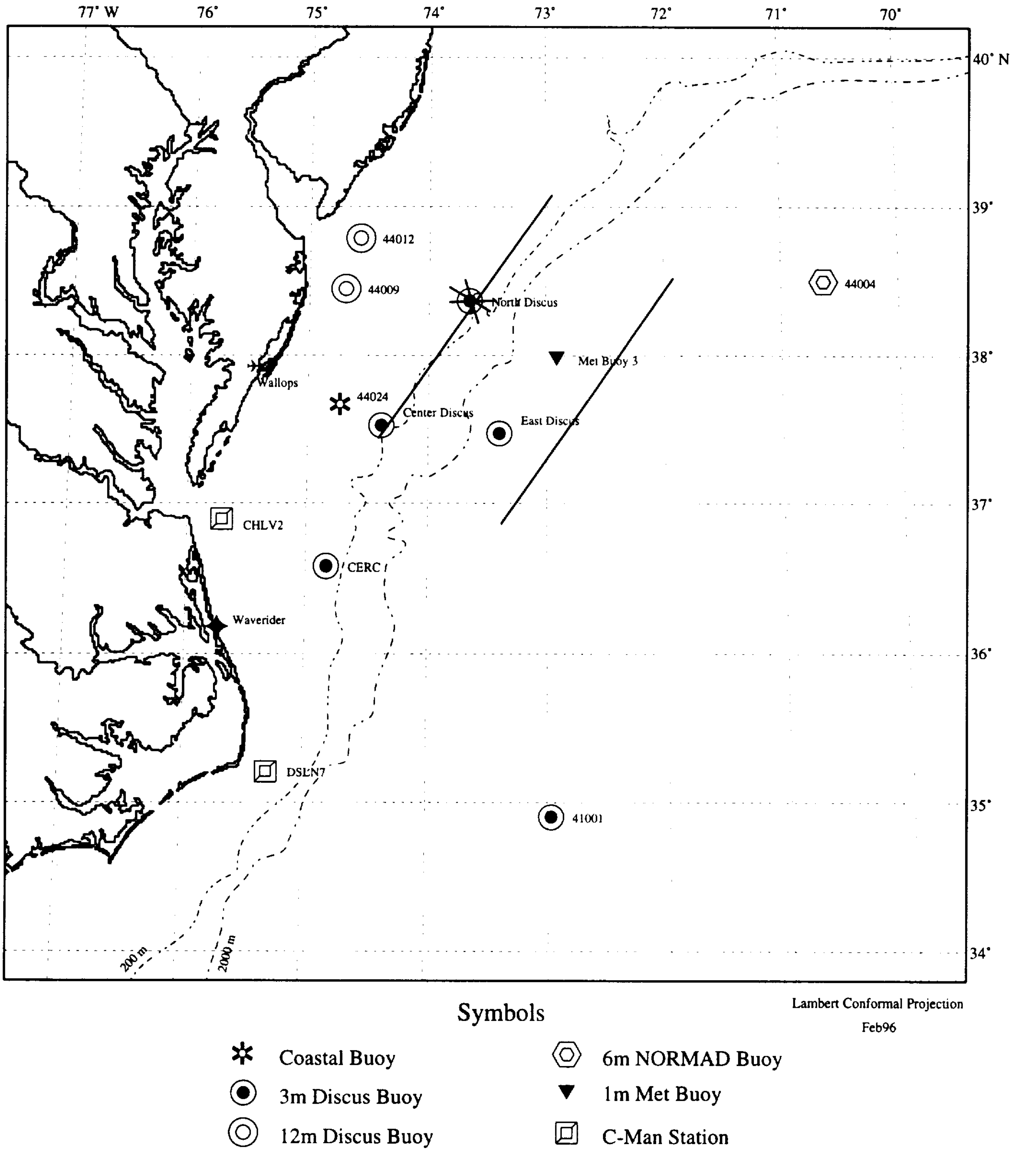
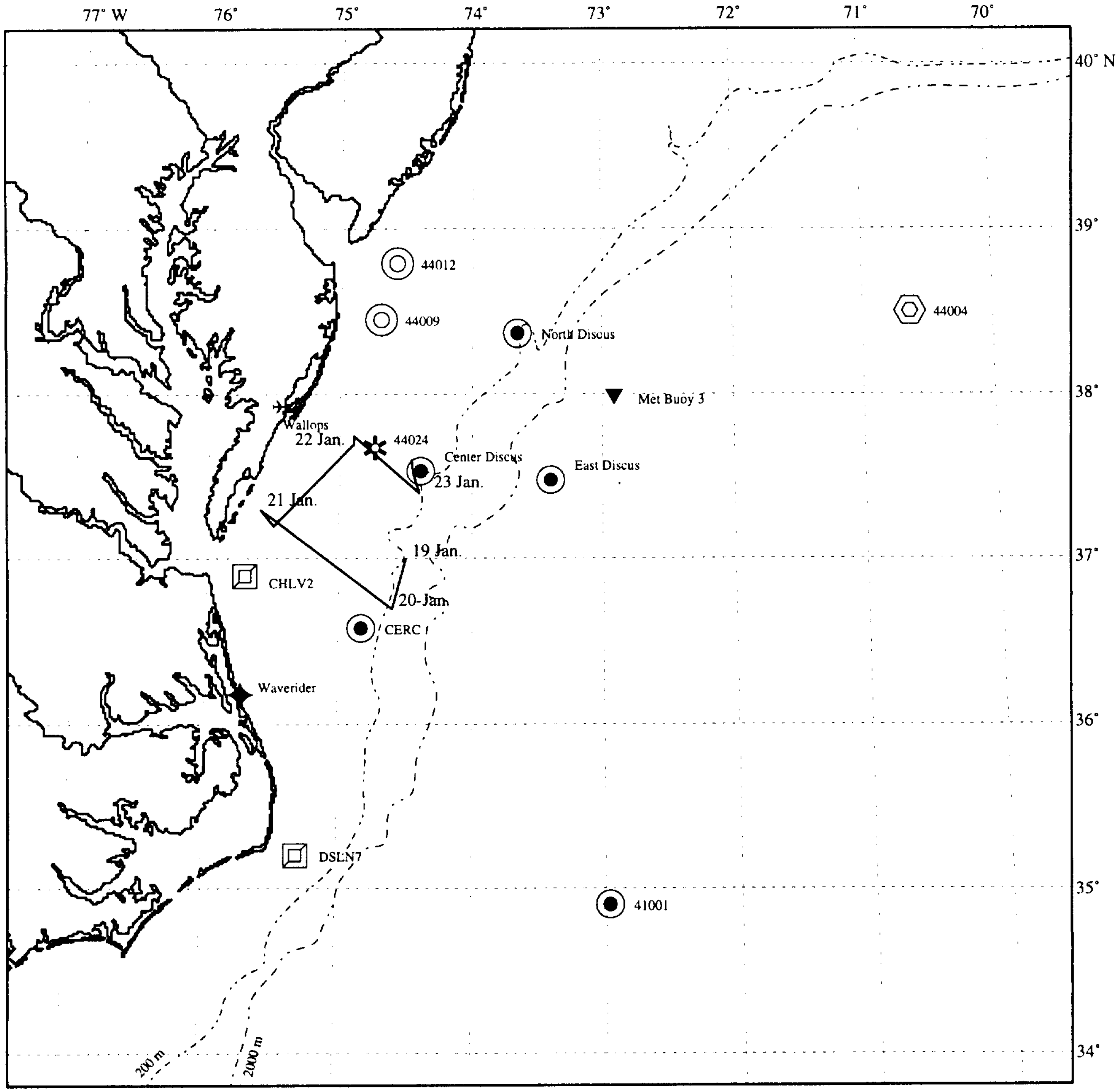
March 7, 1991



SWATH Ship Location January 1991

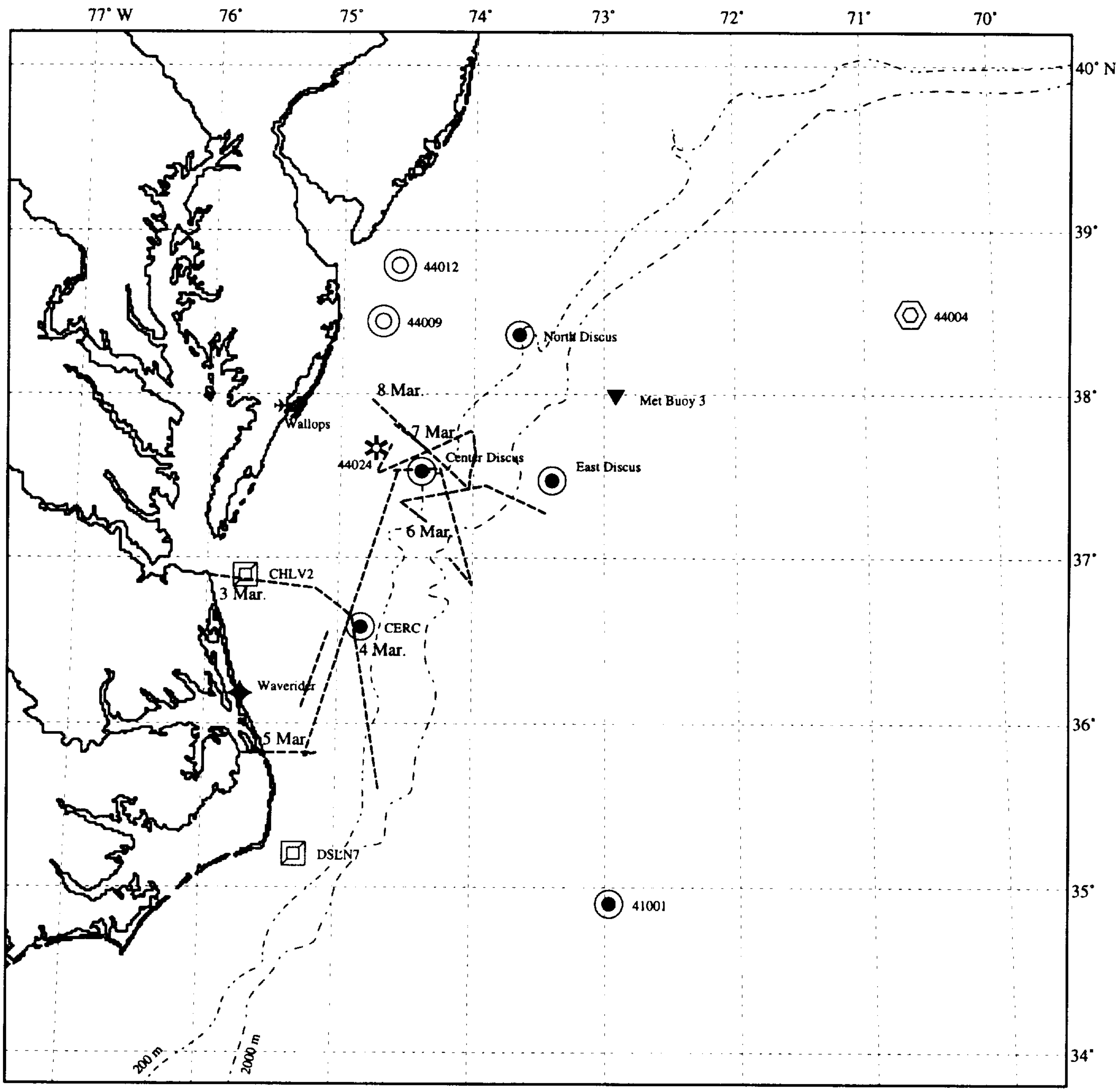


Lambert Conformal Projection
Feb96

Symbols

Coastal Buoy	6m NORMAD Buoy
3m Discus Buoy	1m Met Buoy
12m Discus Buoy	C-Man Station

SWATH Ship Location
March 1991



Lambert Conformal Projection

Feb96

Symbols

Coastal Buoy

3m Discus Buoy

12m Discus Buoy

6m NORMAD Buoy

1m Met Buoy

C-Man Station

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13. ABSTRACT *(Maximum 200 words)*
This is a guide to the data that was collected during the Surface Wave Dynamics Experiment (SWADE) carried out from October 1990 through March 1991. The area studied was the Mid-Atlantic bight. Buoys collected data continuously during this time. Included are three 3-meter discus buoys the National Data Buoy Center (NDBC) set in the area for this project, then later added a fourth 3-meter discus and an experimental coastal buoy. Data from all of the NDBC buoys and stations from New England to Florida have been included in the data set; in addition, several other buoys monitored meteorological and ocean conditions for parts of the experiment. Several times during the project, there were intensive data collection periods. During the third of these, there were 7 aircraft and a ship collecting data. Maps of each mission from the platforms that have shared their data are included. The anonymous ftp site that has been established to make this data public is described.

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