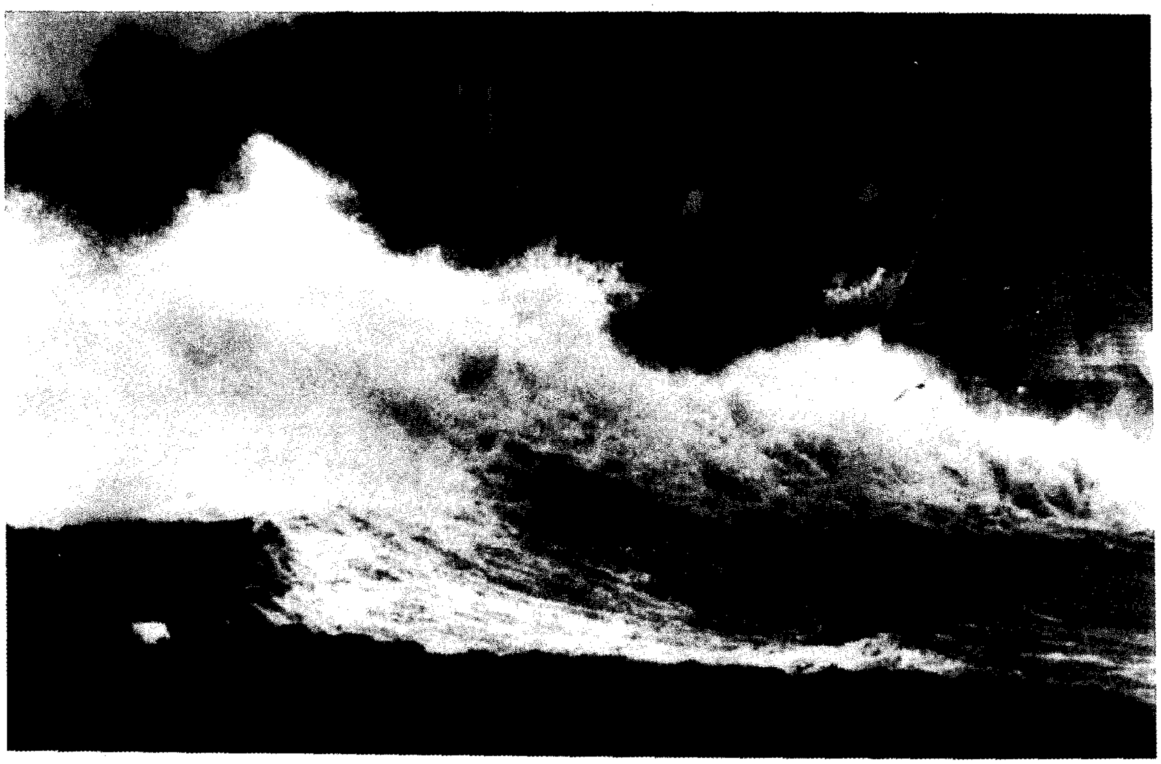
Natural Disaster Survey Report

THE HALLOWEEN NOR'EASTER OF 1991

East Coast of the United States...Maine to Florida and Puerto Rico

October 28 to November 1, 1991



U.S. DEPARTMENT OF COMMERCE
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ational Weather Service, Silver Spring, Maryland

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Cover: Waves crashing into the Massachusetts shore at Nantasket Beach in Hull. Photograph courtesy of Tom Herde and provided by the BOSTON GLOBE.

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June 1992

U.S. DEPARTMENT OF COMMERCE
Barbara H. Franklin, Secretary

National Oceanic and Atmospheric Administration
Dr. John A. Knauss, Administrator

National Weather Service
Dr. Elbert W. Friday, Jr., Assistant Administrator

PREFACE

Nor'easter storms are nothing new to residents along the east coast of the United States. However, the **Halloween Nor'easter of 1991** lasted much longer and impacted an area much larger than what is usually experienced. Due to the efforts of NOAA/National Weather Service meteorologists and meteorological technicians from San Juan, Puerto Rico, to Portland, Maine, the populace of the United States affected by this storm was well served. I congratulate all concerned on their expertise and professionalism in foreseeing this situation and properly responding.

Elbert W. Friday, Jr.
Assistant Administrator
for Weather Services

July 1992

FOREWORD

The report on the **Halloween Nor'easter of 1991** was prepared by the National Oceanic and Atmospheric Administration Disaster Survey team following on-scene assessments and interviews conducted during the week of November 11, 1991. Such surveys are conducted at the direction of the Assistant Administrator for Weather Services whenever significant storms occur.

National Weather Service employees; Federal, state, and local emergency services and other public officials; media representatives; and members of the general public from North Carolina to Maine were contacted and questioned specifically regarding the meteorological and oceanographic conditions that occurred, the timeliness and accuracy of National Weather Service actions in response to these conditions, and the appropriateness of responses to these actions.

The team is grateful to the many people who helped before, during, and after these visits by gathering information and who took time from other activities to spend time with us.

The Disaster Survey Team

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ACRONYMS AND ABBREVIATIONS

AFOS	Automation of Field Operations and Services
AVN	Aviation Weather Forecast Model
CMAN	Coastal Marine Automated Network
DST	Disaster Survey Team
FEMA	Federal Emergency Management Agency
ft	Feet/Foot
GOES	Geostationary Operational Environmental Satellite
kt	Knots
LFM	Limited-area Fine Mesh Model
MARMON	Marine Monitoring Program
mb	Millibar
MIC	Meteorologist in Charge
MLLW	Mean Lower Low Water
MRPECS	NMC Marine Product, East Coast Storm Surge
NAWAS	National Warning System
NDBC	National Data Buoy Center
NESDIS	National Environmental Satellite, Data, and Information Service
NGM	Nested Grid Model
NGWLMS	Next Generation Water Level Measurement System
NHC	National Hurricane Center
nm	Nautical Miles
NMC	National Meteorological Center
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NWR	NOAA Weather Radio
NWS	National Weather Service
NWWS	NOAA Weather Wire Services
NYSPIN	New York Statewide Police Information Network
PC	Personal Computer
PNS	Public Information Statements
SDM	Station Duty Manual
SMS	Satellite Marine Section
SOP	Standard Operating Procedure
SWIS	Satellite Weather Information System
USACE	United States Army Corps of Engineers
UTC	Universal Coordinated Time
VAS	VISSR Atmospheric Sounder
VDUC	VAS Data Utilization Center
VISSR	Visible and Infrared Spin Scan Radiometer
WCM	Warning Coordination Meteorologist
WLTS	Water Level Telemetry System
WSFO	Weather Service Forecast Office
WSMO	Weather Service Meteorological Observatory
WSO	Weather Service Office

DISASTER SURVEY TEAM MEMBERS

The **Halloween Nor'easter of 1991** Natural Disaster Survey Team is listed below. To more effectively investigate the storm, the Team Leader split the group in two. One half consisting of Scavia, Waters, Thurm, Coleman, and Viets covered the area from the Canadian border to Manasquan, New Jersey, while the other half with Shaffer, Koehn, Feit, Businger, and Overland researched the area from Manasquan to Cape Hatteras, North Carolina. Dr. Scavia led the northern group, and Dr. Shaffer led the southern group. Additional information on damage in Florida and Puerto Rico was provided by local offices and the Southern Region of the National Weather Service (NWS).

TEAM MEMBERS

Team Leader, **Donald Scavia**, Director, National Oceanic and Atmospheric Administration (NOAA) Coastal Ocean Program

Team Technical Leader, **Robert Jacobson**, Meteorologist, NWS/Office of Meteorology/Marine and Applied Services Branch

Field Representative, **David Feit**, Chief, NWS/National Meteorological Center (NMC)/Satellite and Marine Section

Field Representative, **Richard Coleman**, Meteorologist in Charge/Area Manager, Weather Service Forecast Office (WSFO) Memphis, Tennessee

Field Representative, **Harvey Thurm**, Regional Marine and Hurricane Program Leader, NWS/Eastern Region

NOAA Public Affairs Specialist, **Patricia Viets**, NWS/Public Affairs Office

Subject Matter Specialist, **Marshall Waters**, Chief, NOAA/Ocean Products Center

Subject Matter Specialist, **Wilson Shaffer**, Chief, NWS/Office of Systems Development/Marine Techniques Branch

Subject Matter Specialist, **Mark Koehn**, Program Leader, NWS/Office of Meteorology/Tsunami and Oceanographic Services Program

Subject Matter Specialist, **James Overland**, Chief, NOAA/Pacific Marine Environmental Research Laboratory/Marine Assessment Research Division

Non-Governmental Expert, **Steven Businger**, Professor, North Carolina State University/Marine, Earth, and Atmospheric Science Department

EXECUTIVE SUMMARY

Beginning on October 28 and lasting until November 1, 1991, a succession of meteorological events combined over the northwest Atlantic Ocean resulting in a series of extraordinary ocean waves and swells. Driven and maintained by persistent, near-hurricane force winds, these waves and swells spread to the south and southwest before crashing onto the North American coast and the northern shores of the islands of the western Atlantic. Although New England, closest to the storm, received the hardest blows, widespread destruction was the rule as far south as Cape Hatteras, North Carolina, while scattered damage occurred to southern Florida and the north coast of Puerto Rico.

During the course of its investigation, the NOAA Disaster Survey Team (DST) traveled along the East Coast from North Carolina to Maine. Overall, the Team found that the system established to develop and disseminate coastal flood watches, warnings, and statements worked well. The several NWS offices involved--national, regional, and local--recognized the threat early and did yeoman work in keeping Federal, state, and local emergency officials; the media; and the public informed with clear, concise, and timely products.

The Team feels, however, that there are some problems that need to be addressed. These are discussed in the pages that follow and are summarized in the findings and recommendations section of this report. In general, there are three areas that require the most attention: data availability, guidance inadequacy, and public response.

Data Availability

All NWS warning products must begin with reliable and timely observations. The Team found that there are not enough water level observation sites along the East Coast. Where these sites do exist, there is not adequate real-time access by the forecasters to the data provided. Further, the Team found a disturbing shortage of basic marine weather observations available. Specifically, there are too few Coastal Marine Automated Network (CMAN) units and buoys along the East Coast. Thus, in many cases, the forecasters are not able to adequately monitor existing conditions.

Guidance Inadequacy

The various numerical models available provided forecasters with very good guidance on open ocean conditions and on the movements and intensity changes of the weather systems affecting the storm. However, the guidance as to coastal conditions was unreliable and, in at least one case, actually inhibited an early warning issuance.

Current development activities on an extratropical coastal storm surge model and a coastal wave prediction system need to be accentuated.

Public Response

Excellent warnings and statements were disseminated by the NWS to state and local emergency service officials and to the media. In general, the response by these groups of people was excellent. The media forwarded this information to the public in a timely fashion. The emergency service personnel were ready ahead of time to take appropriate actions.

In most cases, however, the public either did not respond or they responded improperly. Many people did not perceive this coastal storm as a threat to them. It is apparent to the Team that a public education campaign is needed to make sure people understand the potential of coastal flooding. Such a campaign needs to include the utilization of the NOAA Weather Radio (NWR). The radio's effectiveness in such places as the Outer Banks of North Carolina highlights its potential as a tool for alerting and informing the public.

FINDINGS AND RECOMMENDATIONS

THE EVENT AND ITS IMPACT (CHAPTER I)

Finding 1:

A coastal flood of unusually long duration and intensity occurred during late October 1991, affecting areas along the entire east coast of the United States and Puerto Rico. This storm caused millions of dollars in damage to beaches and man-made beachfront structures, including the seaside home of President George Bush.

DATA ACQUISITION AND AVAILABILITY (CHAPTER III)

Finding 2:

The availability and continuity of an adequate, reliable, and timely data base (consisting of meteorological observations, sea state conditions, and water level measurements) is vital if NWS offices are to provide accurate and timely coastal flood watches and warnings. This includes those areas behind barrier islands, particularly where large rivers or embayments are involved (e.g., Pamlico Sound) so that adequate warning for seiches and coastal flooding can be given.

Recommendation 2-1:

NWS and National Ocean Service (NOS) should implement a system that will ensure that local NWS offices will have real-time, 24-hour access to reliable water level measurements especially from **critical** tide gage stations. This should include those stations behind the various oceanic barriers. The availability of these data is vital to NWS offices responsible for issuing coastal flood watches and warnings.

Recommendation 2-2:

The phaseover from the Water Level Telemetry System (WLTS) to Next Generation Water Level Measurement System (NGWLMS) technology must be accomplished only after all questions and reservations about the new system have been answered and the operational implementation of the new system has been agreed to by both NWS and NOS.

Recommendation 2-3:

The NWS should install an adequate marine observational network that would fill the gaps in the current arrangement and would provide the minimum coverage necessary for the reconfigured forecast areas in the modernized NWS. This network should include shoreline/shallow water wave height measurements.

Finding 3:

A water level value relayed to WSFO Portland, Maine, from a properly operating gage was discounted by forecasters due to past problems with the gage. The coastal flood warning was issued only after electronics technicians verified that the earlier reading was correct, some 3 hours after the threshold value was reached.

Recommendation 3-1:

Water levels should be monitored on a regular basis, either manually or automatically, so that NWS forecasters are aware of possible gage problems and so that water level trends can be observed.

Finding 4:

Marine weather data are not as accessible to NWS forecasters as are land-based data making the use of this information more difficult.

Recommendation 4-1:

The NWS should ensure that marine weather data are integrated into the Automation of Field Operations and Services (AFOS) hourly surface plots for use at local offices having marine responsibility. The Ocean Products Center should seek other ways to bring needed data to the high seas forecasters of the Satellite Marine Section (SMS) at NMC.

Recommendation 4-2:

The NWS should explore adapting the marine monitoring (MARMON) program, developed at WSFO Cleveland and utilized across the Great Lakes, to assist forecasters in monitoring conditions along the East Coast.

PREPAREDNESS (CHAPTER IV)

Finding 5:

On-station standard operating procedures (SOP) varied widely from one station to another. In some cases, guidance materials were not complete or clear enough for a station's most inexperienced members to carry out their duties with the confidence that they had enough information to make the best decisions possible.

Recommendation 5-1:

All local managers should review their Station Duty Manuals (SDM), checklists, emergency procedures, etc., regarding coastal flooding to ensure they are complete, clear, concise, and up to date.

Finding 6:

Station drills on coastal flooding are not common practice at all offices having such responsibility.

Recommendation 6-1:

Drills should be scheduled at all stations with a frequency that will keep coastal flood procedures fresh in the minds of all watchstanders. Actual coastal flood events could be substituted for a drill.

WARNING SERVICES (CHAPTER V)

Finding 7:

NMC and coastal WSFOs and Weather Service Offices (WSO) recognized the potential for a dangerous ocean storm several days before the storm's major impact on the New England and Mid-Atlantic coastlines. Overall, notification of emergency officials and watch/warning lead times were sufficient for effective preparedness actions yielding a remarkably low loss of life.

Recommendation 7-1:

Appropriate recognition is warranted for individuals and organizations who played pivotal roles in ensuring the effective performance of the warning process.

Finding 8:

Overall, the various atmospheric models performed well. However, statistical output from the NMC Marine Product-East Coast Storm Surge (MRPECS) program was consistently too conservative for this storm and may have inhibited warning effectiveness. Also, forecasters were unfamiliar with its usefulness in forecasting wave conditions during long duration storms.

Recommendation 8-1:

NOAA should be encouraged to complete the development of an extratropical storm surge model.

Recommendation 8-2:

NOAA should finalize development of a replacement for the MRPECS program having sufficient resolution and coupling the NMC deep water wave model to the shallow, coastal areas. Further, NWS should ensure that, once developed, the benefits and utilities of this guidance are made known to field personnel.

Finding 9:

In some cases, the public was drawn to the coast to witness the power of the heavy surf. This created traffic problems that may have obstructed emergency actions.

Recommendation 9-1:

NWS offices, working with local emergency managers, are encouraged to develop wording for use in coastal products designed to discourage spectators from going to the coast during coastal flood and high surf episodes.

COORDINATION AND DISSEMINATION (CHAPTER VI)

Finding 10:

Although NAWAS (National Warning System) was used, its fullest capability was not realized because dissemination to local offices was slow or did not occur.

Recommendation 10-1:

NWS managers at all levels should work with their NAWAS system managers to review dissemination procedures and see if these can be strengthened.

Finding 11:

The NOAA Weather Wire Services (NWWS) does not appear to be the total answer for disseminating emergency weather information to state and local emergency service managers.

Recommendation 11-1:

The NWS needs to strongly encourage those states subscribing to the NWWS to install automatic systems for distributing emergency information to appropriate local officials. Other alternatives for quickly and personally delivering such information to key state and local decision makers, such as the New York Statewide Police Information Network (NYSPIN), need to be explored and developed.

USER RESPONSE (CHAPTER VII)

Finding 12:

Response by the emergency management community and by the various media was generally excellent. Public response to this storm, and to coastal flood watches and warnings in general, was generally poor.

Recommendation 12-1:

The rapport and personal contacts between NWS officials and emergency managers at all levels must be maintained especially during the NWS modernization. This can be accomplished only through frequent visits between NWS personnel and state and local emergency officials. The NWS should look at other ways of coordinating with and informing emergency managers at whatever level is necessary during time-critical events.

Recommendation 12-2:

The NWS should investigate whether some minimum standard of preparedness training should be provided, through briefings or some other mechanism, to high level officials (e.g., mayors and governors) who can play a critical role in responses (e.g., evacuations) to emergency situations.

Finding 13:

Many residents contacted by the DST said that they did not think the storm would be as devastating as it was and took no action to protect their property or to evacuate. Since this was not a hurricane and, in many locations, was not accompanied by "significant weather," the storm was not perceived as a real danger.

Recommendation 13-1:

The NWS should investigate the feasibility of developing an intensity scale for extratropical storms patterned after the Saffir-Simpson Hurricane Intensity Scale for tropical systems.

Recommendation 13-2:

NWS offices are strongly encouraged to continue the practice of comparing potentially damaging storms with noteworthy storms of the past, thereby increasing the sense of urgency to the general public.

Recommendation 13-3:

NWS should produce a pamphlet dedicated solely to coastal flooding. This needs to be done as part of a systematic public information campaign designed to educate the coastal public on the dangers of coastal storms. This campaign could also include press conferences, now used to increase hurricane awareness, public information statements (PNS), and Public Service Announcements.

Finding 14:

Especially in New England, the NWR is not used by the general public as widely as it could be.

Recommendation 14-1:

The existence of NWR needs to be more highly publicized. In communities where NWR is widely accepted (e.g., the Cape Hatteras area), it is highly successful in keeping both local officials and the general public informed. Local managers should use whatever publicity sources they have available, including Public Service Announcements in the local media to encourage the use of NWR.

CHAPTER I -- THE EVENT AND ITS IMPACT

A series of extraordinary meteorological events during the week of October 27, 1991, set the stage for a major coastal flood and erosion event. Although principally affecting sections of the East Coast from Maine through North Carolina, the impact of the storm was felt south from there to the southernmost reaches of Florida, across much of the Bahamas, and as far south as Puerto Rico. Flooding began early and continued throughout the week. The worst impacts, however, were experienced on October 30 and 31. For this reason, the storm will likely go down in the annals of meteorological history as the **"Halloween Nor'easter of 1991."**

The event was especially noteworthy for the following reasons.

a. The storm was of unusually long duration. For example, in North Carolina a heavy surf advisory was in effect for 5.5 days, and a coastal flood warning was in effect for 3.5 days.

b. With the exception of Cape Cod and the eastern shore of Massachusetts which experienced hurricane force wind gusts and heavy rain, the coastal flooding along the remainder of the East Coast was accompanied by relatively benign weather.

c. The coastal flooding was generated by three separate and distinct synoptic-scale systems which contributed individually and in combination to produce the damaging high seas.

d. Coastal flooding was exacerbated when the intense extratropical storm, the third and most potent of the three systems, moved in a very atypical path (i.e., from east to west to south) almost totally opposite the normal storm track, keeping the wave-generating fetch much closer to and pointed directly toward the North American mainland.

An extensive discussion of the meteorology associated with the **Halloween Nor'easter of 1991** is contained in Chapter II. For the purposes of this chapter, the impacts from the interactions of the various weather features will all be considered together under the generic term "storm."

The wind fields generated by the storm covered an extremely large area extending hundreds of miles. This resulted in a tremendous fetch length ranging from south of Labrador to the coast of Florida (figure 1). As the winds persisted, they generated seas over 40 feet (ft) in height. This was somewhat similar to the "Ash Wednesday

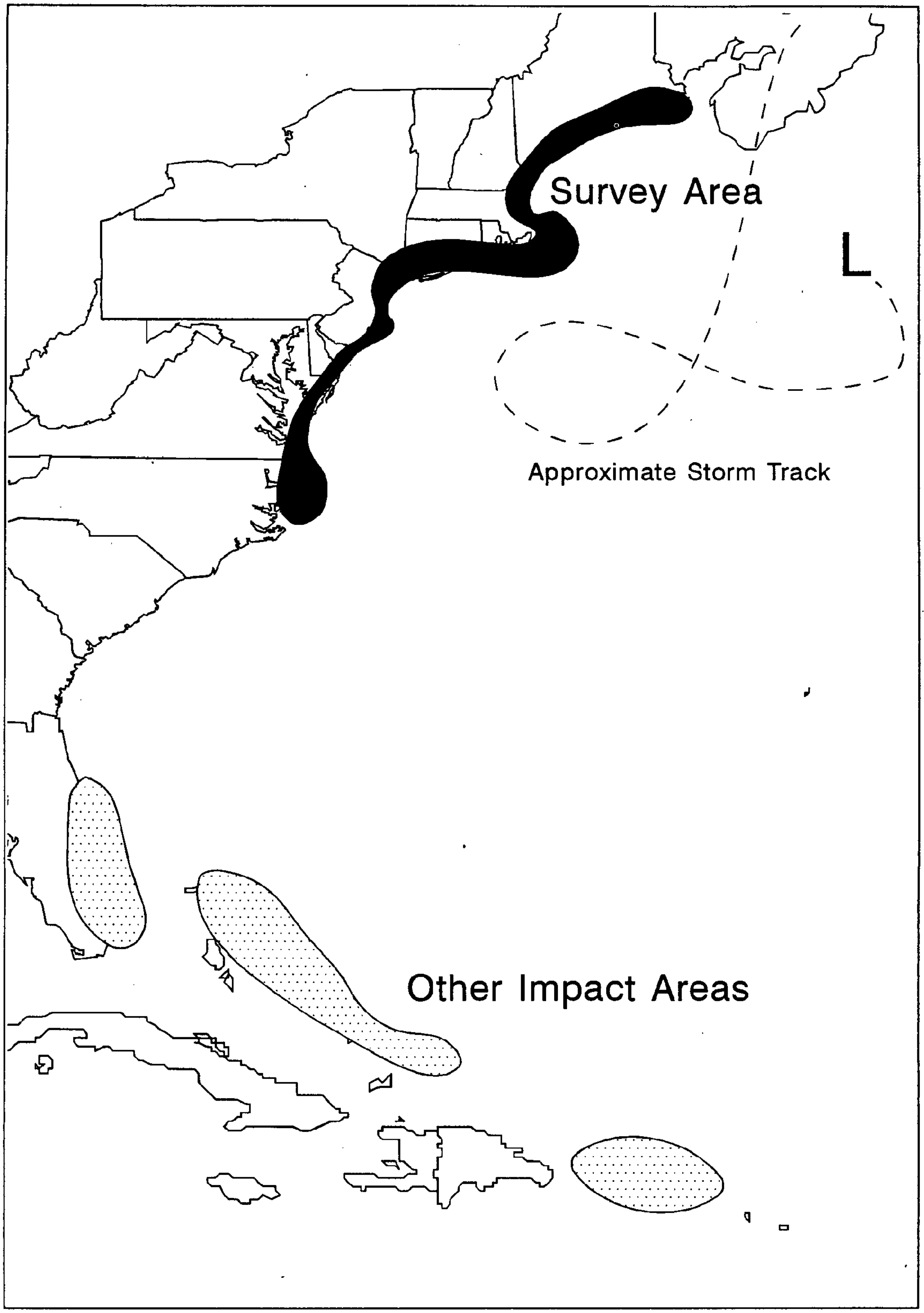


Figure 1. Halloween Nor'easter of 1991...Overview

Storm" of March 1962, in that the long fetch allowed big waves to develop. In areas close to the center of such a tempest, most of the wind energy generally goes into forming shorter-period, wind-driven waves. However, as these waves propagate away from the storm, they are damped much more than are the longer-period waves. What results is called a swell (i.e., the long-period waves that can travel to and impact a coastline thousands of miles away. An excellent example is the swells that crash on the beaches of Oahu, Hawaii. These are often generated by systems halfway across the Pacific and impact Oahu days later.)

Developing after October 27, these swells, traveling unobstructed to the south and southwest, had a clear path to the United States coast bringing abnormally high waves and extreme water levels. Indeed, ocean levels were raised to such an extent that the water acted almost like a dam retarding outward tidal flows and even inhibiting river waters from disgorging into the sea. Flooding in low-lying areas caused by the backup of such flows was seen in such unlikely places as along the Hudson River north to Albany and Troy, New York, and the Potomac River north to metropolitan Washington, D.C. Both of these are over 100 miles from the sea.

Near the coast, the ocean responds to any nor'easter through storm surge as well as through local wave generation. The term "storm surge" is defined as the difference between the observed tide gage water level and the predicted astronomical tide level. Note that this definition excludes waves. These features are damped out by the action of the stilling-well, that part of a tidal gage system holding the water to be measured, and by the longer averaging time of most tide gages.

Tide gages along the East Coast measured storm surges that ranged from just over 5 ft at Boston's gage to roughly 2 ft along North Carolina's Outer Banks. (See tables I and II for water levels measured during this storm and for comparisons with earlier record levels.)

Damage along the coastlines was caused by a combination of relatively high tides, high storm surge levels, and large waves which for several days continuously pounded the shoreline. At low tide, even a fairly large wave will have comparatively little impact on structures. However, when the water level at low tide raises to equal the mean high water mark, the threat from such waves increases. When several feet of storm surge strikes the coastline coincident with high tide, these waves can cause profound damage of the type incurred from this storm.

As experienced during the **Halloween Nor'easter of 1991,** a storm of long duration will impact several tidal cycles. (On the East Coast, one tide cycle is completed about every 12 1/2 hours.) This is in contrast to a fast-moving storm, like a hurricane, where only those tide levels during the few hours of the event are critical.

TABLE I
MAXIMUM STORM SURGE - HALLOWEEN NOR'EASTER OF 1991

Station	Date/Time	Obsvd.	Pred.	Diff.
Eastport, ME	10/30 1048	4.99	2.30	2.69
Cutler, ME	10/30 1000	4.14	1.32	2.82
Portland, ME	10/30 1112	5.13	1.61	3.52
Boston, MA	10/30 2042	8.57	3.46	5.11
Woods Hole, MA	10/30 2318	5.07	0.72	4.35
Nantucket, MA	10/30 1500	7.42	2.82	4.60
Newport, RI	10/31 0106	7.32	3.30	4.02
Providence, RI	10/31 0130	7.95	4.54	3.41
New London, CT	10/31 0312	6.69	2.65	4.04
Montauk, NY	10/31 0218	6.60	2.16	4.44
Bridgeport, CT	10/31 0500	11.50	6.64	4.86
Port Jefferson, NY	10/31 0425	11.63	6.78	4.85
Willets Point, NY	10/31 0436	12.24	7.15	5.09
The Battery, NY	10/31 0430	8.42	3.48	4.94
Sandy Hook, NJ	10/31 0406	8.38	3.44	4.94
Barnegat Inlet, NJ	10/31 0654	4.49	0.22	4.27
Atlantic City, NJ	10/31 0718	5.31	0.66	4.65
Cape May, NJ	10/31 0800	4.55	0.65	3.90
Philadelphia, PA	10/31 1600	5.27	1.21	4.06
Lewes, DE	10/31 0906	4.56	0.66	3.90
Ocean City, MD	10/31 1848	4.68	0.88	3.80
Cambridge, MD	11/01 0548	2.67	0.46	2.21
Annaplois, MD	11/01 0530	3.18	0.54	2.64
Baltimore, MD	11/01 0712	3.19	0.43	2.76
Washington, DC	11/01 1200	3.75	0.99	2.76
Colonial Beach, VA	11/01 0400	3.07	0.27	2.80
Lewisetta, VA	11/01 0200	3.03	0.41	2.62
Hampton Roads, VA	10/31 1900	4.78	1.85	2.93
Ches.Bay Brdg., VA	10/31 1800	5.08	1.85	3.23
Cape Hatteras, NC	11/01 0600	3.93	1.78	2.15

Notes:
Date/Time shows the month and day and the hour and minute (in EST) of the maximum storm surge.

Observed and Predicted values are listed in feet above Mean Lower Low Water (MLLW).

The Difference between the Observed and Predicted values is defined as the Storm Surge.

TABLE II
MAXIMUM WATER LEVELS - HALLOWEEN NOR'EASTER OF 1991 WITH HISTORICAL COMPARISONS

STATION	Date/Time	Obsvd.	Record Date	Height Elev.
Eastport, ME	10/30 1606	20.24	6/77	24.12
Cutler, ME	10/30 1612	15.18	1/79	17.32
Portland, ME	10/30 1636	12.78	2/78	14.17
Boston, MA	10/30 1654	14.29	2/78	15.25
Woods Hole, MA	10/31 0100	5.22	8/54	10.39
Nantucket, MA	10/30 1730	8.11	1/87	6.58
Newport, RI	10/31 0136	7.34	9/38	13.53
Providence, RI	10/31 0136	7.81	9/38	17.71
New London, CT	10/31 0330	6.65	9/38	10.76
Montauk, NY	10/31 0306	6.57	8/54	8.68
Bridgeport, CT	10/31 0518	11.55	9/38	12.44
Port Jefferson, NY	10/31 0530	11.62	2/78	12.12
Willets Point, NY	10/31 0524	12.39	9/38	16.90
The Battery, NY	10/31 0324	8.94	9/60	10.23
Sandy Hook, NJ	10/31 0248	8.80	3/62	10.33
Barnegat Inlet, NJ	10/31 0230	5.27	8/76	5.48
Atlantic City, NJ	10/31 0154	8.19	9/44	9.20
Cape May, NJ	10/31 1512	8.43	9/85	9.09
Philadelphia, PA	10/31 2024	9.04	11/50	10.79
Lewes, DE	10/31 1500	7.81	3/62	9.49
Ocean City, MD	10/31 1348	7.16	9/85	7.54
Cambridge, MD	10/31 2318	4.50	9/79	4.87
Baltimore, MD	11/01 0200	4.03	8/33	7.93
Annapolis, MD	11/01 0036	3.85	8/33	6.40
Washington, DC	11/01 0254	5.34	10/42	11.29
Colonial Beach, VA	11/01 0942	4.32	9/79	4.36
Lewisetta, VA	11/01 0818	4.01	3/83	3.62
Hampton Roads, VA	10/31 1618	5.61	8/33	8.39
Ches.Bay Brdg., VA	10/31 1512	5.83	4/78	6.36
Cape Hatteras, NC	10/31 1336	5.64	9/85	5.84

Note:
Date/Time shows the month and day and the hour and minute (in EST) of the highest observed water level.

The highest observed water level is given in feet above Mean Lower Low Water (MLLW).

The Record Height contains the month and year when the highest water level was measured and the height of that measurement in feet above MLLW.

Tables 1 and 2 are derived from NOAA TECHNICAL MEMORANDUM NOS OES, **Effects of the Late October 1991 North Atlantic Extra-Tropical Storm on Water Levels**, dated January, 1992.

This storm came less than one week after spring tides, the highest tides of the month. Had the storm come 5 days earlier, astronomical tides would have been about 1 ft higher along most of the coast--approximately 1 1/2 ft higher at Boston. As a rule, adding the value of the astronomical tide to the storm surge seems to hold. That would imply that water levels at Boston would have been about 1 1/2 ft above the levels they actually experienced, while other locations would have been about a foot above observed levels. This extra 1 1/2 ft might have been enough to flood part of the downtown section of the city.

The closest in-shore wave gage data were observed approximately 2 miles offshore near the U.S. Army Corps of Engineers (USACE) pier at Duck, North Carolina (figure 2). There, wave heights of 14 ft were observed on the afternoon of October 30. The buoy at Diamond Shoals, 12 nautical miles (nm) southeast of Cape Hatteras, North Carolina, observed its highest waves (25-27 ft) at roughly the same time. These waves are clearly swell, indicated by their long (18 second) wave periods. A buoy within sight of Boston (figure 3) measured significant wave heights of over 30 ft-- some of the highest waves ever recorded at that location by the NWS/National Data Buoy Center (NDBC).

In the hardest hit New England communities, seashore homes, roads, sewer/water lines, docks and piers, and coastal protection projects (e.g., seawalls, revetments and groins) were primary targets. Barrier beaches were breached and sand dunes and coastal bluffs eroded. In some cases up to 50 ft of dunes, beaches, or salt marshes vanished. There were some reports of oil spills.

Also hard hit were New England lighthouses. For example, the storm extinguished the light in the Isles of Shoals Lighthouse (figure 4) and destroyed its generator, control huts, boathouse and ramp, and a walkway from the helicopter pad to the house. Its emergency horn and one fuel tank were missing, and two fuel tanks were knocked over.

The most visible casualty of the **Halloween Nor'easter of 1991** was President Bush's house located in Kennebunkport, Maine. The President's home, which has withstood many past storms, suffered severe damage to its ground floor from wave battering. The degree of damage to the President's house and other structures along the coast served to highlight the awesome power of the ocean and the problems faced by an increasing population along the Nation's shorelines.

Without a doubt, the east coast and coincident islands of Massachusetts, being closest to and directly downfetch from the strongest core of the storm, took the most severe pounding. It was locally compared with the Blizzard of February 1978, which has been considered the benchmark nor'easter in this area. Particularly hard hit were parts of Salisbury, Gloucester, Revere, Lynn, Hull, Scituate (especially Peggotty Beach and the Humarock area), Marshfield, Plymouth (Whitehorse Beach), Chatham

Figure 2. Mid-Atlantic Locations Impacted by the Halloween Nor'easter of 1991.

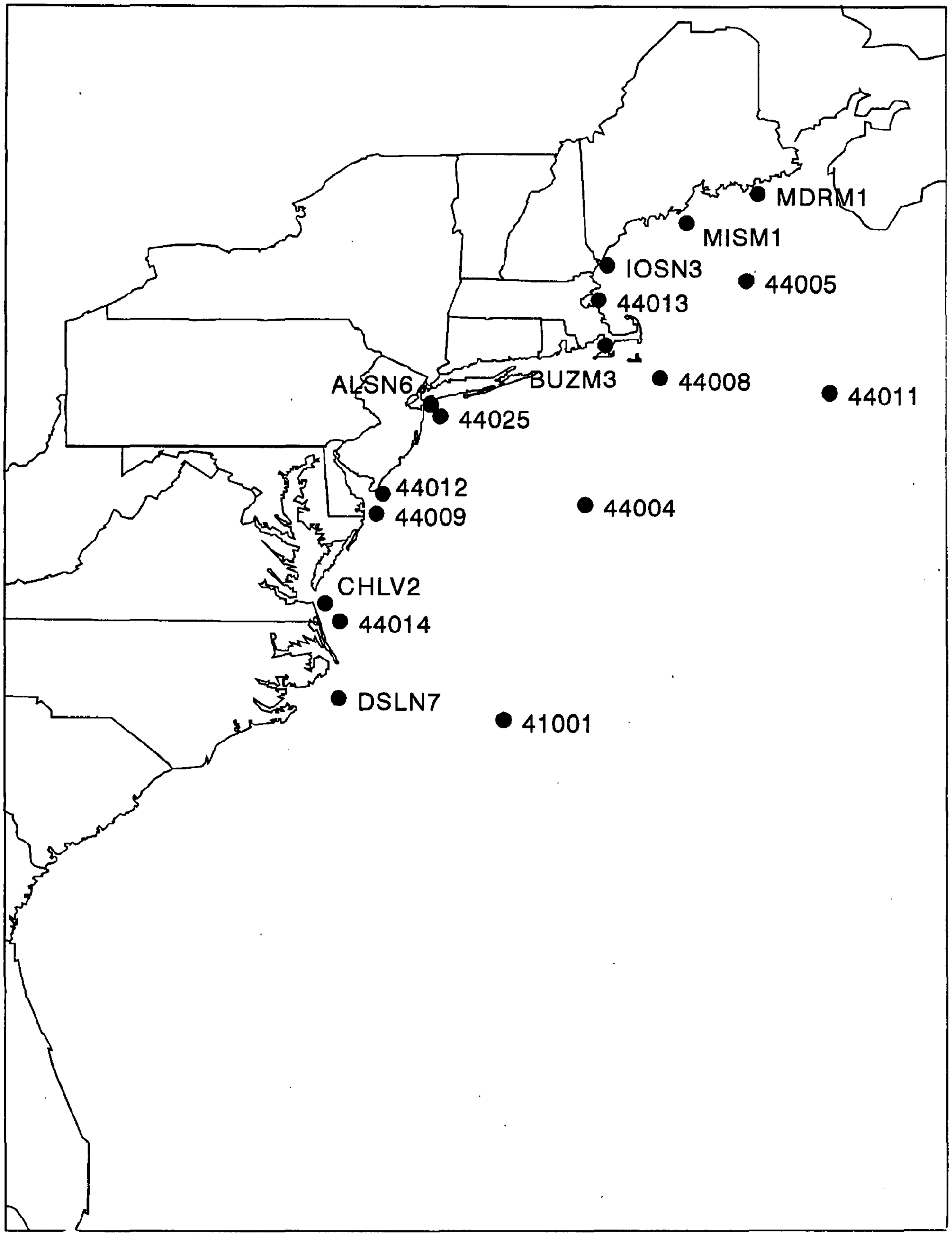


Figure 3. Buoy and C-MAN Stations - Mid-Atlantic and Northeast United States.

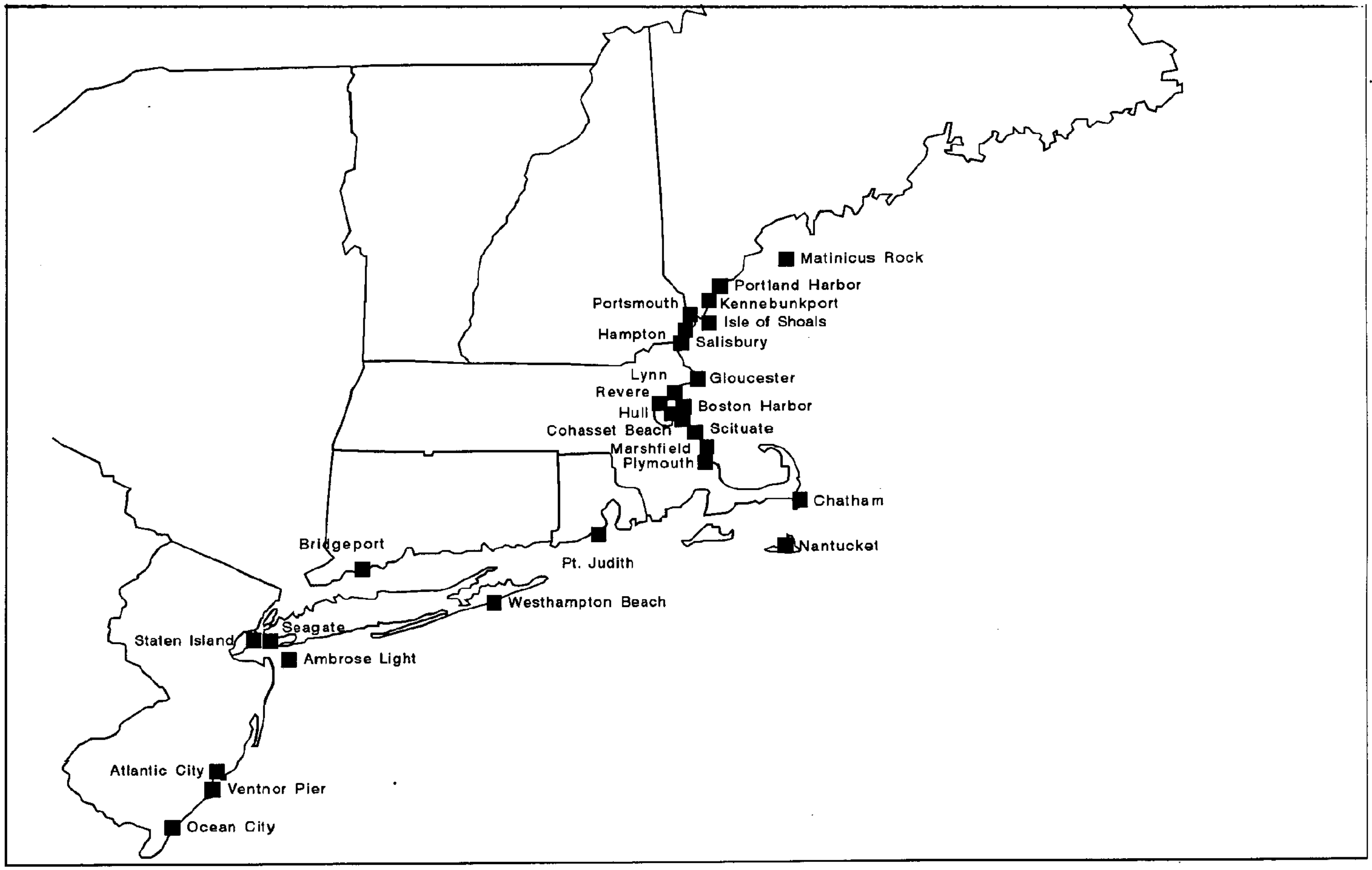


Figure 4. Northeast Locations Impacted by the Halloween Nor'easter of 1991.

(especially North Beach and Morris Island areas), and Nantucket (especially Brant Point). In the town of Scituate alone, according to the American Red Cross, over 1000 single-family dwellings were impacted by the storm with 118 destroyed and 453 suffering major damage.

Besides extensive structural damage to public and private facilities along the Massachusetts coast, considerable boating and fishing gear damage also occurred. The damage to and loss of lobster pots may well have devastating results to people in an industry that has already been experiencing hard economic times.

Relatively few casualties resulted in Massachusetts, however. A 62-year-old man suffered a fatal heart attack in Quincy after tying down his yacht. The Coast Guard is investigating the disappearance of the "Andrea Gail," a deep sea fishing boat with a crew of five out of Gloucester which was reported lost out in the Georges Banks. Two elderly people apparently suffered minor injuries from the wind on Nantucket. A summation of casualties and damages is included in table III.

The coastal flood damage dwarfed the significance of other aspects of the storm. However, because Massachusetts was close enough to the storm's core to receive its full effect, high winds resulted in some direct property damage and caused power outages by downed tree limbs. Additionally, heavy rainfall occurred in some southeastern areas of the state (e.g., 5.57 inches at Blue Hill, Massachusetts, Observatory).

Across coastal sections of Maine and New Hampshire, the most significant damage was limited to those communities which received direct wave battering from the ocean. According to the American Red Cross, 16 single-family dwellings were destroyed while another 51 suffered major damage in York County, Maine. Portsmouth, New Hampshire, suffered a similar blow with 19 single-family dwellings destroyed and 130 reporting major damage. The Hampton area of New Hampshire was also particularly hard hit. In Kennebunkport, outside of the destruction noted to the President's home, fishermen lost an estimated $1.5 million in gear.

Rhode Island and Connecticut were somewhat protected from the most direct effects of the storm. However, some coastal damage similar to that described above was felt. Also, a fisherman was presumed to have been swept off the rocks and drowned near Pt. Judith.

The coastal regions of New York and New Jersey were impacted to a lesser degree, although extensive coastal flooding and beach erosion occurred (figure 5). Homes (basements and first levels), public buildings, coastal roads, and railroad tracks were flooded. In Suffolk County on Long Island's south shore, more than 40 residences were destroyed and another 35 seriously damaged. Also particularly hard hit was the private community of Seagate located just west of Coney Island in New York City.

TABLE III
DAMAGE ESTIMATES (MILLIONS OF DOLLARS)

Damage Estimates (millions of dollars)

States	Death	Injury	Sum	AIA*	NFIP**	Other#
ME	0	0	3.0	-	1.5	1.5
NH	0	0	.7	-	.7	-
MA	2	2	110.1	40.0	65.6	4.5
RI	1	0	5.0	5.0	-	-
CT	0	0	3.9	3.0	.9	-
NY	4	0	31.2	10.0	16.2	5.0
NJ	0	0	8.4	2.0	5.4	1.0
DE	0	0	-	-	-	-
MD	0	0	-	-	-	-
DC	0	0	-	-	-	-
VA	0	0	.1	-	-	.1
NC	0	0	2.2	-	2.2	-
SC	0	0	-	-	-	-
GA	0	0	-	-	-	-
FL	0	14	3.1	-	-	3.1
PR	0	0	-	-	-	-
OFSHR	5	0	.5	-	-	.5
TOTAL	12	16	168.2	60.0	92.5	15.7

* Derived from statistics provided by the American Insurance Association (AIA). Claims represent losses primarily from wind damage.

** Derived from statistics provided by the National Flood Insurance Program (NFIP). Claims represent losses primarily from water damage.

\- Damages were below the insurance organization's threshold, were considered to be too minor for tabulation, or were unreported.

Estimates of other losses were made where possible using existing information. However, millions of dollars in losses due to non-insured "public" items, such as cleanup costs, beach erosion, seawall and pier damage, lighthouse damage, etc., are not included in this list. Also not available are specific tourist dollar losses.

Portions of the boardwalks in Atlantic City and Ocean City, New Jersey, were extensively damaged. Further, the widespread flooding closed off two major roadways into Atlantic City for several hours. The resulting cancellation of buses carrying tourists into the cities' casinos caused a significant economic loss to the area.

The New York and New Jersey coastal regions witnessed at least four storm-related casualties. On October 30 at the height of the storm, an Air National Guard helicopter crashed about 60 miles south of Long Island during a rescue mission. (The helicopter ran out of fuel.) Four of the five-person crew were rescued; the fifth member was never found.

That same night, a man who was fishing alone on a Meadowbrook Parkway drawbridge fell to his death. The specific cause of his death is unknown. On November 2, the body of a teenage boy, believed to be 1 of 2 Staten Island youths who disappeared while fishing during the storm, washed up in the Belford section of Middletown Township. A Coast Guard helicopter unsuccessfully searched the area for the second youth. The Coast Guard did, however, successfully rescue 10 people from the turbulent waters of Long Island Sound during the storm.

Along the Delaware, Maryland, and Virginia coasts, moderate to severe beach erosion occurred primarily on October 30 and 31. In Delaware, damage was most extensive at Bethany, Dewey, and Rehoboth Beaches. Along the Virginia coast, most of the damage occurred along Sandbridge Beach. One bridge access washed out in Hampton Roads. In Maryland, Ocean City officials assessed the damage as "minimal." This may, however, have been the result of a beach renourishment/dune

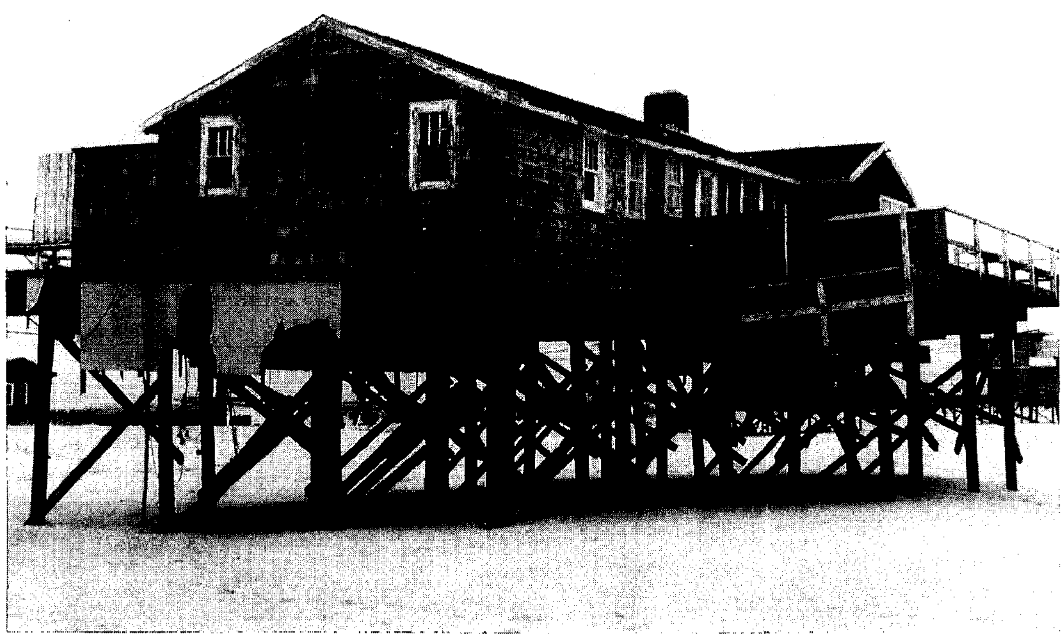


Figure 5. Support pilings, previously buried, have been exposed by severe water action, Westhampton Beach, New York. Photo courtesy of Mark Waters

project completed earlier this year designed specifically to protect the community from storms such as this.

While the Mid-Atlantic coastline of Delaware, Maryland, and Virginia was spared the worst effects of this event, the story was different for portions of the North Carolina shoreline. The extended effects of the storm were most apparent in this region. Sustained winds reached gale force on the Outer Banks, but the weather was characterized by mostly clear skies. Ocean flooding and waves were the only significant sources of destruction. Damage was limited to the ocean beachfront of Currituck and Dare Counties north from Cape Hatteras.

While flooding in North Carolina reached its maximum on October 31, pounding surf attacked and eroded the protective dunes for days before and after that time. Along the Cape Hatteras National Seashore, the dunes were cut in over a dozen places. Sand from the ocean side was washed hundreds of yards inland almost crossing the narrow island. Highway 12 was closed first by water and later by sand deposits up to 4 ft deep. Ferry service to Hatteras Island from Ocracoke was suspended because of flooding near the ferry dock.

The towns of Nags Head, Kitty Hawk, and Kill Devil Hills had flooding for several blocks inland from the beach. Several homes and two or three motels were destroyed or severely damaged by the surf. A total of 76 buildings were condemned in Dare County, North Carolina, alone. Many suffered structural damage while others were condemned because their sewage systems were exposed. The flooding has been called the worst to affect the Outer Banks since the Ash Wednesday Storm of March 1962.

South from North Carolina, damage was less severe and the impacted areas more widely separated. However, effects were reported even along the north coast of Puerto Rico, parts of the U.S. Virgin Islands, and exposed shores of the Bahamas. In Florida, over $3 million in damage and 14 minor injuries were attributed to the swell generated by the storm. This included the destruction of that portion of the Lake Worth, Florida, pier on which an NOS tide gage and an NWS CMAN unit were located. Again, the wave action, spawned over 1000 nm from where the waves reached shore, was the primary cause of the damage.

Overall casualty and damage estimates from the storm are summarized in table III.

An additional factor should be noted. About a week after this storm, a second coastal flood episode impacted the Mid-Atlantic coast. Weakened by the battering from 7 days earlier, many coastal sand dunes could not provide the protection normally expected. Also, several structures that withstood the earlier assault fell during this second attack. These damages would probably not have occurred without the **Halloween Nor'easter of 1991**.

CHAPTER II -- SCIENTIFIC ANALYSIS OF EVENT

OVERVIEW

As briefly mentioned in Chapter I, three significant meteorological systems contributed to the coastal flooding and wave damage along the east coast of the United States during the week of October 27-November 2, 1991.

System number 1. On October 26, buoy reports indicated an intensifying subtropical low near Bermuda was beginning to generate large oceanic swells. By October 27, this low had evolved first into a tropical storm and then quickly strengthened to become a late season hurricane--Grace. Located about 200 nm southwest of Bermuda, Hurricane Grace was forecast by the National Hurricane Center (NHC) to move northwest, in a general direction toward the North Carolina coast, but to remain well offshore. The winds generated by this storm provided a significant northeast to easterly fetch along the United States east coast south of the Virginia Capes and were the primary cause of heavy surf along the Outer Banks.

System number 2. As Grace was intensifying, a near record 1046 millibar (mb) anticyclone which had been building over northern Quebec began spreading high pressure southward. By October 28, the leading edge of this deep air mass, marked by a strong cold front, had pushed southward through North Carolina east of the Appalachian Mountains and southeastward over the North Atlantic across Nova Scotia and New England. In so doing, it stopped the hurricane's drift toward the coast and forced it to turn northward. The high persisted through midweek dominating the entire Eastern Seaboard.

System number 3. As the cold front moved offshore, a low pressure cell, which had formed on and was traveling northeast along this front, reached the ocean southeast of the Canadian Maritimes. This occurred simultaneously with Grace reaching its maximum potency. Encountering Grace's circulation and moisture, this low stalled and strengthened. Fed by a combination of cold, dry, arctic air from the high and warm, moist, subtropical air from Grace, the low, located near 38°N 60°W, became extremely intense having a central pressure of about 972 mb. The rapidity of the intensification is shown by the fact that beginning at 12 Universal Coordinated Time (UTC), October 29, the central pressure dropped about 15 mb in 12 hours and about 28 mb in 24 hours. By this time, the low had sapped the energy and absorbed the remnants of Hurricane Grace and, as the high weakened, had begun a westward drift toward the upper east coast of the United States.

The combination of these three factors--hurricane, strengthening low south of the Maritimes, and high pressure along the East Coast--produced a nearly 1200 nm fetch of gale and storm force north to northeast winds from Newfoundland to the Florida coast which was to continue for days.

DAILY SYNOPSES

SATURDAY, October 26, 1991

At 06 UTC, satellite imagery and data buoy reports suggested that a surface subtropical low, centered at 27°N 66°W, was strengthening. In its high seas forecast, the NHC was carrying a gale warning in association with this system. At the same time the imagery hinted of some amplification of an inverted upper air trough to the northeast of this low.

The 00 UTC run of the NMC aviation weather forecast (AVN) model supported the continued amplification of the inverted trough by tightening the gradient north of 35°N during the next 48 hours. Such amplification generally indicates that the low will continue to intensify.

At this same time, a weak wave appeared in the lower Midwest, on a cold front extending northeast into Canada. This front denoted the leading edge of a deep, strong anticyclone that had formed over the Northwest Territories and intensified over Quebec.

Figures 6 through 17 contain extracts from the NMC surface analyses from October 27 through November 1. Figures 18 through 25 contain infrared (18-21) and water vapor (22-25) satellite photographs for this same period.

SUNDAY, October 27, 1991

At 16 UTC, the subtropical low, now located at 30.4°N 66.6°W, had intensified and reached tropical storm status. NHC named it Grace. Satellite imagery indicated it had a slow westward movement. Storm force winds extended out to 350 nm from Grace's center over its northern semicircle while winds to 30 knots (kt) continued out another 130 nm. By 22 UTC, Grace, continuing to strengthen, was upgraded to hurricane status.

Coincidentally, a strong short-wave trough aloft, associated with the Canadian cold front, moved along the U.S.-Canadian border throughout the day. During the night, the cold front passed through New England toward the south and southeast. The wave, now a low but still weak, was centered over eastern Lake Ontario and was forecast by the AVN model to move east-southeast to roughly 43°N 58°W. At this same time, the high, continuing to build, was forecast to follow along moving from just east of Hudson Bay to the east-southeast. The result of all this would be a greatly increased pressure gradient along the east coast of the U.S. during the next 36 hours.

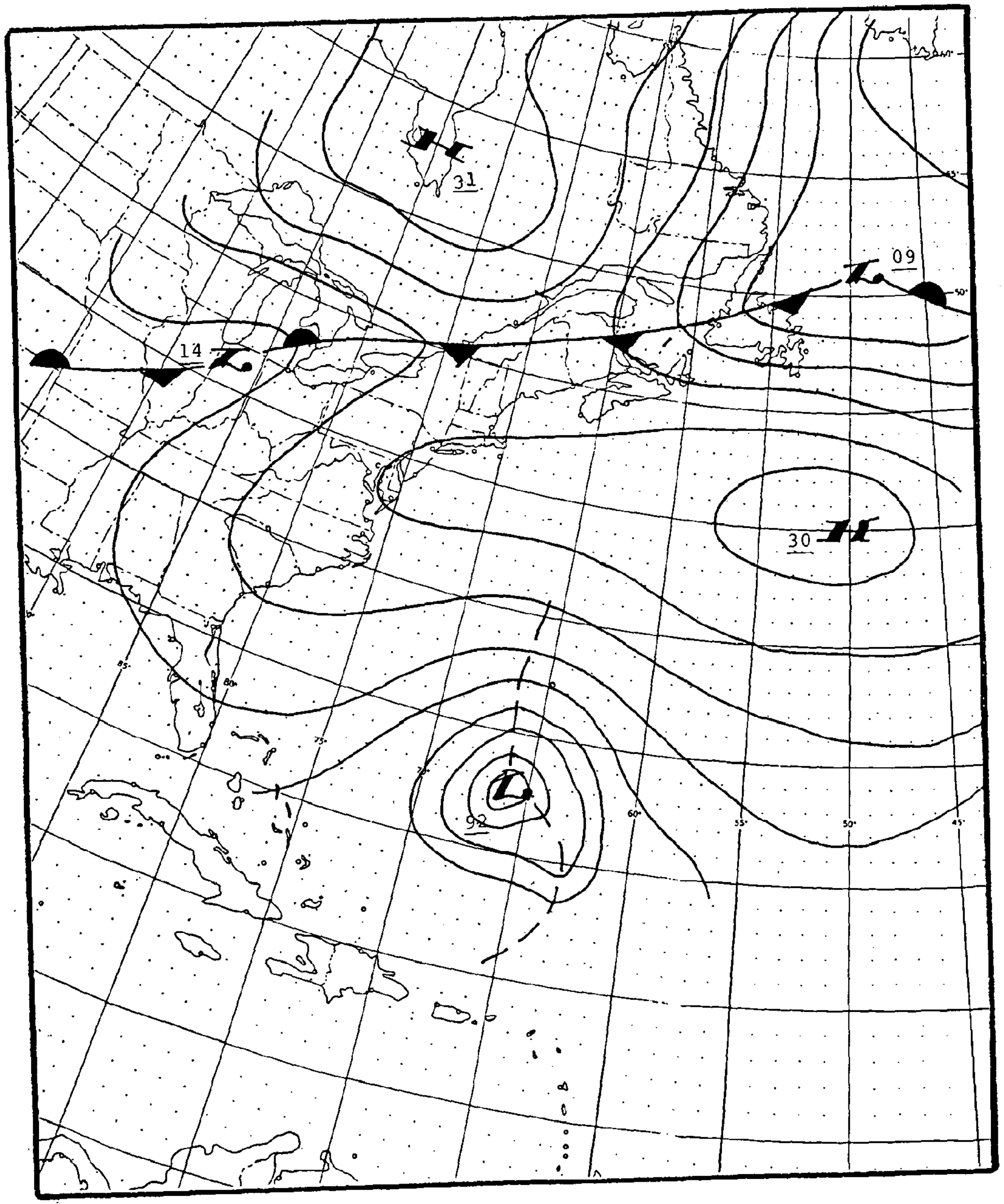


Figure 6. 0000 UTC Surface Analysis - 27 October 1991.

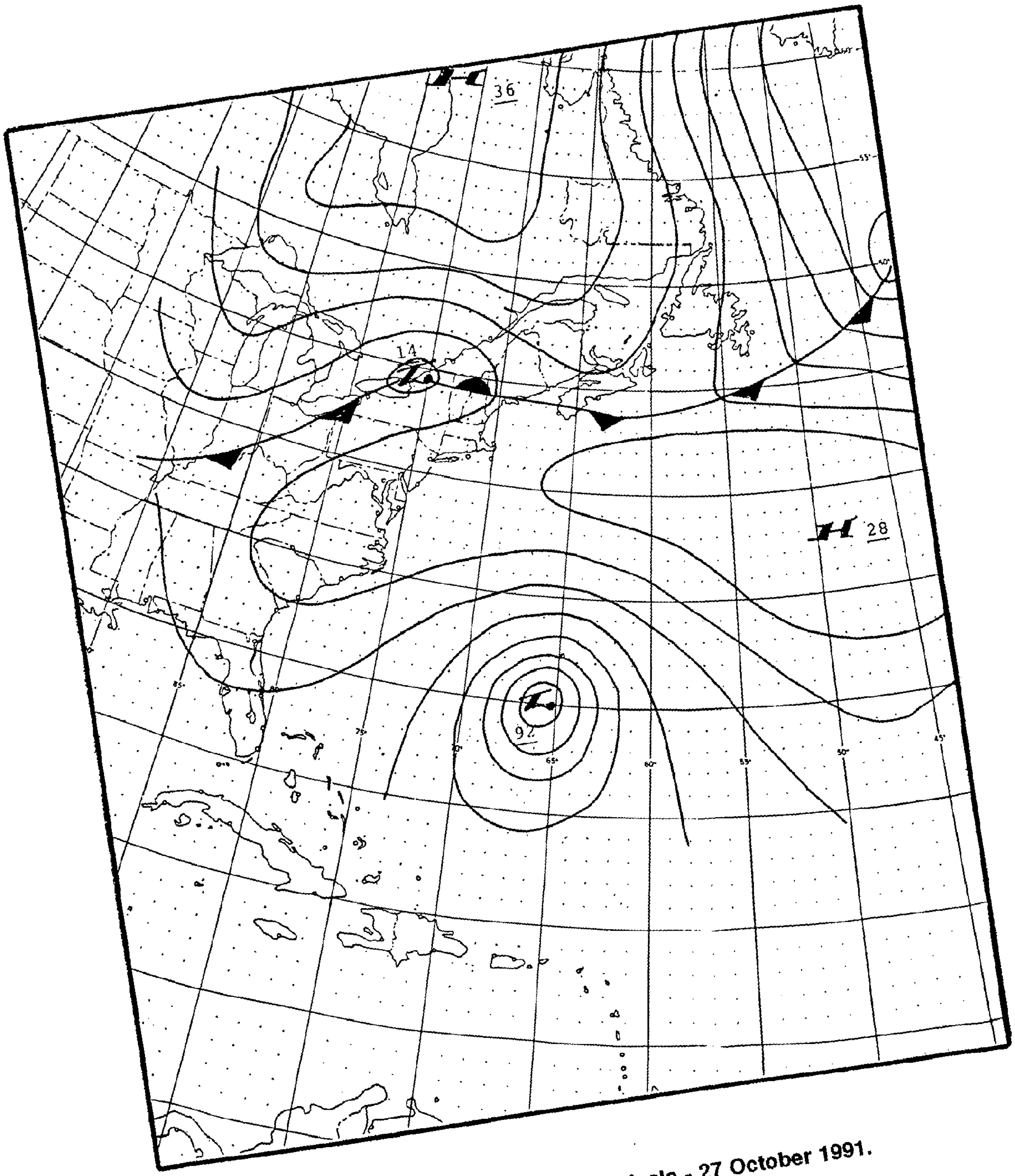


Figure 7. 1200 UTC Surface Analysis - 27 October 1991.

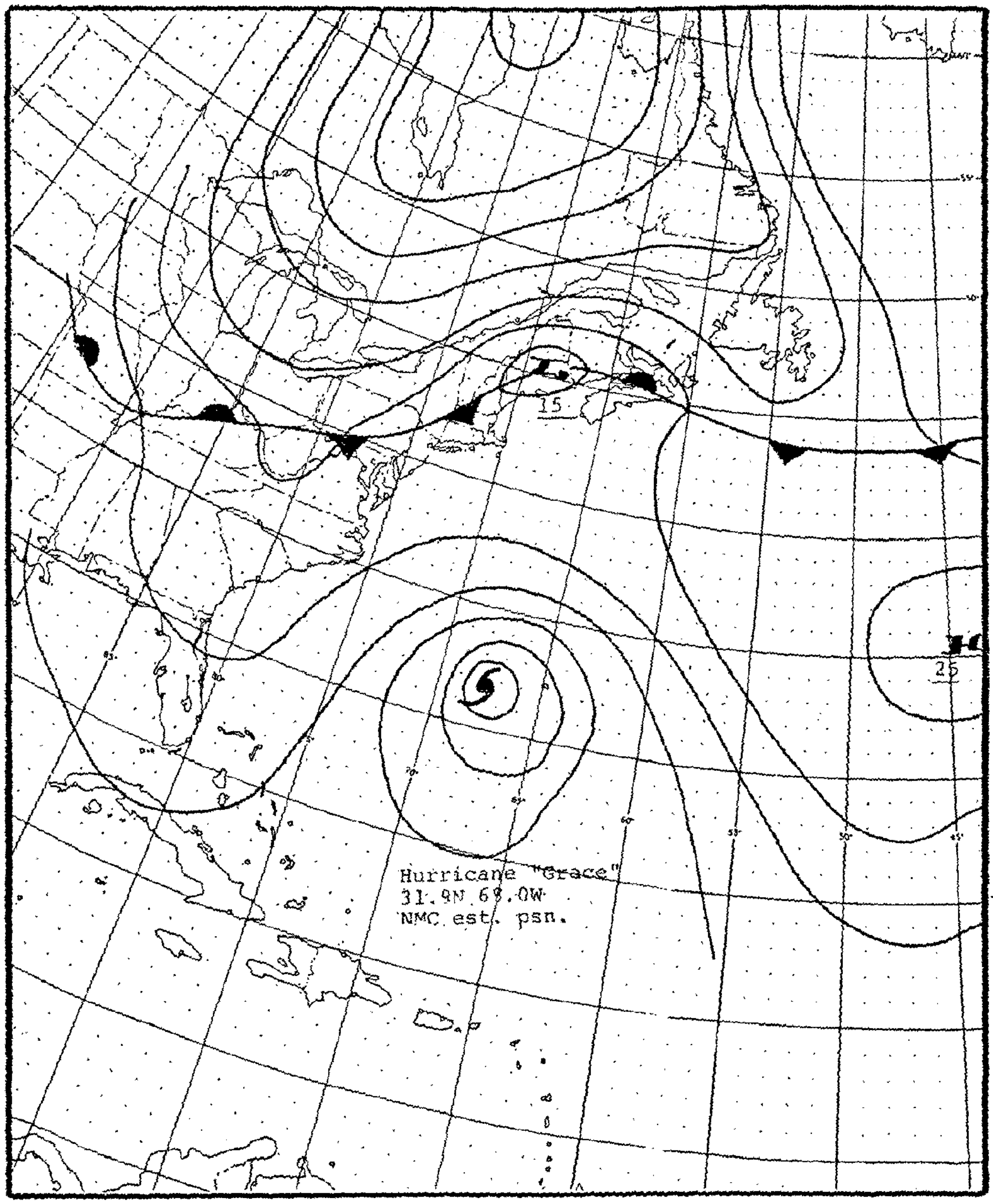


Figure 8. 0000 UTC Surface Analysis - 28 October 1991.

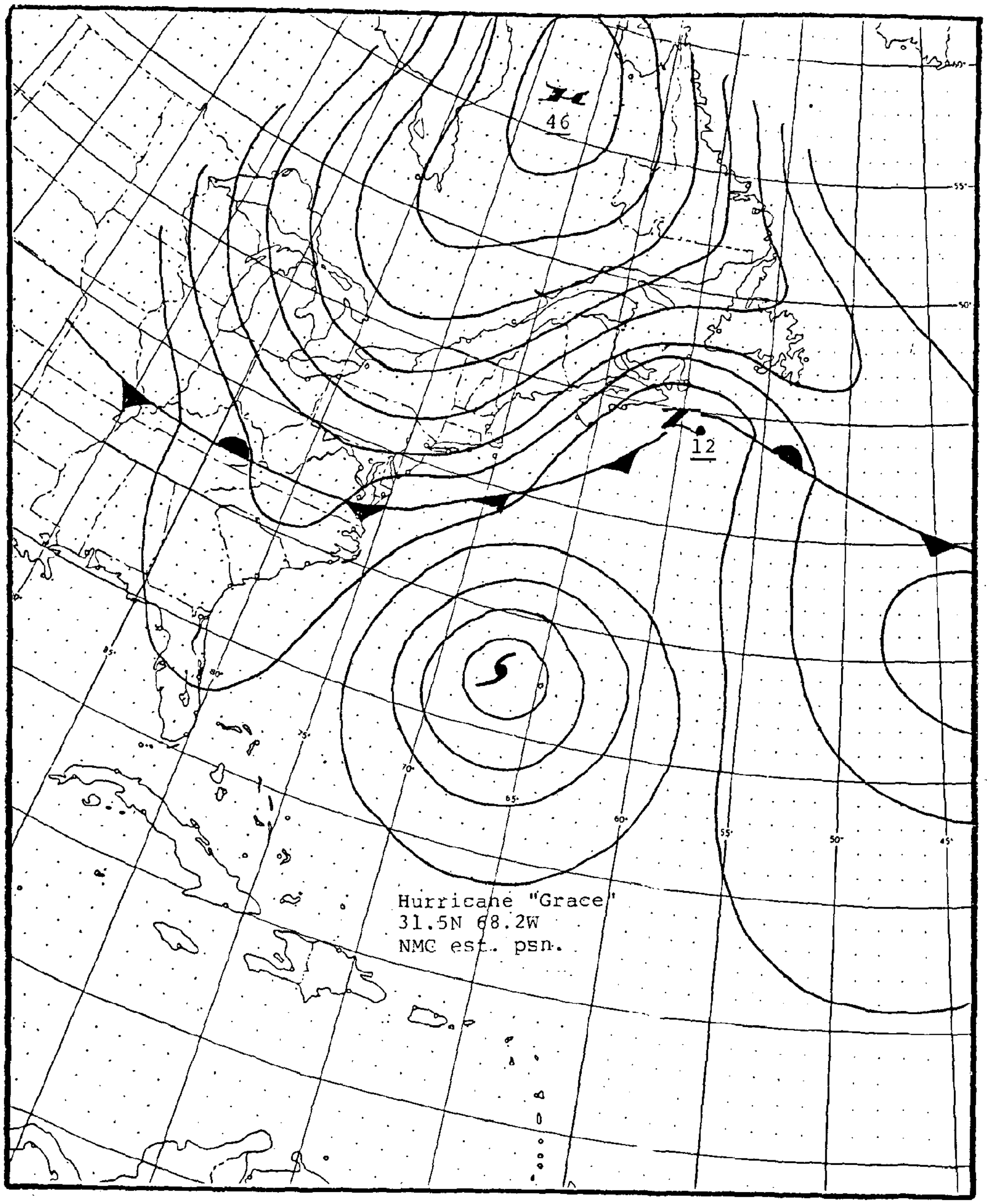


Figure 9. 1200 UTC Surface Analysis - 28 October 1991.

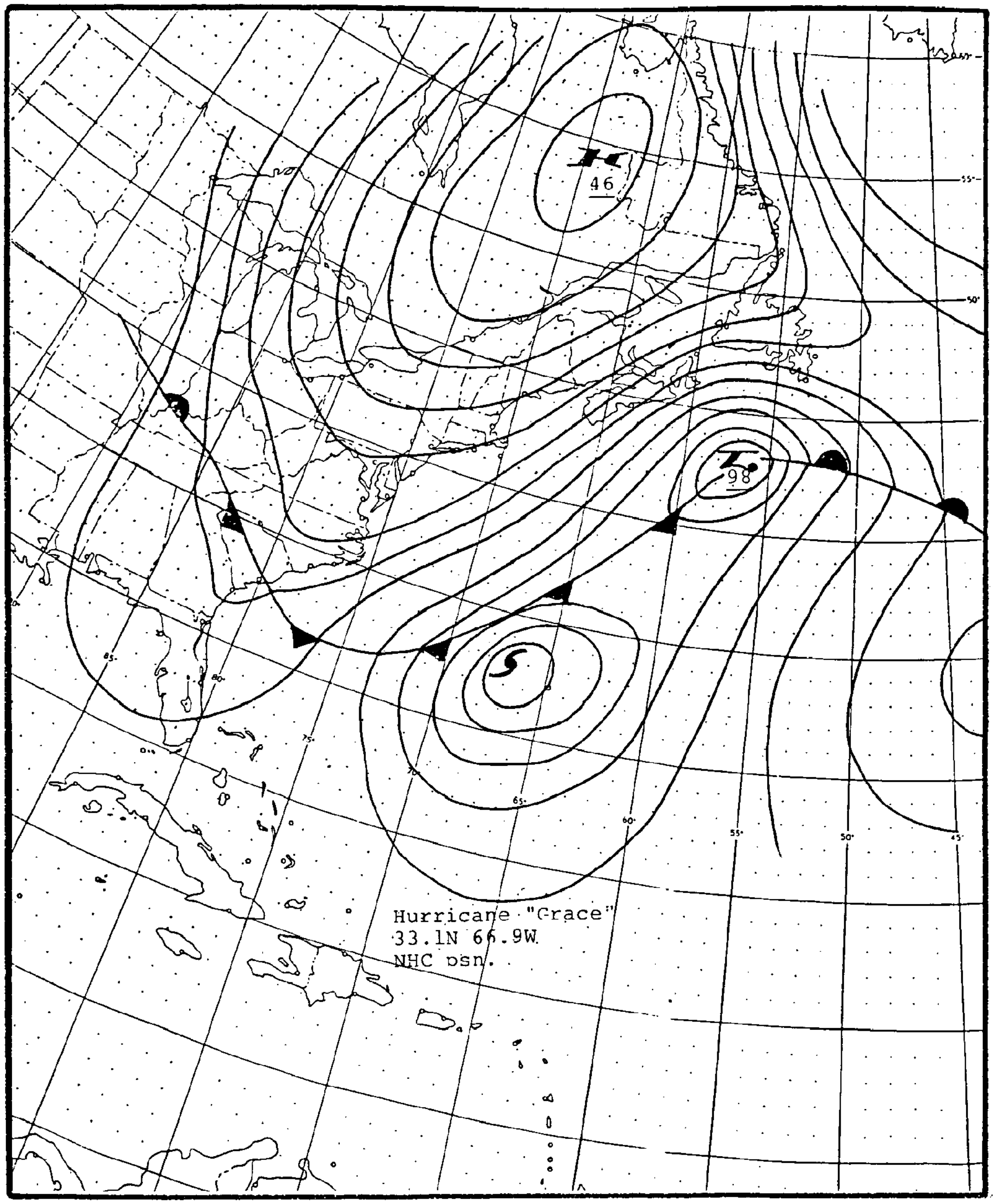


Figure 10. 0000 UTC Surface Analysis - 29 October 1991.

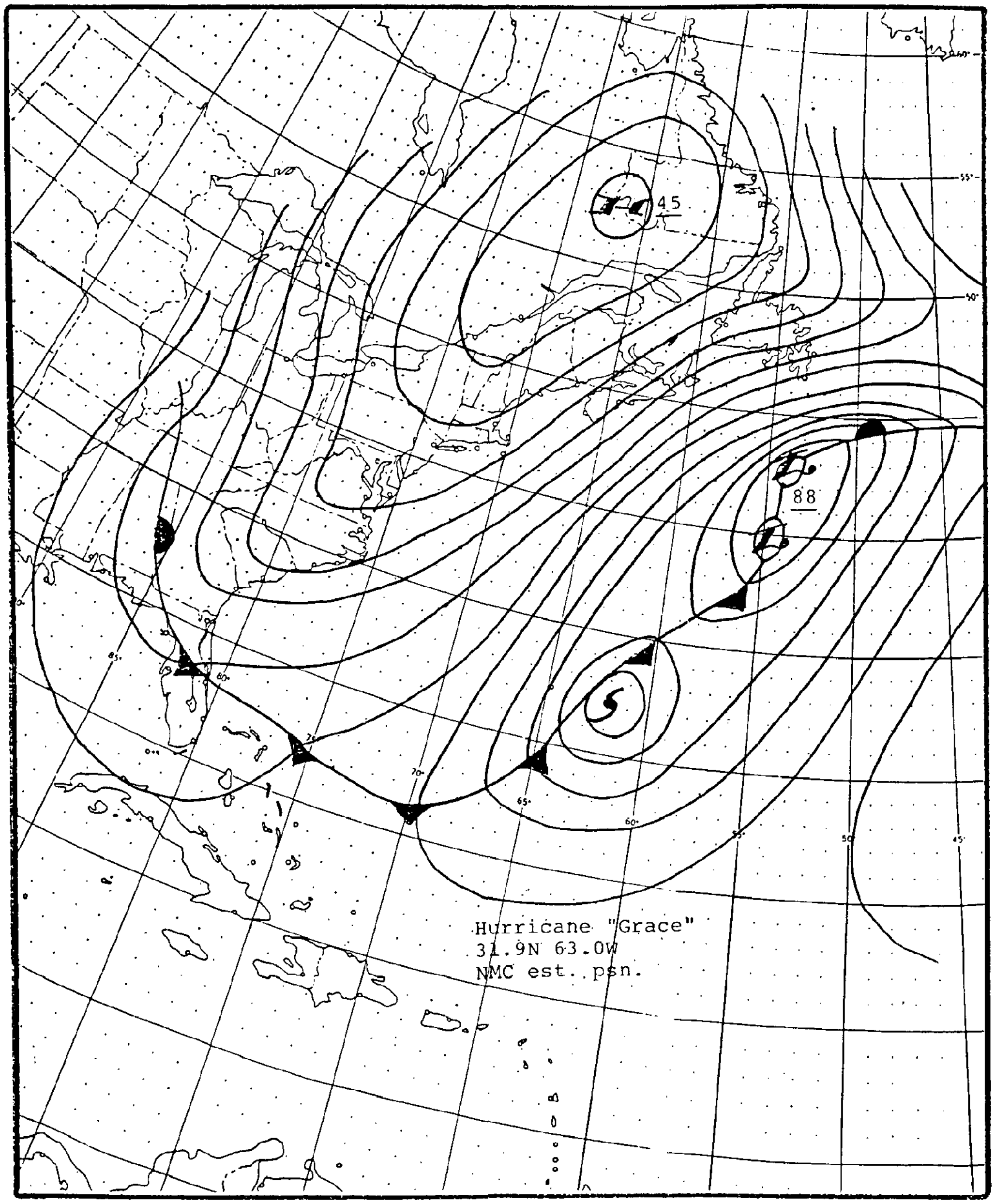


Figure 11. 1200 UTC Surface Analysis - 29 October 1991.

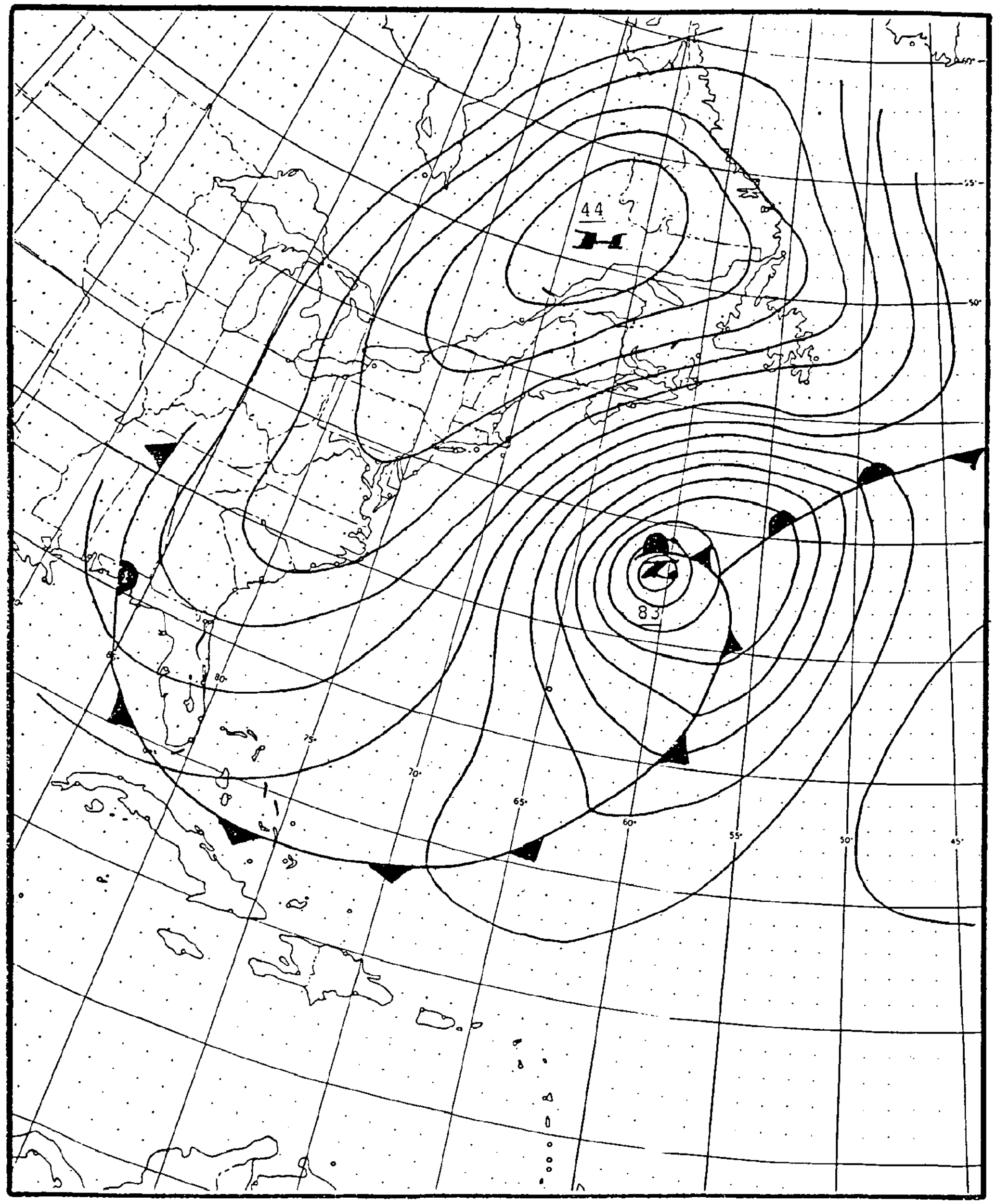


Figure 12. 0000 UTC Surface Analysis - 30 October 1991.

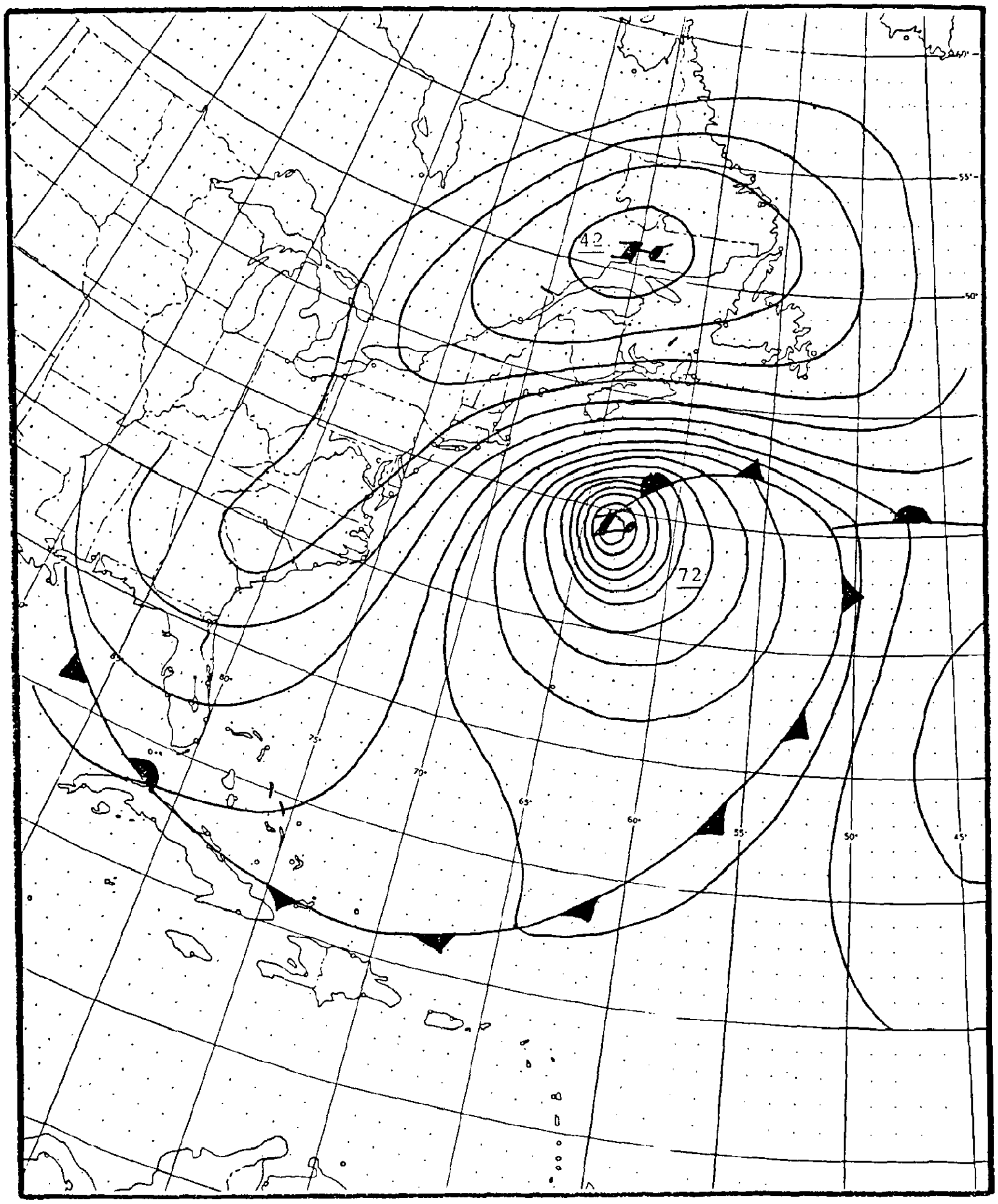


Figure 13. 1200 UTC Surface Analysis - 30 October 1991.

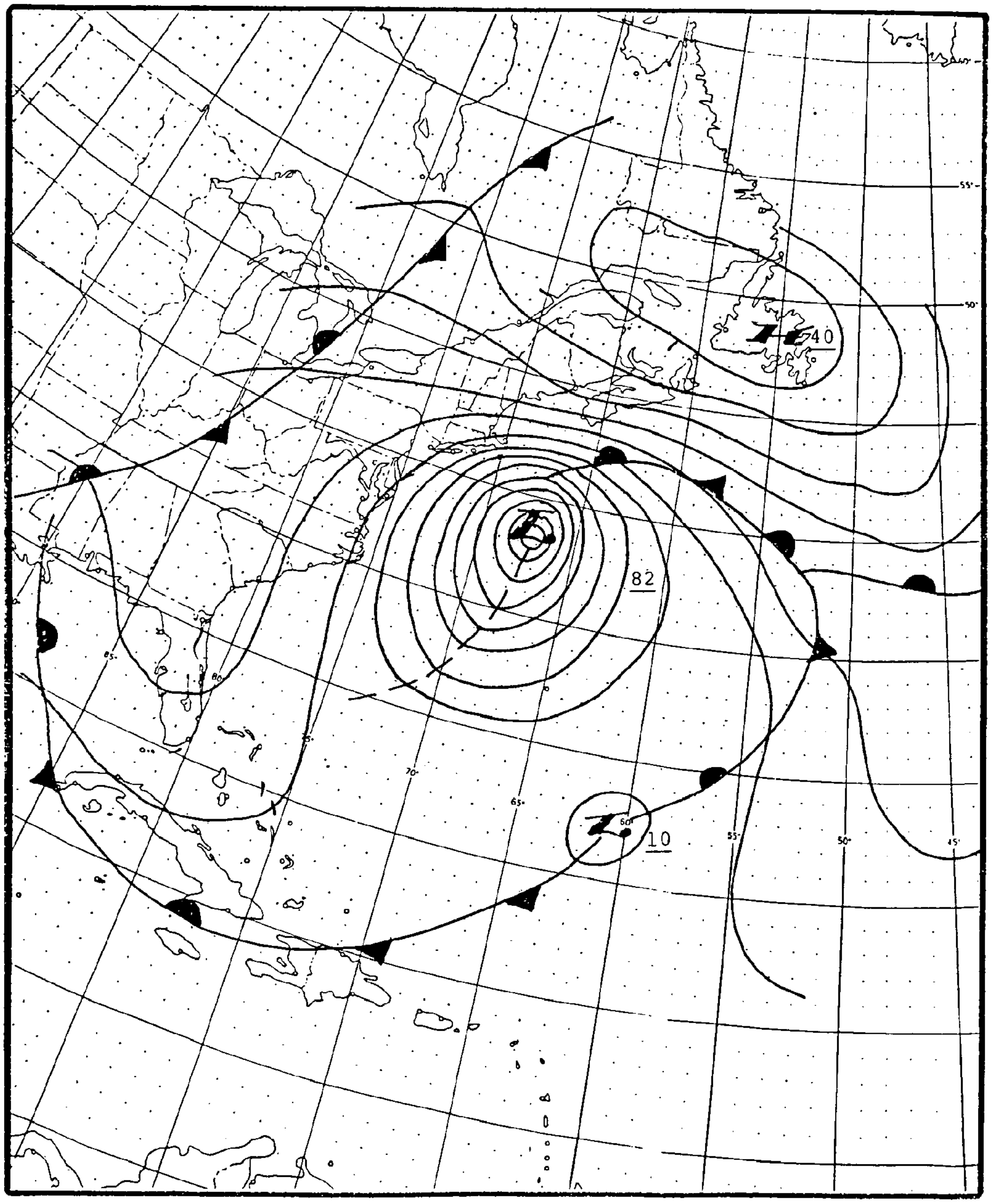


Figure 14. 0000 UTC Surface Analysis - 31 October 1991.

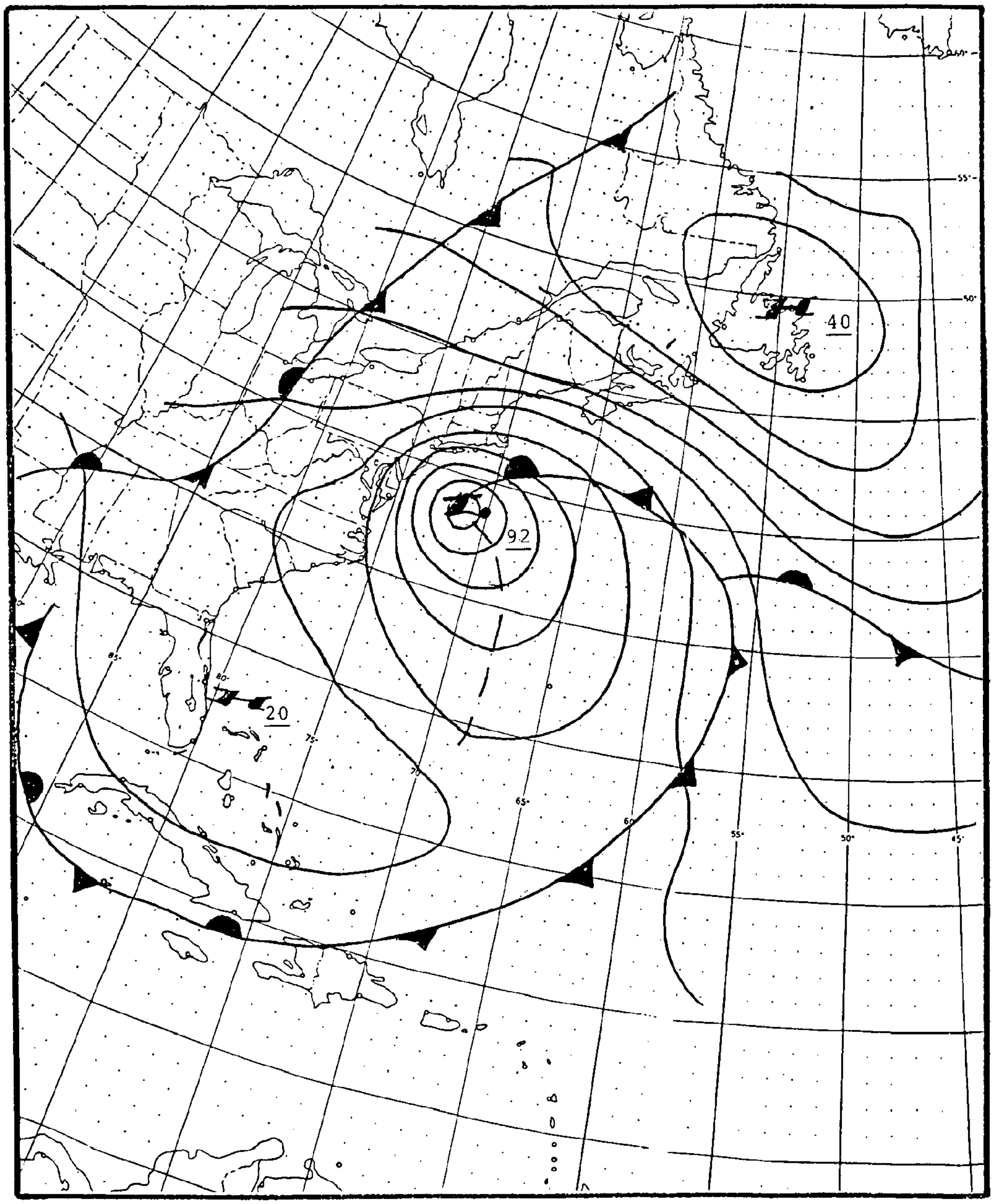


Figure 15. 1200 UTC Surface Analysis - 31 October 1991.

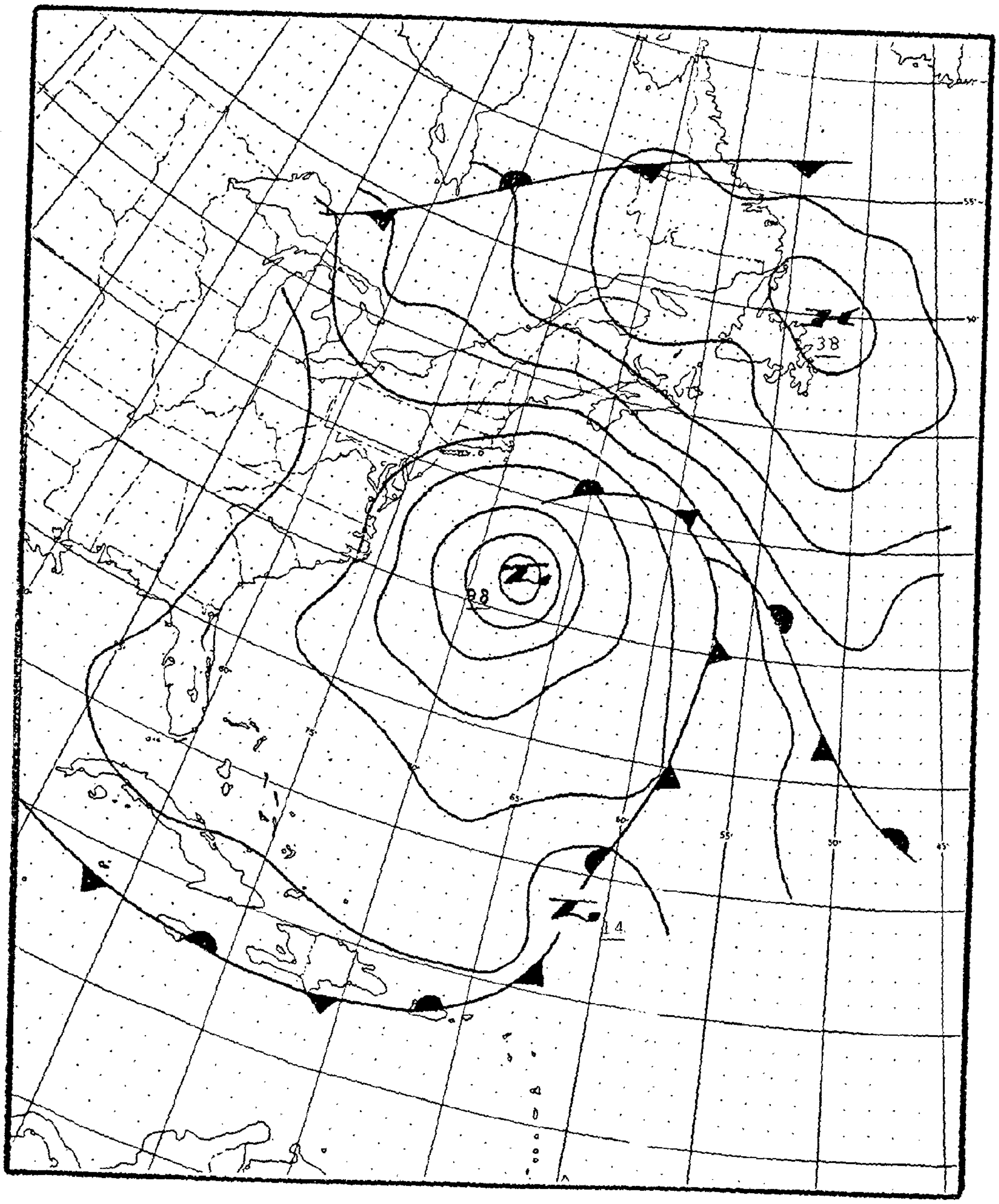


Figure 16. 0000 UTC Surface Analysis - 1 November 1991.

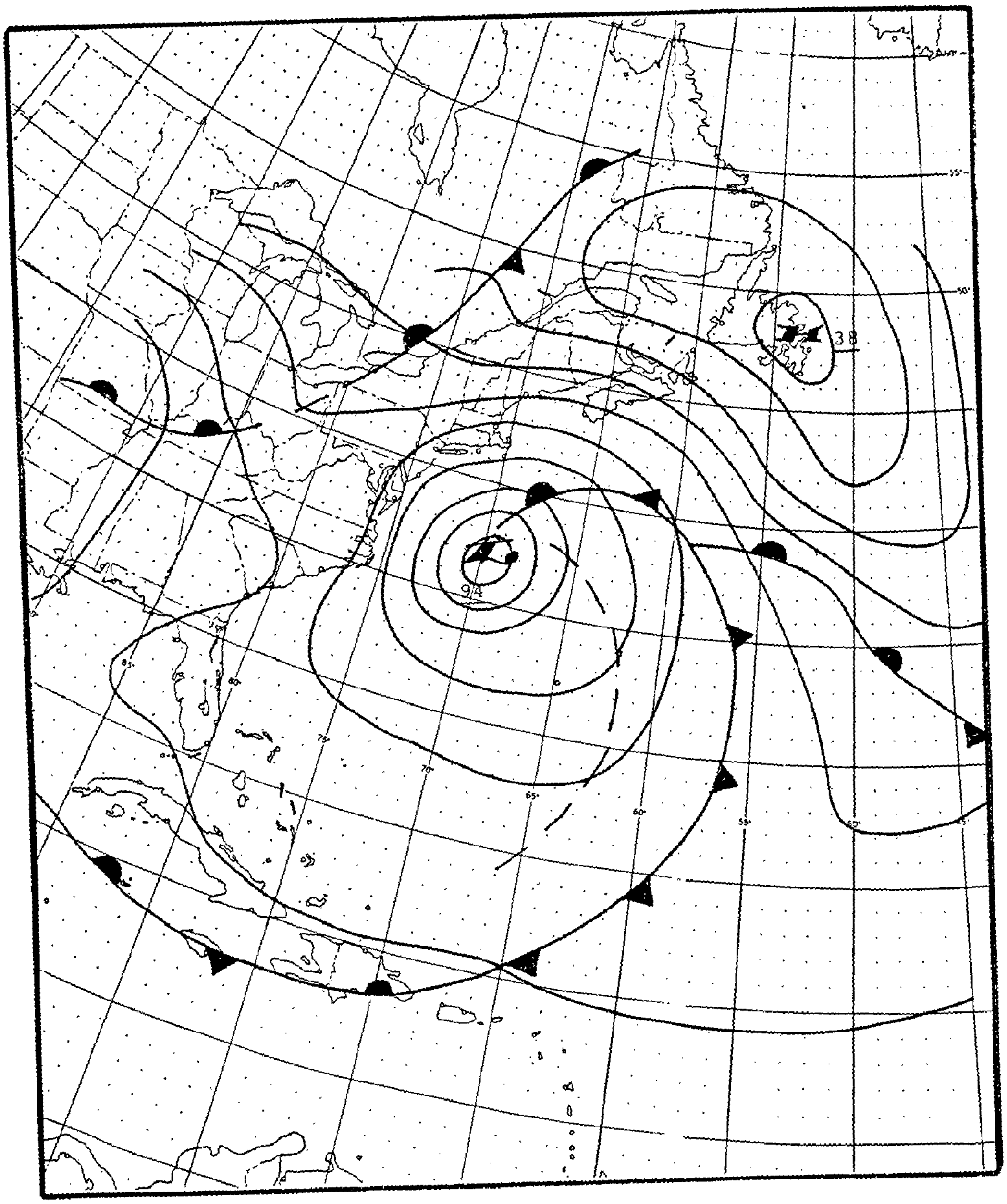


Figure 17. 1200 UTC Surface Analysis - 1 November 1991.

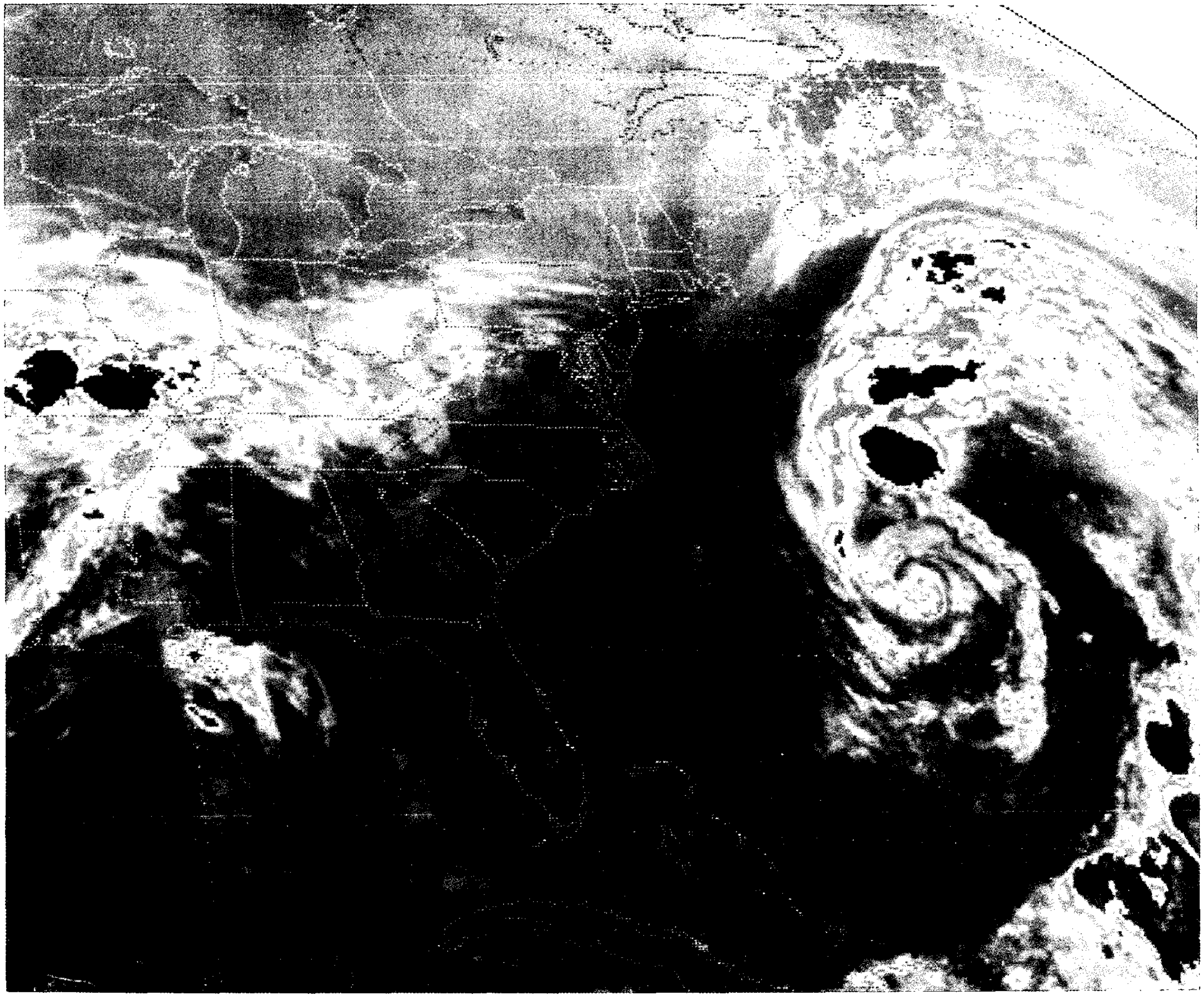


Figure 18. 1201 UTC 28 October 1991 GOES Infared Image - Hurricane Grace near Bermuda/Developing Low east of Maine.

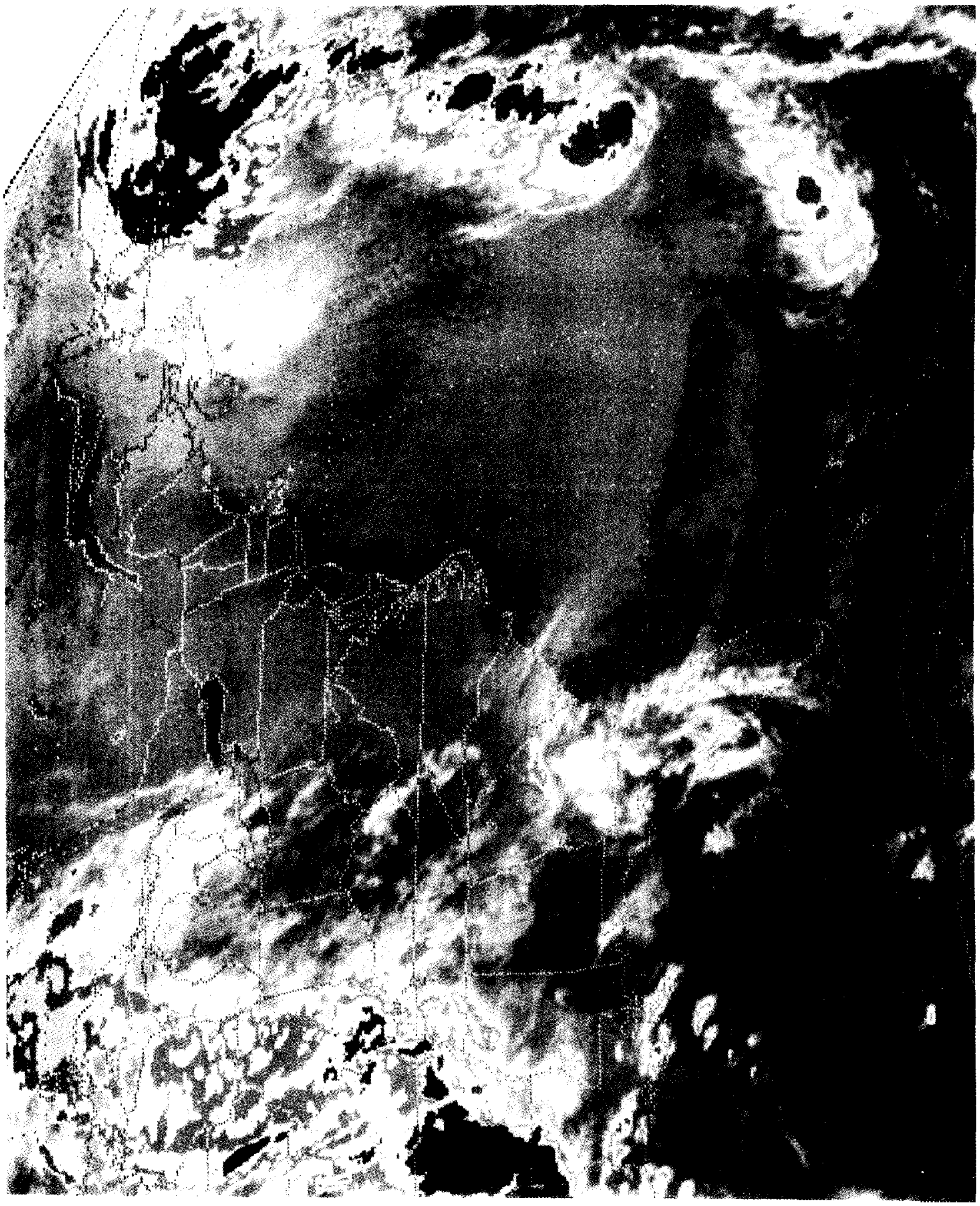


Figure 19. 1201 UTC 29 October 1991 GOES Infrared Image - Cold front from North Atlantic Low is nearing Grace.

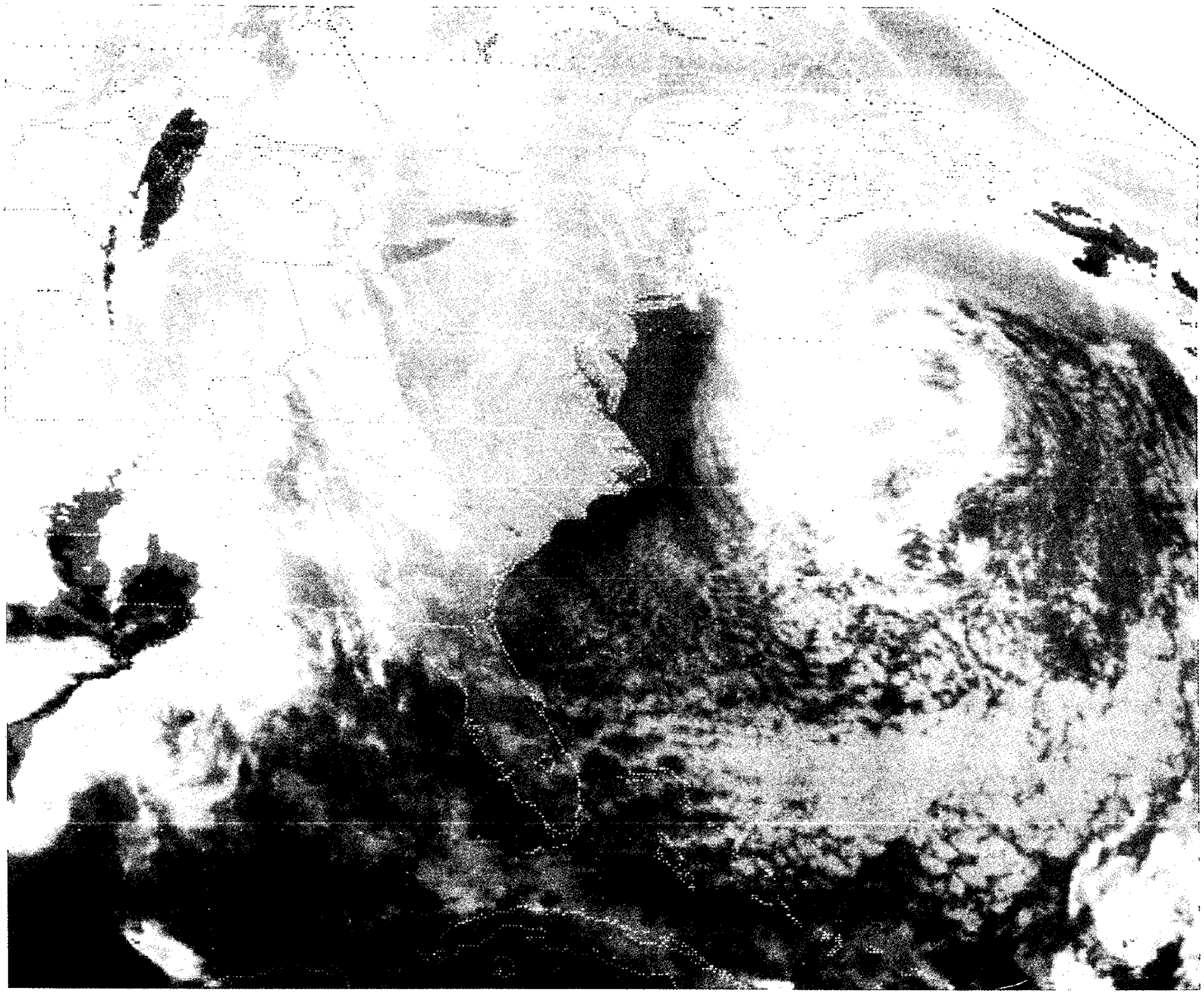


Figure 20. 1201 UTC 30 October 1991 GOES infrared Image - North Atlantic Low at its most intense.

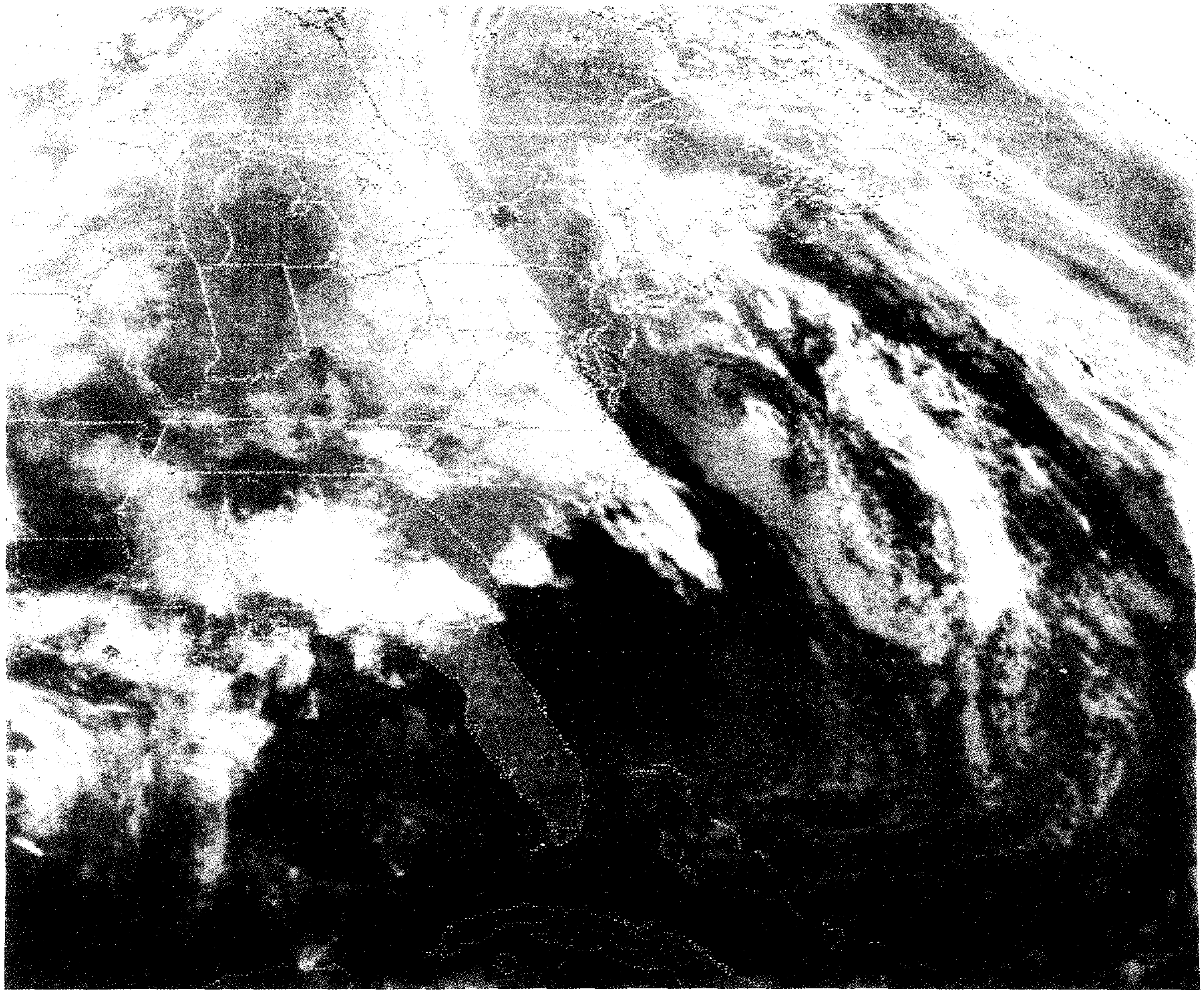


Figure 21. 1201 UTC 31 October 1991 GOES Infrared Image - North Atlantic Low weakening off mid-Atlantic coast.

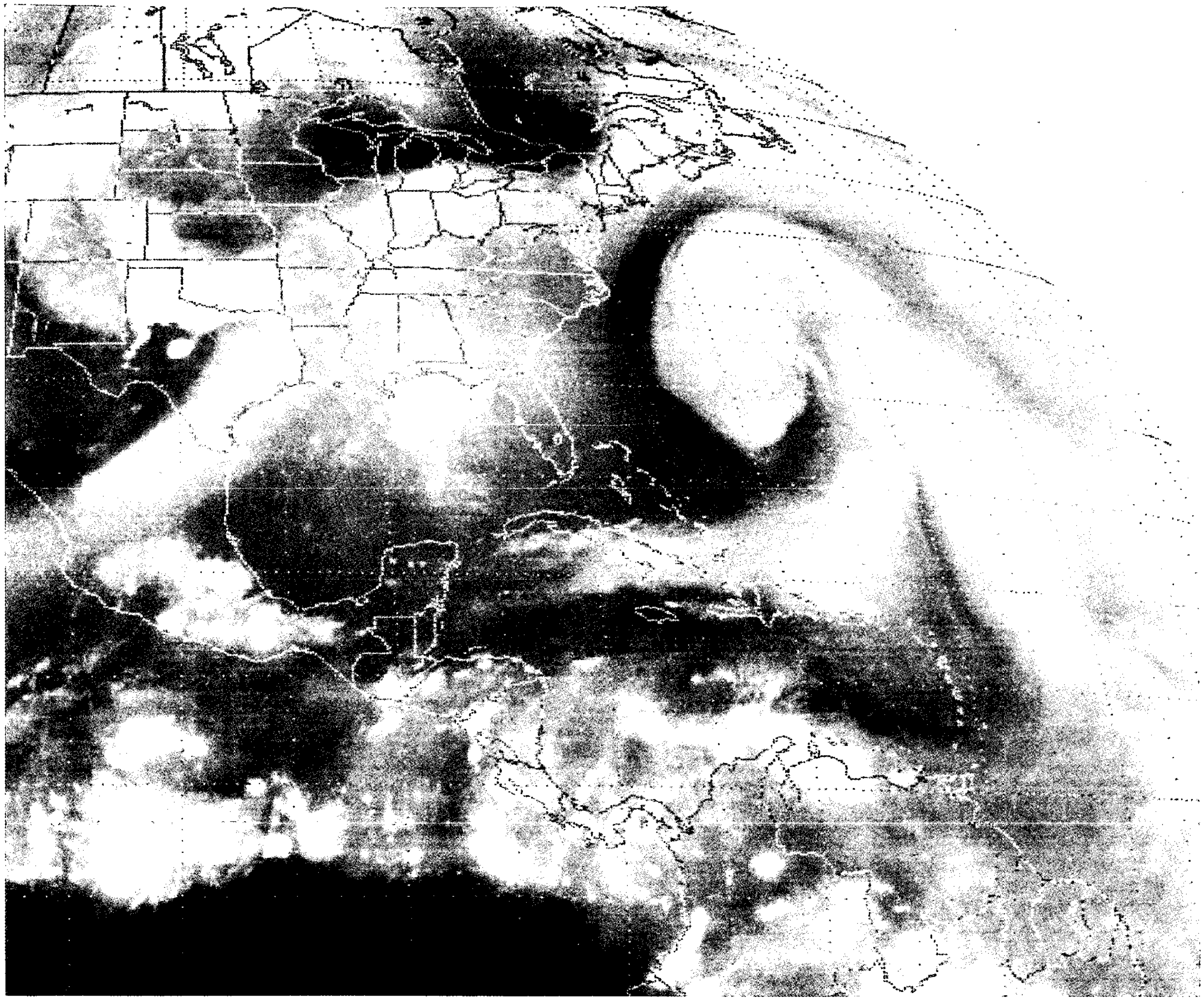


Figure 22. 0301 UTC 28 October 1991 GOES Water Vapor Image - Grace off Bermuda. Dry Canadian High north of New York.

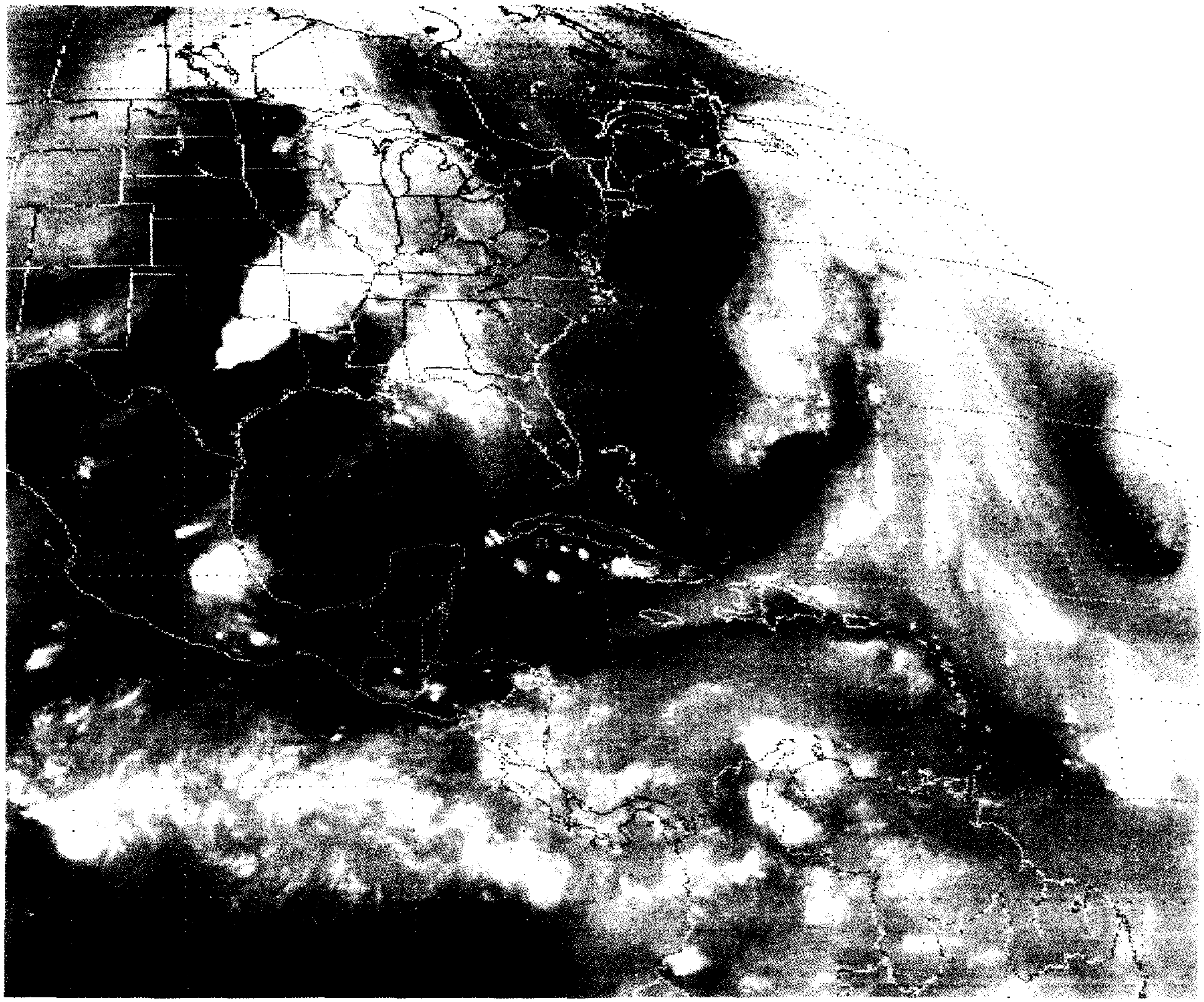


Figure 23. 0301 UTC 29 October 1991 GOES Water Vapor Image - Weak eye of Grace still visible. Dry Air over Northeast U.S.

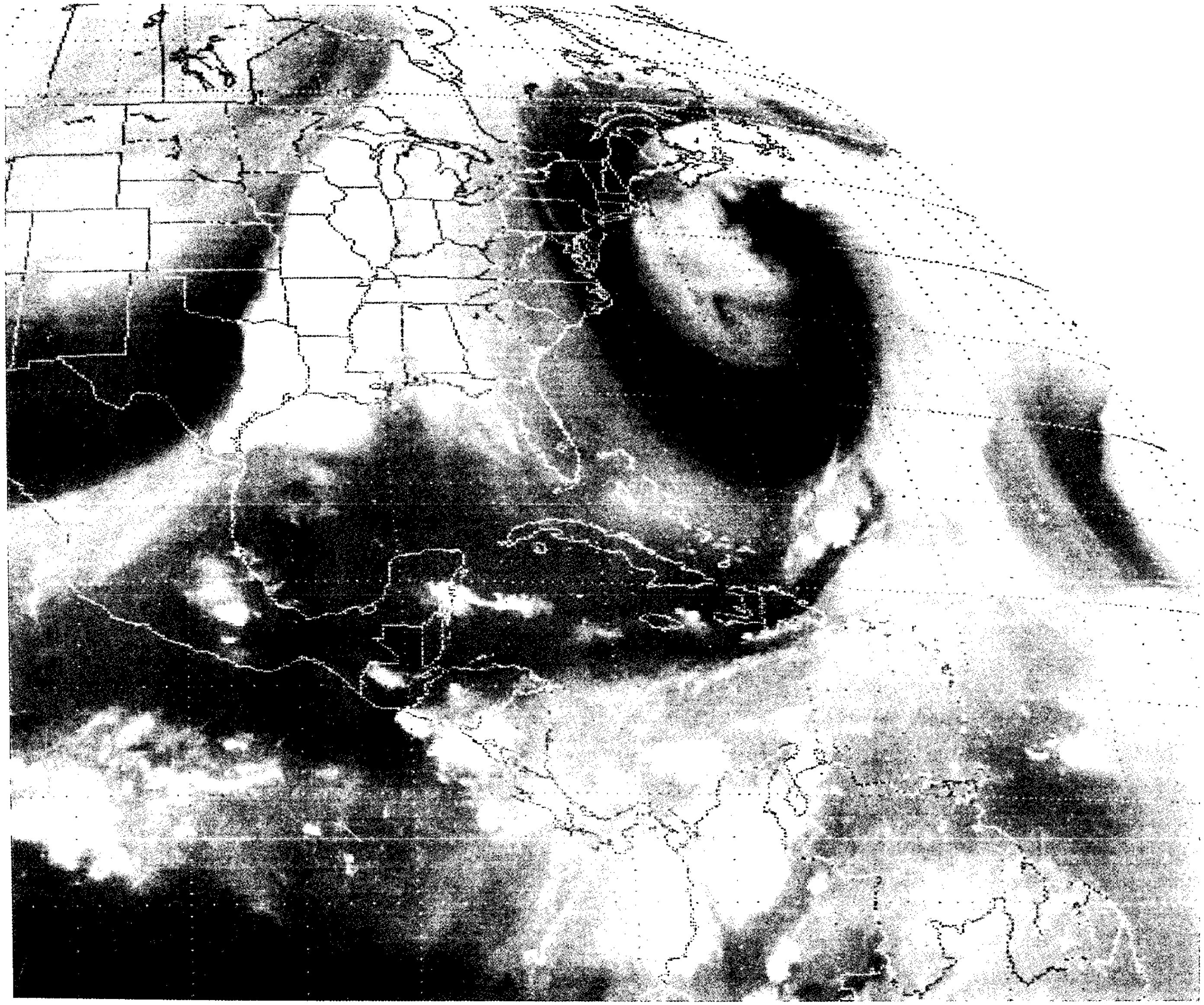


Figure 24. 0701 UTC 30 October 1991 GOES Water Vapor Image - Dry air being wrapped into North Atlantic low.

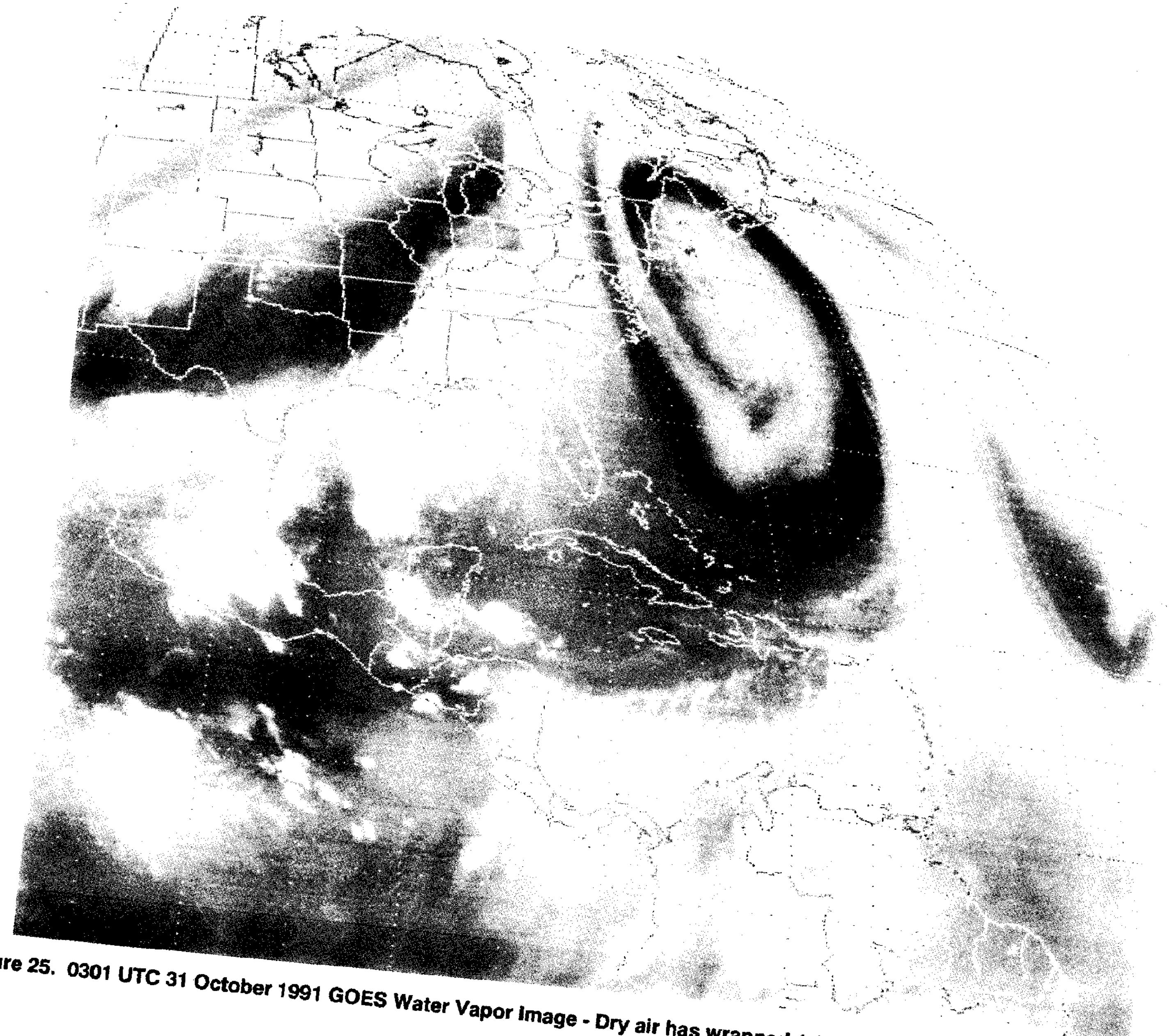


Figure 25. 0301 UTC 31 October 1991 GOES Water Vapor Image - Dry air has wrapped 1 1/2 times around North Atlantic Low.

MONDAY, October 28, 1991

On October 28, a strong surface low pressure system had developed southeast of Nova Scotia from what was originally the weak midwestern wave. This came as a result of the interaction of the now quasi-stationary upper low over the western Atlantic with a higher latitude short-wave trough. Further, Hurricane Grace, now situated west of Bermuda, and the strong high pressure area, now centered north of New England and at its near record peak strength, added to this intensification by supplying warm, moist air and cold, dry air, respectively. These events led to a greatly tightened pressure gradient between the surface low, the now dissipating hurricane, and the Canadian high. As a result, late on October 28, a strong northeast fetch of gale force winds developed and persisted over the oceanic area especially to the north and west of the deepening low near Nova Scotia.

The 00 UTC, October 28, AVN model run dramatically strengthened the surface low. By early morning, the extreme nature of the situation, hinted at the day before, was apparent. At the same time (16 UTC) Grace, positioned at 32.7°N 68.3°W, was moving north at 5 kt. The NHC forecast the hurricane to drift slowly to the northeast. The developing oceanic low, now located at 43°N 60°W, was forecast to move toward the south-southeast at 10 kt to a position near 40°N 58°W. Storm-force conditions were forecast to exist by 00 UTC Tuesday. Winds of 50 to 75 kt with seas 25 to 36 ft within 400 nm northwest semicircle were forecast.

TUESDAY, October 29, 1991

The oceanic storm, previously stationary well southeast of Nova Scotia, began to develop to the southwest and continued to intensify. At this same time, the now downgraded Tropical Storm Grace began to lose its tropical characteristics and weakened. The strong northeast fetch of winds, which had developed on October 28, persisted throughout the day, a consequence of the surface pressure differential between the Canadian high and the Atlantic low. The swell activity continuing to be spawned by this storm contributed to the start of beach erosion as early as the night of October 28, while the erosion caused by Grace was abating. Some minor coastal flooding was also reported at Chatham, Massachusetts.

Among the NWS forecasters involved, there was some concern as to which low center the AVN model was trying to move to the southwest. The model was strengthening an upper low and suggested a drift to the southwest. The satellite imagery seemed to indicate that the strengthening upper low would develop a new surface low center which would intensify.

The dangerous storm previously forecast was now fact. Movement to the southwest at 10 kt was indicated. Lists of observed ship data confirmed the degree of intensity associated with the wind and swell conditions. Two ships just east of Georges Bank, for example, reported 40 and 43 ft combined seas. In the forecast, initial conditions were listed as winds 50 to 75 kt and seas 35 to 50 ft within 400 nm over the northwest semicircle.

WEDNESDAY, October 30, 1991

The strong northeast fetch of gale and storm force winds persisted over the ocean area through the night of October 30. The strong pressure differential between the Canadian high and the Atlantic low was maintained throughout the day. This extratropical storm continued moving west, entrained the tropical moisture from the remnants of Tropical Storm Grace, and intensified further.

The storm continued west-northwest during the afternoon before turning southwest and finally beginning to weaken on the night of October 30. Since the movement of this storm was northeast to southwest, it arrived along the coastal United States via the "back door." As a consequence, the normal experience of increasing cloudiness associated with nor'easters at most of these coastal locations did not occur. The majority of people along the Eastern Seaboard awoke Wednesday morning to generally clear skies.

The NMC surface plot at 12 UTC showed a 977 mb pressure measurement from a ship located at 39.5°N 63°W. The associated winds were given as 40 kt out of the east-southeast. The surface analysis indicated a 972 mb low at 39°N 64°W. Satellite image data, however, indicated that the low was a little farther north centering at 40°N 64°W. The low had an extremely tight center. Winds of 55 to 70 kt and seas of 35 to 50 ft within 300 nm of the storm's northern semicircle and western quadrant were forecast by SMS. This placed the western edge of the area of strongest winds directly over Cape Cod.

The Visible and Infrared Spin Scan Radiometer (VISSR) Atmospheric Sounder (VAS) Data Utilization Center (VDUC) indicated the speed of the low to be 20 kt due west. The NMC AVN and Nested Grid Model (NGM) were slow with the feature, had positioned it too far south, and showed it to be significantly weaker than it actually was. Much of the major damage along the southeastern New England coast was to occur over the next several hours.

The duration, length, and areal extent of the fetch associated with this oceanic storm produced offshore seas reported to be 40 to 78 ft high. Closer to shore over the continental shelf, seas built up as high as 25 to 40 ft. Gale force winds along the southeastern New England coast increased to storm force. The Weather Service Meteorological Observatory (WSMO) in Chatham, Massachusetts, recorded wind gusts greater than 60 mph for more than 15 straight hours and greater than 70 mph for 6 hours. Compounding the problem, the strongest winds occurred near or shortly before the afternoon high tide.

The most severe coastal flood damage was reported along the Massachusetts coast in conjunction with the high tide. In Boston, this came at 4:33 pm while in Chatham at 5:05 pm. Tides were estimated to be 3 to 4 ft above the normal high tide along the entire Massachusetts coast. At Boston, the peak tide during this storm was 14 feet above Mean Lower Low Water (MLLW). The timing of the strongest winds with the incoming high tide resulted in a tremendous build-up of seas just offshore and produced destructive wave action.

THURSDAY, October 31, 1991

The low was now at 38°N 71.5°W. Unlike most extratropical lows, it had formed and maintained a well defined "eye." One ship reported winds of 55 kt within 60 nm to the west of the storm's center. However, removed from its cold air source, the high pressure air mass was becoming modified and the low, no longer able to feed off its previous energy sources, was filling. All NMC models now showed that by Friday the storm would rapidly weaken and move to the northeast.

Although weakening, the system still generated a significant northeast wind and continued to force tides to be well above normal. However, the damage caused by towering coastal waves did diminish. By this time, some of the more protected areas had been affected. For example, Bridgeport, Connecticut's, Sikorsky Airport, at the western end of Long Island Sound, experienced runway flooding Thursday morning forcing a temporary closing of the airport.

FRIDAY, November 1, 1991

During the day, wind and sea conditions diminished considerably along the coast as the large-scale pressure gradients abated. However, as the low pressure center continued eastward, it moved over the warm Gulf Stream. The infusion of new energy from this source reintensified the storm, again generated storm force winds and, as seen on satellite photographs, produced an eyelike center surrounded by convection. This development was confirmed by NHC-ordered aircraft reconnaissance.

Although NHC considered classifying this as a hurricane, NMC, NHC, and NWS Headquarters decided against this to avoid unnecessarily confusing and alarming the public.

SATURDAY, November 2, 1991

Continuing northward toward Nova Scotia, the storm left the Gulf Stream and again crossed over the cold North Atlantic. Early on the morning of November 2, the now rapidly weakening storm made landfall just west of Halifax, Nova Scotia, terminating the event.

SUMMARY

Overall, the NMC computer models did a good job giving adequate lead time for warning purposes on the Atlantic High Seas. However, the development, strength, and rapid westward motion of the surface low on the afternoon and evening of Wednesday, October 30 was not handled well by the models. The surface low moved much further west than prescribed by either the NGM or AVN and did so along 40°N and not 38°N as per model guidance. This rapid westward motion and the fact that the low made it to 71°W before turning southwest away from the New England shore contributed greatly to the coastal flooding and subsequent wave damage along the New England Coast.

CHAPTER III - DATA ACQUISITION AND AVAILABILITY

COASTAL MARINE DATA SOURCES AND AVAILABILITY

Sea surface and marine weather observations utilized routinely by NWS forecasters during coastal and high seas storm events come from several sources: (1) data buoys deployed in both nearshore and offshore locations, (2) remote CMAN platforms, (3) voluntary observing ships, (4) drifting buoys, and (5) NOS-maintained water level gages. The buoys and the CMAN units are operated and maintained by the NDBC.

NDBC Systems

Moored buoys and CMAN stations maintained by the NDBC rely on the Geostationary Operational Environmental Satellite (GOES) system to telemeter hourly observations from the observing platforms through the satellite and the National Environmental Satellite, Data, and Information Service (NESDIS) Wallops Island facility to the NWS central and field offices. Observations are transmitted from the platforms hourly and arrive at NWS field stations over the AFOS Network.

Although most of the network was operational, recent activity, specifically damage caused by Hurricane Bob in August 1991, had depleted the available systems somewhat. The Gulf of Maine data buoy, designated number 44005, was set adrift by Bob and was retrieved by the Coast Guard later that month. Buoy 44004, located at the former Ocean Station 'Hotel' near 38.5°N 70.6°W, failed in early August, was reported adrift in September, and was subsequently retrieved. All other NDBC buoys were on station and reported throughout the storm.

With respect to CMAN units, the sea temperature sensor at Diamond Shoals Light, North Carolina (DSLN7), was inoperative during this event as a result of Hurricane Bob in August. All other CMAN stations were providing reliable data at the beginning of the event. However, damage to several of these stations occurred during the storm.

According to weekly NDBC status reports, CMAN stations at Matinicus Rock, Maine (MISM1), and Ambrose Light, New York (ALSN6), suffered some degradation of reliability during the storm. For the period October 24 - 31, the report showed 95 percent and 98 percent data availability from these two stations, respectively. However, for the period October 31 - November 7, only 83 percent and 90 percent of all observations from these two sites were available due to intermittent transmission problems and parity errors. Elsewhere, the station at Lake Worth, Florida (LKWF1), was destroyed on October 31 when the pier on which it was mounted gave way during the high waves that reached Florida.

National Ocean Service (NOS) Water Level Information

Water level information is provided to forecasters primarily from the NOS-maintained WLTS network in place at many United States coastal sites. This network of gages is maintained by NOS primarily to record long- and short-term variations in water levels. For these tasks, real-time data are not an NOS requirement. The NWS, because it does have a requirement for real-time water level information during potential coastal flooding and tsunami events, and the NOS have modified selected NOS gage installations to allow for such real-time access.

Two methods of providing this access are now in use: (1) Handar, developed by NWS as an offshoot of similar technology used on river gages, and (2) TIDES_ABC, an NOS-developed software package designed to plot water level readings from the past 24 hours against predicted tide heights.

Handar technology, maintained by NWS, incorporates a programmable unit that transmits the NOS water level gage data via commercial telephone line to a computer or dumb terminal remotely located in an NWS field office. Either the field office can initiate the call for a reading or the gage itself can initiate a call to a field office at a certain time interval or whenever the gage height reaches a pre-set critical level. Multiple readings each hour can be obtained by this system which also has the capability to store several weeks' worth of data.

In the TIDES_ABC system, a tide gage and an NWS office computer are again connected through a telephone line. The TIDES_ABC software at a local NWS office initiates a phone call to one of several remote gages available to a particular office. Water level observations for up to the past 24 hours are displayed graphically on the computer screen along with the predicted water levels for the same period. In this way, trends are readily apparent, and departures from tidal predictions can be seen at a glance.

A disadvantage of TIDES_ABC is that it is more cumbersome and time-consuming to use than a simple interrogation of a Handar-equipped gage. Especially in routine situations where no departure from predicted values is expected, NWS forecasters seem to prefer accessing the Handar equipment at locations where both methods of real-time access are available.

As with Handar units, only selected gages are equipped to be accessed via TIDES_ABC. A summary of water level data available during this event to the various field offices involved is shown in table IV. Overall, tide gages along the East Coast performed well throughout this event. However, some discrepancies were noted as follows.

Station	Tide Gage Site	Maintained By	Method of Data Access
WSFO PWM	Portland Harbor, ME	NOS	Dial-up access via NWS Handar unit; gage calls WSFO if level reaches 11.0 ft
WSFO BOS	Boston Harbor, MA	NOS	TIDES_ABC, dial-up access via NWS Handar unit
	Charles R. Dam Tender		Tender reads gage
	Buzzard's Bay, MA	USACE	Remote dial-up access
	New Bedford, MA	USACE	Remote dial-up access
	Sandwich, MA	USACE	Remote dial-up access
	Wing's Neck, MA	USACE	Remote dial-up access
	Nantucket, MA	Steamship	Staff reading
	Woods Hole, MA Oceanographic Institute (WHOI)	WHOI	Staff reading
	Stamford, CT	USACE	Remote dial-up access
	Providence, RI	USACE	Remote dial-up access
WSO BDR	Bridgeport Hbr., CT	NOS	Dial-up access via NWS Handar
WSFO NYC	Willets Point, NY	NOS	TIDES_ABC
	The Battery, NY	NOS	TIDES_ABC
	Bergen Point, NJ	NOS	TIDES_ABC
	Sandy Hook, NY	NOS	TIDES_ABC
WSO ACY	Ventnor City Pier, NJ	NOS	Gage with NWS Handar unit calls ACY hourly and when water level reaches 5.8 ft MLLW
	Cape May, NJ	NOS	TIDES_ABC
	Sandy Hook, NJ	NOS	TIDES_ABC
WSO ILG	Ocean City, MD	NOS	Dial-up access via NWS Handar unit
WSO BWI	Ocean City, MD	NOS	Dial-up access via NWS Handar unit
WSO ORF	Hampton Roads, VA (Sewell's Pt)	NOS	Dial-up access via NWS Handar unit; gage calls ORF if level reaches 4.0 ft MLLW
	Ches. Bay Bridge, VA (South Is.)	NOS	TIDES_ABC; dial-up access via NWS Handar unit; gage calls ORF if level reaches 4.0 ft MLLW
	Windmill Point, VA	NOS	TIDES_ABC
	Lewisetta, VA	NOS	TIDES_ABC
WSO HAT	Cape Hatteras, NC (Frisco)	NOS	Gage with NWS Handar unit calls HAT hourly; prints to Silent 700
	Duck, NC	USACE	Dial-up access every hourly

TABLE IV. REAL-TIME WATER LEVEL INFORMATION AVAILABLE TO NWS FIELD OFFICES NORTH OF CAPE HATTERAS

(1) The NGWLMS gage at Atlantic City, New Jersey, which at the time of the storm was undergoing pre-operational testing, reported water levels 0.9 ft lower than the WLTS gage collocated with it and 1.4 ft lower than the WLTS gage at nearby Ventnor Pier. Atlantic City data from the NGWLMS gage were not available to NWS forecasters in real-time. Report of the discrepancy was made by the USACE to the Official in Charge of WSO Atlantic City after the fact.

(2) The Ocean City, Maryland, WLTS gage was demolished by this storm and will not be returned to service. The NGWLMS gage operating at this location is not presently accessible by NWS field offices in real-time.

(3) The NOS gage collocated with the CMAN station at Lake Worth, Florida, was destroyed when the outer 200 ft of the Lake Worth Pier was destroyed by the high waves associated with this storm.

(4) Gages at Duck, North Carolina, and Boston, Massachusetts, were also affected by the storm but have now been repaired and returned to service.

In addition to the problems noted above, the tide gage at Portland Harbor, Maine, is programmed to call forecasters at WFSO Portland when the water level reaches 11.0 ft above MLLW. At 4 am, EST, October 30, the gage called and reported such a reading. The forecasters felt the reported 11.1 ft above MLLW was excessive since the winds along the Maine and New Hampshire coasts were blowing from the northeast, parallel to most of the coastline. Experience had shown that most coastal flooding on this portion of the coast occurred with strong southeast onshore winds. Finally, this interpretation of the data seemed to be supported by the MRPECS statistical storm surge prediction of only 1.7 ft above normal tide.

Forecasters also mentioned that a couple of days earlier, the gage had malfunctioned. This undermined their confidence in the readings since there was some question whether or not the gage had been repaired by NOS maintenance technicians. In the absence of other interrogatable tide gages in that area, with no other method to verify the reading, and without the Gulf of Maine buoy (44005) to monitor existing sea conditions, the forecasters in Portland were reluctant to rely solely on these data. They filed an A-23 Equipment Outage Form on the NOS tide gage. The station electronics technician visited the gage at 9 am, EST, and confirmed that it was operating correctly and that the 11.1 ft value was undoubtedly accurate.

Upon learning this, a coastal flood warning was issued at 10 am, EST, 4 hours before the onset of significant coastal flooding along the Maine and New Hampshire coasts. Forecasters felt that had they known that the gage was reading correctly, they would have probably issued a coastal flood watch or, perhaps, a warning at 4 am, EST.

The NOS is presently modernizing its network of water level gages throughout the United States. At many locations, NGWLMS instruments are installed but are not yet in an operational mode. This new system is designed to make use of a GOES link to transmit routine data to field offices. This system, as currently envisioned, will transmit data every 3 hours via GOES satellite. Following quality checks by NOS, this data will be released to the NWS field offices via AFOS.

Much concern was raised by NWS local officials throughout the survey area regarding the reliability and access to real-time water level information on an as-needed basis. For the long term, concern was raised by the local officials throughout the affected area about the availability and reliability of the NGWLMS data. For non-storm periods, the three-hourly data dump will likely be satisfactory. But, in the event of a storm or coastal flooding episode, frequent access to real-time water level information is critical. NOS has installed telephone lines from each system for quality control and maintenance, and it would appear reasonable for NOS to permit access to NWS forecasters during coastal flooding episodes for monitoring water levels in real-time. This issue must be resolved before the NGWLMS network is declared operational and the existing WLTS network decommissioned.

There was a need expressed by several NWS managers for water level information from estuarine areas (i.e., sounds and embayments behind barrier islands) to alert forecasters of seiches and flooding from back bays. During extended periods of onshore winds, water from back bay areas cannot escape to sea as efficiently as during light or offshore wind situations. With each subsequent high tide, the departure from predicted water levels increases. For example, WSO Atlantic City reports that, after four or five tidal cycles when strong northeast (onshore) winds are involved, back bay water levels can be as much as 1.5 ft higher than simultaneous oceanfront readings. Several offices get reports from local officials and/or private citizens on water level conditions in these areas. However, data from most of these must be directly read by a human observer. As such, requests for information from the volunteer observers at these sites are made sparingly to maintain cooperation.

SATELLITE DATA SOURCES AND AVAILABILITY

Satellite data, in the form of images and/or image animation, are utilized by NWS forecasters centrally at NMC and NHC and at the various field sites. These data may be the single most important source of information available to all marine forecasters. GOES data are available in visible, infrared, and water vapor formats at both NMC and NWS field offices from NESDIS/Satellite Services Division. In the field, the GOES image data are available via the Satellite Weather Information System (SWIS) and the microSWIS (personal computer [PC] based image display/animation system) as images and/or image animation. In addition, NMC forecasters have satellite information available from the VDUC that is not available to NWS field offices.

OTHER DATA ACCESS AND AVAILABILITY LIMITATIONS

Other than those items noted above, the DST found that the forecasters generally had access to the available tools.

The DST did become aware of a data access problem that seemed to impact the operation during the **Halloween Nor'easter of 1991**. According to NMC SMS staff, the current procedure of having the NOS Ocean Products Branch meteorologist, located at NMC, provide a list of current synoptic observations to the SMS High Seas forecaster is too labor-intensive. They suggest that a plot containing wind speed and direction, combined sea and swell height and direction, visibility, pressure, pressure tendency, and past or present weather would be all that is needed. They did note, however, that several ship reports on the NOS list of October 29 showing seas of over 40 ft just east of Georges Bank did indeed help verify forecast conditions. (Single observations of this type illustrate how important real-time in-situ data are to the forecaster.)

On a related topic, a lead forecaster in Boston recommended that the MARMON program now in use throughout the Great Lakes be adapted for use along the East Coast. This program compares existing forecasts with current observations and alerts the appropriate forecaster when discrepancies arise.

For this to be effective, however, an adequate observational network needs to be in place. The current network available is consistently denigrated by NWS marine forecasters. The sparsity of actual on-water observation points is a major hinderance in accurately specifying wave heights and wind speeds existent over the waters offshore the United States. Visual wave observations, in particular those taken from land-based observers, are prone to have large errors. This is a major problem and needs to be addressed.

CHAPTER IV - PREPAREDNESS

Disaster preparedness activities at NWS offices have a dual focus. The first is internal preparedness dealing with internal station management activities (e.g., drills, checklists, SDMs, and staff awareness). The other focus is external preparedness, whereby NWS officials meet with state and local officials to learn their requirements (as they apply to NWS functions), participate in emergency planning and emergency drills, and take part in post-storm analyses of emergency actions to identify refinements and improvements.

INTERNAL PREPAREDNESS ACTIVITIES

Weather Service forecasters must be ready to respond to all weather-related events in a timely manner to ensure that adequate warnings are delivered to the public. This is accomplished by developing and maintaining detailed, readily available, and easily understood instructions and procedures. Of course, these procedures are useless unless forecasters are aware of their existence and are able to apply them to whatever situation might arise. This familiarization can either be gained through actual practice or through station drills.

The DST found that established SOPs were generally in place at all stations visited. Samples of the on-station guidance are included in appendix A to this report. The type and quality of the guidance varied from station to station. It ranged from fully developed SDM chapters on coastal flooding, with references to historical tide heights and estimated return periods and procedures for backup access to tide gages, etc., to a short one pager with a brief checklist and telephone listing.

The success of SOPs lies in whether or not those who must use them can readily find the information they need to successfully handle the situation at hand. The DST identified no major instances where on-station guidance was incorrect or lacking in the most critical areas. Some stations, however, could include more background information, historical data, and examples. Several minor discrepancies were noted and are, presumably, being corrected.

Station drills focusing on coastal flooding or high surf events were found to have been conducted at Portland, Maine (June and October-November 1991); Boston, Massachusetts (October 1990 and October/November 1991--in progress at the time of the storm); and Norfolk, Virginia (November 1990, June 1991, and November 1991). No other drills had been documented. However, at other offices--Atlantic City, for instance--minor coastal flooding is a common enough occurrence that the local manager believes that proficiency is maintained in real-time without requiring formal drills.

EXTERNAL PREPAREDNESS ACTIVITIES

Preparing state and local officials, the media, and the general public for the eventuality of coastal flooding (or any other weather-related event) is equally important to preparing station personnel for these events. It appears to the DST that NWS officials throughout the area investigated had spent and continue to spend considerable effort in attempting to do this. The responses from the emergency service community and the media were generally, although not uniformly, good. The responses from the public were, in general, poor.

Perception by emergency managers and the public of the potential danger from a particular weather-related event seems to be critical in developing public cooperation and response. Local NWS managers must become actively involved in meeting with emergency managers to develop a common understanding as to the potential of various weather events, participate in planning activities, and conduct post mortem reviews to identify deficiencies and improve the warning system. Although the effort was there, the message, at least as far as most of the public along the Mid-Atlantic and New England Coasts is concerned, has not gotten through for this type of coastal flooding event.

The reality is that each NWS office still has different requirements for meeting this educational responsibility. In places like Cape Hatteras on the Outer Banks of North Carolina, the populace, from the state emergency managers to the hotel operators and wind surfers, is very weather-conscious. The frequency of storms and the potential for destruction they possess makes this apparent even to the most casual observer.

At the other extreme, problems were found in New Hampshire and New Jersey in getting local emergency officials and the public to believe in the power of the approaching storm. These are noted in Chapter VII. In Atlantic City, coastal flood warnings were largely ignored in spite of the local NWS manager's active involvement with emergency managers throughout southern New Jersey in educating the public and developing emergency plans. This, again, was due mainly to a lack of appreciation for the potential of this event.

In Norfolk, Virginia, the DST met with the WSO Meteorologist in Charge (MIC), the Director and Deputy Director of Norfolk Emergency Services, and the City of Virginia Beach Fire Department - Emergency Management Division. In this meeting, all three emergency managers emphasized that their contact with WSO Norfolk is frequent, due, in part, to the particular problems of the Hampton Roads area in evacuation planning. Because tunnels and highways susceptible to flooding are major parts of evacuation plans for the Norfolk-Virginia Beach-Chesapeake areas (average elevation above mean sea level of Virginia Beach and Norfolk is around 13 ft), emergency managers are extremely weather-conscious. All agreed that at least monthly meetings and weekly phone calls take place to discuss various weather-related matters.

The hurricane threat along the Atlantic coast has prompted emergency managers to foster active disaster preparedness programs in all coastal areas. Hurricane preparedness activities and associated drills ensure that necessary weather information can be passed on to state and local emergency managers in the shortest amount of time. A comprehensive hurricane simulation drill is planned for early 1992 in FEMA Region III. "Hurricane Zelda" is intended to involve all levels of emergency management as well as FEMA, NWS, United States Coast Guard, and other agencies to strengthen hurricane plans currently in force. Since coastal flooding can account for a significant part of the damage caused by a hurricane, these preparedness efforts have a carryover effect to other coastal flood episodes as well.

The perception among NWS personnel and emergency managers throughout the survey area was that personal visits and communications are absolutely essential in maintaining the high state of readiness of the warning and preparedness program. Reduced travel budgets have prevented NWS personnel from conducting as many disaster awareness tours. If this continues, everyone (NWS and emergency managers) interviewed indicated that the warning and preparedness efforts invested up to this time will gradually be lost.

Particularly in the restructured NWS, many coastal areas will be without a direct and immediate NWS presence. In these cases, it is imperative that the Warning Coordination Meteorologist (WCM) and the MIC keep actively acquainted with various emergency management personnel in the new Weather Forecast Office area of responsibility. This will require a sufficient and reliable travel budget and enough time to perform this task.

At the DST meeting in Atlantic City, the time-intensiveness of this preparedness task was made clear. The State of New Jersey uses the "home-rule" approach to emergency services. Emergency management is run at a municipality level with local governments having the authority to conduct evacuations and produce their own emergency plans. This situation can cause problems for NWS personnel in conducting Warning and Preparedness programs due to the number of agencies involved in emergency management. Problems arise, as well, in the execution of emergency management plans. In one case during this storm, a municipality ordered an evacuation without coordinating with other municipalities as to where the evacuees were to be sheltered.

In the modernized NWS, the plan currently calls for the Philadelphia office to be responsible for Delaware, southern New Jersey, and eastern Pennsylvania. This totals some 60 counties. Even with WCMs dedicated solely to preparedness activities, they will have a difficult time dealing with all aspects of the warning preparedness in states where individual municipalities direct their own emergency management functions with little centralized coordination or oversight.

Figure 26. The remains of Sandy Beach, Scituate, Massachusetts. Photo courtesy of Pat Viets.

CHAPTER V - WARNING SERVICES

The meteorological scenario that unfolded over the New England and Mid-Atlantic states in late October presented some unique and formidable challenges to the NWS warning and forecast system. While these meteorological details are described elsewhere in this survey report, several points are worthy of reiteration.

Unlike the typical nor'easter that develops off the North Carolina Outer Banks during the winter months and moves north and east along the New England coast, this major ocean storm moved west and then southwest toward the United States coast from its area of origin south of Nova Scotia. This "back door" approach precluded the normal precursory environmental clues so familiar to persons who have often experienced coastal winter storms in the northeast. Such was the case, for example, in Maine during the height of the coastal flooding on October 30. One resident observed, "It was a rather typical autumn day in New England unless you were on the coast."

The formation of Hurricane Grace several days earlier and its subsequent absorption into what was to be an ocean storm of historic proportions was a complicating factor for forecasters in formulating forecasts and statements.

The interaction between the intense extratropical storm and a near record high pressure system over the Canadian Maritimes strengthened the wind field over vast areas of the ocean resulting in a long fetch toward the New England coastline.

Forecasters at NMC SMS and in WSFOs with coastal responsibility recognized the devastating potential for a coastal storm several days in advance of its onslaught. (See selected state forecast discussions [SFDs] in appendix B.) In addition to NHC advisories on Hurricane Grace, SMS's high seas forecasts (appendix C) indicated storm development as early as 22 UTC on October 27 and advertised a dangerous storm in the high seas forecast issued at 10 UTC, October 28. Subsequently, SMS's high seas forecasts and WSFOs' coastal and offshore forecasts highlighted the developing threat to marine interests with gale and storm warnings.

Forecasters at several offices mentioned to the DST the importance of numerical weather prediction and statistical computer guidance from various atmospheric models. Boston issued a coastal flood watch at 3 am, EST, October 29, based, in part, on the Limited-area Fine Mesh (LFM) coastal wind forecast of 46 kt at Nantucket. According to a Boston forecaster, "It looked like the Blizzard of '78 without the snow!" Another Boston forecaster said the 3000 ft wind forecasts were superb! He used, as a rule of thumb, 80 percent of the 3000 ft winds to estimate surface winds.

This forecast guidance, together with forecaster experience in dealing with coastal storms, resulted in a suite of timely, state of the science warning and forecast products and services to a host of users, including government, public safety, and emergency management officials, private sector interests, the media, and the public. (Appendix C contains copies of selected warning and forecast products issued by various NWS offices having marine responsibilities.)

Not all computer guidance was helpful, however. Several comments were received indicating that the output from the MRPECS was consistently too conservative for this storm scenario. One forecaster in Boston stated that he would have issued more strongly worded statements, comparing this storm in terms of its destructive potential with the Blizzard of '78, had it not been for the surge model output.

In defense of the MRPECS, it should be noted that this guidance is statistical in nature. Most storms in this part of the Atlantic are moving away from the United States. In all likelihood, few, if any, storms moving toward the coast, like the **Halloween Nor'easter of 1991**, were in the database used to derive the original statistical regression equations. In such situations, the statistical guidance can't be expected to give good guidance.

Also, at the time of the storm, MRPECS was run using wind and pressure inputs based on the LFM model. Since then, it has been converted so that it now uses inputs from the newer NGM model. However, even though this model provides better offshore wind and pressure predictions, the MRPECS will still be of limited value during unusual storms such as this one.

A common theme reiterated at coastal offices was the need for more real-time tide gage and buoy data. As discussed in Chapter III, members of the staff at WSFO Portland lost confidence in the accuracy of a tide gage reading, and the absence of nearby gages for comparative purposes may have caused the delay in the issuance of a coastal flood watch or coastal flood warning.

WSFO Portland did issue a special weather statement at 4:30 am, EST, on October 30, highlighting heavy surf and beach erosion. However, the forecasters are convinced that the loss of data from the Gulf of Maine buoy that had been torn from its moorings during Hurricane Bob inhibited their ability to gauge the arrival time and magnitude of heavy surf along the coast.

WSFOs and WSOs placed emphasis on different hazardous aspects of the storm, depending upon the orientation of the storm's circulation relative to exposed northeast- and east-facing coastal margins. For example, heavy surf advisories were issued from the North Carolina Outer Banks northward along the Mid-Atlantic coast to Long Island and Cape Cod highlighting the dangers of high surf and the destructive effect of moderate to severe beach erosion. In the early stages of this event, these advisories emphasized the impact of heavy swells radiating from Hurricane Grace while it was approximately 300 miles east of the North Carolina coast. Later, the focus shifted to the effects of the rapidly intensifying extratropical storm as Hurricane Grace fell apart and its energy absorbed into the larger circulation.

At the same time, WSFO Boston issued high wind warnings for eastern Massachusetts, including Cape Cod, which bore the brunt of the storm due to its closer proximity to the center. Winds gusted near or above hurricane force for several hours during the afternoon and evening of October 30.

In addition to marine warnings (gale and storm), coastal flood warnings stretched along the entire northeast coastline highlighting the severe flooding associated with storm surges 3 to 5 ft above normal. As can be seen by a review of selected issuances found in appendix C, WSFOs and WSOs provided excellent, site-specific advice for affected areas, many times incorporating information provided by emergency management, law enforcement, and government officials.

While coastal flood watches did not precede coastal flood warnings in every case, there is good evidence of intensive coordination within the NWS field structure as offices braced to handle this critical weather event. Perhaps as importantly, a recurring theme from the DST's interviews on the scene was the appreciation expressed by emergency managers and other groups external to the NWS for the early and frequent contact with NWS officials and field personnel as the storm approached.

Several NWS statements emphasized the hazardous nature of the high waves attendant to this storm, but the mention of heavy surf may have had the reverse effect on a segment of the population. Many sightseers were drawn into beach areas putting themselves at risk and inhibiting the actions of local officials. One person in Massachusetts lost his life apparently while surfing.

CHAPTER VI - COORDINATION AND DISSEMINATION

The flow of information from the NWS offices was timely, strongly and clearly worded, and accurate. Coordination between NWS and emergency services personnel was in some cases initiated over 72 hours before the storm reached its peak. For example, NWS Eastern Region Headquarters began a close liaison with FEMA Regions I, II, III, and IV beginning on October 28. In many instances, however, this flow required a great deal of effort on the part of one or more persons, usually the local NWS office manager. Although NWWS, NWR, and NAWAS were used, telephone contact between local offices and local emergency managers was extensive.

WSFO PORTLAND, MAINE

Two NWS offices in WSFO Portland's area of responsibility were involved with the storm. These include WSFO Portland itself and WSO Concord, New Hampshire. The MIC of the WSFO maintained almost continuous telephone contact with emergency managers from that state and from New Hampshire throughout the period. Also, as part of this communication effort, the staff at the WSFO issued a special one-time product, a hazardous weather outlook, aimed at the emergency managers and containing alerting information.

The WSFO is equipped with a facsimile machine used to transmit hard copies of warnings and statements. Similar systems were also used at other offices visited by the DST. The labor intensiveness required of such contacts can be overwhelming. If this process is to be continued, the NWS should try to automate it where possible.

In general, the system in place throughout this area requires that the state emergency managers receive warnings and watches and pass them down to their county managers. These officials, in turn, forward the alerts to local managers. Both Maine and New Hampshire emergency managers were contacted by the DST and noted that they have access to the NWWS. (In Maine, this access is through the State Police headquarters. The Maine Emergency Management Agency is attempting to get its own NWWS drop.) Further, the NAWAS already in place at the WSFO, at the WSO, and at various other spots around both states ensured that the state managers were notified. Additionally, both states noted that they are introducing NWR to their local and county emergency managers to diminish the telephone traffic and quicken the local alerting time.

As a backup, the Portland WSFO disseminates messages to the Associated Press via the Family of Services. This allows emergency managers to receive information through the various media outlets across both states should those managers not have immediate access to their NWWS.

WSFO Portland has responsibility for a special location: the home of President George Bush in Kennebunkport, Maine. A Secret Service unit is at that location but was not directly notified by the WSFO. SOPs, as noted in the SDM, did not mandate this. However, the SOPs and SDM have been changed to ensure that this is done whenever a watch or warning affecting the area is issued.

WSFO BOSTON, MASSACHUSETTS

WSFO Boston; WSO Providence, Rhode Island; WSO Hartford, Connecticut; WSMO Chatham, Massachusetts; and WSO Bridgeport, Connecticut; all took part in overseeing the **Halloween Nor'easter of 1991**. Information was disseminated from WSFO Boston directly to the Massachusetts Emergency Management Agency over NAWAS and the NWWS which, in turn, funneled it through the area directors to the local emergency managers in the jurisdictions involved. The staff at Boston contacted appropriate emergency managers and began issuing media alerts and PNSs on October 27, notifying them of the impending conditions.

In this area, a close relationship between personnel at WSFO Boston and the Massachusetts emergency managers resulted in a timely and accurate dissemination of weather material. Those managers interviewed by the DST said that the Boston office did a superb job in providing advanced warning and in keeping them up to date during the run of the storm.

A similar story can be told in Rhode Island and Connecticut. Even though the damage and impact were less severe, WSO managers kept in close contact with their respective state and local emergency officials. WSO Providence, Rhode Island, supplied information to state officials from 07 UTC, October 30, until the storm ended through its connection with the Rhode Island Law Enforcement Telecommunications System. Emergency managers also were serviced by NWWS and by hourly telephone contacts with the WSO.

Connecticut emergency service managers had access to all products issued by the area NWS offices through NWWS. They also maintained telephone contact with WSO Bridgeport for the storm's duration.

WSFO NEW YORK, NEW YORK

The only involved office in this area was the WSFO itself. The state of New York is extremely well organized as far as the emergency services program is concerned. Information flows to the state headquarters through NAWAS or the NWWS and is disseminated downward through the NYSPIN communication's circuitry. The local officials had ample lead time to implement preparedness actions.

One problem was noted in New York. NYSPIN was established to automatically distribute emergency products throughout the state. However, coastal flood messages were not included in this system. This required the New York WSFO to reissue products with a special weather statement communication's header. NYSPIN has been changed to rectify this problem.

WSFO PHILADELPHIA, PENNSYLVANIA

WSO Atlantic City, New Jersey, bore the brunt of the weather in this WSFO's area of responsibility. In New Jersey, the DST met with 18 people, including emergency managers from the state, county, and local governments and local media personnel. The flow of information in New Jersey is more diffuse than in the other states surveyed in that the NWS contacts local officials directly without going through a state organization. These contacts are usually handled over the telephone.

Because of the structure of the emergency service organization in New Jersey, local contacts at the county level are a must. The NWWS does not seem to be a viable alternative in this state. A suggestion was made that an automatic facsimile machine (see discussion noted in the Portland, Maine, area above) be installed at WSO Atlantic City. This would allow the station to automatically call and forward to the concerned county and local officials hard copies of necessary information at the touch of a button.

WSFO WASHINGTON, DC

WSOs in Baltimore, Maryland, and Wilmington, Delaware, were active during this storm. However, WSO Norfolk, Virginia, was the office in the WSFO Washington area most affected by the **Halloween Nor'easter of 1991**, although the WSFO did issue several warnings, forecasts, and statements and retained overall responsibility for the coast. Also, the WSFO used NAWAS frequently to brief both state and local emergency managers and to pass coastal information on to the Virginia State Emergency Operations Center.

The Norfolk MIC and local area emergency managers talked often--four or five times a day--over the telephone through the duration of the storm. This is a normal procedure during such events. The MIC notified officials early in the week of the developing system and of its potential and followed up with the telephone and with facsimiles. Coordination, although labor intensive, was very satisfactory.

WSFO RALEIGH, NORTH CAROLINA

In North Carolina, WSFO Raleigh staff maintained close telephone contact with the State Division of Emergency Management. At the local level, WSO Cape Hatteras, the office responsible for the area impacted, maintained close telephone contact with county and local emergency managers.

These local managers also relied heavily on NWR broadcasts and used this forum for disseminating their own emergency messages to the general public (example in appendix C). This was the only office visited by the DST at which this was done. The extreme reliance placed on the NWR system in this weather-sensitive area was striking.

Conversations with officials from the North Carolina Division of Emergency Management (Area A), from the Dare County Emergency Management Office, and with the Dare County Sheriff all indicated that NWR is utilized extensively. It is used to disseminate timely weather information and to advise the public of weather-related road closures, etc. Local radio stations are not as likely to remain on the air during poor weather as is the Hatteras NWR station. Discussions with individuals and local officials substantiated the emergency managers' claims that NWR enjoys a broad listener base and, in fact, becomes THE source of weather and weather-related emergency information for the citizens of Dare County and the Outer Banks. The local emergency officials relied on and acted on the information provided by the NWS. Those managers debriefed by the DST were very satisfied with the service provided by both offices. They also expressed concern about closing the Hatteras office when the NWS modernizes.

Emergency managers and NWS officials in all locations stressed the value of reliable communications links between NWS offices and emergency managers, primarily as a real-time tool for sharing information and disseminating warnings. In particular, location of facsimile machines at NWS offices was viewed as very desirable for rapidly sending warnings and statements to emergency managers.

Few local emergency management officials rely on NWWS for receiving timely warnings. Instead, they rely on private sector weather companies, NWR, The Weather Channel, or the local media for their information. Most believe that the local NWS office sending the word out in a personal manner (albeit via facsimile) makes the warning more apt to be received and acted upon in a timely manner. The difficulty with facsimile transmissions is that, if there is a long list of addressees, the product being disseminated becomes less and less timely to addressees at the end of the list and the workload is very labor intensive.

The emergency managers in Norfolk, Virginia, suggested that the availability of a rapid conference calling capability would be useful for alerting all emergency managers involved in the large Hampton Roads area as to the onset of hazardous weather conditions.

At WSO Cape Hatteras, where a facsimile machine is currently in place (compliments of local emergency management agencies), a facsimile card for an existing PC was suggested. This machine, used as the station AFOS backup terminal, could be dedicated to sending NWS products to local officials. This would free the existing facsimile machine for receiving reports from these same agencies. Some difficulties arose during the Halloween storm when local phone switches were not properly aligned. This resulted in non-receipt of some reports from local emergency managers.

Finally, NAWAS was successfully utilized to deliver coastal flood warnings to those agencies tied in to the system. However, it was noted that, in almost all cases, the system does not extend to the local emergency management level. To reach these people, other methods (telephone, NWR, facsimile, etc.) had to be used.

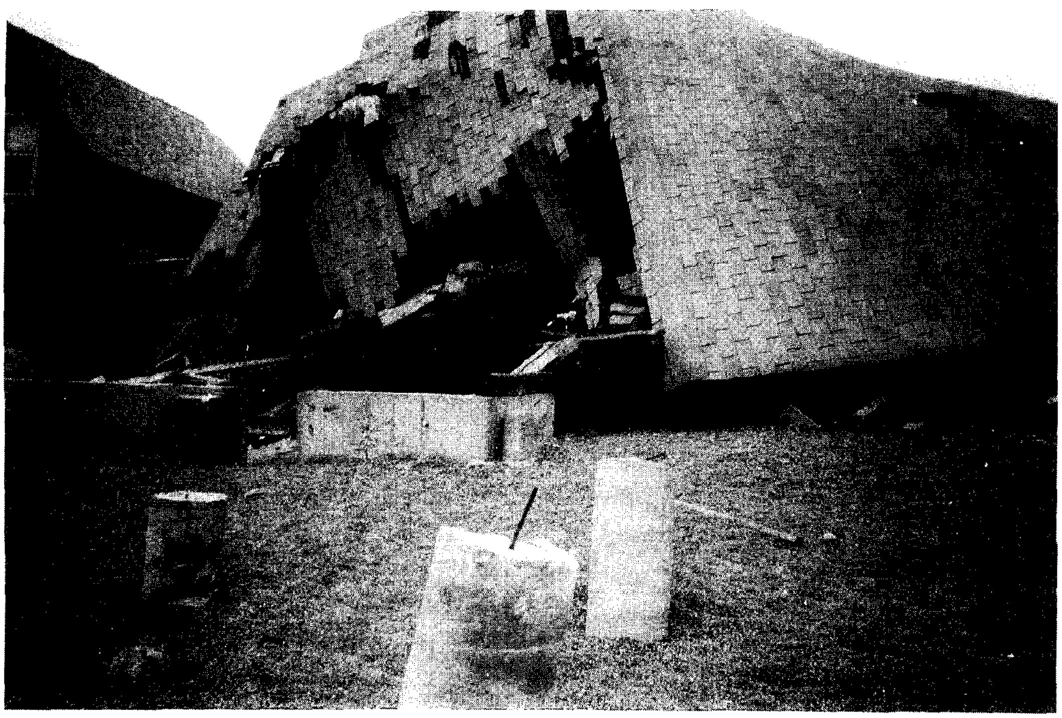


Figure 27. A house moved off its foundation in Scituate, Massachusetts. Photo courtesy of Pat Viets.

CHAPTER VII -- USER RESPONSE

EMERGENCY MANAGEMENT RESPONSE

The overall response by most members of the emergency management community was outstanding. Warnings and watches issued by the NWS were used as a basis to alert local communities about the storm. Most officials with whom the DST talked said they had ample warning. They all noted that they communicate regularly with NWS meteorologists and have come to respect the judgment of the forecasters.

The MIC at WSFO Boston reported that, from an NWS perspective, the emergency management response in southern New England, the hardest hit area, was effective. Numerous preparations were made by state and local officials hours before the crucial Wednesday afternoon high tides. For example, Massachusetts personnel started to implement that state's emergency action plan at 9 am, EST, Wednesday morning, coastal evacuations were recommended before the brunt of the storm struck, and people and equipment needed for immediate recovery efforts were, in many areas, pre-positioned by noon. The city of Chatham made plans Wednesday morning to dismiss school early.

State emergency managers in New Hampshire realized that a warning for a high tide 5 ft above normal would be significant, and they passed the word to their county managers by radio or telephone. However, they told the DST that it was difficult trying to convince officials in the coastal communities of the tide's significance.

Some local officials were very responsive in acting on the warnings received. In the town of Scituate, Massachusetts, for example, the emergency services director received word of the storm and drove to the coastal areas to pass the word. (See figures 26 and 27 for damage in that community.) In general, the emergency managers in Massachusetts related weather information to the Blizzard of '78, a storm considered to be a baseline for nor'easters in this part of the country, and realized the potential power the storm packed.

The responses uncovered by the DST in New Jersey, however, were not so positive. The probability of a coastal flooding episode was broadcast over NWR and via NWWS starting on Monday, October 28. By October 31, when the worst flooding occurred (well preceded by a coastal flood warning issued by the WSO), little action was found to have been taken. The local officials (together with the media and the public), although notified, did not seem to grasp the significance of the event even though terms like "historic levels" included in the warnings and statements made it clear that a significant flooding event was imminent. The general manager of the radio station that has Emergency Broadcast System responsibility in the local area told the DST that he read the warning as it scrolled by on The Weather Channel but did not grasp the significance of the words. The wind and rain that normally heightens the public's awareness of coastal storms was absent.

Many of the local officials and media representatives in attendance at a meeting called for the DST in Atlantic City agreed that they saw the warnings and that the message they contained was clear. Still they did not react. There were several reasons given for this apparent unconcern. However, the underlying basis for the lack of action was: Since the skies were fair and there was no strong wind, what could happen?

MEDIA RESPONSE

Overall response by the media was on target. Radio and television stations and newspapers along the East Coast carried all of the warnings and watches issued by the NWS, urged residents of the coastal communities to take shelter, and warned them against watching the storm. The Weather Channel did its usual fine job on reporting this system.

The print media, while lacking the immediacy of the electronic media, published numerous articles all along the affected areas to increase public awareness of storms. Again, the DST received general praise for the flow of information from the NWS. A representative from the Portland Press-Herald, for example, said that he had no trouble getting information from the WSFO and, in fact, was planning to write more weather-related articles to increase public awareness of weather hazards.

The media all expressed satisfaction in receiving timely and accurate forecasts. A reporter from Channel 8 in Portland, Maine, advised the DST that he needs to establish a link with the WSFO and intends to do so. Channel 8 downlinks its information via satellite from WSI Corporation.

One possible problem was mentioned to the DST in this area. Although several of the media listened to the NWR, the consensus was that the warnings on NWR in that area were not updated frequently enough.

PUBLIC RESPONSE

Overall, the public response fell short of the response by emergency managers and the media. The storm was a unique event and was so advertised. However, it was generally not accompanied by what the public perceives as significant weather. Also, like all non-hurricane storms, it was not named.

These two factors seem to have played a significant role in the public's apparent lack of concern about the potential power of the storm. Also, NWS forecasters and emergency managers speculated that the general belief among the populace that October is not the time of year that a destructive nor'easter is likely to occur added to this apathy. Whatever the reason, the public generally disregarded the warnings.

In researching the lack of response by the public, the DST learned from various sources that the public tends not to understand the significance of coastal flood watches and warnings. Coastal residents without previous first-hand experience had no frame of reference. Faced with sunny skies and the lack of significant weather, many residents did not perceive the potential threat.

In the Portland, Maine, area coastal residents said they realized that the storm could potentially be dangerous, but they underestimated its power. Emergency managers said they realized the potential power of the storm but had difficulty convincing coastal communities of the storm's potential power.

In Massachusetts, although a state of emergency was declared, no mandatory orders were given to evacuate. This contrasts with Hurricane Bob when at least two of these orders were issued.

Information about Bob was provided by the NHC. In the case of the **Halloween Nor'easter of 1991**, local offices handled dissemination. In some cases, the lack of hurricane status and the lack of a central information point were related to the public's misconception about the storm's potential impact. This was true even though the statements issued by NWS offices were clearly worded and stressed the extreme dangers inherent with the storm.

The response of some individuals along the Maine coast can best summarize a typical reaction of many other coastal residents. They knew they were in trouble when the water failed to recede after the morning high tide on October 30. Waves were crashing over the seawall at least 2 hours before the next high tide which was set for 4:22 pm, EST, that day. Instead of moving, however, they watched the storm and even videotaped much of it. They moved out of the storm's way only when it became absolutely necessary.

In the Boston area and along southern Long Island, the wave battering was the key to the destruction of property. The coastal residents realized that low tide was considerably higher than normal but did little to protect their property.

The weather awareness of the populace in the Outer Banks area of North Carolina and the reliance they have on the NWR for their emergency weather information was a notable exception to this trend. (Figures 28 and 29 show examples of the result of the storm in this area.) In general, the DST discovered that the use of this medium outside of North Carolina was much less than they expected.

Finally, officials from FEMA also told the team that, in general, people do not respect and understand the power of the ocean. Additionally, they reported that some of the television meteorologists were tending to overreact. This resulted in skepticism and even increased curiosity by the residents. In several areas along the coast, there was considerable traffic by sightseers into threatened areas. Such traffic could have seriously hampered preparedness efforts and needlessly jeopardized lives. The WSFO Boston MIC reported that in Cohasset, people who drove by the beach to view the storm had to be rescued.

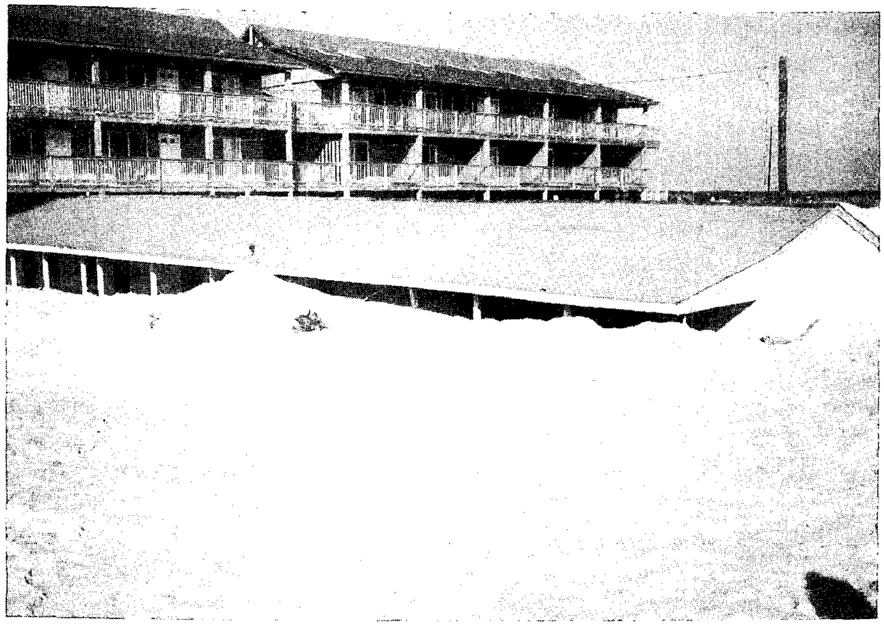


Figure 28. Sand buried motel in Buxton, North Carolina. Photo courtesy of Mark Koehn.

Figure 29. Sand buried beach house in Buxton, North Carolina. Photo courtesy of Mark Koehn.

APPENDIX A - SELECTED OFFICE COASTAL FLOOD INSTRUCTIONS

WSFO BOSTON, MASSACHUSETTS:

WINTER STORM WATCH/WARNING ACTION SHEET DATE:____________

circle type:	WINTER STORM WATCH	WINTER STORM WARNING
	COASTAL FLOOD WATCH	COASTAL FLOOD WARNING
	HIGH WIND WARNING	BLIZZARD WARNING

COORDINATION: Before issuing a watch or warning, coordinate with the appropriate WSO's and WSFO's by phone or by an early SFD.

Note: East Coast Coordination on Hurricane Hotline may be necessary (see instructions in WINTER STORM MANUAL)

Read watch/warning information on NWR __________ and NAWAS_________.
Disseminate watch/warning via Special Weather Statement.

If strong winds and/or high tides may cause coastal flooding, beach erosion, etc., put message on the Coast Guard Circuit __________ (use ACOMMS:XMIT 0) and notify Corp of Engineers with special reference to Stamford, CT.
Corp of Engineers __________ FTS 839-7630 (or 7629)
or #87 (FTS 81-617-647-8630)
(see Coastal Flood SDM for home numbers).

Phone call list:

________MEMA Ops 8a-5p #95 (8-1-508-820-2016)*; 5PM-8am call #96 (81-508-820-2000)* (switch board) ask that receipt of this message be confirmed by MEMA Comms. Director's number 81-508-820-2010 (2011 for secretary). Additional number 1-800-982-6846.

* MA Fiscal crises forces auto transfer of telcon to answering svc between midnight-7am, 7 days/week and also 4pm-midnight sat/sun. The answering svc will ask you if this is an emergency. Say YES and ask them to notify the person on call to give us a call to relay pertinent info. When MEMA calls you, you may wish to coordinate further calls the remainder of the shift.

________City of Boston, Highway Dept. - 482-5300 ext. 169.

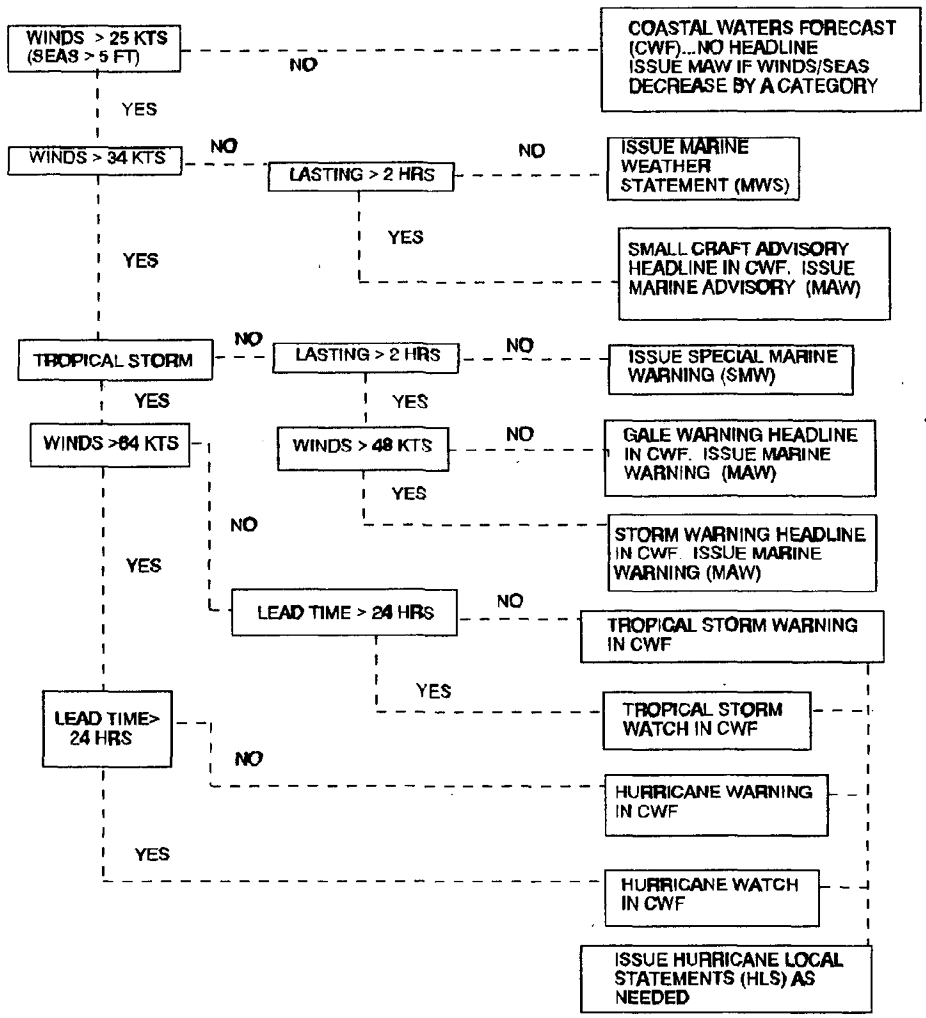
________Red Cross - #94 (1-800-462-2705 then dial 911. Upon answer: day shift ask for Duty Officer; 430 pm-830am give info to a recording).

________Nantucket Police (when included in watch/warning area) 81-508-228-1212.

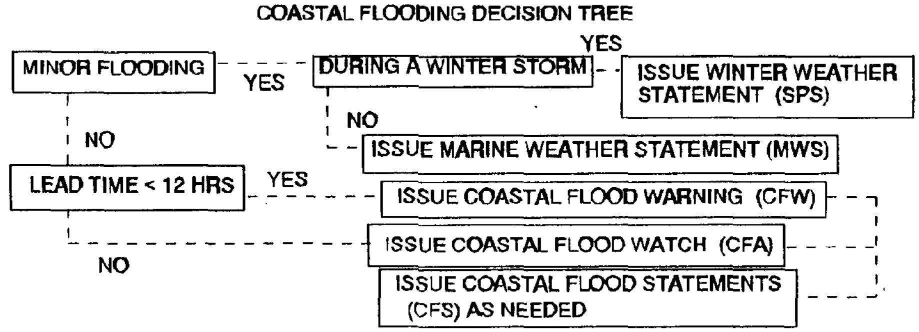
________FEMA - #93 (81-233-9540) (if calling after hours, on weekends, or holidays, ask the answering servce to have Duty Officer call us).

1) Review the staffing situation.
2) Special Weather Statements should be issued every three hours during the on-going storms. Include the time of the next issuance...and meet the deadline.
3) Put snowfall reports for Massachusetts into OPUBOS.
4) For ocean storms...initiate hourly buoy plots.
5) File Non-Routine Board.

Coastal Waters Forecast Decision Tree



COASTAL FLOODING DECISION TREE



WSFO PORTLAND, MAINE:

JULY 1, 1986

TO: ALL

FROM: FRED

SUBJ: TIDE READINGS FROM PORTLAND HARBOR

THE WAY THE TIDE READINGS ARE OBTAINED FOR PORTLAND HARBOR HAS BEEN CHANGED. THE READINGS ARE MADE BY COMPUTER AND THE READINGS MUST BE OBTAINED FROM THE COMPUTER. THE PROCEDURE IS NOT SIMPLE LIKE IT USED TO BE AS THERE IS NO DIRECT READOUT IN THIS OFFICE.

TIDE READINGS ARE STILL AVAILABLE. THEY ARE JUST NOT AS EASY TO OBTAIN. THIS CHANGE IS PART OF A NATIONAL CHANGE TAKING PLACE AS A RESULT OF HURRICANE GLORIA. MANY TIDE GAGE READINGS (INCLUDING OURS) WERE UNAVAILABLE AT THE TIME THEY WERE NEEDED MOST BECAUSE OF POWER FAILURES. THIS SYSTEM WILL STILL PROVIDE A READING AS LONG AS A TELEPHONE LINE IS AVAILABLE.

THE TIDE READINGS CAN BE OBTAINED BY ONE OF TWO METHODS. CALL THE COMPUTER AND GET A VOICE READING. OR CALL THE COMPUTER ON THE TRS-80 AND GET A PRINTOUT OF READINGS AT 15 MINUTE INTERVALS.

THE COMPUTER IS ALARMED TO CALL US ON 780-3552 WHENEVER THE TIDE GOES ABOVE 11 FEET. THE CALL WILL BE A COMPUTER GENERATED VOICE THAT SOUNDS A LITTLE UNUSUAL. IF YOU A FUNNY SOUNDING CALL ON THE FITS LINE, IT MAY BE THE TIDE GAGE CALLING TO ALERT US OF A TIDE READING ABOVE 11 FEET.

TO FIND OUT WHAT THE COMPUTER GENERATED VOICE SOUNDS LIKE, CALL FOR A READING. THE TELEPHONE NUMBER IS 9-871-7215. YOU WILL GET THE IDENTIFIER (ID001). THE TIDE READING, A READING OF BATTERY VOLTAGE, AND A REPEAT OF THE IDENTIFIER. THIS IS THE SAME PROCEDURE FOR OBTAINING A READING.

>>>

SUBJ: TIDE READINGS FROM PORTLAND HARBOR

TO OBTAIN A READING USING THE TRS-80 IS A LITTLE MORE INVOLVED. IT REQUIRES A NUMBER OF COMMANDS TO RESET THE TRS-80 TO THE PROPER PARITY AND THEN RETURN IT FOR HYDRO USE ONCE YOU ARE FINISHED. THE PROPER COMMANDS ARE:

1. STRIKE "BREAK" KEY.
2. TYPE "S" AND ENTER.
3. TYPE "SETCOM A=OFF" AND ENTER.
4. TYPE "S" AND ENTER.
5. TYPE "SETCOM A=)" AND ENTER.
6. TYPE "T" AND ENTER.
7. TYPE "ATDT9,8717215" AND ENTER.
8. AFTER CONNECTION STRIKE "CONTROL S".
9. COMPUTER WILL PRINT THREE LINES OF DATA.
   1ST LINE CONTAINS IS CODE, JULIAN DATE, AND TIME IN EST
   2ND LINE (BEGINS WITH 01) CONTAINS TIDE READINGS
   3RD LINE (BEGINS WITH 02) CONTAINS BATTERY VOLTAGE READINGS
10. AFTER READINGS ARE COMPLETE, STRIKE "CONTROL S" TO OBTAIN PRINTOUT OF OLD DATA.
11. COMPUTER WILL ASK FOR DUMP DATE. SELECT JULIAN DATE FOR WHICH PRINTOUT IS TO BEGIN AND ENTER. (IN SELECTING JULIAN DATE TERMINAL WILL DOUBLE PRINT. THIS IS NORMAL).
12. COMPUTER WILL ASK FOR DUMP TIME. SELECT TIME IN EST FOR WHICH PRINTOUT IS TO BEGIN AND ENTER. (IN SELECTING TIME TERMINAL WILL DOUBLE PRINT. THIS IS NORMAL).
13. READINGS WILL BE GIVEN AT 15 MINUTE INTERVALS FROM DUMP DATE AND TIME TO PRESENT. (TIDE AND BATTERY READINGS).
14. AFTER PRINTOUT HAS FINISHED, COMPUTER WILL ASK FOR ANOTHER DUMP DATE. MAKE NO ENTRIES FOR A LEAST ONE MINUTE. THIS ALLOWS COMPUTER TO DISCONNECT.
15. ONCE DISCONNECT OCCURS, STRIKE "BREAK" KEY.
16. TYPE "S" AND ENTER.
17. TYPE "SETCOM A=OFF" AND ENTER.
18. TYPE "S" AND ENTER.
19. TYPE "DO MODEM300" AND ENTER.
20. TYPE "T" AND ENTER.

>>>

V. COASTAL FLOOD WATCHES/WARNINGS/STATEMENTS

WSOM C-43

Coastal Flooding is defined as being from 2 causes, storm surge and heavy surf. If a MWS is issued for surf conditions, it should headline "HEAVY SURF ADVISORY IN EFFECT".

COASTAL FLOOD WATCHES/WARNINGS and HEAVY SURF ADVISORIES shall be headlined in appropriate coastal zones, local, and marine forecasts.

If coastal flooding is expected due to a winter storm on which we are issuing WINTER WEATHER STATEMENTS (SPS), we can include any coastal flood watch/warning or heavy surf advisory information in the WINTER WEATHER STATEMENT. At other times we will have to teat them as a separate event.

COASTAL FLOOD WATCH..AFOS heading..CFAPWM
A COASTAL FLOOD WATCH should be issued for possible coastal flooding within the next 12 to 36 hours.

COASTAL FLOOD WARNING..AFOS heading..CFWPWM
A COASTAL FLOOD WARNING shall be issued for coastal flooding expected within the next 12 hours.

COASTAL FLOOD STATEMENT..AFOS heading..CFSPWM
A COASTAL FLOOD STATEMENT is used to revise, extend, cancel, or update COASTAL FLOOD WATCHES/WARNINGS.

A MARINE WEATHER STATEMENT (MWS) is used in lieu of the above products during minor coastal flooding episodes or when the severity and extent of coastal flooding are uncertain.

When referring to a forecast or occurence of tidal heights above normal in any statement, watch,or warning concerning coastal flooding, it shall be referenced to the heights above mean low water MLW at Portland as well. (Use NOS tide tables for values). The statement, "To convert mean low water MLW to mean sea level MSL subtract 4.6 feet from the MLW value." shall be included. (from ERH Memo May 6, 1988).

EXAMPLE: The combination of very strong onshore winds and an astronomical high tide early in the afternoon will produce tides 2 to 3 feet above normal at the time of high tide. In Portland, the tide will reach 12.5 to 13.5 feet above mean low water MLW between 1230 PM and 130 PM. To convert mean low water MLW to mean sea level MSL subtract 4.6 feet from the MLW value.

Do not use references to MLW, MSL or exact tidal times in the CWFPWM.

PROBABILITY OF MAXIMUM ANNUAL STORM SURGE FOR PORTLAND, MAINE (based on data 1914-1959) from Fig 5.2 Std Project Northeaster, May, 1963. (feet)

SURGE				SURGE		
1.2	every	1.0	year	2.0	every	1.3 yrs
2.2	every	1.5	yrs	2.5	every	2.2 yrs
2.4	every	2	yrs	3.0	every	4.5 yrs
2.7	every	3	yrs	3.5	every	10 yrs
3.2	every	5	yrs	4.0	every	23 yrs
3.5	every	10	yrs	4.5	every	50 yrs
4.2	every	25	yrs	5.0	every	125 yrs
4.5	every	50	yrs	5.5	every	275 yrs
4.8	every	100	yrs			

>>>

PROBABILITY OF EXTREME HIGH TIDE HEIGHTS AT PORTLAND, MAINE (based on data 1914-1959) from Fig 5.4 Std Project Northeaster, May, 1963. Reference to MLW in feet with respect to tidal datum epoch (1924-1942).

HEIGHT	MAXIMUM ANNUAL SURGE COMBINED WITH ASTRONOMICAL HIGH TIDE ASSUMING SIMULTANEOUS OCCURENCE	*ALL SURGES COMBINED WITH ALL ASTRONOMICAL TIDE, NOT SIMULTANEOUS
10.0......every	1.1 yrs	......every 1 yr
10.5......every	1.3 yrs	......every 1 yr
11.0......every	1.7 yrs	......every 1 yr
11.5......every	2.3 yrs	......every 1 yr
12.0......every	3.8 yrs	......every 2 yr
12.5......every	6 yrs	......every 8 yrs
13.0......every	13 yrs	......every 35 yrs
13.5......every	24 hrs	......every 100 yrs
14.0......every	55 yrs	......every 300 yrs
14.5......every	130 yrs	......every 750 yrs
14.7......		..... every 1000 yrs
15.0......every	370 yrs	
15.4......every	1000 yrs	

*The probability of these heights occuring through 12.0 ft. is higher because these heights are a probability distribution of the quantity total tide at time of maximum annual surge and not the quantity maximum annual total tide. These quantities are the same for high tide heights but not for low tide heights. (p. 53, Std Prjct NEer).

>>>

TOP TEN STORM SURGES SINCE 1914 AT PORTLAND, MAINE

1) 4.3 feet March 3, 1947
2) 4.1 feet March 1, 1914
3) 3.9 feet Dec. 14, 1917
4) 3.6 feet Dec. 19, 1972
5) 3.5 feet Nov. 26, 1950
5) 3.5 feet Feb. 07, 1978
5) 3.5 feet Oct. 30, 1991
6) 3.3 feet Nov. 30, 1945
6) 3.3 feet Aug. 31, 1954 (Hurricane Carol)
7) 3.2 feet Dec. 02, 1942
8) 3.1 feet Mar. 16, 1956
9) 3.0 feet Jan. 15, 1940
9) 3.0 feet Feb. 07, 1951
10) 2.9 feet Nov. 13, 1925

FREQUENCY (RETURN PERIODS)

3.0 feet or higher...once every 4.5 years
last time...February 7, 1978

3.5 feet or higher..once every 10 years
last time...February 7, 1978

4.0 feet or higher...once every 23 years
last time...March 3, 1947

FREQUENCY BY MONTH (all but one from winter storms)

OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	AUG.
1	3	3	1	2	3	1

>>>

TOP TEN TIDES AT PORTLAND (reference height MLLW)

1) 14.17 feet February 07, 1978
2) 13.98 feet January 09, 1978
3) 13.40 feet December 04, 1990
4) 13.31 feet March, 16, 1976
5) 13.29 feet November 30, 1944
5) 13.29 feet November 20, 1945
6) 13.18 feet January 02, 1987
6) 13.18 feet October 30, 1991
7) 13.18 feet April 07, 1958
7) 13.09 feet December 29, 1959
7) 13.09 feet February 19, 1972
8) 13.07 feet January 28, 1979
9) 12.80 feet December 03, 1986
10) 12.79 feet April 28, 1940
10) 12.79 feet January 20, 1961

>>

FREQUENCY (return periods)

13.0 feet...once every 10 years
last time...October 30, 1991
13.5 feet...once every 50 years
last time...February 7, 1978

14.0 feet...once every 170 years

OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	AUG.
1	2	3	4	2	1	2

>>>

SPRING TIDE DATA

Normal 10.4 feet above MLLW
Maximum 11.7 feet above MLLW

WSFO NEW YORK, NEW YORK:

COASTAL FLOOD WATCH CHECKLIST

DATE____________________

Before issuing a Coastal Flood Watch (CFA), coordinate with the following:

Note: Calls to WSFOs might be unnecessary if Watch is discussed during the EAST COAST COORDINATION CALL. Log time of coordination.

1. WSFO Boston FTS 835-4661/2/3 _____ _____

2. WSFO Philadelphia FTS 597-3696/0845 _____ _____

3. WSO Newark 201-DLS-5353
201-624-8098 _____ _____

4. Issue a Coastal Flood Watch statement (CFA) to initiate the Coastal Flood Watch. Make sure the statement contains the UNIVERSAL GENERIC CODE LINE in the header.

5. Broadcast the CFA on NWR. (May be combined with the weather map discussion.) DO NOT tone alert.

6. If watch covers northern New Jersey, make sure NJ SEMO received it (NJ NAWAS) and that it is broadcast on NAWAS. _____ _____

7. Call the NE Bronx Planning day 212-892-1161, night 212-828-0862 _____ _____

8. Advise NY State Warning Point to read Watch Bulletin over NAWAS. _____ _____

9. Call the RED CROSS: 212-787-0210 or 212-870-8855 if serious or major coastal flooding is a potential. _____ _____

10. Inform MIC 718-268-6518 and DMIC 516-331-7206 when they arrive at the office. _____ _____

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11. Issue follow-up statements (CFSNYC) every 3-6 hours.

Note: If a Coastal Flood Watch and Winter Storm Watch/Warning are headlined together, a separate CFS is not needed. Include the CFS info within the Special Weather Statement. Don't forget the UGCs!

Rev. 2/14/91)

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CALL AND COORDINATION LIST: Coastal Flood Warning

COORDINATION PHASE

Before issuing a Coastal Flood Warning (CFW), coordinate with the following:

TIME

INITIALS

1. WSO Atlantic City 609-645-7433 _____ _____
NOTE: do not give out; this is a highly restricted number

2. WSFO Boston FTS 835-4662/63 _____ _____

3. WSO Newark DLS 5353 _____ _____

\>>>

NOTIFICATION PHASE

After a decision has been reached to issue a Warning, and the Warning has been composed and transmitted on AFOS, notify the following:

4. New Jersey SEMO day 609-822-2000 ext 2859 _____ _____
night 609-822-2000

Note: at night, ask that the emergency management duty officer call back immediately

5. Suffolk Co. EMO day 516-924-4400
night 516-286-5354 _____ _____

6. Nassau Co. EMO (Police comm.) day 516-535-7521/6/7
night 516-535-7606 _____ _____

7. Westchester Co. day 914-285-3026
night 914-741-4400 _____ _____

Note: at night, ask county police to page emergency management personnel

8. New York City EMO day 374-5580
night 374-5580 _____ _____

9. Rockland Co. EMO day 914-354-8259
night 941-354-8111 _____ _____

Note: if flooding is NOT expected along the lower Hudson River, do not call.

10. NE Bronx Planning day 212-892-1161
night 212-828-1393_____ _____

11. NY State SEMO day 518-457-2200
night 518-457-2200_____ _____

12. Advise NY State Warning Point to read Warning Bulletin over NAWAS. _____ _____
13. Read Warning Bulletin over NJ NAWAS _____ _____
14. Broadcast Warning Bulletin over NWR. Tone alert only if flooding is expected within the next several hours AND a Watch has not been in effect. _____ _____
15. Phone the RED CROSS: 787-1000/0210 if serious or major coastal flooding is expected. _____ _____
16. Notify MIC 516-543-1317 or DMIC 201-297-5631 _____ _____
17. Issue frequent follow-up statements (CFSNYC) as needed Make sure the time of the next statement is mentioned. Note: If a Coastal Flood Warning and Winter Storm Warning are headlined together, a separate CFS is not necessary. Information normally included in the CFS is to be included in the SPS's issued for the Winter Storm Warning.

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WSO NORFOLK, VIRGINIA:

WSO NORFOLK VA STATION DUTY MANUAL

COASTAL FLOOD WARNINGS
Reference WSOM D-51 and associated ROMLS and OMLS

COASTAL FLOOD PROGRAM
Coastal flooding ranges from minor tidal overflow having little effect to major storm surge inundations with heavy surf. Although it is WSFO Washington's responsibility to issue the COASTAL FLOOD WATCH AND WARNING you should notify them of the potential for significant flooding. It is WSO NORFOLK'S responsibility to issue the COASTAL FLOOD STATEMENT.

1. PRODUCTS

a. COASTAL FLOOD WATCH(AFOS category CFA)- Coastal Flood Watch should be issued by WBC for coastal flooding which is expected in the next 12 to 36 hours. This would be set off at the top of the forecast like any other Watch. ie...Coastal Flood Watch...

b. COASTAL FLOOD WARNING(AFOS category CFW- A Coastal Flood Warning is issued when flooding is occurring or is expected to occur in the next 12 to 24 hours. This too is highlighted before the body of the local forecast. In addition a description of the flooding is given in the body of the forecast and a forecast of the tide crest for the next one or two high tides at Sewells Point should be given in the tide section of the forecast.

c. COASTAL FLOOD STATEMENT(AFOS category CFS M:CFS). A Coastal Flood Statement is issued by WSO NORFOLK to update the public on why a Coastal Flood Watch or Warning has been issued and the expected coverage and extent of tidal flooding for ALL of eastern Virginia. Normally you would issue a CFS just after a Watch or Warning were issued and at least every six hours during a Watch or Warning. There are numerous help sheets in the rear of this section that will give tidal relationships between Sewells Point and other locations in our area of responsibility. Don't hesitate to call any of the normal cooperative observers...County or City agencies...or Amateur Radio observers to get information on the severity or extent of flooding.

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SOURCES OF WATER LEVELS...TIDAL INFORMATION OR SPECIAL WARNING INFORMATION page E.4 10/8

I. LOCAL TIDE GAGES AND/OR RECORDERS

1. Sewells Point, Pier 2 at Norfolk Navy Base. Handar 423-6725.
2. South Island Chesapeake Bay Bridge and Tunnel, Handar 464-2208.
3. City Seawall Pumping Station, dowtown Norfolk. Telemark 441-5396. Coded message...subtrack 1.0 to get MLW reading.
4. Fort Norfolk, Corps of Engineers, hours 8 to 5, M - F, 441-3665. Subtrack 0.5 for MLW.
5. Portsmouth Naval Shipyard...recorder in OD office, 24 hours 396-3221 subtrack 92.89 from reading to get MLW.
6. Langley AFB...local 622-0052 ask for field weather or weather forecaster or 1-764-5908.

II. INFORMATION FROM OTHER LOCATIONS IN OUR COUNTY WARNING AREA

1. Gloucester Point...VIMS...8 to 5 Mon - Fri...1-642-7272 ask for Dr. Boone or Mr. Thomas. They must manually read.Alternate phone 1-642-7000 (switchboard)
2. Lewisette Marina, VA. Mr.Scerbo 529-7299 ...NOS Gage..They read it in the morning but can give you a manual look see.
3. Wachapreague...787-5816...recorder, business hours only. Subtract 2 feet for MLW or ask for the reading in MLW.
4. Colonial Beach...NOS recorder...telemetered to WSFO, Washington or call observer Mr. Jackson 224-7066.

III. COAST GUARD
Coast Guard reports are available at the three hourly intervals...However...they can be obtained as often as needed by conatcting CG Headquarters in Portsmouth or call the station direct. While tide data is not part of the station reports some of the stations might be able to give estimated heights of tides

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IV. FORECASTING TIDE LEVELS AND AREA CRITICAL TIDE LEVELS

1. There is a forecast program in the ABT that will give you an estimate of the tide levels throughout our warning area based on the Sewells Point estimated crest. You can use your own subjective forecast crest for Sewells Point or use the objective forecast found in AFOS under WBCMRPECS.
   a. At ABT hit ESC (this will take you out of the program)**
   b. Type B:...then return
   c. Type Basic...then return
   d. Type Load"Tides"...then return
   e. Type Run
   f. At this point the program will be self explanatory. When you are done to return to the normal ABT system Type System...return, Type A: ...return, Type ABT...return. You should then be back to normal.

**PRINTER MUST BE IN THE B POSITION AS FORECASTS ARE PRINTED ON IT.

2. Critical Tide Levels

	Minimum Flood	Major Flood	Tide of Record
Norfolk	5.0	6.5	9.7 All Heights MLW
Yorktown	4.0	6.5	9.7
Gloucester Pt	5.0	6.0	7.1
Urbanna	3.0	5.0	5.7
Gwynns Is.	5.5	7.5	8.0
Muddy Creek (Near Belle Haven)	2.0	4.0	5.2
Tangier Is	2.0	3.0	4.2
Cape Charles	3.0	5.0	8.4
Wachapreague	7.5	11.0	12.3
Chincogteague	2.5	6.0	8.4

REMEMBER...GIVE TIMES AND HEIGHTS OF THE TIDE ABOVE MEAN LOW WATER...ABOVE NORMAL...AND IN EXTREME FLOODING ABOVE MSL.

ESTIMATED TIDAL RECURRENCESINTERVALS(from Corps House Document 215 2/3/64)

RECURRENCE INTERVAL YEARS	MAXIMUM TIDE LEVEL(abv MSLaadd 1.25'to get MLW) NORFOLK NAVAL SHIPYARD PORTSMOUTH	SEWELLS POINT
1	4.4	3.8
5	5.5	4.9
10	6.2	5.5
25	7.1	6.3
50	7.8	6.9
100	8.5	7.6

The standard project flood...1 in 500 year storm...is 15' MSL in downtown Norfolk and 13' MSL at Sewells Point.

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TIME AND NORMAL TIDAL DEPARTURES FOR OTHER LOCATIONS BASED ON SEWELLS POINT

	HIGH WATER Height Time	LOW WATER Height Time
Outer Coast		
Virginia Beach	+0.9 -1:30	0.0 -1:35
False Cape	+1.1 -1:45	0.0 -1:45
Cape Henry	+0.3 -0:52	0.0 -1:15
Chesapeake Bay		
Lynhaven Inlet	-0.5 -0:13	0.0 +0:01
Bayville(Lynhav-en)	-0:8 +0:46	0.0 +1:38
Newport News	+0.1 +0:20	0.0 +0:18
Jamestown	-0.6 +2.54	0.0 +3:26
Smithfield	+0.3 +1.25	0.0 +1:18
Gloucester Point	-0.1 +0:16	0.0 +0:07
Yorktown	-0.1 +0:16	0.0 +0:07
Windmill Point	0.48xSP+1:49	0.48xSP+2:08
Urbanna	0.56xSP+2:38	0.56xSP+2:59
Gwyns Island	0.52xSP+1:25	0.52xSP+2:02
Chesapeake Bay Western Shore		
Muddy Creek	-0.3 +3:14	0:0 +3.43
Tangier Sound Light	0.64xSP+2:51	0.64xSP+2:48
Onancock	-0.77 +2.52	0.0 +3:09
Cape Charles	-0.1 -0:18	0.0 -0:03

Outer coast of the Eastern Shore should be taken off Sandy Hook NJ using the NOS Tide Tables. An approximation of the surge can be obtained by using our surge and that for BWH. There is also an hourly listing of the tides for Wallops Island in the SDM.

REFER TO THE NOS TIDE TABLES FOR THE LATEST INFORMATION AND FOR OTHER LOCATIONS NOT LISTED ON THIS SHEET.

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COASTAL FLOOD WARNING CALL LIST
WSO NORFOLK VIRGINIA

MAKE COPIES

The forecast office in Washington has the primary responsibility for issuing a COASTAL FLOOD WATCH AND WARNING. However, if time does not permit a coordination call, the final responsibility rests with us especially for the Hampton Roads Area where we have tide information and a forecast (WBCMPECS). For local purposes a COASTAL FLOOD WARNING should be issued whenever the local height above MLW will be 5.5 to 6 feet or greater. A COASTAL FLOOD WARNING issued by WBC will be followed as soon as possible by a COASTAL FLOOD STATEMENT M:CFS. The COASTAL FLOOD STATEMENT will also be used for all coastal flood information that may be issued following a Coastal Flood Watch issued by WSFO Washington. SEE OPERATIONS MANUAL LETTER 2-86 FILED WITH CHAPTER D-51 IN THE WSOM.

DISSEMINATION FOR COASTAL FOOD WARNING

1. Call the MIC
2. Prepare a Coastal Flood Statement M:CFS..address to ce and put it on the NWR. Use TONE ALERT for the first statement of each new Coastal Flood Warning.

DATE/TIME ISSUED ______________________

CALL LIST

( ) Virginia Office of Emergency Services (read statement on NAWAS if WBC hasn't done so)

( ) Virginia State Highway Department 494-2451 nights 487-3546

( ) Red Cross if major evacuation expected 446-7745 nights 427-3823 (Rick Russell)

( ) Virginia Beach O.E.S. 427-4192/4228, Home 486-1340 Mark Marchbank

( ) Portsmouth O.E.S. 383-8551, Home 383-1800 Donald Brown

( ) Norfolk, O.E.S. 441-5600/5610 Home 497-1277 Jim Talbot

( ) Hampton, O.E.S. 727-7414 Home 722-4850 Kurt Schaffer

Any local statements that you feel are significant should go on NAWAS and brought to the attention of those communities affected.

There will be many cases where WBC will issue a Coastal Flood Warning that you feel does not apply to coastal Virginia. If you have a Warning where it appears our tides will not go to 5.5 feet or higher, the calls are optional based on the amount of time you have. If you do call, make sure you give some sort of a tide crest forecast at a minimum for Sewells Point with estimates for the other areas. See the following pages in this section for forecast hints on estimating tide heights.

An example of a Coastal Flood Statement is on the next page.
...TIDES ABC INTERROGATION INFORMATION IN THIS SECTION...

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THE LISTED ARE DESCRIPTIONS OF THE EXTENT OF FLOODING CAUSED BY SPECIFIC TIDAL FLOOD EVENTS.

April 13, 1988
Two high tides approximately 7AM and PM..The tide reached 5.8 feet above MLW at the Seawall and 5.9 feet above MLW and South Island for both high tides. The storm was caused by a closed low aloft that drifted east through Alabama, Georgia etc. the surface low was basically vertical with the upper low and was just east of Wilmington NC during the morning high tide and about 100 miles see of HAT at the time of evening high. Winds from the ENE to NE persisted from the previous afternoon and averaged 30 to 40 MPH prior to the morning and evening high tide. Peak gusts over 50 knots occurred at the coastal marine reporting stations until mid afternoon when they diminished prior to the evening high tide.

Norfolk....no damage, numerous streets were flooded some impassable. The dock area from the Omni east through Bessies Place had water 2 to 4 feet deep. The Tidewater Park area had flooded streets and at least two homes had water a couple of inches deep into the living area. Ocean View and Willoughby had street flooding that backed up from street drains. The beach that was re-built two years ago saved them from structural damage from buildings too near the water. Erosion on the beaches was just under moderate.

Hampton...no significant damage, water into 4 homes numerous streets flooded and some impassable. Most of the flooding was in Buckroe and the Grandview areas and along Hampton Creek.

Poquoson...many streets covered with 4 inches to 2 feet of water. 8 homes known to have water in them, 200 to 300 had water around them.

Portsmouth...no homes and no damage, Crawford Pky and a few other streets were impassable.

Chesapeake...no known flood problem.

Newport News...no known flood problem.

Virginia Beach...damage estimated at 3.6 million. Street flooding mainly in the Lynhaven Shores, Bay Island, and some in Bay Colony. The majority of the damage occurred in Sandbridge from erosion and wave action. One home almost totally destroyed, 3 homes with major damage. A large section of Sandfiddler Road was undermined and collapsed.

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APPENDIX B - SELECTED STATE FORECAST DISCUSSIONS

STATE FORECAST DISCUSSION
NATIONAL WEATHER SERVICE RALEIGH/DURHAM, NC
244 PM EDT SAT OCT 26 1991

GENLY SAME FCST AS PAST SVRL WITH A COUPLE OF WRINKLES. FIRST SL MENTION PATCHY DENSE FOG IN MUCH OF CNTRL AND NEARLY SUN MORNING SINE HAD LOTS OF LOG THIS MORNING..AND BECAUSE NGM BNDRY RH FCST NR 100 PCR OVERNIGHT AND LO LVL THICKENS CHART THIS MRNG SHOWD WEAK WEDGE OVR PIEDMT. HAVE CONTD TO TRACK BAND OF WDLY SCT SHOWERS OVER OPEN WATERS MOVG WWD TWD NC CST. SINCE FEW MOVED INLAND LAST NIGHT..WL MENTION 20 PCT CHC RW FOR CSTL ZNS..BUT WL RESTRICT ANY OTHERS TO CSTL WTRS SUN/SUN NGT. TRMW PTLY CLOUDY WITH LTL TEMP CHANGE .. THINK GUID TEMPS AGAIN TOO LOW.

MAIN WX FTR TO CONCRND WITH IS MNLY A MARINE PROBLEM..FOR NOW UPR LO WHICH HAS NOW WORKED ITS WAY DOWN TO SFC NR 28N 66W IS FCST BY MIA TO MOVE NW TO 30N70W (PER HIGH SEAS FCST) WITH 360 NM OF GALE FORCE WINDS IN NRN SEMICRCL. THIS PUTS GALE FORCE WINDS WITHIN 60 MILE OF HAT BY LATE SUN. SAT PIX SHOWS SYSTEM IN GULF MEX MOVG EWD AND ITS OUTFLOW IS WRAPPING AROUND SYSTEM OF CONCERN.. AND ITS OUTFLOW HAS BULGED BACK WNWWD IN RESPONSE. AVN MODEL AND MOST OTHER MDLS INCLUDING EUROPEAN MODELS TAK SYSTEM ON N.NOT NW OR W. BUT NGM HAS BEEN CONSISTENT IN PAST 2 TUNS IN CXSTS CLOSD SFC LO CNTR NT 28W 75W..AND LOOP OF NGM BNDRY WINDS SHOWS WATCHG.FOR NOT WL UP WNDS TO 25 TO 30 KTS FOR CSTL WATERS BY SUN NGT..BUT TOO FAR AWAY IN TIME TO ISSUE SCA.

VERY DEEP WRN U.S. TROF FCST TO DEVELOP NEXT 36-48 HRS WITH RDG AMPLIFY IN E. UPR TRO OFF NE U.S. CST DEEPENS A LTL LATE IN PD AND NGM/AVN BOTH HINT AT SUBTLE PSBL BACKDOOR FROPA INTO NERN NC ON MON AFTERNOON. WL SHADE TEMPS DOWNWARD THERE ON CAUTIOUS SIDE..NC...NONE GAF

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FORECAST DISCUSSION OF SOUTHERN NEW ENGLAND
NATIONAL WEATHER SERVICE BOSTON MA
320 AM EST SUN OCT 27 1991

AREAS OF FOG ONCE AGAIN EARLY AM. ALTHO A REPEAT OF THE PAST 2 OR 3 MORNINGS..WL PROBABLY ISSUE SPS.

MODELS RELATIVELY CONSISTENT IN HANDLING OF S/W TROF TO PASS THRU NE US TNGT. MOST ENERGY PASSES N OF FCST AREA SO HAVE KEPT POPS IN CHC CAT. ALTHO INCRSG MID/HI CLDNS...SOME SUN AND MILD TEMPS SHOULD PREVAIL TDA ONCE FOG THIS OUT. BASED ON CUR TRENDS...HAVE RESTRICTED ANY CHC SHWRS TDA TO JUST WRN ZNS. CHC TSTM THIS EVE MAY BE LTL HEIR W THAN INDCTC ON FPC BUT STILL NOT VRY LKLY GIVEN ORIENTATION OF INSTBLTY AXIS AND DYNAMICS.

IMPRESSIVE CAA MON BHND S/W TROF WITH INCRSG N TO NE FLOW. GRADIENT IN CAA PATTERN CUD SUPPORT GALES OVR MUCH OF MARINE AREA MON. HYBRID LO PRES SYSTEM SW OF BERMUDA BEARS WATCHING..SPECLY FOR INCRSG SWELLS IN A COUPLE OF DAYS..BUT WL PROBABLY REMAIN WELL S AND E OF AREA.

HI AMPLITUDE PATTERN TO CONTINUE AS INDCTD BY LTST AVN RUN OUT TO 72 HRS. THUS CANNOT REACH THE ONSET OF THE WARMER RETURN FLOW IN THE EFP.

WRKZFP AVBL FOR YOUR REVIEW/COMMENTS.
.MA...NONE. GALES MAY BE REQUIRED MON MAZ501-502 AND OFFSHORE.
.RI...NONE. SCA MAY BE REQUIRED MON FOR RIZ501.
.CT...NONE.
REFER TO NYCCWFNYC FOR MARINE ADVYS/WRNGS.

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STATE FORECAST DISCUSSION
NATIONAL WEATHER SERVICE NEW YORK NY
230 PM EST SUN OCT 27 1991

DISC: INTERESTING FCST.

FIRST FCST PROB IS FOG. 18Z USCG STATIONS REPORTED VSBY FM 0 TO 1 MI IN FOG. USCG AT SANDY HOOK AND ROCKAWAY REPORTED 0 MI IN FOG AND FIRE ISLAND REPORTED 1/2 MI IN FOG. WITH SFC COLD FNT JUST MVG INTO EXTREME WRN NY AND PA...THERE IS NO MECHANISM TO IMMEDIATELY LIFT FOG. WILL ISSUE DENSE FOR ADVISORY FOR ALL COASTAL AREAS TNGT. FOG WILL LIFT WITH PASSAGE OF FNT LATE TNGT.

SECOND FCST PROB IS CHC OF WHWRS TNGT. LEADING EDGE OF LGT SHWRS IS OVER WRN NY AND PA. SHWRS MVG NE BETWEEN 20 AND 25 KTS. BEST CHC OF SHWRS WILL FCST FOR NW NJ..ZONE 1 AND ROCKLAND AND WESTCHESTER COUNTIES..NY ZONE 14. WILL IGNORE FWC PERCENT PROG POPS OF 20 PERCENT IN FOURTH PD. ATTM..SEE NO JUSTIFICATION FOR THESE POPS.

THIRD FCST PROB IS WINDS. SFC LOW NORTH OF NY INTENSIFIES AS IS MVS EAST..THEN COMBINES WITH THE CIRCULATION OF TROPICAL STORM GRACE WLL OFFSHORE DURING MON. SFC WIND GRAD BETWEEN STORM LOW PRES SYSTEMS OFFSHORE AND HIGH PRES SYS OVR SE CANADA INCREASES SIGNIFICANTLY OVER AREA MON. ATTM. WILL ISSUE GALE WARNINGS FOR COASTAL WATER INCLUDING LI SOUNDS AND SCA FOR NY HARBOR.

GET READY FOR SIG CHILL. AUTUMN RETURNS TO THE AREA.

. NY...SERN...DENSE FOR ADVY TNGT Z14>17
... GALE WARNINGS FOR COASTAL WATERS AND LI SOUND
... SCA FOR NY HARBOR
.NJ...NRN...DENSE FOR ADVY TNGT Z05-07-15
...GALE WARNINGS FOR COASTAL WATERS

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STATE FORECAST DISCUSSION
NATIONAL WEATHER SERVICE / RALEIGH, DURHAM, NC
222 AM EST WED OCT 30 1991

WILL MAKE SOME ADJUSTS TO CSTL WRNG AND ADVSY. WILL DROP GALES BACK TO SCA S OF CAPE LOOKOUT...KEEPING GALE AND CSTL FLOOD WRNGS CAPE LOOKOUT N. ALSO HEAVY SURF ADVSY ALG OUTER BANKS TDA. MODELS CONTF TO POINT TO WNDS GRDLY BCMG MORE NE AFT TDA AS LARGE SFC LO PRES MEADERS ARND OFFSHR OF MID-ATLC RNG. ALTHO WNDS STILL BE RESPECTABLE ALG UPR CST TDA AND ON INTO THU...LOOKS AS THO THEY MAY DMSHG SOME AS THEY COME MORE FROM OFF LAND. THIS DOES PRESENT A PRBLM WITH SOME SOUND SIDE FLOODING ALG OUTER BANKS TNGT AND THU AND WILL MENTION THAT IN OUTER BANKS FCST. OTRW BLOCKING PATN ALF WILL KEEP THINGS MOVING ALG RATHER SLOWLY BUT BEGINNING TO SEE THE OMEGA BLOCK WEAKENING SOME WITH TIME. MAY BEGIN TO SEE SOME CLDS CREEPING INTO W TNGT AND THU AND THIS IS REFLECTED IN CURRENT FCST. GENTLY OTHER ASPECTS OF FCST LOOK OK AND WILL ONLY MAKE AN MINOR ADJUST CAPE LOOKOUT N
.NC... GALE WARNINGS CSTL WATERS HERE AND THERE.
...HEAVY SURF ADVISORY ZONE 1.
...CSTL FLOOD WARNING S OF VA BEACH TO CAPE LOOKOUT.
...SCA S OF CAPE LOOKOUT AND ON ALBEMARLE AND PAMLICO SOUNDS.

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STATE FORECAST DISCUSSION
NATIONAL WEATHER SERVICE RALEIGH/DURHAM, NC
316 PM EST SUN OCT 27 1991

TROPICAL STORM GRACE CONTINUES TO INTENSIFY WITH 988 MB OBN LAST RECON AND MAY RCH HRCN STRNGTH..AND CONT MOVG NW UNTIL IT SHUD TURN MORE TO N. LONG PD SWELLS HAVE ALREADY LAPPED AT THE CSTLN AND HVY SWELLS WL CONT TO MOVE ASHORE TNGT THRU AT LEAST MON NGT. SO WL CONT HVY SURF ADV FOR ENTIRE CST...SEAS ARE UP TO 13-15 FT AT 41001 BOUY 130 MI E OF HAD AND 7-9 FT AT DIAMOND SHOALS. SITUATION WL GET EVN WORSE MON INTO TUE AS STG HI PRES BLDS SE SM SERN CAN. DRY CDFNT WL PRECEDE THIS HI PRES SYSTM. EXPCT FNT TO MOVE INTO NRN CSTL WATERS LATE MON AFTN OR EARLY EVE. SINCE THIS IS CLOSE ENUF TO THE 24 HR THRESHOLD FOR ISSUING GALES..PLAN TO ISSUE GALE WARNINGS FOR CSTL WATER N OF CAPE LOOKOUT. WNDS MAY ACTUALLY GO MORE NLY MOE NGT WHICH WL MAZIMIZE SEAS ALG THE CST. WITH MORE THAN 10 FT SEAS CAN GET SOME PROPERTY DMG FM MAJOR EROSION AND/OR FLDG..SO PLAN TO ISSUE CSTL FLD WATCH FOR OUTER BANKS...ZN 2 FOR MON INTO TUES. TIME OF HI TIDE THERE IS JUST BFR NOON MON.

OTRW NGM BNDRY MSTR SHOWS BAND OF HI RH ALG FNT LATE MON/MOD NGT SPCLY IN NE. SO...CAN ENVISION PILY-MOSTLY CLDY SKIES FOR A WHILE MON NGT AND TUE..WITH STG COOL ADVCTN. WL SAY WNDY E/BREEZY W AND COOLER TUE STATEWIDE.

SML CHC SHWRS NOT OUT OF QSTN IN MTNS AS PER GOING FCST DUE TO TN PRECIP PSLY MOVG E..SO DO NOT PLAN TO CHG.

DO NOT EXPECT WNDS TO INCRS TO SCA CRITERIA TIL MON OVR SOUNDS SO WL NOT ISSUE SCA THERE. WL LV UP SCA CSTL WATERS AN DIMPLY GALES MON NGT.

.NC...HEAVY SURF ADVISORY ZONES 1 AND 16
...GALE WARNINGS CSTL WATERS S OF VA BEACH TO CAPE LOOKOUT
...SCA CTSL WATERS FM S OF CAPE LOOKOUT TO LITTLE RIVER INLET
...CSTL FLOOD WATCH MON INTO TUES OF VA BEACH TO CAPE LOOKOUT

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STATE FORECAST DISCUSSION
NATIONAL WEATHER SERVICE NEW YORK NY
830 PM EST MON OCT 28 1991

DISC: EVEN ANAL SHWS STRN HI E OF JMS BAY IN CAN LO PRES SE OS NS AND OFF COURSE HUR GRACE W OF BERMUDA. ALL THREE OF THESE SYS WL PLAY A MAJOR ROLE IN OUR WX DURG THE NXT DAY OR TWO. FIRST HI PRES WL GV US CLR SKIES TNGT AND TMRW AS IT MOVES EVER SO SLOWLY EWD. THIS SYS COMB WITH LO SE WL LV GALE WRNGS UP OVERNGT FOR CSTL WTRS AND KP WINDY IN OUR FCST. SEAS WL BLD AS WELL OVERNT AND SWELLS WITH EFFECT CSTL AREAS. CUD SEE SOM BREACH EROSION AND SM POSS FLDG AT TIMES OF HI TIDES MNLY ON TUE ARND NOON FOR SNDY HK AND N SIDE OF MONTAUK. WL HV TO KP EYE ON THIS ANY MAY HV TO FOLLOW UP WITH A STATEMENT BY MRNG..BUT WL LV THAT UP TO MRNG FRSTR TO SEE HOW SNDS ARE BLOWING. RGT NOW ALL IS GD.

NO REAL CHNGS TO FCST OCKG ATTEN..WL KN MINOR ADJUSTMENT. WL KP GALE WNGS OVR NJ CSTL..NY HRBR AND LI SOUND. ALSO HEAVY SURF ADVY OVR JJ CSTL AND ERN LI FOR TNGT THRU TUES.

.NY...SERN...GALE WRNG FOR COASTAL WATERS...LI SOUND....AND NY HARBOR. HVY SURF ADVY FOR ERN LI.
.NJ...NRN...GALE WRNG FOR COASTAL WATERS AND HVY SURF ADVY FOR CST.

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STATE FORECAST DISCUSSION UPDATE
NATIONAL WEATHER SERVICE RALIEGH/DURHAM, NC
1035 PM EST MON OCT 28 1991

CSTL FLD WRNG WAS ISSUED BECAUSE WNDS/SEAS INCREASED SIGNIFICANTLY THIS EVE. DUCK PIER WEST TO 12 FEET. HISTORICALLY SOME OVERWASH HAS OCCURRED OUTER BANKS WITH DUCK AT 10FT. IN CSTL WTRS DSLN7 TO 16 FT FROM 14Z 8 FT...WHILE 130 E OF HAT BOUY UP FROM 16 TO 18 FT. MEANWHILE WHILE CFP PASSAGE SFC GRADIENT TIGHTENED AND NE WNDS AT OREGON INLET..HAT INLET...AND ON OCRACOKE INCRS FROM 15 KTS (21z0 TO 30--35 KTS. ALSO DOPPLER AT WBS SHOWED 45 IN BNDRY LAYER. SINCE SUNOPTIC PATTERN SO FAVORABLE FOR CSTAL FLOODING OVER PROLONG PERIOD FELT LIKELIHOOD OF FLOODING WITHIN NEXT 12 HOURS TOO LIKELY TO LEAVE AS WATCH.

FEW CHNGS TO INLAND ZNS. FNT VCTY OF SE CST VERBAL CLDS WITH IT.

.NC...GALE WARNINGS CSTL WATERS AND ABEMARLE AND PAMLICO LOOKOUT
...HEAVY SURF ADVISORY ZONES 1 ASND 16
...SOUND FLOODING LIKELY SOUTH END OF PAMLICO SOUND.

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STATE FORECAST DISCUSSION
NATIONAL WEATHER SERVICE RALEIGH/DURHAM,NC
253 PM EST MON OCT 28 1991

SEAS CONT TO BLD ALG CST. WL CONT GALE WRNGS N CST AND UPGRADE TO MINIMAL GALE WRNGS CST. HURCN HAS SLOWED TO CRAWL AND SINCE STILL TO TIGHT GRADIENT NTWN STG HI BLDG IN AND THE HURCN. WL ALSO ISSUE GALE WRNGS FOR SOUNDS WITH 25035 KTS MENTIONED. UPR LO/HURCAN MAY GET ADSORBED IN TROP EXITS CAN MARTIMES...THEN REORGANIZE INTO ANOTHER DEEP UPR AND SFC LO...PER NE MODEL RUNS. A GLANCE AT THE OXU...UKMET SCENARIO FRO THURS EVE WOULD RAISE YOUR EYEBROWSI...WITH DEEP LO ONCE AGAIN BTWN HAT AND BERMUDA. AGREE WITH NMC HEMISPHERIC DISCUSSION THAT POTENTIAL EXISTS FOR PROLONGED PD OF PSBL CSTL FLDG. SINCE HAVE NOT HAD DLDG PROBLEMS AS YET...WL NOT UPGRADE TO WRNG...BUT WK EXTEND CSTL FLD WATCH THU WED.

BAND OF LO CLDS ACRS NE 1/2 OF NC ASSOCD WITH CDFNT..WITH RAIN REPORTED AT ECG PAS HR. MODELS GIVE CLR TO SCT FOR CLD GUID MOST AREAS TNGT SO THAT/S NOT BELIVERED. WL GO WITH MSTLY OR PRLY CLDY MOST PLACES. ALSO...WINDY SPCLY IN E...THRU TUE. MUCH COOLER TEMPS EXPECD. BUT THEREIN LIES NEXT PROBLEM. PPC TEMPS BLO FREEZG AT RDU...GSO...AVL TUR NGT. WITH WINDS AND LO LVL MSTR PERHAPS HANGING ARND...WL OPT FOR HIER NGM TEMPS...IN MID 30S TO AROUND 40 FOR NOW.

ALSO...PLAN TO MENTION SHALLOW SOUNDSIDE FLOODING PSBL IN ZN 17 ON S SIDE OF PAMLICO SOUND TNGT AND TUE ESPECIALLY AT TIME OF HI TIDE.

.NC...GALE WARNINGS CSTL WATERS AND ALBEMARLE AND PAMLICO SOUND
...HEAVY SURF ADVISORY ZONES 1 AND 16
...CSTL FLOOD WATCH THRU WED S OF VA BEACH TO CAPE LOOKOUT.

GAF

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STATE FORECAST DISCUSSION
NATIONAL WEATHER SERVICE NEW YORK NY
930 AM EST MON OCT 28 1991

DISC: STG HI PRES OVR EN CAN WILL INTSFY GRDNT AND GIVE US STRG WINDS OVER FCST AREA THU TUES. HUR GRACE MVG NWD AND THEN NEWD WILL REMAIN WEL OFFSHR...THIS WILL CMBN WITH THE HI PRES OVER CAN WITH CONT STRONG WINDS.

HAVE GALE WARNINGS OVER NJ CSTL..NY HARBOR AND LI SOUND. ALSO HEAVY SURF ADVY OVER NJ COASTAL AND SERN FOR TONIGHT THRU TUES.
NO ADJ FOR TEMPS.
.NY...SERN...GALE WRNG FOR COASTAL WATERS...LI SOUND...AND NY HARBOR.HVY SURF ADVY FOR ERN LI.
.NJ...NRN...GALE WRNG FOR CSTAL WATERS AND HVY SURF ADVY FOR CST.

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FORECAST DISCUSSION FOR SOUTHERN NEW ENGLAND
NATIONAL WEATHER SERVICE BOSTON, MA
315 PM EST MON OCT 28 1992

GRACE...SEE TCPATI AND TCDAT1.

DANGEROUS OCEAN STORM EXPECTED TO AT LEAST AFFECT MA THRU AT LEAST FRIDAY WITH WIND AND HEAVY SURF AND MAYBE RAIN WED-FRI. SEE PMDHMD/EPD.

BASICALLY THE FIRST STG WIND SURGE W CAA APPEARS TO HAVE OCCURRED LATE THIS MORNING. CHH PEAK 53 MPH; FALMOUTH 52 MPH AND KALMUS 51 MPG. TIGHTEN UP AGAIN SOMETIME WED OR THUR. MODELS TAKE A PIECE OF GRACE A SPLIT IT NE LEAVING LOTS OF TROP JUICE BEHIND TO INTERACT W UNUSUAL AND NEAD RECORD UA ANOMALIES AND HFC DEVELOPING S OF BENCH MARK LATE TUE AND CARVING OUT A MAJOR OCEAN STORM SSE OF BENCHMARK. SO ANOTHER HIGH WIND EVENT MAY OCCUR MIDWEEK...HEAVY SURF ADVYS HAVE EVEN BEE ISSUED BY THIS OFFICE AND WILL HOLD OF ON SAME UNTIL MRPECS CAN GIVE US MAJOR BEACH EROSION PBLM WHICH IS POSSIBLE DURING MINOR LATE WK. WILL CONT AND ZFP MENTION OF BEACH EROSION.

EFPMA HAS BEEN ADJUSTED FOR POTENTIAL RAIN/HIGH WIND BASED ON ECMWF/UKMET EVEN FURTHER W THAN MRF AND STM CENTER 12 TO 18MB DEEPER THAN MRF. SINCE SO MUCH COLD AIR DRIVING SW INTO THE SYSTEM ACRE E NEW ENG NEXT 24 HRS...MAJOR OCEAN STORM APPEARS LIKELY AS THE COLD AIR MIXES W WARM TROP WTERS AND LEFTOVERS FROM FRACE. IT CONCEIVABLE 60KT WINDS MAY B N OF THE ENTER OF THE NEXT 4/5 DAYS.

BLV LK EFFECT SHWRS A REASONABLE POSSIBILITY TUE AM CAPE CODE AS- 5 IN NRN MARINE ROLLES OVER THE +12 h20 OFFERING 17 SPREAD EARLY TUE. 7H/8H/BL FLOW SIMILAR WHICH IS FVBL FOR SUSTAINING SHWR COLUMNS THO INVERSION WILL CAP POTENTIAL. HAVE ADDED CLDS TO CAPE AND SE MA THIS THINKING IN MIND. ALREADY FPC GUIDANCE WAY TOO COLD AT ORH INCLUDING TO DRY.

FPC GUIDANCE RAISED CONSIDERABLY HIGHER ALL STNS NEXT 4 PRDS. BL OF 35 OVER HTO OF 54 GIVE LOW OF 45 ON CAPE. THEREFORE GUIDANCE ADJUSTED.

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STATE FORECAST DISCUSSION
NATIONAL WEATHER SERVICE RALEIGH/DURHAM, NC
253 PM EST MON OCT 28 1991

SEAS CONT TO BLD ALG CST. WL CONT GALE WRNGS N CST AND UP\GRADE TO MINIMAL GALE WRNGS S CST. HURCN HAS SLOWED TO CRAWL AND SINCE STILL TO THE SE OF HAT...PROLONGED PD OF SWELLS MOVG ASHORE EXPECTED..AS WLL AS TIGHT GRADIENT BTWN STG HI BLDG IN AND THE HURCN. WL ALSO ISSUE GALE WRNGS FOR SOUND WITH 25-35 KTS MENTIONED. UPR LO/HURCAN MAY GET ABSORBED IN TROF EXITS CAN MARTIMES...THEN REORGANIZE INTO ANOTHER DEEP UPR AND SFC LO...PER NEW MODEL ROUNDS. A GLANCE AT THE OXU...UKMET SCENIONATIO FOR THUS EVE WOULD RAISE YOUR EYEBROWS!...WITH DEEP LO ONCE AGAIN BTWN HAT AND BERMUDA. AGREE WITH NMC HEMISPHERIC DISCUSSION THAT POTENTIAL EXISTS FOR PROLONGED PD OF PSBL CSTL FLDG. SINCE HAVE NOT HAD FLDG PROBLEMS AS YET..WL NOT UPGRADE TO WRNG. BUT WL EXTEND CSTL FLD WATCH THRU WED.

BAND OF LO CLDS ACRS BE 1/2 OF NC ASSOCD WITH CDFNT..WITH RAIN REPORTED AT ECG PAST HR. MODELS GIVE CLR TO SCT FOR CLD GUID MOST AREAS TNGT SO THAT/S NOT BELIEVED. WL GO WITH MSTLY OF PTLY CLDY MOST PLACES. ALSO... WINDY SPCLY IN E...THRU TUE. MUCH COOLER TEMPS EXPECTED. BUT THEREIN LIES NEXT PROBLEM. FPC TEMPS BLO FREEZG AT RDU..GSO..AVL TUR NGT. WITH WINDS AND LO LVL MSTR PERHAPS HANDING ARND...WL OPT FOR HEIR NGM TEMPS...IN MID 30S TO AROUND 40 FOR LOW.

ALSO...PLAN TO MENTION SHALLOW SOUNDSIDE FLOODING PSBL IN ZN 17 ON S SIDE OF PAMLICO SOUND TNGT AND TUE ESPCLY AT TIME OF HI TIDE.

. NC...GALE WARNINGS CSTL WATERS AND ALBEMARLE AND PAMLICO SOUNDS
...HVY SURF ADVISORY ZONES 1 AND 16
...CSTL FLOOD WATCH THRU WED S OF VA BEACH TO CAPE LOOKOUT.

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STATE FORECAST DISCUSSION
NATIONAL WEATHER SERVICE BOSTON MA
245 AM EST TUE OCT 29 1991

GRACE..SEE TCPAT1 AND TCDAT1.

GRACE IS EXPECTED TO BCM ABSORBED IN LOW TO N AS 5H LOW CUTS OFF. BOTH LFM AND AVN MODELS SHOWS SFC SYSTEM ESSENTIALLY DRIFTING W THRU PD ENDING UP NEAR 38.0N. AND 65.0W AND THEN WNW AFTERWARDS. AVN IS CONSIDERABLY STRONGER (17 MB) ON INTENSITY OF LOW SO LFM WIND FCST..ALREADY STG...COULD BE UNDERDONE. 18Z WED HAD ACK AT 0446I

WITH THIS IN MIND HV DECIDED TO GO WITH A COASTAL FLOOD WATCH FOR THE SAME AREAS MENTIONED BEFORE IN SPS. MRPECS LOOKS LIKE A PUZZLE TO BE CONSIDERABLE WIND DIRECTION. MORE ONSHORE AT BOS THEN AT SFD YET SFD GREATER STORM SURGE??? THANKS TO NYC FOR CO-ORD ON THIS ONE.

LOOKS LIKE ERN MA WL GET CHC FOR RAIN LATE WED AS LOW APCHS.

.MA...GLW...CFA2..3..7..8
.RI...GLW.
.CT...NONE.
REFER TO NYCCWFNYC FOR MARINE ADVYS/WRNGS.

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FORECAST DISCUSSION FOR SOUTHER NEW ENGLAND
NATIONAL WEATHER SERVICE BOSTON MA
1015 AM EST TUE OCT 29 1991

DANGEROUS OCEAN STOWN..PROBABLY ONE OF THE WORST SINCE THE BLIZZARD OF 78...IS HEADING SW PER PPP FALLS TO THE SW OF THE CENTER AND RISES TO THE N AS WELL AS WATER VAPOR IMAGERYI COORD NMC ON MARINE.

ALREADY 3 DOZEN BOATS BEACHED OR SUNK AT NAUSET BEACH. BEACH EROSION SIGNIFICANT CHH/NAUSET. SHIP REPORT AT 41/59 OF 63 FOOT SEAS WHICH IS PROBABLY HIGH BUT A SIGN OF THE PROBLEMS UPCOMING. THAT SAME VESSEL REPORTS SEAS OF 33 FEET. AVN MODEL SUPPORTS STORM CENTER TO NR GEORGE BANK 12Z THU...IF THIS OCCURS...MAJOR PBLMS COASTAL CAPE COD BOTH IN AND OUTSIDE. 65 KT SFC WIND YSA AT 13Z.

HEAVY SURF ADVY BEING ISSUED NOW FOR SWELL DESPITE TEMPORARY LULL IN THE WIND FIELD. CFA CONTINUED FOR E COAST CAPE COD. HIGH WIND WATCH WOULD BE APPROPRIATE FOR CAPE COD WED BUT PRIMARILY USED IN MTN AREAS AND ALREADY STRONGLY WORDED IN CWFBOS W MAIN THRUST HIGH WIND WED NITE/THU AM.

CONSULT W STAMFORD CODE AND SURGE SO FAR THIS SYSTEM HAS BEEN HALF OF MRPECS PREDICTION SO NO CFA WED BUT PRIMARILY USED IN MTN AREAS AND ALREADY STRONGLY WORDED IN CWFBOS W MAIN THRUST HIGH WIND WED NITE/THU AM.

YDY PEAK WIND WAS 48KT AND CHH. IPW ETM AT CHH. MWN WIND HAS TURNED NE AND CLDS/SHWRS W 8H AIR SEA WATER DIFF ON NRNLY 22 DEGS MEANS HEAVY SHWRS OF SLEET AND RAIN SHUD START BEING BLOWN WWD SOMETIME SOON.

GRACE...SEE TCPAT1 AND TCDAT1.

LFM 1 HR LATE..ALREADY FASTER W RAIN TO SW HEADING OFR NEW ENG. RW--AT CHH AT 1510Z. NGM STARTED LATE TOO. ONLY 4 CANADIAN UA STNS IN MODEL MAY AFFECT MODEL POSITS A BIT.

RELYING HEAVILY ON LAST NIGHTS AVN MODEL.

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FORECAST DISCUSSION FOR SOUTHERN NEW ENGLAND
NATIONAL WERATHER SERVICE BOSTON MA
140 PM EST WED OCT 30 1991

OCEAN STORM SHOULD BE WEAKING AND FOLLOWING NGM TRENDS PER OCCLUSION. CHH MAY BE SEEING CENTER OF STORM ON RADAR. HEAVY STORM DAMAGE AS WE ARE MOVING THRU HI TIDE COASTAL FLOODING NOW. BELIEVED THE WORST OF TIDAL FLOODING NOW WILL CONTINUE CFW THRU THUS AS PREV BUT WORD THAT WORST MAY HAVE OCCURRED THIS AFTN. CT COASTAL FLOOD THREAT UNKNOWN ATTEN BUT TIDES THIS AM WERE 2-3 FT ABV NORMAL AND EXPECT TO RUN 3-4 FT ABV NORMAL AT TIME OF HI TIDE THIS AFTN. MAYBE THIS TIDAL FLOODING PBLM CAN BE TERMINATED ON THE 4 AM THURSDAY PKG. WEAKENING SFC PPP MAY ALLOW SLOWLY LOWERING SURGE W HUGE SWELL EVER SO SLOWLY DAMPENING OUT NEXT 72 HRS.

HEAVY RAIN BANDS PROBABLE AND ASSTD STREET FLOODING DUE TO LEAF CLOGGED DRAINS. SWISS IMAGERY SHWG STORM MOTION 1016 SINCE 12Z....WHEN WILL IT LOOP S? WIL THERE B A 50 KT LOW LVL WIND FIELD 200 MI OUT FM CENTER EVEN TOMORROW DESPITE THE WKNG OCCLUDED CENTER.

HAVE SEEN SVRL 60KT SHIP REPORTS W WAVES OF 50 TO 71 FT.

HWW PROBABLY MAY BE TERMINATED IN PART ON THE 9 PM PKG...WORST IS OR SHUD HAVE OCCURRED BY 00Z/31 PER FD (1,2,3) FA1 3 K WINDS AT BOS/ACK.

FOR THE RECORD HAD 3 REPORTS OF SLEET TDY...WOBURN...NEWTON CTR AND OSTERVILLE (EVAP COOLING PER NGM T3/T5 PREDICTORS)

GRASS FIRES ETC REPORTED IN SOME AREAS WHERE IT WAS PARCHED TDY W STG WIND. (BURNING LEAVES?)

1815Z SCATTERED REPORT PWR OUT AND TREES DOWN RI/E MA. FLOODING ALREADY OCCURRING BRANT PT.

. MA...HWW MAZ001>004-007>009 FOR THIS EVE. ENTIRE CST THRU STORM ALL CWF.
.RI...STORM R1Z501. CFW ENTIRE CST THRU THUS. HWW ALL RI.
.CT...CFW ENTIRE CT CST FOR THRU THU.
REFER TO NYCCWFNYC FOR MARINE ADVYS/WRNGS.
DRAG

APPENDIX C - SELECTED FORECASTS AND STATEMENTS

HIGH SEAS FORECASTS NATIONAL WEATHER SERVICE,
WASHINGTON, DC
2200 UTC SUN OCT 27 1991

NORTH ATLANTIC NORTH 32N TO 65N WEST OF 35W
.FORECAST VALID 0600 UTC TUE OCT 29 1991

WARNINGS.

SEE S OF 32N FOR HURRICANE GRACE 31.5N 67.8W AT 2200 UTC.

DEVELOPING STORM 45N 73W 1013 MB AT 1800 UTC MOVING E 25 KTS WILL TURN ESE 20 KTS AFTER 18 HRS. BY 1200 UTC OCT 28 WINDS INCREASING TO 25 TO 35 KTS AND SEAS BUILDING TO 10 TO 16 FT WITHIN 400 NM OVER THE NW SEMICIRCLE. FORECAST STORM 42N 55W 999 MB. EXCEPT AS MENTIONED IN WARNINGS SECTION FOR AREA S OF 32N FORECAST WINDS 40 TO 55 KTS AND SEAS 14 TO 24 FT W OF A LINE FROM 46N 50W TO 40N 60W. ELSEWHERE FORECAST WINDS 25 TO 35 KTS AND SEAS 12 TO 18 FT WITHIN 650 NM OVER THE SW SEMICIRCLE.

GALE 50N 38W 996 MB AT 1800 UTC MOVING E 25 KTS THEN TURNING NE OVER THE NEXT 18 HRS. WINDS 25 TO 35 KTS AND SEAS 12 TO 18 FT WITHIN 550 NM OVER THE SW SEMICIRCLE. FORECAST GALE E OF AREA. FORECAST WINDS DESCRIBED WITH DEVELOPING STORM MENTIONED ABOVE.

SYNOPSIS AND FORECAST.

HIGH 38N 47W 1026 MB AT 1800 UTC MOCING ESE 15 KTS WITH A RIDGE EXTENDING WNW THRU 41N 60W AND ANOTHER ESE THRU 33N 35W. FORECAST HIGH 36N 36W 1024 MN.

DAS

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HIGH SEAS FORECAST NATIONAL WEATHER SERVICE WASHINGTON, DC
1000 UTC MON OCT 28, 1991
NORTH ATLANTIC NORTH OF 32N TO 65N WEST OF 35W
.FORECAST VALID 1800 UTC TUE OCT 29 1991

HURRICANE GRACE 32.5N 68.9W AT 1000 UTC MOVING NW 8 KTS BUT WILL TURN NE AND ACCELERATE. MAXIMUM SUSTAINED WINDS 65.KTS GUSTS TO 80 KTS. RADIUS OF 50 KTS WINDS 125 NM E SEMICIRCLE AND 75 NM W SEMICIRCLE. RADIUS OF 34 KT WINDS AND SEAS 12 FT OF HIGHER 350 NM N SEMICIRCLE AND 200 NM S SEMICIRCLE. FORECAST HURRICANE 35.0N 65.5W. FORECAST MAXIMUM SUSTAINED WINDS 65 KTS GUSTS TO 80 KTS. RADIUS OF 34 KT WINDS AND SEAS OF 12 FT OR HIGHER 350 NM N SEMICIRCLE AND 200 NM S SEMICIRCLE. SEE DEVELOPING STORM BELOW FOR FORECAST OF HIGHER WINDS AND SEAS TO THE W AND N OF HURRICANE.

DEVELOPING DANGEROUS STORM 46N 63W 1013 MB AT 0600 UTC MOVING E 35 KTS WILL TURN SE AND SLOW BY 12 HRS. BY 1800 UTC OCT 28 WINDS INCREASING TO 25 TO 40 KTS AND SEAS BUILDING TO 10 TO 17 FT WITHIN 450 NM OVER THE NW SEMICIRCLE. FORECAST DANGEROUS STORM 41N 54W 990 MR. FORECAST WINDS 50 TO 65 KTS AND SEAS 22 TO 32 FT WITHIN 400 NM NE SEMICIRCLE. ELSEWHERE WITHIN 900 NM W QUADRANT AND 200 NM SE SEMICIRCLE WINDS 35 TO 50 KTS SEAS 12 TO 22 FT.

STORM 62N 32W 980 MT AT 0600 UTC WILL MOVING W 10 KTS WILL TURN SW AFTER 12 HRS. WINDS 35 TO 50 KTS AND SEAS 14 TO 22 FT WITHIN 550 NM W QUADRANT. ELSEWHERE WINDS 25 TO 40 KTS SEAS 10 TO 18 FT WITHIN 900 NM OF CENTER. FORECAST STORM 59N 36W 998 MN. FORECAST WINDS 40 TO 55KTS AND SEAS TO 30 FT WITHIN 450 NM W QUADRANT. ELSEWHERE WINDS 30 TO 45 KTS SEAS 12 TO 20 FT WITHIN 600 NMOF CENTER.

GALE 48N 29W 999 MB AT 0600 UTC MOVING E 25 KTS. WINDS 25 TO 30 KTS AND SEAS 11 TO 17 FT WITHIN 500 NM OVER THE SW SEMICIRCLE. FORECAST GALE AND CONDITIONS E OF AREA.

SYNOPSIS AND FORECAST.

EXPECT AS NOTED IN WARNING SECTION WINDS INCREASING TO 20 TO 30 KTS SEAS 8 TO 15 FT N OF 35N W OF 48W.

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HIGH SEAS FORECAST NATIONAL WEATHER SERVICE WASHINGTON, DC
1000 UTC TUE OCT 29 1991
NORTH ATLANTIC NOTHER OF 32N TO 65N WEST OF 35W
.FORECAST VALID 1800 UTC WED OCT 30 1991

WARNINGS. CORRECTED CURRENT POSITION OF HURRICANE GRACE

SEE SECTION BELOW FOR FORECASTS S OF 32N FOR CURRENT CONDITIONS WITH HURRICANE GRANCE 31.6N 64.2W AT 1000 UTC. FORECAST EXTRATROPICAL CENTER 38.5N 57.5W AND MERGING WITH DANGEROUS STORM DISCUSSED NEXT PARAGRAPH. DESCRIPTION OF THE FORECAST WINDS AND SEAS ARE DESCRIBED IN RELATION TO THIS DANGEROUS STORM.

DANGEROUS STORM 42N 55W 994 MB AT 0600 UTC MOVING E 15 KTS WIL BECOME NEARLY STATIONARY THEN DRIFT SW AND MERGE WITH REMAINS OF HURRICANE GRACE. CURRENT WINDS 55 TO 70 KTS SEAS 17 TO 27 FT WITHIN 250 NM N SEMICIRCLE. ELSEWHERE WITHIN 700 NM NW SEMICIRCLE WINDS 40 TO 55 KTS SEAS 14 TO 24 FT. ELSEWHERE WITHIN 1000 NM W QUADRANT AND STORM 39N 56W 981 MB. FORECAST WINDS 50 TO 70 KTS SEAS 25 TO 35 FT WITHIN 400 NM SE SEMICIRCLE WINDS 35 TO 50 KTS AND SEAS 15 TO 25 FT.

STORM 60N 39 W 989 MB AT 0600 UTC WILL MOVE SE KTS. WITHIN 500 NM W SEMICIRCLE WINDS 40 TO 55 KTS SEAS 20 TO 30 FT. ELSEWHERE WITHIN 600 NM OF CENTER WINDS 25 TO 40 KTS SEAS 13 TO 23 FT. FORECAST STORM 57N 32W 992 MB. FORECAST WINDS 35 TO 50 KTS SEAS 18 TO 28 FT WITHIN 400 NM OF CENTER.

SYNOPSIS AND FORECAST.

EXCEPT WHERE MENTIONED IN WARNINGS ABOVE WINDS 20 TO 30 KITS SEAS 10 TO 18 FT N OF 43 N.

EXCEPT WHERE MENTIONED IN WARNING ABOVE WINDS 20 TO 30 KTS SEAS TO 18 FT W OF 50W.

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HIGH SEAS FORECAST NATIONAL WEATHER SERVICE
WASHINGTON,DC
1600 UTC WED OCT 30 1991
FORECAST VALID 0000 UTC FRI NOV 01 1991

WARNINGS
DANGEROUS STORM 40N 64W 972 MB AT 1200 UTC MOVING W 10 KTS TURNING SW. WINDS 55 TO 70 KTS AND SEAS 35 TO 50 FT WITHIN 300 NM W SEMICIRCLE AND W QUADRANT. ALSO... WINDS 40 TO 50 KTS SEAS 25 TO 40 FT WITHIN 450 NM NW SEMICIRCLE AND 600 NM NE QUADRANT. ELSEWHERE WINDS 25 TO 40 KTS AND SEAS 15 TO 30 FT WITHIN 750 NM OF CENTER. FORECAST STORM 37N 70W 988 MB. FORECAST WINDS 35 TO 50 KTS AND SEAS 20 TO 35 FT WITHIN 300 NM NW SEMICIRCLE. ELSEWHERE FORECAST WINDS 25 TO 40 KTS AND SEAS 16 TO 25 FT WITHIN 600 NM OF CENTER EXCEPT WITHIN 750 NM OVER NE QUADRANT.

AREA OF WINDS 35 TO 50 KTS AND SEAS 18 TO 30 FT N OF 45N OF 45W. ELSEWHERE WINDS 25 TO 35 KITS AND SEAS 15 TO 22 FT N OF 40N AND E OF 50 W. FORECAST WINDS 25 TO 40 KTS AND AREAS 12 TO 16 FT N OF 58N AND W OF GREENLAND WITH MODERATE SUPERSTRUCTURE ICING.

SYNOPSIS AND FORECAST.

HIGH 50N 65W 1043 MB AT 1200 UTC MOVING ESE 15 KTS. FORECAST HIGH 49N 51W 1033 MB.

EXCEPT WHERE DESCRIBED ABOVE WINDS TO 25 KTS AND SEAS TO 14 FT W OF 45W N OF 32N.

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HURRICANE GRACE ADVISORY NUMBER
NATIONAL WEATHER SERVICE MIAMI FL
6 AM AST MON OCT 28 1991

TROPICAL STORM WARNINGS REMAIN IN EFFECT FOR BERMUDA.

STEERING CURRENT ARE EXPECTED TO KEEP GRACE WELL OFF THE U.S. EAST COAST. HOWEVER..THERE IS UNCERTAINTY IN THE FORECAST TRACK AND ALL INTERESTS ALONG THE CENTRAL AND NORTHERN U.S. ATLANTIC COAST SHOULD MONITOR THE PROGRESS OF GRACE.

AT 6 AM AST...10000Z...THE CENTER OF GRACE WAS LOCATED NEAR LATITUDE 32.5 NORTH...LONGITUDE 68.9 WEST OR ABOUT 235 MILES...380 KM...WEST OF BERMUDA.

GRACE IS MOVING TOWARD THE NORTHWEST NEAR 9 MPH...15 KM/HR..AND A TURN TOWARD THE NORTH AND NORTHEAST IS EXPECTED DURING THE NEXT 24 HRS.

MAXIMUM SUSTAINED WINDS ARE NEAR 75 MPH...120 KN/HR..AND LITTLE CHANGE IN STRENGTH IS LIKELY TODAY.

HURRICANE FORCE WINDS ARE EXTEND OUTWARD UP TO 35 MILES..55KN FROM THE CENTER..AND TROPICAL STORM FORCE WINDS EXTEND OUTWARD UP TO 405 MILES..650 KM TO THE NORTH OF THE CENTER AND UP TO 225 MILES..360 KM..TO THE SOUTH OF THE CENTER.

THE LARGE AREA OF STRONG WINDS TO THE NORTH OF THE CENTER IS PRODUCING LARGE SWELLS ALONG PORTIONS OF THE U.S. EAST COASTAL FROM NORTHEAST FLORIDA NORTHWARD. CONSULT STATEMENTS FROM YOUR LOCAL NATIONAL WEATHER SERVICE FORECAST OFFICE FOR ADDITIONAL INFORMATION.

THE MINIMAL CENTRAL PRESSURE REPORTED BY RECONNAISSANCE AIRCRAFT WAS 982 MR...29.00 INCHES.

REPEATING THE 6 AM AST POSITION...32.5 N...68.9W. MOVEMENT...NORTHWESTWARD NEAT 9 MPH. MAXIMUM SUSTAINED WINDS...75 MPH. MINIMUM CENTRAL PRESSURE 982 MB.

AN INTERMEDIATE ADVISORY WIL BE ISSUED BY THE NATIONAL HURRICANE CENTER AT 9 AM AST FOLLOWED BY THE NEXT COMPLETE ADVISORY AT NOON AST..11 AM EST.

LAWRENCE

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TROPICAL STORM GRACE ADVISORY NUMBER 10
NATIONAL WEATHER SERVICE MIAMI FL
6 PM AST TUE OCT 29 1991

SATELLITE IMAGES SHOW THAT GRACE HAS BEEN OVERTAKEN BY A COLD FRONT AND IS LOSING ITS TROPICAL CHARACTERISTICS.

AT 6 PM AST..2200Z..THE CENTER OF GRACE WAS LOCATED NEAR LATITUDE 34.0 NORTH..LONGITUDE 57.0 WEST OF ABOUT 460 MILES...740 KM..EAST NORTHEAST OF BERMUDA.

GRACE IS MOVING TOWARD THE NORTHEAST NEAT 40 MPH...65 KM/HR..AND A TURN TOWARD THE NORTH IS EXPECTED TONIGHT.

MAXIMUM SUSTAINED WINDS ARE NEAR 70 MPH...110 KM/HR..AND WEAKENING IS LIKELY DURING THE NEXT 24 HOURS.

TROPICAL STORM FORCE WINDS EXTEND OUTWARD UP TO 230 MILES...370 KM.

REPEATING THE 6 PM AS POSITION..34.0N... 57.0W. MOVEMENT..NORTHEAST NEAR 40 MPR. MAXIMUM SUSTAINED WINDS...70 MPH.

THE REMNANTS OF GRACE ARE EXPECTED TO BE ABSORBED BY A DEVELOPING MAJOR STORM OFF THE U.S. EAST FRONT LAST TONIGHT. FUTURE INFORMATION ON THE EXTRATROPICAL REMNANTS OF GRACE WILL BE CARRIED IN THE HIGH SEAS FORECASTS ISSUED BY THE NATIONAL METEOROLOGICAL CENTER IN WASHINGTON.

THIS IS THE LAST PUBLIC ADVISORY ISSUED BY THE NATIONAL HURRICANE CENTER ON THIS SYSTEM.

PASCH

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SPECIAL WEATHER STATEMENT
NATIONAL WEATHER SERVICE PORTLAND ME
430 AM EDT WED OCT 30 1991

...MARINE STORM WARNINGS AND LARGE SURF FOR COASTAL SECTIONS TODAY INTO THURSDAY.

A VERY LARGE AND INTENSE OCEAN TOWN CENTERED 600 MILES SOUTHEAST OF NOVA SCOTIA IS MOVING TOWARD THE NORTHWEST. WINDS AND EAVE ALONG THE COAST HAVE BEEN INCREASING OVERNIGHT. AS OF EARLY THIS MORNING FREQUENT WINDS GUSTS OF OVER 40 KNOTS WERE BEING REPORTED ALONG THE MAINE AND NEW HAMPSHIRE COASTS AS WELL AS SWELLS OF 10 FEET. DURING THE DAY AS THE STORM CONTINUES TO MOVE CLOSER TO LAND, WIND WILL INCREASE TO 50 KNOTS WITH HIGHER GUSTS AND SEAS WILL CONTINUE TO BUILD TO BETWEEN 12 TO 20 FEET. SOME MINOR BEACH EROSION IS EXPECTED.

DON'T UNDER ESTIMATE THE POWER OF THE OCEAN. LARGE WAVES CAN BE DEADLY. COASTAL RESIDENTS AND THOSE VISITING THE SHORE TODAY SHOULD NOT VENTURE TOO CLOSE TO THE WAVES.

FURTHER STATEMENTS WILL BE ISSUED IF NECESSARY.

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BULLETIN
COASTAL FLOOD STATEMENT FOR MAINE AND NEW HAMPSHIRE
NATIONAL WEATHER SERVICE PORTLAND, ME
530 PM EST WED OCT 30 1991

...COASTAL FLOOD WARNING CONTINUES IN EFFECT FOR THE COASTAL OF MAINE AND NEW HAMPSHIRE FOR TONIGHT.

THE TIDE AT PORTLAND HARBOR PEAKED AT 13.2 FEET AT 445 PM. THIS TIDE WAD 3.4 FEET ABOVE NORMAL..MAKING IT THE 7TH HIGHEST STORM SURGE IN PORTLAND HARBOR SINCE RECORD BEGAN IN 1914. THE TIDE WILL FALL SLOWLY THROUGH THE EVENING HOURS. ANTHER HIGH TIDE WILL OCCUR AT 516 THURSDAY MORNING. WITH THE STORM REMAINING OFFSHORE...MORE PROBLEMS WITH THE NEXT HIGH TIDE ARE LIKELY.

A WEATHER SPOTTER AT HIGGINS BEACH IN SCARBOROUGH REPORTED WATER BREAKING ONTO THE ROAD. THE ROAD TO THE BEACH HAS BEEN CLOSED.

THE ABNORMALLY HIGH TIDES HAVE BEEN CAUSED BY A LARGE AND DANGEROUS OCEAN STORM LOCATED ABOUT 130 MILES SOUTHEAST OF NATUCKET. WINDS AT THE PORTLAND LARGE NAVIGATIONAL BUOY WERE GUSTING TO 47 MPH WITH 18 FOOT AT 4 PM.

HEAVY SURF WILL CONTINUE TO BE DANGEROUS ALONG THE COASTAL FOR THE NEXT SEVERAL HOURS. DO NOT VENTURE NEAT THE WATER TO WALK OF THE ROCK..YOU COULD BE SWEPT AWAY.

ALL OCEAN FRONTS AND BOATING INTERESTS SHOULD KEEP UP TO DATE WITH THE LATEST FORECASTS AND STATEMENTS ISSUED BY THE NATIONAL SERVICE.

ANOTHER STATEMENT WILL BE ISSUED BY 9 PM TONIGHT.
VALLIER

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FLOOD WARNING
NATIONAL WEATHER SERVICE ALBANY NY
100 PM EDT THU OCT 31 1991

THE NATIONAL WEATHER SERVICE HAS ISSUED A FLOOD WARNING FOR THE HUDSON RIVER BETWEEN THE BEAR MOUNTAIN BRIDGE AND THE TROY DAM.

SUBSTANTIAL FLOODING OF LOWLANDS ALONG THE RIVER IS LIKELY AT HIGH TIDE THIS AFTERNOON AND EVENING. THE TIME OF HIGH TIDE SHOULD BE AROUND 6PM AT BEAR MTN BRIDGE..AROUND 730 PM AT POUGHKEEPSIE...
AROUND 830 PM AT KINGSTON..10PM AT CATSKILL...AND JUST BEFORE MIDNIGHT IN THE CAPITAL DISTRICT.

THE HIGH TIDE AT ALBANY WAS JUST UNDER 6.6 FT JUST BEFORE NOON. IT WAS A LITTLE MORE THAN TWO FEET ABOVE NORMAL.

WHILE THE TIDE BEGAN TO EBB AT ALBANY EARLY THIS AFTERNOON..IT'S NOT LIKELY TO DROP VERY MUCH. ALSO..THIS EVENING'S TIDE IS LIKELY TO BE CONSIDERABLY HIGHER THAN THE NOONTIME TIDE BETWEEN SAUGERTIES AND TROY DAM. SOUTH OF SAUGERTIES THE EVENING TIDE IS LIKELY TO BE A FEW INCHES TO A FOOT HIGHER..AND THERE WAS CONSIDERABLE FLOODING OF LOWLANDS ALONG THE HUDON AND ITS INLETS EARLIER TODAY.

IN THE ALBANY AREA..THE HIGH TIDE TONIGHT WILL PROBABLY BE CLOSE TO 8 FT...WHICH WOULD PUT WATER INTO PARTS OF THE CORNING PRESERVE.

A FLOOD WARNING MEANS THAT FLOODING IS EITHER OCCURRING...OR LIKELY TO TAKE PLACE.

ITEMS THAT CAN BE DAMAGED BY WATER..SUCH AS AUTOMOBILES AND MAY ELECTRICAL ITEMS..SHOULD BE MOVED TO A SAFE AREA WELL BEYOND THE WATER/S REACH.

BOAT AND FLOATING DOCK MOORINGS SHOULD BE CHECKED TO INSURE THERE IS ADEQUATE MOVEMENT FOR THE HIGH WATER.

THE UNUSUALLY HIGH WATER LEVEL IS LIKELY TO FLOT DEBRIS OFF THE SHORE LIKE SUCH AS TREES AND WOOD..WHICH WILL THEN BECOME A HAZARD TO NAVIGATION IN THE RIVE, AND CAUSE DAMAGE TO BOATS.

THE UNUSUALLY HIGH TIDES ARE CAUSED BY A STORM IN THE ATLANTIC. THE STORM IS FORECAST TO WEAKEN TONIGHT..SO THAT THE HIGH TIDE TOMORROW MORNING SHOULD BE LOWER THAN TONIGHT.
KILPATRICK
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SPECIAL WEATHER STATEMENT
BOSTON, MA
420PM EST SUN OCT 27 1991

...A BEACH EROSION EPISODE MAY BE SETTING UP FOR LATE MONDAY AND EARLY TUESDAY.

A STRONG COLD FRONT WILL MOVE SOUTHWARD ACROSS NEW ENGLAND TONIGHT..USHERING IS A MUCH COOLER AIRMASS AND ALLOWING STRONG HIGH PRESSURE TO BUILD SOUTHWARD OVER NEW ENGLAND.

EARLIER TODAY A LARGE AND RAPIDLY INTENSIFYING LOW SOUTHWEST OF BERMUDA BEGAN TO TAKE ON TROPICAL CHARASTERICS..AND HAS NOW BEEN CATEGORIZED AS TROPICAL STORM GRACE. THIS SYSTEM IS FORECAST TO INITIALLY TRACK NORTHWARD BEFORE CURING NORTHEAST OF MONDAY...AND WILL SET UP A TIGHT PRESSURE GRADIENT ACROSS MUCH OF THE NORTHWEST ATLANTIC OCEAN.

AS A RESULT...AT LEAST GALE FORCE WINDS WILL DEVELOP OVER THE COASTAL AND OFFSHORE WATERS EAST OF NEW ENGLAND. HIGH SURF AND LARGE BREAKERS WILL LIKELY DEVELOP LATER MONDAY AND CONTINUE INTO TUESDAY..WITH SOME BEACH EROSION POSSIBLE.

IF THE PRESSURE FIELD BETWEEN THE HIGH AND THE LOW DEVELOPS ANY STRONGER..A COSTAL FLOOD WATCH MAY BE REQUIRED...BUT AT THIS POINT IT IS STILL TOO EARLY TO TELL. STAY TUNED TO YOUR NOAA WEATHER RADIO OR LOCAL MEDIA FOR ADDITIONAL DETAILS ON THIS SITUATION.
RW

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COASTAL FLOOD WATCH
NATIONAL WEATHER SERVICE BOSTON MA
315 AM TUE OCT 29 1991

..COASTAL FLOOD WATCH IN EFFECT FOR WEDNESDAY FOR NORTH AND EXACT FACING COASTAL AREAS OF MASSACHUSETTS..

THE COMBINATION OF STRONG HIGH PRESSURE TO THE NORTH OF NEW ENGLAND AND HURRICANE GRACE NEAR BERMUDA HAS SET UP NORTH TO NORTHEAST GALE FORCE WINDS ALONG THE EASTERN MASSACHUSETTS COAST. SEAS ARE UP TO 10 TO 15 FT AND TIDES ARE ALREADY RUNNING A FOOT ABOVE NORMAL.

BY WEDNESDAY GRACE WILL BECOME ABSORBED IN ANOTHER LOW SOUTH OF THE CANADIAN MARTIMES. THE NEW LOW CENTER WILL BE CLOSE ENOUGH AND STRONG ENOUGH TO THE NORTHEAST COASTAL TO CAUSE STORM FORCE WINDS OF THE NORTHEAST. THESE ONSHORE WINDS ALONG WITH HIGH TIDE DURING THE LAST AFTERNOON AND EARLY EVENING WEDNESDAY WILL CREATE THE POTENTIAL FOR COASTAL FLOODING. IN ADDITION, STRONG WAVES PRODUCED BY NORTH TO NORTHEAST WINDS WILL LIKELY PRODUCE SOME BEACH EROSION TODAY INTO WEDNESDAY/

NORTH AND EAST FACING COASTAL SECTIONS WILL EXPERIENCE THE EFFECTS OF THE STRONG WINDS. MOST VULNERABLE LOCALES APPEAR TO BE FROM CHATHAM NORTHWARD ON THE CAPE COD COAST.

REMEMBER..A COASTAL FLOOD WATCH MEANS THAT CONDITIONS ARE POSSIBLE FOR COASTAL FLOODING. RESIDENTS AND LOCAL OFFICIALS SHOULD BE PREPARED TO TAKE PROTECTIVE ACTION IN CASE WARNINGS ARE NECESSARY. THIS SITUATION IS BEING MONITORED CLOSELY. KEEP TUNED TO LOCAL RADIO...TV...OR NOAA WEATHER RADIO FOR FURTHER INFORMATION.
GIRODO

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COASTAL FLOOD STATEMENTS
NATIONAL WEATHER SERVICE BOSTON MA
200 PM EST WED OCT 30 1991

...MAJOR COASTAL FLOODING WILL OCCUR THIS AFTERNOON FOR MANY EAST FACING MASSACHUSETTS COASTAL LOCATIONS...

UNCONFIRMED REPORTS OF 2 HOUSES COLLAPSING HAVE BEEN RECEIVED FROM THE GLOUCESTER AREA. THE NAHANT CAUSEWAY HAS BEEN CLOSED.

AT TIME OF HIGH TIDE...WATER SHOULD BE AROUND 4 FEET ABOVE NORMAL WHICH WILL RESULT IN DAMAGE TO EXPOSED EAST FACING LOCATIONS. TIDAL RIVERS FACING INTO THE NORTHEAST WIND WILL BE PARTICULARLY VULNERABLE TO MAJOR FLOODING.

OTHER MASSACHUSETTS LOCATIONS UNDER THE GUN FOR SERIOUS FLOODING ARE THE FOLLOWING...THE REGION FROM CHATHAM TO PROVINCETOWN.PLUM ISLAND...REVERE BEACH...THE NAHANT LYNN CAUSEWAY...THE REGION FROM QUINCY TO PLYMOUTH AND ESPECIALLY HULL AND SITUATE AS WELL AS BRANT POINT ON NANTUCKET ISLAND. SOME ROADS NEAR THE COASTAL WILL BECOME IMPASSABLE.

FLOODING IS ALREADY OCCURRING AND WILL BECOME MORE SERVE AS TIDES RISE TOWARD THEIR MAXIMUM BETWEEN 330 AND 630 PM.

THIS IS A DANGEROUS SITUATION FOR THE VULNERABLE COASTAL LOCATIONS MENTIONED EARLIER IN THIS STATEMENT AND POSSIBLY WILL BE THE WORST COASTAL FLOODING FOR EAST FACING MASSACHUSETTS COASTAL POINTS SINCE THE BLIZZARD OF 78.

PEOPLE WITH INTERESTS IN LOW LYING COASTAL LOCATIONS SHOULD STAY TUNED FOR LATER STATEMENTS AND BE PREPARED TO EVACUATE IF REQUESTED.
DRAG

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COASTAL FLOOD STATEMENT
NATIONAL WEATHER SERVICE BOSTON, MA
430 PM EST TUE OCT 29 1991

...A COASTAL FLOOD WATCH HAS BEEN EXPANDED TO INCLUDE VIRTUALLY OF THE SOUTHERN NEW ENGLAND COASTAL WEDNESDAY THRU THURSDAY..

FLOODING IS POSSIBLE AT TIME OF HIGH TIDE FOR NORTH AND EAST FACING COASTAL AREAS OF MASSACHUSETTS AS WELL AS NARRAGANSETT BAY.. BLOCK ISLAND AND THE SOUTH COASTAL OF CONNECTICUT.

THE FOLLOWING IS A LIST OF TIMES AND HEIGHTS OF HIGH TIDES FOR BOSTON HARBOR AND CHATHAM MA.

DATE	TIMES OF HIGH TIDE (EST) BOSTON HARBOR/CHATHAN	HEIGHT (FEET) ABOVE MLLW	FLOODING BEGINS ABOVE MLLW (FEET)
WED OCT 30	417 AM/449 AM	9.3/6.5	13.6/9.1
	433 PM/505 PM	10.2/7.1	13.6/9.1
THU OCT 31	521 AM/553 PM	9.4/6.8	13.8/9.1
	540 PM/612 PM	10.0/7.0	13.6/9.1
FRI NOV 01	624 AM/656 AM	9.7/6.8	13.6/9.1

THESE VALUES DO NOT TAKE IN ACCOUNT THE AFFECTS OF STORMS SURGES AND WAVE HEIGHTS.

THE MOST LIKELY TIME FOR FLOODING SHOULD COINCIDE WITH HIGH TIDE OCCURRENCES BOTH WEDNESDAY AFTERNOON AND THURSDAY MORNING.

SEAS OF 25 TO 45 FEET HAVE OCCURRED TODAY FROM GEORGE BANK EAT INTO THE ATLANTIC. THE DANGEROUS OCEAN STORM ASSOCIATED WITH HIGH SEAS IS MOVING SOUTHWEST..CLOSER TO NEW ENGLAND. THIS STORM MAY PARK ITSELF TO THE SOUTH OF NEW ENGLAND THURSDAY AND FRIDAY PROLONGING BEACH EROSION DAMAGE AND COASTAL FLOOD THREATS.

THE FOLLOWING LOCATIONS IN MASSACHUSETTS ARE THREATENED WITH COASTAL FLOODING..THE REGION FROM CHATHAM TO PROVINCETOWN..PLUM ISLAND..REVERE BEACH..THE NHANT LYNN CAUSEWAY.. THE REGION FROM HULL TO PLYMOUTH INCLUDING SCITUTAE AS WELL AS BRANT POINT ON NANTUCKET ISLAND. MANY OF THESE LOCATIONS SHOULD BE EXPERIENCE DAMAGE FROM HEAVY SURF. ALREADY SEVERAL DOZEN BOATS HAVE BEEN BEACHED OR SUNK NEAR NAUSET BEACH ON CAPE COD AND NANTUCKET ISLAND.

COASTAL FLOODING MAY ALSO OCCUR AT HIGH TIDE ON THE WEST SIDE OF NARRAGANSETT BAY AND BLOCK ISLAND RHODE ISLAND AS WELL AS NEAR STAMFORD CONNECTICUT.

TODAY'S SURGE WAS ABOUT ONE AND ONE HELD FEET ABOVE THE NORMAL TIDE. INCREASING WIND TOMORROW AND CLOSER PROXIMITY OF THE STORM SHOULD MAKE THE SURGE BETWEEN 2 AND 3 FEET ABOVE NORMAL RAISING THE LIKELIHOOD OF SOME FLOODING AT HIGH TIDE.

BEACH EROSION..FROM THE HEAVY SURG WILL BE COMMON ALONG MANY EAST FACING COASTAL POINTS OF MASSACHUSETTS WITH THE WORST EXPECTED ON THE LOWER AND OUTER CAPE.

PEOPLE WITH INTERESTS IN LOW LYING COASTAL LOCATIONS SHOULD STAY TUNED FOR LATER STATEMENTS AND BE PREPARED TO EVALUATE IF REQUESTED.

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COASTAL FLOOD STATEMENT
NATIONAL WEATHER SERVICE BOSTON MA
650 PM EST WED OCT 30 1991

...MAJOR COASTAL FLOODING HAS OCCURRED ALONG MANY EAST FACING MASSACHUSETTS COASTAL LOCATIONS AND A COASTAL FLOOD WARNING REMAINS IN EFFECT THROUGH THURSDAY.

THE GOVERNOR OF MASSACHUSETTS DECLARED A STATE OF EMERGENCY EARLIER THIS EVENING FOR THE NINE COASTAL COUNTIES OF MASSACHUSETTS.

COASTAL FLOODING...IN SOME LOCATIONS AS BAD OR WORSE THAN THE 78 BLIZZARD...HAS RESULTED IN NUMEROUS EVACUATIONS AND ROAD CLOSING. MUCH OF THE MASSACHUSETTS EAST COAST FROM THE MERRIMACK RIVER TO CHATHAM AS WELL AS THE ISLAND HAVE BEEN HARD HIT WITH MANY SHORE ROAD INUNDATED AND BOATS DESTROYED. THERE HAVE BEEN REPORTS OF HOUSES BEING SWEPT AWAY IN GLOUCESTER...SWAMPSCOTT...AND NAUSET BEACH ON CAPE COD. FLOODING HAS BEEN REPORTED HALF WAY INTO DOWNTOWN NANTUCKET BY THE NANTUCKET NEWS.

WINDS GUSTS HAVE BEEN REPORTED AS HIGH AS 78 MPH AT THE WEATHER SERVICE OFFICE IN CHATHAM. THERE HAVE BEEN REPORTS OF SCATTERED POWER OUTAGES IN EASTERN MASSACHUSETTS DUE TO DOWNED TREES AND LIMBS.

FLOOD WATERS FROM THIS AFTERNOONS HIGH TIME TILL GRADUALLY SUBSIDE THIS EVENING. ALTHOUGH THE NEXT HIGH TIDE EARLY THURSDAY MORNING MAY NOT BE QUITE AS HIGH..SIGNIFICANT COASTAL FLOODING IS STILL LIKELY.

PEOPLE IN COASTAL LOCATIONS SHOULD NOT TRAVEL UNLESS ABSOLUTELY NECESSARY. DO NOT HEAD BACK INTO AREAS JUST FLOODED BY THIS STORM TIDE DUE TO RECOVER EFFORTS AND THE RISK OF ADDITIONAL FLOODING NEAR THE NEXT HIGH TIDE DURING THE EARLY MORNING HOURS.
THOMPSON

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COASTAL FLOOD STATEMENT FOR RHODE ISLAND
NATIONAL WEATHER SERVICE PROVIDENCE RI
735 AM EDT WED OCT 30 1991

...A COASTAL FLOOD WARNING HAS BEEN ISSUED FOR RHODE ISLAND FOR WEDNESDAY AND THURSDAY.

A DANGEROUS OCEAN STORM WILL CAUSE TIDES TO RUN 2 TO 3 FEET ABOVE NORMAL NEAR THE TIMES OF HIGH TIDE IN RHODE ISLAND THIS AFTERNOON. PARTICULARLY VULNERABLE ARE THE EAST FACING SHORES OF NARRAGANSETT BAY...INCLUDING EAST FACING SECTION OF THE ISLAND IN THE BAY. EAST FACING COASTAL SECTION OF THE STATE SUCH AS NARRAGANSETT...AND IN PARTICULAR POINT JUDITH..AND THE EAST SHORE OF BLOCK ISLAND WILL BE MOST AT RISK. THE ADDITION OF EASTERN SWELLS OF UP TO 15 FEET COULD INTENSIFY THE PROBLEM AT BLOCK ISLAND AND S COSTAL RI..ESPECIALLY IN THE POINT OF JUDITH AREA OF NARRAGANSETT. SOME BEACH EROSION IS ALSO POSSIBLE ALONG WITH HEAVY SURF ALONG EAST FACING SHORES OF THE STATE.

THE LAST HIGH TIDE EARLY THIS MORNING RAN 2 AND ONE HALF FEET ABOVE NORMAL. STRONGER WINDS WITH HIGHER GUSTS AND LOWER BAROMETRIC PRESSURE TODAY WILL RAISE TIDES EVEN HIGHER TODAY.

HIGH TIDE AT PROVIDENCE IS AT 1:34 PM
HIGH TIDE AT NEWPORT IS AT 1:20 PM

ANY FLOODING IN RHODE ISLAND COULD BEGIN WITHIN ONE HOUR OF HIGH TIDE AND WILL PROBABLY COINCIDE WITH STRONG NORTHEAST WINDS.

THE MASSIVE...INTENSE STRONG IN THE OPEN ATLANTIC WAS LOCATED ABOUT 360 MILES SOUTH OF NOVA SCOTIA. IT IS CURRENTLY MOVING WEST AT ABOUT 10 MPH. THIS WILL BRING IT CLOSER TO NEW ENGLAND TODAY.

PEOPLE LIVING IN LOW LYING COASTAL SECTION OF RHODE ISLAND SHOULD STAY TUNED TO RADIO..TV...OR NOR WEATHER RADIO FOR FURTHER STATEMENTS. THE NEXT STATEMENTS WILL BE ISSUED AS SOON AS CONDITIONS WARRANT.
CARBONE

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COASTAL FLOOD STATEMENT
NATIONAL WEATHER SERVICE HARTFORD CT
306 AM EST THU OCT 31 1991

...A COSTAL FLOOD WARNING CONTINUES TODAY FOR THE SHORELINE OF CONNECTICUT...

STRONG NORTHEAST WINDS TODAY WILL CAUSE TIDES TO RUN 3 TO 4 FEET ABOVE NORMAL ALONG THE COASTLINE OF CONNECTICUT. ROADWAYS THAT BECAME FLOODED ON WEDNESDAY WILL LIKELY BECOME FLOODED AGAIN TODAY. THE FLOODING WILL OCCUR WITHIN 1 HOUR...EITHER SIDE OF THE HIGH TIDES TODAY.

HERE ARE THE TIME OF HIGH TIDE TODAY ALONG THE CONNECTICUT COASTLINE.

NEW LONDON	BRIDGEPORT	STAMFORD CT
343 AM	527 AM	530 AM
407 PM	554 PM	602 PM

THE POWERFUL STORM PRODUCING STRONG GUSTY WINDS AND HIGH TIDES ALONG THE ENTIRE SOUTHERN NEW ENGLAND SHORELINE WILL LAST ONE MORE DAY. THE STORM AT 300 AM WAS LOCATED 150 MILES SOUTH OF CHATHAM MASSACHUSETTS. IT WAS TRACKING SOUTHWEST.

PEOPLE LIVING IN AREAS SUBJECT TO COASTAL FLOODING DURING ABOVE NORMAL TIDES WILL EXPERIENCE MORE FLOODING TODAY. TAKE NECESSARY ACTIONS TO PREVENT ANY LOSS OR DAMAGE ASSOCIATED WITH HIGH WATER. MOTORISTS SHOULD NOT ATTEMPT TO CROSS FLOODED ROADWAYS.
SEKELSKY

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COASTAL FLOOD STATEMENT
NATIONAL WEATHER SERVICE BRIDGEPORT CT
730 AM EST THRU OCT 31 1991

...A COASTAL FLOOD WARNING REMAINS IN EFFECT FOR TODAY...

AN INTENSE ATLANTIC STORM WAS LOCATED ABOUT 200 MILES SOUTHEAST OF CONNECTICUT EARLY THIS MORNING. SWELLS BEING GENERATED BY THIS STORM WILL CONTINUE TO CAUSE COASTAL FLOODING TODAY..ESPECIALLY NEAR TIMES OF HIGH TIDE.

EARLY REPORTS INDICATE CONSIDERABLE FLOODING OCCURRED THIS MORNING ALONG THE CONNECTICUT COAST. HAREST HIT AREA APPEARS TO BE MILFORD...ALTHOUGH DAMAGE REPORTS WERE NOT YET AVAILABLE. AS OF 700AM...SIKORSKI MEMORIAL AIRPORT IN STRATFORD WAS CLOSED DUE TO FLOODED RUNWAYS.

THE NEXT HIGH TIDE WILL OCCUR ALONG THE CONNECTICUT COAST THIS AFTERNOON AND EVENING BETWEEN 400 AND 600 PM EST. HOWEVER...COASTAL FLOODING IS NOT EXPECTED TO BE AS WIDE SPREAD OR AS SEVERE AS THIS MORNING.

THE NEXT HIGH TIDES FOR THIS AFTERNOON AND EVENING ARE..

NEW LONDON... 407 PM EST
BRIDGEPORT... 554 PM EST
STAMFORD..... 602 PM EST

THE NEXT COASTAL FLOOD STATEMENT WILL BE ISSUED AS DAMAGE REPORTS ARE RECEIVED AND EXACT TIDE GAGE READINGS ARE OBTAINED.
BINGHAM

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SPECIAL WEATHER STATEMENT AND WEATHER MAP DISCUSSION FOR NORTHER NEW JERSEY AND EXTREME SOUTHEASTERN NEW YORK INCLUDING LONG ISLAND
NATIONAL WEATHER SERVICE NEW YORK NY
420 AM EST MON OCT 28 1991

...A HEAVY SURF ADVISORY IS IN EFFECT FOR THE NORTHERN NEW JERSEY COASTAL SOUTHWARD TO MANASQUAN INLET TONIGHT AND INTO TUESDAY...

A CHANGE IN AIRMASS WILL BRING ABOUT A NEW MASS OF WEATHER FEATURES TODAY WHICH WILL LAST INTO THE MIDDLE OF THE WEEK. A COLD FRONT PUSHED SOUTHEASTWARD THROUGH THE TRI-STATE REGION AROUND AND JUST AFTER MIDNIGHT LAST NIGHT. THE DENSE FOG OVER PARTS OF NEW YORK CITY AND EASTWARD OVER LONG ISLAND PRETTY WELL DISSIPATED...AND VISIBILITIES IMPROVED.

WINDS SWITCHED AROUND TO NORTH...AND THESE NORTH WINDS WILL BRING SOME CLOUDS DOWN FROM UPSTATE NEW YORK AND NEW ENGLAND THIS MORNING. COASTAL LOCATIONS MAY HAVE SUN MIXED WITH THE CLOUDS AT TIME ESPECIALLY THIS AFTERNOON. INLAND AREAS WILL LIKELY HAVE LESS SUNSHINE.

THOSE NORTH WINDS WILL ALSO BE STRENGTHENING TODAY AS A COUPLE OF THINGS ARE HAPPENING. STRONG HIGH PRESSURE OVER CANADA WILL CONTRAST SHARPLY WITH LOW PRESSURE OFF THE EAST COASTAL. ALSO...HURRICANE GRACE WHICH WAS WEST OF BERMUDA THIS MORNING WILL MOVE NORTHWESTWARD THEN NORTHWARD TODAY AND CURVE NORTHEASTWARD TONIGHT...MERGING WITH THE OFFSHORE LOW PRESSURE SYSTEM. THESE ACTIONS WILL SERVE TO INCREASE THE AIRFLOW OVER OUR TRI-STATE REGION DURING TODAY TONIGHT AND INTO TUESDAY.

COASTAL NEW JERSEY MAY SEE SOME SEARCH EROSION AND MINOR FLOODING OF LOW-LYING COASTAL AREAS MAINLY AS TIME OF HIGH TIDES TONIGHT AND INTO TUESDAY AS THE NORTHEAST WINDS WILL RIDE A LONG WAY OVER OPEN WATER. ALSO...THE SURF WILL BECOME QUITE HEAVY AND COASTAL RESIDENTS SHOULD BE AWARD THAT THE SURF ALONG THE COASTAL WILL BE QUITE ROUGH FROM LATER TODAY THROUGH TONIGHT AND INTO TUESDAY. THE SWELL GENERATED FROM HURRICANE GRACE IS EXPECTED TO CAUSE HIGHER THAN NORMAL SURF AND STRONG RIP CURRENTS ON MANY EAST-FACING BEACHES BEGINNING LATE TODAY AN TONIGHT. MARINERS ARE URGED TO BE AWARE OF THIS AND TAKE ALL NECESSARY PRECAUTIONARY MEASURES. BE ESPECIALLY CAREFUL AT AND NEAR INLETS.

TEMPERATURES WILL BE MUCH COOLER EARLY THIS WEEK AS COMPARED TO LATE LAST WEEK AND OVER THE WEEKEND. TEMPERATURES WILL DROP DOWN TO THE 30S AND LOW 40S TONIGHT AND RISE ONLY TO THE UPPER 40S AND LOW 50S TUESDAY. SOME WARMING WILL OCCUR BY WEDNESDAY WITH TEMPERATURES RETURNING TO ABOVE NORMAL BY LATE IN THE WEEK AS THE HIGH PRESSURE AREA GRADUALLY MOVES OVER US AND THEN OFFSHORE.

THE NEXT STATEMENT WILL BE ISSUED AROUND 10 AM
PORIER

COASTAL FLOOD STATEMENT
FOR NORTHERN NEW JERSEY AND EXTREME SOUTHEASTERN NEW YORK INCLUDING LONG ISLAND
NATIONAL WEATHER SERVICE NEW YORK NY

...COASTAL FLOOD WARNING REMAINS IN EFFECT THROUGH THIS AFTERNOON FROM WATCH HILL RHODE ISLAND TO MONTAUK POINT TO MANASQAUAN INLET NEW JERSEY INCLUDING LONG ISLAND SOUND...NEW YORK HARBOR..AND THE LOWER HUDSON RIVER...

AN INTENSE ATLANTIC STORM...CURRENTLY LOCATED ABOUT 180 MILES SOUTHEAST OF MONTAUK PINT...HAS VEERED AROUND TO THE SOUTHWEST AND IS NOW HEADING AWAY FROM THE TRI-STATE REGION. HOWEVER, SWELLS BEING GENERATED BY THIS POWERFUL STORM WILL CONTINUE TO CAUSE COASTAL FLOODING TODAY, ESPECIALLY NEA TIME OF HIGH TIDES. IT IS BELIEVED THAT THE WORST FLOODING HAS JUST RECENTLY OCCURRED WITH THE PASSING OF OUT LATEST ASTRONOMICAL HIGH TIDE. DURING THIS PERIOD TIDES AROUND OUR REGION AVERAGED BETWEEN 4 AND 5 FEET ABOVE NORMAL. THIS LEAD TO MAJOR FLOODING ALONG THE COASTAL SECTIONS OF LONG ISLAND AND NORTHERN NEW JERSEY LAST NIGHT AND EARLY THIS MORNING. IN FACT THE TIDES HAVE RISEN SO MUCH ABOVE NORMAL THAT SOME RIVERS AND STREAMS IN NORTHERN NEW JERSEY..THAT FEED INTO THE HUDSON RIVER OR NEW YORK BAY..HAVE EXPERIENCE SOME SIGNIFICANT TIDAL FLOODING ALONG THEIR BANKS.

MANY COSTAL SECTIONS REMAIN FLOODED AT THIS TIME BUT WITH THE COMING OF LOWER ASTRONOMICAL TIDE THIS MORNING..MOST OF THIS FLOODING SHOULD RECEDE. UNFORTUNATELY..OUR ABNORMALLY HIGH TIDES ARE EXPECTED TO PERSIST THROUGH THE AFTERNOON HOURS WHICH WOULD BEING US TO OUR NEXT SCHEDULED ASTRONOMICAL HIGH TIDE. THE STORM GENERATED TIDES OF THEIR AFTERNOON WILL BE LESS THAN THOSE EXPERIENCED LAST NIGHT OR EARLY THIS MORNING..BUT NON-THE-LESS ARE EXPECTED TO RANGE BETWEEN 2 1/2 AND 3 1/2 FT ABOVE NORMAL. THIS MEANS THAT ANOTHER EPISODE OF COASTAL FLOODING IS EXPECTED...HOWEVER IT SHOULD NOT BE NEARLY AS EXTENSIVE OR SEVER AS THIS MORNINGS.

WITH THE STORM NO MOVING AWAY FROM OUR REGION AND WEAKENING AT THAT...OUR ABNORMALLY HIGH TIDES WILL CONTINUE T DOWNWARD TREND TO MORE ACCEPTABLE LEVELS BY TONIGHT.

THE NEXT STATEMENT WILL BE ISSUED AROUND 10 AM THIS MORNING
STALKER

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SPECIAL WEATHER STATEMENT
FOR NORTHERN NEW JERSEY AND EXTREME SOUTHEASTERN NEW YORK
INCLUDING LONG ISLAND
NATIONAL WEATHER SERVICE NEW YORK NY
345 PM EST WED OCT 30 1991

...COASTAL FLOOD WARNING THIS AFTERNOON AND TONIGHT FOR WATCH HILL RHODE ISLAND TO MONTAUK POINT MANASQUAN INLET NEW JERSEY INCLUDING LONG ISLAND SOUND AND NEW YORK HARBOR..
STORM WARNING THIS AFTERNOON AND TONIGHT FOR THE ATLANTIC COASTAL WATER INCLUDING LONG ISLAND SOUND
...GALE WARNING THIS AFTERNOON AND TONIGHT FOR NEW YORK HARBOR
...HIGH WIND WARNING THIS AFTERNOON AND TONIGHT FOR SUFFOLK COUNTRY..

AN INTENSE STORM IN THE NORTH ATLANTIC ABOUT 450 MILES EAST SOUTHEAST OF LONG ISLAND WILL CONTINUE MOVING WESTSOUTHWEST THROUGH TONIGHT. STRONG NORTH TO NORTHEAST WINDS AROUND THE STORM WILL MAINTAIN A STRONG FETCH THAT WILL DRIVE TIDES UP TO 5 FEET ABOVE NORMAL ALONG SOME COASTAL SECTIONS TONIGHT.

THIS WILL CONTINUE TO CAUSE EXTENSIVE FLOODING ALONG MANY COASTAL SECTIONS. SINCE 1 P.M. THE NATIONAL WEATHER SERVICE HAS RECEIVED SEVERAL REPORTS OF COASTAL FLOODING CAUSING THE NEED OF EVACUATION FROM AREAS THAT INCLUDE MONTAUK...FIRE ISLAND AND CONEY ISLAND ALONG THE SOUTH SHORE OF LONG ISLAND. WE HAVE ALSO RECEIVED REPORTS OF HIGHWAY FLOODING AND BASEMENT FLOODING ALONG AREAS OF SOUTH LONG ISLAND. SPECIFICALLY..THE POLICE HAVE REPORTED ALL LANES CLOSED SOUTH OF MERRICK ROAD OF MEADOWBROOK STATE PARKWAY AND UNDER BAY DRIVE ON WANTAGH STATE PARKWAY. PLEASE USE EXTRA PRECAUTIONS DURING THIS EVENING S RUSH HOUR. LISTEN TO THE RADIO FOR ALTERNATE TRAVEL ROUTES. DON'T BE FOOLED BY THIS AFTERNOONS BLUE SKIES.

TIDES WILL BE THE HIGHEST THIS AFTERNOON BETWEEN 2PM AND 5PM WITH SECONDARY HIGH TIDES AGAIN LATE TONIGHT. AT 2:45 PM. AREA TIDES ARE AVERAGING 2 TO 4 FEET ABOVE NORMAL AT SANDY HOOK.NEW JERSEY..WILLETS POINT AND THE BATTERY NEW YORK,. WITH WINDS CONTINUING TO INCREASE THROUGH THIS EVENING BEFORE PEAKING LATER TONIGHT..EXTENSIVE FLOODING IS EXPECTED TO CONTINUE ESPECIALLY THROUGH TIMES OF HIGH TIDES. WINDS RE FORECAST TO SUBSIDE LATER TONIGHT AND FLOODING WILL DECREASE. SIGNIFICANT BEACH EROSION WILL ALSO OCCUR.
THE TIDE WILL REACH ITS CLOSETS POINT TO THE REGION BY LATE TONIGHT AND IS FORECAST TO MOVE SOUTH WELL EAST OF THE SOUTHERN NEW JERSEY COAST.

STAY TUNED. THE NEXT STATEMENT WILL BE ISSUED BY 5 A.M. OR SOONER IF CONDITIONS WARRANT.
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COASTAL FLOOD STATEMENT
NATIONAL WEATHER SERVICE ATLANTIC CITY NJ
428 PM EST OCT 30 1991

...COASTAL FLOOD WARNING THROUGH THURSDAY FROM MANASQUAN INLET SOUTH TO CAPE MAY INCLUDING THE BACK BAYS...
...HEAVY SURF ADVISORY WITH SEVERE BEACH EROSION...
...GALE WARNING IN EFFECT...

A COASTAL FLOOD WARNING IS IN EFFECT FOR THE SOUTHERN NEW JERSEY COASTAL FOR SEVERE TIDAL FLOODING AROUND THE TIME OF HIGH TIDE EARLY THURSDAY MORNING. HIGH TIDE OCCURS ALONG THE OCEAN FRONT AT 144 AM AND 1 TO 2 HOURS LATER IN THE BACK BAYS.

TIDES AT 3 PM EST WERE RUNNING AROUND 4 1/2 FEET ABOVE NORMAL ALONG THE OCEAN FRONT AND WERE ESTIMATED TO BE AROUND 5 FEET ABOVE NORMAL IN SOME OF THE BACK BAYS. THESE DEPARTURES ARE EXPECTED TO CONTINUE OVERNIGHT AND SO FLOODING EARLY THURSDAY MORNING WILL BE SIMILAR TO WHAT HAS OCCURRED THIS AFTERNOON. WE ARE ANTICIPATING HIGH TIDE ALONG THE OCEAN FRONT TO REACH AROUND 8 1/2 FEET ABOVE MEAN LOW WATER AND AROUND 9 FEET IN SOME BACK BAYS 1 TO 2 HOURS LATER.

COSTAL RESIDENTS AND MOTORISTS SHOULD CONTINUE TO MONITOR THE FLOODING SITUATION. FLOODING ALREADY HAS CLOSED SECTIONS OF THE WHITE AND BLACK HORSE PIKES AND THESE ROADS MAY REMAIN CLOSED FOR A GOOD BALANCE OF THE EVENING. OTHER BARRIER ISLAND ROADS ARE CURRENTLY IMPASSABLE ALONG MANY COASTAL COMMUNITIES. ATLANTIC CITY HAS OPENED UP SHELTERS IN THE EVENT THAT EVACUATION MAY BE NECESSARY IN PARTS OF THE CITY.

FOR SURFERS WHO DARE TO VENTURE OUT AND RIDE THE SURF...BE EXTREMELY CAREFUL AND STAY ALERT. RIP CURRENTS ARE QUITE STRONG...ALONG WITH DANGEROUS UNDERTOW.,

THE REASON FOR THE COASTAL FLOOD WARNING IS AN INTENSE LOW PRESSURE SYSTEM ABOUT 450 MILES EAST OF THE NEW JERSEY COAST. THIS SYSTEM HAS BEEN MOVING CLOSER TO THE COAST AND CONTINUED NORTHERLY WINDS ARE CAUSING ONGOING BEACH EROSION AND ROUGH SURF.

COASTAL RESIDENTS AND MARINERS SHOULD CONTINUE TO STAY TUNED TO THE LATEST WEATHER INFORMATION WHICH CAN BE HEARS ON THE VOICE OF THE NATIONAL WEATHER SERVICE...NOAA WEATHER RADIO ON 162.40 MHZ.

THE NATIONAL WEATHER SERVICE OFFICE IN ATLANTIC CITY WILL CLOSELY MONITOR THIS SITUATION AND KEEP YOU INFORMED WITH FURTHER STATEMENTS
WS/SJG

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COASTAL FLOOD STATEMENT
NORTHERN NEW JERSEY AND EXTREME SOUTHEASTERN NEW YORK INCLUDING LONG ISLAND
NATIONAL WEATHER SERVICE NEW YORK NY
350 P, EST THU OCT 31 1991

...COASTAL FLOOD WARNING REMAINS IN EFFECT THROUGH THIS EVENING FROM WATCH HILL RHODE ISLAND TO MONTAUK POINT TO MANASQAUAN INLET NEW JERSEY INCLUDING LONG ISLAND SOUND...NEW YORK HARBOR..AND THE LOWER HUDSON RIVER...

THE MISCHIEF NIGHT AND HALLOWEEN STORM OF 1991 WAS THE MOST DAMAGING COASTAL STORM TO AFFECT THE TRI-STATE ARE IN A LONG TIME...PROBABLY 20 YEARS OF MORE. THE POWERFUL STORM WHICH INTENSIFIES WELL OFF THE NEW ENGLAND COASTAL MOVED IN AN UNUSUAL WESTWARD MOTION AND NEARED THE COAST WITH IT COUNTERCLOCKWISE CIRCULATION WEDNESDAY. THE STRONG NORTHEAST WINDS THREW A GREAT DEAL OF WEATHER UP ONTO THE COASTAL ZONE. TIDES WERE 5 TO 7 FEET ABOVE NORMAL...LIKELY MORE IN SOME CASES...DURING WEDNESDAY NIGHT.

MANY HOUSES WERE DESTROYED ON LONG ISLAND'S OCEAN SIDE. BEACH EROSION WAS CONSIDERABLE. THE NEW JERSEY SHORE ALSO RECEIVED A GREAT DEAL OF DAMAGE. CUTS IN THE BEACH OF 3 TO 5 FEET WERE COMMON.

HIGH TIDE WAS BEING EXPERIENCED IN MANY PLACES AROUND THE NEW YORK METROPOLITAN AREA AT MID AND LATE AFTERNOON...AND SOME SPOTS WILL HAVE HIGH TIDE INTO THE EARLY EVENING. AT 3PM THE TIDE WAS 3 3/4 FEET ABOVE NORMAL AT SANDY HOOK... 2 1/2 FEET AT THE BATTERY...AND 1 FOOT ABOVE NORMAL AT WILLETS POINT. AS YOU CAN SEE..THE TIDES HAVE DECREASED SINCE THIS MORNING. MORE COSTAL FLOODING WILL OCCUR DURING THE HIGH TIDE CYCLE OF THIS AFTERNOON AND EVENING...BUT IT WILL LIKELY BE LESS THAN WEDNESDAY NIGHT'S SEVERE FLOODING. HIGH TIDES WILL BE 2 TO 5 FEET ABOVE NORMAL THROUGH THE LATE AFTERNOON AND EVENING HOURS.

WATER SHOULD SLOWLY RECEDE TONIGHT AS THE WINDS WILL CONTINUE TO DIMISH AS THE STORM SLOWLY WEAKENS.

CLOUDS WILL CONTINUE AROUND THE AREA TONIGHT THROUGH SATURDAY. A CHANGE OF SHOWERS IS IN THE FORECAST AS THE STORM REMAINS RELATIVELY CLOSE TO OUR AREA..BUT THE CHANGE WILL DECREASES AS THE STORM PULLS AWAY TO THE NORTHEAST FRIDAY. ANOTHER FRONT IS EXPECTED TO APPROACH THE TRI-STATE AREA BY SATURDAY..BRINGING WITH IT MOE CLOUDS AND ANOTHER CHANCE OF SHOWERS.

TEMPERATURES WILL BE NEAR OR BELOW NORMAL THROUGH THE NEXT FEW DAYS.

ONE THING WERE ARE GRATEFUL FOR IS THAT THE LOSS OF LIFE HAS BEEN KEPT TO A MINIMUM..DUE IN PART TO COOPERATION FROM PEOPLE WHO AGREED TO BE EVACUATED AS WELL AS THE WARNING THAT PRECEDED AND ACCOMPANIED THIS MAJOR STORM WHICH WILL LIKELY BE A BENCHMARK FOR MANY YEARS TO COME.

THE NEXT STATEMENT WILL BE ISSUED AROUND 6 PM, THIS EVENING..OR SOONER IF CONDITIONS WARRANT AND AS DETAILS BECOME AVAILABLE.

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SPECIAL WEATHER STATEMENT
NATIONAL WEATHER SERVICE ATLANTIC CITY NJ
130 PM EDT MON OCT 28 1991

...MODERATE TIDAL FLOODING POSSIBLE TUESDAY FROM MANAQUAN TO CAPE MAY ESPECIALLY IN BACK BAY AREAS...
..GALE WARNINGS...HEAVY SURF ADVISORY AND BEACH EROSION ALONG COAST...

A COMBINATION OF HIGH PRESSURE OVER EASTERN CANADA AND HURRICANE GRACE OUT OVER THE ATLANTIC OCEAN WILL KEEP A CONTINUED FLOW OF STRONG NORTHEAST WINDS ALONG COASTAL NEW JERSEY FROM TODAY INTO WEDNESDAY.

TIDES AS OF 1 PM THIS AFTERNOON WERE RUNNING NEAR 1 1/2 FEET ABOVE NORMAL. WITH CONTINUED GALE FORCE WINDS INTO TUESDAY TIDES WILL BECOME 2 TO 3 FEET ABOVE NORMAL. THEREFORE TIDE HEIGHTS OF NEAR 7 FEET ABOVE MEAN LOW (MLW) ALONG THE OCEAN FRONT AND 7 1/2 TO 8 FEET ABOVE MLW IN SOME BACK BAYS ARE POSSIBLE AT TIME OF HIGH TIDE TUESDAY. HIGH TIDE OCCURS AT 1146 AM ALONG THE OCEAN FRONT AND 1 TO 2 HOURS LATER IN THE BACK BAYS.

FOR THOSE INTERESTED IN CONVERSING MEAN LOW WATER TO MEAN SEA LEVEL JUST SUBTRACT 2 FEET FROM THE ABOVE VALUES.

AT 7 FEET ABOVE MEAN LOW WATER ACCESS ROAD FROM THE MAINLAND TO THE BARRIER ISLAND BEGIN TO FLOOD.

ROUGH AREAS AND STRONG WIND THROUGH WEDNESDAY WILL ALSO CAUSE MODERATE AND POSSIBLE SEVERE BEACH EROSION THROUGH WEDNESDAY.

PERSONS PLANNING ON COMMUNITY TO OR FROM THE BARRIER ISLAND ON TUESDAY SHOULD KEEP ABREAST OF THE SITUATION BY LISTENING TO NOaA WEATHER RADIO OR LOCAL RADIO AND TV STATIONS FOR THE LATEST STATEMENTS ON THE FLOODING. THE NEXT STATEMENT OR WARNING..IF NEEDED WILL BE ISSUED AROUND 9 PM TONIGHT.
KRIEGER

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SPECIAL WEATHER STATEMENT
NATIONAL WEATHER SERVICE ATLANTIC CITY NY
1240 PM EST TUE OCT 29 1991

...MODERATE TIDAL FLOODING AT THE TIME OF HIGH TIDE EARLY THIS AFTERNOON IN BACK BAY AREAS.

...HEAVY SURF ADVISORY WITH BEACH EROSION...

AT 1150 AM THIS MORNING THE TIDE RAN ALMOST 2 1/2 FEET (2.4) ABOVE NORMAL ALONG THE OCEAN FRONT. THIS CAUSED THE TIDES TO REACH 7.2 FEET ABOVE MEAN LOW WATER. SOME FLOODING HAS OCCURRED.

THE BIGGEST PROBLEM AT THIS TIME IS THE BACK BAYS WHERE FLOODING BEGINS 1 TO 2 HOURS LATER OR BETWEEN 1 PM AND 2 PM. AT THIS TIME WERE ARE EXPECTING TIDES TO REACH 7 1/2 FEET ABOVE MEAN LOWER AND MAYBE SLIGHTLY HIGHER IN SOME BACK BAYS. THIS WILL CAUSE SOME ROAD TO EIGHT HAVE SOME EASTERN ON THEM OR EVEN BE CLOSED. ATLANTIC CITY EMERGENCY MANAGEMENT HAS MADE A REQUEST THAT ALL MOTORISTS USE THE ATLANTIC CITY EXPRESSWAY INSTEAD OF THE WHITEHORSE OR BLACK HORSE PIKES UNTIL 3 30 THIS AFTERNOON.

CONTINUED ROUGH SEAS AND NORTHEAST WINDS WILL CAUSE BEACH EROSION.

PERSONS ALONG BACK BAY AREAS AND THOSE TRAVELING INTO OR OUR OF THE BARRIER ISLAND SHOULD CONTINUE TO MONITOR THE SITUATION CLOSELY. LISTEN TO NOAA WEATHER RADIO OR TV STATIONS FOR FURTHER STATEMENTS.
KRIERGER

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COASTAL FLOOD STATEMENT
NATIONAL WEATHER SERVICE ATLANTIC CITY NJ
455 AM EST THU OCT 3 1991

...COASTAL FLOOD WARNING TODAY FOR THE SOUTHERN NEW JERSEY COAST FROM MANASQUAN INLET TO CAPE MAY INCLUDING THE BACK BAYS...
...HEAVY SURF ADVISORY WITH BEACH EROSION...
...GALE WARNING...

A COSTAL FLOOD WARNING CONTINUES TODAY FROM THE SOUTHERN NEW JERSEY COASTAL AND THE BACK BAYS FOR EXTREME TIDAL FLOODING AROUND THE TIME OF HIGH TIDE EARLY THIS AFTERNOON. HIGH TIDE OCCURS AT THE VENTNOR CITY FISHING PIER AT 203 PM THIS AFTERNOON AND 1 TO 2 HOURS LATER IN THE BACK BAYS.

TIDES AT 4 AM EST THIS MORNING WERE RUNNING 5 TO 5 1/2 FEET ABOVE NORMAL ALONG THE OCEAN FRONT AND ESTIMATED TO BE ABOUR A FOOT HIGHER IN THE BACK BAYS. AT 144 AM THIS MORNING HIGH TIDE CRESTED A 9 FEET ABOVE MEAN LOW WATER. THIS WAS THE 2ND ALL-TIME HIGH TIDE EVER...PASSING SUCH MARKS AS THE 8.7 FOOT READING DURING THE NOVEMBER STORM OF 1950 AND OVERTAKING THE 8.9 FEET OF WATER ALONG THE OCEAN FRONT DURING THE MARCH STORM OF 1962.

THINGS GET WORSE...

HIGH TIDE THIS AFTERNOON SHOULD BE EVEN HIGHER THAN WHAT TOOK PLACE EARLY THIS MORNING. 9 TO 9 1/2 FEET ABOVE MEAN LOW WATER WILL NOT BE OUT OF THE QUESTION ALONG THE OCEAN FRONT. THE ALL-TIME HIGH TIDE RECORD OF 9.3 FEET OCCURRED DURING THE HURRICANE OF 1944.

RESIDENTS ALONG THE COAST AND ESPECIALLY THOSE NEAR BACK BAYS PRONE TO TIDAL FLOODING SHOULD MONITOR THE SITUATION VERY CLOSELY. BE PREPARED TO TAKE ACTION IF FLOOD WATER RISE. MOTORISTS NEAR FLOOD PRONE BACK BAYS SHOULD MOVE THEIR VEHICLES TO HIGHER GROUND OR FARTHER INLAND. IN YOUR MORNING AND LATE AFTERNOON COMMUTE...LEAVE YOURSELF EXTRA TIME TO REACH YOUR SEMINATION SAFELY.

THE REASON FOR THIS HISTORY MAKING EVENT IS A DANGEROUS LOW PRESSURE SYSTEM CENTERED 240 MILES EAST OF ATLANTIC CITY NEW JERSEY. THIS PERSISTENT WAVE MAKING MACHINE WILL CONTINUE MOVING EVER SO SLOWLY TOWARD US BRINGING ITS NORTHERLY WIND FLOW AND ROUGH SEAS.

BEACH EROSION WILL CONTINUE TO POSE ITS PROBLEMS ALONG THE SHORE. ADDING INSULT TO INJURY...THE ROUGH SURF AND STRONG WINDS WILL ENHANCE THE SEVERE BEACH EROSION NOW TAKING PLACE.

NOT ONLY IS THE BEACH ERODING AWAY...

REPORTS OF THE BOARDWALK COMING APART IN THE ATLANTIC CITY INLET AREA BETWEEN PACIFIC AND ORIENTAL AVENUES WERE RECEIVED THIS MORNING.

THE NATIONAL WEATHER SERVING IN ATLANTIC CITY WILL CONTINUE TO MONITOR THIS FLOODING SITUATION AND KEEP YOU INFORMED WITH FURTHER STATEMENTS THROUGHOUT THE DAY.
CHIELLINI

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COASTAL FLOOD STATEMENT
NATIONAL WEATHER SERVICE WASHINGTON DC
1215 AM EST FRI NOV 1 1991

...FLOODING AT THE TIME FOR HIGH TIDE WAS OCCURRING ON THE POTOMAC RIVER EARLY THIS FRIDAY MORNING...

HIGH TIDE AT WISCONSIN AVENUE IS AT 254 AM EST. THE WATER CONTINUED TO RISE EARLY THIS MORNING AND IT WILL BE BETWEEN 6 AND 6.5 FT ABOUT THE TIME OF HIGH TIDE. FLOOD STAGE AT WISCONSIN AVENUE IS 6 FT.

LOW LYING AREAS ALL ALONG THE TIDAL POTOMAC WILL EXPERIENCE SOME MINOR FLOODING...THIS INCLUDES AREAS IN SOUTHEAST FAIRFAX COUNTY SUCH AS OLDTOWN ALEXANDRIA AND MT. VERNON. ALSO THE LOW LYING AREAS IN THE GEORGETOWN WATERFRONT AREA IN WASHINGTON D.C. THERE HAVE ALREADY BEEN REPORTS OF FLOODING ON THE BRIDGE LEADING TO COBBISLAND IN CHARLES COUNTY MARYLAND.

THE TIDE WILL START TO RECEDE IN THE PRE-DAWN HOURS AND THE NEXT HIGH TIDE THIS AFTERNOON IS NOT EXPECTED TO EXCEED THE 6 FT CRITICAL FLOOD STAGE.

PEOPLE LIVING ALONG THE TIDAL POTOMAC RIVER SOUTH OF CHAIN BRIDGE SHOULD BE ESPECIALLY ALERT FOR RISING WATER THROUGH THE EARLY MORNING HOURS. MEASURERS SHOULD BE TAKEN TO PROTECT ANY PROPERTY THAT HAS SUFFERED WATER DAMAGE FROM PROPER FLOODING.
KANE/SCHWERDT

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COASTAL FLOOD STATEMENT
NATIONAL WEATHER SERVICE WILMINGTON DE
1133 AM EST THU OCT 31 1991

...COASTAL FLOOD WARNING FOR THE ATLANTIC COAST OF DELAWARE TODAY...
...HEAVY SURF FOR DELAWARE ATLANTIC COAST TODAY...
...BEACH EROSION ALONG THE ATLANTIC COAST OF DELAWARE TODAY AND TONIGHT...

AN INTENSE STORM ABOUT 175 MILES EAST OF WALLOPS ISLAND VIRGINIA COMBINED WITH HIGH PRESSURE OVER EASTERN CANADA IS CAUSING STRONG GUSTY NORTHERLY WINDS ALONG THE ATLANTIC COAST...THESE WINDS WILL PERSIST TODAY GRADUALLY DIMISHING TONIGHT AND SLOWLY LOSING THEIR GRIP ON THE COAST LATER TONIGHT AND FRIDAY AS THE LOW PRESSURE SYSTEM MOVES SOUTHEAST THEN EAST LATER TODAY AND TONIGHT AND BEGINS TO WEAKEN.

DUNES ALONG THE DELAWARE COAST ARE REPORTED IN BAD SHAPE ALONG WITH CONSIDERABLE FLOODING AND BEACH EROSION THIS MORNING. AS HIGH TIDES OCCURS THIS AFTERNOON SUBSTANTIAL BEACH EROSION AND SIGNIFICANT COASTAL FLOODING WILL KIELY OCCUR.

HIGH TIDES ALONG THE ATLANTIC COAST FOR THIS AFTERNOON... INDIAN RIVER 324 PM EST...OCEAN CITY 205 PM...AND BREAKWATER HARBOR DE 314 PM...TIDES HAVE AND WILL CONTINUE TO RUN 2 TO 3 FEET ABOVE NORMAL.

THE FLOODING HAS AFFECTED BOTH THE OCEAN FRONT AREAS AND THE TIDAL INFLUENCED STREAMS AND BAYS...SOME OF THE BACK BAYS WILL CONTINUE TO FLOOD UNTIL THE STRONG MOVES WELL AWAY FROM THE AREA AND THE WATER HAS A CHANCE TO RECEDE.

WINDS WILL CONTINUE FROM THE NORTH TO NORTHEAST AT 30 TO 40 MPH WITH HIGHER GUST...DIMISHING SLOWLY THIS AFTERNOON AND TONIGHT.

THIS STORM HAS HAD AND WILL CONTINUE TO HAVE A MAJOR IMPACT ALONG THE COAST OF DELAWARE..FLOODING OF BOTH THE COASTAL SECTIONS AND THE BAYS ALONG WITH ANY TIDAL INFLUENCED STEAMS WILL CONTINUE TODAY WITH THE GREATEST PROBLEMS OCCURRING AROUND THE TIMED OF HIGH TIDES. HEAVY SURF AND SIGNIFICANT BEACH EROSION WILL CONTINUE INTO TONIGHT.

THE NEXT STATEMENT WILL BE ISSUED BETWEEN 4 AND 5 PM EST THIS AFTERNOON.
CKD

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COASTAL FLOOD STATEMENT
NATIONAL WEATHER SERVICE NORFOLK VA
1000 PM EDT MON OCT 28 1991

...A COASTAL FLOOD WARNING IS NOW IN EFFECT FOR ALL OF THE ATLANTIC COAST OF VIRGINIA...

THE COMBINATION OF A STRONG HIGH PRESSURE RIDE THAT EXTENDS FROM EASTERN CANADA SOUTH ALONG THE EASTERN SIDE OF THE APPALACHIAN MOUNTAINS AND HURRICANE GRACE WLL OUR OVER THE ATLANTIC IS PRODUCING A STRONG ONSHORE FLOW FOR COASTAL VIRGINIA. THIS IS POTENTIALLY A LONG LASTING COASTAL FLOOD SITUATION. THIS WEATHER PATTERN IS EXPECTED TO CHANCE ONLY SLOWLY DURING THE NEXT 48 HOURS.

COASTAL FLOODING HAS NOT YET DEVELOPED BUT CONDITION ARE FAVORABLE FOR COASTAL FLOODING TO OCCUR WITHIN THE NEXT 12 TO 18 HOURS. THE TIDE CYCLE WILL PRODUCE THE HIGHEST TIDES DURING THE EARLY AFTERNOON HOUR TUESDAY AND WEDNESDAY. THESE WILL BE THE MOST LIKELY TIMES FOR BEACH EROSION AND MINOR TO MODERATE TIDAL FLOODING.

TIDES AT SEWELL POINT ARE 1.5 TO 2 FEET ABOVE NORMAL AT THIS TIME. ANOTHER COASTAL FLOOD STATEMENT WILL BE ISSUED EARLY TUESDAY MORNING.
THOMAS

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COASTAL FLOOD STATEMENT
NATIONAL WEATHER SERVICE WASHINGTON, DC
910 PM EST MON OCT 28 1991

...A COASTAL FLOOD WARNING IS NOW IN EFFECT FOR THE ATLANTIC COAST FROM CAPE HENLOPEN TO AND INCLUDING VIRGINIA BEACH...

THE COMBINATION OF STRONG HIGH PRESSURE OVER THE NORTHEASTERN U.S. AND HURRICANE GRACE IN THE ATLANTIC WEST OF BERMUDA IS CAUSING NORTHEAST WINDS UP TO GALE FORCE AND HEAVY SEAS ALONG PARTS OF THE MID ATLANTIC COAST. SEAS AS HIGH AS 10 FEET ARE BEING FELT ON PORTIONS OF THE VIRGINIA COAST...AND TIDES EVEN AT LOW WATER ARE STARTING TO RUN A FOOT AND A HALF ABOVE NORMAL.

COASTAL FLOODING HAS NT YET DEVELOPED. HOWEVER CONDITIONS ARE VERY FAVORABLE FOR COASTAL FLOODING TO OCCUR WITHIN ABOUT 12 HOURS...AS THE STRONG HIGH WILL REMAIN STATIONARY...AND INTENSE LOW PRESSURE WILL PERSIST OFFSHORE BETWEEN BERMUDA AND TIME MID ATLANTIC COAST FOR AT LEAST THE NEXT COUPLE OF DAYS.

BY MID MORNING TUESDAY...THE WEATHER SERVICE EXPECTS MINOR FLOODING TO DEVELOP ALONG THE DELAWARE AND MARYLAND COASTS..AND MINOR TO MODERATE FLOODING ON THE VIRGINIA COAST. IN ADDITION..THE HEAVY SURF ADVISORY WILL CONTINUE ALL ALONG THE COAST FROM CAPE HENOPEN TO VIRGINIA BEACH.

THIS IS POTENTIALLY A LONG-LASTING COASTAL FLOOD SITUATION. HURRICANE GRACE IS FORECAST TO MOVE EAST OF BERMUDA TUESDAY AND WEAKEN...BUT IT IS EXPECTED TO BE REPLACED BY AN INTENSE NON-TROPICAL LOW PRESSURE SYSTEM BETWEEN BERMUDA AND EASTERN NORTH CAROLINA WITHIN 24 HOURS. THE STATIONARY HIGH OVER THE NORTHEAST WIL COMBINE WITH THE LOW TO MAINTAIN A LONG FETCH OF STRONG NORTHEAST WINDS ALONG THE MID ATLANTIC COAST...FOR AT LEAST THE NEXT 24 TO 36 HOURS. AS A RESULT...CONTINUED HEAVY SURF AND STRONG ONSHORE WINDS WILL BRING INCREASINGLY HIGH WATER LEVELS AS WELL AS POSSIBLE BEACH EROSION...FOR AS LONG AS THIS PERSISTENT WEATHER PATTEN LASTS.

KEEP TUNED TO NOAA WEATHER RADIO FOR UPDATED INFORMATION ON THIS POTENTIALLY DANGEROUS COASTAL FOOD SITUATION,. BE ALERT TO INFORMATION FROM LOCAL GOVERNMENT AGENCIES SHOULD EVACUATION BE DEEMED NECESSARY.

A COASTAL FLOOD STATEMENT WILL BE ISSUED EARLY TUESDAY MORNING TO KEEP YOU UP TO DATE ON THIS SITUATION.
SMITH/BELVILLE/GUSTIN

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COASTAL FLOOD STATEMENT..UPDATED
NATIONAL WEATHER SERVICE NORFOLK VA
530 AM EDT TUE OCT 29 1991

...COASTAL FLOOD WARNING CONTINUED IN EFFECT FOR THE ATLANTIC COAST...
...COASTAL FLOOD WARNING EXTENDED TO INCLUDE THE MOUTH OF THE BAY...
...HEAVY SURF ADVISORY IN EFFECT FOR THE ATLANTIC COAST...
...GALE WARNING IN EFFECT FOR THE COAST AND MOUTH OF THE BAY...

ON THE EARLY MORNING WEATHER MAP...STRONG HIGH PRESSURE OVER EASTERN CANADA IS BUILDING SOUTHWARD INTO THE MID ATLANTIC REGION. A STRONG OCEAN STORM IS DEVELOPING OFF THE NEW ENGLAND COAST...AND HURRICANE GRACE IS POSITIONED NEAR BERMUDA. THE CIRCULATIONS AROUND THESE WEATHER SYSTEMS IS PRODUCING NORTHEAST WINDS AT GALE FORCE AND HEAVY SEAS ALONG THE MID ATLANTIC COAST AND INT HE LOWER CHESAPEAKE BAY.

DURING THE NEXT 24 TO 36 HOURS...HURRICANE GRACE WILL BECOME ABSORBED IN THE LARGE OCEAN STORM OFF THE EASTERN SEABOARD. THIS LARGE STORM WILL BECOME STATIONARY AND COMBINE WITH THE STRONG HIGH PRESSURE SYSTEM BUILDING SOUTHWARD TO MAINTAIN A LONG FETCH OF GALE FORCE NORTH AND NORTHEAST WINDS OVER THE AREA. THIS WILL RESULT IN A LONG-LASTING PERIOD OF HEAVY SURF...BEACH EROSION AND INCREASINGLY HIGH WATER LEVELS.

TIDES WILL RUN 2 TO 3 FEET ABOVE NORMAL THROUGH WEDNESDAY. THIS WILL PRODUCE TIDES OF 5 TO 6 FEET ABOVE MEAN LOWER LOW WATER ALONG THE NORTH FACING BEACHES OF THE LOWER CHESAPEAKE BAY AND ALONG THE ATLANTIC COASTAL DURING HIGH TIDE THIS AFTERNOON AND AGAIN TONIGHT. AREAS MOST VULNERABLE INCLUDE WILLOUGHBY SPIT..OCEAN VIEW...CHESAPEAKE BEACH...BUCKROE AND GRANDVIEW BEACHES IN HAMPTON...AND THE SANDBRIDGE AREA OF VIRGINIA BEACH.

LOCAL TIDAL INFORMATION

	LOW	HIGH	LOW	HIGH
SEWELLS POINT	7:08AM	1:36PM	9:11PM	3:12AM WED
VA BEACH OCEANFRONT	5:38AM	1206PM	7:41PM	1:42AM WED

RESIDENTS IN THE VULNERABLE AREAS SHOULD CONSULT LOCAL AUTHORITIES FOR FURTHER INFORMATION CONCERNING YOUR PARTICULAR LOCATION AND THE POTENTIAL THREAT TO LIFE AND PROPERTY. BE ALERT TO INFORMATION FROM THE LOCAL GOVERNMENT AGENCIES SHOULD EVACUATION BE DEEMED NECESSARY.

STAY TUNED TO NOAA WEATHER RADIO THROUGHOUT THE DAY FOR UPDATED INFORMATION ON THIS POTENTIALLY DANGEROUS COASTAL FLOOD SITUATION. THE NEXT COASTAL FLOOD STATEMENT WILL BE ISSUED BY NOON OR EARLIER IF NEEDED.
WALSTON

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COASTAL FLOOD STATEMENT
NATIONAL WEATHER SERVICE NORFOLK VA
515 PM EST THU OCT 31 1991

...HEAVY SURF ADVISORY IS IN EFFECT ALONG THE COAST...
...MODERATE BEACH EROSION TO CONTINUE THROUGH FRIDAY...
...SMALL CRAFT ADVISORY ALONG THE COAST AND THE MOUTH OF THE BAY...

AN INTENSE OCEAN STORM CENTERED ABOUT 200 MILES EAST OF NORFOLK VIRGINIA WILL DRIFT SOUTH-SOUTHEAST TODAY AND IS EXPECTED TO CONTINUE WEAKENING. ON FRIDAY...THIS LOW PRESSURE SYSTEM WILL MOVE NORTH-NORTHEAST TOWARD NOVA SCOTIA.

THE EFFECTS OF THE STORM ON COASTAL VIRGINIA HAVE BEEN LARGELY FELT ON THE ATLANTIC COAST WHERE A COMBINATION OF HIGH TIDES AND VERY HEAVY SURF HAVE PRODUCED SOME STRUCTURAL DAMAGE IN THE SANDBRIDGE AREA OF VIRGINIA BEACH. THE HOMES THAT SUFFERED THE MOST DAMAGE WHERE THOSE NOT PROTECTED BY A BULKHEAD. THE DAMAGE CONSISTED MOSTLY OF SEPTIC SYSTEMS BEING WASHED OUT AND STRUCTURAL DAMAGE TO WOOD STRUCTED ATTACHED TO THE GROUND LEVEL PILINGS. SANDFIDLER ROAD AND OVERWASHING IN SEVERAL PLACED DURING HIGH TIDE THIS AFTERNOON.

CONDITIONS WILL BE IMPROVING SLOWLY OVERNIGHT AND THROUGH FRIDAY. HOWEVER..THOSE ALONG THE IMMEDIATE ATLANTIC COAST AND ESPECIALLY THE SANDBRIDGE SECTION OF VIRGINIA BEACH WILL AGAIN EXPERIENCE HEAVY SURF AND MODERATE TO HEAVY BEACH EROSION TONIGHT MAINLY DURING TIMES OF HIGH TIDE.

HIGH TIDE TONIGHT WILL OCCUR AT 2:58AM AT VIRGINIA BEACH AND 4:28 AM AT SEWELLS POINT. THE TIDE AT NORTH LOCATIONS SHOULD CREST BETWEEN 4.5 TO 5.5 FEET ABOVE MEAN LOWER LOW WATER WHICH WILL BE ABOUT A HALF FOOT LOWER THAN WAS EXPERIENCED THIS AFTERNOON AT THIGH TIDE. THIS WILL PRODUCE LIGHT TO MODERATE TIDAL FLOODING OF LOW LYING AREAS ALONG TIDAL ESTUARIES.

SUBSIDING WAVES AND TIDES ON FRIDAY SHOULD RESULT IN ONLY MINOR TIDAL FLOODING DURING HIGH TIDE LATE FRIDAY AFTERNOON.

RESIDENCE WHO EXPERIENCE TIDAL FLOODING OR WHO LIVE ALONG THE BEACHES CAN LEARN A VALUABLE LESSON FRO THIS STORM. THE MAXIMUM TIDE AT SEWELLS POINT REACHED 5.6 FEET ABOVE MEAN LOWER LOW WATER DURING THE TIME OF HIGH TIDE THIS AFTERNOON. THIS LEVEL OCCURS ON AVERAGE ABOUT TWO TIMES A YEAR AND RESULTS IN MINOR TO MODERATE TIDAL FLOODING. OVER THE LAST 100 YEARS WERE AVERAGE A STORM SURGE OF 6.1 FEET ABOVE MEAN LOWER LOW WATER ONCE EVERY THREE YEARS AND 8.1 FEET ABOVE MEAN LOWER LOW WATER ONCE EVERY 11 YEARS. EITHER OF THESE STORM SURGES IS RELATIVELY COMMON AND WOULD PRODUCE FAR MORE FLOODING AND DAMAGE THAN THE STORM WE HAVE JUST EXPERIENCED.

IF THIS STORM AFFECTED YOUR PROPERTY...REMEMBER HOW HIGH THE WATER CAME SO THAT YOU WILL KNOW WHAT TO DO IF A STORM SURGE OF 6...7 OR EVEN 8 FEET ABOVE MEAN LOWER LOW WATER IS FORECAST WITH A FUTURE STORM. ADDITIONAL STATEMENTS WILL BE ISSUED IF NEEDED. RITTER

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COASTAL FLOOD STATEMENT
NATIONAL WEATHER SERVICE RALIEGH/DURHAM
1045 PM EST SUN 27 1991

...A COSTAL FLOOD WATCH REMAINS FROM SOUTH OF VIRGINIA BEACH TO CAPE LOOKOUT FOR MONDAY THROUGH TUESDAY...

PORTION OF THE NORTH CAROLINA COAST ALREADY FEELING THE FRINGE EFFECTS OF HURRICANE GRACE TONIGHT...AS LARGE WAVES GENERATED BY THE HURRICANE THREATENED THE OUTER BANKS WITH BEACH EROSION.

AT 10:30PM...THE CENTER OF HURRICANE GRACE WAS LOCATED ABOUT 425 MILES EAST SOUTHEAST OF CAPE HATTERAS. THE STORM WAS MOVING TOWARD THE NORTHWEST AT 12 MPH...BUT IS WAS EXPECTED TO BEGIN A TURN TOWARD THE NORTH AND REMAIN WELL OFFSHORE.

SIX FOOT BREAKERS WERE REPORTED AT THE PIER AT DUCK 10 PM...AND SEAS HAD INCREASED TO 13 FT AT THE DATA BUOY...SOME 130 MILES EAST OF CAP HATTERAS.

WAVES WERE EXPECTED TO GRADUALLY INCREASE IN HEIGHT ALONG THE OUTER BANKS ON MONDAY...AND TO CONTINUE INTO MONDAY NIGHT.

COMPOUNDING THIS PROBLEM IS A STRONG HIGH PRESSURE SYSTEM CENTERED OVER SOUTHEASTERN CANADA THAT WILL BE PUSHING INTO THE MID ATLANTIC REGION LATE MONDAY AND MONDAY NIGHT. THE COMBINATION OF THE LOW PRESSURE ASSOCIATED WITH THE HURRICANE AND THE STRONG HIGH PRESSURE TO THE NORTH WILL LEAD TO INCREASING NORTHEAST TO NORTH WINDS ALONG THE COAST.

WINDS ARE FORECAST TO INCREASE TO 25 TO 35 MPH WITH GUSTS TO 40 MPH FROM SOUTH OF VIRGINIA BEACH TO CAPE LOOKOUT BY LATE MONDAY AFTERNOON OR MONDAY EVENING. SEAS SHOULD CONTINUE TO BUILD TO BETWEEN 11 AND 13 FEET IN THESE AREAS. SIGNIFICANT BEACH EROSION IS LIKELY MONDAY AND TUESDAY. COASTAL FLOODING IS A POSSIBILITY ESPECIALLY AROUND THE TIME OF HIGH TIDE JUST BEFORE NOON MONDAY. THE AREAS THAT COULD BE MOST AFFECTED WILL BE FROM CAP HATTERAS NORTHWARD...ESPECIALLY IN THE NAGS HEAD AND KILL DEVIL HILLS REGION.

GALE WARNINGS ARE IN EFFECT FOR THESE INCREASING WINDS FROM SOUTH OF VIRGINIA BEACH TO CAPE LOOKOUT. SMALL CRAFT ADVISORIES REMAIN IN EFFECT FROM SOUTH OF CAPE LOOKOUT TO LITTLE RIVE INLET. HEAVY SURF ADVISORIES REMAIN IN EFFECT ALONG THE ENTIRE COAST.

REMEMBER...A COASTAL FLOOR WATCH MEANS THAT CONDITIONS ARE FAVORABLE FRO COASTAL FLOODING. YOU SHOULD BE PREPARED TO TAKE PROTECTIVE ACTIONS IF FLOODING OCCURS OR IF WARNINGS ARE ISSUED.

LISTING TO LOCAL RADIO..TV..OR NOAA WEATHER RADIO FOR FURTHER INFORMATION.
CDM

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PUBLIC INFORMATION STATEMENT
NATIONAL WEATHER SERVICE CAPE HATTERAS NC
1140 AM EST THU OCT 31 1991

...EVACUATION OF BEACH AREA ORDERED BY DARE COUNTY CONTROL GROUP...

THE TOWNS OF NAGS HEAD AND KILL DEVIL HILLS ARE EVACUATING IMMEDIATELY...PEOPLE WHO LIKE ON THE NAGS HEAD OCEANFRONT AND THE WEST SIDE OF OLD OREGON INLET ROAD SOUTH OF WHALE-BONE JUNCTION.

KILL DEVIL HILLS IS EVACUATING PEOPLE LIVING ON THE OCEANFRONT BETWEEN THE HIGHWAYS OF THE BY-PASS.

ALL THOSE EVACUATING..WHO NEED SHELTER..ARE INSTRUCTED TO GO TO THE MANTEO HIGH SCHOOL. WE ARE INSTRUCTING PEOPLE TO EVACUATE FOR THEIR OWN SAFETY..SAND NAGS HEAD MAJOR DON DRYAN.

NAGS HEAD AND KILL DEVIL HILLS POLICE AND FIRE DEPARTMENTS ARE GOING HOUSE TO HOUSE..WHERE POSSIBLE...TO ISSUE THE INSTRUCTIONS.

THE ROAD IS STILL PASSABLE...BUT AS WE WAIT MUCH LONER IT WILL BE..BRYAN SAID. WE ALREADY ARE EXPERIENCING OCEAN OVERWASH AND WERE THREE HOUR SWAY FROM HIGH TIDE.

QUITE A FEW PEOPLE EVACUATED ON THEIR OWN LAST NIGHT. THIS HIGH TIDE ID EXPECTED TO BE WORSE THAN THAT.

THOSE GOING TO THE SHELTER SHOULD TAKE BLANKETS..PILLOWS TOILETRY ITEMS..MEDIATION..AND OTHER PERSONAL ITEMS.
END/AP
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COASTAL FLOOD STATEMENT
NATIONAL WEATHER SERVICE CAPE HATTERAS NC
935 PM EST MON OCT 28 1991

...A COASTAL FLOOD WARNING IS IN EFFECT FOR THE NORTH CAROLINA COAST FROM CAPE LOOKOUT NORTH TO VIRGINIA BORDER...
...GALE WARNINGS ARE IN EFFECT FOR THE NORTH CAROLINA COASTAL WATERS INCLUDING THE ALBEMARLE..CURRITUCK...AND PAMLICO SOUNDS...
...A HEAVY SURF ADVISORY IS IN EFFECT FOR THE NORTH CAROLINA COAST...

THE COMBINED EFFECT FROM A STRONG HIGH PRESSURE SYSTEM BUILDING OVER THE AREA...AND THE DISTANT HURRICANE GRACE ABOUT 500 MILES OFFSHORE...HAVE CAUSED A STEADY INCREASE IN BOTH WINDS AND SEA HEIGHTS OVER THE AREA.

A COASTAL FLOOD WARNING MEANS THAT OCEAN FLOODING IS IMMINENT FOR THE WARNED AREA. PEOPLE ALONG THE IMMEDIATE BEACH FRONT SHOULD BE PREPARED FOR OCEAN FLOODING..AND BE PREPARED TO WATER COMING UNDER THE MORE EXPOSED HORSE ON THE BEACHFRONT. MORE EXPOSED SECTION OF THE BEACH ROADS WILL ALSO BE SUBJECT TO OVERWASH CONDITIONS..AND COMBINED WITH SAND AND FLOOD DEBRIS. MAY BECOME IMPASSABLE FOR A PERIOD OF TIME.

THE MORE VULNERABLE AREAS ALONG THE COAST...THE NORTHERN BEACHES OF CURRITUCK COUNTY INCLUDING COROLLA..CORAVA..AND THE PENNY HILL AREA. IN DARE COUNTRY...THE BEACH ROAD BETWEEN KILL DEVIL HILLS AND NAGS HEAD HAS SEVERAL THREATENED AREAS. SOUTH NAGS HAS A HISTORY OF VULNERABILITY DURING STRONG NORTHEAST WINDS.

ON HATTERAS ISLAND...UNPOPULATED PEA ISLAND HAS SEVERAL POINTS WHERE ROUTE 12 IS SUBJECT TO OVERWASH..JUST NORTH OF THE VILLAGE OF RODANTHE AT THE SIGHT ON THE FORMER S-SURVES...AND JUST NORTH OF THE VILLAGE OF BUXTON.

SOUTH OF BUXTON...FLOODING WILL BE MORE LIKELY FROM THE SOUTHSIDE...ALTHOUGH ROUGH SEAS MAY BREAK OVER THE DUNS BETWEEN FRISCO AND HATTERAS. OCRACOKE ISLAND WILL ALSO BE VULNERABLE TO SOUTHSIDE FLOODING IN THE VILLAGE..AND A COMBINATION OF SOUNDSIDE AND OCEAN FLOODING ON THE NORTH END OF THE ISLAND.

NORTHEAST WINDS OF 30 TO 40 MILES AN HOUR CONTINUED TO BUFFET THE AREA. THESE WINDS MAY INCREASE SOME IN SPEED DURING THE NIGHT. THE STRONG NORTHEAST WIND WILL CONTINUE FOR AT LEAST 24 HOURS.

THE WAVE HEIGHTS HAVE INCREASED TO 10 TO 12 FEET.. MAINLY NORTH OF CAP HATTERAS..WITH FURTHER INCREASE LIKELY TONIGHT. WAVE HEIGHTS A DIAMOND SHOALS WERE AT 13 FEET. A BOUY 130 MILES EAST OF CAPE HATTERAS REPORTED WAVE HEIGHTS OF 20 FEET AT 7PM EST. THESE HIGHER WAVES WIL BE WORKING THEIR WAY ONSHORE.

COASTAL RESIDENTS NORTH OF CAPE LOOKOUT...BUT ESPECIALLY NORTH OF CAP HATTERAS...SHOULD KEEP ABREAST OF THE LATEST DEVELOPMENTS...LISTEN FOR FURTHER STATEMENTS..AND BE PREPARED TO TAKE IMMEDIATE ACTION TO PROTECT LIVES AND PROPERTY.
B TERRIZZI

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COASTAL FLOOD STATEMENT
NATIONAL WEATHER SERVICE CAPE HATTERAS NC
100 AM EST WED OCT 30 1991

...A COASTAL FLOOD WARNING IS IN EFFECT FOR THE NORTH CAROLINA COAST FROM CAPE LOOKOUT NORTH TO NC-VA BORDER...
...GALE WARNINGS ARE IN EFFECT FOR THE NORTH CAROLINA COASTAL WATERS...
...A HEAVY SURF ADVISORY IS IN EFFECT FOR THE NORTH CAROLINA COAST NORTH OF CAPE LOOKOUT...

ONCE AGAIN...HIGH TIDE HAS BROUGHT COASTAL FLOODING CONDITIONS ALONG PORTIONS OF THE OUTER BANKS. MOST AREAS REPORTED MINOR FLOODING AND OVERWASH ALONG PORTIONS OF THE BEACH ROAD AND OVER ROUTE 12.

VISITORS TO THE AREA...NOT FAMILIAR WITH COASTAL FLOODING SHOULD BE AWARE THAT AS THE WATER RECEDES...SAND AND DEBRIS WILL COVER THE ROADWAYS. ALSO REMEMBER NOT TO ATTEMPT TO DRIVE ACROSS FLOODED ROADS AS THE ROADWAY MAY BE UNDERMINED. ALSO...SALT WATER IS HIGHLY CORROSIVE TO AUTOMOBILES.

DARE COUNTY COMMUNICATIONS REPORTED OVERWASH WAS OCCURRING IN KITTY HAWK AT THE BATH HOUSE AT MILE POST NUMBER 3 AND IN KILL DEVIL HILLS AT THE SEA RANCH MOTEL AT MILE POST NUMBER EIGHT.

TIDES ALONG THE OUTER BANKS ARE RUNNING ABOUT THE FOOT ABOVE NORMAL WITH BREAKING WAVES OF 8 TO 10 FEET MOST AREAS NORTH OF CAPE HATTERAS. BEACH EROSION CONTINUED OVER THE AREA..MAINLY NORTH OF CAPE HATTERAS.

STRONG GUSTY NORTH WINDS 20 TO 30 PM CONTINUE TO BUFFET THE AREA. THESE WINDS ARE EXPECTED TO CONTINUE THROUGHOUT TONIGHT AND WEDNESDAY.

FLOODING WILL SUBSIDE AROUND 3AM...BUT WILL RETURN WITH HIGH TIDE AROUND 1 PM 3 WEDNESDAY AFTERNOON.

THE NEXT STATEMENT WLL BE ISSUED NEAR THE TIME OF HIGH TIDE.

PEOPLE ON THE OUTER BANKS SHOULD STY TUNED TO NOAA WEATHER RADIO..TV OR LOCAL RADIO STATIONS FOR POSSIBLE FURTHER UPDATES.

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COASTAL OCEAN STATEMENT
NATIONAL WEATHER SERVICE CAPE HATTERAS NC
400 AM EST FRI NOV 01 1991

...A COASTAL FLOOD WARNING IS IN EFFECT FOR THE NORTH CAROLINA COAST FROM VA-NC BORDER TO CAPE LOOKOUT...
...A HEAVY SURF ADVISORY IS IN EFFECT FOR THE NORTH CAROLINA COAST FROM CAPE LOOKOUT NORTHWARD...

DARE COUNTY CONTINUES TO BE UNDER A STATE OF EMERGENCY. ACCESS TO COASTAL DARE COUNTY AND THE OUTER BANKS OF CURRITUCK COUNTY IS LIMITED TO NLY THOSE WITH PROOF OF RESIDENCY. HOWEVER HATTERAS ISLAND REMAINS CLOSED TO ALL TRAFFIC.

TIDE LEVELS DURING THIS MORNINGS HIGH TIDE ARE AROUND 2 AND A HALF FEET ABOVE NORMAL..THIS COMPOUNDED WITH 8 FOOT WAVES BRAKING ALONG THE COASTLINE..COASTAL FLOODING AND SEVERE BEACH EROSION CONTINUE TO PLAGUE TRAVEL AND PEOPLE ALONG THE OUTER BANKS.

COASTAL FLOODING AND OCEAN OVERWASH HAVE RESTRICTED TRAVEL ALONG MOST PLACES ALONG THE OLD BEACH ROAD FROM KITTY HAWK TO NAGS HEAD. NO OFFICIAL WORD TO HOW MANY COTTAGES HAVE BEEN LOST TO THE SEA WITHIN THIS AREA BUT MANY HAVE SUFFERED PARTIAL TO SEVERE DAMAGE.

HIGHWAY 12 ONTO HATTERAS ISLAND HAS NOW BEEN CLOSED TO TRAFFIC FOR ALMOST 2 DAYS. DUNE BREAKS ALONG HATTERAS ISLAND HAS ALLOWED THE OCEAN TO SURGE OVER HIGHWAY 12 AND INTO SEVERAL VILLAGES ALONG THE OUTERBANKS. SOME OF THE SPILLAGE HAS CONTAINANTED SOME OF THE FRESH WATER WELLS IN THE RODANTHE AREA..PROMOTING OFFICIALS TO PLACE PORTABLE WATER TANKS AT HE SALVO FIR DEPARTMENT...SUN REALTY BUILDING IN WAVES..AND EMILYS RESTAURANT IN ROADATHE.

FERRY SERVICE BETWEEN HATTERAS AND OCRACOKE ISLAND WILL RESUME AT 5 THIS MORNING. FERRY SERVICE BETWEEN OCRACOKE ISLAND AND THE MAINLAND WILL BE RUNNING ON SCHEDULE TODAY..CONTACT FERRY SERVICES FRO RESERVATIONS.

SPORADIC POWER OUTAGES HAVE BEEN OCCURRING ON HATTERAS ISLAND SINCE YESTERDAY EVENING. SOME LOCATION SHAVE BEEN WITHOUT POWER FOR OVER 5 HOURS...MAINLY BECAUSE OF TRANSFORMERS EXPLODING DUE TO SALT BUILDUP.

ALTHOUGH SEA HEIGHTS THIS AFTERNOON ARE FORECASTED TO BE LOWER THAN THIS MORNING...TODAY HIGH TIDE...AROUND 3 PM....MAY CONTINUE TO PRODUCE COSTAL FLOODING AND OVERWASH. THIS IS IN PART TO THE OW RESISTANCE OF HAUTE DUNE LINE LEFT BY THE ONSLAUGHT OF THE ATLANTIC THE PAST SEVERAL DAYS.

STAY TUNED FOR NOAA WEATHER RADIO OR YOUR LOCAL RADIO AND TELEVISION STATIONS FOR ADDITIONAL STATEMENTS.
HOEHLER

* U.S. G.P.O.:1992-313-153:60485