Mariners Weather Log

Vol. 44, No. 1 April 2000

Jack Tar

(Completed by Jeremiah Dodge of New York. Courtesy Independence Seaport Museum, Philadelphia, Pennsylvania.)

This seven foot tall wooden Carving is considered an accurate rendition of the typical American merchant seaman of about 1845. **See related article on page 14.**

Mariners Weather Log

U.S. Department of Commerce
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From the Editorial Supervisor

The Mariners Weather Log web site now contains six complete issues (including this one), beginning with the August 1998 issue. The web site receives the magazine several weeks before it is actually in print and contains color photographs. See web address below.

This issue contains a mail-in questionnaire. We would greatly appreciate your cooperation in filling this out and mailing it to us. The business reply form on the back of the questionnaire is postage free if mailed in the United States.

Very Important: Please keep us informed about changes to your mailing address. Voluntary Observing Ships may contact any United States Port Meteorological Officer (PMO) to update or change an address.

The La Niña phenomenon (cooler than normal water over the mid Pacific), present for the past two years, is reducing in strength. As it continues weakening, its enhancing effect on hurricane formation in the Atlantic Basin will diminish (La Niña is associated with weaker Atlantic area upper level winds [reduced wind shear], a condition favorable for tropical storm development). However, hurricane experts believe that current global atmospheric circulation patterns are still conducive to an above-average Atlantic hurricane season in 2000, and total activity is expected to exceed the long-term annual average of 5.7 Atlantic basin hurricanes. The renowned Colorado State hurricane forecast team is calling for eight named Atlantic hurricanes in 2000 (there were eight in 1999 and ten in 1998). Sustained wind must be at least 74 mph to qualify as a hurricane. On the other hand, El Niño years are associated with fewer than normal Atlantic tropical storms (because of greater wind shear aloft). For more information see **http://tropical.atmos.colostate.edu/** and **http://www.ncep.noaa.gov**.

Martin S. Baron⚓

Some Important Webpage Addresses

NOAA	http://www.noaa.gov
National Weather Service	http://www.nws.noaa.gov
AMVER Program	http://www.amver.com
VOS Program	http://www.vos.noaa.gov
SEAS Program	http://seas.nos.noaa.gov/seas/
Mariners Weather Log	http://www.nws.noaa.gov/om/mwl/mwl.htm
Marine Dissemination	http://www.nws.noaa.gov/om/marine/home.htm

See these webpages for further links.

Mariners Weather Log (MWL) Readers' Questionnaire

We want to hear from you!

So we can better serve you in the future, please let us know how we're doing by completing this short questionnaire. Thank you for your feedback.

Please rate MWL on the following features:

1. **What is your favorite column or type of article?**
   ☐ I like them all. ☐ It would have to be this one:____

2. **What's your least favorite article in MWL?**
   ☐ They're all good. ☐ It would have to be this one: ____

3. **Is the content of MWL relevant and useful?**
   ☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree ☐ No Opinion

4. **Ease of reading the articles: (1=poor, 5=excellent)**
   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

5. **Organization/Layout: (1=poor, 5=excellent)**
   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

6. **How did you first hear about MWL?**
   ☐ Word-of-mouth
   ☐ Saw it aboard ship or other place of business
   ☐ Search engine on web
   ☐ Other ____
   ☐ Library
   ☐ Article in newspaper/magazine
   ☐ Conference/trade show

7. **Please rank the MWL departments in order of importance: (5=most valuable)**

	1	**2**	**3**	**4**	**5**
AMVER Article	☐	☐	☐	☐	☐
Great Lakes Wrecks	☐	☐	☐	☐	☐
Physical Oceanography	☐	☐	☐	☐	☐
Marine Biology	☐	☐	☐	☐	☐
National Data Buoy Center	☐	☐	☐	☐	☐
VOS Program	☐	☐	☐	☐	☐
VOS Coop. Ship Reports	☐	☐	☐	☐	☐
Buoy Climatological Data	☐	☐	☐	☐	☐
Marine Weather Review N. Atlantic	☐	☐	☐	☐	☐
Marine Weather Review N. Pacific	☐	☐	☐	☐	☐
Marine Weather Review Tropics	☐	☐	☐	☐	☐
Climate Prediction Center Charts	☐	☐	☐	☐	☐
On The Bridge	☐	☐	☐	☐	☐
Marine History Articles	☐	☐	☐	☐	☐
Special Feature articles	☐	☐	☐	☐	☐
Meteorological Services (Observations)	☐	☐	☐	☐	☐
Meteorological Services (Forecasts)	☐	☐	☐	☐	☐

8. **Overall, how satisfied are you with MWL? (1=poor, 5=excellent)**
   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

9. **How can we improve the MWL?**
   ____
   ____
   ____

Thank you for taking the time to complete this questionnaire.

Fold Here and Seal with Tape at Bottom

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Table of Contents

Dynamic Fetch

Some Insight Into Rapid Increase in Sea Wave Height

Michael Carr
Maritime Institute of Technology & Graduate Studies
Linthicum Heights, Maryland

Editors Note: The author has based this article on research conducted by Scott Prosise, meteorologist with the National Weather Service Marine Prediction Center in Camp Springs, Maryland.

On 26 March 1997 meteorologist Scott Prosise was standing the evening watch at the Marine Prediction Center in Camp Springs, Maryland, monitoring development of a strong low-pressure system located in the Eastern Pacific. Winds associated with this low were increasing rapidly, shown by ship reports and readings from buoy **46003**, located off the California-Oregon coast near the center of the low.

Scott observed the wind speed associated with this low increasing from gale to storm force in a short three-hour period. But what Scott found most fascinating about this storm was the increase in wave height. During the same three hours that winds increased from Gale to Storm force, wave height increased by 3 meters (10 feet), from 5.5 to 9 meters (18 to 28 feet)!

According to guidance provided by the wave development models, the wave height should have increased by, at most, 1 to 1.5 meters (4 to 5 feet), not by 3 meters (10 feet). Scott remembers saying to himself, “Wow! What is going on here?” He was amazed. “I was very anxious to see what the next several hours would bring.”

During the next hour wind speed peaked at fifty knots and sea height increased from 9 to 11 meters (28 to 35 feet)! “This was a tremendous jump,” said Scott, “and I could hardly wait for the next set of buoy reports.” He was not disappointed, for during the following hour seas increased again, rising from 12 to 14 meters (37 to 43 feet; see chart for buoy **46003** on 26-27 March.

Scott was facinated by this dramatic increase in sea height. During his more than ten years as a marine meteorologist he had never seen seas increase so rapidly. He quickly hypothesized that some type of “wave front” development was occurring instigated by a rapidly developing low pressure system, for which few observations were available. Scott searched archived data for repeats of this rapid wave development to determine if what occurred on 26 March was a “fluke” or a valid phenomena. He soon found substantiating data.

Scott identified ten instances in the Eastern Pacific during 1997-98 where seas associated with strong low pressure systems increased 3 meters (10 feet) in 3 hours, the criteria he had decided on using to define rapidly developing seas.

One example was a storm that occurred off the Oregon coast 18-

Continued on Page 7

Dynamic Fetch

Continued from Page 6

19 November 1997. Buoy **46002**, located 250 miles west of the Oregon coast measured an increase in sea wave height from 7 to 11.5 meters (22 to 36 feet) in two hours! Winds during this same period changed little, hovering around 50 knots. Wave models all predicted a sea wave height increase from 7 to 8 meters (22 to 25 feet) with a maximum significant height of 9 meters (28 feet). The actual height exceeded the predicted height by 2.5 meters (8 feet).

After consulting with other meteorologists and wave model developers within the Marine Prediction Center, as well as researchers at the University Corporation for Atmospheric Research (UCAR), Scott discovered that there was a familiarity with this rapidly developing sea state phenomenon, and that the term "Dynamic Fetch" had been used to describe it. According to the wave model developers, the wave models can identify Dynamic Fetch conditions and forecast the associated wave heights, but only when enough accurate observed data is available as initial model input. Also, the wave models obtain important data from other models, especially the Aviation (AVN) model, and depend on the AVN to accurately represent various initial meteorological conditions, such as the speed of movement of weather systems. Because of the scarcity of observed data over the oceans, the available data as model input is sometimes insufficient. The two critical times of day for the models are 0000 UTC and 1200 UTC, when they are initialized with fresh data to produce new guidance products.

Examination of all available data in the ten incidents he identified brought Scott to conclude that these rapid rises in wave height are brought on by three critical factors:

1. Surface wind speed is equal to the speed of the wave group. This allows wind to be "in sync" or "in-step" with direction and speed of developing waves, permitting wind to quickly and efficiently move energy into wave development. Wave group velocity is equal to one-half the speed of individual waves (we are not measuring the speed of individual waves, but the movement of an entire wave train). Individual wave speed is equal to three times wave period.

2. A rapidly intensifying storm is occurring on the surface, indicated by a 1 mb per hour drop in barometric pressure and 100 knot winds within a digging trough (see the beginning of the monthly weather review section for a definition) at the 500-mb level. (A detailed explanation of rapidly intensifying lows is found in "Weather Predicting Simplified: How to Read Weather Charts and Satellite Images" published by International Marine).

3. This rapidly intensifying storm is increasing in forward speed, which is significant because as a storm increases in speed it can stay in step with developing seas.

These three factors enable wave height and wave period to steadily increase, with no "leveling out" or arrival at a maximum sea height, as would be expected. Dynamic Fetch allows maximum energy from winds associated with a strong low-pressure system to build extreme waves, with these waves increasing very rapidly in height. If a swell is already present in an area of developing seas this increase is often accelerated, with breaking seas occurring well before expected.

Dynamic Fetch is most likely a contributing element in other sea-sate phenomena such as rogue (freak waves of exceptional height) and wave convergence (large seas created when faster moving waves overtake other waves and come into phase with them). Dynamic Fetch also provides an explanation for wave development when wave decay would traditionally be expected. It is easy to see how Dynamic Fetch factors into Gulf Stream North Wall events and other cases where large seas are associated with interaction of low-pressure systems and strong ocean currents.

Marine Prediction Center meteorologists are now considering annotating surface weather charts with the words "**Seas Rapidly**

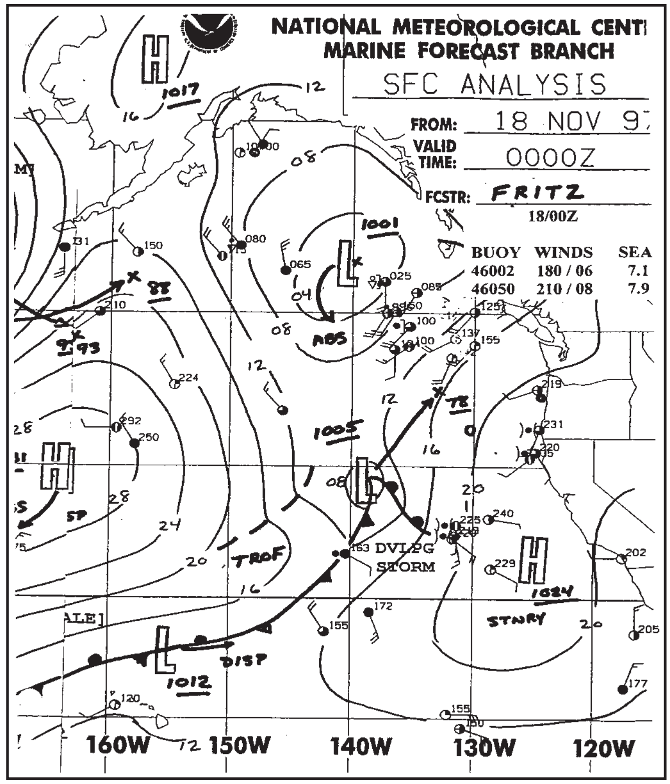
Continued on Page 8

Dynamic Fetch

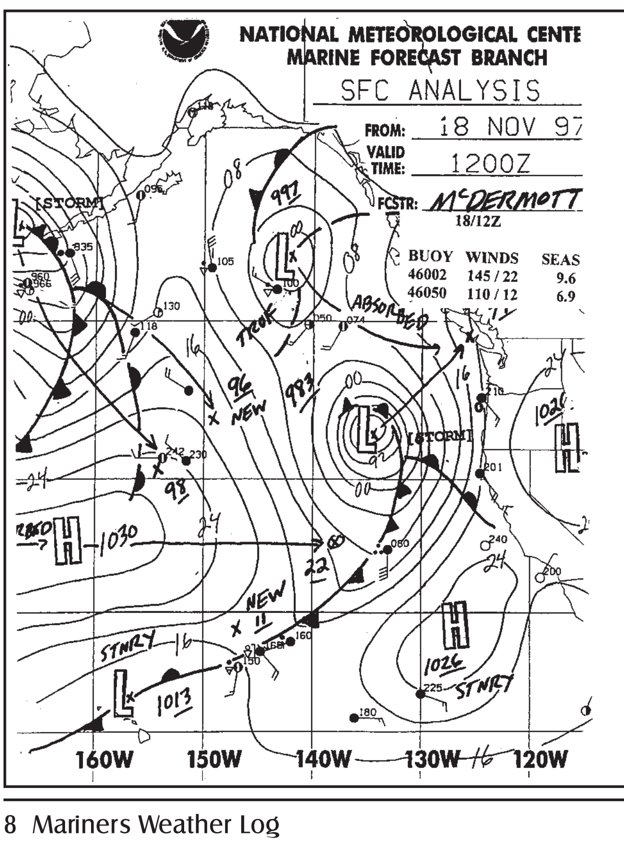
Continued from Page 7

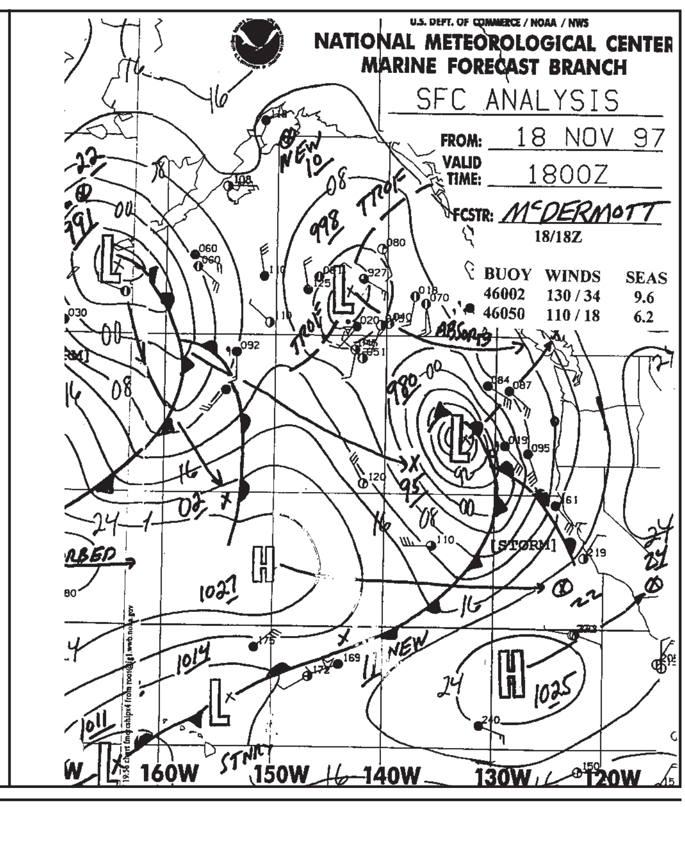
Increasing" when conditions supporting Dynamic Fetch are detected. Mariners should add the Dynamic Fetch phenomena to their "weather checklist," and learn to recognize the factors that lead to its occurrence. Though Dynamic Fetch episodes are unusual events, seasonal in nature, and of short duration, they result in conditions dangerous to all vessels.

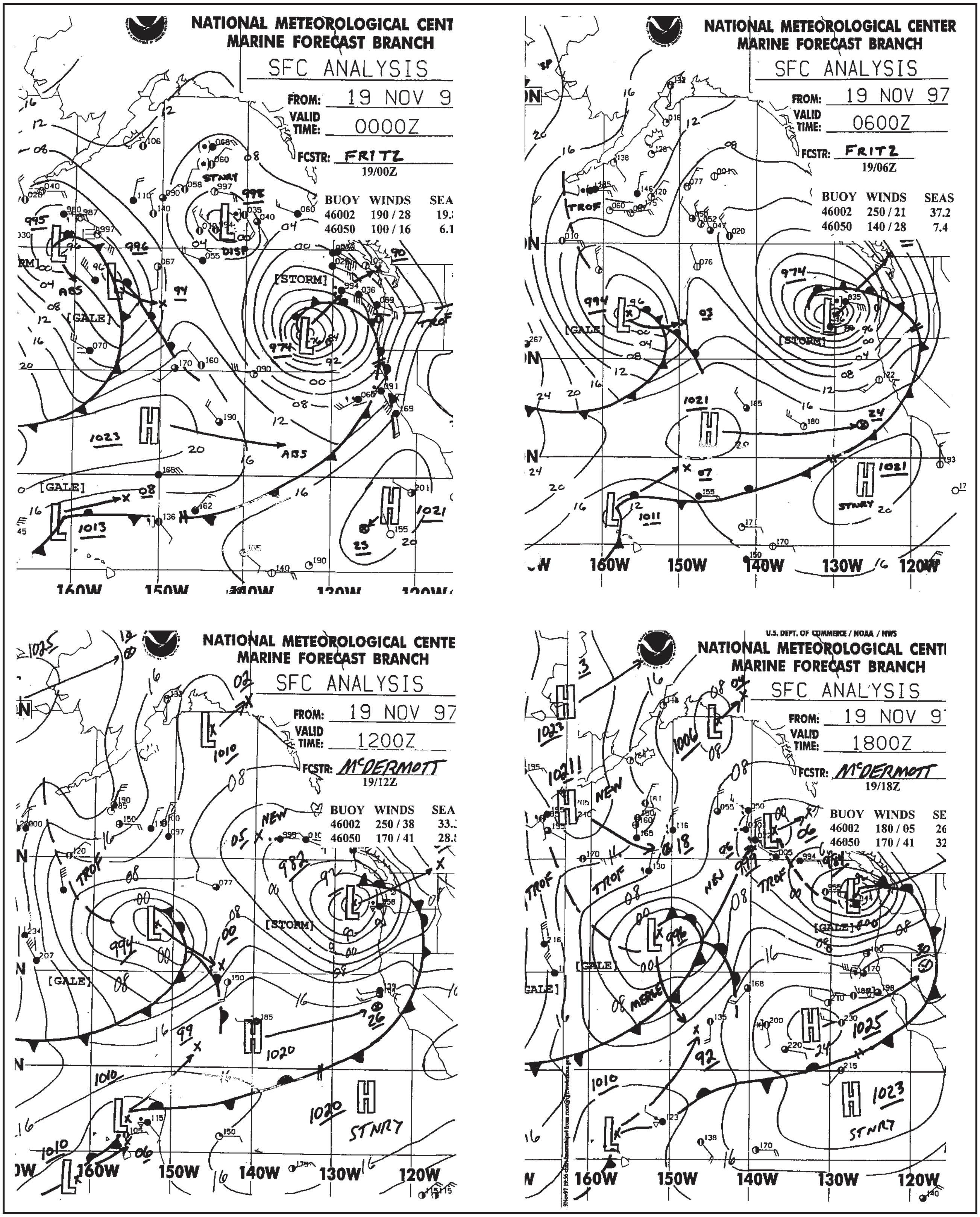
Remember to be on the lookout for these conditions which may cause seas to build rapidly: a rapidly intensifying low, increasing forward speed of the low, and upper-air charts supporting increasing intensity for the low pressure system (indicated by a digging, amplifying trough).⚓



Charts for period 18-19 November 97: **A sequence of 7 surface analysis charts shows a developing storm near 38N/138W at 0000 UTC 18 November, which quickly moves NE and deepens, going from a central pressure of 1005 to 974 mb in 24 hours (a drop of 31 mb in 24 hours). The storm's strength and rapid movement to the NE supported dynamic fetch conditions.**






NATIONAL METEOROLOGICAL CENTER
MARINE FORECAST BRANCH
SFC ANALYSIS
FROM: 19 NOV 97
VALID TIME: 0000Z
FCSTR: FRITZ
19/00Z
BUOY WINDS SEAS
46002 190 / 28
46050 100 / 16
[STORM]
[GALE]
160W 150W 140W 130W 120W
NATIONAL METEOROLOGICAL CENTER
MARINE FORECAST BRANCH
SFC ANALYSIS
FROM: 19 NOV 97
VALID TIME: 0600Z
FCSTR: FRITZ
19/06Z
BUOY WINDS SEAS
46002 250 / 21 37.2
46050 140 / 28 7.4
[STORM]
[GALE]
160W 150W 140W 130W 120W
NATIONAL METEOROLOGICAL CENTER
MARINE FORECAST BRANCH
SFC ANALYSIS
FROM: 19 NOV 97
VALID TIME: 1200Z
FCSTR: McDERMOTT
19/12Z
BUOY WINDS SEAS
46002 250 / 38
46050 170 / 41
[STORM]
[GALE]
160W 150W 140W 130W 120W
U.S. DEPT. OF COMMERCE / NOAA / NWS
NATIONAL METEOROLOGICAL CENTER
MARINE FORECAST BRANCH
SFC ANALYSIS
FROM: 19 NOV 97
VALID TIME: 1800Z
FCSTR: McDERMOTT
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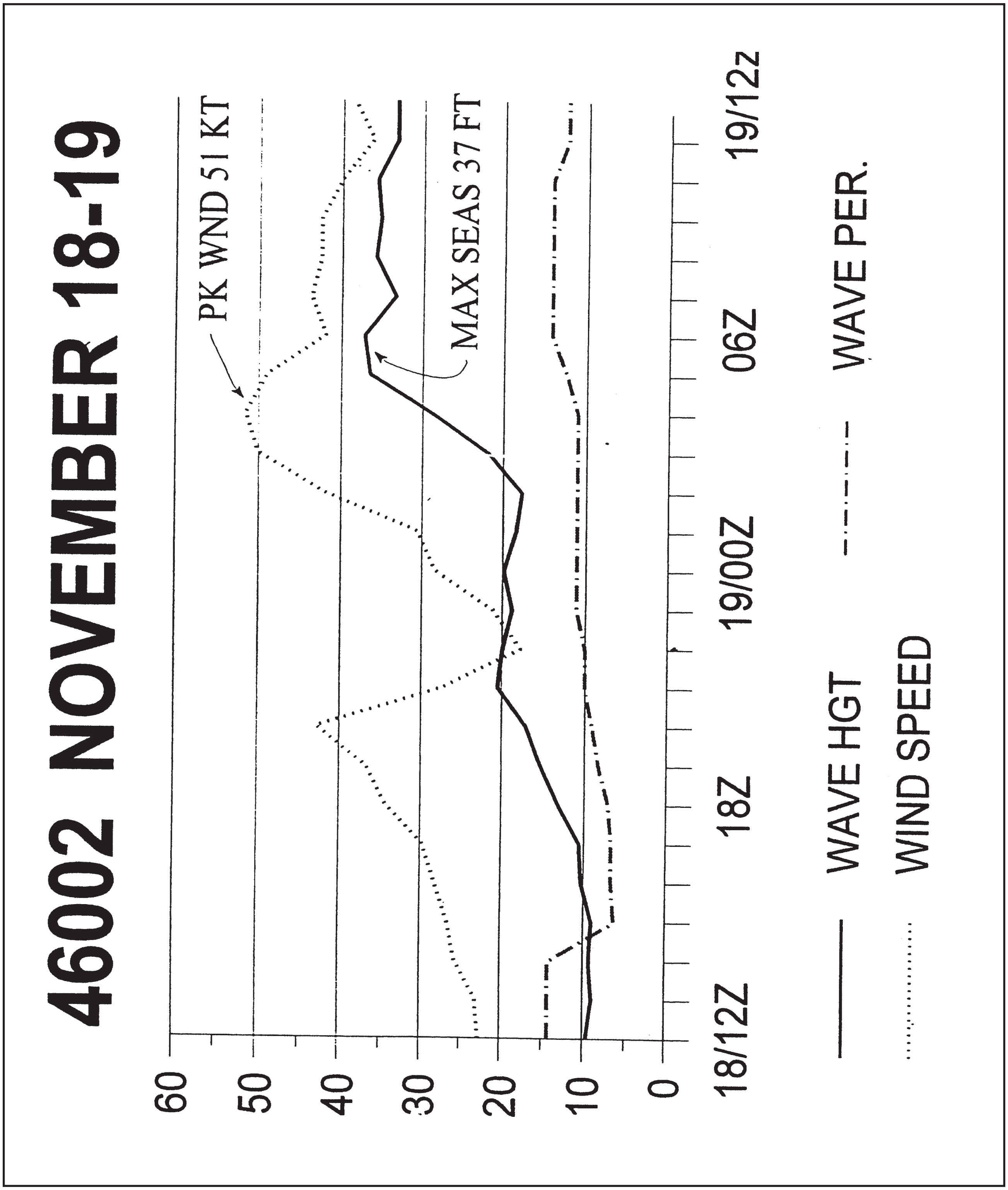
46050 170 / 41
[GALE]
160W 150W 140W 130W 120W



46002 NOVEMBER 18-19
PK WND 51 KT
MAX SEAS 37 FT
60
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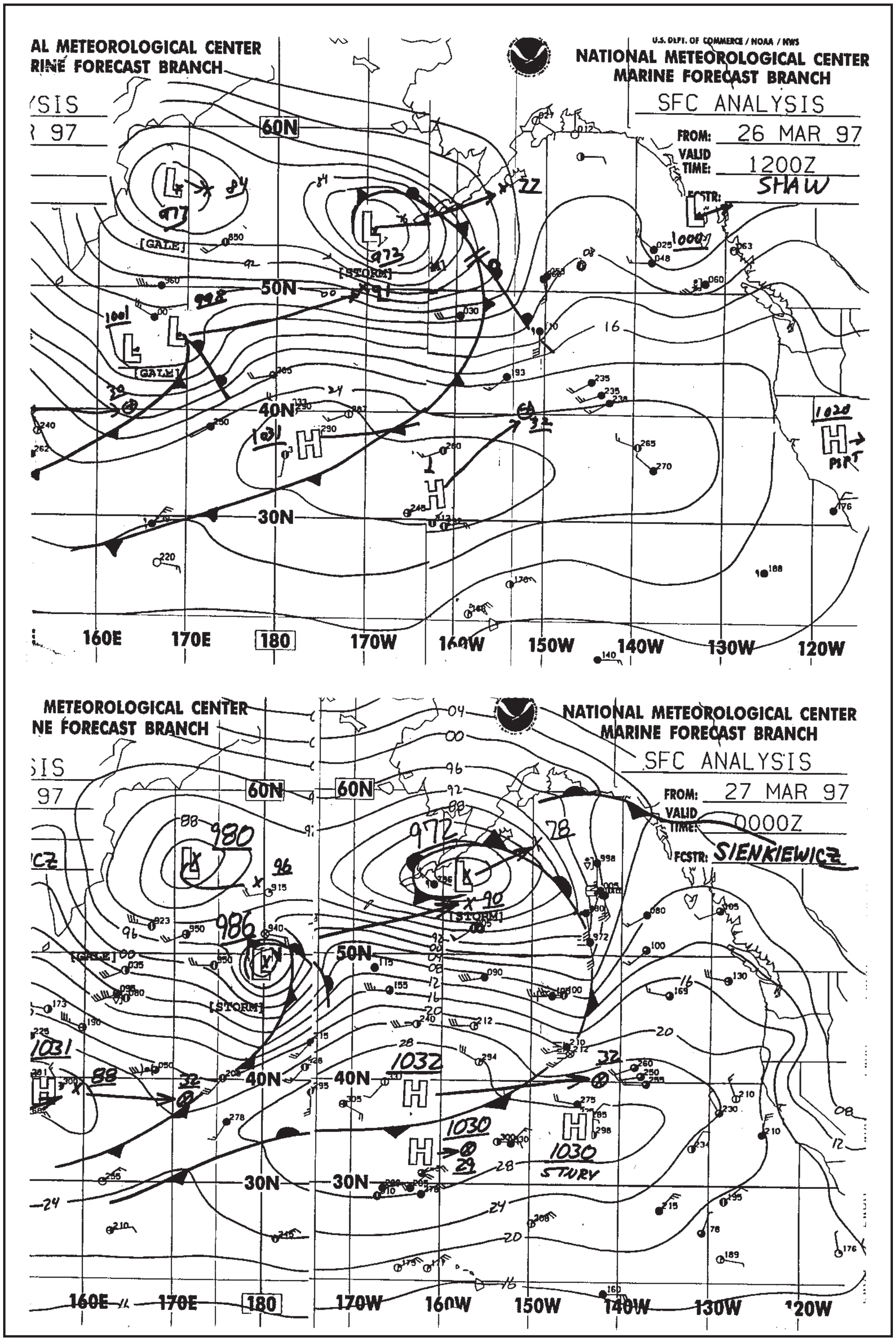
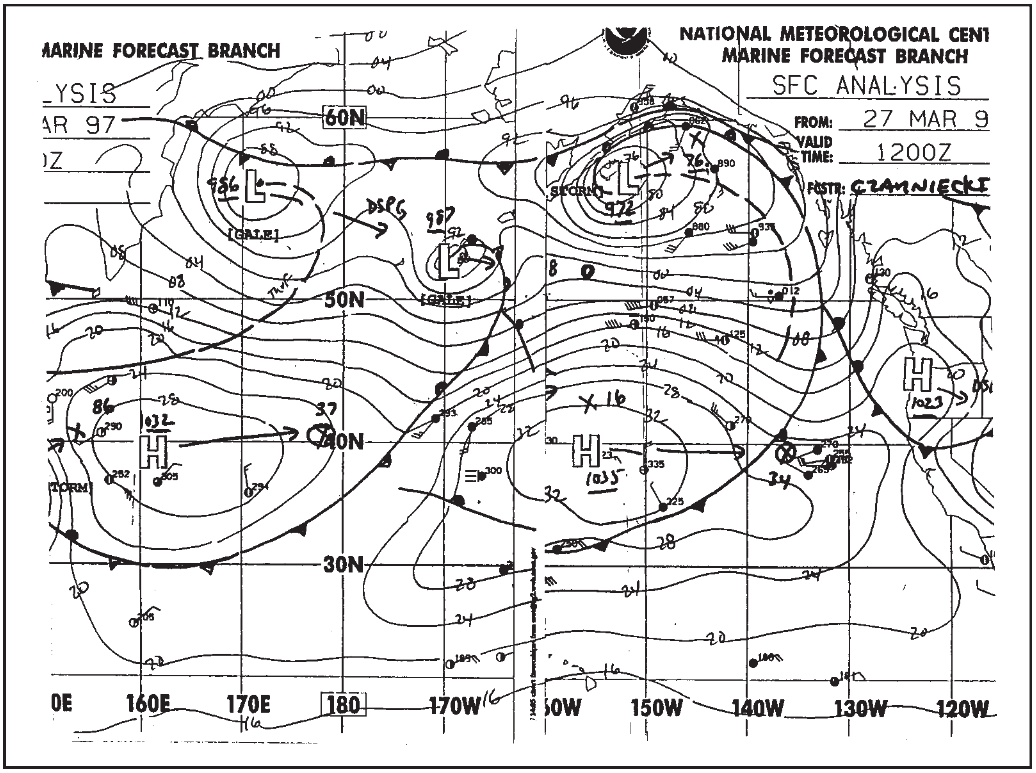


<u>Charts for period of 26-27 March 97:</u> A sequence of 3 surface analysis charts shows a low pressure system moving across the north pacific and into the Gulf of Alaska. Dynamic Fetch conditions developed south of low's center where tight and parallel isobar lines provided the strong, consistent and progressing winds needed for rapid seas state development.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MARINE FORECAST BRANCH
60N
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[GALE]
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130W
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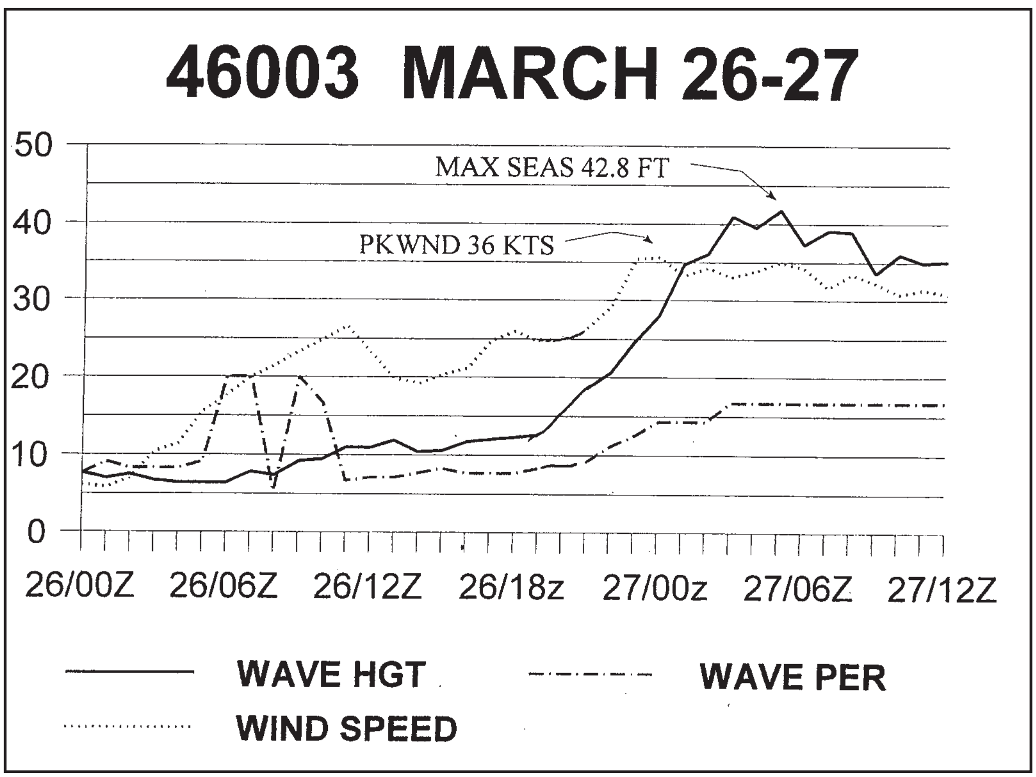
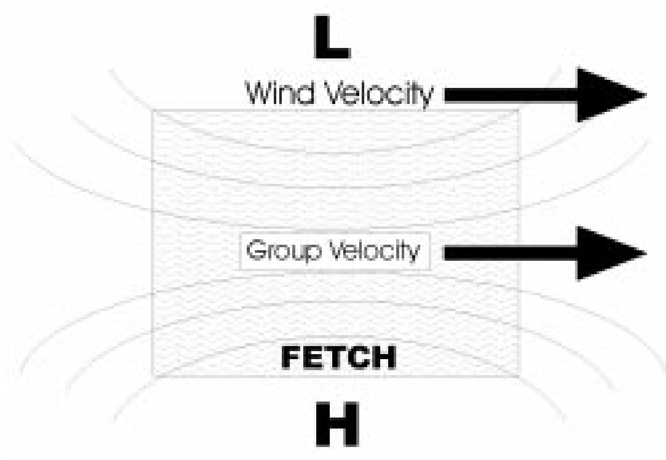

46003 MARCH 26-27
MAX SEAS 42.8 FT
PKWND 36 KTS
50
40
30
20
10
0
26/00Z
26/06Z
26/12Z
26/18z
27/00z
27/06Z
27/12Z
WAVE HGT
WAVE PER
WIND SPEED

Wind Velocity = Wave Group Velocity

Result: Rapid Wave Growth



Dynamic Fetch

Identifying Possible Events While At Sea

- Half the wave period = storm (fetch) movement.
- Rapidly intensifying storm.
- Well-developed storm increasing in forward speed.
- Wave period and wave height steadily increasing (short term - not all the time).

Effects:

- Allows maximum energy from the wind field into the building of waves.
- Wave heights increase rapidly.
- Creation of a wave front.
- Enhancement (steepening) of an already established wave front.

Characteristics:

- Unusual – Not a Common Event
- Seasonal – October through April
- Short Duration – 12 to 18 Hours
- Scale – Small in a Real Extent

The Life of a Sailor: A Collector's Vision

Tania Karpinich
J. Welles Henderson
Independence Seaport Museum
Philadelphia, Pennsylvania

Editors Note: This exhibit is on display at Independence Seaport Museum through September 2000. It provides thought-provoking insights and observations about the men and women who chose a life aboard ship during the 18th and 19th century from 1750-1910. The museum is located on the Penn's Landing Waterfront at 211 S. Columbus Boulevard and Walnut Street in Philadelphia.

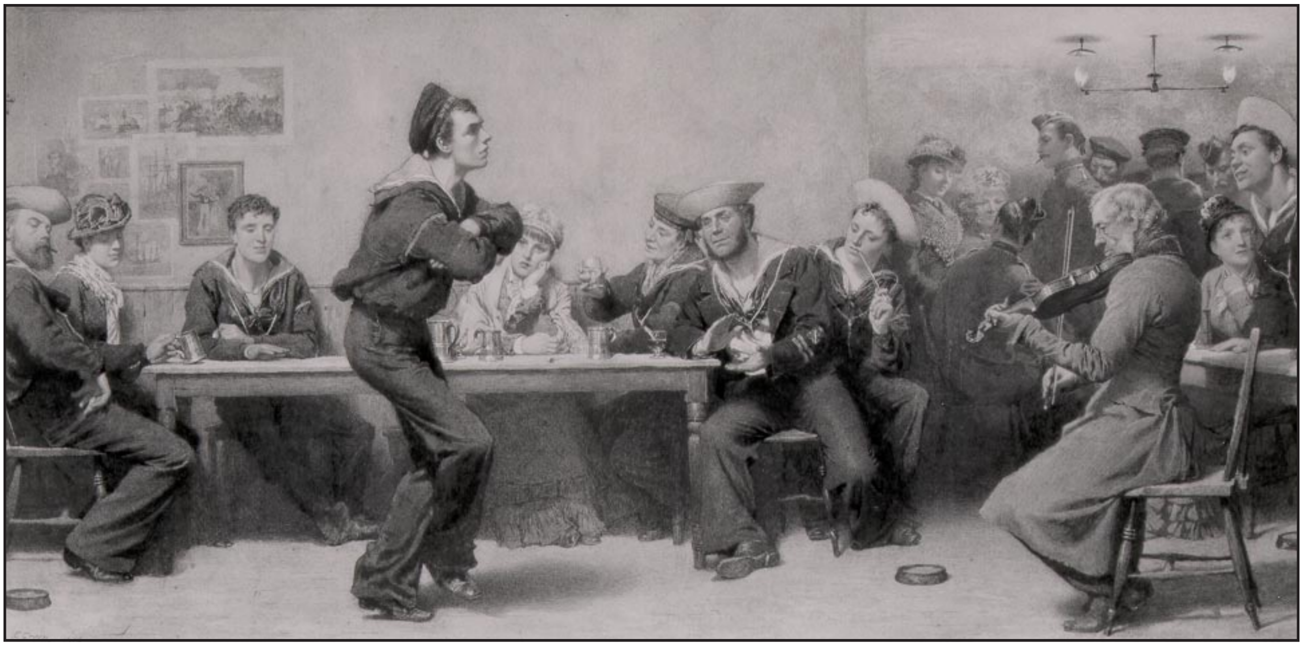
To pursue insights into the life of the sailor, the exhibit begins where sailors began, on shore, motivated to sail but reluctant to depart from their loved ones. It is a story marked by hardship, loneliness, physical labor, heartache, a zest for life on the high seas, as well as hearty binges ashore. It is a story of the ordinary sailor drawn to distant horizons, stirred by the romance of the sea.

A broad spectrum of objects such as hand illustrated diaries, journals, log books, tattoo designs, sketches, models, wood carvings, scrimshaw, uniforms, embroidery, photographs, paintings, prints, and related material highlight aspects of a sailor's life aboard ship and ashore from mid 18th to early 20th century. All of the materials shown in this new exhibit are drawn from the extensive collection of Philadelphia native, J. Welles Henderson, Independence Seaport Museum's Founder and Chairman Emeritus, who has spent a lifetime gathering what is generally regarded as the most comprehensive treasury of material relating to the life of a sailor. Henderson, a retired lawyer, began his collection very early in life when his first precious acquisition spawned a life-long passion for building a collection of nautical art, artifacts, journals and documents. As a seven year old in 1927, Henderson gave fifty cents to save America's most historic ship, the **USS Constitution**—"Old Ironsides." For that donation, Henderson received a small anchor made of metal and wood salvaged from the ship.

According to Henderson, "This event changed my life. It was as if I was inoculated with salt water. My quest as a collector had begun for all things relating to the sea…" As Henderson collected, he noticed that artists in the early days of sail generally were not interested in the life of the common sailor, rather the important admirals and naval battles were of interest. Expeditions to exotic and remote regions of the world had artists accompany them, but little of the everyday life aboard ship was portrayed. And so the hunt began, one piece at a time.

Today, over 70 years after the acquisition of the anchor, the collection has flourished. The exhibit, features 475 maritime artifacts on display in 42 exhibit cases, many oil paintings, and 90 framed visuals including prints, drawings, and watercolor paintings. To convey the flavor and feel of life aboard ship, simple questions that come out of the themes of the gathered materials are posed to the visitor: Why did boys, men and sometimes even women go to

Continued on page 15



This scene captures a sailor dancing the Hornpipe while a civilian plays the fiddle, to the amusement of five of his fellow sailors and their lady friends. Painted in 1878 by British artist George Green.

The Life of a Sailor

Continued from Page 14

sea? Who exactly were these people of the sea and what sort of vessels did they sail? How did seamen spend the workday? What kinds of tools and instruments did sailors use? What did sailors do in their idle time? From such questions, the visitor is guided through an exhibit rich in maritime history, focusing on the sailor as a person.

As any collector, Henderson does have his favorite pieces that are highlighted in the exhibit. Welcoming visitors to the exhibit is the focal piece of his collection, the seven-foot tall American woodcarving, "Jack Tar," described by experts as one of the 100 finest pieces of American folk art (Jack Tar, not an actual person, represented the general sailor of the time, who would tar his hat and hair to waterproof them). Also highly prized is an oil painting by Philadelphia painter Thomas Eakins, "Rear Admiral Charles D. Sigsbee," who was captain of the **USS Maine** when she blew up in Havana Harbor in 1898. The naval engagement painting by Thomas Birch, "**U.S. Frigate United States** defeating **HMS Macedonian** on October 25, 1812" is significant to Henderson's collection as he once loaned it to former President John F. Kennedy for display in the Oval Office at the White House during the years 1961-1963.

The exhibit is based on Henderson's book, Marine Art and Antiques/JACK TAR/A Sailor's Life/1750-1910, published by Antique Collector's Club of England.

The book is a complementary resource for those viewing the exhibit as the storyline and labels closely follow the book. Each chapter focuses on separate aspects of a seaman's life aboard ship and ashore in the age of sail and early steam, and conveys the flavor and feel of life aboard.

Searching for the life of a sailor through marine art and antiques was challenging. But by diligent collecting over the decades, Welles Henderson has put together a wide range of materials of different genres and media that give insights into the human side of the challenge of the sea. With its depth and breadth, this private collection of extraordinary contemporaneous materials offers a remarkably fresh view of the sailor's life.

For more information about the Independence Seaport Museum, visit http://www.libertynet.org/seaport.⚓

Pages from tattoo books like these help identify the popular themes of the era. From an American Tattoo Design Book c. 1890.

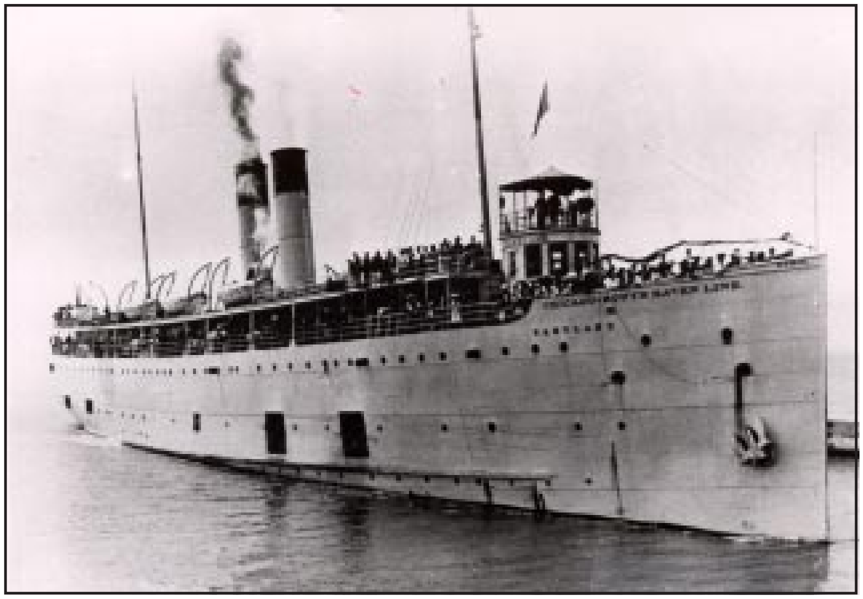
Sailors sewing box decorated with stars, diamonds, hearts, etc. From the private collection of J. Welles Henderson.

Great Lakes Wrecks — The Loss of the Eastland

Skip Gillham
Vineland, Ontario, Canada

The worst marine accident in the history of the Great Lakes was the sinking of the steamer **Eastland** dockside at Chicago, Illinois, on July 24, 1915.

The vessel was one of several that had been chartered to the Western Electric Company for their annual picnic at Michigan City, Indiana. There were 2,500 people on board and they were in a festive mood for their scheduled afternoon of fun and sun.



The Eastland sank on July 24, 1915, while along a dock in Chicago, Illinois. Over 800 people lost their lives.

Before **Eastland** could depart the dock it rolled over on its side, dumping many people into the water and trapping scores inside the hull.

Frantic rescue efforts were not enough and between 812 and 835 people lost their lives.

The 265 foot long **Eastland** was only 38.2 feet wide and some believed this caused a tendency to roll in heavy seas. She may have become top heavy that fateful day and when many of the passengers went to the rail to observe a passing steamer it was enough to cause the disaster.

Eastland had been built by the Jenks Shipbuilding Company and launched at Port Huron, Michigan, on May 6, 1903. The vessel initially operated between Chicago and South Haven, Michigan. carrying passengers and freight, particularly fresh fruit in season. For a time it also worked on Lake Erie between Cleveland the resorts at Cedar Point.

The sunken hull was refloated and rebuilt in 1917 for the U.S. Navy. It was used as a training ship on the Great Lakes during two World Wars and was known as the **USS Wilmette**.

The ship was broken up for scrap at Chicago in 1948.

Skip Gillham is the author of 18 books, most related to Great Lakes ships and shipping.⚓

AMVER Ship Rescues Survivors From Plane's Maiden Flight

Rick Kenney
AMVER Maritime Relations Officer
United States Coast Guard

Editors Note: This article is taken from an account by PA3 Eric Hedaa, United States Coast Guard.

One aspect of AMVER that is often overlooked is its usefulness in aviation emergencies over the ocean. Just recently, AMVER played a key role in the rescue of two Australians who survived a plane ditching at sea in the middle of the night!

A ferry flight of a brand new, $170,000 single-engine Piper Archer III airplane from Vero Beach, Florida, to Hilo, Hawaii, made an unexpected landing in the Pacific Ocean, 305 nm northeast of Hawaii. Pilot Raymond Clamback, a flight instructor from Sydney, Australia had made more than 150 uneventful ocean crossings ferrying planes. He invited his friend, Dr. Shane Wiley, along as company for the ride. The last leg of the trip would take them from Santa Barbara, California, to Hilo, Hawaii, a distance of 2,400 miles.

About 1,700 miles into the trip, an oil pressure light provided the first clue of a possible problem. Clamback initiated search and rescue procedures by notifying the Federal Aviation Administration in Oakland, Caalifornia, that he

Continued on Page 19

AMVER Ship Rescues Survivors

Continued from Page 18

was experiencing a potentially serious problem. As per procedure, the FAA notified the Joint Rescue Coordination Center (JRCC) in Honolulu, staffed jointly by the U.S. Air Force and U.S. Coast Guard.

Upon notification, the Coast Guard Search and Rescue (SAR) Coordinator's first reaction was to find a nearby ship and have the plane ditch close to it, a scenario called a "controlled ditch." The **USCGC KISKA** got underway from Hilo at best speed for a recovery effort. Since it was such a distance from the flight path of the small plane, the JRCC turned to the Automated Mutual-assistance VEssel Rescue (AMVER) system to locate ships under the plane's heading. Three ships were identified, contacted and requested to divert and assist. **M/V LIHUE**, a 720-foot container ship belonging to Matson Navigation of San Francisco, was the ship closest to the plane at that point. After passing on-scene weather conditions to the JRCC, the ship was asked to stand by as the target for the controlled ditch.

Meanwhile a Coast Guard C-130 aircraft was launched from the air station at Barber's Point, Hawaii, to rendezvous with, and provide an escort for, the disabled aircraft. When he heard the aircraft was en route, Clamback decided not to ditch immediately. Three hours later, the C-130 was within visual sight of the Piper plane. The pilots exchanged information on the Piper's status: oil pressure was continuing to drop, but the plane was still flying. There were only two options, fly toward the nearest ship and ditch the plane, with power in daylight; or, try to complete the flight and face the worst-case scenario of a power-off, nighttime ditch at some unplanned point along the route. Commercial airline pilots, listening to the dramatic exchanges as they flew overhead on their way to and from Hawaii, offered the benefit of their experiences and encouragement.

Clamback decided to roll the dice and gamble that the plane would make it. He and the Coast Guard pilot agreed on emergency contingency procedures, and everyone held their breath. At that point, the AMVER ship **M/V Lihue** was stood down and released from the case by JRCC SAR coordinators. Almost 200 miles later, as the planes flew into a rain squall, a loud banging from the engine signaled that no oil remained in the engine and the plane would go down. With radio contact suddenly lost, the C-130's pilot put the ditching plan into action, diving below the Piper and ahead of it. In the back of the Coast Guard plane, crewmen began dropping a string of flares to create a "runway in the sea" on top of 10-foot swells.

Using the flares as a frame of reference to judge the plane's altitude, the Piper plunged into the water just 30 feet from a flare. The impact was substantial, but seatbelts held the two occupants in place, with no major injuries. The two men climbed out onto one of the wings and threw the plane's life raft into the water, only to find it wouldn't inflate. The plane sank within minutes of impact, and the two survivors jumped from the wing into the roiling water, with only their life jackets as they struggled against the waves.

Unable to find the survivors in the dark and short on fuel, the C-130 dropped a data marker buoy and departed the scene. Rescue coordinators sent TELEX messages to the two closest AMVER vessels, asking them to assist. **M/V Nyon**, a 743-foot bulk carrier belonging to Suisse-Atlantique Societe de Navigation Maritime S.A. of Lausanne, Switzerland, acknowledged that it had changed course and was en route to the scene. In the interim, a second C-130 had launched from Barbers Point and headed for the crash area. This aircraft came equipped with night vision goggles (NVGs)

Continued on Page 20

AMVER Ship Rescues Survivors

Continued from Page 19

to assist in the search, and that proved to be the lifesaver for the two survivors.

As that C-130 arrived on scene, the rain squall had passed and the moon was now providing optimum visibility. Only ten minutes into the search, the plane's drop master spotted two traces of light through the NVG's. The plane dropped flares and circled around awaiting the arrival of **M/V Nyon**. The ship, on a voyage from New Orleans to Inchon, South Korea, was 70 nm from the position of the ditch at the time it was contacted by the Coast Guard. It arrived at 3:15 am and was guided by the C-130 to the sources of the light.

Lookouts posted on the **M/V NYON** heard the two survivors yelling from the water. The ship's master reported to the Coast Guard that they heard somebody screaming and were maneuvering into position to pick them up. The lights ultimately turned out to be two small personal marker lights attached to the life jackets. The ship's crew threw life rings out to the two exhausted men as they swam toward the ship, and used them to haul them aboard. They were dehydrated and suffering from hypothermia after their nine-hour ordeal in the water, but otherwise they were in good condition considering what they'd been through. Several hours later, they were transferred to the **USCGC KISKA** and brought safely to Hilo.

Editor's Note

We encourage all mariners to participate in the AMVER program. Now in its 40th year, AMVER has 12,000 participating ships from 143 nations. Over the last 5 years alone, AMVER has rescued over 1,500 people, most of whom would have perished were it not for this extraordinary program. It's very easy to join AMVER—by completing a SAR Questionnaire (SAR-Q), available by fax from the AMVER Maritime Relations Office. You then provide AMVER with your sail plan before leaving port and update your position once every 48 hours while underway. Should you require assistance at sea, alert the nearest rescue coordination center in one of several ways, including INMARSAT, SITOR, EPIRB, or the distress button on your satellite or DSC terminal.

For Voluntary Observing Ships, the special AMVER/SEAS software is now available to simplify preparation of weather and AMVER messages. When COMSAT receives weather messages formatted by this software, your vessel call sign and position is forwarded to the AMVER center (eliminating the need to send a separate AMVER position update), while the weather message goes to the National Weather Service. There is no cost to vessels using AMVER/SEAS software.

For more information about AMVER, contact Mr. Rick Kenney, U.S. Coast Guard Maritime Relations Officer. For more information about the AMVER/SEAS software, contact Mr. Gregg Thomas, SEAS Program Manager. Both are listed in the back of this publication. Port Meteorological Officers and SEAS Field Representatives can also provide information about these valuable programs. You can also download this software from the web at http://seas.nos.noaa.gov/seas.html.⚓

2000 Hurricane and Cyclone Names

Atlantic, Gulf of Mexico, and Caribbean Sea

Alberto	Helene	Oscar
Beryl	Isaac	Patty
Chris	Joyce	Rafael
Debby	Keith	Sandy
Ernesto	Leslie	Tony
Florence	Michael	Valerie
Gordon	Nadine	William

Eastern North Pacific (east of 140W)

Aletta	Ileana	Rosa
Bud	John	Sergio
Carlotta	Kristy	Tara
Daniel	Lane	Vincente
Emilia	Miriam	Willa
Fabio	Norman	Xavier
Gilma	Olivia	Yolanda
Hector	Paul	Zeke

Central North Pacific (from the dateline to 140W)*

Akoni	Aka	Alika	Ana
Ema	Ekeka	Ele	Ela
Hana	Hali	Huko	Halola
Io	Iolana	Ioke	Iune
Keli	Keoni	Kika	Kimo
Lala	Li	Lana	Loke
Moke	Mele	Maka	Malia
Nele	Nona	Neki	Niala
Oka	Oliwa	Oleka	Oko
Peke	Paka	Peni	Pali
Uleki	Upana	Ulia	Ulika
Wila	Wene	Wali	Walaka

Western North Pacific (west of the dateline)*

Contributed by:	I	II	III	IV	V
Cambodia	Damrey	Kong-rey	Nakri	Krovanh	Sarika
China	Longwang	Yutu	Fengshen	Dujuan	Haima
DPR Korea	Kirogi	Toraji	Kalmaegi	Maemi	Meari
HK, China	Kai-Tak	Man-yi	Fung-wong	Choi-wan	Ma-on
Japan	Tenbin	Usagi	Kanmuri	Koppu	Tokage
Lao PDR	Bolaven	Pabuk	Phanfone	Ketsana	Nock-ten
Macau	Chanchu	Wutip	Vongfong	Parma	Muifa
Malaysia	Jelawat	Sepat	Rusa	Melor	Merbok
Micronesia	Ewinlar	Fitow	Sinlaku	Nepartak	Nanmadol
Philippines	Bilis	Danas	Hagupit	Lupit	Talas
RO Korea	Gaemi	Nari	Changmi	Sudal	Noru
Thailand	Prapiroon	Vipa	Megkhla	Nida	Kularb
U.S.A.	Maria	Francisco	Higos	Omais	Roke
Vietnam	Saomai	Lekima	Bavi	Conson	Sonca
Cambodia	Bopha	Krosa	Maysak	Chanthu	Nesat
China	Wukong	Haiyan	Haishen	Dianmu	Haitang
DPR Korea	Sonamu	Podul	Pongsona	Mindule	Nalgae
HK, China	Shanshan	Lingling	Yanyan	Tingting	Banyan
Japan	Yagi	Kaziki	Kuzira	Kompasu	Washi
Lao PDR	Xangsane	Faxai	Chan-hom	Namtheun	Matsa
Macau	Bebinca	Vamei	Linfa	Malou	Sanvu
Malaysia	Rumbia	Tapah	Nangka	Meranti	Mawar
Micronesia	Soulik	Mitag	Soudelor	Rananin	Guchol
Philippines	Cimaron	Hagibis	Imbudo	Malakas	Talim
RO Korea	Chebi	Noguri	Koni	Megi	Nabi
Thailand	Durian	Ramasoon	Hanuman	Chaba	Khanun
U.S.A.	Utor	Chataan	Etau	Kodo	Vicete
Vietnam	Trami	Halong	Vamco	Songda	Saola

* Each year in the Central and Western North Pacific, the next name is just the one following the last from the previous year. Once through a list, the next name will be off the top of the next list. The first names to be used this year for the Central North Pacific and Western North Pacific will be Upana and Kirogi, respectively. A name will be utilized once determined that a tropical storm as 35 knot or greater sustained winds. The National Weather Service defines sustained winds over a one-minute average.⚓

Some Technical Terms Used in This Month's Marine Weather Reviews

Isobars: Lines drawn on a surface weather map which connect points of equal atmospheric pressure.

Trough: An area of low pressure in which the isobars are elongated instead of circular. Inclement weather often occurs in a trough.

Short Wave Trough: Specifies a moving low or front as seen in upper air (constant pressure) weather charts. They are recog-nized by characteristic short wavelength (hence short wave) and wavelike bends or kinks in the constant pressure lines of the upper air chart.

Digging Short Wave: Upper air short waves and waves of longer wavelength (long waves) interact with one another and have a major impact on weather systems. Short waves tend to move more rapidly than longer waves. A digging short wave is one that is moving into a slower moving long wave. This often results in a develop-ing or strengthening low pressure or storm system.

Closed Low: A low which has developed a closed circulation with one or more isobars encircling the low. This is a sign that the low is strengthening.

Cutoff Low: A closed low or trough which has become detached from the prevailing flow it had previously been connected to (becoming cutoff from it).

Blocking High Pressure: A usually well developed, stationary or slow moving area of high pressure which can act to deflect or obstruct other weather systems. The motion of other weather systems can be impeded, stopped completely, or forced to split around the blocking High Pressure Area.

Frontal Low Pressure Wave: refers to an area of low pressure which has formed along a front.

Tropical Wave or Depression: An area of low pressure that originates over the tropical ocean and may be the early stage of a hurricane. Often marked by thunderstorm or convective cloud activity. Winds up to 33 knots.

Wind Shear: Refers to sharp changes in wind speed and/or direction over short distances, either vertically or horizontally. It is a major hazard to aviation. Wind shear above Tropical depressions or storms will impede their development into hurricanes.

Closed off Surface Circulation: Similar to a closed low. Refers to a surface low with one or more closed isobars. When there are falling pressures, the low is considered to be strengthening.

Marine Weather Review—North Atlantic Area September through December 1999

George P. Bancroft
Meteorologist
Marine Prediction Center

Tropical Activity

Unlike the North Pacific, the North Atlantic was much more active, with several named tropical cyclones moving north of 31N. As September began, the area was entering the most active part of the hurricane season. The main belt of westerly flow (westerlies) aloft was north of 50N, with a high pressure ridge aloft dominating the area south of 50N. This ridge of high pressure steered tropical cyclones westward south of the ridge, and then northward until they were picked up by the westerlies and became extratropical. As the westerlies shifted south in October and became more energetic, some of the tropical systems became intense extratropical storms.

In early September, tropical storm Dennis stalled off the North Carolina coast, and the extratropical remains of Hurricane Cindy southeast of Newfoundland cut off from the westerlies, drifted southeast, and weakened. By 5 September, Dennis moved inland over North Carolina and weakened. Other information on Dennis and Cindy may be found in the December 1999 issue of MWL (see References).

Hurricane Floyd moved near 30N, 78W on 15 September (Figure 1) with maximum sustained winds of 105 kts with gusts to 130 kts. The ship **Jo Bried** (**LAVQ2**) reported from 31N 79W at 1800 UTC 15 September just north of the center with an east wind of 65 kts, highest among ships. **Frying Pan Shoals** (**FPSN7**), a C-MAN station off Cape Fear, North Carolina, reported a southeast wind of 87 kts with a peak gust of 97 kts at 0500 UTC 16 September, and pressure of 958.6 mb one hour later, as Floyd passed nearby. **Diamond Shoals** (**DSLN7**) off Cape Hatteras reported a southwest wind 70 kts with gusts to 82 kts at 1300 UTC 16 September. Buoy **41004** (32.5N 79.1W) reported a northwest wind of 54 kts with gusts to 72 kts, highest among moored buoys, along with seas to 11 meters (36 feet). Floyd then moved across eastern North Carolina, to near the Delmarva coast at 1800 UTC 16 September. The **Ever Gaining** (**BKJO)** at 35N 72W encountered south winds of 60 kts at that time. Six hours later, Floyd weakened to a tropical storm over Long Island (Figure 1). The **Heidelberg Express** (**DEDI**) reported a southeast wind of 50 kts near 40N 71W. Seas reached 11.5 meters (38 feet) at the **Nantucket Shoals** buoy (**44008**), accompanied by a southwest wind 37 kts with gusts to 49 kts, at 0500 UTC 17 September. Floyd became extratropical on the Maine coast by 1200 UTC 17 September and then moved over the Canadian Maritimes as a weakening gale by 18 September.

Continued on Page 28

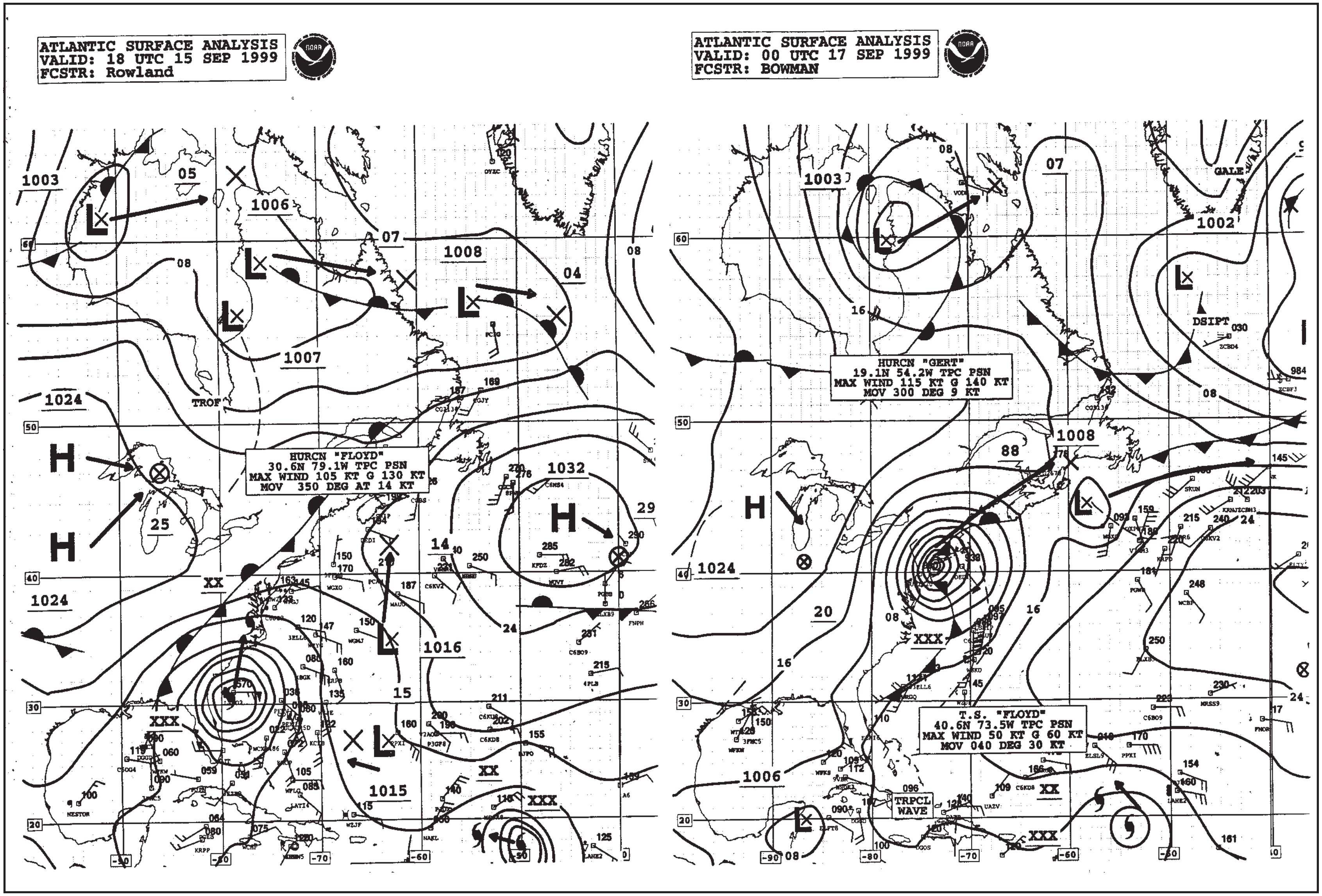


Figure 1. MPC Atlantic Part 2 Surface Analyses for 18 UTC 15 September and 00 UTC 17 September 1999.

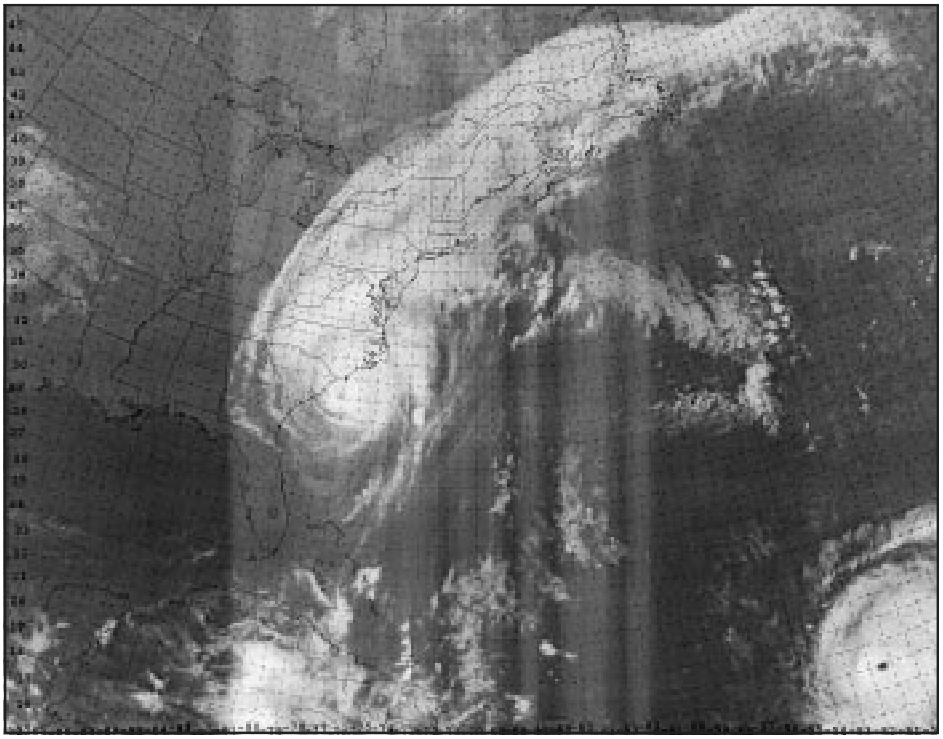


Figure 2. GOES8 infrared satellite image of Hurricanes Floyd and Gert valid 0345 UTC 16 September 1999. Also see Figure 1.

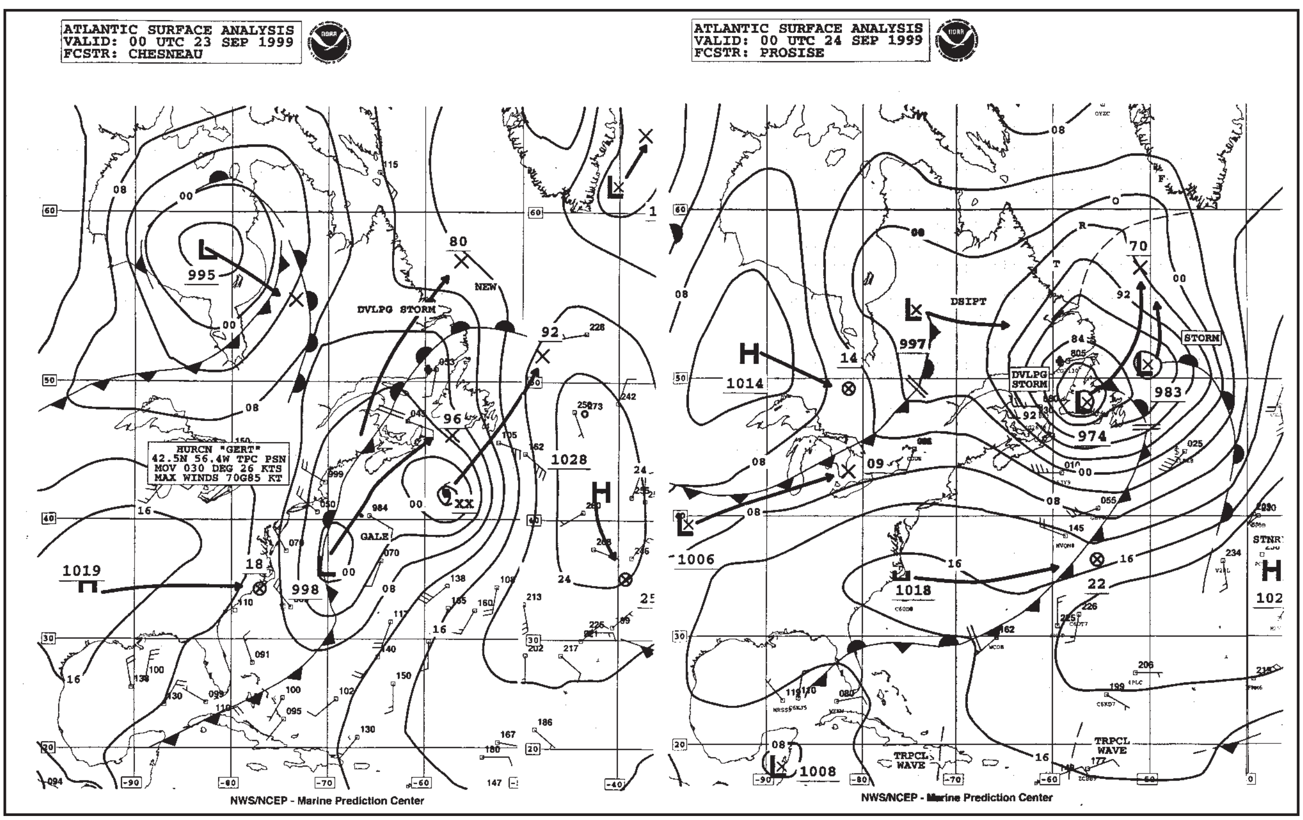
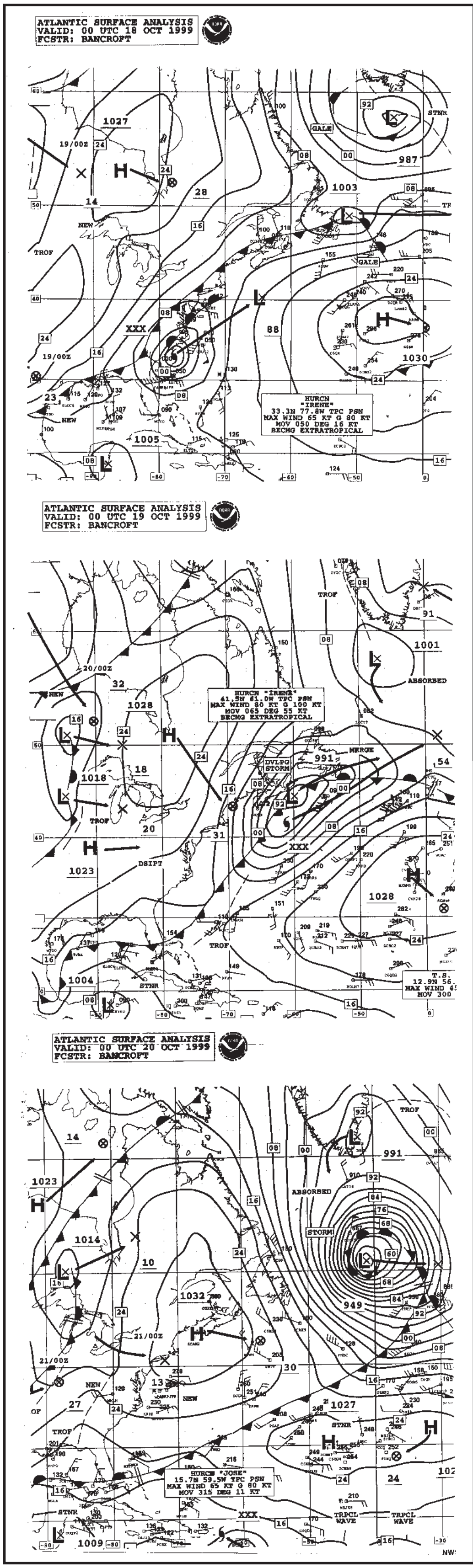


Figure 3. MPC Atlantic Part 2 Surface Analyses valid 00 UTC September 23 and 24, 1999.



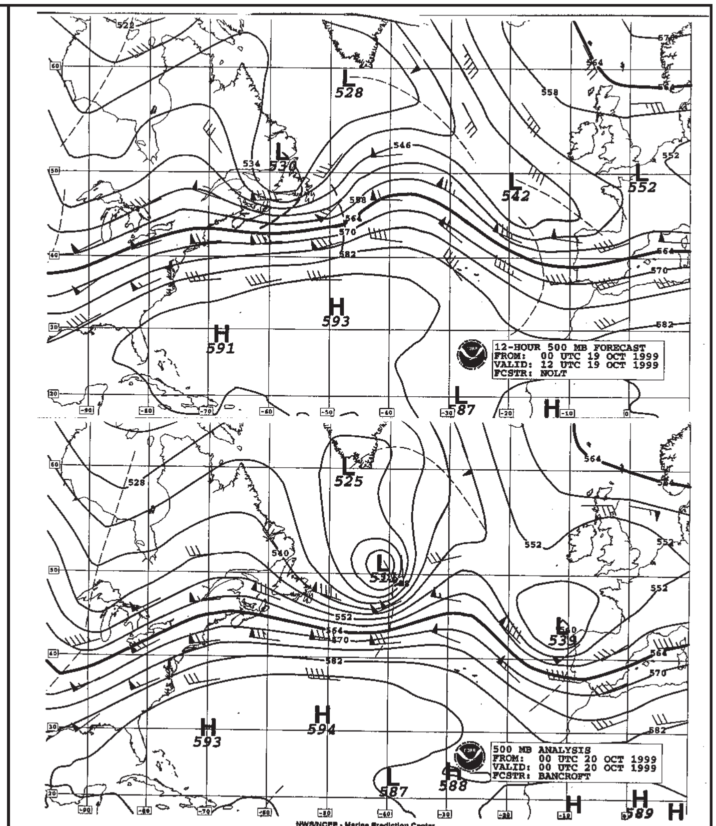
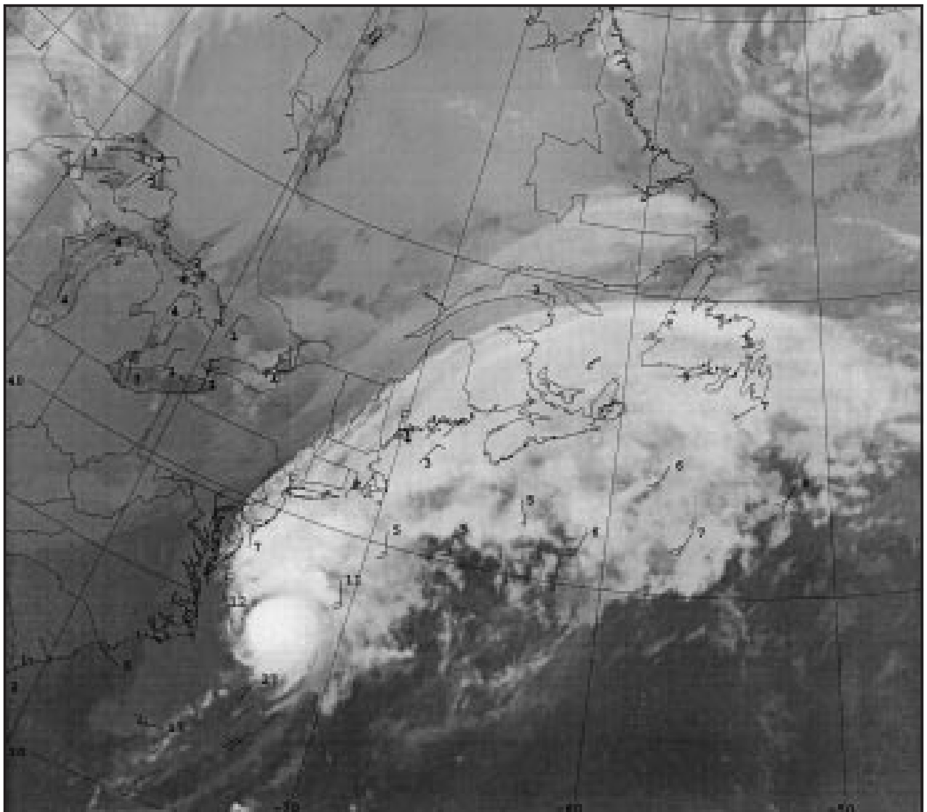


Figure 4. MPC Atlantic Part 2 Surface Analysis valid 00 UTC October 18, 19, and 20, 1999; 500-Mb charts valid 12 UTC 19 October and 00 UTC 20 October 1999.



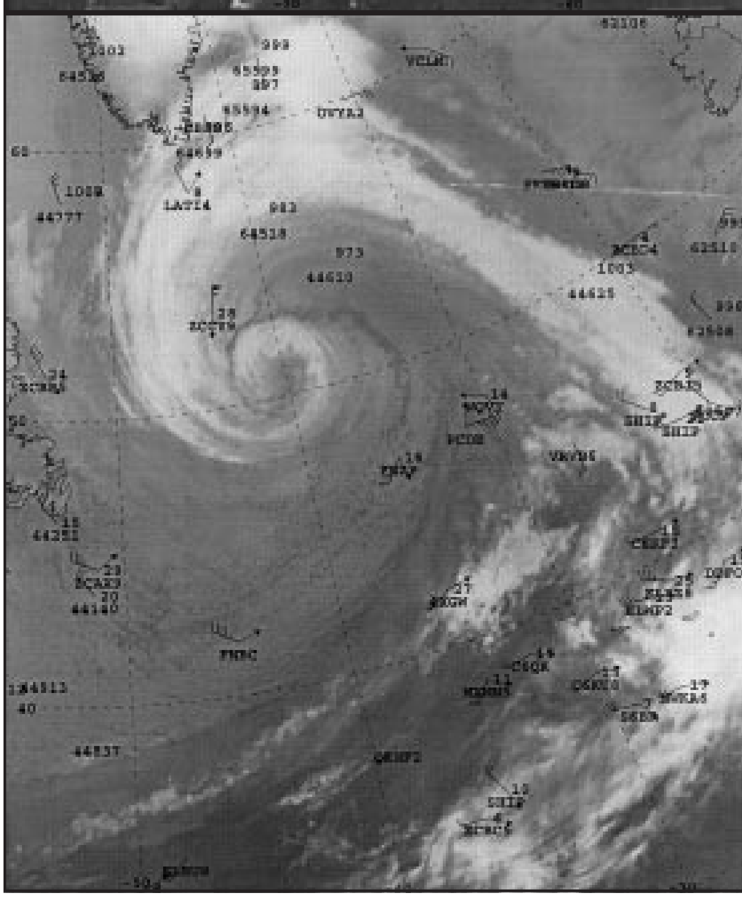


Figure 5. GOES8 infrared satellite images valid 1045 UTC 18 October and 0015 UTC 20 October 1999, the first showing Hurricane Irene and the second showing Irene as an intense extratropical storm. Also see Figure 4.

North Atlantic Area

Continued from Page 23

Figure 2 is a GOES 8 infrared satellite image showing Hurricane Floyd approaching Cape Fear, North Carolina, and a frontal zone extending from the eastern states northeast past Newfoundland.

Also in Figure 2, Hurricane Gert is shown entering the lower right corner of the picture, with a well-defined "eye." Gert crossed 31N southeast of Bermuda at 1200 21 September, following a track east of Floyd's, with maximum sustained winds 95 kts with gusts to 115 kts. Gert recurved to the northeast while slowly weakening (Figure 3), becoming an extratropical storm at 48N 49W at 1800 UTC 23 September. The **Liberty Wave** (**KRHZ)** reported from 35N 56W east of Gert at 1200 UTC 22 September with a south wind of 55 kts. With the passage of Gert just to the west, buoy **44141** (42N 56W) reported an east wind of 52 kts at 2100 UTC 22 September, which shifted to a southwest wind 45 kts with a peak gust of 54 kts at 0200 UTC 23 September. At 0000 UTC 23 September, the pressure at this buoy dropped to 966.2 mb, and seas increased from 7 meters (23 feet) to 14 meters (45 feet) in six hours. The second part of Figure 3 shows Gert as an extratropical storm at 51N 50W becoming absorbed by the developing storm over Newfoundland. The combined system developed into a 968 mb storm in the Labrador Sea late on 24 September before drifting east and weakening.

Hurricane Irene was perhaps the most significant event of the four-month period because it was a hurricane off the U.S. East Coast, and then maintained hurricane force winds as it recurved south of the Canadian Maritimes and became an intense extratropical storm. The first surface analysis of Figure 4 shows Irene as a minimal hurricane at 0000 UTC 18 October close to where Floyd was in the satellite image of Figure 2. The **Galaxy Ace** (**VRUI2**) was northeast of the center near 35N 73W reporting a southeast wind of 50 kts. The ship **9PIU** (name not known) reported a south wind of 55 kts near 34N 73W six hours later. Irene actually re-intensified after passing Cape Hatteras. The second surface analysis of Figure 4 shows the hurricane recurved with winds up to 80 kts with gusts to 100 kts. Irene became extratropical at 0600 UTC 19 October just south of Newfoundland. As the intensifying storm passed to the north at 1200 UTC 19 October, **Hibernia Oil Platform** (**44145**) at 46.7N 48.7W reported a maximum sustained wind 80 kts from the southwest. At this time the **Colby** (**FNBC**) reported from 43N 45W with southwest wind 60 kts and seas 9.5 meters (31 feet). To the west, the **OOCL Innovation** (**WPWH**) reported a west wind of 55 kts near 42N 55W and seas 23 meter (75 feet), (a check of the completed log sheets from the vessel could not confirm this extreme wave height; nearby buoy **44141** about 60 nm to the northwest reported seas of only 6 meters [20 feet]). The extratropical storm Irene deepened to 949 mb near 51N 41W (third surface analysis in Figure 4) at 0000 UTC 20 October before continuing east and beginning a slow weakening trend. The two 500 mb charts in Figure 4 covering the 12-hour period ending at 0000 UTC 20 October show a short wave trough associated with the storm crossing 50W, combining with another to the northwest to form a closed low and intense short wave. The **Iron Bridge** (**ZCCY9**), eastbound north of the center, reported a northeast wind of 50 kts at 0000 UTC 20 October, which increased to northwest 65 kts at 1800 UTC 20 October near 52N 41W, with seas 8 meters (26 feet). This was the highest wind report from a ship. Satellite estimated winds of 75 kts south and southwest of the center at 2100 UTC 19 October were recorded. The storm later weakened to a gale near Ireland on 23 October. The two GOES 8 infrared satellite images of Figure 5 show Irene as a hurricane in the first image, and as an intense extratropical storm at 0000 UTC 20 October when it was at maximum intensity. Ship and buoy data are plotted.

Hurricane Jose moved to near 60W by 1800 UTC 24 October as a minimal hurricane, the last tropical cyclone of the season to affect the North Atlantic. Jose followed a recurving track a little east of Gert's track. Figure 6 shows Jose merging with a front and becoming a rapidly intensifying storm or "bomb" at 45N 48W (second part of Figure 6). At 1800 UTC 25 October, the **Aya II**

Continued on Page 29

North Atlantic Area

Continued from Page 28

(**D5HD**) east of the center encountered south winds of 55 kts. By 1800 UTC 26 October this system was east of Greenland with a pressure of 944 mb ([27.88 in.], third part of Figure 6), down 47 mb (1.39 in.) from the previous 24 hours. The storm then drifted east and began to weaken. The **Nuka Arctica** (**OXYH2**) reported from 61N 35W southeast of the center with a southwest wind of 60 kts.

Other Significant Weather

In September, with the westerlies still displaced to the north near the summer position, most of the action other than the tropical activity noted above was north of 50N. The first intense low pressure system of the fall season, without tropical origins, formed on a front in near 52N on 7 September and moved northeast, dropping 34 mb in a 24 hour period to become a 958 mb storm 60N 16W at 1800 UTC 8 September. An unnamed ship at 58N 12W reported a southwest wind of 50 kts at that time. The storm then turned north toward Iceland, where it weakened. Another developing storm moved off the Labrador coast at 0000 UTC 16 September just as Floyd was moving up the East Coast. This system became almost as intense as the first one mentioned above, dropping 31 mb in the 24 hour period ending at 0000 UTC 18 September, and reached maximum intensity of 962 mb six hours later. The **Atlantic Cartier** (**C6MS4**) reported a northwest wind of 50 kts near 49N 26W at 0000 UTC 18 September, and again near 49N 22W 12 hours later.

Some systems moved from the west or northeast from the Canadian Maritimes and re-formed east of Greenland from September into October. The strongest of these formed east of Greenland at 0000 UTC 29 September and dropped from 998 mb to 965 mb 18 hours later. The ship **UAIS** (name unknown) reported from 59N 29W with a west wind of 50 kts at 1200 UTC 30 September. The center moved inland over Norway by 4 October.

October brought a gradual shift south in the westerlies, forming more of a trough aloft, near the east coast. Just before Irene came north, the first significant development near the East Coast occurred in mid-October. Figure 7 shows this development. Low pressure centers over the St. Lawrence Valley and near Cape Hatteras combined to form a storm in the Labrador Sea over a 48-hour period ending at 0000 UTC 16 October, which then stalled before drifting east and weakening. Much of this intensification occurred in the first 24 hours with pressure down to 975 mb in the Gulf of St. Lawrence by 0000 UTC 15 October, a drop of 27 mb. The **Eastern Bridge** (**C6JY9**) at 1800 UTC 14 October reported a south wind of 55 kts near 44N 62W. At 0900 UTC 15 October, **Hibernia Platform** (**44145**) near 47N 49W reported a southeast wind of 65 kts. The **Concert Express** (**SKOZ**) reported a west wind of 45 kts and seas of 9 meters (30 feet) near 45N 56W at 1800 UTC 15 October. Then, with the storm at maximum intensity at 0000 UTC 16 October, the **Teleost** (**C6CB**) encountered north winds of 55 kts at 59N 60W, while another ship (unidentified) reported a west wind of 55 kts at 47N 49W.

The last major storm of October formed on the trailing front left by former Hurricane Jose, near 31N 62W at 0000 UTC 28 October. It traveled rapidly northeast and intensified rapidly after 1200 UTC 29 October. The central pressure fell 50 mb (1.48 in.) in 24 hours before the storm reached a maximum intensity of 950 mb at 1200 UTC 30 October. Figure 8 shows the development of this system into a “dangerous storm” with hurricane force winds. At 1200 UTC 29 October, the **Galveston Bay** (**WPKD**) reported from 50N 30W with a northwest wind 65 kts, and the **Nuernberg Express** (**9VBK**) encountered northwest winds of 55 kts at 48N 29W, which increased to 65 kts six hours later. At 0000 UTC 30 October, the **Sealand Quality** (**KRNJ**) reported a northwest wind of 65 kts. This storm later moved northeast past Iceland as the month ended.

The upper air pattern became more blocked early in November, as a massive ridge formed over the eastern Atlantic and a deep trough formed off the east coast by 9 November. This supported a track

Continued on Page 30

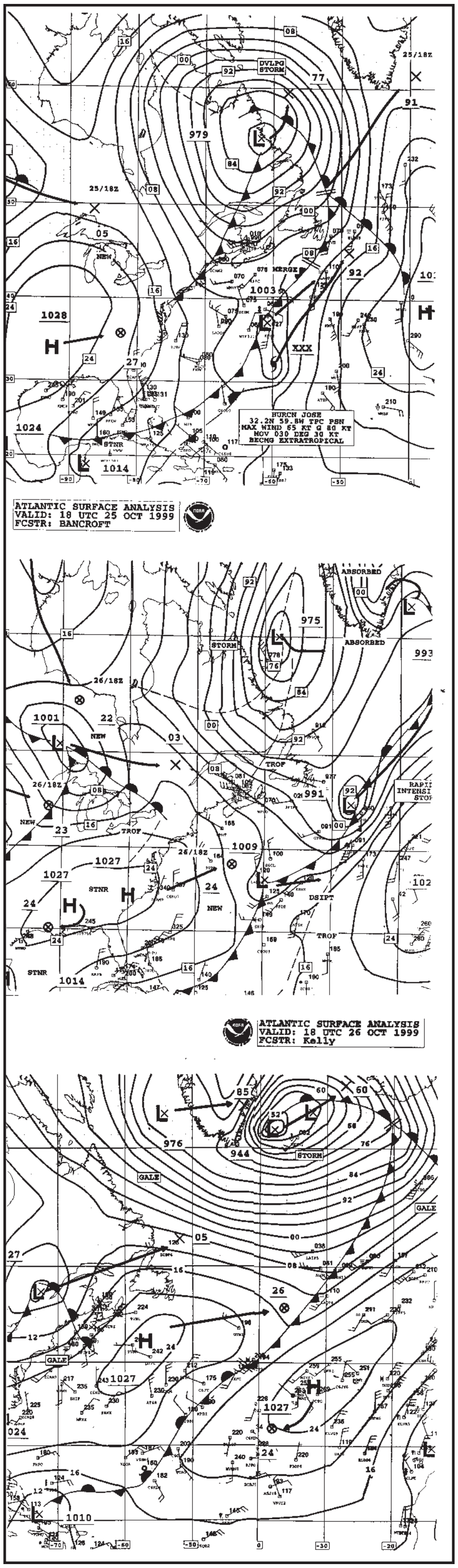


Figure 6. MPC Atlantic Part 2 Surface Analysis Charts valid 18 UTC October 24, 25, and 26, 1999.

North Atlantic Area

Continued from Page 29

of low pressure systems moving from the Canadian Maritimes north toward Greenland or the Davis Strait. Some of these developed storm force winds. The strongest of these formed near 42N 54W at 1200 UTC 16 November and reached 960 mb near 60N 61W before weakening. The blocking pattern abated later in November as the high amplitude Atlantic ridge and trough flattened out (decreased in amplitude). This led to a southwest to northeast flow across the Atlantic and set the stage for December.

December was very active with a strong westerly or southwest flow aloft, leading to a series of strong low pressure systems moving into western Europe beginning 3 December. By the beginning of the month a deep upper trough developed off the U.S. East Coast, leading to the rapid development of a storm relatively far south, shown in Figure 9. The 500 mb charts in Figure 9 are valid 6 hours before and after the valid time of the first surface analysis in Figure 9, and show a strong short wave trough moving off the coast. This triggered rapid development of the surface low (24 mb in 18 hours as indicated in Figure 9). This is an impressive deepening for so far south.

At 1200 UTC 1 December the **Newark Bay** (**WPKS**) at 37N 65W reported a northwest wind of 50 kts, while the **Sealand Quality** (**KRNJ**) to the north of the center at 43N 66W reported north winds 50 kts. Nearer the center and along the Gulf Stream, winds were likely stronger. Twelve hours later the center was near 43N 64W with pressure down to 972 mb. By this time the system was vertically stacked and cut off from the westerlies, and it began to drift southeast and weaken.

From 2 December almost until the end of the month, a series of developing storms moved east off the Canadian Maritimes and then across the British Isles and the North Sea. Later, toward Christmas, they would slam into France. Figure 10 shows a storm which developed from a frontal wave near 52N 33W at 1200 UTC 2 December and moved east with rapid speed and intensification, becoming a 966 mb in the North Sea at 1200 UTC 3 December. This was a remarkable 49 mb (1.45 in.) drop in central pressure in 24 hours, including 14 mb (0.41 in.) in the final 6 hours. The 500 mb analysis valid 0000 UTC 3 December shows the short wave trough, which amplified or came into phase with the upper low east of Iceland, supporting this development. At 1200 UTC 3 December there were numerous reports of winds in the 45 to 65 kt range in the Great Britain area and North Sea. The **Walther Herwig 3** (**DBFR**) reported a west wind 65 kts near 55N 2E at that time.

Continued on Page 38

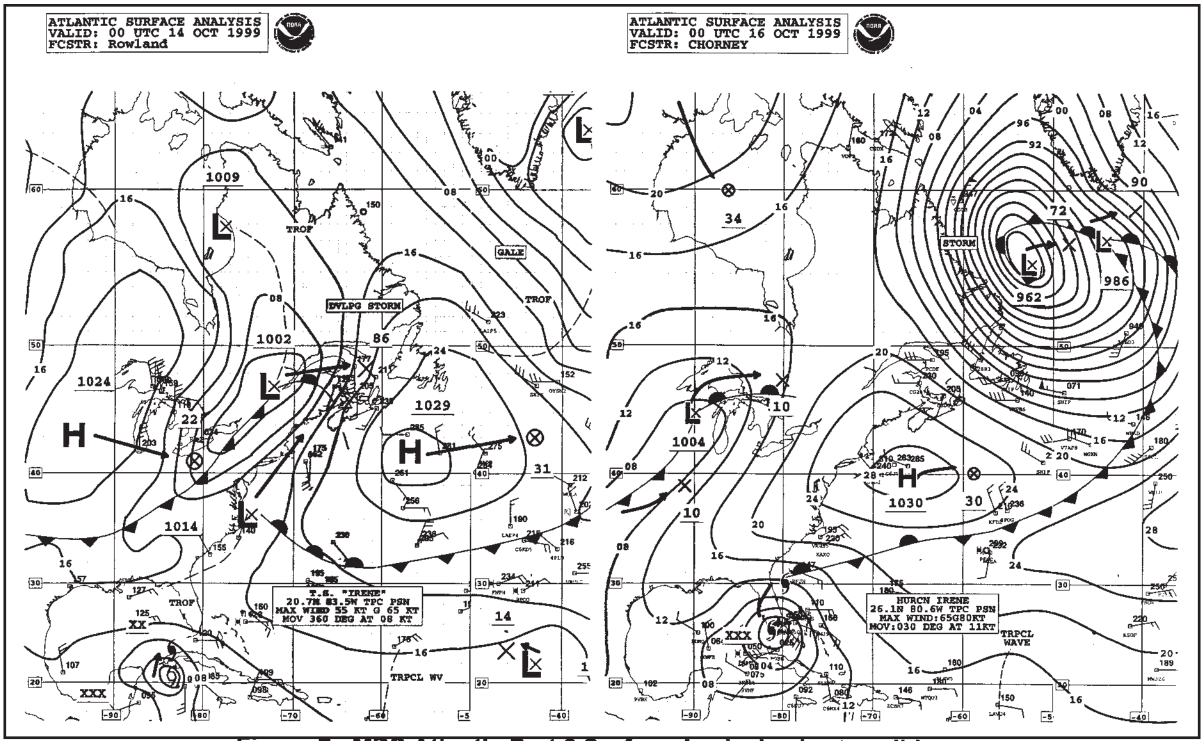


Figure 7. MPC Atlantic Part 2 Surface Analysis charts valid at 00 UTC October 14 and 16, 1999.

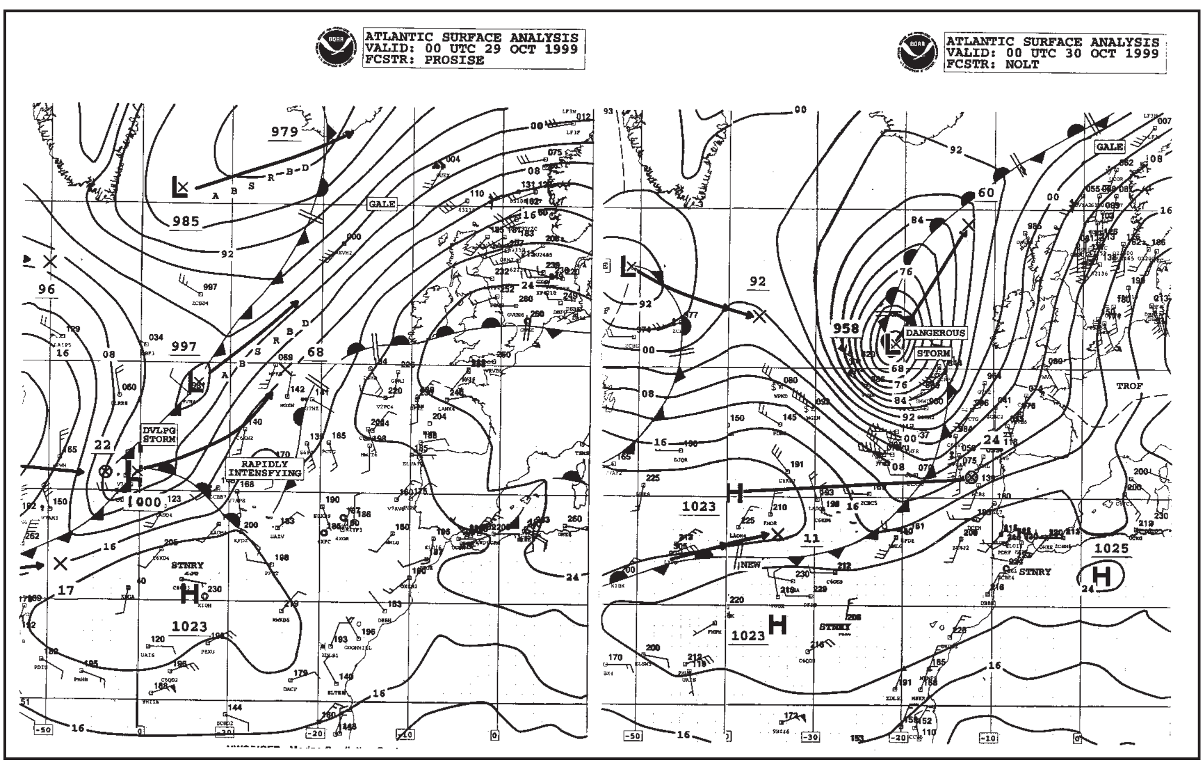


Figure 8. MPC Atlantic Part 1 Surface Analysis charts valid at 00 UTC October 29 and 30, 1999.

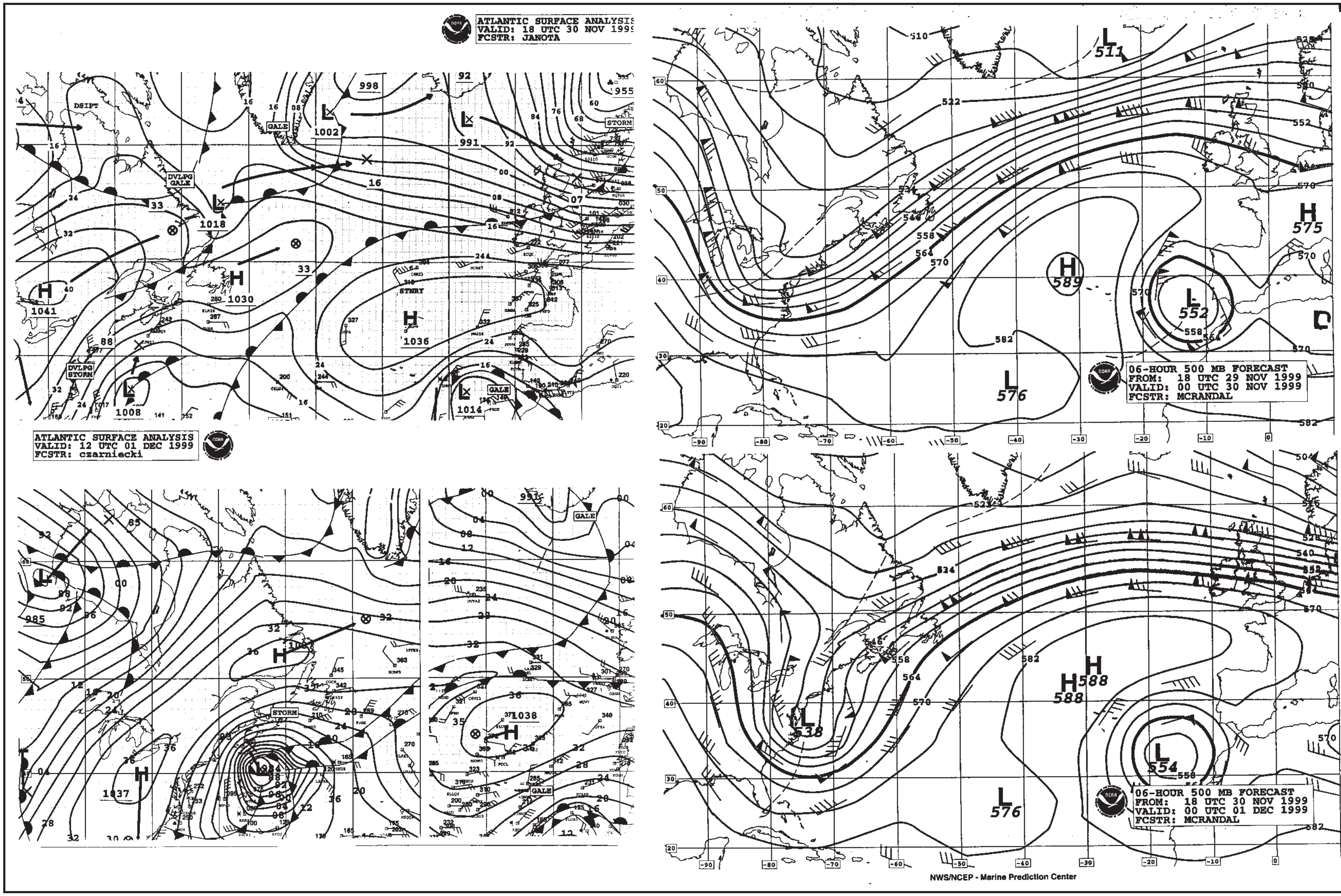


Figure 9. MPC Atlantic Surface Analysis charts valid 18 UTC 30 November and 12 UTC 01 December 1999; 500-Mb charts (6 hour computer model forecasts) valid 00 UTC 30 November and 00Z 01 December 1999.

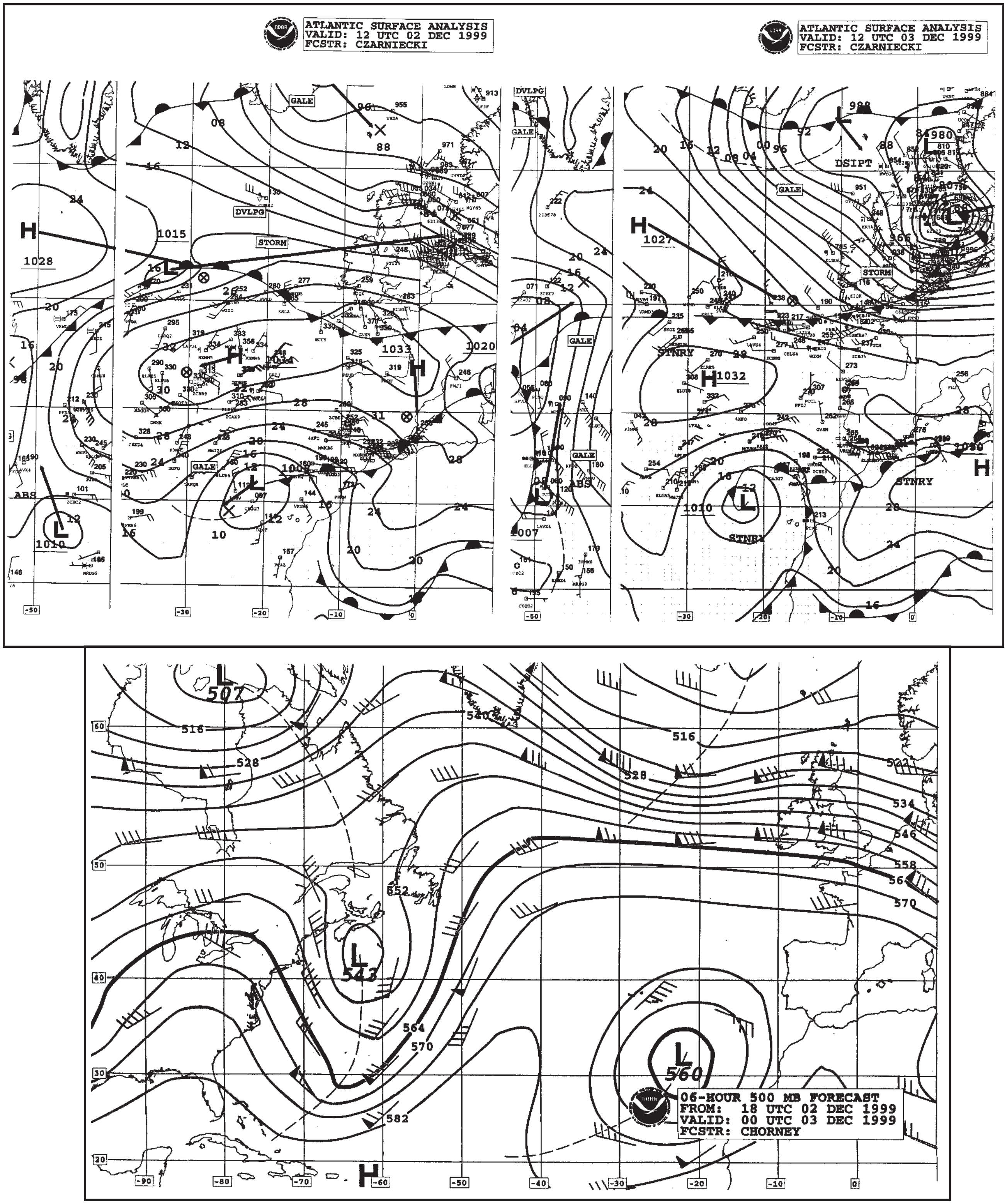


Figure 10. MPC Atlantic Part 1 Surface Analysis charts valid 12 UTC December 2 and 3, 1999; 500-Mb chart (actually 6 hour computer model forecast) valid 00 UTC 03 December 1999, or halfway between valid times of surface analysis charts.

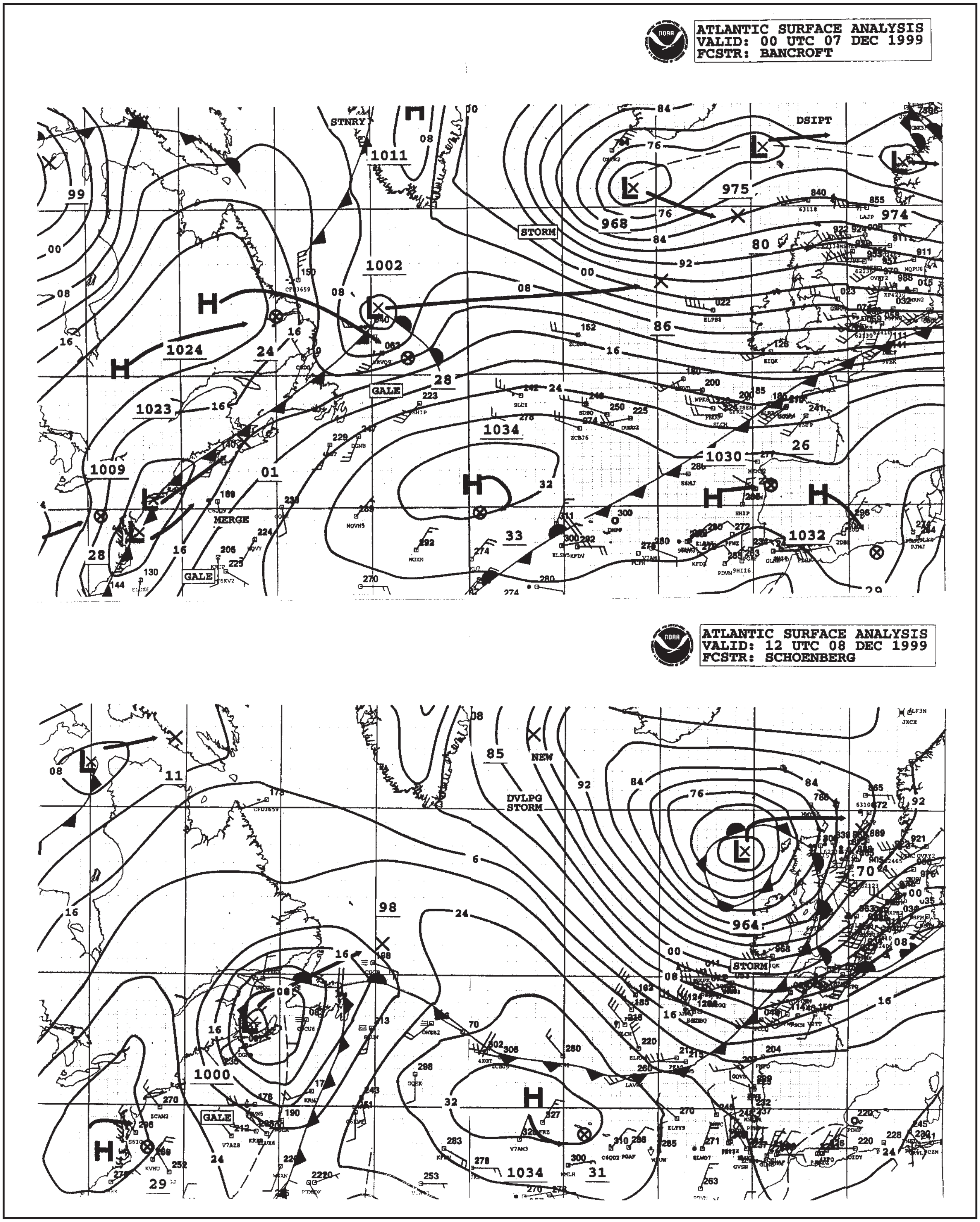


Figure 11. MPC Atlantic Surface Analysis charts valid 00 UTC 07 December and 12 UTC 08 December 1999.

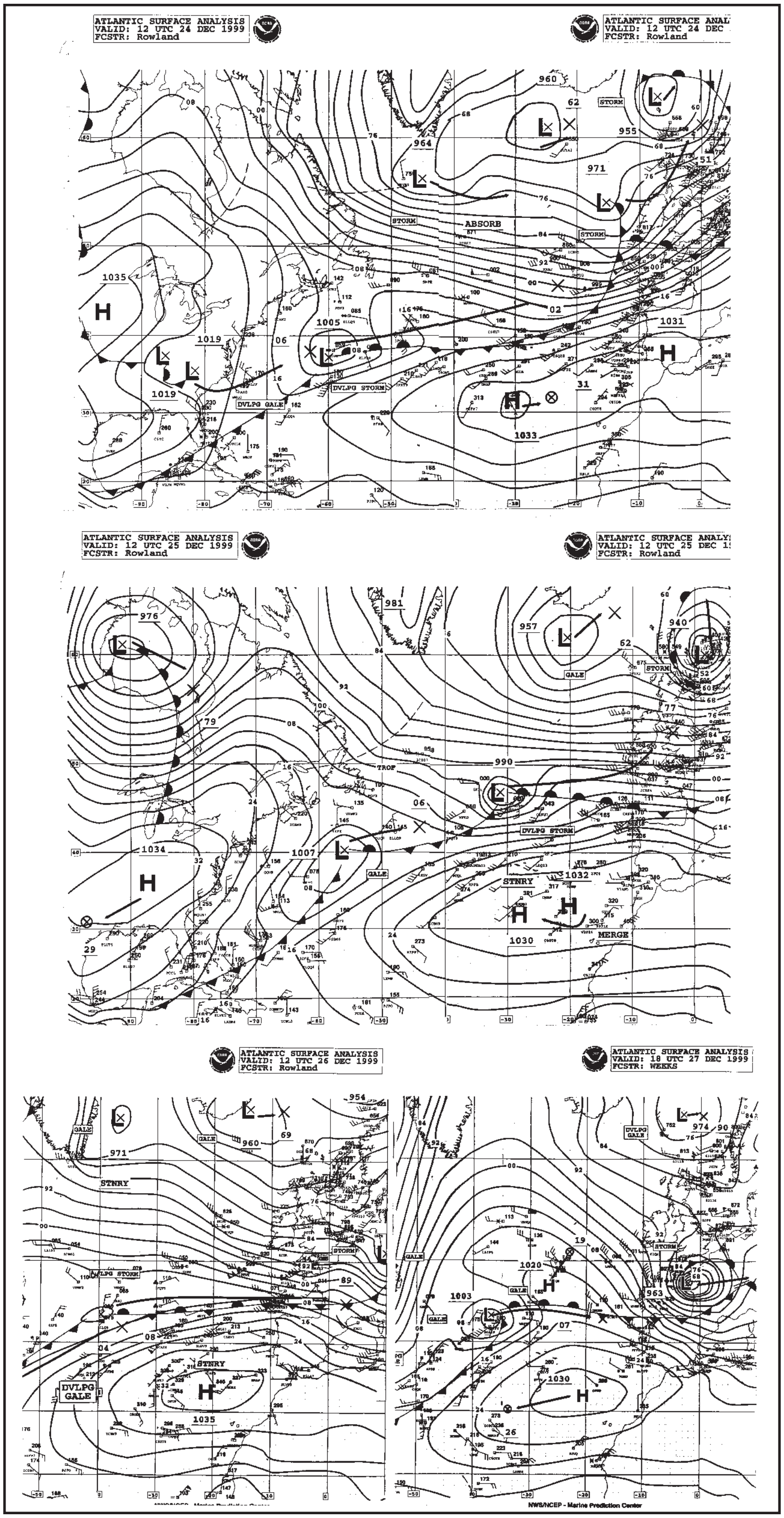


Figure 12. MPC Atlantic Surface Analysis charts valid 12 UTC December 24, 25, and 26, and 18 UTC December 27, 1999.

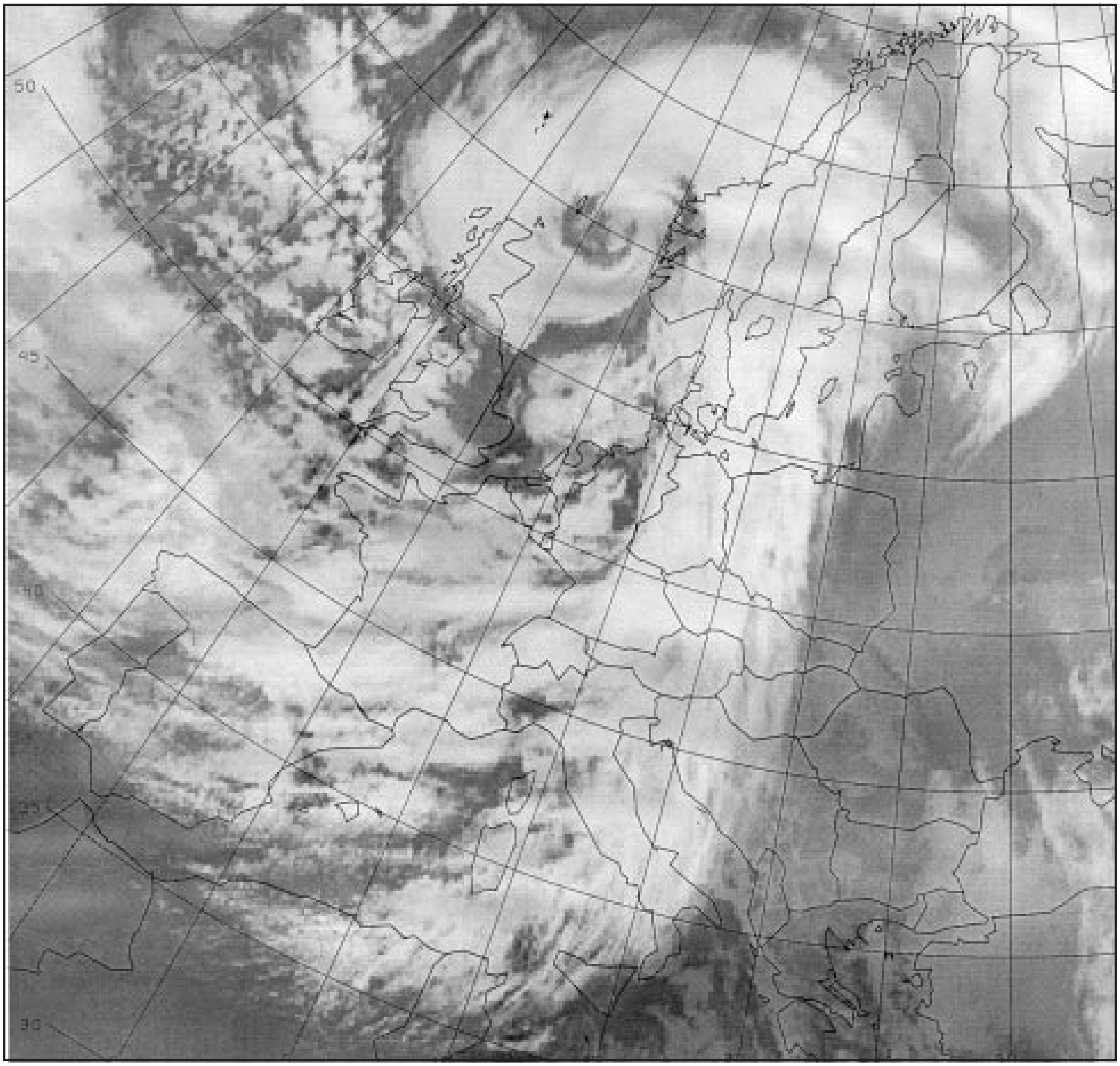


Figure 13. Meteosat7 infrared satellite image of first storm in Figure 12, valid 09 UTC 25 December 1999, or three hours prior to valid time of second surface analysis of Figure 12.

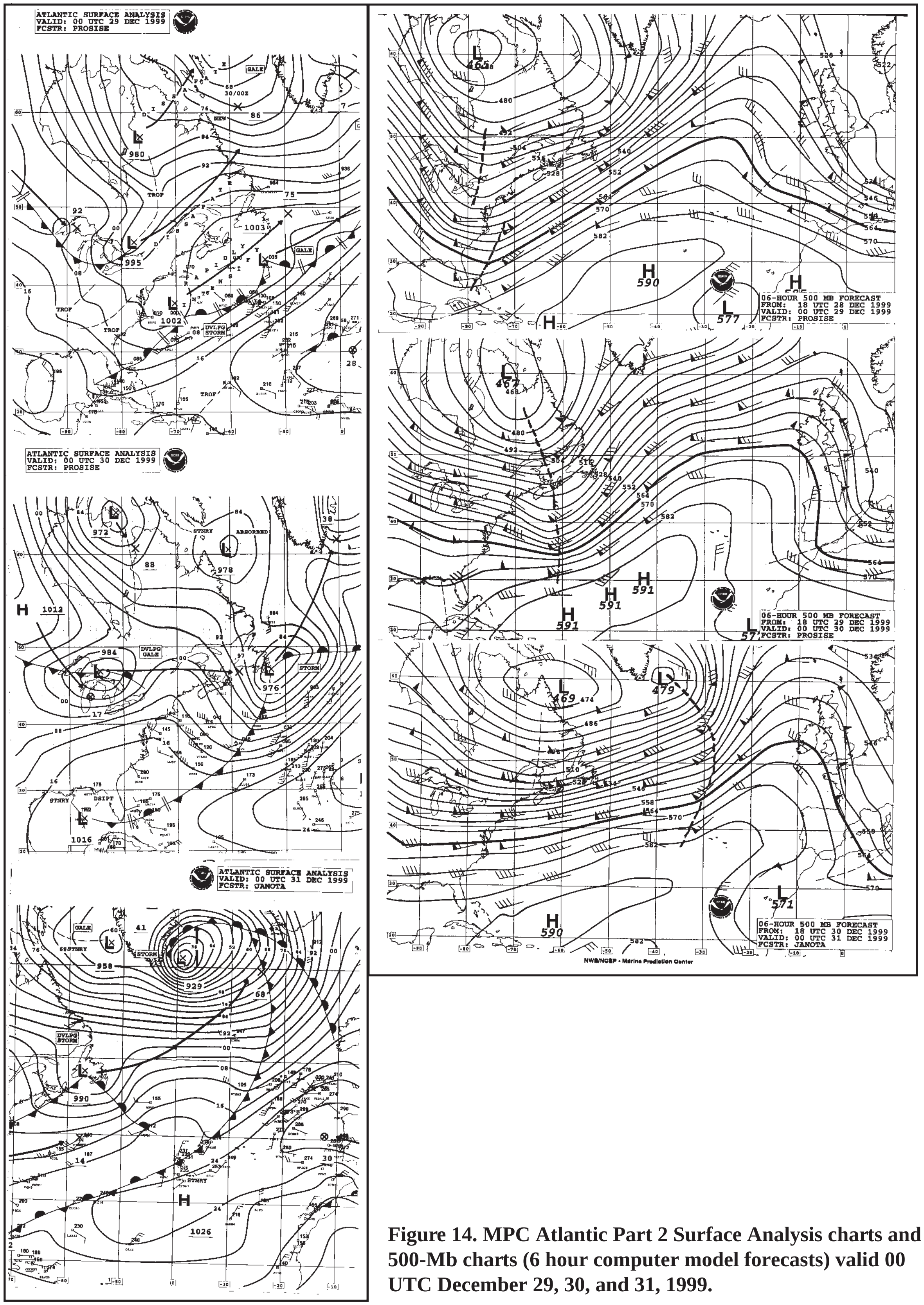


Figure 14. MPC Atlantic Part 2 Surface Analysis charts and 500-Mb charts (6 hour computer model forecasts) valid 00 UTC December 29, 30, and 31, 1999.

North Atlantic Area

Continued from Page 30

The next major system moved off the Canadian Maritimes on 6 December and moved east northeast, absorbing the old storm center near Iceland by 1200 UTC 8 December (Figure 11), before passing through the northern British Isles on 8 December. Unlike the storm in the preceding paragraph, this storm reached maximum intensity (962 mb) at 1800 UTC 8 December before reaching the British Isles. The strongest winds and highest seas were over the open ocean southwest of the center. The ship **SKPE** (name unknown), heading southwest, saw its winds increase from west 35 kts at 0600 UTC 8 December to 70 kts six hours later, near 50N 16W. Reported seas built from 7 meters (22 feet) to 14.5 meters (47 feet) in the 12 hour period ending 1800 UTC 8 December. Buoy **62108** at 54N 19W reported a west wind of 35 kts and seas of 11 meters (36 feet) at 0600 UTC 08 December.

The Christmas Storms

Strong southwest flow aloft continued into late December. Low pressure systems moving from the west or southwest rapidly intensified as they approached Europe. The strongest of these turned out to be the second most intense storm of the September to December period in terms of central pressure. Figure 12 shows the low, already a storm (wind 52 knot or greater), approaching Great Britain, with gale to storm force winds actually extending west to the Newfoundland and Labrador coast. Further deepening to 940 mb occurred in the next 24 hours, a drop of 31 mb. Figure 13 is a Meteosat 7 infrared satellite image of the storm near maximum intensity. The center of this very intense low is well defined by ring clouds around an “eye” near 60N 01E. The highest sustained wind was from buoy **62166** at 57N 2E, which reported a southwest wind of 70 kts at 0300 UTC 25 December. Buoy **63113** (61N 1.7E) reported a lowest pressure of 937.6 mb (27.69 in) at 1300 UTC 25 December. Among ships, the strongest wind report was a southwest wind of 63 kts from the **Mark C** (**8PNL**) in the English Channel near 50N 03W at 0000 UTC 25 December. The ship **ZCBJ6** (name unknown) encountered seas up to 13 meters (42 feet) near 49N 08W at 1800 UTC 24 December.

As the main storm system moved to the north, two significant secondary developments occurred along the front to the south (Figure 12, parts 2 to 4). The first, shown near 47N 31W in the second part of Figure 12, intensified to 981 mb as it moved inland over northern France at 0600 UTC 26 December, and is shown in the third part of Figure 12 on the eastern edge of the chart. The second, near 43N 40W at 1200 UTC 26 December, is shown in the fourth part of Figure 12 slamming into France 30 hours later with a pressure of 963 mb, a drop of 41 mb. The **Mark C** (**8PNL**) reported a north wind of 65 kts at 48N 5W as this system was moving ashore. These two fast-moving systems produced extensive wind damage inland as they moved into France.

Finale

Figure 14 shows an explosive development of a storm off the East Coast, the final event of the year. The formation of a massive upper low and trough near the East Coast helped fuel this development. The three 500 mb charts in Figure 14 show two short wave troughs merging off the East Coast. The surface low is shown deepening by 26 mb in the first 24 hours and another 47 mb in the second 24 hour period. The resulting storm east of Greenland with 929 mb (27.43 in.) central pressure was the most intense of the four-month period, not only for the North Atlantic, but for both oceans. The ship **3FFE8** (name not known) near the center reported a southwest wind 70 kts near 59N 35W at 1200 UTC 31 December, 12 hours after the storm reached peak intensity.

References

Sienkiewicz, J. and Chesneau, L., *Mariner’s Guide to the 500-Millibar Chart* (Mariners Weather Log, Winter 1995).

Bancroft, G., *Marine Weather Review, April to August 1999* (Mariners Weather Log, December 1999).⚓

Marine Weather Review
North Pacific Area—September to December 1999

George P. Bancroft
Meteorologist
Marine Prediction Center

The main storm track across the North Pacific for most of September was from near Japan northeastward into the Gulf of Alaska and southwest mainland Alaska. By late September, as the season advanced into fall, storm developments became more intense. The two most significant storms occurred in the latter half of September, with the second or stronger event illustrated in Figures 1 and 2.

The first storm formed from the merger of gale centers from the Bering Sea and from south of the Aleutians on 16 September. This formed a storm in the southwest Gulf of Alaska with central pressure of 968 mb at 1200 UTC 17 September. The system strengthened to 962 mb just south of Kodiak Island, before moving into southwest Alaska and weakening that same day. Ship **3FLU7** (name not available) reported a southwest wind of 60 kts and seas of 11 meters (35 feet) at 1200 UTC 17 September near 52N 156W (south of the center), while the **Hyundai Explorer** (**3FTG4)** just to the south had a west wind of 50 kts. The **World Spirit** (**ELWG7)** east of the center at 1800 UTC 17 September, reported a south wind of 40 kts and seas of 9 meters (31 feet).

The second storm followed a similar track. It formed on a front near 49N 151W 22 September (in the first surface analysis at 0000 UTC) and deepened by 34 mb in the following 18 hours. The central pressure reached 949 mb at maximum intensity in the northern Gulf of Alaska. This was the second most intense system in the North Pacific for this four-month period, qualifying as a meteorological "bomb." The series of two 500-mb charts in Figure 1 show a strong 500-mb jet stream of 105 kts and associated short wave trough supporting this development (See Mariner's *Guide to the 500-Millibar Chart* in References section). The resulting low pressure system near the Alaska coast became vertically stacked to 500 mb by 0000

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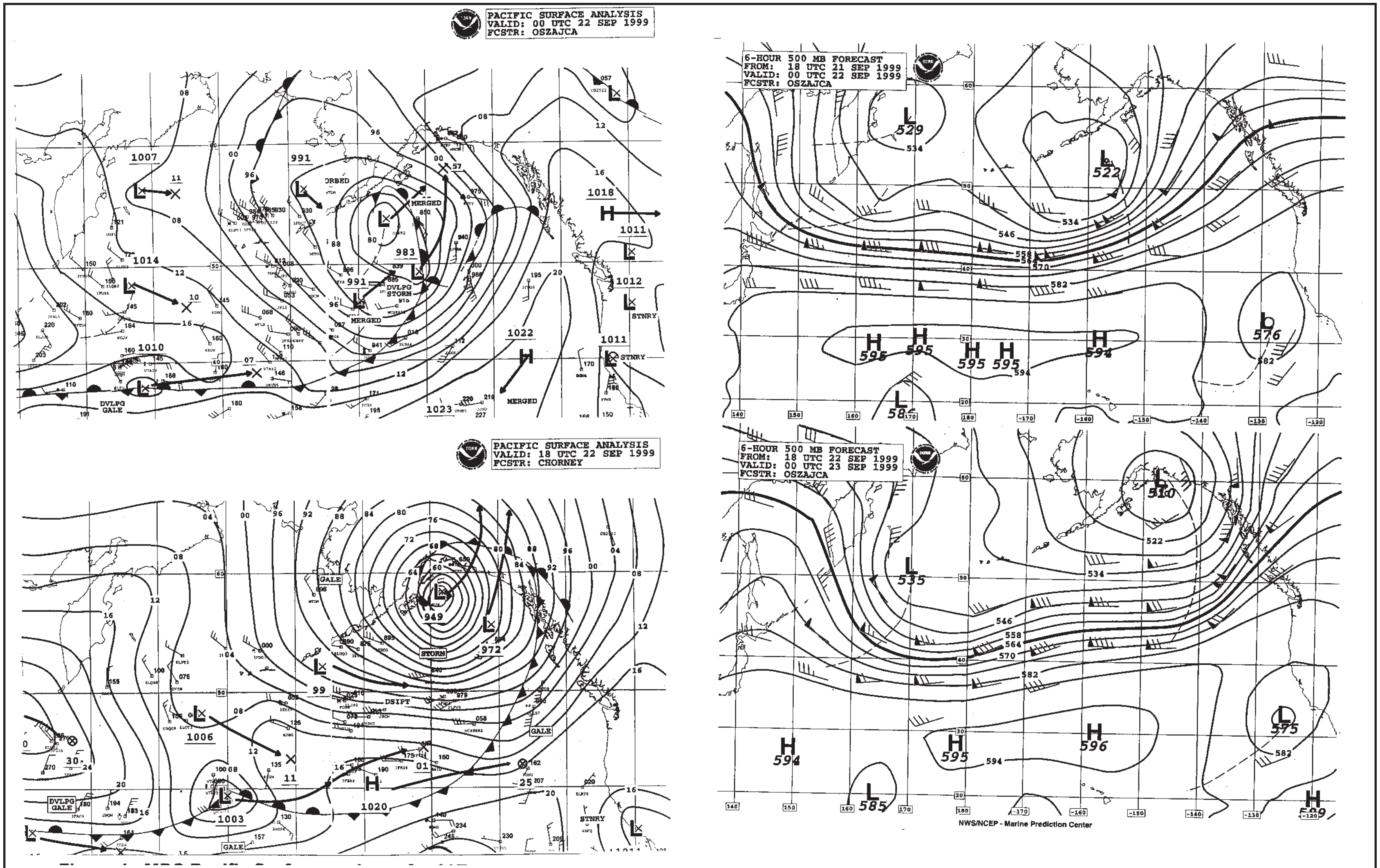

Figure 1. MPC Pacific Surface Analyses for 00 UTC and 18 UTC 22 September 1999; 500-Mb analysis charts (actually 6 hour computer model forecast) for 00 UTC 22 September and 00 UTC 23 September 1999.

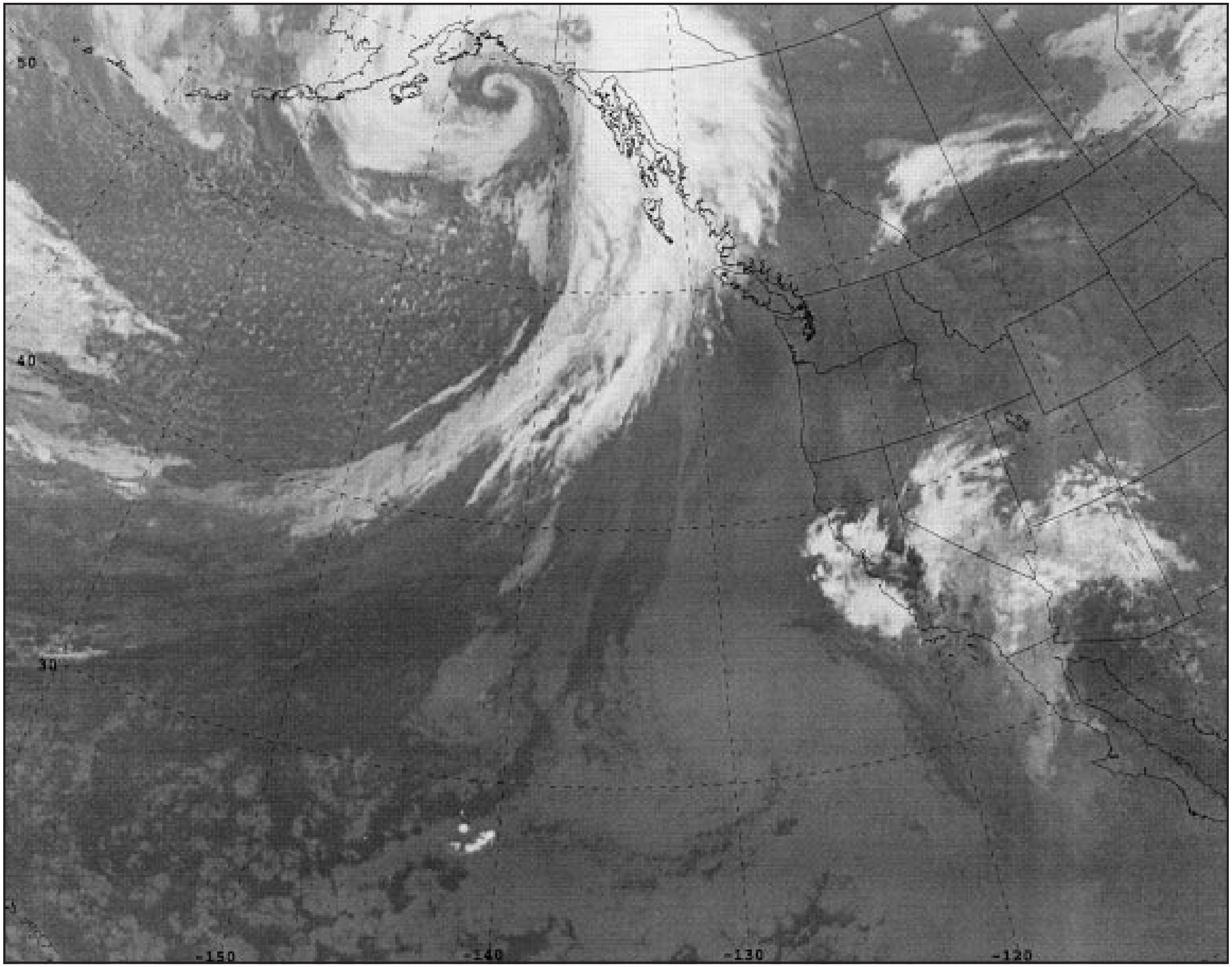

Figure 2. GOES10 infrared satellite image of Gulf of Alaska storm valid 15 UTC 22 September 1999. Also see Figure 1.

North Pacific Area

Continued from Page 39

UTC 23 September and started to weaken. Figure 2 is a GOES-9 infrared satellite image of the storm at 1500 UTC 22 September near maximum intensity, revealing a well-defined center at 59N 146W. The highest wind reported from a ship was a west wind of 45 kts from the **Sealand Explorer** (**WGJF)** located at 51.5N 150.2W at 1800 UTC 22 September. The vessel reported seas of 9 meters (31 feet). The **Chevron Mississippi** (**WXBR)** also reported 9 meter seas, along with a west wind of 35 kts, near 55N 149W at 0000 UTC 23 September. The wind at buoy **46003** (53N 146W) was southwesterly at 41 kts with gusts to 58 kts at 0900 UTC 22 September after the center passed. The **Northern Lights** (**WFJK**) reported a pressure of 951.5 mb at 58N 149W as the center passed nearby at 1800 UTC 22 September.

The storm track shifted south in October, and was directed toward the eastern Gulf of Alaska and the British Columbia coast. What may have been the strongest storm in terms of reported seas in the four-month period occurred off the U.S. Pacific Northwest coast late in October. This system was also the most intense for October in terms of central pressure. Figure 3 depicts the development of this storm from a frontal wave of low pressure at 42N 159W. The storm is shown at maximum intensity, 959 mb (28.29 in.), near 46N 135W at 1800 UTC 27 October in the second part of Figure 3. The third part of Figure 3 is a 500 mb chart valid 0000 UTC 27 October showing a vigorous short wave trough and 85 kt jet stream supporting this development. Pressure dropped 28 mb between 1200 UTC 26 October and 1200 UTC 27 October. Satellite-sensed winds for this area indicated wind up to 70 kts at 0300 UTC 27 October. The buoy **46006** at 40N 138W south of the center reported a west wind of 50 kts with gusts to 68 kts at 1500 UTC 27 October (buoys provide 8-minute averages for wind). Seas at the buoy rose from 10 meters (34 feet) to 16 meters (53 feet) in the three-hour period ending at 1500 UTC 27 October. In Figure 3, the ships **Taiko** (**LAQT4)** and **3FIQ7** (name not available) were off Vancouver Island at 1800 UTC 27 October reporting east winds of 50 kts, the strongest wind reported. Figure 4 is an infrared satellite image of the storm at maximum intensity, showing extensive deep frontal cloudiness north and east of the center and some frontal clouds wrapping around the center.

This storm then weakened before moving inland near Vancouver Island on October 28. On October 29, another storm developed and took a course more northward toward the southeast panhandle of Alaska. Figure 5 shows this system as it reached storm strength (52 kts) before moving inland. There were two noteworthy ship reports from the **Sealand Kodiak** (**KGTZ)—**a southeast wind of 60 kts near the warm front at 1200 UTC 29 October, and a southwest wind of 70 kts in the tight pressure gradient south of the center at 0000 UTC 30 October.

In November and early December, some of the low pressure systems went northeast into the Bering Sea. One of these, developed east of Japan and moved into the Bering Sea on November 6, attaining a central pressure of 960 mb near 55N 178E at 1800 UTC 6 November. The **Sealand Endurance** (**KGJX**) reported near 51N 178W south of the center with west winds of 55 to 60 kts at 0600 and 1800 UTC 6 November. This system moved east and weakened, redeveloping as a gale on 8 November.

The strongest of these Bering Sea storms had tropical origins. Typhoon Gloria passed south of Japan on 15 November and turned northeast, merging with a polar front and the developing storm depicted in the first surface analysis of Figure 6 east of Japan. By 0000 UTC 17 November the developing storm had absorbed Gloria and deepened by 34 mb to form the storm in the western Bering Sea shown in the second analysis of Figure 6. The central pressure deepened to 940 mb (27.76 in.) in the central Bering Sea (third surface analysis in Figure 6), the lowest pressure of the year in the North Pacific. The ship **Ever Union (3FFG7**) reported a pressure of 949.0 mb with east wind of 38 kts north of the center near 59N 176E at 0000 UTC 18 November. At 1800 UTC 18 November the **Arctic Sun** (**ELQB8**) reported a southwest

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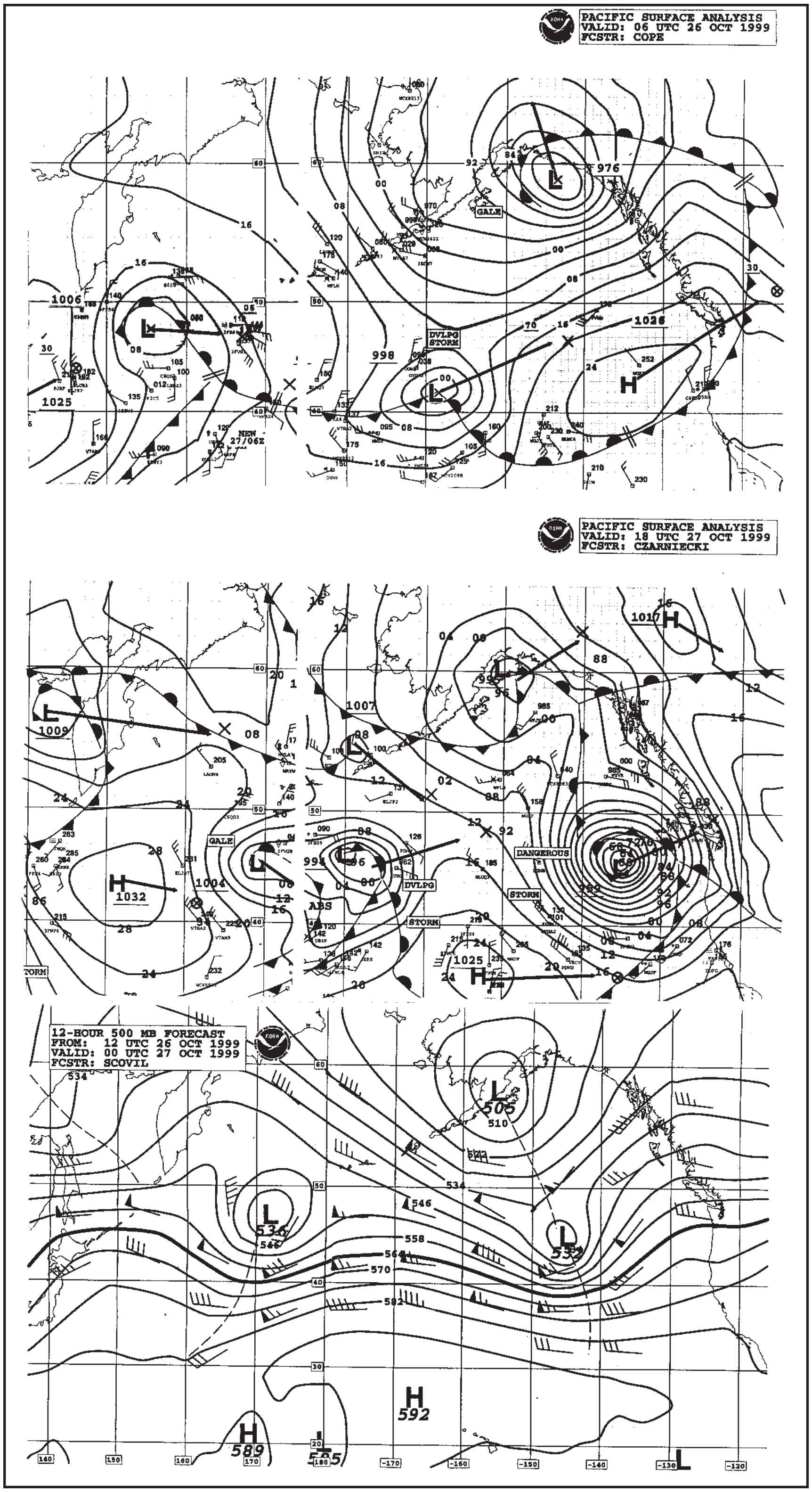

Figure 3. MPC Pacific Surface Analyses valid 06 UTC 26 October and 18 UTC 27 October 1999; 500-Mb chart (12 hour computer model forecast) valid 00 UTC 27 October, or halfway between valid times of surface charts.

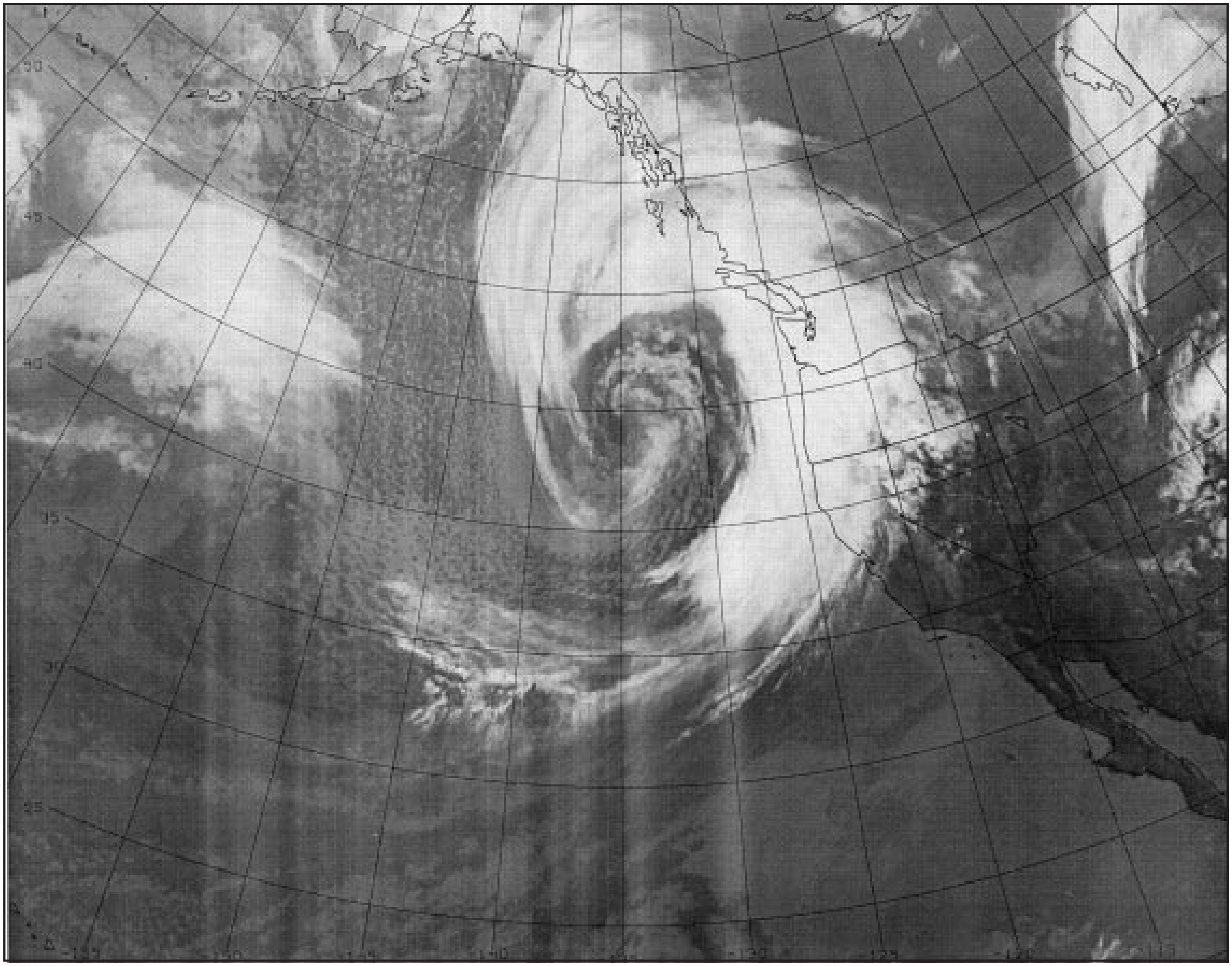

Figure 4. GOES10 infrared satellite image of intense storm off U.S. West Coast valid 18 UTC 27 October 1999. Valid time is same as that of second surface analysis in Figure 3.

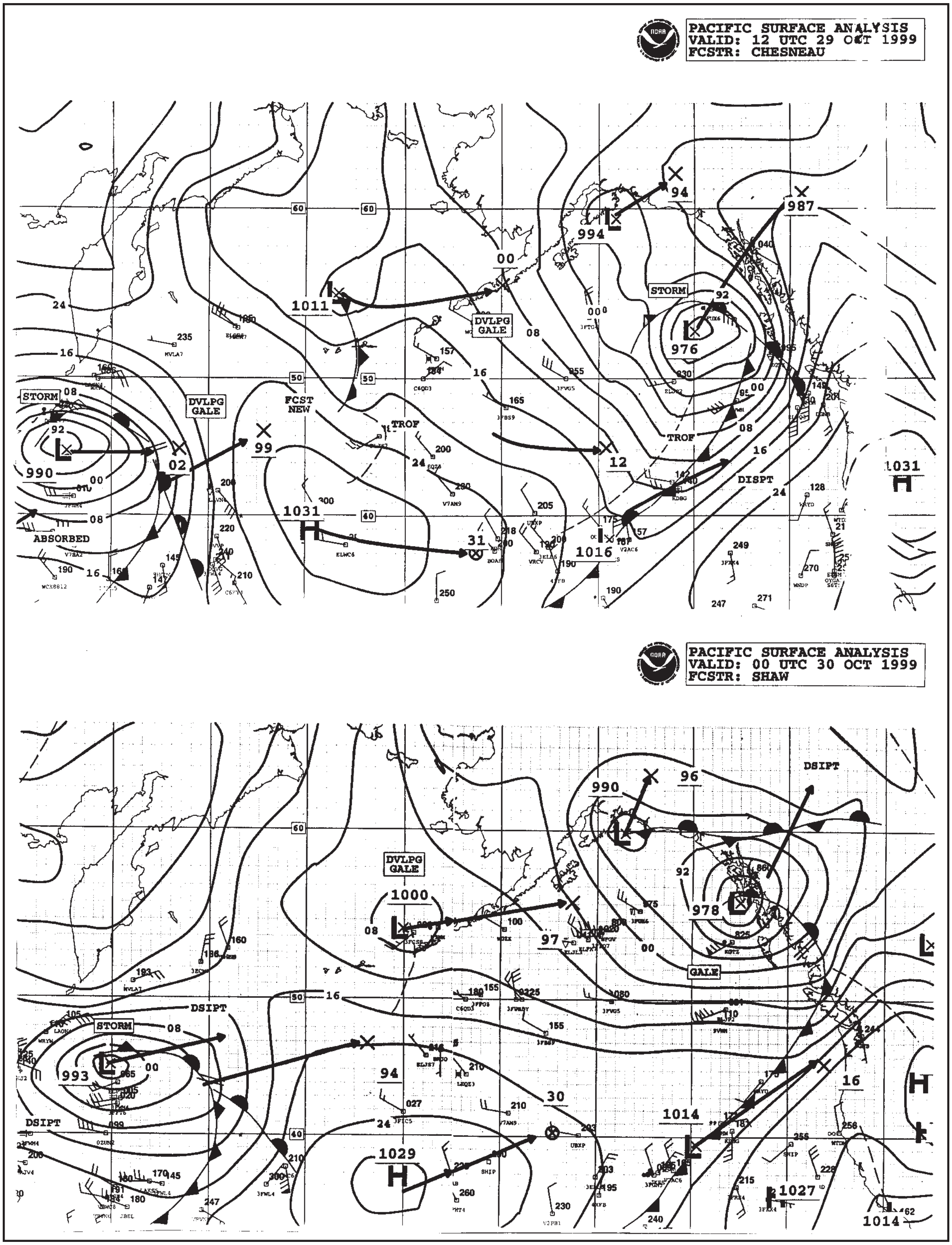

Figure 5. MPC Pacific Surface Analyses valid 12 UTC 29 October and 00 UTC 30 October 1999.

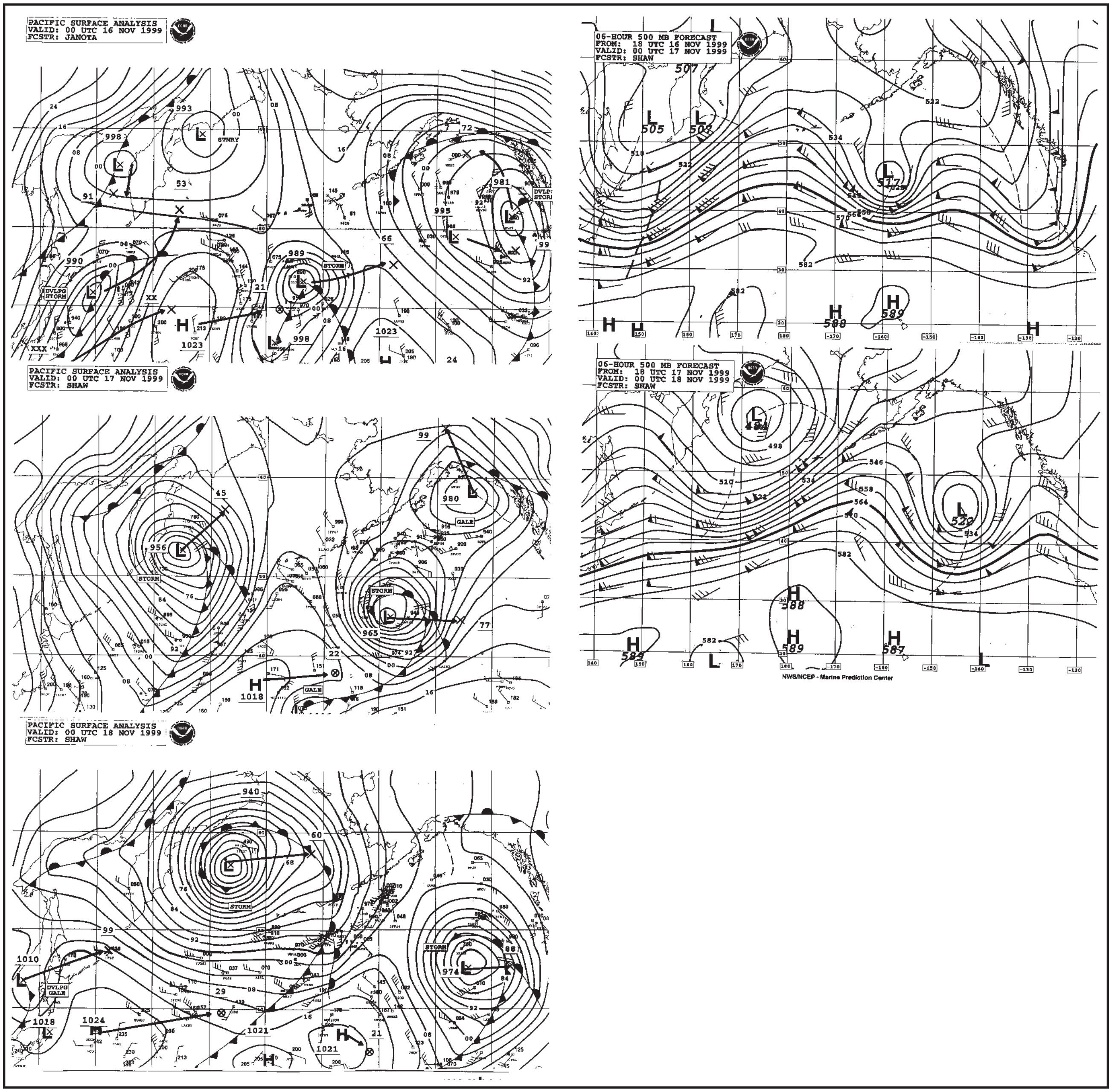

Figure 6. MPC Pacific Surface Analyses valid at 00 UTC November 16, 17, and 18, 1999; 500-Mb analysis charts (actually 6 hour computer model forecasts) valid 00 UTC November 17 and 18, 1999, and third surface analyses.

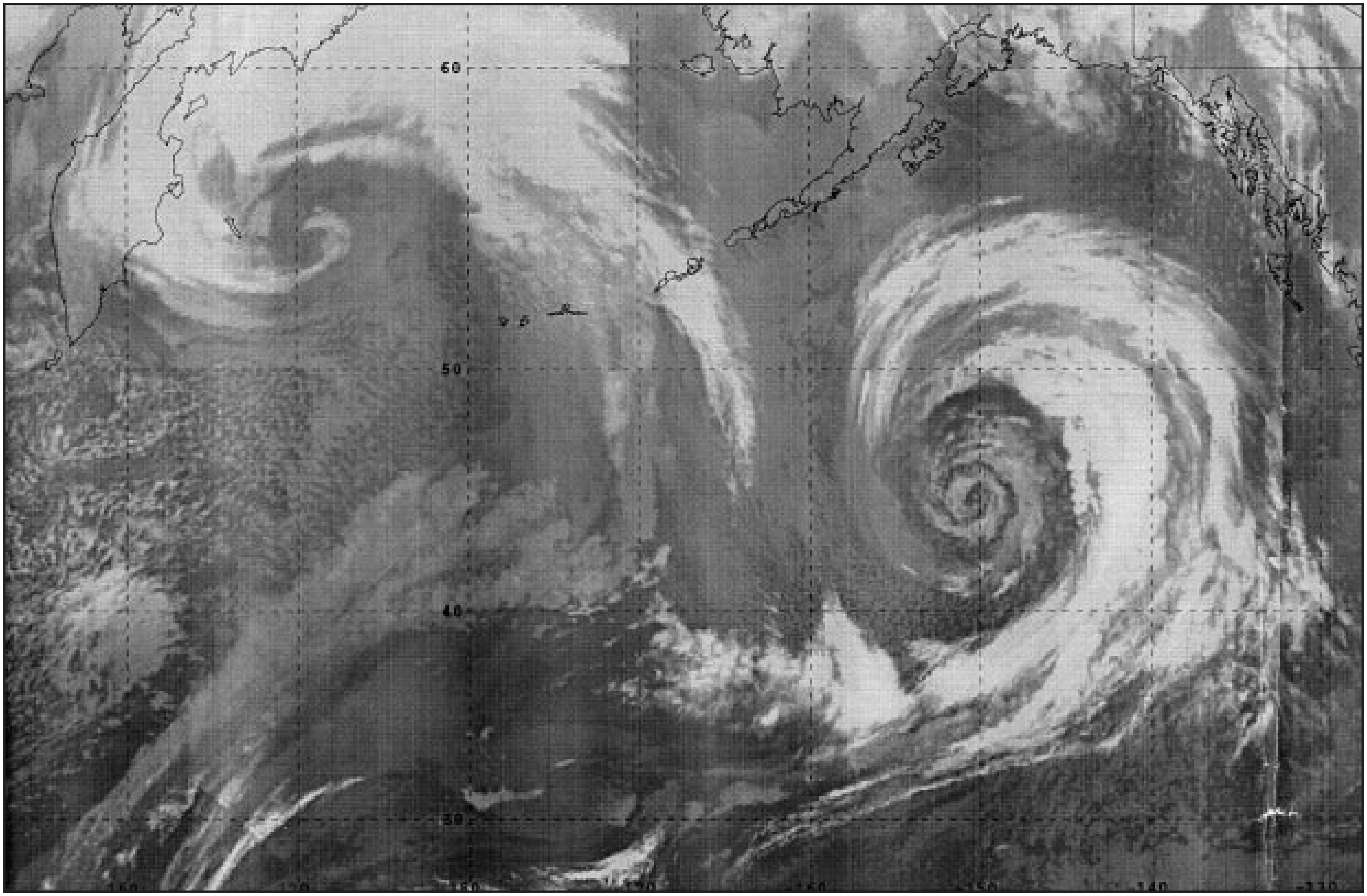

Figure 7. Composite of GOES10 and GMS infrared satellite imagery valid 1145 UTC 17 November 1999. Also see Figure 6.

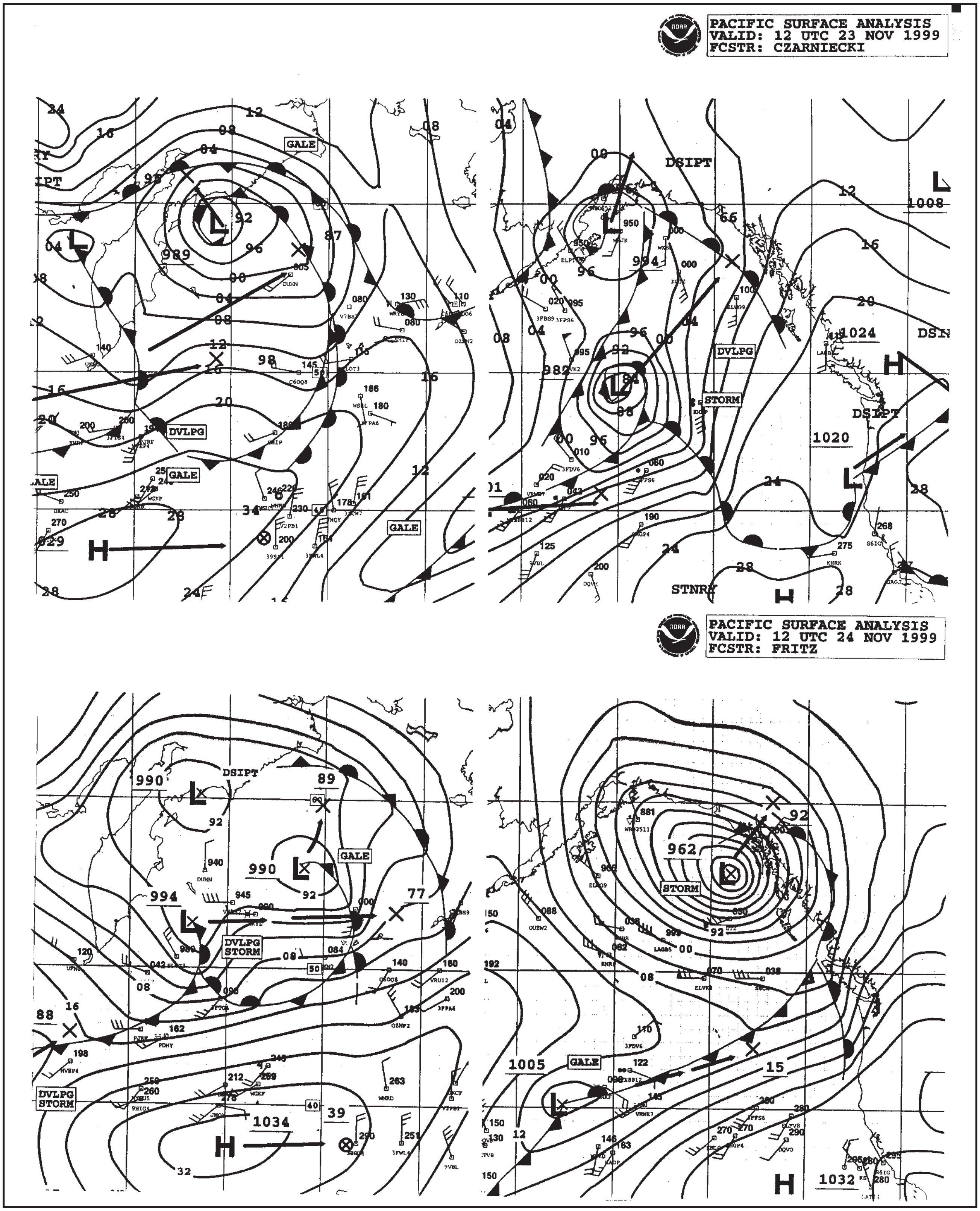

Figure 8. MPC Pacific Surface Analysis charts valid 12 UTC November 23 and 24, 1999.

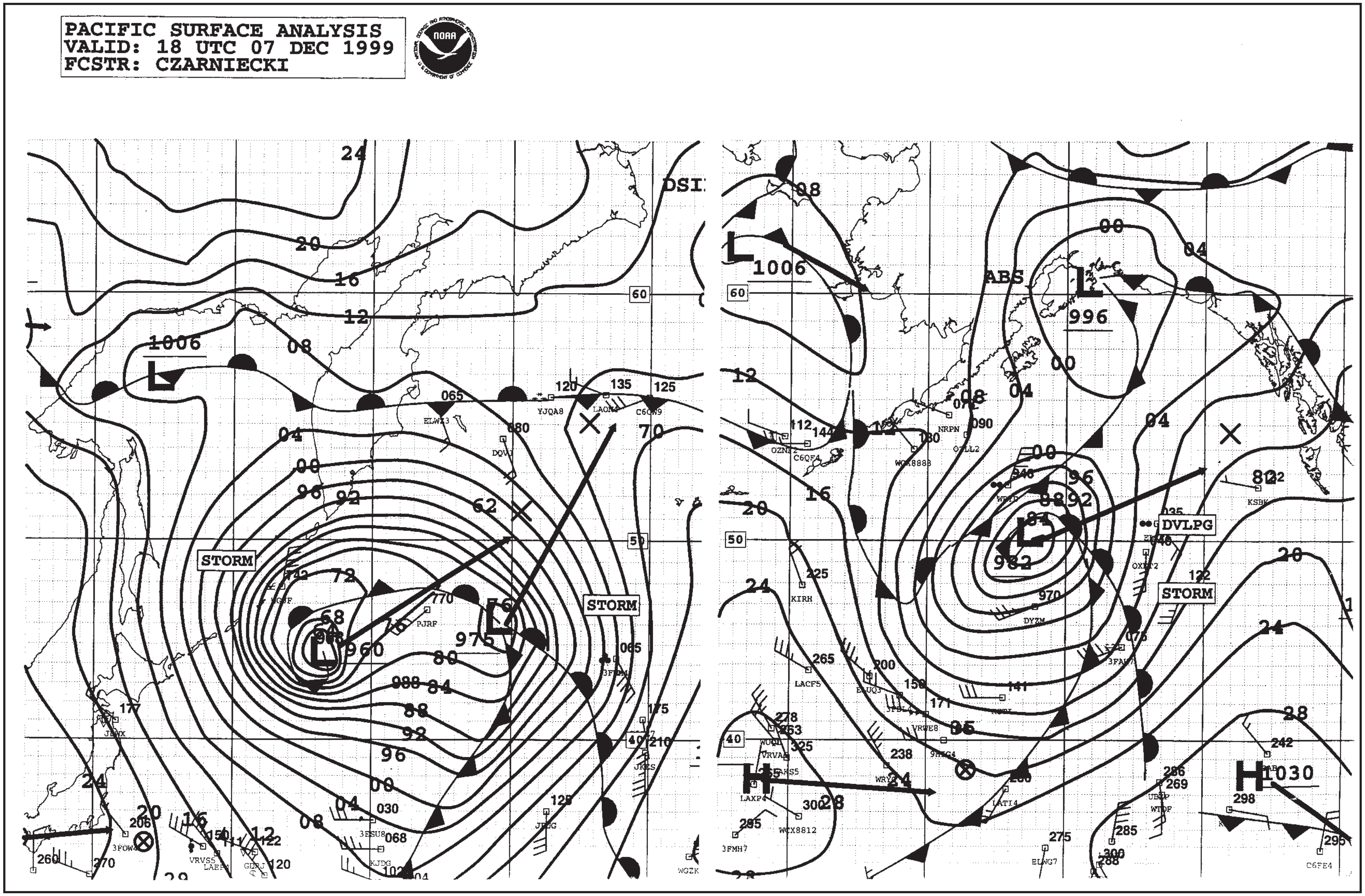

Figure 9. MPC Pacific Surface Analysis valid 18 UTC 7 December 1999.

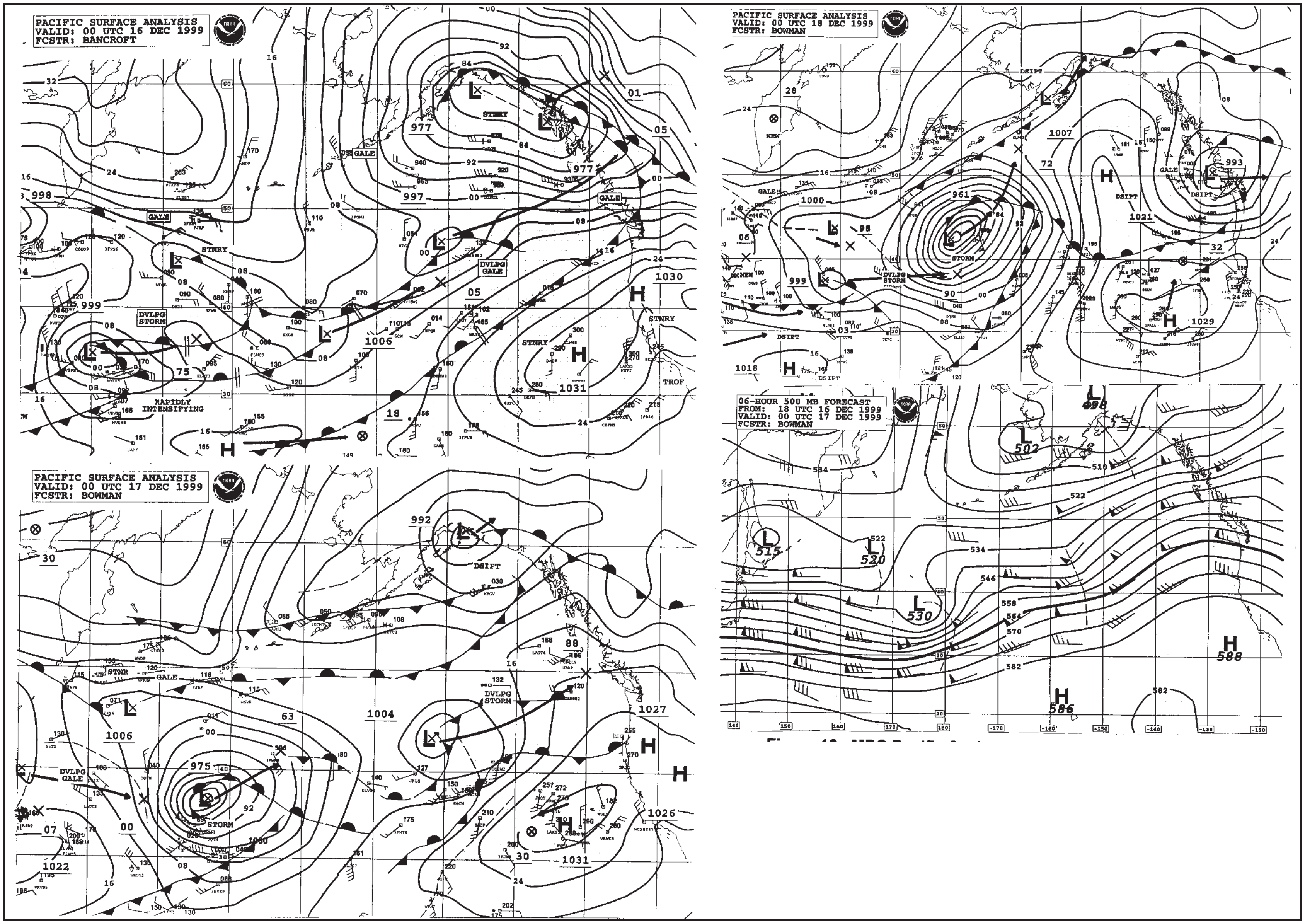

Figure 10. MPC Pacific Surface Analysis charts valid 00 UTC December 16, 17, and 18, 1999; 500-Mb analysis (6 hour computer model forecast) valid 00 UTC 17 December 1999. Valid time of 500-Mb chart is same as that of second surface analysis.

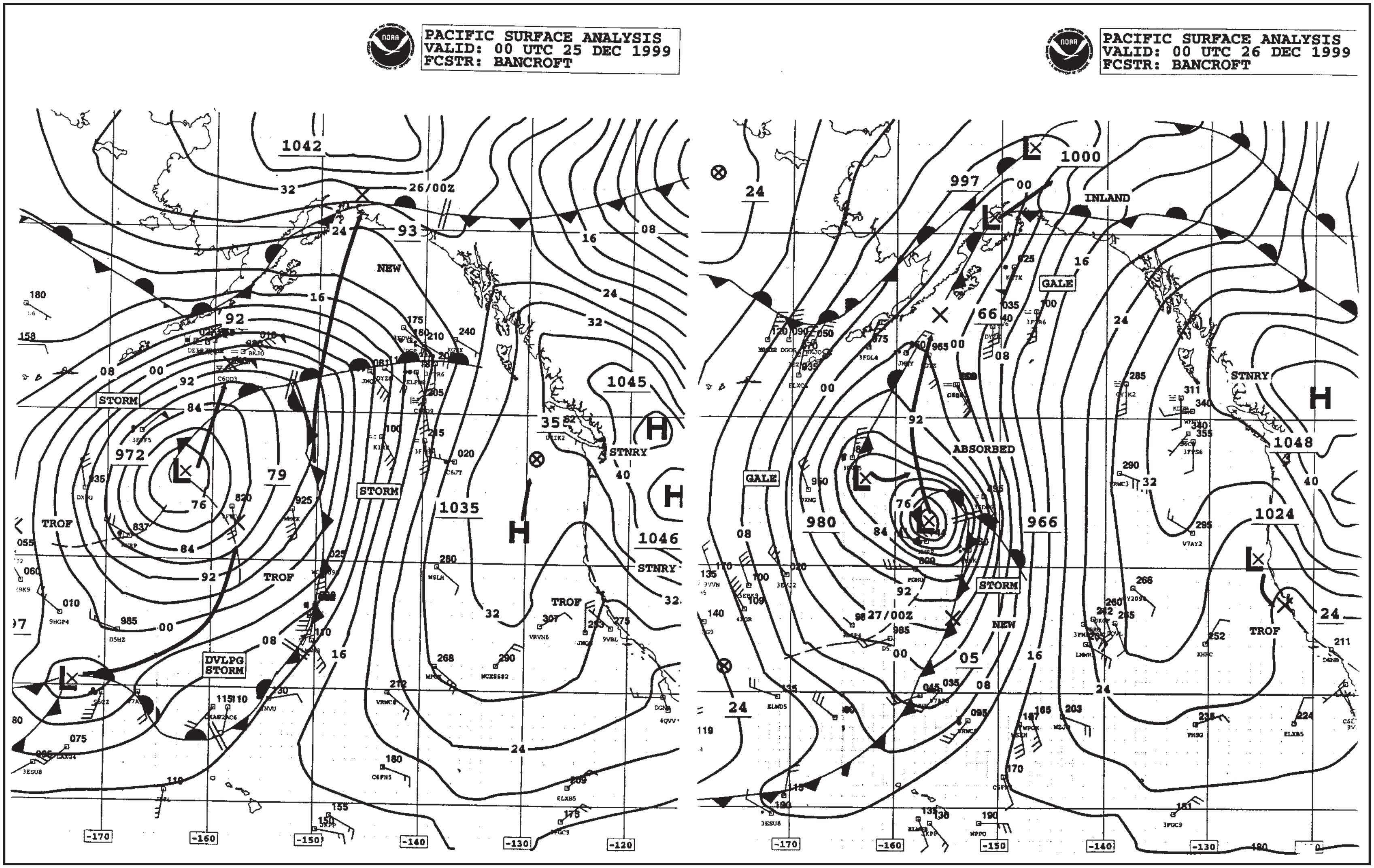

Figure 11. MPC Pacific Surface Analysis charts valid 00 UTC December 25 and 26, 1999.

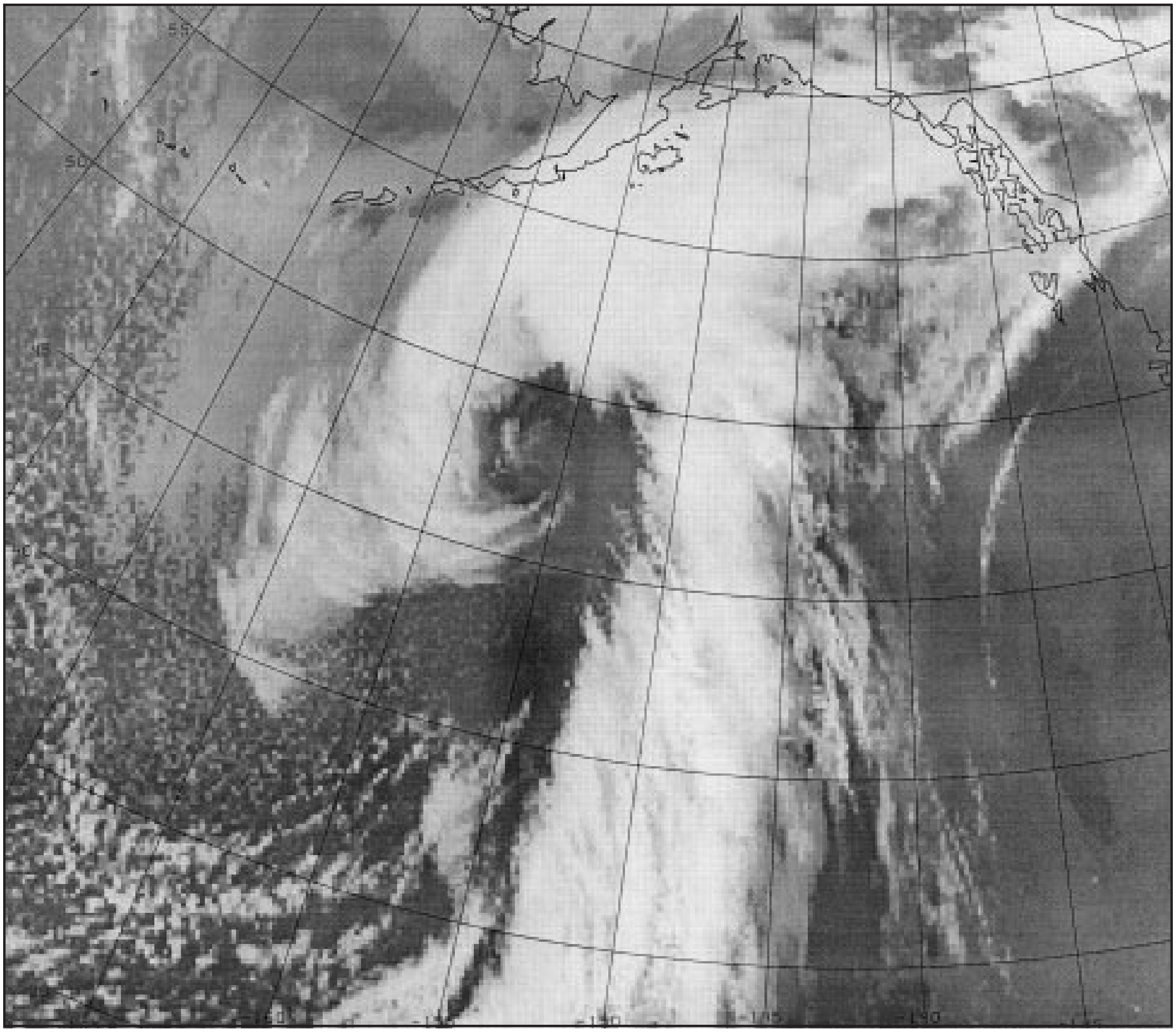

Figure 12. GOES10 infrared satellite image of storm in Figure 11, valid 06 UTC 26 December 1999, or six hours later than valid time of second surface analysis of Figure 11.

North Pacific Area

Continued from Page 42

wind of 55 kts at 54N 174W. From 0000 UTC to 0600 UTC 18 November, there were several ships south of the central Aleutians reporting winds of 40 to 45 kts and seas up to 11 meters (35 feet). In the Bering Sea the **Niitaka Maru** (**JBGY**) had west winds 45 to 50 kts and seas to 11 meters (35 feet) near 55N 168W on 19 November. The storm moved to the Gulf of Alaska and weakened on 19 November, but storm force winds persisted until 20 November south of the center.

Also as indicated in Figure 6, this energetic upper air pattern supported a second storm south of the Gulf of Alaska. This system originated south of 30N near 170E and reached a maximum intensity of 965 mb at 0000 UTC 17 November. Although smaller and less intense then the system to the west, it had a strong pressure gradient around the south and west sides. Maximum winds were at least 55 kts as reported from the **Chesapeake Bay** (**DIOB**) northwest of the center at 0000 UTC 17 November. The **President Adams** (**WRYW**) reported a southwest wind of 45 kts and seas

Continued on Page 53

North Pacific Area

Continued from Page 52

of 14 meters (44 feet) near 43N 143W at 0000 UTC 18 November, the highest seas reported in this storm. This system weakened as it moved east, but still produced south winds up to 55 kts near the British Columbia coast at 0600 UTC 19 November. The infrared composite satellite image (Figure 7) shows this storm and the Bering Sea storm near maximum intensity.

Another storm developed on 23 November, and Figure 8 shows the final 24 hours of development to maximum intensity (962 mb). A "bomb", it's central pressure dropped 25 mb (0.74 in.) in the 24 hour period ending at 0000 UTC 24 November. The **Sealand Kodiak** (**KGTZ**) is shown in Figure 8 south of the center with a 75 kt southwest wind at 0000 UTC 24 November. The **Star Harmonia** (**LAGB5**) reported a west wind 55 kts at 53N 144W 1800 UTC 23 November.

In early December two more strong systems formed northeast of Japan and moved toward the western Aleutians and southern Bering Sea before turning east and weakening. One of these formed a compact 960 mb center near the Kurile Islands at 1800 UTC 07. Ship data was scarce, but at 0000 UTC 08 December **Tower Bridge** (**ELJL3**) reported northeast winds of 61 kts at 50N 157E and seas of 8.5 meters (28 feet). Twelve hours later, the ship **C6QF** (name not available) reported a southeast wind of 55 kts near 54N 175W. The **Pacific Sandpiper** (**GDRJ**) reported the highest seas, 12 meters (38 feet) near 34N 151E at 0000 UTC 08 December, and northwest wind of 50 kts.

A blocking high developed by mid-December over the Bering Sea, forcing the main storm track south to the latitude of Japan. During the third week of December strong high pressure at the surface and aloft formed near the West Coast, deflecting low pressure systems coming from the west northward into the Gulf of Alaska. The most significant of these developed as shown in Figure 10, east of Japan, over a two-day period ending at 0000 UTC 18 December, as the system reached maximum intensity. It developed hurricane force winds southwest of the center. The **Nedlloyd Yantian** (**ELUC3**) encountered a west wind 65 kts near 34N 175E. Six hours later the same ship reported a northwest wind of 85 kts. Satellite sensed winds confirmed these wind speeds. The ship **DQVM** (name not available) reported a west wind 60 kts and seas of 12 meters (39 feet) at 33N 180E. The 500 mb chart in Figure 10 valid for 0000 UTC 17 December shows the strong short wave trough and jet supporting this storm development, and the blocking high mentioned earlier. The upper ridge shown near 130W strengthened after the gale center near Vancouver Island (third surface chart) moved inland.

This storm and others that followed late in the month were forced north by the building high pressure to the east. Figure 11 shows one of these storms at 972 mb heading north toward western Alaska where it weakened. Several ships reported winds of 45 to 55 kts in the southwest Gulf of Alaska. The **Jinsei Maru** (**JNNB)** reported from near 54N 160E with a northeast wind of 55 kts at 1800 UTC 24 December. Seas were reported up to 8 meters (27 feet).

The final significant storm of this period was a smaller but more potent low that formed near 30N 173W (Figure 11). The second surface analysis in Figure 11 shows the storm near maximum intensity absorbing the old system to the northwest. This system had deepened an impressive 14 mb (0.41 in.) in the preceding 6 hours. At 0000 UTC 26 December, the **Sealand Liberator** (**KHRP**) reported a west wind 60 kts at 42N 157W after passage of the center, and seas of 8 Meters (26 feet). To the east the **Stellar Image (3FDO6)** at 45N 151W reported a south wind of 55 kts and seas of 12 meters (39 feet). By 1200 UTC 26 December the center was in the Gulf of Alaska and beginning to weaken, but the **Westwood Marianne** (**C6QD3**) east of the center reported a south wind 45 kts and seas of 12.5 meters (41 feet). Figure 12 is a GOES 10 infrared satellite image of this storm at maximum intensity, with central pressure of 963 mb. Deep frontal clouds wrap around the west and south sides. The strong ridge at the surface and aloft to the east (denoted by the relatively cloud-free dark area) is shown forcing the storm north.⚓

Marine Weather Review
Tropical Atlantic and Tropical East Pacific Areas—September through December 1999

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I. Introduction

The last four months of 1999 were busy for the Tropical Prediction Center (TPC). Above normal hurricane activity occurred in the tropical Atlantic, with below-normal activity in the eastern Pacific. As the hurricane season closed, winter weather systems produced several gale events in the Atlantic and Gulf of Tehuantepec in the Pacific.

II. Gulf of Tehuantepec Wind Events

Strong northerly wind events or surges are regular occurrences in the Gulf of Tehuantepec during the late fall and winter months. The winds pose a significant hazard to mariners, especially those in smaller fishing vessels in and near the Gulf. Over the last few years, improved remote sensing technologies, such as scatterometer and Special Sensor Microwave Imager (SSM/I) data, have made it easier for forecasters to monitor the development and progress of Tehuantepec events.

The Gulf of Tehuantepec is a unique geographical area located just south of the Isthmus of Tehuantepec. The Isthmus is a narrow land area, about 120 nm wide, between the Gulf of Mexico and the tropical Pacific Ocean. The unique feature is the Chivela Pass, a 20 nm wide gap in the 2000-3000 meter high Sierra Madre range. The pass, which is 250 meters above sea level, allows strong northerly winds to be funneled from the Gulf of Mexico into the tropical Eastern Pacific.

Gulf of Tehuantepec wind events develop when strong high pressure builds over the eastern and central United States and the Gulf of Mexico. As pressures build over the western Gulf of Mexico, a strong pressure gradient develops along the northeast side of the Sierra Madres. The result is cold dense air funneling into the Gulf of Tehuantepec (Stumpf, 1975) through the Chivela Pass. As the northerly wind surge moves through the Gulf of Tehuantepec, the wind direction changes to northeast or sometimes east, and the surge can extend several hundred nautical miles downwind. The events can last several days, and several events reach gale force each season. Stronger Tehuantepec events can produce winds as high as 50 to 60 kts. Sea heights in the Gulf of Tehuantepec are somewhat limited due to the small fetch, but sea heights can build significantly well offshore in the pacific ocean.

From a marine forecaster's point of view, Tehuantepec events are

Continued on Page 55

Tropical Prediction Center

Continued from Page 54

usually easily forecast, but there are occasional difficulties. Global forecast models generally do well in predicting the start of an event, but they do not always get the intensity right. Experience with previous events can be very helpful in forecasting the strength of similar events when the numerical models get it wrong. There is a lack of marine surface data in the area. Ship observations in or near the Gulf are sporadic, although they are a great asset when available. Fortunately, satellite scatterometer (ERS-2 and QuikScat) and SSM/I data have become available in near real time and are great diagnostic and forecasting tools for Tehuantepec events. Figure 1 shows an example of a QuikScat overpass of a Tehuantepec event at 1220 UTC 8 February 2000. The data indicate an area of 30 to 40 kt northerly winds over the Gulf. At approximately the same time, the **Koeln Express** reported northerly winds of 38 kts and 40 kts at 1200 and 1500 UTC respectively (providing ground truth verification of the satellite data).

Since the waters are rather shallow in the Gulf of Tehuantepec, the strong winds produce upwelling and entrainment of subsurface water into the surface layer (Steenburgh et al. 1998). This can significantly cool the sea surface temperature in and downwind of the Gulf. Observations indicate sea surface temperatures (SSTs) can cool by as much as 8C in only a few hours (Steenburgh et al., 1998). During an event in November 1999, the **Bonn Express** reported hourly SST observations during a northwest-to-southeast traverse across the Gulf. At 1000 UTC 6 November, the ship reported a 30C SST along the Mexican coast just west of the Gulf. Six hours later, the ship was in the core of the strong winds reporting northerly winds of 36 kts and a 22C SST. By 0100 UTC November 7, the ship had exited the Gulf and reported northwest winds of only 5 kts and the SST back to 30C. This example not only highlights the changes in SST, but also how hourly ship observations in such situations are critical to the marine forecaster.

During the 8-9 February 2000 event mentioned above, the **Koeln Express** provided three-hourly observations during its southeast-to-northwest traverse of the Gulf. At 0600 UTC 8 February, the ship reported an SST of 28C and northwest winds of 10 kts. Six hours later, the ship reported northerly winds of 38 kts and an SST of 20C. By 2100 UTC the ship was west of the Gulf with the SST at 25C and the winds at 10 kts. Just after this event, infrared satellite imagery clearly detected the large area of upwelling and cooling which had occurred. A seven-day composite SST chart (Figure 2) ending 10 February indicates SSTs on either side of the Gulf of about 28C with 21-22C SSTs in the middle of the Gulf. The upwelling and cooling causes locally higher concentrations of phytoplankton which results in increased fishing productivity (Steenburgh et al, 1998; Stumpf, 1975). Another effect of the upwelling is the formation of stratus and sea fog over the area of cool SSTs. These have been observed in the days following an event as warmer and humid air moves north over the cool sea surface. While satellite imagery indicates the fog can be quite dense, the areal coverage is usually small.

In summary, Gulf of Tehuantepec wind surges are interesting events which are enhanced by the local geography. The events can be hazardous to smaller marine vessels during the often-produced gale-force winds. The events not only affect the winds, but also significantly reduce sea surface temperatures in the area. Hopefully, future Gulf of Tehuantepec events will be better understood, monitored, and forecast thanks to timely ship reports and scatterometer/microwave imager technology.

III. Significant Weather of the Period

A. Tropical Cyclones: Hurricane Dennis was ongoing in the Atlantic at the start of the period. Ten other tropical cyclones developed over the Atlantic during the period, including five hurricanes, two tropical storms, and three tropical depressions. Three of the hurricanes (Floyd, Gert, and Lenny) reached Category 4 status (winds of 114 to 135 kts) on the Saffir-Simpson Hurricane Scale (SSHS). Three tropical cyclones

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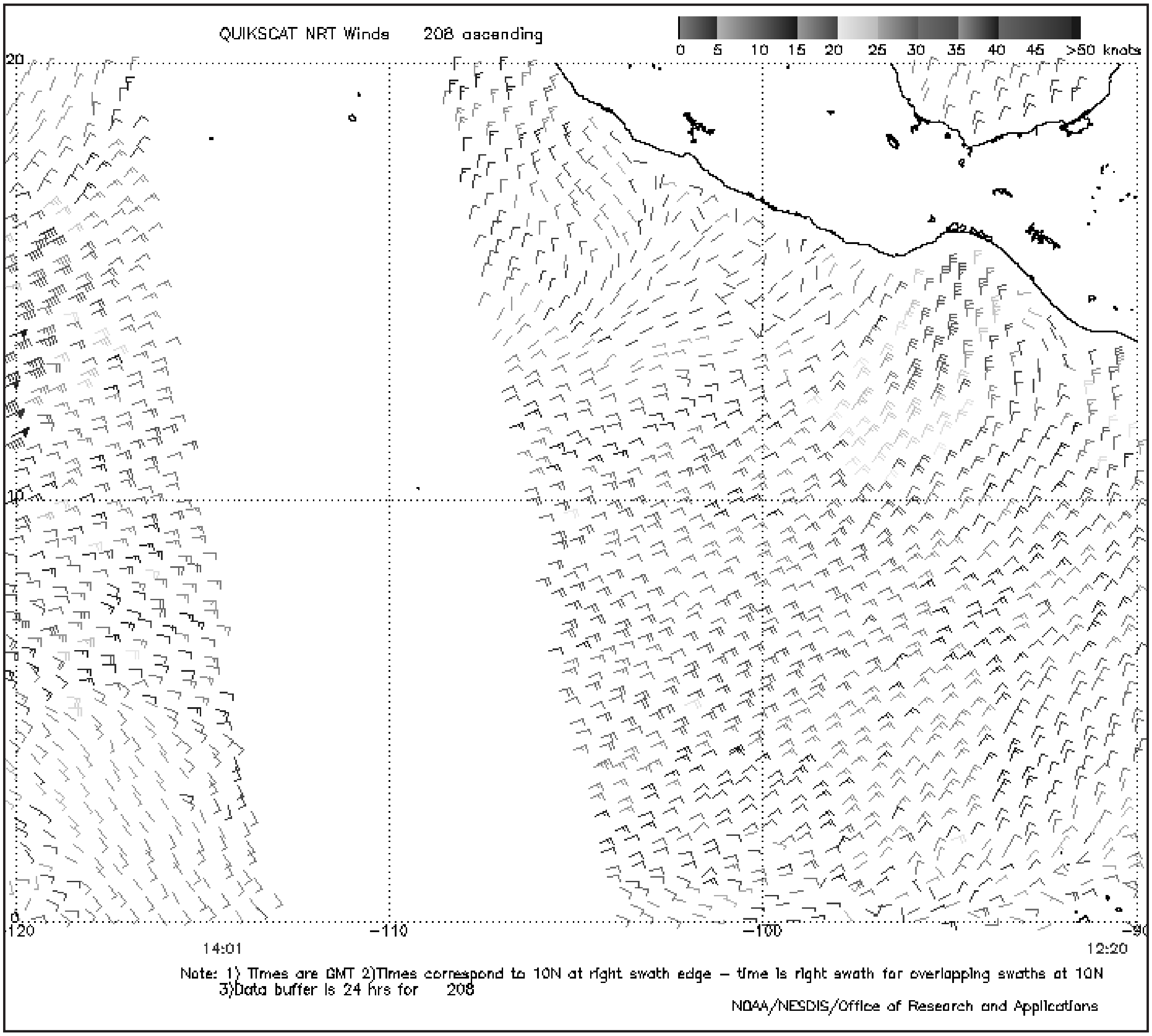

Figure 1. QuikScat scatterometer data for 1220 UTC and 1401 UTC 8 February 2000. Image courtesy of NOAA/ NESDIS/Office of Research and Applications.

Tropical Prediction Center

Continued from Page 55

formed over the eastern Pacific basin, including two hurricanes and one tropical storm.

1. Atlantic

Hurricane Dennis: At the start of the period, Dennis was stalled about 110 nm east of Cape Hatteras, North Carolina (Figure 3). An erratic drift would persist into 2 September. A combination of vertical wind shear and cooler, drier air weakened Dennis to a tropical storm on 1 September. The 45 kt storm began a southward drift late on 2 September, followed by a northwestward turn the next day. This motion continued on 4 September, bringing the center of Dennis to the North Carolina coast just east of Harkers Island at 2100 UTC that day. Some re-intensification occurred as the storm approached the coast and sustained winds at landfall were estimated at 60 kts. Dennis moved west-northwest into central

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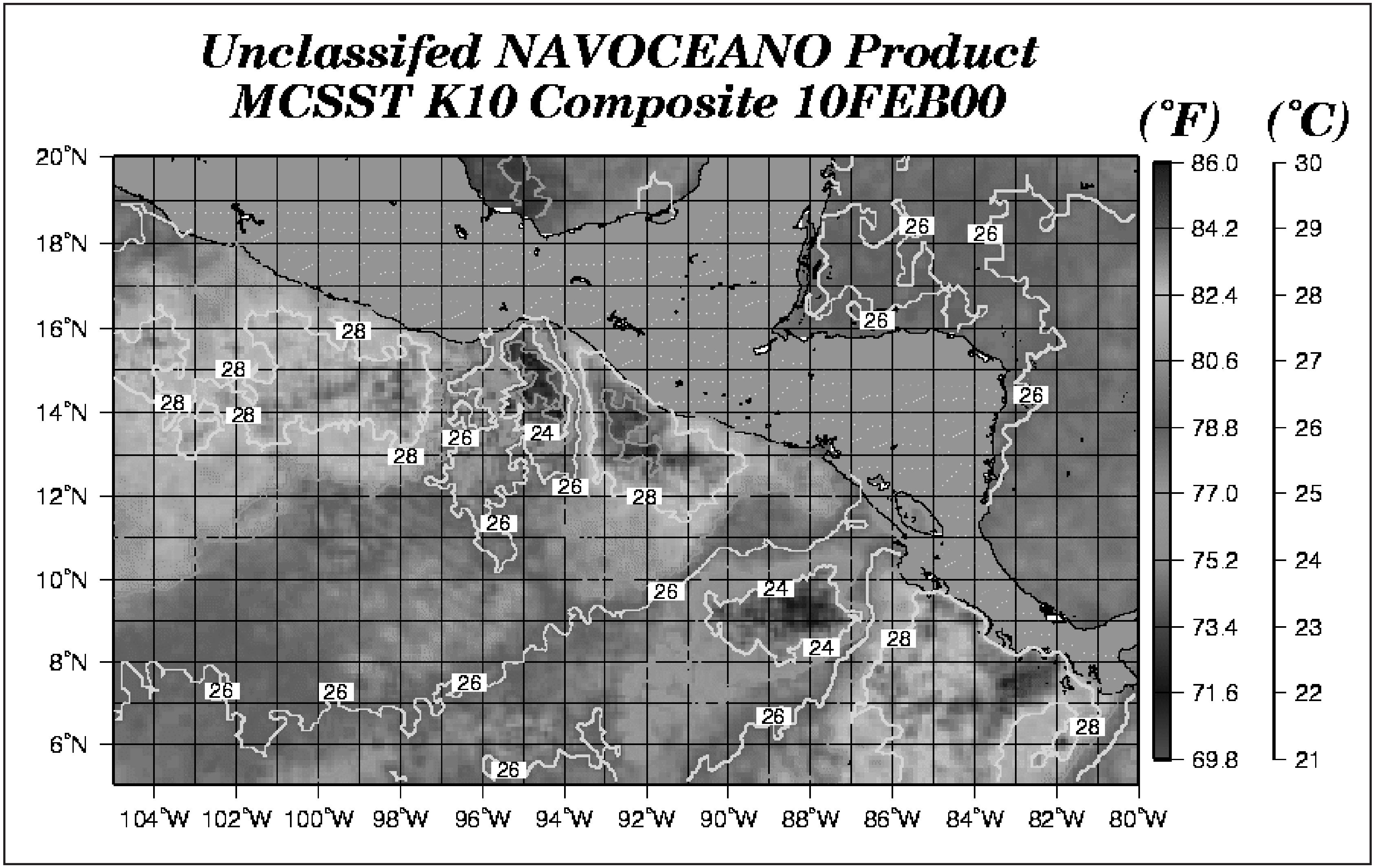


Figure 2. Sea surface temperature analysis for the Gulf of Tehuantepec, 10 February 2000. Isotherms in degrees Celsius. Image courtesy of the U.S. Naval Oceanographic Command.

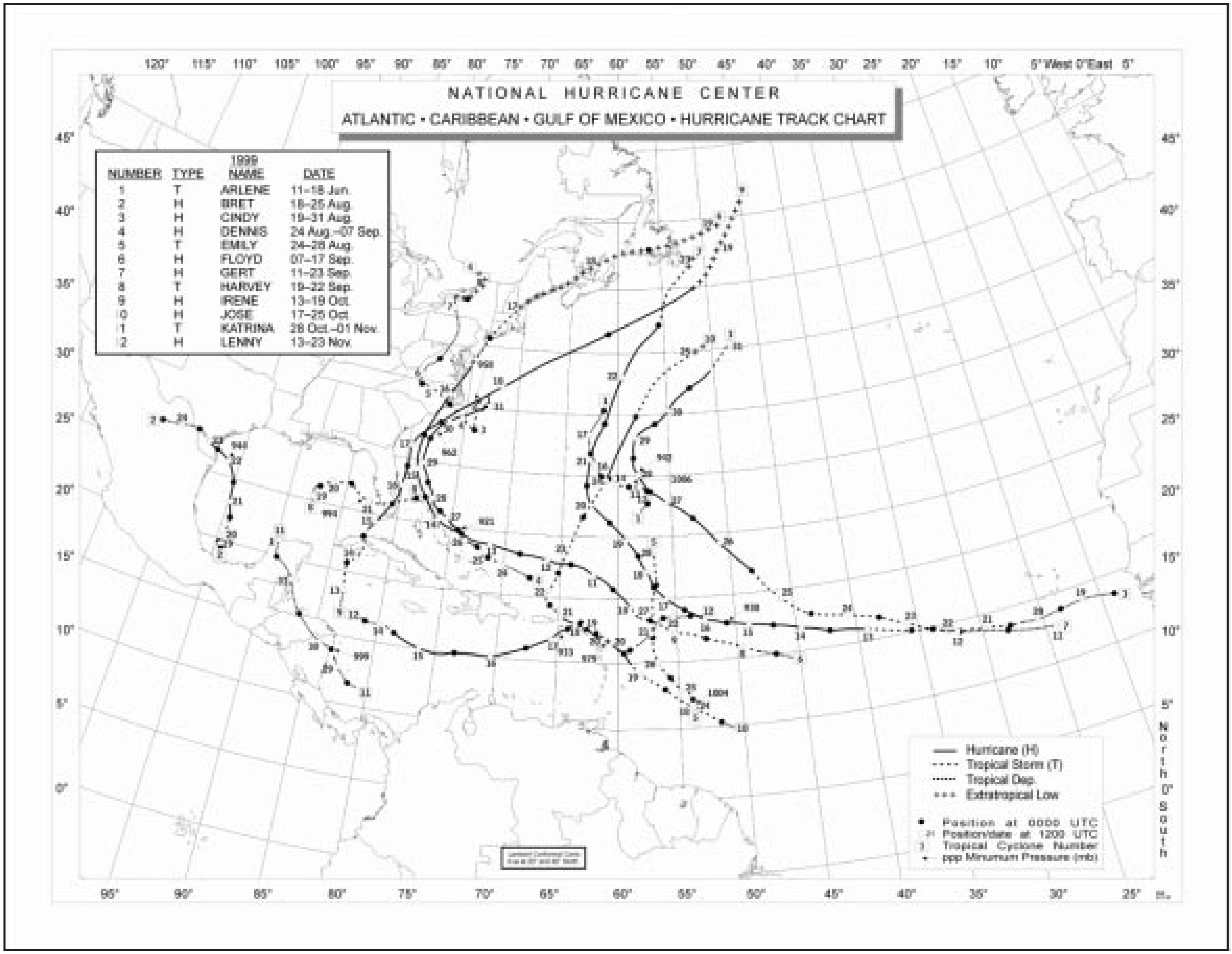


Figure 3. Atlantic hurricane and tropical storm tracks of 1999.

Tropical Prediction Center

Continued from Page 56

North Carolina on 5 September and weakened to a depression. The cyclone then moved erratically northward through the mid-Atlantic states until becoming extratropical over northern New York on 7 September.

The landfall of Dennis caused tropical-storm force winds over portions of eastern North Carolina and coastal southeastern Virginia. Langley Air Force Base, Virginia, reported 45 kt sustained winds with gusts to 66 kts, while Cherry Point Marine Corp Air Station, North Carolina, reported 41 kt sustained winds with gusts to 53 kts.

Dennis continued to affect shipping in this period (ship observations included in Table 1). The **OOCL Friendship** reported 45 kt winds on 2 September, and a 993.6 mb pressure. The **Mette Maersk** also reported 45 kt winds. The **Hoegh Dene** passed close to the center, reporting 40 kt winds and a 987.3 mb pressure.

Four deaths were reported in Florida due to high surf generated by Dennis. The estimated damage in the United States is $157 million.

Tropical Depression Seven: A tropical wave interacting with a monsoon-type wind flow spawned a tropical depression on 5 September about 65 nm east-southeast of Tampico, Mexico. The cyclone moved northwestward and made landfall near La Pesca, Mexico the next day. It dissipated over land on 7 September.

Although satellite and radar data indicate the depression was near tropical storm strength as it made landfall, there are no reports of damage or casualties.

Hurricane Floyd: A large tropical wave moved westward off the coast of Africa on 2 September. It gradually organized and became a tropical depression on 7 September about 850 nm east of the Lesser Antilles (Figure 3). The depression became Tropical Storm Floyd the next day as it moved west-northwestward. Floyd did not reach hurricane strength until 10 September, when it turned northwestward and continued this motion into 11 September. Maximum sustained winds on this day varied between 85 and 95 kts.

Floyd turned westward on 12 September and strengthened rapidly. Maximum sustained winds increased to 135 kts on 13 September (Figure 4) with an aircraft-measured minimum pressure of 921 mb at 1121 UTC. This made Floyd a strong Category 4 hurricane on the Saffir-Simpson Hurricane Scale. Floyd turned west-northwest on 14 September and weakened slightly before passing over Eleuthera and the Abaco island group in the Bahamas. This was followed by a gradual northward turn on 15 September and a north-northeastward motion on 16 September, which brought the center of Floyd to the North Carolina coast at Cape Fear around 0630 UTC that day. Some further weakening occurred before landfall, and Floyd was a Category 2 hurricane when it crossed the coast. It weakened to a tropical storm later on 16 September while near the New Jersey coast, and it became extratropical over New England the next day. Extratropical Floyd crossed the Canadian Maritime and Atlantic provinces before merging with another low on 19 September.

Floyd possessed a large circulation that affected much of the western Atlantic and the United States eastern seaboard. Hurricane-force winds occurred over portions of the Bahamas, as well as portions of eastern North Carolina. The strongest reported winds on land were sustained 83 kts with gusts to 106 kts near Topsail Beach, North Carolina. Additionally, tropical storm-force winds affected the remainder of the U.S. coast from central Florida to New Hampshire, as well as many other islands in the Bahamas.

Many ships encountered the outer portions of Floyd (ship observations included in Table 2). The **Ever Gaining** reported 60 kt winds at 1800 UTC 16 September, while the **Heidelberg Express** reported 50 kt winds and a 993.3 mb pressure at 0000 UTC 17 September. The Coastal Marine Automated Network (C-MAN) station at **Frying Pan Shoals**, North Carolina, reported sustained winds of 86 kts over a 20 minute

Continued on Page 60

Table 1. Selected ship observations of tropical storm force or greater winds associated with Hurricane Dennis, 1 through 7 September 1999.

Ship	Date/Time (UTC)	Lat. (N)	Lon. (W)	Wind dir/speed (deg/kt)	Pressure (mb)
Stonewall Jackson	02/0000	33.5	75.1	300/36	1010.0
Trojan Star	02/0000	36.8	70.7	110/38	1010.1
Shanghai Senator	02/0900	37.6	75.1	040/35	1011.0
V2PE1	02/1200	35.0	72.1	200/43	1005.2
OOCL Friendship	02/1800	34.1	74.7	300/45	999.2
V2PE1	02/1800	35.6	72.9	140/42	1004.5
OOCL Friendship	02/2100	34.1	73.5	200/45	993.6
Chemical Pioneer	03/1500	34.3	76.3	320/40	1004.7
Hoegh Dene	04/1800	34.4	75.6	150/40	987.3
Mette Maersk	04/1800	35.4	74.4	110/45	1002.9

Tropical Prediction Center

Continued from Page 59

period with gusts to 97 kts at 0512 UTC 16 September, and a 958.7 mb pressure at 0600 UTC. Additionally, the eye of Floyd passed over NOAA **buoy 41010** located about 105 nm east-northeast of Cape Canaveral. The buoy reported 72 kt sustained winds with gusts to 91 kts at 0700 UTC 15 September and a 939.6 mb pressure two hours later. The buoy also reported 17 meter (54 ft) seas.

The combination of Floyd and a frontal system produced widespread heavy rains over portions of the mid-Atlantic States and New England. The resultant flooding was responsible for much of the $3-$6 billion estimated damage in the U.S. Fifty-seven deaths were blamed on Floyd, 56 in the U.S. (primarily from inland freshwater flooding) and one in the Bahamas.

Hurricane Gert: A tropical wave that moved off the west coast of Africa on 10 September organized into a tropical depression about 140 nm south of the Cape Verde Islands the next day (Figure 3). The system moved west-northwest on 12 September as it became a tropical storm, and this motion persisted for the next four days. Gert reached hurricane strength on 13 September and an estimated peak intensity of 130 kts on 16 September. Some fluctuations in intensity occurred on 17 September as Gert turned northwest. This motion continued for two days as the hurricane maintained 105 to 115 kt winds. Gert turned north-northwest on 20 September (Figure 5) and north-northeast on 21 September, passing about 115 nm east of Bermuda. The hurricane continued north-northeast and weakened to a tropical storm on 23 September, becoming extratropical later that day just southeast of Newfoundland.

Bermuda reported 65-70 kt sustained winds with gusts to 76 kts on 21 September. Gert, like Floyd, had a large circulation that affected many ships (observations included in Table 3). The **Liberty Wave** reported 60 kt winds at 0900 UTC 22 September, and drifting **buoy 44521** reported a

Continued on Page 63

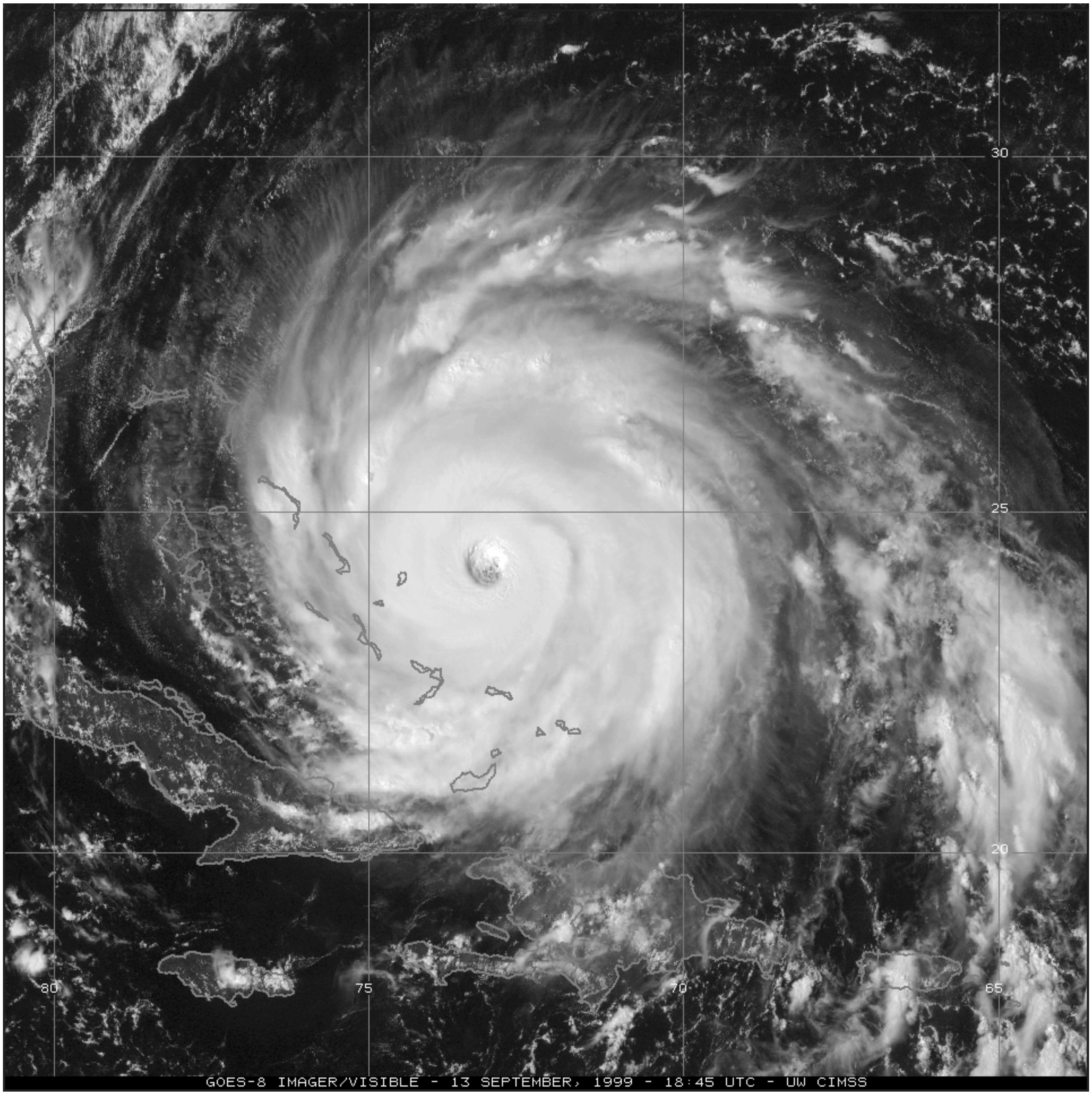


Figure 4. GOES-8 visible image of Hurricane Floyd at 1845 UTC 13 September 1999 just past its peak intensity of 135 kt. Image courtesy of CIMMS University of Wisconsin.

Table 2. Selected ship observations of tropical storm force or greater winds associated with Hurricane Floyd, 7-17 September 1999.

Ship	Date/Time (UTC)	Lat. (N)	Lon. (W)	Wind dir/speed (deg/kt)	Pressure (mb)
Elandsgracht	08/1500	19.0	52.6	070/39	1011.1
Husky Racer	09/1500	16.6	55.4	180/45	1005.5
Northern Progress	12/1800	24.9	63.1	130/58	1009.3
Sea Lynx	13/0000	24.5	69.9	040/45	994.8
Sea Lynx	13/0600	25.6	70.5	040/52	998.5
CCNI Potrerillos	13/1200	24.9	53.1	170/37	1013.9
Sea Lynx	13/1200	27.0	71.0	090/52	1002.9
Sealand Developer	13/1800	19.5	74.7	360/50	994.0
Sealand Crusader	13/1800	21.3	66.9	135/35	1009.5
Copacabana	14/0000	30.6	74.3	070/50	1001.0
El Yunque	14/0900	22.0	73.5	180/35	998.2
Iver Pride	14/1500	26.7	70.6	120/37	1009.2
SHIP	15/0300	30.3	74.3	100/45	1006.5
Hong Kong Express	15/1200	28.9	73.8	130/47	1003.5
Koningsgracht	15/1200	30.6	74.0	120/38	1004.4
Jeb Stuart	16/0000	31.5	75.4	160/46	N/A
Jeb Stuart	16/0600	31.2	75.2	200/41	1001.0
SHIP	16/0600	36.8	73.0	140/36	1006.8
La Seine	16/1200	32.0	72.5	200/36	1007.2
Ever Gaining	16/1800	34.7	72.2	190/60	1005.0
Mayaguez	16/1800	32.1	72.3	210/52	1009.6
SHIP	16/2100	36.6	69.5	180/47	1007.0
Heidelberg Express	17/0000	40.4	70.8	140/50	993.3
SHIP	17/0000	36.6	68.4	190/40	1009.5
Endurance	17/0000	36.0	68.5	190/46	1009.7

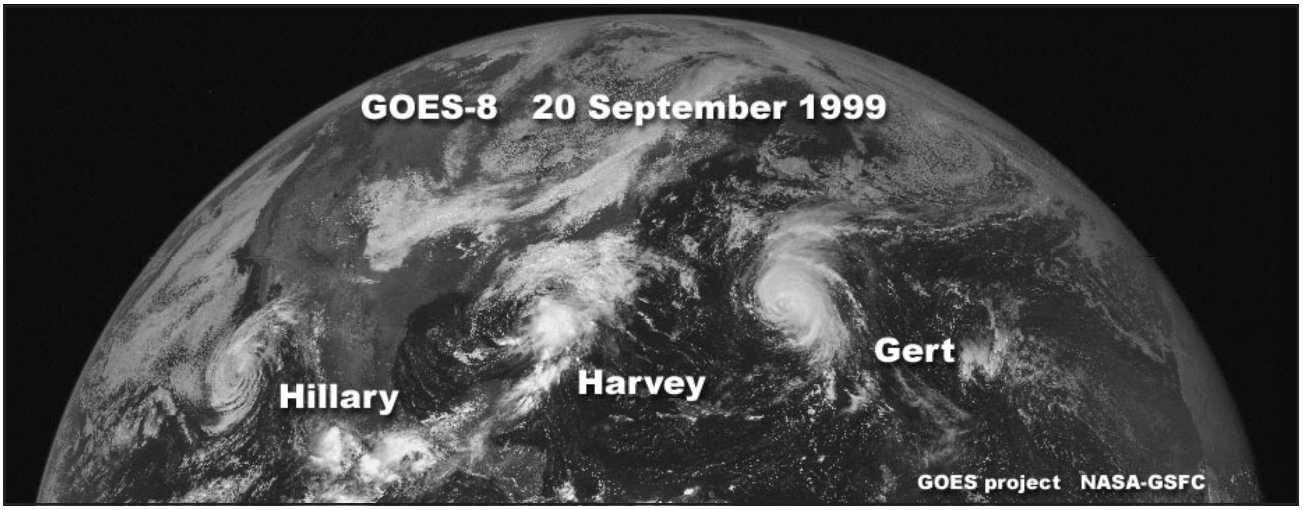


Figure 5. GOES-8 visible image of Hurricanes Gert (right) and Hilary (left) and Tropical Storm Harvey (center) on 20 September 1999. Image courtesy of NASA-Goddard Space Flith Center, data from NOAA GOES.

Tropical Prediction Center

Continued from Page 60

964.6 mb pressure at 0000 UTC 23 September.

Although there are no reports of damage or casualties from the winds and rains of Gert, large swells reportedly generated by the hurricane caused two deaths on the Maine coast.

Tropical Storm Harvey: A tropical wave that moved off the west coast of Africa on 4 September moved into the western Caribbean on 16 September. It gradually organized as it moved northwest and became a tropical depression over the eastern Gulf of Mexico on 19 September (Figure 3). The cyclone turned east-northeastward and reached tropical storm strength on 20 September (Figure 5). Harvey turned east-southeast on 21 September as it reached a peak intensity of 50 kts and a minimum pressure of 994 mb. The storm turned eastward and made landfall later that day near Everglades City, Florida. It then moved east-northeastward and merged with an extratropical cyclone forming off the southeast U.S. coast on 22 September.

Harvey produced tropical-storm force winds over the eastern Gulf of Mexico and southern Florida (ship observations included in Table 4). The **Liberty Sun** reported 47 kt winds at 1800 UTC 20 September and a 1000.5 mb pressure. Additionally, the C-MAN station at Molasses Reef, Florida, reported 47 kt sustained winds with gusts to 59 kts at 1743 UTC 21 September.

There are no reports of casualties from Harvey. The estimated damage in the United States is $15 million.

Tropical Depression Eleven: A tropical wave which moved off the west coast of Africa on 22 September spawned a broad low over the northwest Caribbean Sea on 30 September. Further development was slow as the system moved westward, and the low took until 4 October to become a tropical depression over the Bay of Campeche about 120 nm east-northeast of Veracruz, Mexico. The cyclone meandered erratically through its lifetime, which ended on 6 October when it merged with a trough about 130 nm northeast of Veracruz.

Ship and aircraft observations indicated gale-force winds over the western part of the system on 6 October. These appear to have been associated with a wind surge moving southward over the western Gulf of Mexico.

Although this depression was poorly organized, it contributed to widespread and prolonged heavy rains over the Mexican states of Puebla, Tabasco, and Veracruz. The Mexican government reported

Continued on Page 66

Table 3. Selected ship observations of tropical storm force or greater winds associated with Hurricane Gert, 11-23 September 1999.

Ship	Date/Time (UTC)	Lat. (N)	Lon. (W)	Wind dir/speed (deg/kt)	Pressure (mb)
Polar Chile	17/1800	18.1	53.4	160/46	1009.0
Maracas Bay	17/2100	19.5	52.8	130/40	1010.8
1st Lt. Alex Bonnyman	18/0000	18.1	54.3	150/40	1010.0
Arctic Goose	18/1800	22.5	54.6	170/55	1006.2
Tiber	18/1800	23.1	54.1	120/52	1013.0
UAZV	19/0000	26.0	59.0	050/49	1002.6
UAZV	19/0600	26.2	58.1	080/49	997.3
Drifting Buoy 41521	20/0000	26.2	61.2	350/36	964.6
Cape Vincente	20/1200	27.4	65.3	000/37	1003.2
Ltc. Calvin P. Titus	20/1800	23.0	60.2	220/44	1009.0
Cape Vincente	20/1800	26.1	64.5	330/37	999.4
ARCO Sag River	20/2200	26.3	56.7	180/35	1010.0
ARCO Sag River	21/0000	26.2	57.2	210/35	1010.9
Bess	21/1800	31.2	56.9	170/36	1011.5
Liberty Wave	22/0900	35.3	56.6	180/60	1005.6
Drifting Buoy 41505	22/1100	38.5	59.6	N/A	967.9
3FSN8	22/1200	43.9	60.2	090/40	1009.3
Westerburg	22/1800	43.3	57.4	110/35	1002.5
WASX	22/1800	44.0	59.6	090/37	1003.0
Buoy 44141	22/2100	42.1	56.2	100/52	981.2
Argonaut	22/2200	36.4	56.9	190/35	1007.0
WASX	23/0000	44.0	59.6	040/36	997.0
Mayview Maersk	23/0000	45.0	49.8	130/35	1016.2
Atlantic Concert	23/0000	45.8	52.5	110/37	1010.5
Buoy 44141	23/0000	42.1	56.2	200/23	966.2
Buoy 44139	23/0200	44.3	57.4	070/37	989.9
3FPK7	23/0600	46.4	48.4	140/38	1013.6
C6IF9	23/0600	46.8	48.0	140/37	1014.6
Traviata	23/0600	47.0	50.0	120/37	1010.0
Buoy 44145	23/0600	46.7	48.7	140/42	1017.6
Buoy 44251	23/0800	46.4	53.4	130/37	986.1
Buoy 44138	23/0900	44.3	53.6	260/39	983.3

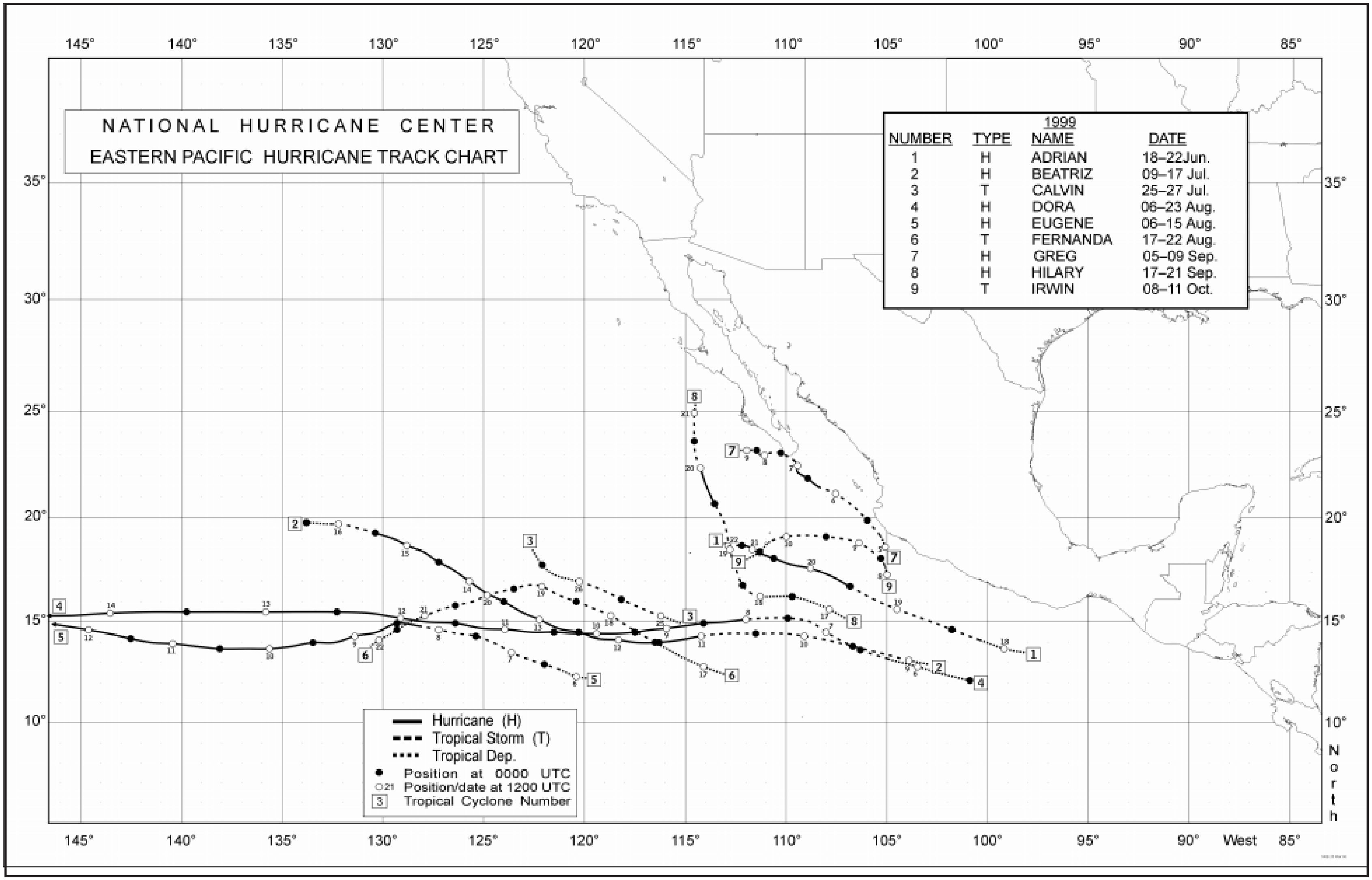


Figure 6. Eastern Pacific hurricane and tropical storm tracks of 1999.

Tropical Prediction Center

Continued from Page 63

that the resulting severe flooding was responsible for 384 deaths.

Tropical Depression Twelve: A tropical wave that moved off the African coast on 30 September organized into a tropical depression on 6 October about 950 nm east of the Lesser Antilles. The cyclone moved generally west-northwest until it dissipated on 8 October about 750 nm east of the Lesser Antilles. There are no reports of damage or casualties.

Hurricane Irene: A broad low pressure area developed over the southwest Caribbean Sea on 8 October. The low slowly developed at it drifted north, and a tropical depression formed just east on Swan Island, Honduras, on 13 October (Figure 3). The depression became Tropical Storm Irene later that day. Irene started an erratic north-northeast motion on 14 October that would continue for two days. Irene crossed Cuba as a tropical storm later that day, then reached hurricane intensity while crossing the Florida Straits. The center passed over the lower Florida Keys and south Florida on 15 October as a Category 1 hurricane on the Saffir-Simpson Hurricane Scale. The hurricane moved into the Atlantic and turned northward on 16 October, followed by a northeastward turn the next day. Irene accelerated northeastward on 18 October passing 40-60 nm offshore of the North Carolina Outer Banks. At this time, the hurricane reached its maximum strength with 95 kt winds and an aircraft-measured minimum pressure of 958 mb. Irene continued rapidly northeast and became extratropical about 130 nm south-southeast of Cape Race, Newfoundland, on 19 October.

Irene produced hurricane-force winds over portions of the lower Florida Keys, and tropical-storm force winds elsewhere over the Keys, southern Florida, and western Cuba. Havana, Cuba, reported gusts to 68 kts at 2020 UTC 14 October. Big Pine Key (in the Florida keys near key West) reported sustained winds of 69 kts with gusts to 89 kts on 15 October, while Tropical-storm force gusts were also reported along parts of the North Carolina coast.

The C-MAN station at Fowey Rocks, Florida, reported 57 kt

Continued on Page 68

Table 4. Selected ship observations of tropical storm force winds associated with Tropical Storm Harvey, 19-22 September 1999.

Ship	Date/Time (UTC)	Lat. (N)	Lon. (W)	Wind dir/speed (deg/kt)	Pressure (mb)
Liberty Spirit	19/2300	25.6	86.7	180/40	1004.0
PFFV	20/1200	25.3	85.8	230/40	1003.2
Sealand Consumer	20/1500	25.0	84.8	200/40	1004.8
Liberty Sun	20/1800	25.7	85.2	210/47	1003.0
Carnival Cruise Line	20/2200	26.2	83.6	---/40	N/A
ELXB9	21/0000	24.3	83.2	230/35	1007.0
Tropicale	21/0600	25.7	83.6	210/40	N/A
Liberty Sun	21/1800	25.5	79.7	210/45	1000.5

Table 5. Selected ship observations of tropical storm force or greater winds associated with Hurricane Irene, 13-19 October 1999.

Ship	Date/Time (UTC)	Lat. (N)	Lon. (W)	Wind dir/speed (deg/kt)	Pressure (mb)
U.S. Navy Minesweeper	15/1300	24.5	80.5	125/50	996.3
Sealand Peformance	15/2100	25.0	80.1	190/35	992.5
Columbus Canterbury	16/0000	26.3	79.6	080/49	995.0
Columbus Canterbury	16/0300	26.0	79.6	140/65	996.2
Sealand Peformance	16/0300	27.1	79.8	080/50	995.8
Maersk Colorado	16/0600	26.1	77.8	160/42	1001.1
Majesty of the Seas	16/1100	26.0	78.1	180/39	1005.0
Sealand Spirit	16/1200	28.9	79.1	050/68	997.5
SHIP	16/1200	30.7	76.1	110/36	1013.5
Newark Bay	16/1500	26.3	78.5	200/35	1004.0
Overseas New Orleans	17/0000	30.5	77.4	090/54	1003.0
SHIP	17/0000	27.6	76.4	170/38	1006.5
3FFM8	17/1200	28.9	77.2	180/34	1006.0
Zim Jamaica	17/1800	31.0	76.7	150/40	1004.0
SHIP	18/0000	29.8	79.6	260/34	1005.0
Galaxy Ace	18/0600	33.8	72.3	170/47	1001.5
Star Skarven	18/0600	34.7	73.4	180/49	995.3
City of Alberni	18/0600	34.1	73.2	170/56	994.0
SHIP	18/0600	30.7	79.5	270/35	1006.0

Tropical Prediction Center

Continued from Page 66

sustained winds with gusts to 73 kts at 2200 UTC 15 October. Irene also affected many ships (observations included in Table 5). The **Sealand Performance** reported a 992.5 mb pressure from the Florida Straits at 2100 UTC 15 October. The **Columbus Canterbury** reported 65 kt winds in the Florida Straits at 0300 UTC 16 October.

No deaths are directly attributed to Irene, although eight deaths in Florida were indirectly related to the storm (five people were electrocuted from downed wires, and three people drowned in their cars when swept by floodwaters into drainage canals). Damage estimates in the U.S. are $800 million. No damage estimates are available from Cuba.

Hurricane Jose: A tropical wave which moved off the west coast of Africa on 8 October organized into a tropical depression on 17 October about 600 nm east of the southern Windward Islands (Figure 3). Moving west-northwestward, the cyclone became Tropical Storm Jose the following day. Jose turned northwestward and reached hurricane intensity the following day, then it again moved west-northwestward on 20 October as it reached a peak intensity of 85 kts. This motion brought the center near or over Antigua, St. Martin, and St. Barthelemy on 20-21 October. The cyclone turned northwest and weakened to a tropical storm on 21 October, recurving to the northnortheast the next day. A gradual acceleration and intensification occurred on 23 October, and Jose regained hurricane status on 24 October. This was short-lived, as Jose weakened to a tropical storm before becoming extratropical about 400 nm south of Cape Race on 25 October.

Jose brought hurricane-force winds to Antigua and St. Martin, and tropical storm force winds to most of the other Leeward and Virgin Islands. Antigua reported 70 kt sustained winds with gusts to 89 kts at 1523 UTC 20 October, and a minimum pressure of 982.0 mb at 1600 UTC. Ships generally avoided Jose, as the only significant observation was a 44 kt wind and 1005 mb pressure from the **9HII6** (name unknown) at 1200 UTC 24 October.

Two deaths are blamed on Jose, one in Antigua and one in St. Maarten. Damage is reported to be minor to minimal with no monetary figures available.

Tropical Storm Katrina: A broad area of low pressure formed over the western Caribbean Sea on 22 October. The system slowly organized and became a tropical depression on 28 October about 150 nm east of Bluefields, Nicaragua (Figure 3). The cyclone moved northwest and became a 35 kt tropical storm just before making landfall near Puerto Cabezas, Nicaragua, early on 30 October. Katrina continued northwest across Honduras and the Gulf of Honduras as a tropical depression, then dissipated over the Yucatan Peninsula on 1 November.

There are no reports of damage, casualties, or tropical-storm force winds associated with Katrina.

Hurricane Lenny: Yet another broad area of low pressure formed over the southwest Caribbean on 8 November. As with its predecessors, development was slow and the low did not become a tropical depression until 13 November (Figure 3). The depression became Tropical Storm and then Hurricane Lenny the next day while moving eastward. A general, and very unusual, eastward motion continued into 16 November as maximum sustained winds varied between 70-85 kts. An east-northeastward turn and steady intensification occurred late on 16 November, and Lenny reached a peak intensity of 135 kts while passing just southeast of St. Croix the next day. The aircraft-measured minimum pressure was 933 mb. The forward motion slowed to a drift near St. Maarten on 18 November, followed by a southeastward motion the next day as the cyclone weakened to a tropical storm. Lenny turned northeastward on 20 November, followed by an eastward turn the next day as it weakened to a depression. The eastward motion continued until Lenny dissipated on 23 November about 600 nm east of the Leeward Islands.

Lenny affected many ships (selected observations included in

Continued on Page 69

Tropical Prediction Center

Continued from Page 68

Table 6). The most significant ship report was from the **V7BV7** (name unknown), which reported 50 kt winds and a 996.6 mb pressure at 0000 UTC 17 November. Lenny also brought hurricane-force winds to portions of the Virgin and Leeward Islands, and tropical-force winds to other northeastern Caribbean islands. St. Maarten reported a minimum pressure of 972.1 mb at 1730 UTC 18 November, and 73 kt sustained winds with gusts to 90 kts at 0200 UTC 19 November.

Seventeen deaths were associated with Lenny, including 3 in Dutch St. Maarten, 2 in Colombia, 5 in Guadeloupe, 1 in Martinique, and 6 offshore. Two of the offshore deaths occurred when the sailing yacht **VIDAR** was lost in the southern Caribbean. Damage in the U.S. Virgin Islands and Puerto Rico is estimated at $330 million. While considerable damage occurred on other islands affected by Lenny, no monetary damage figures are available.

The size, intensity, and unpredictable (unclimatological) motion of Lenny caused unusual problems for mariners in the central and eastern Caribbean. Many towns and harbors in the Lesser Antilles are built on the west sides of islands to protect them from strong easterly winds and waves. Lenny created strong westerly winds and waves throughout the region which affected the towns and harbors, contributing to the deaths and damage mentioned above.

2. Eastern Pacific

Hurricane Greg: Part of the tropical wave that spawned Atlantic Tropical Storm Emily moved into the eastern Pacific on 31 August. This system developed into a tropical depression just offshore from Manzanillo, Mexico on 5 September, becoming Tropical Storm Greg later that day (Figure 6). The cyclone tracked northwestward and reached minimal hurricane strength the next day. At that time, Mexican coastal radar data indicated that Greg had an eye. Strong vertical wind shear weakened Greg to a tropical storm before it made landfall over Cabo San Lucas, Mexico, on 7 September. It then tracked west-northwestward and dissipated about 150 nm west-northwest of Cabo San Lucas on 9 September.

Greg produced heavy rains over portions of western and northwestern Mexico, with nearly 9 inches in Manzanillo, 8 inches in Colima, and 5 inches in the Islas Marias. Reports from the Mexican government indicate the associated flooding caused two deaths. San Jose Del Cabo, Mexico, reported 35 kt sustained winds with gusts to 40 kts and a 995 mb pressure at 2100 UTC 7 September. The ship **Hume Highway** reported 42 kt winds and a 1006.5 mb pressure at 1800 UTC 5 September, which was the basis for upgrading Greg to a tropical storm.

Hurricane Hilary: Hilary formed from a tropical wave that left the African coast on 29 August and moved into the eastern Pacific on 11-12 September. The wave organized into a tropical depression about 280 nm south-southwest of Manzillo, Mexico, on 17 September (Figure 6). It became a tropical storm the next day while moving west-northwestward. Hilary turned north-northwestward on 19 September and became a 65 kt hurricane the next day (Figure 5). The cyclone eventually dissipated about 130 nm west of central Baja California on 22 September.

Few ships encountered Hilary, and the only significant surface observation from Hilary was from the **Salus**. It reported 37 kt winds about 120 nm from the center at 0000 UTC 1320 September.

Tropical Storm Irwin: The tropical wave which spawned Tropical Depression Eleven in the Bay of Campeche produced disturbed weather near Acapulco, Mexico, on 5 October. This system slowly organized and formed into a tropical depression on 8 October about 125 nm south-southwest of Manzanillo, Mexico (Figure 6). The cyclone moved northwestward and became a tropical storm later that day. Irwin turned west-northwestward the following day as it reached an estimated peak intensity of 50 kts. The cyclone passed near Socorro Island on 10 October as a weakening depression, and it dissipated the following day about 350 nm

Continued on Page 70

Tropical Prediction Center

Continued from Page 69

southwest of the southern tip of Baja California.

The **Lincoln Spirit** reported 45 kt winds at 1800 UTC 9 October, which is the only known observation of tropical storm force winds. There are no reports of damage or casualties.

B. Other Significant Events:

1. Atlantic, Caribbean, and Gulf of Mexico

Southwest Gulf of Mexico Gale of 20-22 October: A cold front moved southeastward into the northwest Gulf of Mexico on 19 October. The front became stationary on 20 October from the Florida big bend (Apalachee Bay) across the central Gulf to the Bay of Campeche. High pressure built over Texas and the Gulf of Mexico northwest of the front. The strongest pressure gradient was over the southwest Gulf of Mexico just west of the cold front. At 1200 UTC 20 October, a gale warning was issued for the southwest Gulf. At 0000 UTC 21 October, the **President Arthur** reported 48 kt winds in the extreme southwest Bay of Campeche. This was confirmed by an ERS satellite scatterometer pass from 1646 UTC 20 October, which showed 40-45 kt winds in the area. Gale conditions continued until 0000 UTC 22 October, when the high pressure over Texas weakened and the stationary front began to dissipate.

Eastern Atlantic Gale of 17-19 November: On 15 November, a 1006 mb low developed near 20N 51W at the tail end of a central Atlantic cold front and trough. The low moved east-northeastward at 15 kts for the next two days. By 1200 UTC 17 November the low was a 1010 mb gale near 22N 41W. Although the central pressure of the newly developed gale center had actually risen, strong high pressure over the northeast Atlantic helped create a tight pressure gradient over the northeast quadrant of the gale center. As the low drifted northward over the next two days, several ships reported 30-35 kt winds. The **Jarikaba**, reported 34 kt winds at 0000 UTC 18 November. The **Foylebank** observed 6 meter (19 ft) combined seas including a 5 meter (16 ft) southeast swell at 1800 UTC 18 November. The gale weakened by 0600 UTC 19 November, but moderate to strong southeast winds continued across the area for the next two days.

Western Atlantic Gale of 19-21 November: During 19-21 November, a large area of 20-30 kt northeast winds covered much of the western Atlantic in response to the pressure gradient between weakening Tropical Storm Lenny over the extreme northeastern Caribbean and strong high pressure over the northern Atlantic. Late on 19 November, a small gale area developed from 25N to 30N between 63W and 67W. At 0000 UTC 20 November, the **Polar Ecuador** reported northeast winds of 33 kts within the gale area. Twelve hours later, the area of gale force winds expanded and shifted slightly eastward and was located north of 25N between 60W and 68W. Gale conditions ended at 0600 UTC 21 November as Lenny continued to weaken and the pressure gradient relaxed. However, moderate to strong northeast to east winds continued over the western Atlantic for several days.

Eastern Atlantic Gale of 25 November - 2 December: A large and complex low pressure system, elongated northeast-southwest and with multiple centers, formed in the eastern Atlantic on 23 November. By 1200 UTC 25 November the low pressure system intensified and consolidated into a 998 mb gale center near 30N 43W. The gale center drifted southeastward for the next two days. The **Kansas Trader** traversed the affected area and provided several observations of gale force winds along 31N between 35W and 45W. These included 34 kts at 0600 UTC 26 November and 40 kts at 1200 UTC 28 November. The gale center drifted southward to near 25N 38W on 28 November and began to show some subtropical cyclone characteristics, including thunderstorms near the center and in a band over the eastern semicircle. This somewhat organized convection continued for the next few days. However, it never became concentrated enough near the center to call the system a subtropical or tropical storm, and the strongest winds remained well north of the center.

Continued on Page 72

Table 6. Selected ship observations of tropical storm force or greater winds associated with Hurricane Lenny, 13-23 November 1999.

Ship	Date/Time (UTC)	Lat. (N)	Lon. (W)	Wind dir/speed (deg/kt)	Pressure (mb)
Eemsgracht	15/0900	14.0	81.8	300/37	1006.5
CGM Saint Exupery	15/1500	13.4	78.8	280/37	1005.0
Crown Princess	15/1500	16.6	74.5	120/39	1001.0
Boree	16/0000	13.9	72.7	220/40	998.2
Schackenborg	16/0000	14.3	71.9	160/37	998.5
Boree	16/0300	13.9	73.0	230/44	999.8
Schackenborg	16/0600	13.5	72.1	270/45	999.0
Iver Explorer	16/1200	12.6	71.4	250/39	1005.6
Duhollow	16/1200	12.7	71.2	250/35	1003.6
V7BV7	17/0000	14.7	67.6	210/50	996.6
Libra Buenos Aires	17/0300	14.6	70.0	290/41	1006.0
Maasdam	18/2100	15.8	62.8	200/41	1005.0
Dawn Princess	20/0000	15.7	62.4	270/38	1002.0
MOBILE	20/1200	15.7	59.1	210/35	1009.5

Tropical Prediction Center

Continued from Page 70

The gale center moved westward and then northwestward on 28-29 November and was centered near 26N 43W at 1200 UTC November 30. The system weakened early on 2 December and merged with a cold front near 30N 50W on 3 December.

Caribbean Gale of 2-4 December: A strong cold front moved off the east coast of the United States and into the western Atlantic on 30 November. The front gradually weakened as it moved into Puerto Rico and the Virgin Islands on 2 December. A strong 1032 mb high over the southeast United States was building over the western Atlantic and Caribbean northwest of the front. The combination of the unusually strong high and lower surface pressures over South America created a strong pressure gradient across the portions of the central and eastern Caribbean. At 1200 UTC 2 December a gale warning was issued for a small section of the north central Caribbean. Within the area near the Mona Passage, **VRWB8** (name unknown) reported a northeast wind of 32 kts and combined seas of 5 meters (16 feet). The high moved eastward into the Atlantic on 3 December and the gale area was expanded to most of the Caribbean from 69W to 80W. The high weakened and gale conditions ended by 1200 UTC 4 December. However, as the weakened high remained over the western Atlantic, moderate to strong northeast to east winds continued across much of the central and eastern Caribbean for the next few days.

Atlantic Gale of 9-12 December: On 6-7 December a weakening stationary front was located across the central Atlantic. By 1200 UTC 8 December a 1012 mb low developed along the front near 26N 51W. The low moved north-northeastward and slowly strengthened over the next 24 hours. By 1800 UTC 9 December the low became a 1000 mb gale center near 30N 50W. Two ships near 30N 40W reported gale force winds at 0000 UTC 10 December. The **Vine** reported 40 kt southeast winds and the **Hornbreeze** observed 34 kt easterly winds. The gale center moved slowly north-eastward and at 1200 UTC 10 December it was near 31N 48W with a 989 mb central pressure. Several ships within a 600 nm radius of the gale reported winds of 25-40 kts. Over the next two days, the gale center moved slowly northeastward, north of 31N, but gale conditions continued in the area until 1800 UTC 12 December. Large swells of 3 to 5 meters (10 to 15 feet) were observed over the Atlantic north of 18N between 40W and 65W. The large swells slowly subsided and decreased to around 2.5 meters (8 feet) on 15 December.

Other events: The broad low that spawned Tropical Depression Eleven produced an area of gale force winds over portions of the central and western Gulf of Mexico (well removed from the center) on 3-4 October. Early on 27 October, a marginal gale center developed northeast of the Bahamas and moved rapidly northeast. The center moved north of 31N toward Bermuda early on 28 October. Between 25-28 November, another low developed and deepened about 300 nm north of Puerto Rico, and briefly became a gale as it drifted north-northwest. The system weakened on 27 November, but re-intensified as it moved north of 31N near Bermuda on 28 November.

2. Eastern Pacific

Six gale events occurred in the Gulf of Tehuantepec during the period. The first event of the 1999 fall season occurred on 20-23 October. The longest event during the period lasted 5 days and occurred from 27 November through 2 December. Other events occurred on 3-4 November, 6-8 November, 6-7 December, and 25-28 December. One cold front produced a brief period of gale force wind near 30N 140W on 11-12 November.

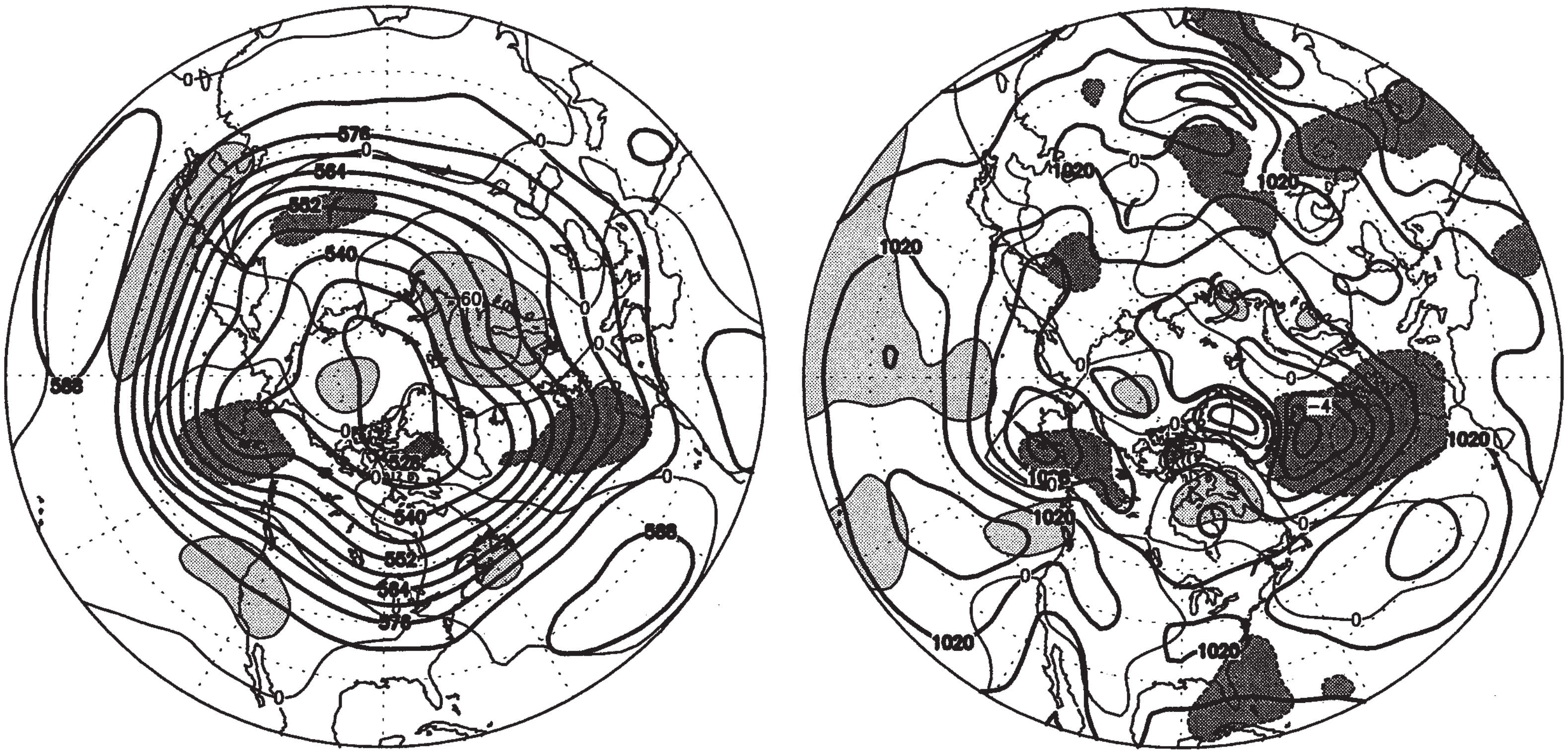
IV. References

Steenburgh, J.W., D.M. Schultz, B.A. Colle, 1998: The Structure and Evolution of Gap Outflow over the Gulf of Tehuantepec, Mexico. *Mon. Wea. Rev*, **126**, 2673-2691.

Stumpf, H.G., 1975: Satellite Detection of Upwelling in the Gulf of Tehuantepec, Mexico. *J. Phys. Ocean.*, **5**, 383-388.⚓

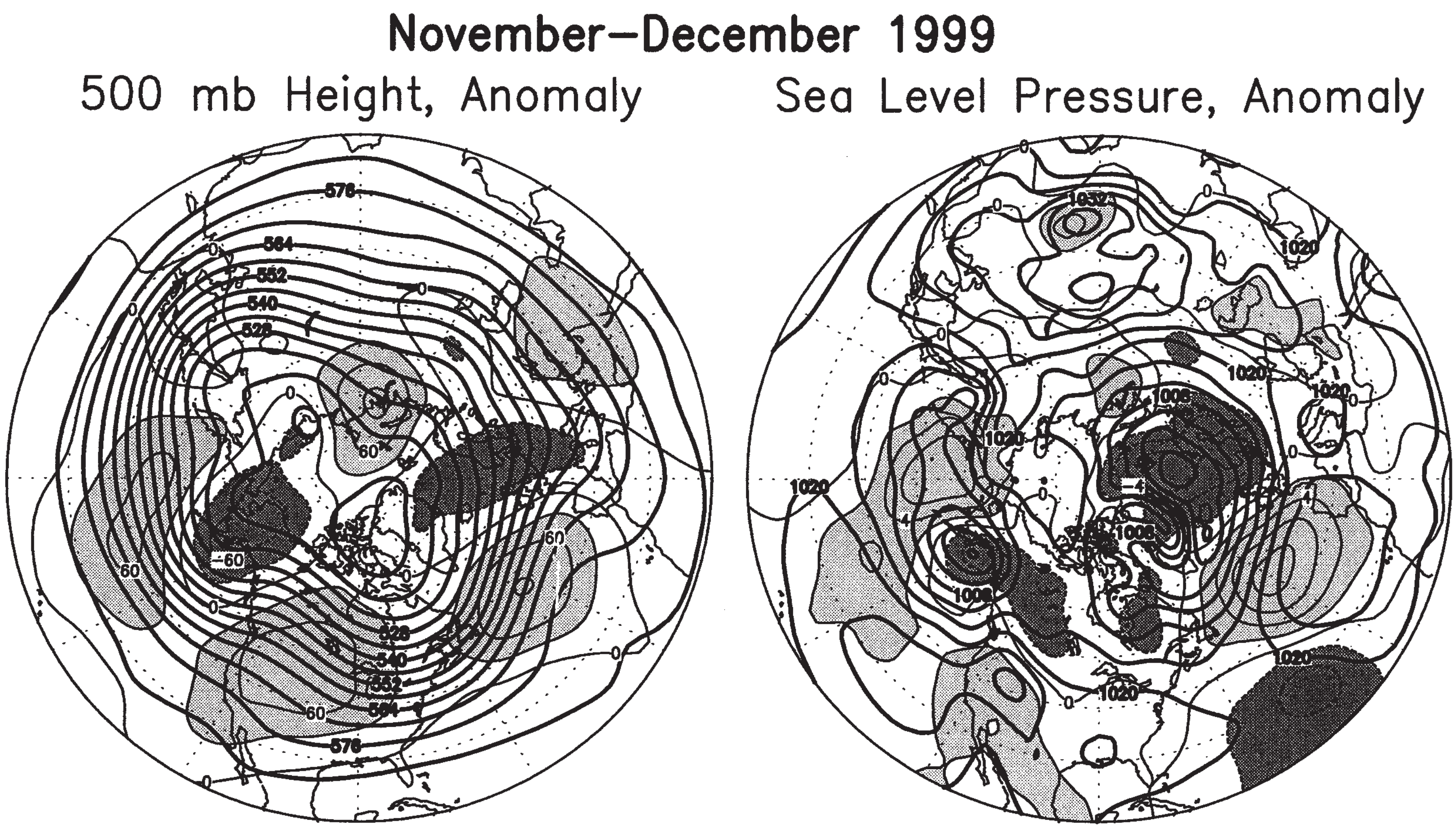
September–October 1999

500 mb Height, Anomaly — Sea Level Pressure, Anomaly



The chart on the left shows the two-month mean 500-mb height contours at 60 m intervals in solid lines, with alternate contours labeled in decameters (dm). Height anomalies are contoured in dashed lines at 30 m intervals. Areas where the mean height anomaly was greater than 30 m above normal have light shading, and areas where the mean height anomaly was more than 30 m below normal have heavy shading

The chart on the right shows the two-month mean sea level pressure at 4-mb intervals in solid lines, labeled in mb. Anomalies of SLP are contoured in dashed lines and labeled at 2-mb intervals, with light shading in areas more than 2 mb above normal, and heavy shading in areas in excess of 2 mb below normal.



The chart on the left shows the two-month mean 500-mb height contours at 60 m intervals in solid lines, with alternate contours labeled in decameters (dm). Height anomalies are contoured in dashed lines at 30 m intervals. Areas where the mean height anomaly was greater than 30 m above normal have light shading, and areas where the mean height anomaly was more than 30 m below normal have heavy shading

The chart on the right shows the two-month mean sea level pressure at 4-mb intervals in solid lines, labeled in mb. Anomalies of SLP are contoured in dashed lines and labeled at 2-mb intervals, with light shading in areas more than 2 mb above normal, and heavy shading in areas in excess of 2 mb below normal.

Rendezvous with Mitch

The Strongest October Hurricane Ever in the Atlantic Basin

James A. Eberwine Meteorologist
National Weather Service Forecast Office
Mt. Holly, Nnew Jersey

Editors Note: At its peak on 26 October 1998, hurricane Mitch's maximum winds were estimated to be 155 knots, making it a category 5 hurricane on the Saffir-Simpson Hurricane Scale. The estimated death toll from Mitch was just under 10,000 people, mainly in Honduras and Nicaragua.

After 26 years of talking about, studying, and teaching hurricane preparedness, I had an opportunity to fly onboard aircraft N43RF, one of the WP-3D planes operated by NOAA's Aircraft Operations Center (AOC) at McDill Air Force Base, Tampa, Florida. I was beginning to think that such an experience of flying through an actual hurricane would elude me for the remainder of my career. My interests in hurricanes were stimulated in 1976 when I had the occasion to fly with Dr. Neil Frank, then director of the National Hurricane Center (NHC), as he took pictures of the New Jersey and Delaware coastlines while remarking about the construction of homes and build up taking place.

As each new hurricane season rolled around, and a tropical storm formed in the Atlantic Basin, the cries from my colleagues were, “Jim, this could be IT!” Then, after listening to the hurricane forecasters at National Hurricane Center/Tropical Prediction Center discussing this dangerous late season hurricane, after plotting Mitch's position on our six- by four-foot magnetic plotting board, after broadcasting the latest bulletins all night over the NOAA weather radio and returning home following my fourth midnight shift, the call finally came. At 0930 A.M. 26 October. **“IT” was soon to become a reality!**

Several others were to be a part of this flight. Professor Stan Gedzelman, a university scientist from the City College of New York (CCNY), John Gamache, a lead project scientist from the Hurricane Research Division (HRD), and Rob Rogers a post doctoral student from HRD.

We arrived at McDill AFB around 11:30 am and were escorted into the Aircraft Operations Centers' hangar which housed several aircraft, including the latest research platform, the sleek looking Gulfstream IV-SP high altitude jet (G-IV). As I reached the second floor of the hanger bay area, I glanced at the white fuselage gleaming in the noontime sun sitting on the tarmac. It was N43RF, my chariot into Hurricane Mitch. By 12:45 pm, room 205 was abuzz as the project scientists were handing out and discussing the assignments. Mission 981027I1 was going to conduct a modified “Eyewall Vertical Motion Structure Experiments” (EVMSE) in Hurricane Mitch. This experiment was part of the “1998 Hurricane Field Program Plan,” a progression of experiments that were conducted throughout the hurricane season. Knowing that previous analysis

Continued on Page 76

Hurricane Mitch

Continued from Page 75

"confirmed the results of the flight level study in that the EYEWALL contained the strongest and largest updrafts," this was going to be a very interesting flight to say the least. I spent the last few minutes chatting with several people and going over the latest bulletins from the National Hurricane Center which indicated that there had been some weakening, but not much.

Prior to departing, we went over important safety issues. The very first directive we were given by one of the pilots was to pay particular attention to the "fasten seat belt" sign, especially when it is illuminated, but that we could walk around when it wasn't lit. There was also a bell and an announcement that it was time to buckle-up. He showed us how to get into our three-point shoulder and lap harness. We were also instructed how to properly put on the life vest in the event the aircraft had to "ditch." "Ditching" is when the plane is forced to land in the water because of mechanical or other problems. I refused to even think that this would be a viable option, especially when the seas under the hurricane were heaped up and rough, and the winds 150 miles an hour or more. Finally, we were shown the exit doors and the quickest and safest way to get to them. **It was time to taxi!**

The four engines roared as N43RF climbed at 300 meters (1,000 feet) per minute on our outbound leg in search of its assigned altitude of 7,500 meters (23,000 feet). The seat belt sign went out and you could hear metal striking the floor of the aircraft as we freed ourselves from the harnesses. This was a maneuver that I would repeat many, many times during the flight. Once free, I was able to walk throughout the aircraft. The forward area was made up of a series of workstations with an isle between them about the same width that you would find in an MD-80 commercial aircraft. The primary positions at the computer consisted of the Lead Project, Cloud Physics, Radar/Doppler, Dropsonde, and C-band scatterometer/Stepped-Frequency Microwave Radiometer Scientists. The navigator sits aft and starboard of the cockpit.

The middle section had one computer. The computer was where the scientist launching the dropsondes (an instrument which measures pressure, temperature, and humidity while it descends on a parachute) would sit. There was plenty of room to walk around in this area.

As we approached the Yucatan Channel, I noticed the sky and sea state undergoing change. I was told that we were under the Central Dense Overcast (CDO), that part of the cirrus cloud outflow that looks similar to the teeth of a buzz saw. At the lower levels I could see the swirling motion of the cumulus clouds. This was the extreme outer edge of the storm. Smooth sea conditions were changing to whitecaps, and the frequency between the waves was reduced with each passing mile.

Enjoying this new experience, I sat down to drink a cup of coffee when one of the engineers walked toward me with a screwdriver in his hand. He bent down next to my seat and with a couple of turns managed to pull up one of the floor panels. I held onto the armrest and glanced straight down to see more of the white caps and low clouds. He reached down into the well and attached a camera to a track. The belly-cam was ready. Needless to say, I made sure that I inspected my every step when leaving my seat! After tossing the coffee cup into the trash bin I walked toward the cockpit, just as I heard the tone, saw the red "seat belt" sign come on, and heard the pilot say, **"It's time to buckle up."**

No sooner did I fasten the harness then we were into the first "shock waves" emanating from the hurricane at ten thousand feet. I glanced down the center aisle toward the cockpit and did not see a soul walking around. The scientists were glued to their computers, and the navigator steadfastly plotting our course. I had company next to me on my right and across the aisle from me. Paul, to my right was, matter of factly, describing our encounter and other hurricanes he had flown into. Jack, across the way, was busy recording the flight with the digital camera. The anticipation

Continued on Page 77

Hurricane Mitch

Continued from Page 76

was mounting. The aircraft was jolted several times, but then, the turbulence subsided. I heard the pilot give the seat belts off command as he proudly proclaimed, **"We are entering the eye!"**

I couldn't get the harness off quick enough. What surprised me was how excited everyone in the aircraft got, but they allowed me the first glimpse at the eye and shared their window seat. This is the image that remains with you forever! The air was very still and there were low clouds within the eyewall. I looked straight up and could see breaks in the clouds overhead and the curving motion of the clouds. I tried from every vantage point to see the eye. I walked to the cockpit stopping along the way to talk with several scientists while gaping out every porthole that I could find. It was everything I imagined. Mitch was still a strong category four hurricane.

For the next several hours, we repeated 50 nm radius legs into one side of the hurricane then out the other side, dropping the Global Positioning Sondes (GPS) into the eyewall to determine the strength of the storm and measure the intense up and down drafts. It wasn't long before I realized that, even though I was not at one of the computers, I could tell exactly when the ride was going to get very rough. I continued to keep one eye on the seat belt sign, but then once belted in, I listened for the "swoosh" sound made by the GPS tube as the scientist opened the top of the tube and prepared for another release. Shortly after release, we were into the turbulence. With each pass through the eye, the turbulence increased until we were pulling two and a half Gs, or two and a half times our body weight. As we approached the eyewall, the sound of the engines was drowned out by the wind driven rain sweeping across the fuselage as if we were in a car wash with fire hoses at each side.

As the last minutes of daylight faded, the eyewall had enveloped the island of Guanaja, and was heading directly for Roatan. The wind profile showed 131 knots seventeen miles north of the eye by this time. Hurricane Mitch had already claimed its first casualties.

We departed 10,000 for 18,000 feet. The mission called for a few more GPS sondes through the eyewall at approximately 500 mb. As you ascend, the eye opens up and the thunderstorms tilt away from the core. The passes through the eyewall were still turbulent, but the frequency and magnitude had subsided. It is similar to an ocean swell wave decaying the farther away you get from the generating force. The temperature dropped and it wasn't long before the rain turned to ice. You could hear it striking the aircraft, but only for a short time. The work complete, we headed for home, not really knowing that parts of Central America were soon to become a "Meteorological Crime Scene." The Deadliest Atlantic Hurricane since 1780.

On the return flight, the mood was one of excitement, but at the same time subdued. As one scientist said, after I asked him how rough this flight was, "I'd much rather be here than at the mercy of this storm on the ground," and he was right.

On the way back I rode in the cockpit. A carpet of bright lights welcomed the P3 as it descended to Tampa Bay. The day was ending just as it had begun, on a beautiful weather note under the clear skies of Tampa. But tonight, I knew the difference a few hundred miles had made. As we walked back to room 205, N43RF was being towed to the hangar. After a brief stay, it was time to return to the hotel. At 12:15 am, thirteen hours after it all began, I sat down and devoured a soggy tuna fish sandwich and chips.

As my return flight home pulled away from the gate the next day, I heard the "bong," looked up and saw the seat belt sign come on. With a gentle tug on the belt, I thought to myself, this is going to be a piece of cake!

It is with sincere appreciation, that I thank everyone that was on the flight into Mitch that day. In addition, I would like to thank :

Frank D. Marks and John Mamache of the Hurricane Research Division, James D. McFadden and Staff of the Aircraft Operations Center, Jerry Jarrell and Staff of the Tropical Prediction Center, and Gary Szatkowski and Staff of NWS Mt. Holly, New Jersey.⚓

Voluntary Observing Ship program

Martin S. Baron
National Weather Service
Silver Spring, Maryland

The National Weather Service Thanks You

The National Weather Service (NWS) thanks the thousands of ships officers participating in the Voluntary Observing Ship (VOS) Program. Taking observations from aboard ship, formatting them into the Ships Synoptic Code, and transmitting them real-time is an effort worthy of our highest praise.

Ship reports continue to be of great importance to weather forecasting and climate research. Your observations provide the meteorologist with information about actual local weather conditions, and for marine areas, ships are usually the only source of such information. Ship reports are especially important for preparation of the marine surface analysis, one of the most fundamental meteorological guidance products. Most weather forecasts begin with a review of the data on the surface analysis. This analysis contains isobars (lines of equal barometric pressure) which makes it possible to locate weather systems such as fronts, troughs, high and low pressure areas, and tropical storms. Barometric readings from ships provide the data needed to draw the isobars over marine areas. For vast expanses of ocean, the surface analysis could not be produced without ship reports.

Please continue following the weather reporting schedule for ships as best you can—REPORT WEATHER AT 0000, 0600, 1200, and 1800 UTC. This is the worldwide reporting schedule for all marine areas. There is also a 3-hourly reporting schedule for vessels operating within 300 miles of named tropical storms or hurricanes, also in effect worldwide. The United States and Canada also request 3-hourly reports from within 200 miles of the United States and Canadian coastlines and from the Great Lakes. (These near shore areas suffer from a severe shortage of data.)

A Word About Data Accuracy

Great care must be taken at all times to ensure the accuracy of your data. Make sure your equipment is properly calibrated. Sea water thermometers should be calibrated annually and checked at every opportunity. If your vessel has an anemometer, the recommended interval for calibration is once every six months. Make sure the anemometer is located where the ship's superstructure will not interfere with air motion. A PMO should calibrate your barometer and barograph once every three months and check your psychrometer during every ship visit. The recommended interval between PMO ship visits is three months. When recording dry and wet bulb temperatures, take your psychrometer to the windward side of the ship.

When estimating wind speed using the Beaufort scale, some points to remember are:

Continued on Page 79

VOS Program
Continued from Page 78

- Heavy rain and floating ice will damp down the sea surface, and can cause an underestimate of wind speed.

- When wind speed is increasing or decreasing, there is a lag time before any changes occur to the sea surface.

- Wind blowing against the tide or against a strong current will cause a greater than normal sea-disturbance, and may result in an overestimate of wind speed. On the other hand, wind blowing in the same direction as the tide or current will result in a smaller sea-disturbance than normal, and could cause an underestimate of wind speed.

- The presence of swell may cause more whitecaps to form, because sea waves have a greater tendency to break when superimposed on swell.

When any of these factors are present, please remember to adjust your Beaufort scale wind estimate accordingly.

NWS VOS Program Size and Scope

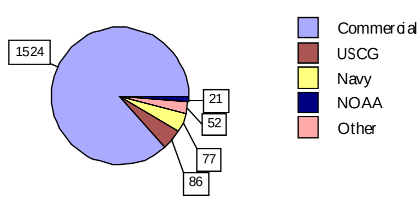
As of April 15, 2000, there were 1,760 vessels in the NWS VOS Program. This makes it the largest real-time meteorological data acquisition program in the world. (The NWS land-based Cooperative Substation Program has more observing sites, nearly 12,000, but these are mainly climate and hydrologic stations that do not report data real-time.)

The breakdown of vessels by ownership:

Commercial: 1,524
U.S. Coast Guard: 86
Navy: 77
NOAA: 21
Other: 52 (Miscellaneous, including state and University owned ships.)

United States VOS Program

Vessel Ownership



Reminder about Y2K Problem with AMVER/SEAS Software

The PKZIP.EXE and PKUNZIP.EXE version 2.03 files on many AMVER/SEAS program disks, used to archive VOS observation data, are not Y2K compliant. Performance is erratic but will usually result in the loss of archived data. A repair disk, as well as a complete new set of AMVER/SEAS software, is available from your U.S. PMO or SEAS representative. The repair disk upgrades the PKWARE files on your hard disk to version 2.50 without loss of your Administrative and AMVER files, as well as any previously collected VOS observations.

Until such time that your AMVER/SEAS software has been upgraded to include the version 2.50 of PKWARE, we request that you not attempt to archive any VOS observation data to floppy disk as this will likely result in the unrecoverable loss of data.

You can determine if you have the older version of PKWARE by looking in the SEAS4 directory. The older versions of PKZIP and PKUNZIP are dated 1993.

NOTE: This Y2K bug does not affect the real-time transmit function of the AMVER/SEAS program. Please continue to take observations and participate in the AMVER and VOS programs.

New Recruits—September through December 1999

During the four-month period September through December 1999, United States Port Meteorological Officers recruited 21 vessels into the Voluntary Observing Ship Program. Thank you for joining the program. Please make every effort to follow the weather reporting schedule. Your observations are important to the weather forecasting effort, and to your safety and well-being at sea.

Continued on Page 80

VOS Program

Continued from Page 79

Summary of Weather Report Transmission Procedures

Weather observations sent by ships participating in the VOS program are sent at no cost to the ship except as noted.

The stations listed accept weather observations which enter an automated system at National Weather Service headquarters. This system is not intended for other types of messages. To communicate with NWS personnel, see phone numbers and e-mail addresses at the beginning of this manual.

INMARSAT

Follow the instructions with your INMARSAT terminal for sending a telex message. Use the special dialing code 41 (except when using the SEAS/AMVER software in compressed binary format with INMARSAT C), and do not request a confirmation. Here is a typical procedure for using an INMARSAT A transceiver:

1. Select appropriate Land Earth Station Identity (LES-ID). See table below.
2. Select routine priority.
3. Select duplex telex channel.
4. Initiate the call. Wait for the GA+ signal.
5. Select the dial code for meteorological reports, 41+.
6. Upon receipt of our answerback, NWS OBS MHTS, transmit the weather message starting with BBXX and the ship's call sign. The message must be ended with five periods. Do not send any preamble.
   GA+
   41+
   NWS OBS MHTS
   BBXX WLXX 29003 99131 70808 41998 60909 10250 2021/ 4011/ 52003 71611 85264 22234 00261 20201 31100 40803.....

The five periods indicate the end of the message and must be included after each report. Do not request a confirmation.

Land-Earth Station Identity (LES-ID) of U.S. Inmarsat Stations Accepting Ships Weather (BBXX) and Oceanographic (JJYY) Reports

Operator	Service	Station ID			
		AOR-W	AOR-E	IOR	POR
COMSAT	A	01	01	01	01
COMSAT	B	01	01	01	01
COMSAT	C	001	101	321	201
COMSAT	C (AMVER/SEAS)	001	101	321	201
STRATOS/IDB	A (octal ID)	13-1	13-1	13-1	13-1
STRATOS/IDB	A (decimal ID)	11-1	11-1	11-1	11-1
STRATOS/IDB	B	013	013	013	013

Continued on Page 81

VOS Program

Continued from Page 80

Use abbreviated dialing code 41.
Do not request a confirmation

If your ship's Inmarsat terminal does not contain a provision for using abbreviated dialing code 41, TELEX address **0023089406** may be used via COMSAT. Please note that the ship will incur telecommunication charges for any messages sent to TELEX address 0023089406 using any Inmarsat earth station other than COMSAT.

Some common mistakes include: (1) failure to end the message with five periods when using INMARSAT A, (2) failure to include BBXX in the message preamble, (3) incorrectly coding the date, time, latitude, longitude, or quadrant of the globe, (4) requesting a confirmation.

Using The SEAS/AMVER Software

The National Oceanic and Atmospheric Administration (NOAA), in cooperation with the U.S. Coast Guard Automated Mutual-assistance VEssel Rescue program (AMVER) and COMSAT, has developed a PC software package known as AMVER/SEAS which simplifies the creation of AMVER and meteorological (BBXX) reports. The U.S. Coast Guard is able to accept, at no cost to the ship, AMVER reports transmitted via Inmarsat-C in a compressed binary format, created using the AMVER/SEAS program. Typically, in the past, the cost of transmission for AMVER messages has been assumed by the vessel. When ships participate in both the SEAS and AMVER programs, the position of ship provided in the meteorological report is forwarded to the Coast Guard as a supplementary AMVER position report to maintain a more accurate plot. To obtain the AMVER/SEAS program contact your U.S. PMO or AMVER/SEAS representative listed at the back of this publication.

If using the NOAA AMVER/SEAS software, follow the instructions outlined in the AMVER/SEAS User's Manual. When using Inmarsat-C, use the compressed binary format and 8-bit X.25 (PSDN) addressing (31102030798481), rather than TELEX if possible when reporting weather.

Common errors when using the AMVER/SEAS include sending the compressed binary message via the code 41 or a plain text message via the X.25 address. Only COMSAT can accept messages in the compressed binary format. Text editors should normally not be utilized in sending the data in the compressed binary format as this may corrupt the message.

Telephone (Landline, Cellular, Satphone, etc.)

The following stations will accept VOS weather observations via telephone. **Please note that the ship will be responsible for the cost of the call in this case.**

GLOBE WIRELESS	650-726-6588
MARITEL	228-897-7700
WLO	334-666-5110

Continued on Page 82

VOS Program

Continued from Page 81

The National Weather Service is developing a dial-in bulletin board to accept weather observations using a simple PC program and modem. **The ship will be responsible for the cost of the call when using this system.** For details contact:

Tim Rulon, NOAA
W/OM12 SSMC2 Room 14114
1325 East-West Highway
Silver Spring, MD 20910 USA
301-713-1677 Ext. 128
301-713-1598 (Fax)
timothy.rulon@noaa.gov
marine.weather@noaa.gov

Reporting Through United States Coast Guard Stations

U.S. Coast Guard stations accept SITOR (preferred) or voice radiotelephone weather reports. Begin with the BBXX indicator, followed by the ships call sign and the weather message**.**

U.S. Coast Guard High Seas Communication Stations

Location	(CALL)	Mode	SEL CAL	MMSI #	ITU CH#	Ship Xmit Freq	Ship Rec Freq	Watch
Boston	(NMF)	Voice		003669991	424	4134	4426	Night[3]
Boston	(NMF)	Voice		003669991	601	6200	6501	24Hr
Boston	(NMF)	Voice		003669991	816	8240	8764	24Hr
Boston	(NMF)	Voice		003669991	1205	12242	13089	Day[3]
Chesapeake	(NMN)	SITOR	1097		604	6264.5	6316	Night[2]
Chesapeake	(NMN)	SITOR	1097		824	8388	8428	24Hr
Chesapeake	(NMN)	SITOR	1097		1227	12490	12592.5	24hr
Chesapeake	(NMN)	SITOR	1097		1627	16696.5	16819.5	24Hr
Chesapeake	(NMN)	SITOR	1097		2227	22297.5	22389.5	Day[2]
Chesapeake	(NMN)	Voice		003669995	424	4134	4426	Night[2]
Chesapeake	(NMN)	Voice		003669995	601	6200	6501	24Hr
Chesapeake	(NMN)	Voice		003669995	816	8240	8764	24Hr
Chesapeake	(NMN)	Voice		003669995	1205	12242	13089	Day[2]
Miami	(NMA)	Voice		003669997	601	6200	6501	24Hr
Miami	(NMA)	Voice		003669997	1205	12242	13089	24Hr
Miami	(NMA)	Voice		003669997	1625	16432	17314	24Hr
New Orleans	(NMG)	Voice		003669998	424	4134	4426	24Hr
New Orleans	(NMG)	Voice		003669998	601	6200	6501	24Hr
New Orleans	(NMG)	Voice		003669998	816	8240	8764	24Hr
New Orleans	(NMG)	Voice		003669998	1205	12242	13089	24Hr
Kodiak	(NOJ)	SITOR	1106		407	4175.5	4213.5	Night
Kodiak	(NOJ)	SITOR	1106		607	6266	6317.5	24Hr
Kodiak	(NOJ)	SITOR	1106		807	8379.5	8419.5	Day
Kodiak	(NOJ)	Voice		003669899[1]	***	4125	4125	24Hr
Kodiak	(NOJ)	Voice		003669899[1]	601	6200	6501	24Hr
Pt. Reyes	(NMC)	SITOR	1096		620	6272.5	6323.5	Night
Pt. Reyes	(NMC)	SITOR	1096		820	8386	8426	24Hr

Continued on Page 83

VOS Program

Continued from Page 82

Location	(CALL)	Mode	SEL CAL	MMSI #	ITU CH#	Ship Xmit Freq	Ship Rec Freq	Watch
Pt. Reyes	(NMC)	SITOR	1096		1620	16693	16816.5	Day
Pt. Reyes	(NMC)	Voice		003669990	424	4134	4426	24Hr
Pt. Reyes	(NMC)	Voice		003669990	601	6200	6501	24Hr
Pt. Reyes	(NMC)	Voice		003669990	816	8240	8764	24Hr
Pt. Reyes	(NMC)	Voice		003669990	1205	12242	13089	24Hr
Honolulu	(NMO)	SITOR	1099		827	8389.5	8429.5	24hr
Honolulu	(NMO)	SITOR	1099		1220	12486.5	12589	24hr
Honolulu	(NMO)	SITOR	1099		2227	22297.5	22389.5	Day
Honolulu	(NMO)	Voice		003669993[1]	424	4134	4426	Night[4]
Honolulu	(NMO)	Voice		003669993[1]	601	6200	6501	24Hr
Honolulu	(NMO)	Voice		003669993[1]	816	8240	8764	24Hr
Honolulu	(NMO)	Voice		003669993[1]	1205	12242	13089	Day[4]
Guam	(NRV)	SITOR	1100		812	8382	8422	24hr
Guam	(NRV)	SITOR	1100		1212	12482.5	12585	Night
Guam	(NRV)	SITOR	1100		1612	16689	16812.5	24hr
Guam	(NRV)	SITOR	1100		2212	22290	22382	Day
Guam	(NRV)	Voice		003669994[1]	601	6200	6501	Night[5]
Guam	(NRV)	Voice		003669994[1]	1205	12242	13089	Day[5]

Stations also maintain an MF/HF DSC watch on the following frequencies: 2187.5 kHz, 4207.5 kHz, 6312 kHz, 8414.5 kHz, 12577 kHz, and 16804.5 kHz.

Voice frequencies are carrier (dial) frequencies. SITOR and DSC frequencies are assigned frequencies. Note that some stations share common frequencies.

An automated watch is kept on SITOR. Type “HELP+” for the of instructions or “OBS+” to send the weather report.

For the latest information on Coast Guard frequencies, visit their webpage at: http://www.navcen.uscg.mil/marcomms.

1 MF/HF DSC has not yet been implemented at these stations.
2 2300-1100 UTC Nights, 1100-2300 UTC Days
3 2230-1030 UTC Nights, 1030-2230 UTC Days
4 0600-1800 UTC Nights, 1800-0600 UTC Days
5 0900-2100 UTC Nights, 2100-0900 UTC Days

U.S. Coast Guard Group Communication Stations

U.S. Coast Guard Group communication stations monitor VHF marine channels 16 and 22A and/or MF radiotelephone frequency 2182 kHz (USB). Great Lakes stations do not have MF installations.

The following stations have MF DSC installations and also monitor 2187.5 kHz DSC. Additional stations are planned. Note that although a station may be listed as having DSC installed, that installation may not have yet

Continued on Page 84

VOS Program

Continued from Page 83

been declared operational. The U.S. Coast Guard is not expected to have the MF DSC network installed and declared operational until 2003 or thereafter.

The U.S. Coast Guard is not expected to have an VHF DSC network installed and declared operational until 2005 or thereafter.

STATION			MMSI #
CAMSLANT Chesapeake VA	MF/HF	—	003669995
COMMSTA Boston MA	MF/HF	Remoted to CAMSLANT	003669991
COMMSTA Miami FL	MF/HF	Remoted to CAMSLANT	003669997
COMMSTA New Orleans LA	MF/HF	Remoted to CAMSLANT	003669998
CAMSPAC Pt Reyes CA	MF/HF	—	003669990
COMMSTA Honolulu HI	MF/HF	Remoted to CAMSPAC	003669993
COMMSTA Kodiak AK	MF/HF	—	003669899
Group Atlantic City NJ	MF		003669903
Group Cape Hatteras NC	MF		003669906
Group Southwest Harbor	MF		003669921
Group Eastern Shore VA	MF		003669932
Group Mayport FL	MF		003669925
Group Long Island Snd	MF		003669931
Act New York NY	MF		003669929
Group Ft Macon GA	MF		003669920
Group Astoria OR	MF		003669910

Reporting Through Specified U.S. Commercial Radio Stations

If a U.S. Coast Guard station cannot be communicated with, and your ship is not INMARSAT equipped, U.S. commercial radio stations can be used to relay your weather observations to the NWS. When using SITOR, use the command "OBS +", followed by the BBXX indicator and the weather message. **Example:**

OBS + BBXX WLXX 29003 99131 70808 41998 60909 10250 2021/
40110 52003 71611 85264 22234 00261 20201 31100 40803

Commercial stations affiliated with Globe Wireless (KFS, KPH, WNU, WCC, etc.) accept weather messages via SITOR or morse code (not available at all times).

Commercial Stations affiliated with Mobile Marine Radio, Inc. (WLO, KLB, WSC) accept weather messages via SITOR, with Radiotelephone and Morse Code (weekdays from 1300-2100 UTC only) also available as backups.

MARITEL Marine Communication System accepts weather messages via VHF marine radiotelephone from near shore (out 50-60 miles), and from the Great Lakes.

Continued on Page 85

VOS Program

Continued from Page 84

Globe Wireless

Location	(CALL)	Mode	SEL CAL	MMSI #	ITU CH#	Ship Xmit Freq	Ship Rec Freq	Watch
Slidell,	(WNU)	SITOR			401	4172.5	4210.5	24Hr
Louisina	(WNU)	SITOR				4200.5	4336.4	24Hr
	(WNU)	SITOR			627	6281	6327	24Hr
	(WNU)	SITOR			819	8385.5	8425.5	24Hr
	(WNU)	SITOR			1257	12505	12607.5	24Hr
	(WNU)	SITOR			1657	16711.5	16834.5	24Hr
Barbados	(8PO)	SITOR			409	4176.5	4214.5	24Hr
	(8PO)	SITOR			634	6284.5	6330.5	24Hr
	(8PO)	SITOR			834	8393	8433	24Hr
	(8PO)	SITOR			1273	12513	12615.5	24Hr
	(8PO)	SITOR			1671	16718.5	16841.5	24Hr
San Francisco,	(KPH)	SITOR			413	4178.5	4216	24Hr
California	(KPH)	SITOR			613	6269	6320	24Hr
	(KPH)	SITOR			813	8382.5	8422.5	24Hr
	(KPH)	SITOR			822	8387	8427	24Hr
	(KPH)	SITOR			1213	12483	12585.5	24Hr
	(KPH)	SITOR			1222	12487.5	12590	24Hr
	(KPH)	SITOR			1242	12497.5	12600	24Hr
	(KPH)	SITOR			1622	16694	16817.5	24Hr
	(KPH)	SITOR			2238	22303	22395	24Hr
	(KFS)	SITOR			403	4173.5	4211.5	24Hr
	(KFS)	SITOR				6253.5	6436.4	24Hr
	(KFS)	SITOR			603	6264	6315.5	24Hr
	(KFS)	SITOR				8323.5	8526.4	24Hr
	(KFS)	SITOR			803	8377.5	8417.5	24Hr
	(KFS)	SITOR			1203	12478	12580.5	24Hr
	(KFS)	SITOR			1247	12500	12602.5	24Hr
	(KFS)	SITOR				16608.5	17211.4	24Hr
	(KFS)	SITOR			1647	16706.5	16829.5	24Hr
	(KFS)	SITOR			2203	22285.5	22377.5	24Hr
Hawaii	(KEJ)	SITOR				4154.5	4300.4	24Hr
	(KEJ)	SITOR			625	6275	6326	24Hr
	(KEJ)	SITOR			830	8391	8431	24Hr
	(KEJ)	SITOR			1265	12509	12611.5	24Hr
	(KEJ)	SITOR			1673	16719.5	16842.5	24Hr
Delaware,	(WCC)	SITOR				6297	6334	24Hr
USA	(WCC)	SITOR			816	8384	8424	24Hr
	(WCC)	SITOR			1221	12487	12589.5	24Hr
	(WCC)	SITOR			1238	12495.5	12598	24Hr
	(WCC)	SITOR			1621	16693.5	16817	24Hr
Argentina	(LSD836)	SITOR				4160.5	4326	24Hr
	(LSD836)	SITOR				8311.5	8459	24Hr
	(LSD836)	SITOR				12379.5	12736	24Hr
	(LSD836)	SITOR				16560.5	16976	24Hr
	(LSD836)	SITOR				18850.5	19706	24Hr
Guam	(KHF)	SITOR			605	6265	6316.5	24Hr
	(KHF)	SITOR			808	8380	8420	24Hr
	(KHF)	SITOR			1301	12527	12629	24Hr
	(KHF)	SITOR			1726	16751	16869	24Hr
	(KHF)	SITOR			1813	18876.5	19687	24Hr
	(KHF)	SITOR			2298	22333	22425	24Hr
Newfoundland	(VCT)	SITOR			414	4179	4216.5	24Hr

Continued on Page 86

VOS Program

Continued from Page 85

Location	(CALL)	Mode	SEL CAL	MMSI #	ITU CH#	Ship Xmit Freq	Ship Rec Freq	Watch
Canada	(VCT)	SITOR			416	4180	4217.5	24Hr
	(VCT)	SITOR			621	6273	6324	24Hr
	(VCT)	SITOR			632	6283.5	6329.5	24Hr
	(VCT)	SITOR			821	8386.5	8426.5	24Hr
	(VCT)	SITOR			838	8395	8435	24Hr
	(VCT)	SITOR			1263	12508	12610.5	24Hr
	(VCT)	SITOR			1638	16702	16825	24Hr
Cape Town,	(ZSC)	SITOR			408	4176	4214	24Hr
South Africa	(ZSC)	SITOR			617	6271	6322	24Hr
	(ZSC)	SITOR			831	8391.5	8431.5	24Hr
	(ZSC)	SITOR			1244	12498.5	12601	24Hr
	(ZSC)	SITOR			1619	16692.5	16816	24Hr
	(ZSC)	SITOR			1824	18882	19692.5	24Hr
Bahrain,	(A9M)	SITOR			419	4181.5	4219	24Hr
Arabian Gulf	(A9M)	SITOR				8302.5	8541	24Hr
	(A9M)	SITOR				12373.5	12668	24Hr
	(A9M)	SITOR				16557.5	17066.5	24Hr
	(A9M)	SITOR				18853.5	19726	24Hr
Gothenburg,	(SAB)	SITOR			228	2155.5	1620.5	24Hr
Sweden	(SAB)	SITOR				4166.5	4259	24Hr
	(SAB)	SITOR			626	6275.5	6326.5	24Hr
	(SAB)	SITOR			837	8394.5	8434.5	24Hr
	(SAB)	SITOR			1291	12522	12624	24Hr
	(SAB)	SITOR			1691	16728.5	16851.5	24Hr
Norway,	(LFI)	SITOR				2653	1930	24Hr
	(LFI)	SITOR				4154.5	4339	24Hr
	(LFI)	SITOR				6250.5	6467	24Hr
	(LFI)	SITOR				8326.5	8683.5	24Hr
	(LFI)	SITOR				12415.5	12678	24Hr
	(LFI)	SITOR				16566.5	17204	24Hr
Awanui,	(ZLA)	SITOR			402	4173	4211	24Hr
New Zealand	(ZLA)	SITOR			602	6263.5	6315	24Hr
	(ZLA)	SITOR			802	8377	8417	24Hr
	(ZLA)	SITOR			1202	12477.5	12580	24Hr
	(ZLA)	SITOR			1602	16684	16807.5	24Hr
	(ZLA)	SITOR				18859.5	19736.4	24Hr
Perth,	(VIP)	SITOR			406	4175	4213	24Hr
Western	(VIP)	SITOR			806	8379	8419	24Hr
Austrailia	(VIP)	SITOR			1206	12479.5	12582	24Hr
	(VIP)	SITOR			1210	12481.5	12584	24Hr
	(VIP)	SITOR			1606	16686	16809.5	24Hr

The frequencies listed are used by the stations in the Global Radio network for both SITOR and GlobeEmail. Stations listed as being 24hr may not be operational during periods of poor propagation.

For the latest information on Globe Wireless frequencies, visit their webpage at: http://www.globewireless.com

Stations and channels are added regularly. Contact any Globe Wireless station/channel or visit the website for an updated list.

Continued on Page 87

VOS Program

Continued from Page 86

Mobile Marine Radio Inc.

Location	(CALL)	Mode	SEL CAL	MMSI #	ITU CH#	Ship Xmit Freq	Ship Rec Freq	Watch
Mobile, AL	(WLO)	SITOR	1090	003660003	406	4175	4213	24Hr
	(WLO)	SITOR	1090	003660003	410	4177	4215	24Hr
	(WLO)	SITOR	1090	003660003	417	4180.5	4218	24Hr
	(WLO)	SITOR	1090	003660003	606	6265.5	6317	24Hr
	(WLO)	SITOR	1090	003660003	610	6267.5	6319	24Hr
	(WLO)	SITOR	1090	003660003	615	6270	6321	24Hr
	(WLO)	SITOR	1090	003660003	624	6274.5	6325.5	24Hr
	(WLO)	SITOR	1090	003660003	806	8379	8419	24Hr
	(WLO)	SITOR	1090	003660003	810	8381	8421	24Hr
	(WLO)	SITOR	1090	003660003	815	8383.5	8423.5	24Hr
	(WLO)	SITOR	1090	003660003	829	8390.5	8430.5	24Hr
	(WLO)	SITOR	1090	003660003	832	8392	8432	24Hr
	(WLO)	SITOR	1090	003660003	836	8394	8434	24Hr
	(WLO)	SITOR	1090	003660003	1205	12479	12581.5	24Hr
	(WLO)	SITOR	1090	003660003	1211	12482	12584.5	24Hr
	(WLO)	SITOR	1090	003660003	1215	12484	12586.5	24Hr
	(WLO)	SITOR	1090	003660003	1234	12493.5	12596	24Hr
	(WLO)	SITOR	1090	003660003	1240	12496.5	12599	24Hr
	(WLO)	SITOR	1090	003660003	1251	12502	12604.5	24Hr
	(WLO)	SITOR	1090	003660003	1254	12503.5	12606	24Hr
	(WLO)	SITOR	1090	003660003	1261	12507	12609.5	24Hr
	(WLO)	SITOR	1090	003660003	1605	16685.5	16809	24Hr
	(WLO)	SITOR	1090	003660003	1611	16688.5	16812	24Hr
	(WLO)	SITOR	1090	003660003	1615	16690.5	16814	24Hr
	(WLO)	SITOR	1090	003660003	1625	16695.5	16818.5	24Hr
	(WLO)	SITOR	1090	003660003	1640	16703	16826	24Hr
	(WLO)	SITOR	1090	003660003	1644	16705	16828	24Hr
	(WLO)	SITOR	1090	003660003	1661	16713.5	16836.5	24Hr
	(WLO)	SITOR	1090	003660003	1810	18875	19685.5	24Hr
	(WLO)	SITOR	1090	003660003	2210	22289	22381	24Hr
	(WLO)	SITOR	1090	003660003	2215	22291.5	22383.5	24Hr
	(WLO)	SITOR	1090	003660003	2254	22311	22403	24Hr
	(WLO)	SITOR	1090	003660003	2256	22312	22404	24Hr
	(WLO)	SITOR	1090	003660003	2260	22314	22406	24Hr
	(WLO)	SITOR	1090	003660003	2262	22315	22407	24Hr
	(WLO)	SITOR	1090	003660003	2272	22320	22412	24Hr
	(WLO)	SITOR	1090	003660003	2284	22326	22418	24Hr
	(WLO)	SITOR	1090	003660003	2510	25177.5	26105.5	24Hr
	(WLO)	SITOR	1090	003660003	2515	25180	26108	24Hr
	(WLO)	DSC		003660003		4208	4219	24Hr
	(WLO)	DSC		003660003		6312.5	6331.0	24Hr
	(WLO)	DSC		003660003		8415	8436.5	24Hr
	(WLO)	DSC		003660003		12577.5	12657	24Hr
	(WLO)	DSC		003660003		16805	16903	24Hr
	(WLO)	Voice		003660003	405	4077	4369	24Hr
	(WLO)	Voice			414	4104	4396	24Hr
	(WLO)	Voice			419	4119	4411	24Hr
	(WLO)	Voice		003660003	607	6218	6519	24Hr
	(WLO)	Voice		003660003	824	8264	8788	24Hr
	(WLO)	Voice			829	8279	8803	24Hr
	(WLO)	Voice			830	8282	8806	24Hr

Continued on Page 88

VOS Program

Continued from Page 87

Location	(CALL)	Mode	SEL CAL	MMSI #	ITU CH#	Ship Xmit Freq	Ship Rec Freq	Watch
	(WLO)	Voice		003660003	1212	12263	13110	24Hr
	(WLO)	Voice			1226	12305	13152	24Hr
	(WLO)	Voice			1607	16378	17260	24Hr
	(WLO)	Voice			1641	16480	17362	24Hr
	(WLO)	VHFVoice			CH 25,84			24Hr
	(WLO)	DSC Call		003660003	CH 70			24Hr
	(WLO)	DSC Work		003660003	CH 84			24Hr
Tuckerton,	(WSC)	SITOR	1108		419	4181.5	4219	24Hr
NJ	(WSC)	SITOR	1108		832	8392	8432	24Hr
	(WSC)	SITOR	1108		1283	12518	12620.5	24Hr
	(WSC)	SITOR	1108		1688	16727	16850	24Hr
	(WSC)	SITOR	1108		1805	18872.5	19683	24Hr
	(WSC)	SITOR	1108		2295	22331.5	22423.5	24Hr
Seattle, WA	(KLB)	SITOR	1113		408	4176	4214	24Hr
	(KLB)	SITOR	1113		608	6266.5	6318	24Hr
	(KLB)	SITOR	1113		818	8385	8425	24Hr
	(KLB)	SITOR	1113		1223	12488	12590.5	24Hr
	(KLB)	SITOR	1113		1604	16685	16808.5	24Hr
	(KLB)	SITOR	1113		2240	22304	22396	24Hr

WLO Radio is equipped with an operational Thrane & Thrane TT-6200A DSC system for VHF and MF/HF general purpose digital selective calling communications.

Ship Telex Automatic System Computer Commands and Guidelines for Contacting Mobile Marine Radio stations.

Ship Station Response	Land Station Response
1) INITIATE ARQ CALL	
	2) RTTY CHANNEL
	3) "WHO ARE YOU" (Requests Ship's Answerback)
4) SHIP'S ANSWERBACK IDENTITY	
	5) GA+?
6) Send Command OBS+ (Weather Observations) OPR+ (Operator Assistance) HELP+ (Operator Procedure)	
	7) MOM
	8) MSG+?
9) SEND MESSAGE	
10) KKKK (End of Message Indicator, WAIT for System Response DO NOT DISCONNECT)	
	11) RTTY CHANNEL
12) SHIP'S ANSWERBACK	
	13) SYSTEM REFERENCE, INFORMATION, TIME, DURATION

Continued on Page 89

VOS Program

Continued from Page 88

14) GA+?

15) GO TO STEP 6, or

16) BRK+? Clear Radio Circuit)

Stations listed as being 24Hr may not be operational during periods of poor propogation.

For the latest information on Mobile Marine Radio frequencies, visit their webpage at: http://www.wloradio.com.

MARITEL Stations

Instructions for MARITEL

Key the mike for five seconds on the working channel for that station. You should then get a recording telling you that you have reached the MARITEL system, and if you wish to place a call, key your mike for an additional five seconds. A MARITEL operator will then come on frequency. Tell them that you want to pass a marine weather observation.

Stations	VHF Channel(s)
WEST COAST	
Bellingham, WA	28,85
Port Angeles, WA	25
Camano Island, WA	24
Seattle, WA	26
Tumwater, WA	85
Astoria, OR	24,26
Portland, OR	26
Newport, OR	28
Coos Bay, OR	25
Santa Cruz, CA	27
Santa Barbara, CA	86
Redondo Bch, CA	27,85,87
HAWAII	
Haleakala,HI (Maui)	26
GREAT LAKES	
Duluth, MN (Superior)	84
Ontonagon, MI (Superior)	86
Copper Harbor (Superior)	87
Grand Marias (Superior)	84
Sault Ste Marie (Superior)	86
Port Washington, WI (Mich)	85
Charlevoix (Michican)	84
Roger City (Huron)	28
Alpena, MI (Huron)	84
Tawas City, MI (Huron)	87
Detroit, MI (Erie)	28
Cleveland, OH (Erie)	86
Buffalo, NY (Erie)	28
NORTH EAST COAST	
Portland, ME	87
Southwest Harbor, ME	28
Rockport, ME	26,84
Gloucester, MA	25
Boston, MA	26,27
Hyannisport, MA	28
Nantucket, MA	85
New Bedford, MA	24,26
Narragansett, RI	84
New London, CT	26,86
Bridgeport, CT	27
Staten Island, NY	28
Sandy Hook, NJ	24
Toms River, NJ	27
Ship Bottom, NJ	28
Beach Haven, NJ	25
Atlantic City, NJ	26
Philadelphia, PA	26
Delaware WW Lewes, DE	27
Dover, DE	84
Ocean City, MD	26
Virginia Bch, VA	26,27
CHESAPEAKE BAY	
Baltimore, MD	25,26
Cambridge, MD	28
Point Lookout, MD	26
Belle Haven, VA	25
SOUTH EAST COAST	
Morehead City, NC	28
Wilmington, NC	26
Georgetown, SC	24
Charleston, SC	26
Savannah, GA	27
Jacksonville, FL	26
Daytona Beach, FL	28
Cocoa Bch, FL	26
Vero Bch, FL	27
St Lucie, FL	26
W Palm Bch,	28
Ft Lauderdale, FL	84
Miami, FL	24,25
Key Largo, FL	28
Marathon, FL	27
Key West, FL	26,84
GULF COAST	
Port Mansfield, TX	25
Corpus Christi, TX	26
Port O'Conner, TX	24
Matagorda, TX	84
Freeport, TX	27
Galveston, TX	24

Continued on Page 90

VOS Program

Continued from Page 89

Arcadia, TX	87
Houston, TX	26
Port Arthur, TX	27
Lake Charles, LA	28,84
Erath, LA	87
Morgan City, LA	24,26
Houma, LA	86
Venice, LA	27,28,86
New Orleans, LA	24,26,87
Hammond, LA	85
Hopedale, LA	85
Gulfport, MS	28
Pascagoula, MS	27
Pensacola, FL	26
Ft Walton Bch, FL	28
Panama City, FL	26
Apalachicola, FL	28
Crystal River, FL	28
Clearwater, FL	26
Tampa Bay, FL	24
Venice, FL	27
Ft Myers, FL	26
Naples, FL	25

For the latest information on MARITEL frequencies, visit their webpage at: http://www.maritelinc.com.

Military Communications Circuits

Navy, Naval, and U.S. Coast Guard ships wishing to participate in the VOS program may do so by sending unclassified weather observations in synoptic code (BBXX format) to the following Plain Language ADdress (PLAD):

SHIP OBS NWS SILVER SPRING MD

As weather observations received by NWS are public data, vessels should check with their local command before participating in the VOS Program.

Very Important: Please keep us informed about changes to your mailing address. Voluntary Observing Ships may contact any United States Port Meteorological Officer (PMO) to update or change an address.

National Weather Service Voluntary Observing Ship Program

New Recruits from September 1 through December 31, 1999

NAME OF SHIP	CALL	AGENT NAME	RECRUITING PMO
1ST LT. HARRY L. MARTIN	NDFH	OSPREY SHIP MANAGEMENT	JACKSONVILLE, FL
BESIRE KALKAVAN	TCAO	TURKON SHIPPING % STRACHAN SHIPPING CO	NEW YORK CITY, NY
CARNIVAL TRIUMPH	3FFM8	CARNIVAL CRUISE	MIAMI, FL
HANJIN NAGOYA	3FJW8	HANJIN SHIPPING CO.	NEW YORK CITY, NY
HOUSTON EXPRESS	3FQT9	HAPAG-LLOYD (AMERICA) INC	HOUSTON, TX
J. BENNETT JOHNSTON	C6QE3	CHEVRON SHIPPING CO LLC	SAN FRANCISCO, CA
JAMES A. HANNAH	WU8842	HANNAH MARINE	CHICAGO, IL
LYKES CHALLENGER	ELXM4	STRACHAN SHIPPING CO.	HOUSTON, TX
NORDCOAST	P3MC8	AGENT TO CHANGE IN 1 MONTH	NORFOLK, VA
NORWEIGEAN SKY	C6PZ8	NORWEIGEAN CRUISE LINES	NEW YORK CITY, NY
RICHARD H MATZKE	C6FE5	CHEVRON SHIPPING COMPANY LLC	SAN FRANCISCO, CA
SEARIVER CHARLESTON	WBVY	SEARIVER MARITIME INC	HOUSTON, TX
SKAGEN MAERSK	OYOS2	MAERSK PACIFIC LTD.	SEATTLE, WA
SOVEREIGN MAERSK	OYGA2	MAERSK PACIFIC LTD	SEATTLE, WA
STAR FRASER	LAVY4	STRACHAN SHIPPING AGENCY, BLDG. 13, SUITE 201	NORFOLK, VA
SVENDBORG MAERSK	OZSK2	MAERSK PACIFIC LTD.	SEATTLE, WA
USCGC ANACAPA	NEXY	COMMANDING OFFICER USCGC ANACAPA WPB1335	ANCHORAGE, AK
USCGC HEALY WAGB-20	NEPP	C/O MARINE SCIENCE OFFICER	SEATTLE, WA
USNS FISHER T-AKR 301	NHMX	COMMANDING OFFICER	NEW ORLEANS, LA
VOYAGER OF THE SEAS	ELWU7	ROYAL CARBBIEAN CRUISE LINES	MIAMI, FL
WEATHERBIRD II	WCT6653	R/V WEATHERBIRD	SEATTLE, WA

VOS Program Awards and Presentations Gallery

Houston PMO Jim Nelson prsenting a 1998 VOS award to Capital Brennan of the ***Newark Bay****.*

Houston PMO Jim Nelson prsenting a 1998 VOS award to Capital Austin of the ***OOCL Inspiration****.*

PMO Jim Nelson presenting a 1998 VOS award to Captain Berry of the ***Sealand Hawaii****.*

VOS Coop Ship Reports — September through December 1999

The National Climatic Data Center compiles the tables for the VOS Cooperative Ship Report from radio messages. The values under the monthly columns represent the number of weather reports received. Port Meteorological Officers supply ship names to the NCDC. Comments or questions regarding this report should be directed to NCDC, Operations Support Division, 151 Patton Avenue, Asheville, NC 28801, Attention: Dimitri Chappas (828-271-4060 or dchappas@ncdc.noaa.gov).

SHIP NAME	CALL	PORT	SEP	OCT	NOV	DEC	TOTAL
1ST LT ALEX BONNYMAN	WMFZ	New York City	2	0	0	0	2
1ST LT JACK LUMMUS	WJLV	New York City	0	0	54	1	55
A. V. KASTNER	ZCAM9	Jacksonville	67	3	0	1	71
AALSMEERGRACHT	PCAM	Long Beach	40	37	52	0	129
ACT 7	GWAN	Newark	20	44	63	49	176
ADVANTAGE	WPPO	Norfolk	0	28	33	80	141
AGDLEK	OUGV	Miami	0	0	4	9	13
AGULHAS	3ELE9	Baltimore	0	0	16	11	27
AL FUNTAS	9KKX	Miami	49	4	8	0	61
AL SAMIDOON	9KKF	Houston	0	16	5	3	24
ALBEMARLE ISLAND	C6LU3	Newark	0	0	10	33	43
ALBERNI DAWN	ELAC5	Houston	2	3	4	0	9
ALBLASGRACHT	PCIG	Houston	46	57	52	60	215
ALEXANDER VON HUMBOLD	Y3CW	Miami	712	733	710	710	2865
ALKMAN	C6OG4	Houston	16	7	8	6	37
ALLEGIANCE	WSKD	Norfolk	6	0	0	14	20
ALLIGATOR BRAVERY	3FXX4	Oakland	38	50	42	48	178
ALLIGATOR COLUMBUS	3ETV8	Seattle	8	9	13	34	64
ALLIGATOR FORTUNE	ELFK7	Seattle	12	13	6	9	40
ALLIGATOR GLORY	ELJP2	Seattle	17	29	12	21	79
ALLIGATOR HOPE	ELFN8	Seattle	28	22	15	21	86
ALLIGATOR LIBERTY	JFUG	Seattle	74	40	65	50	229
ALPENA	WAV4647	Cleveland	0	10	9	1	20
ALTAIR	DBBI	Miami	452	583	664	510	2209
ALTAMONTE	3EIG4	Long Beach	1	0	4	6	11
AMAZON	S6BJ	Norfolk	14	4	0	0	18
AMBASSADOR BRIDGE	3ETH9	Oakland	34	66	37	49	186
AMERICA FEEDER	ELUZ8	Miami	9	2	0	0	11
AMERICA STAR	C6JZ2	Houston	66	67	100	13	246
AMERICA STAR	GZKA	Houston	0	0	0	71	71
AMERICAN MARINER	WQZ7791	Cleveland	11	21	26	18	76
AMERICAN MERLIN	WRGY	Norfolk	0	0	0	6	6
AMERICANA	C6QG4	New Orleans	12	26	24	12	74
ANASTASIS	9HOZ	Miami	0	0	0	2	2
ANATOLIY KOLESNICHENKO	UINM	Seattle	19	19	5	21	64
ANKERGRACHT	PCQL	Baltimore	9	29	13	45	96
APL CHINA	S6TA	Seattle	0	54	31	27	112
APL CHINA	V7AL5	Seattle	48	9	0	0	57
APL GARNET	9VVN	Oakland	55	52	46	30	183
APL JAPAN	S6TS	Seattle	0	30	38	34	102
APL JAPAN	V7AL7	Seattle	66	0	0	0	66
APL KOREA	WCX8883	Seattle	52	42	28	58	180
APL PHILIPPINES	WCX8884	Seattle	26	34	37	8	105
APL SINGAPORE	WCX8812	Seattle	48	43	58	54	203
APL THAILAND	WCX8882	Seattle	32	0	18	58	108
APOLLOGRACHT	PCSV	Baltimore	55	44	28	10	137
AQUARIUS ACE	3FHB8	New York City	20	0	5	10	35
ARCO ALASKA	KSBK	Long Beach	9	3	11	12	35
ARCO CALIFORNIA	WMCV	Long Beach	11	9	10	0	30
ARCO FAIRBANKS	WGWB	Long Beach	7	0	0	2	9
ARCO INDEPENDENCE	KLHV	Long Beach	7	9	6	6	28
ARCO JUNEAU	KSBG	Seattle	31	17	0	0	48
ARCO PRUDHOE BAY	KPFD	Long Beach	1	0	0	0	1
ARCO SAG RIVER	WLDF	Long Beach	7	0	0	0	7
ARCO SPIRIT	KHLD	Long Beach	0	0	10	16	26
ARCO TEXAS	KNFD	Long Beach	6	10	15	12	43
ARCTIC OCEAN	C6T2062	Newark	6	0	9	6	21

Continued on Page 93

Continued from Page 92

SHIP NAME	CALL	PORT	SEP	OCT	NOV	DEC	TOTAL
ARGONAUT	KFDV	Newark	29	42	49	60	180
ARIES	KGBD	New York City	13	7	0	0	20
ARINA ARCTICA	OVYA2	Miami	105	108	122	91	426
ARKTIS FUTURE	OXUF2	Miami	88	0	0	0	88
ARMCO	WE6279	Cleveland	23	3	1	0	27
ARTHUR M. ANDERSON	WE4805	Chicago	7	51	94	67	219
ATLANTIC	3FYT	Miami	203	206	218	198	825
ATLANTIC CARTIER	C6MS4	Norfolk	22	32	13	14	81
ATLANTIC COMPANION	SKPE	Newark	27	18	29	40	114
ATLANTIC COMPASS	SKUN	Norfolk	22	21	27	32	102
ATLANTIC CONCERT	SKOZ	Norfolk	3	17	0	16	36
ATLANTIC CONVEYOR	C6NI3	Norfolk	34	28	21	21	104
ATLANTIC ERIE	VCQM	Baltimore	2	0	1	0	3
ATLANTIC NOVA	3FWT4	Seattle	27	11	18	0	56
ATLANTIC OCEAN	C6T2064	Newark	0	0	9	18	27
ATLANTIS	KAQP	New Orleans	0	0	15	15	30
AUCKLAND STAR	C6KV2	Baltimore	58	61	56	57	232
AUSTRAL RAINBOW	WEZP	New Orleans	0	0	0	38	38
AUTHOR	GBSA	Houston	0	0	50	61	111
B. T. ALASKA	WFQE	Long Beach	1	0	13	63	77
BARBARA ANDRIE	WTC9407	Chicago	40	30	16	22	108
BARRINGTON ISLAND	C6QK	Miami	44	38	45	70	197
BAY BRIDGE	ELES7	Seattle	8	9	8	3	28
BELLONA	3FEA4	Jacksonville	14	4	0	0	18
BERNARDO QUINTANA A	C6KJ5	New Orleans	5	0	4	8	17
BESIRE KALKAVAN	TCAO	New York City	0	9	0	0	9
BLACKHAWK	WBN2081	Seattle	0	0	4	1	5
BLUE GEMINI	3FPA6	Seattle	0	0	43	21	64
BLUE HAWK	D5HZ	Norfolk	0	9	21	20	50
BLUE NOVA	3FDV6	Seattle	23	15	27	19	84
BOHEME	SIVY	New York City	0	0	0	26	26
BONN EXPRESS	DGNB	Houston	594	247	654	628	2123
BP ADMIRAL	ZCAK2	Houston	46	54	24	4	128
BRIGHT PHOENIX	DXNG	Seattle	18	22	40	42	122
BRIGHT STATE	DXAC	Seattle	50	0	52	58	160
BRISBANE STAR	C6LY4	Seattle	12	14	16	1	43
BRITISH ADVENTURE	ZCAK3	Seattle	31	31	12	60	134
BRITISH RANGER	ZCAS6	Houston	46	39	54	36	175
BT NAVIGATOR	ZCBL6	New Orleans	0	75	13	0	88
BT NESTOR	ZCBL4	New York City	4	13	3	24	44
BT NIMROD	ZCBL5	Long Beach	10	1	5	0	16
BUCKEYE	WAQ3520	Cleveland	12	7	2	6	27
BUFFALO	WXS6134	Cleveland	19	16	5	4	44
BUNGA ORKID DUA	9MBQ4	Seattle	13	32	29	11	85
BURNS HARBOR	WQZ7049	Chicago	120	110	121	138	489
CALCITE II	WB4520	Chicago	20	55	6	8	89
CALIFORNIA HIGHWAY	3FHQ4	Seattle	6	7	0	0	13
CALIFORNIA JUPITER	ELKU8	Long Beach	32	36	39	65	172
CALIFORNIA LUNA	S6CM	Seattle	0	0	1	0	1
CALIFORNIA MERCURY	JGPN	Seattle	3	28	0	0	31
CAPE INTREPID	WLDL	Houston	0	0	0	1	1
CAPE KNOX	KAOP	New Orleans	28	15	51	10	104
CAPE MAY	JBCN	Norfolk	16	17	18	5	56
CAPE ROGER	VCBT	Norfolk	0	0	1	0	1
CAPT STEVEN L BENNETT	KAXO	New Orleans	26	46	0	27	99
CARIBBEAN MERCY	3FFU4	Miami	5	9	17	58	89
CARNIVAL DESTINY	3FKZ3	Miami	12	14	14	17	57
CARNIVAL PARADISE	3FOB5	Miami	8	21	8	32	69
CARNIVAL TRIUMPH	3FFM8	Miami	0	0	40	27	67
CASON J. CALLAWAY	WE4879	Chicago	71	76	52	53	252
CELEBRATION	ELFT8	Miami	13	15	7	3	38
CELTIC SEA	C6RT	Miami	1	0	0	0	1
CENTURY HIGHWAY #2	3EJB9	Long Beach	16	25	13	20	74
CENTURY HIGHWAY NO. 1	3FFJ4	Houston	26	23	35	40	124
CENTURY LEADER NO. 1	3FBI6	Houston	77	66	54	40	237
CHARLES ISLAND	C6JT	Miami	75	55	54	66	250
CHARLES M. BEEGHLEY	WL3108	Cleveland	10	5	18	9	42
CHC NO.1	3FSL2	Seattle	22	5	0	0	27
CHELSEA	KNCX	Miami	21	12	7	9	49
CHESAPEAKE BAY	WMLH	Houston	41	63	26	44	174

Continued on Page 94

Continued from Page 93

SHIP NAME	CALL	PORT	SEP	OCT	NOV	DEC	TOTAL
CHESAPEAKE TRADER	WGZK	Houston	79	50	26	96	251
CHEVRON ARIZONA	KGBE	Miami	18	2	0	0	20
CHEVRON ATLANTIC	C6KY3	New Orleans	53	41	13	0	107
CHEVRON COPENHAGEN	A8GL	Oakland	10	6	1	0	17
CHEVRON EDINBURGH	VSBZ5	Oakland	43	63	46	19	171
CHEVRON FELUY	ELIN	Houston	68	52	0	0	120
CHEVRON MISSISSIPPI	WXBR	Oakland	29	73	65	27	194
CHEVRON PERTH	C6KQ8	Oakland	1	45	12	36	94
CHEVRON SOUTH AMERICA	ZCAA2	New Orleans	23	20	15	21	79
CHEVRON WASHINGTON	KFDB	Oakland	22	0	0	6	28
CHIEF GADAO	WEZD	Oakland	10	11	11	8	40
CHIQUITA BELGIE	C6KD7	Baltimore	44	51	43	28	166
CHIQUITA BREMEN	ZCBC5	Miami	39	55	54	10	158
CHIQUITA BRENDA	ZCBE9	Miami	57	59	55	49	220
CHIQUITA DEUTSCHLAND	C6KD8	Baltimore	36	60	70	72	238
CHIQUITA ELKESCHLAND	ZCBB9	Miami	51	53	60	63	227
CHIQUITA FRANCES	ZCBD9	Miami	25	44	69	31	169
CHIQUITA ITALIA	C6KD5	Baltimore	46	50	53	30	179
CHIQUITA JEAN	ZCBB7	Jacksonville	51	53	41	46	191
CHIQUITA JOY	ZCBC2	Miami	48	53	54	62	217
CHIQUITA NEDERLAND	C6KD6	Baltimore	40	57	70	42	209
CHIQUITA ROSTOCK	ZCBD2	Miami	40	40	39	44	163
CHIQUITA SCANDINAVIA	C6KD4	Baltimore	63	67	43	42	215
CHIQUITA SCHWEIZ	C6KD9	Baltimore	5	1	7	19	32
CHO YANG ATLAS	DQVH	Seattle	46	17	44	31	138
CHOYANG PHOENIX	P3ZY6	Norfolk	13	5	0	0	18
CITY OF DURBAN	GXIC	Long Beach	45	79	82	46	252
CLEVELAND	KGXA	Houston	47	16	17	8	88
COLORADO	KWFE	Miami	0	58	34	18	110
COLUMBIA STAR	WSB2018	Cleveland	1	8	3	0	12
COLUMBIA STAR	C6HL8	Long Beach	64	88	86	59	297
COLUMBINE	3ELQ9	Baltimore	44	26	35	67	172
COLUMBUS CALIFORNIA	ELUB7	Houston	0	40	58	60	158
COLUMBUS CANADA	ELQN3	Seattle	0	38	28	22	88
COLUMBUS CANTERBURY	ELUB8	Norfolk	59	32	31	59	181
COLUMBUS QUEENSLAND	ELUB9	Norfolk	29	31	18	65	143
COLUMBUS VICTORIA	ELUB6	Long Beach	24	28	19	22	93
CONDOLEEZZA RICE	C6OK	Baltimore	9	2	4	0	15
CONTSHIP ENDEAVOUR	ZCBE7	Houston	39	20	32	35	126
CONTSHIP SUCCESS	ZCBE3	Houston	86	79	70	112	347
COPACABANA	PPXI	Norfolk	27	0	0	0	27
CORAL SEA	C6YW	Miami	24	38	0	0	62
CORMORANT ARROW	C6IO9	Seattle	0	0	35	0	35
CORNUCOPIA	KPJC	Oakland	0	2	6	7	15
CORWITH CRAMER	WTF3319	Norfolk	0	15	14	8	37
COURTNEY BURTON	WE6970	Cleveland	38	37	17	25	117
COURTNEY L	ZCAQ8	Baltimore	13	29	21	25	88
CROWN OF SCANDINAVIA	OXRA6	Miami	80	87	79	65	311
CSL CABO	D5XH	Seattle	22	42	39	38	141
CSS HUDSON	CGDG	Norfolk	23	41	43	37	144
DAGMAR MAERSK	DHAF	New York City	33	33	29	49	144
DAISHIN MARU	3FPS6	Seattle	73	87	87	83	330
DANIA PORTLAND	OXEH2	Miami	94	54	7	10	165
DARYA PREETH	VRUX8	Long Beach	0	0	1	0	1
DAVID Z. NORTON	WZF9655	Cleveland	3	10	2	1	16
DAWN PRINCESS	ELTO4	Miami	0	15	8	4	27
DELAWARE BAY	WMLG	Houston	19	8	32	44	103
DENALI	WSVR	Long Beach	30	3	21	29	83
DIRECT CONDOR	ELWP7	Long Beach	40	38	33	43	154
DIRECT EAGLE	ELWY5	Long Beach	0	84	51	47	182
DIRECT KOOKABURRA	ELWB8	Long Beach	2	7	21	14	44
DOCK EXPRESS 20	PJRF	Baltimore	0	37	40	72	149
DON QUIJOTE	SFQP	New York City	7	2	0	6	15
DRAGOER MAERSK	OXPW2	Long Beach	16	1	42	17	76
DUHALLOW	ZCBH9	Baltimore	67	86	67	83	303
DUNCAN ISLAND	C6JS	Miami	26	44	12	45	127
DUSSELDORF EXPRESS	S6IG	Long Beach	256	594	434	435	1719
E.P. LE QUEBECOIS	CG3130	Norfolk	232	233	50	0	515
EAGLE BEAUMONT	S6JO	New York City	1	0	0	0	1
EASTERN BRIDGE	C6JY9	Baltimore	55	43	41	0	139

Continued on Page 95

Continued from Page 94

SHIP NAME	CALL	PORT	SEP	OCT	NOV	DEC	TOTAL
ECSTASY	ELNC5	Miami	12	19	19	23	73
EDELWEISS	VRUM3	Seattle	12	0	0	0	12
EDGAR B. SPEER	WQZ9670	Chicago	90	99	104	126	419
EDWIN H. GOTT	WXQ4511	Chicago	72	65	45	41	223
EDYTH L	C6YC	Baltimore	8	0	0	70	78
EL MORRO	KCGH	Miami	5	1	3	1	10
EL YUNQUE	WGJT	Jacksonville	51	41	42	28	162
ELATION	3FOC5	Miami	3	3	2	6	14
ENDEAVOR	WAUW	New York City	8	24	7	31	70
ENDURANCE	WAUU	New York City	37	8	7	42	94
ENERGY ENTERPRISE	WBJF	Baltimore	0	18	0	3	21
ENGLISH STAR	C6KU7	Long Beach	33	55	81	81	250
ENIF	9VVI	Houston	22	15	0	0	37
ENTERPRISE	WAUY	New York City	33	49	0	16	98
EVER DELIGHT	3FCB8	New York City	0	2	0	5	7
EVER DEVELOP	3FLF8	New York City	0	0	4	0	4
EVER DEVOTE	3FIF8	New York City	6	10	6	2	24
EVER DIADEM	3FOF8	New York City	0	5	0	3	8
EVER GAINING	BKJO	Norfolk	6	14	14	15	49
EVER GIFTED	BKHF	Long Beach	4	2	9	6	21
EVER GLOWING	BKJZ	Long Beach	6	15	0	0	21
EVER GOING	3EZW2	Seattle	14	0	0	0	14
EVER GUIDE	3EVJ2	Seattle	10	17	23	13	63
EVER LAUREL	BKHH	Long Beach	2	0	0	0	2
EVER LEVEL	BKHJ	Miami	11	8	11	11	41
EVER RESULT	3FSA4	Norfolk	6	0	0	14	20
EVER RIGHT	3FML3	Long Beach	0	4	3	5	12
EVER ROYAL	3FGI3	Long Beach	0	0	8	0	8
EVER ULTRA	3FEJ6	Seattle	7	8	13	14	42
EVER UNION	3FFG7	Seattle	21	21	26	19	87
EVER UNIQUE	3FXQ6	Seattle	18	14	7	0	39
EVER UNISON	3FTL6	Long Beach	12	10	7	5	34
EVER UNITED	3FMQ6	Seattle	8	9	3	1	21
FAIRLIFT	PEBM	Norfolk	58	29	6	17	110
FAIRMAST	PJLC	Norfolk	24	2	1	15	42
FANAL TRADER	VRUY4	Seattle	48	42	23	38	151
FANTASY	ELKI6	Miami	14	11	5	5	35
FARALLON ISLAND	FARIS	Oakland	144	103	72	0	319
FASCINATION	3EWK9	Miami	0	0	0	1	1
FAUST	WRYX	Jacksonville	25	31	37	46	139
FIDELIO	WQVY	Jacksonville	38	49	40	45	172
FIGARO	S6PI	Newark	0	0	33	24	57
FLAMENGO	PPXU	Norfolk	0	15	0	0	15
FRANCES HAMMER	KRGC	Jacksonville	15	39	19	8	81
FRANCES L	C6YE	Baltimore	19	13	10	15	57
FRANK A. SHRONTZ	C6PZ3	Oakland	14	30	12	22	78
FRANKFURT EXPRESS	9VPP	New York City	12	34	31	13	90
FRED R. WHITE JR	WAR7324	Cleveland	15	2	0	0	17
G AND C PARANA	LADC2	Long Beach	0	1	8	8	17
GALAXY ACE	VRUI2	Jacksonville	52	67	34	25	178
GALVESTON BAY	WPKD	Houston	45	50	45	51	191
GANNET ARROW	C6QF5	Seattle	0	6	11	0	17
GEETA	VRUL7	New Orleans	6	9	13	0	28
GEMINI	KHCF	New York City	0	0	7	37	44
GEORGE A. SLOAN	WA5307	Chicago	28	20	14	28	90
GEORGE A. STINSON	WCX2417	Cleveland	8	24	30	9	71
GEORGE SCHULTZ	ELPG9	Baltimore	45	20	0	0	65
GEORGE WASHINGTON BRIDGE	JKCF	Long Beach	54	37	77	43	211
GEORGIA RAINBOW II	VRVS5	Jacksonville	66	37	70	31	204
GINGA MARU	JFKC	Long Beach	0	0	72	77	149
GLOBAL LINK	WWDY	Baltimore	0	5	35	10	50
GLOBAL MARINER	WWXA	Baltimore	0	0	14	12	26
GLOBAL NEXTAGE	XYLV	Seattle	11	0	0	0	11
GLORIOUS SUCCESS	DUHN	Seattle	12	2	40	35	89
GOLDEN BELL	3EBK9	Seattle	16	9	14	24	63
GOLDEN GATE	KIOH	Long Beach	75	68	53	73	269
GOLDEN GATE BRIDGE	3FWM4	Seattle	79	74	76	89	318
GRANDEUR OF THE SEAS	ELTQ9	Miami	17	15	6	0	38
GREAT LAND	WFDP	Seattle	28	21	11	0	60
GREEN BAY	KGTH	Long Beach	27	34	18	27	106

Continued on Page 96

Continued from Page 95

SHIP NAME	CALL	PORT	SEP	OCT	NOV	DEC	TOTAL
GREEN ISLAND	KIBK	New Orleans	0	28	5	12	45
GREEN LAKE	KGTI	Baltimore	10	0	35	87	132
GRETE MAERSK	OZNF2	New York City	7	35	24	21	87
GROTON	KMJL	Newark	0	7	2	0	9
GUANAJUATO	ELMH8	Jacksonville	21	31	29	18	99
GUAYAMA	WZJG	Jacksonville	23	0	10	19	52
HADERA	ELBX4	Baltimore	31	52	53	32	168
HANJIN BARCELONA	3EXX9	Long Beach	0	0	0	1	1
HANJIN KAOHSIUNG	P3BN8	Seattle	8	0	0	0	8
HANJIN KEELUNG	P3VH7	Houston	43	4	13	2	62
HANJIN NAGOYA	3FJW8	New York City	0	0	13	14	27
HANJIN OSAKA	3EQD9	New York City	0	5	11	0	16
HANSA CALADONIA	DHFN	Norfolk	59	58	36	0	153
HEICON	P3TA4	Norfolk	0	17	19	7	43
HEIDELBERG EXPRESS	DEDI	Houston	687	297	597	640	2221
HENRY HUDSON BRIDGE	JKLS	Long Beach	43	58	62	55	218
HERBERT C. JACKSON	WL3972	Cleveland	15	6	2	0	23
HOEGH DENE	ELWO7	Norfolk	48	0	11	27	86
HOEGH DUKE	ELWP2	Norfolk	0	29	0	21	50
HOEGH MINERVA	LAGI5	Seattle	0	1	0	0	1
HOLIDAY	3FPN5	Long Beach	6	6	4	0	16
HONG KONG SENATOR	DEIP	Seattle	23	22	4	32	81
HONSHU SILVIA	3EST7	Seattle	8	7	24	41	80
HOOD ISLAND	C6LU4	Miami	19	3	14	35	71
HORIZON	ELNG6	Miami	27	50	13	0	90
HOUSTON EXPRESS	3FQT9	Houston	0	0	0	25	25
HUMACAO	WZJB	Norfolk	25	22	22	37	106
HUMBERGRACHT	PEUQ	Houston	7	27	47	39	120
HUME HIGHWAY	3EJO6	Jacksonville	23	35	26	22	106
HYUNDAI DISCOVERY	3FFR6	Seattle	29	25	39	31	124
HYUNDAI EXPLORER	3FTG4	Seattle	48	39	37	32	156
HYUNDAI FORTUNE	3FLG6	Seattle	7	0	1	0	8
HYUNDAI FREEDOM	3FFS6	Seattle	23	15	25	27	90
HYUNDAI INDEPENDENCE	3FDY6	Seattle	1	17	5	6	29
HYUNDAI LIBERTY	3FFT6	Seattle	10	8	10	10	38
IMAGINATION	3EWJ9	Miami	0	15	9	8	32
INDIAN OCEAN	C6T2063	New York City	13	0	13	21	47
INDIANA HARBOR	WXN3191	Cleveland	27	32	54	17	130
INLAND SEAS	WCJ6214	Chicago	10	1	0	0	11
INSPIRATION	3FOA5	Miami	15	4	2	3	24
IRENA ARCTICA	OXTS2	Miami	82	55	77	83	297
ISLA DE CEDROS	3FOA6	Seattle	27	61	76	30	194
ITB BALTIMORE	WXKM	Baltimore	5	16	5	0	26
ITB MOBILE	KXDB	New York City	33	8	0	0	41
ITB NEW YORK	WVDG	Newark	2	0	5	0	7
IVARAN CONDOR	DGGD	Houston	60	29	25	42	156
IVARAN EAGLE	DNEN	Houston	30	47	16	32	125
IVARAN RAVEN	DIGF	Houston	3	44	47	41	135
IVER EXPLORER	PEXV	Houston	0	0	16	3	19
IWANUMA MARU	3ESU8	Seattle	35	102	69	84	290
J. DENNIS BONNEY	ELLE2	Baltimore	0	7	16	0	23
J.A.W. IGLEHART	WTP4966	Cleveland	4	4	0	19	27
JACKLYN M.	WCV7620	Chicago	5	7	1	11	24
JACKSONVILLE	WNDG	Baltimore	47	36	11	19	113
JADE ORIENT	ELRY6	Seattle	8	3	9	0	20
JADE PACIFIC	ELRY5	Seattle	11	5	8	21	45
JAMES	ELRR6	New Orleans	39	26	32	36	133
JEB STUART	WRGQ	Oakland	6	0	0	82	88
JO CLIPPER	PFEZ	Baltimore	99	65	43	57	264
JOHN G. MUNSON	WE3806	Chicago	41	26	14	29	110
JOHN J. BOLAND	WF2560	Cleveland	0	0	0	1	1
JOSEPH H. FRANTZ	WA6575	Cleveland	5	0	0	0	5
JOSEPH L. BLOCK	WXY6216	Chicago	4	8	5	6	23
JOSEPH LYKES	ELRZ8	Houston	30	27	39	52	148
JUBILEE	3FPM5	Long Beach	16	24	35	51	126
JULIUS HAMMER	KRGJ	Jacksonville	6	12	14	35	67
JUSTINE FOSS	WYL4978	Seattle	0	0	1	2	3
KANIN	ELEO2	New Orleans	20	25	0	23	68
KAPITAN BYANKIN	UAGK	Seattle	49	40	42	40	171
KAPITAN KONEV	UAHV	Seattle	24	40	46	46	156

Continued on Page 97

Continued from Page 96

SHIP NAME	CALL	PORT	SEP	OCT	NOV	DEC	TOTAL
KAPITAN MASLOV	UBRO	Seattle	39	30	0	19	88
KAREN ANDRIE	WBS5272	Chicago	17	18	10	6	51
KAREN MAERSK	OZKN2	Seattle	0	0	46	0	46
KATRINE MAERSK	OZLL2	New York City	13	0	9	27	49
KAUAI	WSRH	Long Beach	7	15	13	14	49
KAYE E. BARKER	WCF3012	Cleveland	16	15	7	4	42
KAZIMAH	9KKL	Houston	56	37	67	54	214
KEN SHIN	YJQS2	Seattle	32	26	18	17	93
KEN YO	3FIC5	Seattle	0	20	27	9	56
KENAI	WSNB	Houston	4	2	11	9	26
KENNETH E. HILL	C6FA6	Newark	32	9	8	16	65
KENNETH T. DERR	C6FA3	Newark	20	13	10	30	73
KENTUCKY HIGHWAY	JKPP	Norfolk	21	21	24	20	86
KINSMAN INDEPENDENT	WUZ7811	Cleveland	71	49	46	27	193
KIWI ARROW	C6HU6	Houston	8	0	0	0	8
KNOCK ALLAN	ELOI6	Houston	14	53	101	11	179
KNUD MAERSK	OYBJ2	New York City	0	0	19	27	46
KOELN EXPRESS	9VBL	New York City	0	77	39	54	170
KRISTEN MAERSK	OYDM2	Seattle	12	0	0	9	21
KURE	3FGN3	Seattle	26	20	21	22	89
LEONARD J. COWLEY	CG2959	Norfolk	0	0	29	30	59
LEOPARDI	V7AU8	Baltimore	19	10	2	0	31
LIBERTY SEA	KPZH	New Orleans	17	0	0	0	17
LIBERTY SPIRIT	WCPU	New Orleans	18	1	0	44	63
LIBERTY STAR	WCBP	New Orleans	24	0	9	0	33
LIBERTY SUN	WCOB	Houston	45	10	20	30	105
LIHUE	WTST	Seattle	29	23	44	36	132
LILAC ACE	3FDL4	Long Beach	15	36	12	78	141
LNG AQUARIUS	WSKJ	Oakland	34	30	38	33	135
LNG CAPRICORN	KHLN	New York City	16	17	15	20	68
LNG LEO	WDZB	New York City	41	35	34	40	150
LNG LIBRA	WDZG	New York City	13	12	26	43	94
LNG TAURUS	WDZW	New York City	7	14	25	22	68
LNG VIRGO	WDZX	New York City	0	35	43	13	91
LOK PRAGATI	ATZS	Seattle	29	9	10	33	81
LONG BEACH	3FOU3	Seattle	44	0	0	0	44
LOOTSGRACHT	PFPT	Houston	59	32	31	34	156
LOUIS MAERSK	OXMA2	Baltimore	24	4	1	0	29
LTC CALVIN P. TITUS	KAKG	Baltimore	18	1	0	6	25
LUISE OLDENDORFF	3FOW4	Seattle	0	0	6	37	43
LURLINE	WLVD	Oakland	14	21	29	34	98
LUTJENBURG	ELVF6	Long Beach	0	0	7	0	7
LYKES CHALLANGER	FNHV	Houston	55	54	37	60	206
LYKES COMMANDER	3ELF9	Baltimore	24	20	50	68	162
LYKES DISCOVERER	WGXO	Houston	34	77	63	65	239
LYKES EXPLORER	WGLA	Houston	17	21	37	34	109
LYKES HAWK	ELVB6	Houston	18	16	32	36	102
LYKES LIBERATOR	WGXN	Houston	20	49	39	48	156
LYKES NAVIGATOR	WGMJ	Houston	26	29	26	17	98
LYKES PATHFINDER	3EJT9	Baltimore	1	34	0	0	35
M/V SP5. ERIC G. GIBSON	KAKF	Baltimore	19	12	0	0	31
MAASDAM	PFRO	Miami	9	1	23	0	33
MACKINAC BRIDGE	JKES	Long Beach	72	64	48	108	292
MADISON MAERSK	OVJB2	Oakland	41	13	29	20	103
MAERSK CALIFORNIA	WCX5083	Miami	36	28	0	0	64
MAERSK COLORADO	WCX5081	Miami	0	13	3	0	16
MAERSK GANNET	GJLK	Miami	3	0	0	0	3
MAERSK GIANT	OU2465	Miami	224	244	238	240	946
MAERSK SCOTLAND	MXAR9	Houston	12	12	25	34	83
MAERSK SEA	S6CW	Seattle	67	54	64	78	263
MAERSK SHETLAND	MSQK3	Miami	54	48	25	17	144
MAERSK SOMERSET	MQVF8	New Orleans	46	46	51	67	210
MAERSK STAFFORD	MRSS9	New Orleans	44	42	52	4	142
MAERSK SUN	S6ES	Seattle	0	11	0	0	11
MAERSK SURREY	MRSG8	Houston	47	49	19	13	128
MAERSK TAIKI	9VIG	Baltimore	0	0	0	8	8
MAERSK TENNESSEE	WCX3486	Miami	39	38	46	34	157
MAERSK TEXAS	WCX3249	Miami	51	9	13	17	90
MAGLEBY MAERSK	OUSH2	Newark	0	1	5	3	9
MAHARASHTRA	VTSQ	Seattle	0	0	1	0	1
MAHIMAHI	WHRN	Oakland	42	48	72	33	195

Continued on Page 98

Continued from Page 97

SHIP NAME	CALL	PORT	SEP	OCT	NOV	DEC	TOTAL
MAIRANGI BAY	GXEW	Long Beach	35	57	75	64	231
MAJESTY OF THE SEAS	LAOI4	Miami	15	59	35	13	122
MANHATTAN BRIDGE	3FWL4	Long Beach	58	76	41	55	230
MANOA	KDBG	Oakland	53	61	23	41	178
MANUKAI	KNLO	Oakland	0	6	17	5	28
MARCHEN MAERSK	OWDQ2	Long Beach	27	15	12	16	70
MAREN MAERSK	OWZU2	Long Beach	3	15	23	18	59
MARGRETHE MAERSK	OYSN2	Long Beach	23	17	0	7	47
MARIE MAERSK	OULL2	Newark	9	19	18	20	66
MARINE CHEMIST	KMCB	Houston	11	0	8	38	57
MARINE COLUMBIA	KLKZ	Oakland	8	0	0	0	8
MARIT MAERSK	OZFC2	Miami	15	6	5	9	35
MARK HANNAH	WYZ5243	Chicago	11	26	13	17	67
MATHILDE MAERSK	OUUU2	Long Beach	22	18	23	14	77
MATSONIA	KHRC	Oakland	6	12	27	50	95
MAUI	WSLH	Long Beach	49	37	56	46	188
MAURICE EWING	WLDZ	Newark	45	27	29	45	146
MAYAGUEZ	WZJE	Jacksonville	31	21	12	26	90
MAYVIEW MAERSK	OWEB2	Oakland	12	27	24	18	81
MC-KINNEY MAERSK	OUZW2	Newark	25	7	25	15	72
MEDUSA CHALLENGER	WA4659	Cleveland	67	80	66	100	313
MEKHANIK KALYUZHNIY	UFLO	Seattle	42	12	29	39	122
MEKHANIK MOLDOVANOV	UIKI	Seattle	29	38	59	82	208
MELBOURNE STAR	C6JY6	Newark	55	14	0	0	69
MELVILLE	WECB	Long Beach	48	65	65	1	179
MERCURY ACE	JFMO	Norfolk	25	0	0	15	40
MESABI MINER	WYQ4356	Cleveland	31	60	30	86	207
METEOR	DBBH	Houston	70	657	663	656	2046
METTE MAERSK	OXKT2	Long Beach	14	9	15	36	74
MICHIGAN	WRB4141	Chicago	21	2	22	2	47
MIDDLETOWN	WR3225	Cleveland	17	24	13	0	54
MING ASIA	BDEA	New York City	22	20	21	32	95
MING PEACE	ELVR9	Long Beach	0	0	0	1	1
MOKIHANA	WNRD	Oakland	39	4	33	36	112
MOKU PAHU	WBWK	Oakland	47	50	42	19	158
MORELOS	PGBB	Houston	32	47	55	34	168
MORMACSKY	WMBQ	New York City	25	3	1	15	44
MORMACSTAR	KGDF	Houston	25	7	14	24	70
MORMACSUN	WMBK	Norfolk	31	49	34	24	138
MOSEL ORE	ELRE5	Norfolk	0	0	37	58	95
MSC BOSTON	9HGP4	New York City	45	60	36	67	208
MSC GINA	C4LV	New York City	33	34	30	0	97
MSC NEW YORK	9HIG4	New York City	28	42	56	53	179
MV CONTSHIP ROME	ELVZ6	Norfolk	23	57	38	19	137
MV MIRANDA	3FRO4	Norfolk	0	10	51	0	61
MYRON C. TAYLOR	WA8463	Chicago	13	12	0	3	28
MYSTIC	PCCQ	Long Beach	72	33	41	62	208
NADA II	ELAV2	Seattle	14	0	0	0	14
NAJA ARCTICA	OXVH2	Miami	107	98	133	58	396
NATHANIEL B. PALMER	WBP3210	Seattle	14	0	0	27	41
NATIONAL DIGNITY	DZRG	Long Beach	12	4	0	0	16
NEDLLOYD HOLLAND	KRHX	Houston	48	43	53	48	192
NEDLLOYD MONTEVIDEO	PGAF	Long Beach	65	47	0	28	140
NEDLLOYD RALEIGH BAY	PHKG	Houston	9	16	27	36	88
NELVANA	YJWZ7	Baltimore	3	0	6	8	17
NEPTUNE ACE	JFLX	Long Beach	0	22	3	0	25
NEPTUNE RHODONITE	ELJP4	Long Beach	20	6	27	0	53
NEW HORIZON	WKWB	Long Beach	14	38	13	0	65
NEW NIKKI	3FHG5	Seattle	64	11	44	42	161
NEWARK BAY	WPKS	Houston	86	75	54	65	280
NIEUW AMSTERDAM	PGGQ	Long Beach	13	45	28	14	100
NOAA DAVID STARR JORDAN	WTDK	Seattle	65	30	71	24	190
NOAA SHIP ALBATROSS IV	WMVF	Norfolk	31	96	73	0	200
NOAA SHIP DELAWARE II	KNBD	New York City	93	55	0	0	148
NOAA SHIP FERREL	WTEZ	Norfolk	38	24	10	0	72
NOAA SHIP KA'IMIMOANA	WTEU	Seattle	232	62	161	52	507
NOAA SHIP MCARTHUR	WTEJ	Seattle	198	151	174	62	585
NOAA SHIP MILLER FREEMAN	WTDM	Seattle	161	113	106	0	380
NOAA SHIP OREGON II	WTDO	New Orleans	130	82	90	0	302
NOAA SHIP RAINIER	WTEF	Seattle	82	79	5	0	166
NOAA SHIP RONALD H BROWN	WTEC	New Orleans	83	99	91	27	300

Continued on Page 99

Continued from Page 98

SHIP NAME	CALL	PORT	SEP	OCT	NOV	DEC	TOTAL
NOAA SHIP T. CROMWELL	WTDF	Seattle	30	70	12	37	149
NOAA SHIP WHITING	WTEW	Baltimore	6	26	13	0	45
NOAAS GORDON GUNTER	WTEO	New Orleans	39	41	21	23	124
NOBEL STAR	KRPP	Houston	14	8	25	38	85
NOL AMAZONITE	9VBX	Long Beach	0	1	0	0	1
NOL DIAMOND	9VYT	Long Beach	4	0	0	0	4
NOL STENO	ZCBD4	New York City	42	44	43	46	175
NOLIZWE	MQLN7	New York City	55	48	36	62	201
NOMZI	MTQU3	Baltimore	70	59	42	43	214
NOORDAM	PGHT	Miami	25	24	31	19	99
NORASIA SHANGHAI	DNHS	New York City	18	8	4	14	44
NORD JAHRE TRANSPORTER	LACF4	Baltimore	4	10	8	4	26
NORDMAX	P3YS5	Seattle	82	43	72	22	219
NORDMORITZ	P3YR5	Seattle	57	78	24	62	221
NORTHERN LIGHTS	WFJK	New Orleans	85	47	64	57	253
NORWAY	C6CM7	Miami	14	1	0	3	18
NORWEGIAN WIND	C6LG6	Miami	0	0	1	0	1
NOSAC YOHJIN	3FCR5	New York City	0	0	0	1	1
NTABENI	3EGR6	Houston	63	22	41	73	199
NUERNBERG EXPRESS	9VBK	Houston	712	724	703	723	2862
NYK SEABREEZE	ELNJ3	Seattle	57	31	40	51	179
NYK SPRINGTIDE	S6CZ	Seattle	9	11	8	16	44
NYK STARLIGHT	3FUX6	Long Beach	47	39	46	32	164
NYK SURFWIND	ELOT3	Seattle	0	3	2	3	8
OCEAN CAMELLIA	3FTR6	Seattle	0	0	0	17	17
OCEAN CITY	WCYR	Houston	34	39	24	7	104
OCEAN CLIPPER	3EXI7	New Orleans	0	0	5	60	65
OCEAN PALM	3FDO7	Seattle	72	40	73	76	261
OCEAN SERENE	DURY	Seattle	1	0	0	0	1
OCEAN SPIRIT	ELKI8	Seattle	11	0	0	0	11
OCEANBREEZE	ELLY4	Miami	45	27	22	21	115
OGLEBAY NORTON	WAQ3521	Cleveland	3	11	33	25	72
OLEANDER	PJJU	Newark	8	0	4	0	12
OLYMPIAN HIGHWAY	3FSH4	Seattle	5	21	24	30	80
OOCL AMERICA	ELSM7	Oakland	39	42	30	1	112
OOCL CALIFORNIA	ELSA4	Seattle	24	26	0	0	50
OOCL CHINA	ELSU8	Long Beach	22	34	5	0	61
OOCL FAIR	ELFV2	Long Beach	27	0	0	0	27
OOCL FAIR	VRWB8	Long Beach	0	0	13	19	32
OOCL FAITH	ELFU9	Norfolk	32	24	27	37	120
OOCL FIDELITY	ELFV8	Long Beach	28	37	42	13	120
OOCL FORTUNE	ELFU8	Norfolk	18	11	19	1	49
OOCL FREEDOM	VRCV	Norfolk	51	56	41	27	175
OOCL FRIENDSHIP	ELFV3	Long Beach	34	16	0	0	50
OOCL HONG KONG	VRVA5	Oakland	35	26	36	37	134
OOCL INNOVATION	WPWH	Houston	36	28	48	28	140
OOCL INSPIRATION	KRPB	Houston	59	48	46	68	221
OOCL JAPAN	ELSU6	Long Beach	57	0	0	0	57
ORIANA	GVSN	Miami	41	45	71	50	207
ORIENTAL ROAD	3FXT6	Houston	59	20	33	0	112
ORIENTE GRACE	3FHT4	Seattle	13	34	5	31	83
ORIENTE HOPE	3ETH4	Seattle	10	13	18	12	53
ORIENTE NOBLE	3FVF5	Seattle	49	26	0	19	94
ORIENTE VICTORIA	3FVG8	Seattle	8	13	4	0	25
OVERSEAS JOYCE	WUQL	Jacksonville	44	43	55	51	193
OVERSEAS MARILYN	WFQB	Houston	0	38	3	16	57
OVERSEAS NEW ORLEANS	WFKW	Houston	36	43	26	12	117
OVERSEAS NEW YORK	WMCK	Houston	15	8	5	13	41
OVERSEAS OHIO	WJBG	Oakland	23	11	7	16	57
OVERSEAS PHILADELPHIA	WGDB	Houston	5	0	0	15	20
OVERSEAS WASHINGTON	WFGV	Houston	7	19	17	15	58
P & O NEDLLOYD BUENOS AI	PGEC	Houston	6	20	8	27	61
P & O NEDLLOYD VERA CRUZ	PGFE	Houston	2	11	21	22	56
P&O NEDLLOYD CHILE	DVRA	New York City	9	3	7	0	19
P&O NEDLLOYD HOUSTON	PGEB	Houston	30	22	21	36	109
P&O NEDLLOYD LOS ANGELES	PGDW	Long Beach	27	34	20	23	104
P&O NEDLLOYD TEXAS	ZCBF6	Houston	71	62	56	50	239
PACDREAM	ELQO6	Seattle	12	20	4	2	38
PACDUKE	A8SL	Seattle	7	14	11	9	41
PACIFIC HIRO	3FOY5	Seattle	0	0	0	28	28
PACIFIC SENATOR	ELTY6	Long Beach	2	22	0	0	24

Continued on Page 100

Continued from Page 99

SHIP NAME	CALL	PORT	SEP	OCT	NOV	DEC	TOTAL
PACKING	ELBX3	Seattle	16	5	7	16	44
PACOCEAN	ELJE3	Seattle	25	28	28	25	106
PACPRINCE	ELED7	Seattle	4	13	5	9	31
PACPRINCESS	ELED8	Houston	0	15	15	0	30
PACROSE	YJQK2	Seattle	2	0	0	0	2
PATRIOT	KGBQ	Houston	6	0	0	18	24
PAUL BUCK	KDGR	Houston	0	3	21	5	29
PAUL R. TREGURTHA	WYR4481	Cleveland	11	15	26	28	80
PEARL ACE	VRUN4	Seattle	72	33	88	36	229
PEGGY DOW	PJOY	Long Beach	0	0	0	1	1
PFC DEWAYNE T. WILLIAMS	WJKJ	Norfolk	0	0	0	1	1
PFC EUGENE A. OBREGON	WHAQ	Norfolk	0	4	9	12	25
PFC WILLIAM B. BAUGH	KRPW	Norfolk	9	13	3	3	28
PHILADELPHIA	KSYP	Baltimore	0	0	0	27	27
PHILIP R. CLARKE	WE3592	Chicago	25	49	77	59	210
PIERRE FORTIN	CG2678	Norfolk	212	197	42	0	451
PINO GLORIA	3EZW7	Seattle	3	0	16	11	30
PISCES EXPLORER	MWQD5	Long Beach	45	79	47	52	223
POLYNESIA	D5NZ	Long Beach	62	78	69	67	276
POTOMAC TRADER	WXBZ	Houston	54	51	50	57	212
PRESIDENT ADAMS	WRYW	Oakland	49	40	43	64	196
PRESIDENT GRANT	WCY2098	Long Beach	55	42	25	47	169
PRESIDENT HOOVER	WCY2883	Houston	38	38	4	0	80
PRESIDENT JACKSON	WRYC	Oakland	31	42	56	63	192
PRESIDENT KENNEDY	WRYE	Oakland	57	67	80	66	270
PRESIDENT POLK	WRYD	Oakland	64	65	62	82	273
PRESIDENT TRUMAN	WNDP	Oakland	52	50	46	54	202
PRESIDENT WILSON	WCY3438	Long Beach	34	15	0	0	49
PRESQUE ISLE	WZE4928	Chicago	25	29	53	53	160
PRIDE OF BALTIMORE II	WUW2120	Baltimore	21	18	8	3	50
PRINCE OF OCEAN	3ECO9	Seattle	25	69	69	0	163
PRINCE WILLIAM SOUND	WSDX	Long Beach	1	0	0	0	1
PRINCESS OF SCANDINAVIA	OWEN2	Miami	89	47	0	0	136
PROJECT ARABIA	PJKP	Miami	57	6	0	0	63
PROJECT ORIENT	PJAG	Baltimore	29	71	25	93	218
PUDONG SENATOR	DQVI	Seattle	5	57	8	73	143
PUSAN SENATOR	DQVG	Seattle	37	46	22	37	142
QUEEN ELIZABETH 2	GBTT	New York City	61	56	25	35	177
QUEEN OF SCANDINAVIA	OUSE6	Miami	47	47	47	49	190
QUEENSLAND STAR	C6JZ3	Houston	45	69	15	0	129
R. HAL DEAN	C6JN	Long Beach	0	2	2	34	38
R.J. PFEIFFER	WRJP	Long Beach	1	1	0	14	16
RAINBOW BRIDGE	3EYX9	Long Beach	79	49	65	87	280
RANI PADMINI	ATSR	Norfolk	0	0	0	1	1
REBECCA LYNN	WCW7977	Chicago	8	0	0	0	8
REPULSE BAY	MQYA3	Houston	9	0	8	0	17
RESERVE	WE7207	Cleveland	0	25	3	5	33
RESOLUTE	KFDZ	Norfolk	47	43	24	65	179
RHAPSODY OF THE SEAS	LAZK4	Miami	1	0	0	1	2
RICHARD G MATTHIESEN	WLBV	Jacksonville	0	0	0	6	6
RICHARD REISS	WBF2376	Cleveland	14	16	7	1	38
RIO APURE	ELUG7	Miami	29	32	38	13	112
ROBERT E. LEE	KCRD	New Orleans	0	13	15	0	28
ROGER BLOUGH	WZP8164	Chicago	0	61	45	56	162
ROGER REVELLE	KAOU	New Orleans	0	4	0	0	4
ROYAL PRINCESS	GBRP	Long Beach	20	10	14	44	88
RUBIN BONANZA	3FNV5	Seattle	0	30	32	6	68
RUBIN KOBE	DYZM	Seattle	86	42	72	76	276
RUBIN PEARL	YJQA8	Seattle	59	40	49	30	178
SAGA CREST	LATH4	Miami	24	17	1	8	50
SALLY MAERSK	OZHS2	Seattle	21	5	0	0	26
SALOME	S6CL	Newark	7	30	14	27	78
SAM HOUSTON	KDGA	Houston	0	29	2	0	31
SAMUEL RISLEY	CG2960	Norfolk	116	37	114	188	455
SAN ISIDRO	ELVG8	Norfolk	52	33	20	36	141
SAN MARCOS	ELND4	Jacksonville	8	39	39	29	115
SANDRA FOSS	WYL4908	Seattle	0	2	0	0	2
SANTA CHRISTINA	3FAE6	Seattle	12	5	18	5	40
SC BREEZE	ELOC6	New York City	41	33	18	11	103
SC HORIZON	ELOC8	New York City	11	9	1	2	23
SCHACKENBORG	OYUY4	Houston	9	4	12	6	31

Continued on Page 101

Continued from Page 100

SHIP NAME	CALL	PORT	SEP	OCT	NOV	DEC	TOTAL
SEA COMMERCE	ELGH7	Miami	0	0	0	34	34
SEA FOX	KBGK	Jacksonville	6	0	0	6	12
SEA INITIATIVE	DEBB	Houston	50	60	37	7	154
SEA LION	KJLV	Jacksonville	1	0	0	0	1
SEA LYNX	DGOO	Jacksonville	39	21	0	1	61
SEA MARINER	J8FF9	Miami	26	2	34	52	114
SEA NOVIA	ELRV2	Miami	0	0	1	0	1
SEA PRINCESS	KRCP	New Orleans	40	13	26	28	107
SEA RACER	ELQI8	Jacksonville	66	65	56	45	232
SEA WISDOM	3FUO6	Seattle	43	14	55	52	164
SEA-LAND CHARGER	V7AY2	Long Beach	64	18	23	52	157
SEA-LAND EAGLE	V7AZ8	Long Beach	9	53	15	18	95
SEA/LAND VICTORY	DIDY	New York City	38	35	27	25	125
SEABOARD FLORIDA	3FBW5	Miami	12	12	11	4	39
SEABOARD UNIVERSE	ELRU3	Miami	2	0	14	22	38
SEALAND ANCHORAGE	KGTX	Seattle	51	42	76	66	235
SEALAND ATLANTIC	KRLZ	Norfolk	10	22	34	43	109
SEALAND CHALLENGER	WZJC	Newark	1	16	8	7	32
SEALAND CHAMPION	V7AM9	Oakland	33	26	34	37	130
SEALAND COMET	V7AP3	Oakland	40	6	39	32	117
SEALAND CONSUMER	WCHF	Houston	54	61	63	35	213
SEALAND CRUSADER	WZJF	Jacksonville	82	65	69	65	281
SEALAND DEFENDER	KGJB	Oakland	36	31	42	38	147
SEALAND DEVELOPER	KHRH	Long Beach	32	32	37	38	139
SEALAND DISCOVERY	WZJD	Jacksonville	56	49	47	65	217
SEALAND ENDURANCE	KGJX	Long Beach	16	28	28	33	105
SEALAND ENTERPRISE	KRGB	Oakland	59	63	54	36	212
SEALAND EXPEDITION	WPGJ	Jacksonville	50	40	44	51	185
SEALAND EXPLORER	WGJF	Long Beach	52	38	33	33	156
SEALAND EXPRESS	KGJD	Long Beach	21	25	36	17	99
SEALAND FREEDOM	V7AM3	Houston	16	43	35	57	151
SEALAND HAWAII	KIRF	Seattle	7	7	10	39	63
SEALAND HONDURAS	OUQP2	Miami	26	27	37	43	133
SEALAND INDEPENDENCE	WGJC	Long Beach	46	30	56	46	178
SEALAND INNOVATOR	WGKF	Oakland	21	8	40	0	69
SEALAND INTEGRITY	WPVD	Norfolk	39	34	100	130	303
SEALAND INTREPID	V7BA2	Norfolk	21	62	0	31	114
SEALAND KODIAK	KGTZ	Seattle	32	42	51	39	164
SEALAND LIBERATOR	KHRP	Oakland	6	37	37	20	100
SEALAND MARINER	V7AM5	Houston	30	19	20	31	100
SEALAND MERCURY	V7AP6	Oakland	15	42	20	14	91
SEALAND METEOR	V7AP7	Long Beach	17	21	54	13	105
SEALAND NAVIGATOR	WPGK	Long Beach	66	65	71	77	279
SEALAND PACIFIC	WSRL	Long Beach	34	36	44	67	181
SEALAND PATRIOT	KHRF	Oakland	17	19	30	53	119
SEALAND PERFORMANCE	KRPD	Houston	50	60	55	44	209
SEALAND PRODUCER	WJBJ	Long Beach	49	65	61	67	242
SEALAND QUALITY	KRNJ	Jacksonville	35	42	32	35	144
SEALAND RACER	V7AP8	Long Beach	29	38	16	42	125
SEALAND RELIANCE	WFLH	Long Beach	62	73	72	74	281
SEALAND SPIRIT	WFLG	Oakland	40	45	30	47	162
SEALAND TACOMA	KGTY	Seattle	26	29	45	48	148
SEALAND TRADER	KIRH	Oakland	49	66	58	50	223
SEALAND VOYAGER	KHRK	Long Beach	60	65	54	51	230
SEARIVER BATON ROUGE	WAFA	Oakland	0	0	2	0	2
SEARIVER BAYTOWN	KFPM	Oakland	0	0	5	5	10
SEARIVER NORTH SLOPE	KHLQ	Oakland	8	5	17	15	45
SENSATION	3ESE9	Miami	1	1	0	0	2
SETO BRIDGE	JMQY	Oakland	44	58	52	63	217
SEVEN OCEAN	3EZB8	Seattle	19	10	0	0	29
SEWARD JOHNSON	WST9756	Miami	0	21	1	4	26
SHIRAOI MARU	3ECM7	Seattle	100	133	111	103	447
SIDNEY FOSS	WYL5445	Seattle	0	3	7	0	10
SIDNEY STAR	C6JY7	Houston	61	40	8	0	109
SINGA STAR	9VNF	Seattle	0	53	43	0	96
SKAGEN MAERSK	OYOS2	Seattle	0	2	13	0	15
SKAUBRYN	LAJV4	Seattle	40	15	31	3	89
SKAUGRAN	LADB2	Seattle	7	1	0	19	27
SKODSBORG	OYRJ4	Houston	0	0	0	31	31
SKOGAFOSS	V2QT	Norfolk	0	0	0	1	1
SNOW CRYSTAL	C6ID8	New York City	10	0	22	85	117

Continued on Page 102

Continued from Page 101

SHIP NAME	CALL	PORT	SEP	OCT	NOV	DEC	TOTAL
SOL DO BRASIL	ELQQ4	Baltimore	59	20	30	53	162
SOLAR WING	ELJS7	Jacksonville	77	91	82	82	332
SOROE MAERSK	OYKJ2	Seattle	0	35	0	0	35
SOUTH FORTUNE	3FJC6	Seattle	17	0	0	25	42
SOVEREIGN MAERSK	OYGA2	Seattle	0	30	19	0	49
SPLENDOUR OF THE SEAS	LAUS4	Miami	0	5	46	32	83
ST BLAIZE	J8FO	Norfolk	31	34	17	11	93
STACEY FOSS	WYL4909	Seattle	0	0	8	0	8
STAR ALABAMA	LAVU4	Baltimore	26	31	21	15	93
STAR AMERICA	LAVV4	Jacksonville	27	18	65	32	142
STAR DOVER	LAEP4	Seattle	15	10	32	33	90
STAR EVVIVA	LAHE2	Jacksonville	16	5	8	22	51
STAR FUJI	LAVX4	Seattle	30	29	11	28	98
STAR GEIRANGER	LAKQ5	Norfolk	49	19	11	24	103
STAR GRAN	LADR4	Long Beach	28	0	12	42	82
STAR GRINDANGER	LAKR5	Norfolk	0	0	43	27	70
STAR HANSA	LAXP4	Jacksonville	11	46	15	42	114
STAR HARDANGER	LAXD4	Baltimore	5	6	8	3	22
STAR HARMONIA	LAGB5	Baltimore	16	39	25	46	126
STAR HERDLA	LAVD4	Baltimore	28	16	20	16	80
STAR HOYANGER	LAXG4	Baltimore	0	7	0	66	73
STAR SKARVEN	LAJY2	Miami	21	35	15	30	101
STAR TRONDANGER	LAQQ2	Baltimore	13	12	10	12	47
STATENDAM	PHSG	Miami	0	27	10	28	65
STELLAR IMAGE	3FDO6	Seattle	0	0	24	32	56
STELLAR KOHINOOR	3FFG8	Seattle	19	25	16	0	60
STENA CLIPPER	C6MX4	Miami	71	53	35	34	193
STEPHAN J	V2JN	Miami	121	113	131	106	471
STEWART J. CORT	WYZ3931	Chicago	61	56	65	59	241
STONEWALL JACKSON	KDDW	New Orleans	10	0	11	14	35
STRONG CAJUN	KALK	Norfolk	10	5	12	2	29
SUGAR ISLANDER	KCKB	Houston	27	13	1	5	46
SUMMER BREEZE	ZCBB4	Miami	1	1	0	0	2
SUN ACE	3EMJ6	Seattle	21	3	16	5	45
SUN DANCE	3ETQ8	Seattle	9	19	20	22	70
SUNBELT DIXIE	D5BU	Baltimore	10	15	12	11	48
SUNDA	ELPB8	Houston	15	15	19	11	60
SUSAN MAERSK	OYIK2	Seattle	28	4	0	25	57
SUSAN W. HANNAH	WAH9146	Chicago	11	18	20	19	68
SVEND MAERSK	OYJS2	Seattle	2	32	0	2	36
SVENDBORG MAERSK	OZSK2	Seattle	3	0	0	22	25
TAI CHUNG	3FMC5	Seattle	51	26	0	0	77
TAI HE	BOAB	Long Beach	65	55	49	20	189
TAIHO MARU	3FMP6	Seattle	88	106	88	74	356
TAIKO	LAQT4	New York City	14	9	7	0	30
TAMPERE	LAOP2	Norfolk	9	0	2	25	36
TANABATA	LAZO4	Baltimore	13	0	0	0	13
TAPIOLA	LAOQ2	Norfolk	0	16	3	16	35
TAUSALA SAMOA	V2KS	Seattle	0	76	66	66	208
TECO TRADER	KSDF	New Orleans	17	51	28	23	119
TEQUI	3FDZ5	Seattle	18	10	26	21	75
THORKIL MAERSK	MSJX8	Miami	15	19	35	50	119
TMM MEXICO	3FRY9	Houston	0	0	0	49	49
TMM OAXACA	ELUA5	Houston	32	24	16	13	85
TOBIAS MAERSK	MSJY8	Long Beach	44	53	43	26	166
TORM FREYA	ELVY8	Norfolk	19	24	19	27	89
TOWER BRIDGE	ELJL3	Seattle	15	12	11	13	51
TRADE APOLLO	VRUN7	New York City	16	27	8	0	51
TRANSWORLD BRIDGE	ELJJ5	Seattle	15	17	28	18	78
TREIN MAERSK	MSQQ8	Baltimore	1	0	30	51	82
TRINITY	WRGL	Houston	0	12	26	0	38
TRITON	WTU2310	Chicago	30	55	45	19	149
TROPIC JADE	J8NY	Miami	11	0	0	0	11
TROPIC LURE	J8PD	Miami	17	14	14	11	56
TROPIC SUN	3EZK9	New Orleans	16	23	21	22	82
TROPIC TIDE	3FGQ3	Miami	12	20	8	14	54
TROPICALE	ELBM9	New Orleans	6	0	3	0	9
TUI PACIFIC	P3GB4	Seattle	69	77	87	92	325
TUSTUMENA	WNGW	Seattle	6	11	1	8	26
USCGC ACACIA (WLB406)	NODY	Chicago	0	0	1	0	1
USCGC ACTIVE WMEC 618	NRTF	Seattle	0	4	5	0	9

Continued on Page 103

Continued from Page 102

SHIP NAME	CALL	PORT	SEP	OCT	NOV	DEC	TOTAL
USCGC ALEX HALEY	NZPO	Norfolk	0	1	0	0	1
USCGC BRISTOL BAY	NRLY	Cleveland	0	1	0	0	1
USCGC DURABLE (WMEC 628)	NRUN	Houston	0	0	3	18	21
USCGC HARRIET LANE	NHNC	Norfolk	0	0	1	4	5
USCGC JEFFERSON ISLAND	NORW	New York City	1	0	0	0	1
USCGC KUKUI (WLB-203)	NKJU	Seattle	4	0	0	0	4
USCGC MACKINAW	NRKP	Chicago	15	1	0	0	16
USCGC MELLON (WHEC 717)	NMEL	Seattle	1	1	0	0	2
USCGC MIDGETT (WHEC 726)	NHWR	Seattle	0	0	0	6	6
USCGC MORGENTHAU	NDWA	Oakland	0	34	17	0	51
USCGC NORTHLAND WMEC 904	NLGF	Norfolk	34	0	20	15	69
USCGC POLAR STAR (WAGB 1	NBTM	Seattle	0	25	150	75	250
USCGC SHERMAN	NMMJ	Oakland	0	32	1	0	33
USCGC SUNDEW (WLB 404)	NODW	Chicago	10	4	4	0	18
USCGC WOODRUSH (WLB 407)	NODZ	Seattle	0	2	0	0	2
USNS GORDON	NAKL	Norfolk	6	0	0	0	6
USNS GUS W. DARNELL	KCDK	Houston	14	27	18	4	63
USNS HENSON	NENB	New Orleans	19	8	1	0	28
USNS NAVAJO_(TATF-169)	NOYK	Long Beach	0	1	11	0	12
USNS PERSISTENT	XXXX	Norfolk	0	0	0	1	1
USNS REGULUS	NLWA	New Orleans	9	0	4	2	15
USNS SODERMAN	NANL	Norfolk	0	0	6	0	6
VEENDAM	C6NL6	Miami	0	2	2	0	4
VEGA	9VJS	Houston	62	24	61	8	155
VIRGINIA	3EBW4	Seattle	6	4	0	26	36
VISION	LAKS5	Seattle	11	27	62	84	184
VLADIVOSTOK	UBXP	Seattle	51	61	32	57	201
VOYAGER OF THE SEAS	ELWU7	Miami	0	0	6	0	6
WAARDRECHT	S6BR	Seattle	73	57	63	46	239
WASHINGTON HIGHWAY	JKHH	Seattle	63	61	25	0	149
WASHINGTON SENATOR	DEAZ	Long Beach	38	30	21	36	125
WEATHERBIRD II	WCT6653	Seattle	0	0	1	18	19
WESTERN BRIDGE	C6JQ9	Baltimore	0	0	46	41	87
WESTERN CONDOR	DXHN	Seattle	0	41	0	0	41
WESTWARD	WZL8190	Miami	0	0	0	3	3
WESTWARD VENTURE	KHJB	Seattle	44	36	15	21	116
WESTWOOD ANETTE	C6QO9	Seattle	48	40	55	35	178
WESTWOOD BELINDA	C6CE7	Seattle	34	32	45	58	169
WESTWOOD BORG	LAON4	Seattle	48	82	45	69	244
WESTWOOD BREEZE	LAOT4	Seattle	10	16	27	61	114
WESTWOOD CLEO	C6OQ8	Seattle	22	32	33	28	115
WESTWOOD JAGO	C6CW9	Seattle	33	27	31	35	126
WESTWOOD MARIANNE	C6QD3	Seattle	54	55	57	53	219
WIELDRECHT	S6BO	Seattle	0	11	2	7	20
WILFRED SYKES	WC5932	Chicago	15	17	13	12	57
WILLIAM E. CRAIN	ELOR2	Oakland	10	0	5	4	19
WILSON	WNPD	New Orleans	0	0	0	21	21
WORLD SPIRIT	ELWG7	Seattle	36	31	32	33	132
YURIY OSTROVSKIY	UAGJ	Seattle	47	84	95	98	324
ZENITH	ELOU5	Miami	0	1	0	0	1
ZIM AMERICA	4XGR	Newark	39	32	36	67	174
ZIM ASIA	4XFB	New Orleans	37	66	33	25	161
ZIM ATLANTIC	4XFD	New York City	28	0	33	64	125
ZIM CANADA	4XGS	Norfolk	40	45	39	16	140
ZIM CHINA	4XFQ	New York City	29	42	16	12	99
ZIM EUROPA	4XFN	New York City	0	0	8	2	10
ZIM HONG KONG	4XGW	Houston	65	19	18	43	145
ZIM ISRAEL	4XGX	New Orleans	27	24	47	41	139
ZIM ITALIA	4XGT	New Orleans	34	59	64	18	175
ZIM JAMAICA	4XFE	New York City	35	17	57	39	148
ZIM JAPAN	4XGV	Baltimore	7	20	2	18	47
ZIM KOREA	4XGU	Miami	1	8	7	1	17
ZIM MONTEVIDEO	V2AG7	Norfolk	71	84	70	68	293
ZIM PACIFIC	4XFC	New York City	65	46	28	86	225
ZIM SEATTLE	ELWZ3	Seattle	28	19	24	51	122
ZIM U.S.A.	4XFO	New York City	38	35	14	22	109

Totals	Sep	24902
	Oct	25040
	Nov	24857
	Dec	25083
Period Total		99882

Buoy Climatological Data Summary — September through December 1999

Weather observations are taken each hour during a 20-minute averaging period, with a sample taken every 0.67 seconds. The significant wave height is defined as the average height of the highest one-third of the waves during the average period each hour. The maximum significant wave height is the highest of those values for that month. At most stations, air temperature, water temperature, wind speed and direction are sampled once per second during an 8.0-minute averaging period each hour (moored buoys) and a 2.0-minute averaging period for fixed stations (C-MAN). Contact NDBC Data Systems Division, Bldg. 1100, SSC, Mississippi 39529 or phone (601) 688-1720 for more details.

September 1999

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
41001	34.7N	072.6W	717	24.2	24.8	2.5	9.0	16/16	13.6	NE	37.5	01/06	1013.1
41002	32.3N	075.2W	717	25.7	26.9	2.4	10.3	16/05	13.9	E	36.7	16/02	1012.5
41004	32.5N	079.1W	356	26.0	26.7	1.9	12.5	15/22	14.3	NE	39.6	15/23	1011.8
41008	31.4N	080.9W	717	25.7	27.0	1.3	5.8	15/17	13.3	NE	47.4	15/18	1013.0
41009	28.5N	080.2W	1431	27.0	28.7	1.8	9.8	15/06	13.2	E	53.4	15/10	1011.6
41010	28.9N	078.6W	489	27.1	28.0	1.6	5.1	01/03	10.4	S	21.4	06/18	1013.0
42001	25.9N	089.6W	711	28.2	29.2	0.8	2.4	22/20	10.6	NE	22.9	09/21	1012.0
42002	25.9N	093.6W	694	28.2	29.4	1.0	2.9	30/03	12.0	NE	26.2	29/20	1012.9
42003	25.9N	085.9W	713	28.1	29.5	1.0	3.8	19/23	11.2	NE	33.2	20/03	1011.4
42007	30.1N	088.8W	703	26.0	27.8	0.6	1.8	20/07	10.8	NE	25.3	08/22	1013.9
42019	27.9N	095.4W	705	27.4	28.7	1.0	2.4	29/15	9.9	SE	28.8	29/13	1012.8
42020	26.9N	096.7W	708	27.5		1.0	3.4	29/17	10.0	SE	28.2	29/17	1012.5
42035	29.2N	094.4W	713	27.1	29.0				10.2	NE	22.5	29/16	1014.6
42036	28.5N	084.5W	712	27.2	28.7				11.3	N	28.0	19/18	1011.6
42039	28.8N	086.0W	716	27.3	28.9	1.0	3.2	20/18	11.4	N	23.1	22/06	1013.1
42053	29.6N	088.5W	603	26.6	28.4	0.8	2.9	20/12	12.1	NE	25.3	30/01	1012.9
44004	38.5N	070.7W	717	23.0	23.4	2.2	7.7	17/01	12.9	E	38.9	16/21	1015.7
44005	42.9N	068.9W	716	17.8	17.5	1.7	6.1	17/12	10.8	S	36.3	17/10	1015.6
44007	43.5N	070.1W	715	16.9	16.1	1.1	3.5	17/12	8.8	S	30.5	17/00	1014.9
44008	40.5N	069.4W	716	19.8	19.7	2.0	11.5	17/04	10.4	E	36.9	17/03	1016.2
44009	38.5N	074.7W	713	21.4	22.2	1.6	6.1	16/19	14.2	NE	38.5	16/17	1014.8
44011	41.1N	066.6W	557	20.1	19.4	2.1	8.7	17/13	9.8	S	32.6	17/04	1017.1
44013	42.4N	070.7W	715	17.3	16.7	0.8	3.6	16/22	9.5	SE	33.0	17/18	1015.4
44014	36.6N	074.8W	686	23.1		2.1	7.4	01/02	14.2	NE	47.8	16/15	1012.7
44025	40.3N	073.2W	709	20.4	20.9	1.6	6.8	16/23	12.2	NE	35.0	16/22	1015.0
45001	48.1N	087.8W	716	13.8	14.4	0.9	2.9	13/21	12.5	SW	26.4	30/22	1012.0
45002	45.3N	086.4W	717	16.7		0.8	3.0	26/21	13.0	S	25.8	26/14	1014.2
45003	45.4N	082.8W	715	16.5	17.8	0.7	2.0	26/13	12.0	S	28.0	30/00	1014.0
45004	47.6N	086.5W	715	14.5	15.2	0.9	2.7	26/13	12.8	W	31.9	30/22	1013.0
45005	41.7N	082.4W	717	19.5	20.9	0.4	1.8	30/03	10.6	SW	28.0	30/04	1014.5

Continued on Page 105

Continued from Page 104

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
45006	47.3N	089.9W	716	13.5	13.2	0.6	2.2	30/21	11.1	W	27.0	30/23	1012.7
45007	42.7N	087.0W	703	18.1	19.7	0.8	3.2	29/13	12.0	N	27.8	29/00	1015.1
45008	44.3N	082.4W	717	17.8	19.5	0.8	3.3	30/05	12.8	N	29.5	30/06	1014.6
46001	56.3N	148.2W	714	10.7	11.1	2.8	7.7	18/00	15.3	W	35.6	10/18	1005.9
46005	46.1N	131.0W	309	14.3	15.3	2.1	3.9	06/04					1021.4
46006	40.8N	137.5W	554	16.8	17.9	1.9	4.5	05/21	10.0	N	22.3	30/18	1024.5
46011	34.9N	120.9W	719	14.0	15.0	1.6	3.6	27/18	7.0	NW	23.9	01/02	1012.3
46012	37.4N	122.7W	716	13.4	14.0	1.7	3.5	27/07	6.1	W	25.1	01/05	1012.5
46013	38.2N	123.3W	709	12.3	11.5	2.0	4.2	27/01	7.6	NW	25.8	01/00	1013.0
46014	39.2N	124.0W	710	12.4		2.1	4.6	27/01	9.7	NW	28.4	26/23	1014.2
46022	40.7N	124.5W	471	11.9	11.6	2.3	5.0	26/03	9.8	N	27.4	26/22	1014.8
46023	34.7N	121.0W	717	14.3	15.5	1.7	3.3	01/05	8.7	NW	27.0	01/03	1013.1
46025	33.8N	119.1W	717	16.5	17.7	0.9	1.5	14/05	5.5	W	16.1	11/02	1011.4
46026	37.8N	122.8W	714	12.8	13.5	1.6	3.4	27/07	6.5	NW	25.3	01/05	1012.7
46027	41.8N	124.4W	662	11.3	10.6	2.1	4.2	07/02	10.3	NW	33.0	06/22	1013.7
46029	46.1N	124.5W	705	13.4	13.3	1.8	5.0	25/16	10.2	N	24.9	25/03	1018.1
46030	40.4N	124.5W	154	11.5	10.0	2.8	4.5	26/11	15.0	N	22.2	26/18	1017.7
46035	56.9N	177.8W	590	7.5	8.0	2.0	5.9	27/23	15.2	N	29.9	17/20	1006.6
46041	47.3N	124.8W	668	12.4	12.4	1.8	5.4	25/13	7.1	NW	23.9	25/03	1018.1
46042	36.7N	122.4W	716	13.6	13.8	1.8	3.8	27/08	6.3	NW	19.6	15/23	1013.0
46047	32.4N	119.5W	676	16.6	17.7	1.8	3.5	01/10	9.9	NW	22.7	14/04	1012.4
46050	44.6N	124.5W	600	13.3		1.9	5.0	25/21	12.1	N	23.7	10/04	1017.4
46053	34.2N	119.8W	692	15.2	16.3	0.9	2.0	01/05	8.1	W	20.4	14/03	1012.1
46054	34.3N	120.4W	678	14.3	14.9	1.6	3.1	01/01	12.3	NW	29.1	01/05	1011.8
46059	38.0N	130.0W	712		17.8	2.5	4.8	26/17	17.2	N	27.0	27/19	
46060	60.6N	146.8W	1376	10.5									

October 1999

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
41001	34.7N	072.6W	741	22.3	25.3	1.8	8.5	18/11	12.9	E	38.5	18/08	1018.6
41002	32.3N	075.2W	741	23.8	26.1	1.7	6.8	18/05	12.5	E	32.3	18/04	1018.0
41008	31.4N	080.9W	739	22.4	23.6	1.3	4.5	17/09	12.6	NE	40.4	17/07	1018.2
41009	28.5N	080.2W	1480	25.5	27.5	1.8	7.1	16/11	15.0	E	45.5	16/10	1015.5
42001	25.9N	089.6W	730	26.3	28.0	1.4	3.0	21/10	13.5	NE	29.3	03/20	1015.0
42002	25.9N	093.6W	731	26.0	27.9	1.5	4.2	04/16	13.4	NE	28.4	05/23	1015.9
42003	25.9N	085.9W	737	26.0	27.7	1.3	3.1	15/14	14.3	E	24.7	15/02	1014.7
42007	30.1N	088.8W	726	22.3	24.5	0.8	2.5	07/17	11.3	NE	25.6	08/04	1018.0
42019	27.9N	095.4W	739	24.3	26.8	1.2	2.8	05/16	11.6	NE	25.5	31/00	1016.4
42020	26.9N	096.7W	731	24.9		1.3	2.7	05/15	11.7	NE	25.3	18/03	1016.3
42035	29.2N	094.4W	735	22.8	24.8	0.8	1.5	31/00	10.1	NE	24.9	23/13	1018.4
42036	28.5N	084.5W	731	24.6	26.8				13.3	E	26.2	04/00	1015.9
42039	28.8N	086.0W	742	24.5	26.7	1.2	2.7	08/06	13.0	E	24.9	08/04	1017.3
42040	29.2N	088.2W	454	23.2	26.5	1.1	2.4	31/19	12.9	NE	22.9	21/05	1017.9
42053	29.6N	088.5W	725	23.5	26.3	1.0	3.4	07/18	13.0	NE	28.4	08/01	1017.3
44004	38.5N	070.7W	742	18.6	21.5	1.7	6.3	18/17	12.6	NW	41.0	18/15	1019.7
44005	42.9N	068.9W	741	11.2	11.8	1.6	4.7	23/14	14.4	S	40.8	14/18	1017.7
44007	43.5N	070.1W	741	10.3	11.7	0.9	3.1	23/19	12.7	S	31.7	14/16	1017.1
44008	40.5N	069.4W	737	14.9	16.9	1.6	5.9	14/18	13.2	N	39.8	18/19	1018.9
44009	38.5N	074.7W	737	16.5	18.8	1.1	3.4	18/13	12.6	SW	35.2	14/11	1020.1
44011	41.1N	066.6W	697	14.3	14.8	1.9	7.8	19/01	12.7	NW	41.8	18/21	1018.4
44013	42.4N	070.7W	735	11.3	12.3	0.8	2.9	04/20	12.5	S	35.0	14/17	1018.1
44014	36.6N	074.8W	725	18.9	27.3	1.3	4.5	18/16	11.9	N	36.5	18/11	1019.3
44025	40.3N	073.2W	732	15.0	17.6	1.1	3.8	14/14	12.8	SW	33.6	14/13	1018.7
45001	48.1N	087.8W	691	6.3	7.7	1.3	4.0	23/08	14.7	SW	36.7	22/19	1015.7
45002	45.3N	086.4W	743	9.7		1.1	3.5	08/08	15.7	S	32.6	23/14	1016.8
45003	45.4N	082.8W	696	8.7	10.7	1.2	3.4	22/22	15.1	S	31.9	22/18	1016.4
45004	47.6N	086.5W	741	7.0	8.9	1.4	5.9	23/10	15.6	W	37.7	23/09	1015.7
45005	41.7N	082.4W	741	12.5	14.6	0.6	2.1	04/03	12.9	S	31.9	13/20	1018.0
45006	47.3N	089.9W	742	6.4	6.6	0.8	2.9	23/08	12.5	W	29.9	23/06	1016.4
45007	42.7N	087.0W	735	11.8	13.9	1.1	4.8	23/16	14.2	S	32.6	23/16	1018.3
45008	44.3N	082.4W	742	10.6	13.3	1.2	3.9	23/23	15.7	S	33.0	23/21	1017.1
46001	56.3N	148.2W	736	6.9	8.3	3.0	6.5	16/20	16.1	W	40.0	21/17	999.4
46005	46.1N	131.0W	575	13.1	14.6	3.2	9.5	28/12	14.6	W	43.3	27/11	1020.0
46006	40.8N	137.5W	672	15.6	16.9	3.1	16.3	27/14	15.0	NE	48.0	27/14	1020.1

Continued on Page 106

Continued from Page 105

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
46011	34.9N	120.9W	143	14.3	15.0	1.2	1.6	03/05	10.0	NW	24.7	06/23	1014.1
46012	37.4N	122.7W	718	13.4	14.2	1.8	6.6	28/22					1016.8
46013	38.2N	123.3W	565	12.2		2.1	8.3	28/14	9.9	NW	26.8	15/01	1017.9
46014	39.2N	124.0W	598	11.3	12.0	2.3	8.8	28/16	8.5	NW	27.4	15/11	1018.1
46022	40.7N	124.5W	717	10.9	10.9	2.4	10.7	28/13	8.6	N	36.3	27/22	1018.6
46023	34.7N	121.0W	724	14.4	15.0	1.9	7.5	28/22	10.9	NW	28.6	07/02	1016.7
46025	33.8N	119.1W	719	17.2	18.2	1.1	2.4	29/04	6.4	NW	21.2	06/08	1014.3
46026	37.8N	122.8W	712	13.1	14.1	1.6	6.8	28/17	8.3	NW	23.5	29/03	1017.1
46027	41.8N	124.4W	666	10.5	10.1	2.2	10.0	28/11	8.9	NW	32.4	15/01	1018.0
46029	46.1N	124.5W	668	11.6	11.6	2.2	8.8	28/10	12.0	N	36.7	28/04	1019.4
46030	40.4N	124.5W	714	10.7	10.4	2.3	9.3	28/19	11.7	N	39.1	27/20	1018.6
46035	56.9N	177.8W	623	4.4	6.7	2.4	5.9	20/11	17.0	N	35.9	20/08	1010.6
46041	47.3N	124.8W	602	10.9	11.2	2.2	8.9	28/11	10.0	NW	36.3	27/20	1018.8
46042	36.7N	122.4W	717	13.6	14.4	1.8	6.8	28/21	9.0	NW	21.6	07/04	1017.2
46047	32.4N	119.5W	679	16.2	16.9	2.0	5.9	29/22	11.3	NW	25.8	07/07	1015.3
46050	44.6N	124.5W	611	11.4	10.8	1.8	8.7	28/15	9.0	N	37.5	27/20	1020.3
46053	34.2N	119.8W	668	15.5	16.1	1.1	3.2	29/02	8.8	W	27.2	06/22	1014.9
46054	34.3N	120.4W	706	14.3	14.3	1.8	6.6	28/23	14.9	NW	28.4	29/00	1014.9
46059	38.0N	130.0W	710	15.7	16.8	2.6	11.5	28/03	13.2	N	29.3	27/15	1020.2
46060	60.6N	146.8W	1351	6.2	9.2	0.9	2.5	02/15	14.1	E	33.4	02/12	1000.3
46061	60.2N	146.8W	1463	6.4	9.2	1.9	5.3	26/07	16.5	E	34.4	05/03	999.5
46062	35.1N	121.0W	724	14.3	15.3	1.8	6.8	29/02	9.5	NW	28.0	29/02	1015.7
46063	34.2N	120.7W	738	14.3	14.2	2.0	8.5	28/23	13.0	NW	26.6	29/15	1015.1
51001	23.4N	162.3W	734	25.2	26.3	2.0	3.6	20/03	11.7	E	23.7	21/05	1017.4
51002	17.2N	157.8W	721	25.3	26.0	2.1	3.3	28/03	14.5	NE	24.0	11/17	1015.4
51003	19.2N	160.7W	727	25.7	26.5	2.0	3.4	21/07	11.1	NE	20.7	19/15	1015.2
51004	17.4N	152.5W	685	24.7	25.3	2.1	3.2	06/20	14.1	E	23.3	07/16	1014.9
51028	00.0N	153.9W	697	25.5	25.5	2.0	3.2	05/02	13.6	E	19.4	28/21	1010.6
ABAN6	44.3N	075.9W	743	9.4	14.1				5.1	S	21.6	04/08	1018.0
ALSN6	40.4N	073.8W	707	14.1	16.5	0.8	1.6	14/14	13.7	SW	39.7	14/13	1020.0
AUGA2	59.4N	153.4W	1004	1.0					16.0	W	52.3	16/02	999.3
BLIA2	60.8N	146.9W	1457	5.4					12.4	N	36.0	19/18	1001.7
BURL1	28.9N	089.4W	743	23.5					13.3	NE	33.1	08/13	1017.1
BUZM3	41.4N	071.0W	742	13.5		1.0	2.8	19/04	16.3	SW	41.5	14/16	1018.8
CARO3	43.3N	124.4W	736	10.4					10.2	NE	41.1	27/22	1020.2
CDRF1	29.1N	083.0W	742	22.5					8.9	NE	21.0	07/16	1017.1
CHLV2	36.9N	075.7W	740	17.6	20.0	0.8	0.9	29/16	13.9	N	48.6	18/12	1019.4
CLKN7	34.6N	076.5W	744	19.6					11.1	NE	28.2	18/02	1019.8
CSBF1	29.7N	085.4W	742	22.1					6.3	NE	21.9	23/08	1017.3
DBLN6	42.5N	079.3W	742	11.6					10.8	S	38.5	14/04	1018.9
DESW1	47.7N	124.5W	727	10.3					11.4	SE	49.2	28/06	1019.2
DISW3	47.1N	090.7W	733	7.1					12.0	W	36.2	22/11	1017.1
DPIA1	30.2N	088.1W	720	21.7					11.8	N	27.6	08/06	1018.4
DRFA2	60.5N	152.1W	1461	3.0					9.7	N	25.9	16/04	1000.8
DRYF1	24.6N	082.9W	495	26.1	27.5				15.2	NE	40.6	15/09	1013.6
DSLN7	35.2N	075.3W	735	20.5		1.2	2.8	18/17	15.3	N	43.4	18/09	1019.0
DUCN7	36.2N	075.8W	723	17.5					11.7	N	36.9	18/10	1021.5
FBIS1	32.7N	079.9W	741	20.2					10.2	NE	31.6	17/07	1023.8
FFIA2	57.3N	133.6W	728	7.3					14.1	SE	35.5	16/11	1009.9
FPSN7	33.5N	077.6W	741	21.6		1.4	7.8	18/01	15.6	NE	47.3	17/23	1018.9
FWYF1	25.6N	080.1W	741	26.5	27.6				16.1	E	56.9	15/22	1014.3
GDIL1	29.3N	089.9W	676	22.7	24.2				10.1	NE	22.0	23/14	1017.6
GLLN6	43.9N	076.4W	733	11.0					16.0	S	42.7	22/14	1018.2
IOSN3	43.0N	070.6W	743	10.7					15.5	NW	39.3	14/18	1017.4
KTNF1	29.8N	083.6W	742	21.3					7.4	NE	20.6	07/16	1017.2
LKWF1	26.6N	080.0W	716	25.8	27.3				12.4	E	43.8	16/03	1015.4
LONF1	24.8N	080.9W	735	26.1	26.8				12.9	E	49.7	15/20	1014.2
LPOI1	48.1N	116.5W	699	10.3	13.2				7.2	S	31.7	31/20	1021.5
MDRM1	44.0N	068.1W	741	10.0					18.3	NW	43.2	14/21	1017.1
MISM1	43.8N	068.8W	744	10.0					17.7	S	48.4	14/18	1017.1
MLRF1	25.0N	080.4W	739	26.5	27.9				15.2	E	50.9	15/17	1014.4
MRKA2	61.1N	146.7W	1468	4.3					8.3	NE	26.2	21/22	1002.2
NWPO3	44.6N	124.1W	735	10.5					8.5	S	38.4	28/04	1020.2
PILM4	48.2N	088.4W	741						16.3	NW	44.9	22/19	
POTA2	61.1N	146.7W	1457	4.3					15.0	N	31.8	21/22	1001.0
PTAC1	39.0N	123.7W	740	11.9					8.6	N	22.2	27/12	1017.4

Continued on Page 107

Continued from Page 106

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
PTAT2	27.8N	097.1W	718	23.2	25.2				10.3	E	22.8	18/04	1017.0
PTGC1	34.6N	120.6W	710	13.9					14.3	N	28.7	29/12	1016.1
ROAM4	47.9N	089.3W	291	5.3					17.2	W	41.1	23/02	1013.7
SANF1	24.4N	081.9W	743	26.4	28.3				14.2	E	44.1	15/06	1013.2
SAUF1	29.8N	081.3W	743	23.7	24.8				12.6	NE	48.9	16/23	1017.2
SBIO1	41.6N	082.8W	744	12.1					12.5	SW	43.8	13/20	1018.6
SGNW3	43.8N	087.7W	741	9.9	9.0				11.7	S	28.7	08/00	1017.9
SISW1	48.3N	122.8W	656	10.1					7.7	W	37.1	28/13	1020.1
SMKF1	24.6N	081.1W	742	26.3	27.8				15.9	E	55.2	15/15	1015.1
SPGF1	26.7N	079.0W	498	25.4					13.6	NE	35.6	16/11	1014.8
SRST2	29.7N	094.0W	735	21.0					8.2	N	23.0	08/16	1017.9
STDM4	47.2N	087.2W	744	7.4					18.4	W	49.3	22/22	1015.4
SUPN6	44.5N	075.8W	744	9.5	14.5				10.7	S	28.2	09/07	1017.6
THIN6	44.3N	076.0W	731	9.4									
TPLM2	38.9N	076.4W	744	14.9	17.2				10.7	S	28.1	18/17	1020.7
TTIW1	48.4N	124.7W	738	9.7									

November 1999

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
41001	34.7N	072.6W	719	19.8	24.0	2.2	6.4	03/07	14.6	NW	34.0	30/23	1019.2
41002	32.3N	075.2W	716	20.8	23.9	2.0	4.0	30/20	12.3	E	30.7	03/00	1019.4
41004	32.5N	079.1W	341	19.8	23.0	1.7	3.3	30/12	13.4	NE	29.0	30/09	1020.0
41008	31.4N	080.9W	719	18.8	20.2	1.2	3.0	30/11	11.3	N	28.8	30/11	1020.5
41009	28.5N	080.2W	1410	22.9	25.6	1.9	3.5	30/20	14.3	NE	30.1	03/06	1018.2
41010	28.8N	078.8W	400	23.0	24.9	2.5	3.6	30/16	14.0	E	27.8	30/11	1019.1
42001	25.9N	089.6W	712	23.7	26.5	1.3	3.8	03/11	13.2	NE	24.7	02/22	1019.1
42002	25.9N	093.6W	709	23.6	25.8	1.1	3.0	25/23	11.7	NE	29.7	25/19	1020.3
42003	25.9N	085.9W	713	23.2	25.9	1.3	3.2	03/16	14.4	NE	25.5	03/03	1018.0
42007	30.1N	088.8W	694	18.6	21.0	0.6	1.6	01/02	10.1	NE	26.2	02/20	1021.5
42019	27.9N	095.4W	712	22.0	24.7	1.0	3.2	25/11	10.9	SE	27.6	25/06	1020.1
42020	26.9N	096.7W	712	22.9		1.2	3.7	25/10	11.4	SE	29.0	25/05	1019.8
42035	29.2N	094.4W	715	19.4	21.0	0.7	1.9	30/13	9.3	SE	27.8	02/13	1021.7
42036	28.5N	084.5W	701	21.0	23.6				12.9	NE	26.6	03/09	1019.1
42039	28.8N	086.0W	717	21.3	24.2	1.0	3.6	03/07	12.2	NE	27.0	03/03	1020.5
42040	29.2N	088.2W	717	21.0	24.5	1.0	3.2	30/08	11.8	N	28.0	03/05	1020.5
42053	29.6N	088.5W	462	20.6	24.1	0.9	2.1	03/03	12.5	E	28.6	03/06	1021.1
44004	38.5N	070.7W	717	15.4	18.5	2.2	7.2	03/11	14.5	NW	33.2	03/09	1019.5
44005	42.9N	068.9W	718	8.2	9.6	1.9	5.0	04/02	16.2	S	31.7	17/16	1016.4
44007	43.5N	070.1W	716	7.1	8.5	1.1	3.9	03/10	13.4	S	28.8	03/09	1015.6
44008	40.5N	069.4W	713	11.5	13.6	2.1	6.9	03/18	14.3	NW	35.6	30/23	1018.1
44009	38.5N	074.7W	710	12.7	14.8	1.4	4.1	02/23	14.1	NW	33.2	02/22	1019.9
44011	41.1N	066.6W	717	11.3	12.2	2.4	6.2	03/20	14.8	W	33.2	17/20	1017.6
44013	42.4N	070.7W	716	8.2	9.4	0.9	3.0	11/09	13.8	S	29.3	16/21	1016.9
44014	36.6N	074.8W	690	16.1	18.3	1.6	4.9	02/21	12.9	NW	34.6	02/21	1019.5
44025	40.3N	073.2W	711	11.2	13.6	1.5	4.4	03/04	14.6	NW	31.1	03/00	1018.3
45001	48.1N	087.8W	126	4.3	5.3	1.6	5.1	02/00	18.1	NW	35.0	01/20	1010.4
45002	45.3N	086.4W	424	6.8		1.2	2.7	13/21	16.5	S	28.2	13/17	1016.7
45003	45.4N	082.8W	708	5.4	7.4	1.2	3.6	14/14	16.4	S	35.0	14/13	1015.9
45004	47.6N	086.5W	201	4.7	5.2	1.6	5.8	02/02	17.8	NW	38.3	01/23	1014.2
45005	41.7N	082.4W	712	8.0	9.1	0.6	2.2	11/09	12.9	SW	29.7	02/23	1018.4
45006	47.3N	089.9W	215	5.1	4.7	0.8	3.5	01/23	13.1	SW	34.8	01/18	1014.7
45007	42.7N	087.0W	713	8.4	10.4	1.0	3.0	24/05	13.8	NW	29.0	24/04	1018.9
45008	44.3N	082.4W	117	8.0	10.4	1.8	4.2	03/16	20.7	NW	34.6	03/17	1011.1
46001	56.3N	148.2W	706	4.2	5.8	3.5	7.5	12/19	15.8	W	30.7	12/15	993.0
46005	46.1N	131.0W	660	11.2	12.7	3.9	7.8	27/23	16.3	S	35.0	08/20	1009.1
46006	40.8N	137.5W	655	12.2	13.3	3.8	9.1	18/12	16.3	W	31.5	17/20	1012.3
46012	37.4N	122.7W	677	12.8	13.1	2.3	4.9	19/20					1019.3
46013	38.2N	123.3W	679	12.5	12.5	2.7	6.0	19/19	11.3	NW	33.4	07/21	1019.6
46014	39.2N	124.0W	687	12.3	12.6	2.6	5.9	19/17	11.2	SE	33.0	19/15	1018.7
46022	40.7N	124.5W	676	12.2	11.9	3.0	7.0	19/15	13.1	S	35.2	19/15	1018.2
46023	34.7N	121.0W	659	13.6	14.0	2.2	4.5	23/05	11.4	NW	31.1	21/20	1020.0
46025	33.8N	119.1W	681	15.5	16.9	1.2	2.9	21/23	6.7	W	25.6	21/23	1018.2
46026	37.8N	122.8W	675	12.6	13.1	2.2	5.0	19/20	10.7	NW	30.7	07/22	1019.6
46027	41.8N	124.4W	661	11.7	11.3	2.9	6.7	19/17	12.2	SE	36.9	08/08	1017.0
46029	46.1N	124.5W	602	11.0	11.4	3.4	7.0	09/17	15.4	S	37.1	09/16	1013.2

Continued on Page 108

Continued from Page 107

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
46030	40.4N	124.5W	675	12.1	12.0	2.9	6.0	19/15	15.2	SE	39.2	08/03	1018.6
46035	56.9N	177.8W	484	1.7	3.7	3.9	11.3	18/06	19.5	NW	45.3	28/10	1003.2
46041	47.3N	124.8W	598	10.3	11.0	3.3	7.6	09/16	13.7	SE	35.0	09/08	1012.5
46042	36.7N	122.4W	684	13.0	12.8	2.3	4.8	19/21	10.2	NW	32.1	07/22	1019.8
46047	32.4N	119.5W	631	15.3	16.1	2.3	5.9	22/05	10.1	NW	30.5	21/20	1018.9
46050	44.6N	124.5W	681	11.1	11.1	3.5	7.2	09/23	15.7	S	35.8	09/16	1015.2
46053	34.2N	119.8W	591	14.5	15.2	1.5	3.2	21/02	7.1	W	25.6	21/07	1019.1
46054	34.3N	120.4W	697	14.0	14.4	2.3	5.1	20/07	11.5	NW	29.5	22/01	1018.5
46059	38.0N	130.0W	688	14.9	15.8	3.2	7.2	19/01	15.3	SW	34.6	30/12	1016.0
46060	60.6N	146.8W	1333	3.5	7.0	1.0	2.8	13/08	13.6	E	35.0	13/04	996.5
46061	60.2N	146.8W	1359	3.4	7.1	2.2	5.9	13/14	18.2	E	38.7	04/18	995.3
46062	35.1N	121.0W	680	13.6	14.0	2.3	4.6	23/05	10.1	NW	27.6	08/01	1019.0
46063	34.2N	120.7W	700	14.0	14.5	2.5	4.9	20/01	11.6	NW	29.0	21/20	1018.6
51001	23.4N	162.3W	585	24.6	25.7	2.5	4.9	04/11	13.5	E	24.0	29/02	1018.7
51002	17.2N	157.8W	696	24.9	25.9	2.6	4.3	30/08	17.4	NE	26.3	27/21	1015.9
51003	19.2N	160.7W	709	25.3	26.2	2.5	4.3	29/14	13.9	NE	22.4	05/04	1015.3
51004	17.4N	152.5W	651	24.2	25.0	2.6	3.6	11/17	15.5	NE	23.3	30/04	1015.4
51028	00.0N	153.8W	683	24.4	24.5	1.8	2.4	30/18	14.1	E	21.6	04/09	1010.1
ABAN6	44.3N	075.9W	718	6.5	9.5				5.3	S	20.1	24/12	1016.8
ALSN6	40.4N	073.8W	717	10.5	12.6	1.0	3.2	03/03	17.0	NW	40.0	16/22	1019.5
AUGA2	59.4N	153.4W	1408	-1.3					19.6	NE	55.4	04/19	996.6
BLIA2	60.8N	146.9W	1393	2.5					16.3	N	36.9	17/11	997.6
BURL1	28.9N	089.4W	718	19.8					11.2	NE	31.2	02/23	1021.1
BUZM3	41.4N	071.0W	713	9.9		1.2	4.1	03/08	18.0	NW	39.3	03/23	1018.1
CARO3	43.3N	124.4W	711	11.3					12.9	S	35.8	06/22	1016.5
CDRF1	29.1N	083.0W	716	18.2					7.2	NE	18.8	13/02	1019.9
CHLV2	36.9N	075.7W	707	14.1	15.8	1.1	3.1	12/03	15.6	N	44.8	02/21	1020.7
CLKN7	34.6N	076.5W	716	16.1					10.6	N	31.7	02/15	1020.8
CSBF1	29.7N	085.4W	707	17.7					5.6	NE	24.6	02/08	1020.4
DBLN6	42.5N	079.3W	717	8.3					14.8	SW	40.4	03/20	1018.7
DESW1	47.7N	124.5W	688	9.5					16.2	SE	45.2	09/17	1013.0
DISW3	47.1N	090.7W	716	4.2					13.3	SW	37.8	01/20	1017.3
DPIA1	30.2N	088.1W	685	17.5					10.0	N	30.7	30/06	1021.8
DRFA2	60.5N	152.1W	1403	-2.2					9.5	N	25.9	20/01	998.1
DRYF1	24.6N	082.9W	716	23.5	25.2				14.8	NE	26.7	03/10	1016.7
DSLN7	35.2N	075.3W	715	17.7		1.4	3.1	30/20	16.5	N	45.3	02/16	1019.9
DUCN7	36.2N	075.8W	170	14.2		0.8	1.3	07/15	10.7	SW	27.8	07/13	1025.0
FBIS1	32.7N	079.9W	716	16.4					8.0	NE	23.3	02/11	1023.9
FFIA2	57.3N	133.6W	384	5.5					14.2	SE	41.6	01/11	1003.3
FPSN7	33.5N	077.6W	719	19.2		1.4	4.7	02/16	15.6	N	49.2	02/15	1020.3
FWYF1	25.6N	080.1W	715	24.0	25.6				17.3	NE	31.9	30/22	1016.6
GDIL1	29.3N	089.9W	536	18.6	20.0				8.5	NE	25.2	02/17	1021.4
GLLN6	43.9N	076.4W	714	7.5					18.6	W	47.2	04/02	1017.3
IOSN3	43.0N	070.6W	717	7.8					16.4	S	38.0	03/08	1015.9
KTNF1	29.8N	083.6W	718	16.8					6.3	NE	22.9	02/00	1020.0
LKWF1	26.6N	080.0W	717	23.2	24.7				13.5	NE	26.8	30/23	1017.3
LONF1	24.8N	080.9W	714	23.1	23.5				13.3	NE	25.4	03/11	1016.6
LPOI1	48.1N	116.5W	639	6.6	9.1				7.6	NE	30.7	12/20	1018.9
MDRM1	44.0N	068.1W	716	7.6					19.8	NW	43.3	03/17	1015.5
MISM1	43.8N	068.8W	716	7.3					19.7	W	42.3	03/15	1015.4
MLRF1	25.0N	080.4W	716	24.0	25.5				16.9	NE	30.4	13/02	1016.4
MRKA2	61.1N	146.7W	1399	0.3					10.9	NE	24.4	16/09	998.8
NWPO3	44.6N	124.1W	696	10.6					11.4	S	39.5	24/22	1016.0
PILA2	59.7N	149.5W	637	1.7					17.6	N	34.9	19/15	995.8
PILM4	48.2N	088.4W	716						16.6	NW	44.3	01/20	
POTA2	61.1N	146.7W	1370	0.4					22.4	NE	38.2	17/04	997.1
PTAC1	39.0N	123.7W	708	12.1					10.8	SE	33.6	07/22	1019.0
PTAT2	27.8N	097.1W	657	20.7	22.1				9.8	SE	29.4	25/07	1020.4
PTGC1	34.6N	120.6W	703	13.4					11.5	N	36.3	22/02	1019.4
ROAM4	47.9N	089.3W	717	3.2					16.7	NW	43.7	01/23	1015.8
SANF1	24.4N	081.9W	717	23.2					15.4	NE	27.5	03/11	1015.9
SAUF1	29.8N	081.3W	715	19.7	20.6				10.8	N	29.5	30/11	1019.7
SBIO1	41.6N	082.8W	715	7.9					13.8	S	32.6	02/23	1019.0
SGNW3	43.8N	087.7W	717	6.7	7.8				11.0	S	38.6	10/23	1018.5
SISW1	48.3N	122.8W	534	8.5					12.6	SE	41.4	04/05	1013.9
SMKF1	24.6N	081.1W	715	23.4	25.7				16.7	NE	29.5	09/13	1017.5
SPGF1	26.7N	079.0W	716	23.1					13.0	NE	25.7	30/21	1017.5

Continued on Page 109

Continued from Page 108

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
SRST2	29.7N	094.0W	693	17.6					8.2	SE	23.5	02/18	1021.6
STDM4	47.2N	087.2W	718	4.3					19.1	S	46.5	02/02	1015.5
SUPN6	44.5N	075.8W	713	6.5	9.6				13.0	SW	39.2	03/23	1016.4
THIN6	44.3N	076.0W	681	6.7									

December 1999

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
41001	34.7N	072.6W	380	17.9	22.3	2.6	7.5	01/11	15.1	NW	32.6	01/09	1020.5
41002	32.3N	075.2W	740	18.1	21.9	2.2	6.5	02/02	13.1	N	28.6	01/01	1020.0
41004	32.5N	079.1W	743	15.6	21.9	1.5	4.0	19/11	14.3	N	31.5	27/01	1020.5
41008	31.4N	080.9W	738	14.3	16.5	1.0	2.4	25/14	11.9	N	26.4	29/04	1021.4
41009	28.5N	080.2W	1480	19.9	23.8	1.4	3.4	02/16	13.2	NW	27.4	25/21	1020.3
41010	28.9N	078.5W	1481	21.1	24.1	1.8	4.5	02/19	13.2	N	28.2	29/04	1021.9
42001	25.9N	089.6W	736	22.0	25.2	1.4	3.4	13/21	13.8	SE	26.6	04/03	1019.5
42002	25.9N	093.6W	727	21.2	23.9	1.6	3.5	04/15	15.5	SE	30.1	13/05	1020.0
42003	25.9N	085.9W	733	22.1	26.3	1.4	2.7	28/14	13.9	E	28.2	28/10	1019.3
42007	30.1N	088.8W	740	14.1	16.9	0.7	2.3	21/13	12.4	S	31.3	21/03	1021.2
42019	27.9N	095.4W	315	19.9	23.1	1.9	4.3	04/11	16.8	SE	29.3	03/06	1017.5
42020	26.9N	096.7W	737	19.5		1.6	4.6	04/06	14.6	SE	28.0	05/05	1019.3
42035	29.2N	094.4W	726	14.9	16.7	1.0	2.9	03/05	11.9	SE	27.0	15/06	1020.8
42036	28.5N	084.5W	722	18.1	21.3				12.9	E	22.7	28/09	1020.2
42039	28.8N	086.0W	738	18.5	22.3	1.3	2.9	14/02	13.6	SE	26.2	18/23	1020.9
42040	29.2N	088.2W	739	17.6	22.1	1.3	4.5	21/08	14.2	N	32.4	21/07	1020.3
42041	27.2N	090.4W	456	19.5	24.4	1.4	3.6	21/08	13.2	N	30.1	18/18	1019.2
44004	38.5N	070.7W	738	12.4	17.8	2.6	7.3	01/05	16.6	NW	40.4	01/01	1017.7
44005	42.9N	068.9W	734	4.0	8.1	2.0	7.4	02/02	16.8	W	37.3	12/02	1015.0
44007	43.5N	070.1W	730	2.0	6.3	1.0	3.5	02/02	13.1	W	31.3	30/07	1015.2
44008	40.5N	069.4W	741	7.3	11.0	2.3	8.3	01/18	16.2	NW	37.1	01/09	1016.2
44009	38.5N	074.7W	737	7.7	11.2	1.4	4.0	01/07	14.7	NW	32.8	11/04	1019.1
44011	41.1N	066.6W	736	7.2	9.5	2.8	10.2	01/18	16.7	NW	46.4	01/14	1014.9
44013	42.4N	070.7W	741	3.3	7.3	1.1	4.5	01/18	14.7	W	36.7	11/18	1016.1
44014	36.6N	074.8W	690	11.0	16.9	1.6	4.8	01/10	14.1	NW	32.4	01/06	1018.9
44025	40.3N	073.2W	738	6.5	10.8				15.9	W	36.3	14/19	1017.3
45007	42.7N	087.0W	167	6.3	8.8	1.4	3.1	05/19	16.6	S	26.6	05/14	1017.7
46001	56.3N	148.2W	742	2.1	4.8	4.1	10.0	27/02	18.9	W	35.8	25/04	999.4
46005	46.1N	131.0W	481	9.5	10.9	4.0	8.3	09/17	17.1	W	37.1	17/19	1021.0
46006	40.8N	137.5W	361	11.6	12.1	4.4	7.5	04/16	18.8	SW	30.9	08/17	1024.2
46012	37.4N	122.7W	739	11.4	11.5	2.4	4.7	10/23					1023.5
46013	38.2N	123.3W	736	11.0	11.2	2.8	6.1	10/07	12.1	NW	29.1	10/23	1024.4
46014	39.2N	124.0W	740	10.5	11.5	2.9	6.1	10/07	9.8	N	28.6	09/04	1024.6
46022	40.7N	124.5W	740	10.0	11.0	3.1	6.7	10/05	9.7	N	36.1	09/03	1025.7
46023	34.7N	121.0W	743	12.8	13.1	2.5	5.5	10/17	12.3	NW	30.7	08/02	1022.4
46025	33.8N	119.1W	743	14.7	14.6	1.2	2.6	10/21	6.5	NW	26.0	08/03	1019.8
46026	37.8N	122.8W	738	11.1	11.3	2.3	5.0	10/08	10.0	NW	25.3	10/23	1024.1
46027	41.8N	124.4W	714	9.8	10.8	2.9	5.8	10/02	10.0	SE	34.8	09/04	1025.1
46029	46.1N	124.5W	709	9.4	10.3	3.3	6.7	09/04	14.6	S	37.3	09/03	1022.1
46030	40.4N	124.5W	739	10.0	10.6	2.9	6.2	10/07	11.5	N	38.5	09/02	1025.9
46035	56.9N	177.8W	590	-3.6	2.3	2.6	6.3	30/13	17.5	N	39.8	08/18	1011.9
46041	47.3N	124.8W	645	8.6	10.3	3.0	6.3	09/04	12.9	SE	32.4	09/03	1021.4
46042	36.7N	122.4W	734	11.5	11.4	2.5	5.3	11/04	10.6	NW	25.1	11/01	1023.7
46047	32.4N	119.5W	723	14.1	14.4	2.5	5.4	11/00	11.0	NW	29.5	07/23	1020.3
46050	44.6N	124.5W	742	9.7	10.5	3.4	7.0	10/01	13.8	SW	41.2	09/03	1024.0
46053	34.2N	119.8W	744	13.7	13.7	1.6	2.9	06/17	7.1	W	29.9	08/01	1020.8
46054	34.3N	120.4W	735	13.3	12.5	2.5	5.3	10/22	12.4	NW	34.4	02/01	1020.6
46059	38.0N	130.0W	743	12.7	14.4	3.0	6.4	05/14	12.0	N	29.1	09/00	1027.0
46060	60.6N	146.8W	1423	1.5	5.9	1.1	4.0	22/10	13.5	SE	41.0	22/05	999.4
46061	60.2N	146.8W	1483	1.5	5.7	2.3	7.7	19/14	17.0	E	43.7	19/11	998.7
46062	35.1N	121.0W	734	12.8	12.6	2.5	5.5	10/22	10.8	N	26.4	19/17	1021.6
46063	34.2N	120.7W	743	13.1	12.8	2.4	4.6	11/00	12.6	NW	28.6	02/23	1020.8
51001	23.4N	162.3W	248	23.4	24.5	3.2	6.8	25/02	14.9	E	25.4	12/14	1016.3
51002	17.2N	157.8W	742	24.2	25.1	2.8	5.4	05/12	14.5	NE	25.4	06/20	1015.0
51003	19.2N	160.7W	516	24.6	25.5	2.6	4.8	04/22	13.8	E	26.3	11/13	1015.8
51004	17.4N	152.5W	734	24.0									

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Continued from Page 110

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Continued on Page 115

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Continued from Page 114

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