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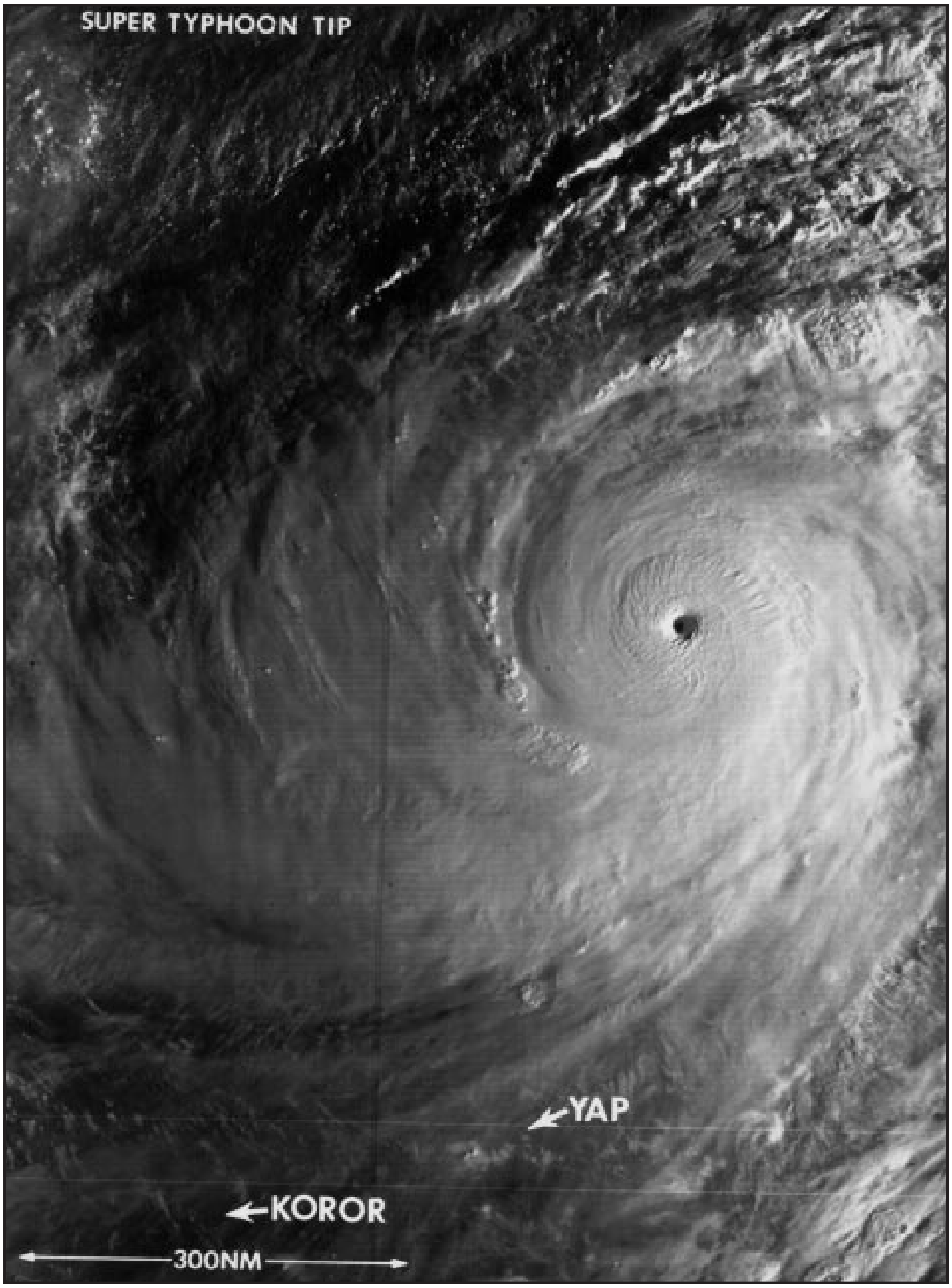

Supertyphoon Tip on October 12, 1979, as it set the record for lowest sea-level pressure ever observed (870 mb, 25.69″ of mercury).

See article on page 4.

Photo courtesy of Debi Iacovelli.

Mariners Weather Log

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From the Editorial Supervisor

The Mariners Weather Log has been receiving many wonderful articles from different authors, and this issue is no exception. Featured in this issue is an article about Supertyphoon Tip (the most powerful tropical storm ever recorded), a report on the El Niño, and an informative article on the Coriolis effect (explaining the effect of the earth's rotation on winds and ocean currents, and why wind doesn't blow directly from high to low pressure). We also have a report on "Dial-A-Buoy," a new National Data Buoy Center program providing phone access to wind and wave data and marine forecasts. We are very fortunate to have these and many other well-written articles, and I thank the authors for their outstanding work.

There remains some confusion about our printing schedule. As reported in the April 1998 issue, a trimester production schedule has begun, with issues scheduled to appear in April, August, and December of each year. During 1997, only one issue (Spring, 1997, Vol. 41, No.1) was produced. Vol. 41, No.2 and Vol. 41, No. 3 were not produced. Paid subscribers will receive their full allotment of issues.

The Government Printing Office has informed me that effective December 9, 1998, the subscription price for the Mariners Weather Log will be $10.00 domestic and $12.50 foreign. This is a subscription price increase of 50 cents domestic and 60 cents foreign. See the inside back cover for the subscription form and ordering information.

I am pleased to announce that Skip Gillham is resuming his Great Lakes Wrecks column beginning with the December 1998 issue. He will provide an article on the sinking of the ARGUS on Lake Huron in 1913 (with 24 lives lost). This is the first issue going to press in many years without Whale oil & Wicks. Elinor De Wire, who produced this extraordinary column, has indicated that she can no longer provide a regular column. This very special and unique column will be missed immensely.

The National Weather Service now has a new and very informative Marine Product Dissemination Information web site. Also, the Voluntary Observing Ship (VOS) Program now has a web site. For those without access to the Web, this is available free of charge at most libraries.

http://www.nws.noaa.gov/om/marine/home.htm
http://www.vos.noaa.gov

Martin S. Baron⚓

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Supertyphoon Tip

"Shattering all records..."

The Atlantic Ocean has never known anything as severe as some of the tropical cyclones that occasionally roam the western Pacific. The worst of these storms was Supertyphoon Tip, which set the record for the lowest sea-level pressure ever observed on Earth.

Debi Iacovelli
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Tim Vasquez
Weather Graphics Technologies
Norman, Oklahoma

Pope John Paul II became the first pope ever received at the White House, and the Pirates, proclaiming the slogan, "We Are Family," took the World Series in the fifth game over the Orioles. "Sad Eyes" by Robert John peaked at the top of the music charts, while in Bonn, Germany, 100,000 people marched against nuclear energy. As world events unfolded during the month of October 1979, an unprecedented meteorological event was underway in the remote reaches of the western Pacific Ocean.

The early morning rays illuminated the skies over Guam's Andersen Air Force Base on October 12th as the Lockheed four-engine turboprop reconnaissance aircraft, known as the WC-130 "Hercules," lifted off the runway. It headed across many miles of vast ocean and penetrated the east side of a strong typhoon. Bob Korose, who is now the assistant Chief, Aerial Reconnaissance Coordination, All Hurricanes (CARCAH), at the National Hurricane Center in Coral Gables, Florida, was at the controls.

"As you approach a storm, you're always putting the wind on your left wing, so that you're approaching perpendicular to the wind flow," he said. "As you get closer to the center of the storm you can pick up the eye on the radar. You head on in based on the radar and the windflow data that you're receiving. Generally you just go in as straight as you can, unless you're able to take advantage of a weak spot in the typhoon."

But this storm called for different tactics. "It's a solid wall cloud, so there's no easy way in. As you head for the eye, you constantly have to make corrections for the winds. You're getting blown sideways at 150 mph, or even more than that, so you have a lot of correction. In other words, the nose of your aircraft isn't pointing to where you are going. You see on the radar that the eye is right straight ahead of you, but actually

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Supertyphoon Tip

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you point off to the left side as you're going in because you have such a drift to the right from the crosswinds spinning into the storm."

On this day, Supertyphoon Tip smashed all records for the lowest recorded pressure inside any tropical storm on Earth. Not only was its 870 mb (25.69" of mercury) pressure reading unprecedented, Tip had one of the largest circulation patterns on record: 1380 miles (2220 km) in diameter. A hurricane this size in the Gulf of Mexico would cover everything from Guatemala to Kentucky, and Mexico City to the Bahamas! (Note: The size of the circulation pattern in a tropical cyclone is determined by the diameter of the highest closed isobar associated with the tropical cyclone.)

"Tip was a big storm," remembers Korose, "I mean big in surface area. When it was at its peak, it stretched halfway between Guam and the Philippines. That's about 1500 miles (2400 km). The outflow from the storm pretty much covered most of that area."

Lt. Commander George Dunnavan was also on the missions that flew into Tip. He agreed. "It was a little bit strange because not only was it a supertyphoon, but it also had a huge wind radii on it. That's what was so interesting about it. It covered everything from the Philippines over to Guam, and from southern Japan all the way to the equator. The 30 kt (55 km/h) wind radius was something like 600 miles (965 km) on it. It also had an extremely warm eye temperature—86 degrees F (30 degrees C) at 700 mb (about 1 mile up in the storm). I don't think I've ever seen anything over 88 degrees F (31 degrees C) in a tropical cyclone."

Tropical storm winds are classified as winds of 30 knots (55 km/h) or greater. While these extended over 600 nm (1100 km) out from Supertyphoon Tip, 50 kt (93 km/h) winds were over 150 nm (280 km) in radius. If Hurricane Andrew of 1992 had a similar wind structure, its swath of destruction would have enveloped most of southern Florida from the Keys northward to West Palm Beach! Aloft, reconnaissance reports indicated that 700 mb winds of 105 kts (194 km/h) existed more than 120 nm (220 km) from the center of Tip during 13-17 October.

Looking at the birth of this monster storm, we find that on 4 October a reconnaissance aircraft was sent to investigate a tropical disturbance near Truk. They discovered a closed surface circulation with maximum observed surface winds of 25 kts (46 km/h), and a minimum sea-level pressure of 1003.9 mb (29.65"). The disturbance became Tropical Depression 23 on 5 October at 0000 UTC. The Joint Typhoon Warning Center (JTWC) in Guam issued the first tropical cyclone warning, since reconnaissance missions discovered that surface winds had increased to tropical storm strength. The depression became Tropical Storm Tip on 6 October at 0000 UTC.

The initial erratic movement of Tropical Storm Tip and its failure to intensify was caused by the interaction of the storm with weak but extensive circulation patterns associated with Tropical Storm Roger, just to its west. Roger quickly sped northwestward, generating heavy rains and tides in the Tokyo area. Although it rapidly lost its influence over Tip, Tip still did not intensify. On October 9, as Tip was heading toward Guam, reconnaissance aircraft found that the sea-level pressure in the storm had only dropped to 995 mb (29.38") with surface wind speeds of 40 kts (74 km/h). Upper-level maps showed that a tropical upper-level trough (technically known as a TUTT) was to the north of Tip, interfering with its ability to vent its upper-level outflow. This caused mass to accumulate within the storm.

Tip was forecast to pass directly over the center of the island of Guam, but radar positions and recon reports from Andersen Air Force Base showed the storm had actually passed 28 miles (45 km) south of the island. Stations located in southern Guam recorded sustained surface winds of only 48 kts (89 km/h) with gusts to 64 kts (118 km/h), but in some locations they reported over 9 inches (228 mm) of rain.

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Supertyphoon Tip

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Tip officially reached typhoon strength after passing south of Guam later on 9 October. It moved into an area of strong, upper-level divergence that was covering most of the Western Pacific, so being in favorable conditions allowing mass to be removed from Tip. It was vented into the surrounding upper atmosphere, thus intensifying the storm. Surface pressures in the typhoon dropped tremendously, falling 92 mb (2.7") to 898 mb (26.51") between the 9th and 11th of October. The storm reached supertyphoon strength during this period (maximum sustained surface winds of 130 kts [241 km per hour] or greater) and maintained supertyphoon strength for the next 54 hours while moving northwest between 3 to 7 knots. Tip's highest measured windspeed of 165 kts (190 mph) was measured during this period, along with gusts that exceeded 200 mph.

The most intense tropical cyclones on Earth develop in the Western Pacific because of the long journey over warm ocean waters. Statistics show that about 30 typhoons develop annually, and some of these are bound to explode into intense storms. Lt. Col. Charles Holliday, in a Monthly Weather Review article published by the American Meteorological Society (AMS) about rapidly deepening typhoons, showed where explosive deepening usually occurs in the western Pacific. The area that Holliday came up with was right where Tip was.

Rapid deepening of a tropical cyclone (as established by Lt. Col. Charles Holliday and Professor Aylmer Thompson) is "greater or equal to 42 mb (1.24") in 24 hours." Tip's central sea-level pressure dropped 59 mb (1.74") during one 27-hour period. Bob Korose remembered this well. "Tip blew up in only a couple of days. It came across Guam as a tropical storm, but then the conditions got perfect and it exploded. The central pressure just dropped like a rock. It had good conditions as far as sea-surface temperatures, and upper air. Evidently there was tremendous outflow above the storm, so it developed. There was nothing to inhibit it."

This huge tropical cyclone had a circulation pattern which extended from the surface through 500 mb and higher. "Tip had a strange structure," said George Dunnavan. "One of the ARWOs (Aerial Reconnaissance Weather Officers) who flew into the typhoon remarked to me that normally when they're flying in the 700 mb (flight level) range, there's a big drop in the height of the surface as you penetrate the eyewall. I remember the ARWO telling me that one thing curious about Supertyphoon Tip was that on the record-setting flight when they were flying the 700 mb surface all the way from Guam, it was a gradual slope all the way into the center of the system. They thought it was rather strange, because usually once you cross the eyewall of a typhoon it's an abrupt change in everything. In fact, if you look at the windspeed and temperature profile data on Supertyphoon Flo (a supertyphoon in the Western Pacific in September 1990), you'll see that once you get inside the eye the wind drops off just in a matter of seconds. The temperature structure changes once you get inside the eyewall as well. It's usually very abrupt. They set the reconnaissance aircraft on autopilot during the 700 mb penetration and it will try to fly at a pressure level making the altitude adjustment. So usually when you penetrate the eye and the 700 mb surface changes radically, the airplane is going to drop and try to stay on that surface. But that didn't happen with Tip."

Bob Korose knew this flight would be different. "We were on a WC-130 plane out of the 54th weather recon squadron, Anderson AFB, Guam. We normally have a crew of 6 people on the reconnaissance aircraft, but there were extra people in training on that flight. There were at least eight of us. I was one of the pilots on that crew. In the cockpit was the pilot, an instructor pilot, the co-pilot, the navigator, an aerial reconnaissance weather officer, and the flight engineer. We had an idea that we would be setting a record that day. We knew that the old record had been 876 mb (25.87") set by Typhoon Rita, and we knew from the previous mission the pressure was pretty close to Rita's. It

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Supertyphoon Tip

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looked like the storm had continued to intensify, so there was a good chance that we would set a record."

As the crew of the WC-130 flew toward Tip, many aboard did not know what they would find. "In a way, every storm that you approach you're a little apprehensive, because you're not sure what you will encounter," explained Korose. "Each storm is a little different, and the dynamics of the system are always changing. Sometimes they're real turbulent, sometimes they're real smooth. Sometimes you get a lot of rain, sometimes you can see a lot visually. Everyone on board was a little excited with the possibility that we were going to be the crew that would set a new record low pressure recorded in a tropical storm."

The eyewall of a hurricane is a ring of big thunderstorms enclosing the eye. But in strong typhoons the eyewall can present a formidable hazard for pilots trying to reach the center of the storm. What surprised Korose was how smooth the penetration into Tip's eyewall was. "Being that it was such a big storm, I thought, 'Boy, it was going to be rough!' But what I found out later, after flying into storms for four years out there, was that the roughest storms were usually the ones that were changing character—they were intensifying or weakening, due to the meteorological dynamics taking place inside the storm. Supertyphoon Tip was at its maximum intensity, so there was very little change going on inside the storm. There wasn't nearly as much turbulence as I would have expected. The wall cloud itself was only 10 miles wide, so the penetration time at 180 kts ground speed (3 miles a minute) was a little over 3 minutes. Going through the eyewall we got some real heavy rain and were bounced around a little bit, but nothing out of the ordinary."

As the crew of the WC-130 reconnaissance aircraft broke through the eyewall, they were curious what the ocean's surface would look like. "As we were approaching the outside of Tip there was a lot of cloudiness, but once we broke into the eye, it cleared up," said Korose. "It was blue skies and sunshine. We could look back under the wall cloud from inside the eye and observe the sea surface. Once a typhoon's winds get above 130 kts (241 km/h), you really can't tell much of a difference with the surface of the water. It's just totally white, because the surface is blown into spray. It's hard to see where the air ends and the sea starts." Even though ships in the western Pacific were giving wide berth to Tip, they were still encountering gale-force winds in 25-foot swells 200 to 300 miles (320 to 480 km) from the storm's center.

When asked for his observations inside the eye of Tip, Korose replied, "Some eyewalls you see look like a stadium; in other words the tops of the clouds around the eye are narrower at the bottom and wider at the top. But this one was straight up and down and really tall. Some typhoons seem higher in altitude than other ones. Inside Tip it looked like a wall; just a mass of dark clouds with bright sunshine above. At night it was stars above, and sometimes you'd see lightning that lit up the wall cloud. Tip's eyewall was totally circular, with no gaps or breaks in it. It was solid all the way around."

Supertyphoon Tip had "spiral striations in the wall cloud, and it looked like a double helix spiraling from the base of the wall cloud to the top, making about two revolutions around the eye in climbing," as was reported from the ARWO aboard the recon mission. When asked about this, Dunnavan said, "That means Tip had some pretty violent vertical motion in it. What it looks like is a spiral staircase that spirals around the eye. The air, once it gets into the eyewall, is going to be spiraling up to the top of the eyewall before it spins away from the storm at about 100 mb (53,000 feet) or higher. The more pronounced this striation, the more intense the tropical cyclone. With eyewalls, they talk about the 'stadium effect' and the 'fishbowl effect'. Sometimes, if you get a real intense tropical cyclone, the eyewall shape will be like a fishbowl. It will bow out so that it will be narrower at the top than it is at the middle or the bottom, and the upper-level clouds kind of

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overhang a little bit into the eye. What causes this overhang is probably the vertical motion bringing up a lot of clouds (the eyewall), and you're also getting a lot of subsidence (downward motion) taking place in the eye, which is going to heat the air up and dissipate clouds. So clouds sometimes spill back over into this subsiding air before they dissipate."

A mid-level trough moving from China towards Japan on 17 October caused Tip to weaken in size and strength and begin recurvature northward under the influence of increased mid-level southwesterlies. Its outer rain bands brushed the Philippines, dumping copious amounts of precipitation over the mountains of northern Luzon, but the storm moved northward and passed within 35 nm (65 km) of Kadena AFB on Okinawa. The weather station there reported sustained winds of 38 kts (70 km/h) with gusts to 61 kts (113 km/h).

On 19 October, Typhoon Tip weakened to a tropical storm and made landfall on the Japanese island of Honshu about 70 miles (110 km) south of Osaka. Rapidly caught up in the prevailing westerlies, it came onshore with forward speeds in excess of 45 kts (78 km/h). Flooding from the typhoon became the main threat. At a joint U.S.-Japanese military training center near Tokyo, flooding breached a fuel-retaining wall which led to a fuel storage fire which killed 13 and injured 68. Throughout Japan, a total of 42 people died, while 71 were missing and 283 injured. More than 22,000 homes were flooded, and 600 landslides ravaged the countryside. Out at sea, eight ships were grounded or sunk by Tip, and 44 fishermen were dead or unaccounted for. The Chinese freighter Ying Shan went aground off Cape Erimo, Hokkaido, and broke in two by the pounding of the mountainous seas, while gusty winds delayed the rescue of its 46 crew members. The remnants of Tip maintained winds of 50 kt (93 km/h) until 21 October, when it moved east of Kamchatka toward Alaska.

Back in the U.S., Bill Rogers and Grete Waitz won the New York Marathon. Spent and exhausted, they collapsed after the race. And over the Bering Sea, the remnants of once-Supertyphoon Tip became extra-tropical and dissolved quietly into history books.

Missions flown out of Andersen Air Force base into Typhoon Tip numbered upwards to 40, which made it one of the most closely watched tropical cyclones of all time. Many associated with this reconnaissance effort felt privileged to have been an eyewitness to the beauty and the strength that is rarely seen in such magnitude, and some even described Tip as the most incredible storm they had ever seen. "You're in awe any time you get in those storms," said Korose. "Even though they seem small on satellite pictures compared to the overall weather patterns, they're still awesome as far as the power and the strength of them."

Acknowledgements:
We would like to thank Bob Korose, Lt. Commander George Dunnavan, Kevin Shaw, John Diercks, John Pavone, Dr. Hugh Willoughby, and Jack Beven for their kind assistance.

Note:
The record low sea-level pressure of 870 mb (25.69" of mercury) set by hurricane Tip on October 12, 1979, still stands as the lowest sea-level pressure ever recorded. Professional affiliations of some people mentioned in the article may have changed since it was written in 1993.

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The Difference—An Account of How Important Ship Reports Can Be

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Marine Forecast Branch
Marine Prediction Center

It's been said before but cannot be stressed enough: ship observations are of paramount value to the marine community. The impact of just a single observation was demonstrated in August 1997 when a report from a ship resulted in a more accurate NWS computer model forecast. This observation not only assisted the Marine Prediction Center (MPC) Pacific marine forecaster in his analysis and forecast, but also helped other users, government and private, local and international, to use an improved NWS computer model forecast over the Western Pacific Ocean.

In August 1997, the **APL PHILIPPINES** was in route from Hong Kong to San Pedro, California, when the ship passed through an extratropical cyclone that origi-

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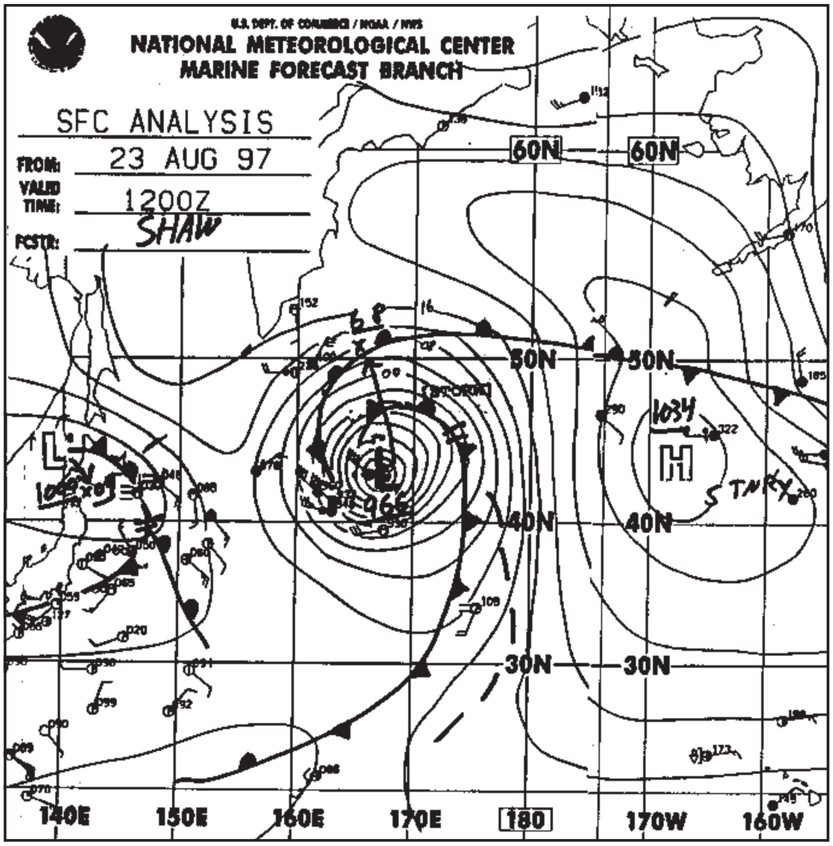

Figure 1. MPC surface analysis valid 23 AUG 12Z.

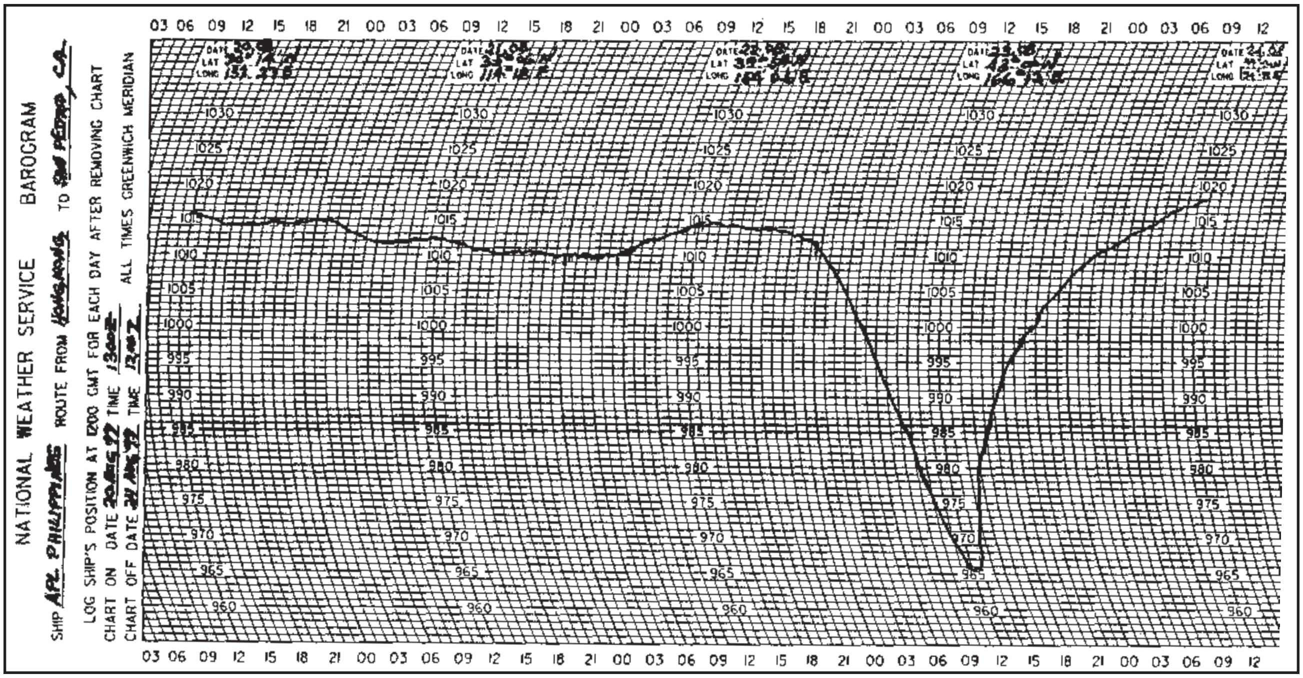

Figure 2. Barograph chart August 20-24 from the APL PHILIPPINES.

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nated from Tropical Storm "Yule." Figure 1 is the MPC surface analysis from August 23 at 1200Z. The **APL PHILIPPINES** is the ship plotted at 43N 168E reporting a 40 kt wind from the northwest with a surface pressure of 970.0 mb. Several other ships located south of the low also aided in the surface analysis. Figure 2 is a copy of the barograph chart from the **APL PHILIPPINES** from August 20 through 24. This chart shows a pressure drop of 46 mb in 12 hours between 23/00Z and 23/12Z, with the lowest pressure 965.6 mb at about 12Z on the 23rd. It was this critical observation from August 23 at 1200Z

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Figure 3. PMO Pat Brandow presents letter of appreciation to Capt. Grunau of the APL PHILIPPINES.

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which allowed the marine forecasters to access the strength of this storm for the analysis and subsequent forecast. Not only did this observation benefit the marine forecasters, but the NWS computer model forecast for the Western Pacific improved as well. Because of this, the NWS presented a letter of appreciation to the crew of the **APL PHILIPPINES** for their “dedication to the VOS program” and “consistent high quality of their observations.” PMO Pat Brandow (Seattle) presented this letter to Capt. Grunau of the **APL PHILIPPINES** (Figure 3).

“Yule” formed as a tropical depression on August 16, near 9N 166E and moved north-northeast. It began weakening on August 22 as it moved north of 30N. The last tropical advisory was issued by the Joint Typhoon Warning Center (JTWC) at 06Z on the 23rd with sustained winds of 60 kt as “Yule” was becoming extratropical. This transition is important because once the JTWC declares a system extratropical, responsibility for the forecast shifts from the JTWC to the NWS marine forecasters if the cyclone is east of 160E.

Although the importance of all marine observations to the marine community is always emphasized as a general concept, this is one case where a specific observation also made a considerable difference in the NWS global computer models, as can be demonstrated by viewing the different model runs.

Figures 4 through 7 show the NWS AVN model forecast of surface pressures over the Pacific. Figures 4 and 5 are the 24 hour and 48 hour forecast from 22AUG/12Z, valid at 23/12Z and 24/12Z, respectively. Figures 5 and 6 are the model analysis for 23AUG/12Z and the 24 hour forecast valid at 24/12Z with the inclusion of the observation from the **APL PHILIPPINES** (and additional ships). Although the model’s analysis of the low pressure system is not as low as reflected in the MPC manual surface analysis (Figure 1), it is much improved over the previous forecast. The difference between the 24 hour forecast valid at 23/12Z and the (models) surface analysis show a difference of 13 mb. Twenty-four hours later, this difference is more profound in the updated model forecast showing a stronger low, and a 200-mile improvement over the previous 24 hour forecast. These differences affect an area of about 800,000 square miles.

Would the model forecast have been as accurate without the observation from the **APL PHILIPPINES**? Not likely, since the only source of new surface data input into the models over this part of the world comes from ship and buoy observations. This ship was in the right place at the right time for data input into the computer forecast model and serves as a prime example of the high degree of importance of ship observations to the marine meteorologist and to the NWS’s computer model.⚓

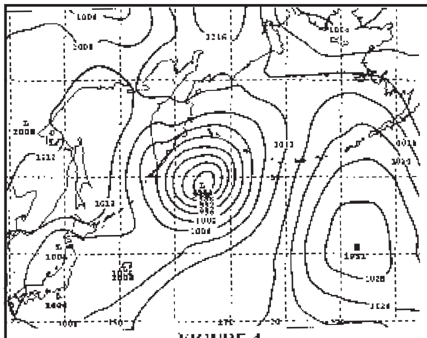

FIGURE 4
24 HR FCST from 22 AUG 12Z valid 23 AUG 12Z

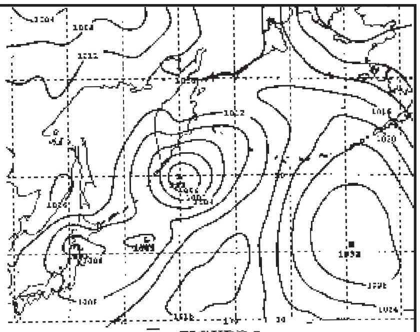

FIGURE 5
48 HR FCST from 22 AUG 12Z valid 24 AUG 12Z

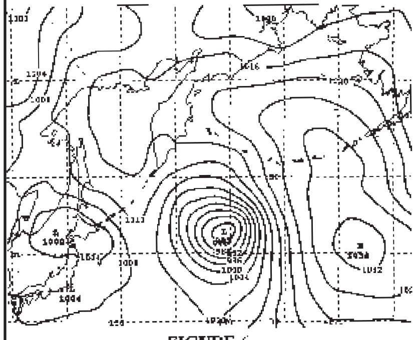

FIGURE 6
Analysis from 23 AUG 12Z

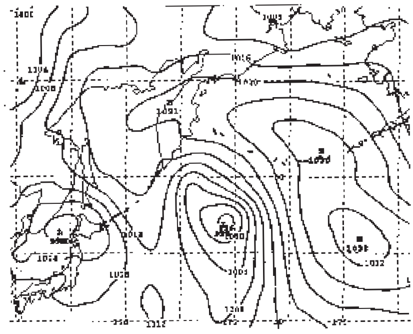

FIGURE 7
24 HR FCST from 23 AUG 12Z valid 24 AUG 12Z

A Look at El Niño's Relation to Marine Resources

Ramona Schreiber, Marine Biologist
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Washington, D.C.

With the El Niño event of 1997-98 drawing to a close, it's likely we all have experienced some component of its effects. Depending on your location, El Niño may have brought droughts, wild fires and abnormally warm conditions, perhaps flooding, mudslides and torrential rains, unusually cold temperatures, or tornadoes where such natural disasters are less frequent.

Weather patterns are easy for us to relate to in our daily lives. Typically, an El Niño pattern is associated with higher precipitation, enhanced snowpack, and higher stream flow in the southwest U.S., while the opposite conditions occur in the northwest U.S. These conditions are generally heightened between November and April. During an El Niño event, autumn tropical storms are less frequent in the eastern Pacific, west of Mexico. Those storms that do occur generally track toward Mexico or the southwest U.S., and draw greater than normal strength due to the higher than usual water temperatures. This division of conditions splits generally between warm and dry conditions in some regions, and cold and wet conditions elsewhere.

In southern California, Arizona, southern Nevada and Utah, New Mexico, and parts of Texas, winter months between October and March are wetter than normal. Rainfall is more frequent and in greater concentrations. Southern Alaska also tends to receive increased rainfall during an El Niño winter. In contrast, the Pacific northwest including Washington, Oregon, and parts of Idaho, western Montana, and northwest Wyoming experiences a generally drier winter during El Niño periods. Likewise, Hawaii experiences a dry winter, such that droughts are more likely. Abnormally arid conditions in parts of South America, including Brazil, caused wild fires where conditions are often more temperate as a result of the uncharacteristic dry conditions brought on by this year's El Niño. In between, central and northern California, northern Nevada, southern Oregon, northern Utah, southern Wyoming, and most of Colorado experiences moderate conditions, neither particularly wetter or drier than normal.

Temperatures during an El Niño event are also divided across the country. In the Pacific northwest and across the northern tier to Montana, temperatures are warmer than usual. As a result, warm and dry conditions result in reduced precipitation, freezing levels at higher elevations (thus causing in more rain in lower regions), and shorter seasons for snowpack accumulation. In contrast, cooler temperatures occur in the far southeastern parts of the West. Combined with the wet conditions, the effect is a tendency for greater snowpack in these areas. As temperatures warm, or precipitation increases, the likelihood for floods and mudslides increases dramatically. These effects were demonstrated repeatedly during the winter of 1997-98 in Southern California.

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El Niño and Marine Resources

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Relayed through the media for several months, these land-oriented extreme events are easy for us to identify and contemplate.

While all of these effects are experienced on land, El Niño, a condition derived from the ocean, understandably has related effects in the marine environment. Though not as evident as mudslides carrying homes toward the sea, the effects can be equally dramatic. Fisheries are altered and marine mammals modify their normally consistent patterns. Ecosystem conditions can change drastically through removal of prey and changes in physical and chemical parameters such as temperature, nutrient levels, and dissolved oxygen concentrations. Cumulatively, the marine environment experiences the effects of El Niño as much as we experience on land. This discussion reviews past and recent El Niño events, and considers the effects of these events upon the marine ecosystem.

A Brief Background

Typical non-El Niño conditions involve trade winds that blow towards the west across the tropical Pacific. As a result, warm surface water is piled in the west Pacific, and sea surface is about one half meter higher at Indonesia than Ecuador. The sea surface temperature is about 8 degrees Celsius higher in the west, and temperatures are cooler off South America, where an upwelling of cold water from deeper levels is available. The cold water is nutrient-rich, supporting high levels of primary productivity, diverse marine ecosystems, and major fisheries. This band of cool water is within 50 meters of the ocean's surface. Normally, rainfall is found in rising air over the warmest water, while the east Pacific is relatively dry.

When El Niño conditions set in, the trade winds relax in the central and western Pacific. This results in a depression of the thermocline, an area where the temperature gradient is strongest, in the eastern Pacific, and an elevation of the thermocline in the west. Upwelling can no longer cool the surface, thus a supply of nutrient rich water is isolated from the upper layer of the water column. Under these conditions, the cool, nutrient-rich band is generally 150 meters below the surface. Primary productivity is decreased and ultimately, higher trophic levels, including commercial fisheries, are impacted. Rainfall follows the warm water eastward, bringing flooding to Peru and drought in Indonesia and Australia. The eastward displacement of the atmospheric heat source overlaying the warmest water results in large changes in the global atmospheric circulation, eventually impacting weather in regions far removed from the tropical Pacific. Fishermen in areas of Peru and Ecuador seemed to first notice this oscillation as it occurred near the first of the year. Due to the recurrent timing near Christmas, they named it El Niño, meaning The Little Boy or Christ Child. An El Niño generally occurs every three to seven years, when severe conditions set in, lasting from a few weeks to 18 months.

Effects on the Marine Environment

The general conditions of the marine ecosystem rely strongly on a pyramid within the trophic system. Nutrients and phytoplankton, microscopic plants in the water, provide a foundation for all other marine plants and animals. They support zooplankton, small animal-like organisms, and juvenile and small fish that fill in the middle zone of the web. On the other end of the spectrum, large predators such as whales, dolphins, and large fish rely on large quantities from the middle zone as prey. If one link within the chain is displaced, the entire system may be upended. El Niño appears to cause such an effect on marine resources.

As warm waters reach nearshore with the onset of El Niño, small fish relying on rich upwelled waters are displaced and forced to move farther offshore, deeper, or to the north or south in search of cooler, productive water. With this movement, domino effects have been seen repeatedly, such as in the El Niño systems of the 1970s, 1982-83, and most recently in the 1997-98 El Niño event. Species found in abundance under normal conditions all but vanish as El Niño sets in.

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The devastating effect these conditions have on sea lions and seals off the California coast has been brought to the public's attention by the media. With the 1997-98 event, the news reported on pups and older sea lions washed onshore, battered from the waves pushing them over rocky beaches. Pups, most only a few months old, spend their early adolescence dependent upon adults to provide nourishment. They are too young to fish for themselves, and have not yet added sufficient blubber to keep warm over extended periods in the water. Adults, in order to produce milk for the young, must have ample supplies of fish. As the warm waters associated with El Niño move eastward, schools of small fish move offshore, forcing adults to swim farther, spending less time nursing young pups. As a result, pups may grow weak with starvation, and less able to fend for themselves against the brutal waves pounding the coastline. Older adults, unable to forage over the greater distances, also face these difficult conditions.

Similar circumstances have been monitored a significant distance from our local view of El Niño's force. Studies of seals at Ross Island in the Antarctic note a decline in births every four to six years, coincident with El Niño conditions elsewhere (Monarstevsky 1992). The reductions could likely be a result of declines in fish populations caused by shifts in ocean currents. Weddell seals apparently feel the effects of climate disruptions occurring in the tropics more than 6,000 km away. Other studies focused on fur seals in the Antarctic found that two species responded differently to the effects of El Niño (Guinet et al. 1994). One species, *Arctocephalus gazella* demonstrated reductions in pup production after the 1984-85, 1988-89, 1991-92, and 1992-93 seasons, following three El Niño events. A second species, *Arctocephalus tropicalis* only experienced depressed pup production following 1987 and 1990-91 events. The study found that production typically lags one year following the climatic event and associated food shortage. During the climatic year, females are likely to forage at sea for longer periods of time, thus spending less time ashore and otherwise available to breed. The difference between the species could be a result of variations in breeding cycles. Where *A. gazella* nurses pups for four months, *A. tropicalis* nurses pups for 11 months. The additional time with the mother prior to weaning may provide enough food to increase survivorship for the pups.

Birds, Even Reptiles Affected

Not surprisingly, seabirds are affected in a similar manner. They depend on marine predators of small fish to chase the fish toward surface waters where the birds are able to swoop in and catch fish. If the small fish have moved out of the area or the predators have gone because the fish populations are not sufficient to sustain them, the seabirds are also without their food source. Seabirds typically lay one large egg, have long incubation periods, long periods of developmental care by the parents, and long life spans. Should the

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Marine mammals are affected by El Niño. In some cases, food resources can become greatly reduced.

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parent of an egg be forced to extend its range in search of food, its lone, unguarded egg is at greater risk of predation. In normally arid landscapes where El Niño events bring increased precipitation, often the adult will return to its egg only to find that it rotted in the excess rainwater. The end result on the population may unrecoverable. Because of their slow reproductive rate, young seabirds are not replaced, and the adults may perish before they are able to reproduce successfully. Another possibility is that the population will be forced to relocate entirely, to an area where a more stable food source exists. This was noted during the 1982-83 event on Christmas Island (Thayer *et al.* 1984). In June 1982, researchers noted large numbers of birds, including blue face, brown and red footed boobies, lesser and greater frigate birds, and sooty, crested and gray back terns. Numbers of greater frigates topped 8,000, but by November, with an El Niño event in full swing, less than 100 frigates remained. Those that were present were found in greatly deteriorated condition.

Animals such as the Galapagos iguana face a unique effect from El Niño. The only lizard that swims in the ocean, it feeds on tender algae growing on the sea floor. Under normal conditions, these iguanas have unlimited supplies of sea lettuce in nearshore waters. The warm, nutrient poor waters brought in by the 1993 El Niño, however, caused a shift in algal growth (Grove 1994). Algae that replaced the favored species were types less desirable and even indigestible by the iguanas. Without their normal food source, many iguanas died of starvation. Other land-feeding iguana species, however, fared much better. Increased rainfall became a boon to terrestrial vegetation, providing plentiful food supplies for those species.

Pacific Coast landslide as a result of an El Niño storm. Courtesy National Landslide Information Center, USGS.

Fisheries Experience Economic Effects

While sometimes less noted in the media than the stories of starving seal pups, effects cast upon Pacific fisheries have been no less in magnitude. Many of the fisheries on the Pacific coast target migratory species, including salmon, herring, anchovy, sardine and squid. These species concentrate in cool, upwelled waters normally close to shore. Without these conditions, the species also move to other locations, either deeper or farther from the coastline. Unusually warm waters bring more tropical species in to fill empty niches. El Niño conditions in 1993 raised the temperatures off British Columbia an average of 2.5 degrees Celsius. That small increase is sufficient to significantly alter typical conditions. Normally, waters off Vancouver Island are teaming with salmon and herring. El Niño conditions, however, brought mackerel that fed heavily on herring and juvenile salmon. The result was poor herring and salmon recruitment over the next few years. These are similar to the conditions that occurred in association with the 1982 El Niño. That event resulted in a closure of the herring fishery on the west coast. Due to many factors beyond climatic events, the coho fishery off Oregon and

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California has continued to decline over the past several years, and the El Niño conditions of 1997-98 have not helped. Altered currents stemming from El Niño can affect the migratory paths salmon take when returning to natal streams. Certainly, several factors contribute to the decline in salmon stocks, however, effects such as these should be included in ecological assessments. Economic consequences of lost fisheries can be sizeable. The California Seafood Council monitors the state's fishing industry and estimates the revenues to be over $800 million annually (Wallace 1998). The effects of El Niño could jeopardize a considerable portion of that figure. When the fisheries were virtually wiped out after the 1982-83 El Niño, the state declared the coast a disaster area. Following the recent 1997-98 events, similar requests were made again in California as well as Oregon.

Not all effects of El Niño on fisheries, however, are negative. The conditions associated with the 1982-83 El Niño were initially devastating to the fishing industry of Peru. Precipitation was 1,000 percent above normal (Arntz 1984). The regular fisheries disappeared as the anchovies, sardines, pejerry and cojinoba moved south or offshore beyond the reach of the fishery's nets. Other species moved in but filled the nets with unmarketable catch. Yet, other tropical species entered the fishery and became more profitable for the industry. The dolphin fish, skipjack, Spanish mackerel, tuna, and bonito became high value resources, helping the local economy to recover. Likewise, scallops exploded with the onset of warmer waters and catches reached levels 20 times normal conditions. Thus, while the local fisheries were forced to convert from their traditional expertise, the new fisheries provided additional revenue and assistance for recovery to their community.

Lessons Learned

With the modernizing of our weather services, the public has been able to see real time effects of our most recent 1997-98 El Niño phenomenon. Surface buoys across the Pacific and satellites overhead returned information that was quickly converted into information for the entire public. As a result, we continue to grow in our understanding of the relationships between land and sea, as well as these natural events and the biological and physical environment. The long-term effects that influence the fisheries will likely continue to be evident in the marketplace as well as the ecosystem, as will the effects on the landscape and the human environment. Fortunately, the environment we inhabit is fairly resilient. Bearing the effect of Darwin's survival concept, strong species tend to survive despite reduced pup production, lost food sources, and reduced spawning. Rain-soaked regions eventually dry and natural vegetation recovers from fire. What we can learn from this and other natural events is that the environment is a continuum. Species that falter will likely recover, and species that are relocated will eventually return to their longstanding niches.

A great deal of background and general information on El Niño and NOAA's involvement in studying and tracking its effects can be found on the Internet. NOAA's website, **http://www.elnino.noaa.gov/** was instrumental in developing this article.

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The Coriolis Effect: Motion On a Rotating Planet

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In the last three “Physical Oceanography” columns, we have seen that the Coriolis effect plays a critical role in a number of important oceanographic and meteorological phenomena. In those columns we briefly explained that the Coriolis effect is the effect of the Earth’s rotation on moving objects and that such moving objects are deflected to the right in the Northern Hemisphere and to the left in the Southern Hemisphere. However, we left a full explanation of where the Coriolis effect comes from to a later column, knowing that it would take a entire column to explain it clearly. Devoting an entire column to the Coriolis effect seems justified by its critical importance in all large scale motions on the Earth, especially in the ocean and the atmosphere. Without the Coriolis effect there would be no trade winds or westerlies, no hurricanes, no high and low pressure systems for the TV weathermen to point at, no large ocean gyres, and no major ocean currents like the Gulf Stream, to name only a few examples (more are mentioned below).

The analogy often used to help explain the Coriolis effect is the example of a merry-go-round that is rotating counter-clockwise, with two boys sitting on opposite sides (one with a ball to be thrown to the other), and a person standing in the playground watching the merry-go-round. When one boy tries to throw the ball across to the boy on the opposite side of the merry-go-round, the ball appears (to the boys) to curve sharply to the right and miss the target (see the left side of Figure 1). The person on the ground, however, sees what really happens. The boy does indeed throw the ball straight, but by the time the ball gets across to the other side, the other boy is no longer there, having been rotated around by the merry-go-round to another position (see the right side of Figure 1). The ball appears to curve only to the boys on the merry-go-round, not to the observer on the ground.

Physics equations can be formulated, *relative to the rotating merry-go-round*, that describe the motion of the thrown ball, but these equations must include a “force” acting perpendicular to the motion of the ball that “pushes” the ball to the right. This force, called the Coriolis force, is a

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fictitious force, since it comes about because we are observing motion *from within* a rotating reference frame. Although fictitious, the Coriolis "force" feels like a real force to someone on the rotating merry-go-round; in that reference frame, it acts on mass like a real force.

This is not the only fictitious force that the boys on the merry-go-round notice. They also feel a force trying to push them outward and off the merry-go-round. This is called the *centrifugal force* and is also fictitious. An object set in motion tends to stay in motion and to travel in a straight line, unless acted on by another force. This is called Newton's First Law of Motion, and the tendency to keep moving (unless stopped by some force) is called "*inertia*." If you attach a rock to a string and swing it around in a circle, but then suddenly cut the string, the rock will travel off in a straight line (that is tangent to the circle it had been tracing). Before it was cut, the string exerted a real force (called *centripetal force*), pulling on the rock to keep it from flying off. The centrifugal force that the boys think they feel is really their inertia, i.e. their bodies trying to maintain their inertial straight-line motion relative to the playground, but their seats keep holding them on the merry-go-round and pulling them into the circular motion of the merry-go-round. Similarly, the thrown ball is maintaining its inertial straight line motion (relative to the playground), and the boys observe a fictitious Coriolis force causing the ball to curve (relative to the rotating merry-go-round).

Now we change the example by replacing the counter-clockwise rotating merry-go-round with the rotating Earth. The person in the playground reference frame is replaced with an observer in a reference frame among the stars. The Earth rotates once every 24 hours from west to east, which is counter-clockwise when looking down from the North Pole (and clockwise when looking from the South Pole). We replace the thrown ball with a rocket launched from one location and aimed to hit a target location. In this Earth example, the same deflection to

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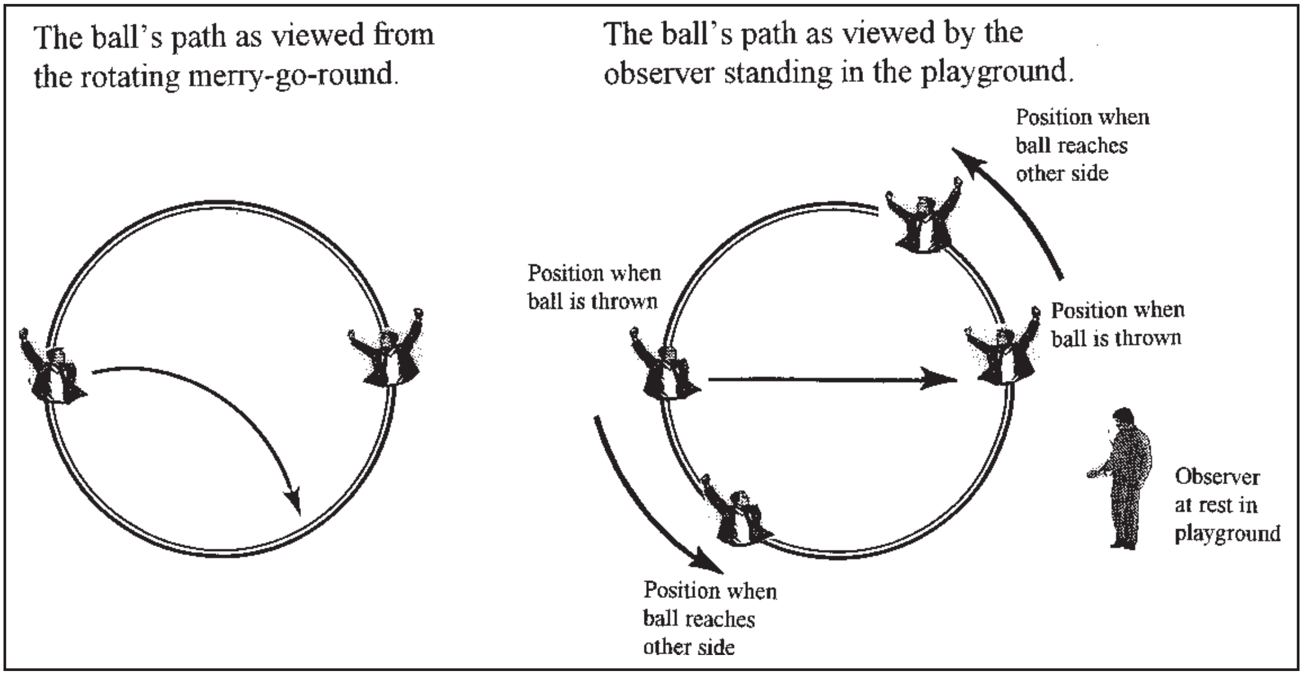

Figure 1. (Left side) The path of a thrown ball on a merry-go-round as viewed by the boys on the merry-go-round. (Right side) The path of a thrown ball on a merry-go-round as viewed by an observer on the playground.

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the right occurs (in the Northern Hemisphere, where the rotation is counter-clockwise), since by the time the rocket goes the distance required to hit the second location, that location has been moved out of harm's way by the rotating Earth (see Figure 2).

We have to make a slight modification because now we are dealing with a rotating sphere instead of a flat merry-go-round. The "inertial straight line" on the merry-go-round is replaced by an inertial "great circle" that the rocket would follow around the Earth if it continued traveling for a long distance (essentially like being in orbit).

On the rotating Earth, the Coriolis effect is easiest to visualize if the rocket is launched from the North Pole and aimed at a second location directly south. Then, by the time the rocket travels the necessary distance, the second location has rotated eastward out of the rocket's path (see the left side of Figure 2), and thus appears to deflect to the right (westward in this case) when viewed from the Earth. If we launched the rocket from a location some distance south of the North Pole, that location will also be rotating eastward, but at a slower speed than the speed of rotation at the target location further south (since the distance from the axis of rotation to the Earth's surface is smaller the closer one is to the North Pole, i.e. at higher latitudes). So along with the rocket's large southward speed, the rocket will also have some eastward speed (due to the Earth), but not enough to keep up with the eastward motion at the target's latitude, so it will still deflect to the right when viewed from the Earth. Launching the rocket northward from the equator is an opposite situation, but still easy to visualize (see the left side of Figure 2). The rocket leaves the equator with a certain amount of eastward motion (due to the rotating Earth), and travels northward over parts of the Earth which have less eastward motion, so it will again deflect to the right

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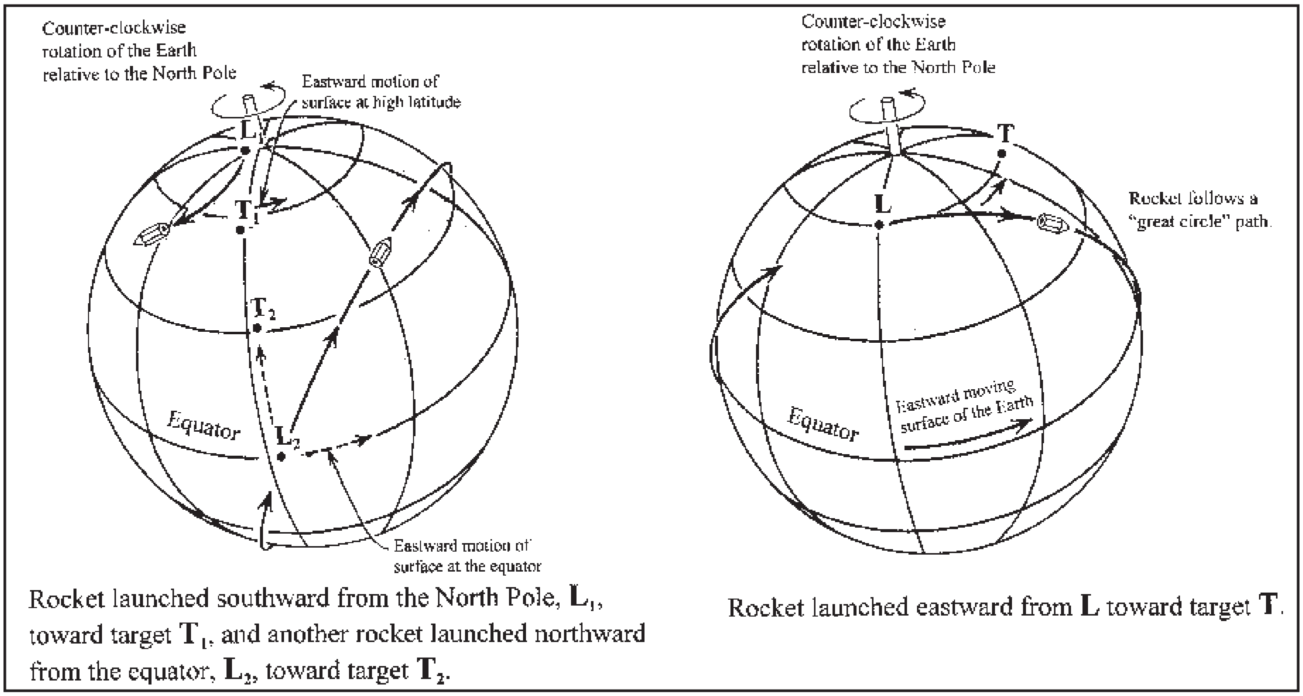

Rocket launched southward from the North Pole, L_1, toward target T_1, and another rocket launched northward from the equator, L_2, toward target T_2.

Rocket launched eastward from **L** toward target **T**.

Figure 2. (Left side) A rocket launched from the North Pole (L_1) directly south toward target T_1, and a rocket launched from the equator (L_2) directly north toward target T_2. (Right side) A rocket launched eastward toward a target, T, at the same latitude.

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(eastward in this case) when viewed from the Earth.

Although less easy to visualize, there is also a Coriolis effect when the rocket is aimed east (or west). This is because the rocket must travel along an inertial great circle, which means that it will not continue traveling in the initial east or west direction (see right side of Figure 2), since a latitudinal circle is not a great circle (except at the equator). The one situation where a rocket aimed east (or west) will not be deflected is if it is launched from the equator and aimed at a target location also on the equator. The equator is a great circle and so the rocket's path will stay along the equator and the second location will not be rotated out of its way. Thus, there is no Coriolis effect right at the equator. In this case, the rocket's orbit will look the same whether viewed from the Earth or from outer space. Anywhere else on the Earth this will not be true. An observer fixed to the Earth's surface will rotate around the Earth's axis of rotation along a latitudinal circle, but a moving object will "orbit" around the Earth in a great circle that is different from the observer's motion . This difference increases with latitude, being most pronounced at the North Pole (from where the rocket must always head south). Thus, the Coriolis effect increases from zero at the equator to a maximum at the North Pole.

The strength of the Coriolis effect depends on the speed of the moving object (the ball or the rocket) compared with the speed of the rotating reference frame (the merry-go-round or the Earth). Thus, the slower the boy on the merry-go-round throws the ball, the more time there will be for the second boy to rotate away, and the more the ball will appear to curve away from him.

The faster an object moves on the Earth the less Coriolis effect there will be. However, the Coriolis effect can still be important for fast moving objects, if they travel far enough. The first serious consideration of the Coriolis effect was for firing artillery at distant targets. There is one well-known naval engagement between the British and Germans in World War I near the Falkland Islands where the Coriolis effect played an important role. The British gunners had been taught about the Coriolis effect on the shells fired long distances from their cannons, and they made what they determined to be the necessary adjustments, yet they consistently hit approximately 100 yards to the left of the German ships. The one thing that they had apparently not considered was that in the Southern Hemisphere the deflection will be to the left and not to the right. They had done their Coriolis adjustment for 50°N, not for 50°S (the latitude of the Falkland Islands), so their shells hit a distance from the ships that was *twice* the distance caused by the Coriolis deflection.

Parcels of water in the ocean and parcels of air in the atmosphere move much more slowly than cannon shells and rockets, and the Coriolis effect is thus much more important. The greater the distances the water moves along the Earth's surface the more pronounced the effect.

We mentioned above that the Coriolis effect increases with latitude. The speed at which the surface of the Earth moves around the rotational axis of the Earth is different at different latitudes because the Earth is a sphere. Although the Earth rotates with the same "angular" velocity everywhere (one cycle per day), the "linear" speed at the surface will be largest at the equator, where the radius of rotation around the Earth's axis is largest. It is smaller at higher latitudes, because the surface is a shorter distance from the axis of rotation. The linear speed decreases more and more quickly as one approaches the North Pole, finally reaching zero. For a rocket launched northward from the equator, the Coriolis force keeps increasing as the rocket moves northward, because its eastward motion (gained by being launched from the equator) gets larger and larger compared with the eastward motion of the Earth's surface under it.

The fact that the Coriolis effect is zero at the equator is the reason that hurricanes never form right at the equator, even though the

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warmest water temperatures are there (the heat being needed to drive the hurricane). Most hurricanes are generated between 5° and 20° north or south of the equator, where there is enough Coriolis effect to start the air turning.

Hurricanes might seem to turn in the wrong direction, i.e. counter-clockwise in the Northern Hemisphere, when wind turning to the right would seem to imply that they should turn clockwise. The reason becomes clearer when we look at Figure 3. The hurricane is a low-pressure area with higher-pressure air masses on all sides. The air masses flow in from the north, south, east, and west, each air mass being pushed toward the right by the Coriolis effect. These multiple pushes, however, drive the rotation around the low-pressure center of the hurricane in a counter-clockwise direction (like small gears around one large gear in the middle, the large gear rotating in a direction opposite from that of the small gears).

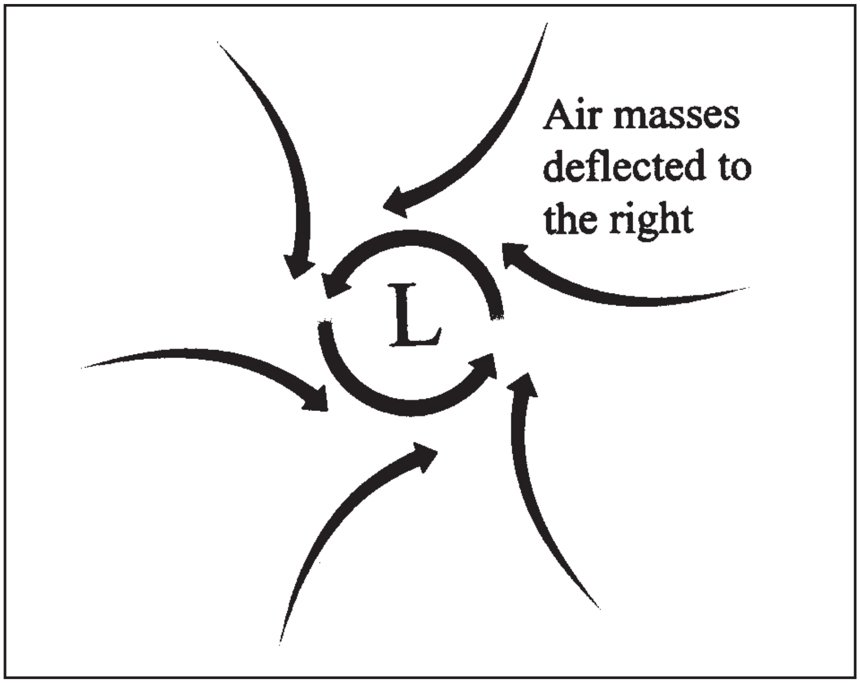

Figure 3. A hurricane's warm low-pressure area into which air masses flow from all directions, each deflected to the right (in the Northern Hemisphere) by the Coriolis effect, resulting in a counter-clockwise rotation around the low-pressure center.

One can see from the importance of Coriolis in forming low and high pressure systems, hurricanes, the trade winds, westerlies, and easterlies, that without its rotation and resulting Coriolis force, the entire Earth would have weather that does not change much (as is the case in the tropics where the Coriolis effect is very small or zero). This is, in fact, the case on Venus, which rotates very slowly (one rotation every 243 days). Jupiter, on the other hand, rotates much faster than the Earth and thus has a very dynamic atmosphere, including the giant red spot (which is actually a high pressure system, rather than a low pressure system like in a hurricane). The Sun also rotates on its axis, and the Coriolis effect is a controlling factor in the directions of rotation of sun spots.

Tornados are sometimes mentioned as being caused by the Coriolis effect, but their size is too small, and their wind speeds too great, for Coriolis to have any effect. Likewise the direction of rotation of a water spout going down the drain in a sink is not affected by the Coriolis effect, its size being much too small.

The Coriolis effect is very small, but the long distances that water travels in an ocean current provide plenty of time for the Coriolis effect to accumulate. In special situations, motions over limited distances can demonstrate a cumulative effect if observed over long time periods. The classic example is the *Foucault pendulum*, which is a pendulum with a heavy weight hung on a very long wire (several stories high) from an approximately frictionless pivot. These are often seen in science museums. The back-and-forth

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motion of the weight appears to stay in the same vertical plane, but if one waits long enough one will notice that the weight is not coming back to exactly the same spot at the full extent of each swing. Typically small wooden blocks are set up in a large circle around the pendulum at just the right distance to be hit by the weight. Over a day or more each block is eventually knocked over by the oscillating weight. The plane of oscillation of the pendulum is thus seen to be slowing rotating (clockwise in the Northern Hemisphere) around a vertical axis perpendicular to floor (the Earth's surface). This rotation is caused by the Coriolis effect.

The amount of time it takes for the oscillating weight of the Foucault pendulum to come back to the first block it knocked down depends on the latitude where the pendulum is located. At the North Pole it takes 24 hours (see Figure 4). Here it is easy to visualize the Earth actually turning under the oscillating pendulum, which itself is really staying in the exact same oscillating plane relative to the stars. If the pendulum is somewhere south of the North Pole (but not on the equator) its plane of oscillation still rotates but it takes longer for the pendulum to come back to where it started. This is more difficult to visualize, because now the whole pendulum is traveling around with the rotating earth along a latitudinal circle (see Figure 4). As it does so, its oscillations still stay in the same direction relative to the stars, so that the plane of oscillation rotates relative to the Earth's surface. On the equator, the pendulum will stay in the same plane relative to the Earth, since its plane of oscillation is perpendicular to the Earth's axis of rotation.

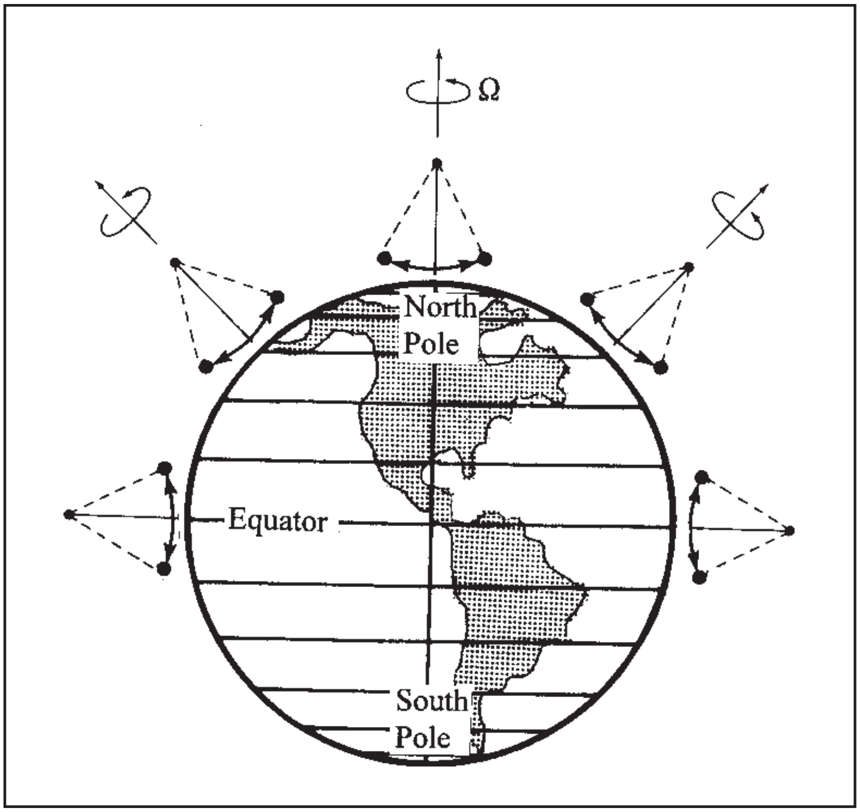

Figure 4. Foucault pendulums shown at the North Pole, at the equator (2 positions of the same pendulum shown), and at high latitude (2 positions of the same pendulum shown).

In the last column we saw how the Coriolis effect caused the large gyres in the circulation of the major oceans. It also has more local effects. When the wind suddenly stops blowing after causing currents in the ocean, the currents keep flowing, acted upon only by the Coriolis force. This makes the currents turn more and more to the right (in the Northern Hemisphere), leading to a circular flow with a period determined by the latitude at which the motion takes place (e.g. at 45^o it would take 17 hours to complete one cycle; less time if closer to the pole; more time if closer to the equator). When these *inertial currents* are superimposed on a mean drift, one sees stretched out loops.

In an earlier column we explained how the Coriolis effect was responsible for the Ekman spiral

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in wind-driven currents. The surface currents are “pushed” to the right of the wind, currents a little deeper move a little slower and are pushed further to the right, and so on with each deeper layer. On the average, over the entire depth of the current, the (Ekman) transport is to the right of (and approximately perpendicular to) the wind (in the Northern Hemisphere). So if the longshore component of the wind is blowing from the north along the west coast of the U.S., the surface water will be pushed away from the coast, replaced by water from near the bottom. This *upwelling* brings colder nutrient-rich water up to the surface. This also happens off the coast of Peru, where the longshore component of the wind blowing from the south will also push water westward away from the coast (the Coriolis effect causing transport to the left of the wind in the Southern Hemisphere). The nutrients brought to the surface are responsible for the abundant phytoplankton at the bottom of the food chain feeding the large fish populations that support a major fishing industry. (This upwelling off Peru ceases during an El Niño because the winds and currents change direction.)

There are also special types of very long waves that are affected by the Coriolis effect, or even caused by it. For example, when the tide propagates southward as a very long wave along an east coast in the Northern Hemisphere, the Coriolis effect on southerly flowing flood currents causes a raised water level at the coast. The Coriolis effect on northerly flowing ebb currents causes a lowered water level at the coast. The result is a greater tide range at the coast than offshore. This long tide wave called a coastal *Kelvin wave.* The restoring force to the vertical oscillation of the water surface in this wave is gravity, but it is the Coriolis effect which causes the slope in water surface toward the coast. Kelvin waves can also propagate eastward along the equator, where there obviously is no coast, but where the fact that the Coriolis force is zero acts like a boundary.

The Coriolis force can also be a restoring force in a wave, in this case causing horizontal oscillations. In the last column we explained how the Gulf Stream and other strong currents on the western sides of the oceans were caused by the change in Coriolis force with latitude. This change in Coriolis force with latitude can also be the restoring force in a wave called a *Rossby wave*. In such a wave, which propagates westward across an ocean, parcels of water oscillate north and south about a latitude line. The current is approximately in geostrophic balance (discussed in the last column), but when it moves a little northward it is forced back southward by the change in Coriolis force, and vice versa.

Both eastward propagating equatorial Kelvin waves and westward propagating Rossby waves play key roles in the phenomena of El Niño. When the westward trade winds collapse and the warm water in the western Pacific moves eastward to the South American coast, it is in the form of equatorial Kelvin waves. At the coast these waves split, heading north toward California and south toward Peru in the form of coastal Kelvin waves. Some of the energy is also reflected back westward in the form of Rossby waves. This all plays some (as yet not fully understood) role in the timing of El Niños.

Rossby waves are also found in the atmosphere at high elevations above the Earth. Around the North Pole (where the change in Coriolis force with latitude is large) there are typically between four and six very long horizontal waves, with a wavelength greater than the width of the U.S.

In Paris, in 1835, when Gustave Gaspard de Coriolis published the paper that first explained the effect that is now named after him, he probably did not realize how important that effect would be in explaining motions in the atmosphere and ocean. His other major (and much longer) publication that same year, was probably viewed with more interest— a 176-page book explaining the mathematical theory of billiards.⚓

Coastal Forecast Office News

The 1997/1998 Ice Season on The Great Lakes

Daron Boyce
Senior Marine Forecaster
NWSFO Cleveland, Ohio

Thanks to El Niño, the 1997-98 ice season on the Great Lakes was the lightest in decades. Many lakes mariners found it to be the lightest in their lifetime.

Lakes Erie and Ontario had only small patches of ice at the peak of the season, and the upper lakes had generally small amounts as well. Even shallow water areas, which usually freeze up early and stay that way in a typical winter, experienced several freeze and thaw cycles this year.

Freezing Degree Days (FDD), which are used by forecasters as a measure of the winter severity, were the lowest since World War II. FDD are based on the mean daily temperature (F°) and departure of this mean from 32°F, i.e., a daily mean of 20°F produces 12 FDD. The maximum total for Duluth this past season was 1338 (compared to a mean value of 2280 maximum FDDs). Only two years in the last 80 years of records had lower figures–1942 and 1931.

As El Niño got underway last fall, the season started off at a normal pace. Some ice even formed earlier than normal on bays and harbors on Lake Superior. However, once El Niño became more intense, Arctic intrusions into the lakes region became fewer and less intense than would normally be expected, and the freeze and thaw cycles that became typical this year began. Ice melted much earlier than normal during the late winter and spring months and commercial carriers started operations with little difficulty in March.

Lake Michigan Storm of March 9, 1998

Kevin Greene and Peter Chan
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A powerful late-season winter storm moved across the Lower Great Lakes Region on Monday, March 9, 1998, producing near blizzard conditions with up to a foot of snow reported in portions of northeast Illinois, northwest Indiana, and much western Lower Michigan. In addition, storm force winds built waves to 15 feet, which caused severe beach erosion and property damage along the south end of Lake Michigan from Chicago, Illinois, to Benton Harbor, Michigan.

The winter storm began as a modest surface low pressure system (996 mb) along a stationary front over southern Missouri on Sunday morning, March 8. A secondary wave of energy in the upper atmosphere associated with a strong southern branch of the jet stream caused the system to deepen as it slowly tracked northeastward into western Ohio at daybreak on Monday, March 9. Earlier in the weekend, mild and rainy weather prevailed across much of the Lower Great Lakes and Ohio Valley. However, arctic high pressure and plenty of cold air over the Northern Plains had begun to build into Wisconsin on Sunday night so that by early Monday morning a large area of rain over northeast Illinois and western Lower Michigan quickly changed to heavy snow. The storm further deepened (988 mb) during the day on Monday as it tracked northeast across Lake Erie resulting in an impressive pressure gradient over Lake Michigan during the morning and afternoon hours. This tight pressure gradient and strong push of cold air produced northerly gale- to storm-force winds across the southern half of Lake Michigan, thus utilizing the maximum fetch

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Coastal Forecast Office News

Continued from Page 24

length of the lake and generating large waves capable of causing major beach erosion and coastal flooding.

The National Weather Service issued Lakeshore Warnings for the Lake Michigan shoreline from Winthrop Harbor, Illinois, to Ludington, Michigan, at 4:30 am EST on Monday, March 9. In addition, a Storm Warning was hoisted for the open waters of Lake Michigan which called for northerly storm force winds to reach 50 knots with wave heights building to 12 to 15 feet.

Ship and Coast Guard observations, Lake Michigan buoy 45007, and law enforcement agencies along the southern end of Lake Michigan reported north winds sustained at 25 to 40 knots with gusts between 50 and 60 knots during the morning and early afternoon hours of March 9. Waves reached 8 to 15 feet along the Illinois, Indiana, and southwest Michigan shorelines, and there were unconfirmed reports of 20 foot waves farther offshore.

The already high water level of Lake Michigan, combined with the lack of protective shoreline ice from the unseasonably mild El Niño winter, made the shoreline more vulnerable than normal to major beach erosion from this winter storm. Berrien County law enforcement officials in southwest Lower Michigan reported significant damage along Shore Drive in New Buffalo, near the Indiana border. One home was destroyed when it fell down the dunes into Lake Michigan, and two other homes were left precariously hanging above the water's edge. Part of a seawall along Shore Drive was also destroyed and, as a result, seven homes within the seawall were inundated by flood waters. Freezing spray off the lake coated many trees and power lines of lakefront properties which resulted in numerous power outages at the height of the storm. A portion of Lakeshore Drive in downtown Chicago had to be closed due to coastal flooding, while wind blown debris and chunks of ice falling from skyscrapers posed an additional hazard to motorists and pedestrians in the Windy City.

Storm Warnings were lowered to Gale Warnings at 4:00 pm EST on March 9. Winds and waves gradually subsided during the evening hours. When all was said and done, the March 9 storm was the most damaging of 1997-98 winter season on and along the shores of Lake Michigan.

El Niño Effects on Weather Over Southeast Alaska

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Coordination Meteorologist
NWSFO Juneau, Alaska

El Niño effects for Southeast Alaska during the winter are much warmer and drier than normal. Also, there are fewer major storms moving into the Gulf of Alaska, and not as many outbreaks of Arctic air from Canada. The strong 1997-98 El Niño generally followed this pattern and was similar to the 1982-83 event. Juneau had the 9th warmest winter (December 21 - March 21). The winter ranked 22nd for total precipitation, even with the wettest December on record. The biggest effect in Juneau was a winter season snowfall of only 22.2 inches compared to the normal winter average of 61.8 inches. (Total Juneau snow October through April was 35.5 inches, or one third of normal.) The warmer, drier, and much less snow totals also applied to the remainder of Southeast Alaska.

The mean winter position of the blocking 500 mb ridge line normally is along the west coast of North America. During an El Niño, the winter the position is shifted 300-500 miles east into Canada. This gives a more southerly prevailing flow aloft. This pattern both prevents normal frequency of occurrence of outflow of intense Arctic air from Canada, and shifts the early winter storm track farther west into the Bering Sea. Except for one storm in early December and two series of developing lows in January, there were no other major winter storms that moved into the Gulf of Alaska. This shift in the storm track, and the lack of Arctic outbreaks, produced a much below normal occurrence of high wind events in Southeast Alaska during the winter of 1997-98.

Overall, the 1997-98 El Niño was very kind to mariners in Southeast Alaska waters with significantly fewer big wind and sea events.⚓

Call *Dial-A-Buoy* for Wind and Wave Reports

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Data Systems Division
National Data Buoy Center
Stennis Space Center, Mississippi

Imagine this: You're fishing in protected waters and want to know if the weather has calmed down enough to head offshore. You reach for the cell phone, dial (228) 688-1948 and hear, "Welcome to the National Data Buoy Center's Dial-A-Buoy Line." You then enter a nearby buoy station number and hear a computer voice—somewhat like Tim Conway in an old Carol Burnett rerun—say, "Winds northeast 15 knots gust to 18 knots. Wave height 4 feet."

Such a scenario is now possible. Mariners can obtain the latest coastal and offshore weather observations through our new telephone service called Dial-A-Buoy. Dial-A-Buoy provides wind and wave measurements taken within the last hour at 65 buoy and 54 Coastal-Marine Automated Network (C-MAN) stations. The stations are located in the Atlantic, Pacific, Gulf of Mexico, and the Great Lakes, and are operated by the National Data Buoy Center (NDBC). NDBC, a part of the National Weather Service, created Dial-A-Buoy to give mariners an easy way to obtain the reports via a cell phone.

Large numbers of boaters use the observations, in combination with forecasts, to make decisions on whether it is safe to venture out. Some even claim that the reports have saved lives. Surfers use the reports to see if wave conditions are, or will soon be, promising. Many of these boaters and surfers live well inland, and knowing the conditions has saved them many wasted trips to the coast.

An increasingly popular way to obtain the observations has been through the Internet. In fact, NDBC's web site has received more than a million hits a month. Dial-A-Buoy is a logical extension to the Internet because it allows the mariner a way to get the conditions while offshore, at the marina, or away from the Internet.

Buoy reports include wind direction, speed, gust, significant wave height, swell and wind-wave heights and periods, air temperature, water temperature, and sea level pressure. Some buoys report wave directions. All C-MAN stations report the winds, air temperature, and pressure; some also report wave information, water temperature, visibility, and dew point.

To access Dial-A-Buoy, dial (228) 688-1948 using any touch tone or cell phone. Enter the five-digit (or character) station identifier in response to the prompt, and you will hear the latest buoy or C-MAN observation read via computer-generated voice. Characters are entered by pressing the key containing the character. For "Q" press "7", and for "Z" press "9".

There are several ways to find the station locations and identifiers. For Internet users, maps showing buoy locations are given at **http://www.ndbc.noaa.gov/**. Telephone users have several options: They can enter a fax. number to receive a location map by following the prompts, or they can enter a latitude and longitude and receive the closest station locations and identifiers.

The Dial-A-Buoy system does not actually dial into a buoy or C-MAN station. The phone calls are answered by a computer at the Stennis Space Center in Mississippi, where NDBC is located. The computer runs software to control the dialog and read the forecasts and observations from NDBC's web site.⚓

Marine Weather Review
North Atlantic Area
October 1997—March 1998

George P. Bancroft
Meteorologist
Marine Prediction Center

The period was strongly influenced by El Niño, which had set in during the preceding summer. This was marked by an unusually strong southern branch of the jet stream which not only had suppressed the 1997 Atlantic hurricane season, but also led to frequent appearance of fronts and low pressure developments unusually far south. Figure 1 is an analysis for 18Z October 17, 1997, which shows such features, including a front across Florida and part of the Gulf of Mexico. Many of the stronger low pressure systems affecting Marine Prediction Center's (MPC's) area north of 31N during the fall-winter period developed in that area. The first winter-like event of the season was the low shown in the southeast Gulf of Mexico that became a storm in the offshore waters south of Georges Bank on the morning of the 20th.

November and December were especially active. Split flow conditions characteristic of a well developed El Niño did not develop until January, so as a result the northern branch of the jet stream could interact with the southern jet to produce some intense storms. In fact, most of the warnings for extratropical hurricane force winds issued by MPC in high seas text forecasts (for the area 31N to 67N west of 35W) were issued during these two months. From late January through March there were none.

The most significant weather event in terms of winds and seas affecting the MPC high seas area and also located near the shipping lanes is depicted in Figure 2. Surface analyses every 12 hours for the period 00Z 11 December to 12Z 12 December 1997 show a development off Cape Hatteras

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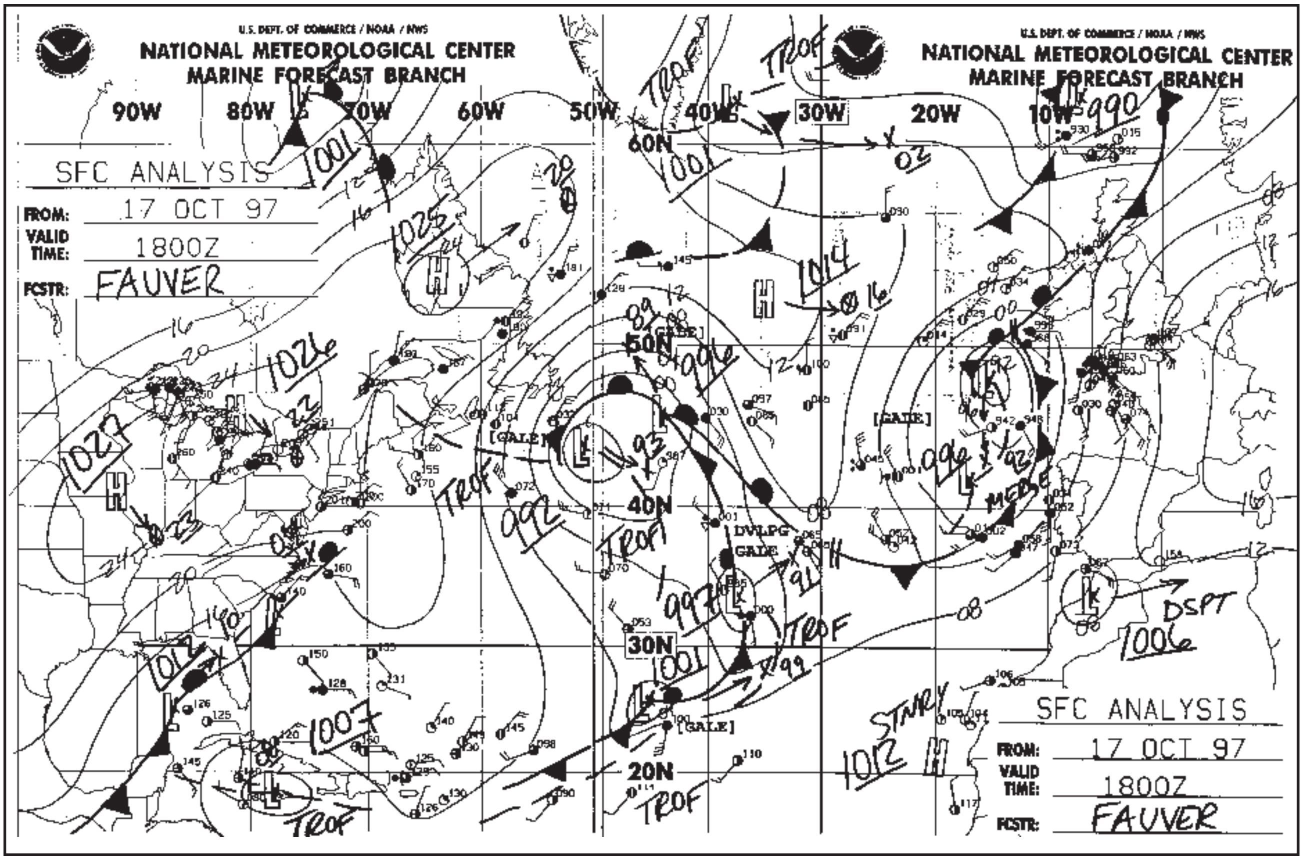

Figure 1. MPC North Atlantic surface analysis for 18Z 17 October 1997.

North Atlantic Area

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which originated on the stationary front across Florida and the Gulf of Mexico. The system appears to merge with a front to the north associated with the northern jet stream after 12Z 11 December which, along with passage over the warm Gulf Stream, fuels rapid intensification. The storm center passed two ships traveling east, placing them in the cold air and tight pressure gradient south of the center. The **STAR FUJI (LAVX4)** reported 65 kt winds from the west (plotted on 12/00Z analysis) and the **SEA-LAND PERFORMANCE** (**KRPD**) reported northwest wind 75 kt 12 hours later near 39N 49W (plotted) along with 13 meter seas (43 ft). The 60 kt wind report plotted southwest of **KRPD** is that of **LAVX4**. The storm is shown near maximum intensity at 12Z 12 December.

Another storm worthy of mention is shown in Figure 3. This storm took a more northeastward track to the eastern Grand Banks at 18Z 21 November (shown). At that time the center had passed oil platform **HIBERNIA** at 46.7N 48.7W, which reported a northwest wind 80 kt, and platform **44147** which reported northwest wind 69 kt (not plotted). Note the ship reports with 65 kt wind and 50 kt wind southeast and south of the center. Reported seas were 8 to 11 meters (26 to 35 ft) south of the center. On November 23 the storm weakened in the eastern Atlantic off France, but there were still reports of 50 to 55 kt winds and northwest swells as high as 14 to 17 meters (46 to 56 ft) in the vicinity of 40N between 20W and 30W. This area is actually east of

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North Atlantic Area

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the MPC high seas area, but is included in the full-ocean analysis.

During the fall-winter period, the deepest low on the MPC North Atlantic ocean analyses reached 933 mb near Iceland at 12Z 30 December 1997 (Figure 4). This analysis is based on reliable drifting buoy observations in the area. The system developed from a frontal wave near the South Carolina coast and tracked northeast, deepening only 20 mb in the first 36 hours. It then merged with an arctic front near Newfoundland after 00Z 29 December and deepened explosively, dropping almost 50 mb in the following 36 hours. The accompanying 500 mb analyses shows the system evolving rapidly from a full-latitude trough, with the stronger southern jet stream apparent. As the trough rotated northeast it received an injection of energy from the polar jet stream east of Labrador before 12Z 30 December. The system then formed a closed low aloft.

Early January marked the transition to split flow aloft and warm El Niño conditions over North America. Figure 5 shows a 500 mb analysis for 00Z 04 January (actually a good 12 hour model forecast) which is several days after the case in Figure 4. Note the increased ridging near the East Coast and the northern jet stream in Canada. An intense short wave is shown approaching Europe,

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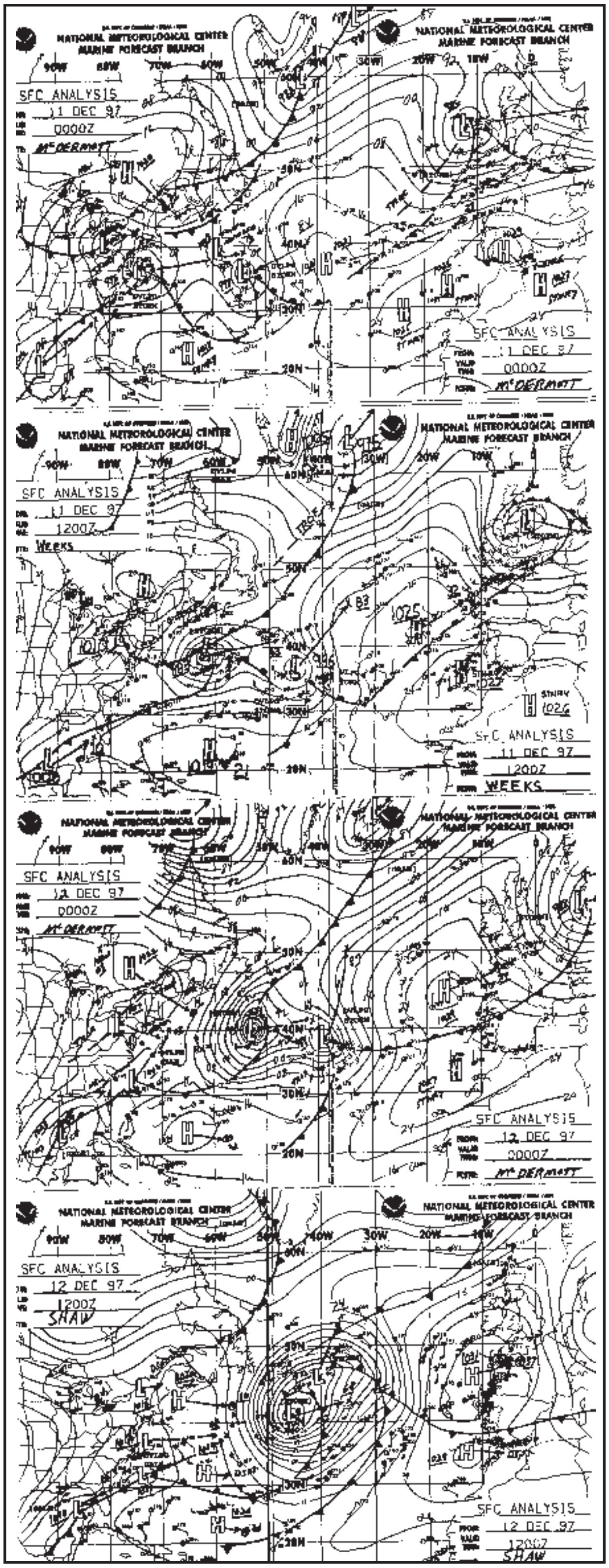

Figure 2. Four-panel display of surface analyses every 12 hours from 00Z 11 December 1997 to 12Z 12 December 1997.

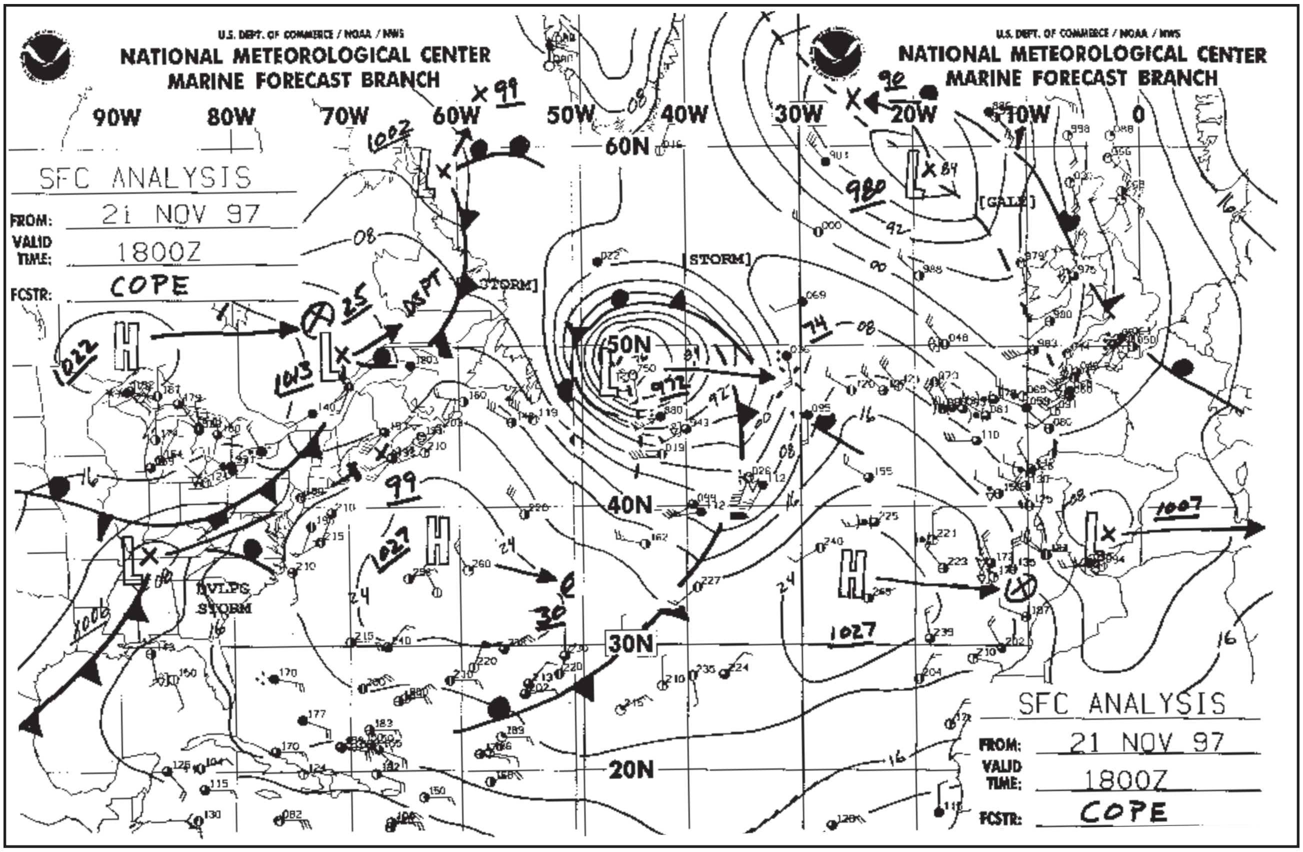

Figure 3. MPC North Atlantic surface analysis for 18Z 21 November 1997.

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supporting a 964 mb storm depicted in the second panel of Figure 5. Winds to 65 kt and seas as high as 8 to 14 meters (26 to 46 ft) were reported from the southern British Isles to the Bay of Biscay with this system.

Figure 6 is an example of a series of weather systems relatively far south in the North Atlantic and associated with the southern jet stream. By February 2, one gale formed in the Gulf of Mexico and moved northeast over the next three days, emerging off the mid-Atlantic coast by 12Z 05 February and then continuing to move northeast. Split flow is apparent in the corresponding 500 mb charts of Figure 6. Note that on the third panel of the figure, yet another low forms in the Gulf of Mexico. In late January, one low that formed in this pattern intensified to 962 mb while following a track similar to the early December case and was almost as intense. This system later turned north toward Greenland.

The pattern became more changeable in March, especially near the East Coast. The westerlies shifted south early in the month while high pressure in the eastern Atlantic forced movement of many lows north toward Greenland and Iceland where some became intense. Later in the month a warm ridge developed in the western Atlantic.

Reference

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

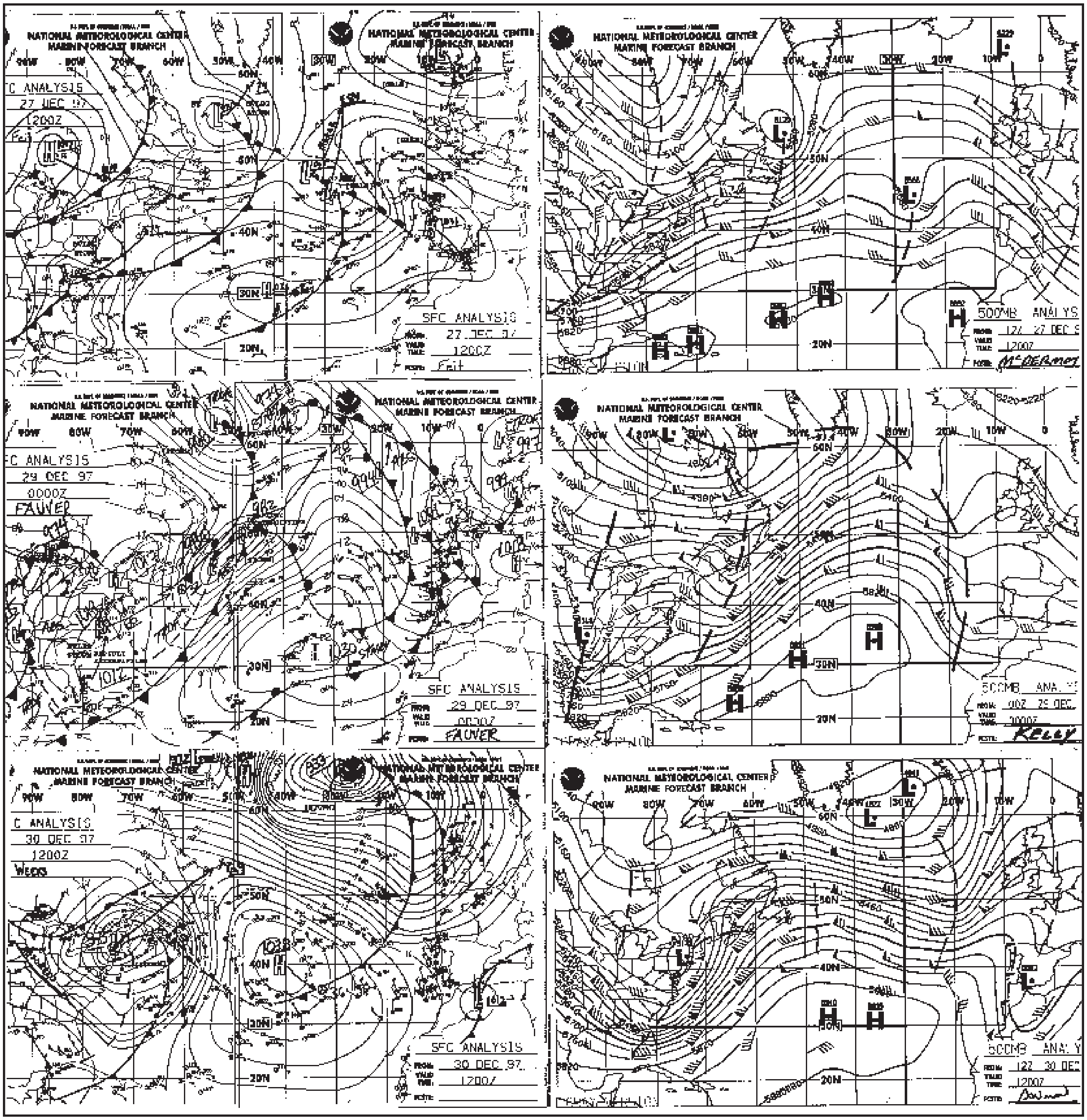

Figure 4. Three-panel display of surface analyses and corresponding 500 mb analysis charts for 12Z 27 December, 00Z 29 December, and 12Z 30 December 1997.

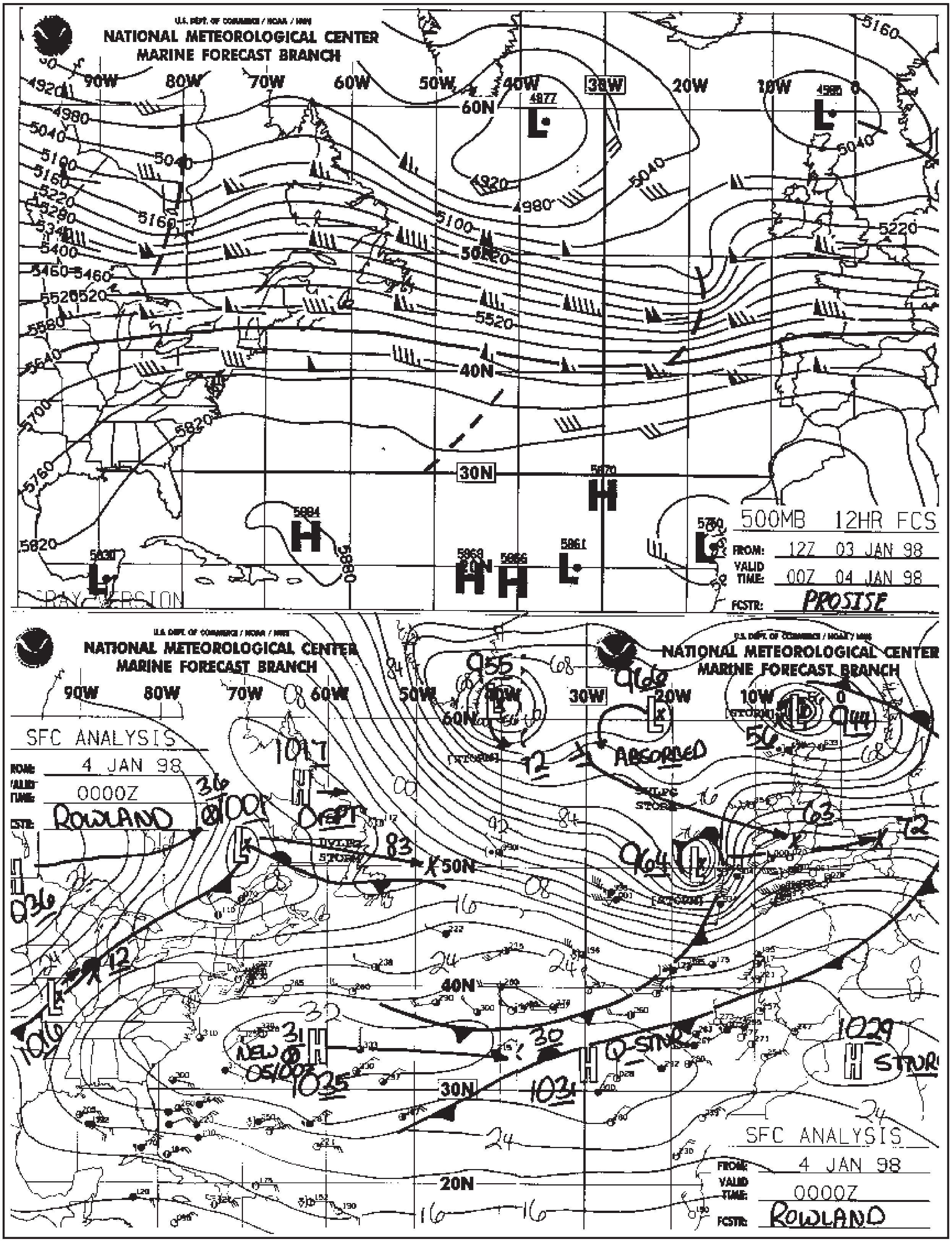

Figure 5. Two-panel display of 500 mb analysis (12 hour backup computer model forecast) and surface analysis valid 00Z 04 January 1998.

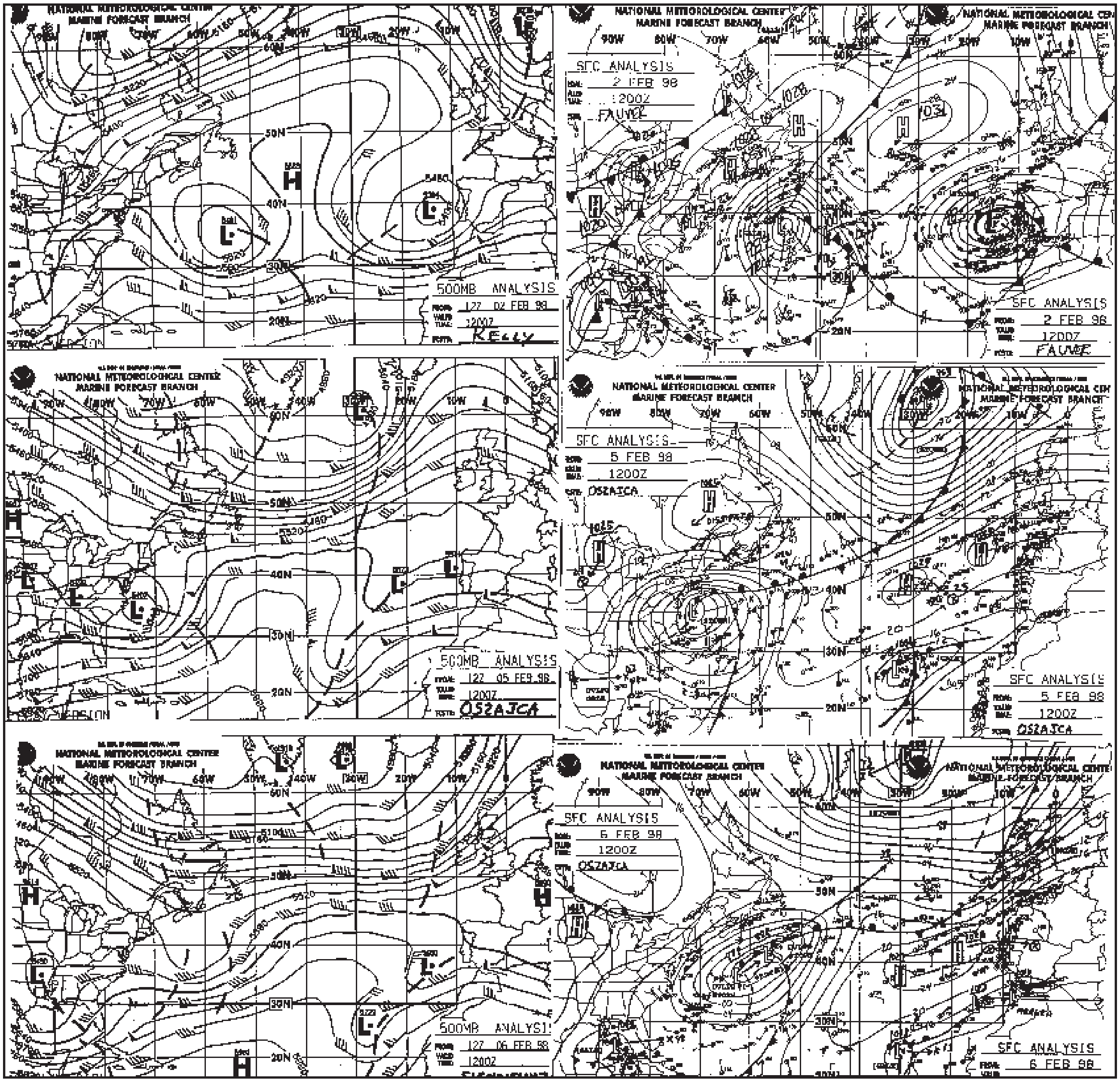

Figure 6. Three-panel display of surface analyses and corresponding 500 mb analysis charts for 12Z 02 February, 12Z 05 February, and 12Z 06 February, 1998. Shorter interval between second and third panels is chosen to show new development in the Gulf of Mexico.

Marine Weather Review
North Pacific Area
October 1997—March 1998

George P. Bancroft
Meteorologist
Marine Prediction Center

This period covers the fall and winter seasons, which is the period of most active weather in the North Pacific. There were many cyclonic systems producing storm-force winds. The most noteworthy storms are discussed here, in most cases ones with hurricane force winds, tropical origin, or other features such as rapid intensification and unusual ship reports.

October and November featured the last two tropical cyclones of the season to not only appear in Marine Prediction Center's (MPC's) surface analysis area (the entire North Pacific north of latitude 20° N), but also to move into the MPC high seas area of responsibility which is north of 30N and east of a line from 50N, 160E to the Bering Strait. In late October, Super Typhoon Joan recurved in the western Pacific and entered the southwest corner of the high seas area as a minimal typhoon which weakened and merged with a polar front. It then redeveloped as an intense extratropical storm (Figure 1). Another Super Typhoon, Keith, approached the southwest high seas waters on November 8 as a tropical storm, but became extratropical when crossing 160E and was swept east along a southern polar front as a gale (not shown).

As the season progressed, there was an active southern branch of the jet stream which fed a seemingly endless series of developing cyclonic systems originating south of Japan northeast into the North Pacific, with many tracking toward the Gulf of Alaska or U.S. Pacific Northwest and some moving into the Bering Sea (especially during the fall season). Figure 2 shows the development

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of what turned out to be the most intense storm of the fall-winter period in the eastern North Pacific. This system deepened almost 40 mb in 24 hours beginning on Christmas day. Note the 500 mb short wave trough crossing 170W on the middle panel with a jet speed maximum of 100 kt approaching from the west supporting development. This short wave developed negative tilt and became a closed low aloft as shown in the third panel. Six hours after the last chart, a ship report (name not available) from just north of the front in the Gulf of Alaska indicated 65 kt wind and pressure of 944 mb.

A series of lows moved from near Japan northeast into the Bering Sea from late December into early January. The most intense of these was one that originated south of Japan and rapidly intensified after merging with another low and associated front to the north (Figure 3). On the corresponding 500 mb charts one finds two short wave troughs, one in the southern jet stream and the other in the northern branch of the jet stream, merging to form one intensifying short wave in the second panel. This development was noteworthy because of the 41 mb drop in the central pressure of the surface low in the 24-hour period between the first and second panels of Figure 3, and the ship report with southeast 70 kt ahead of the front.

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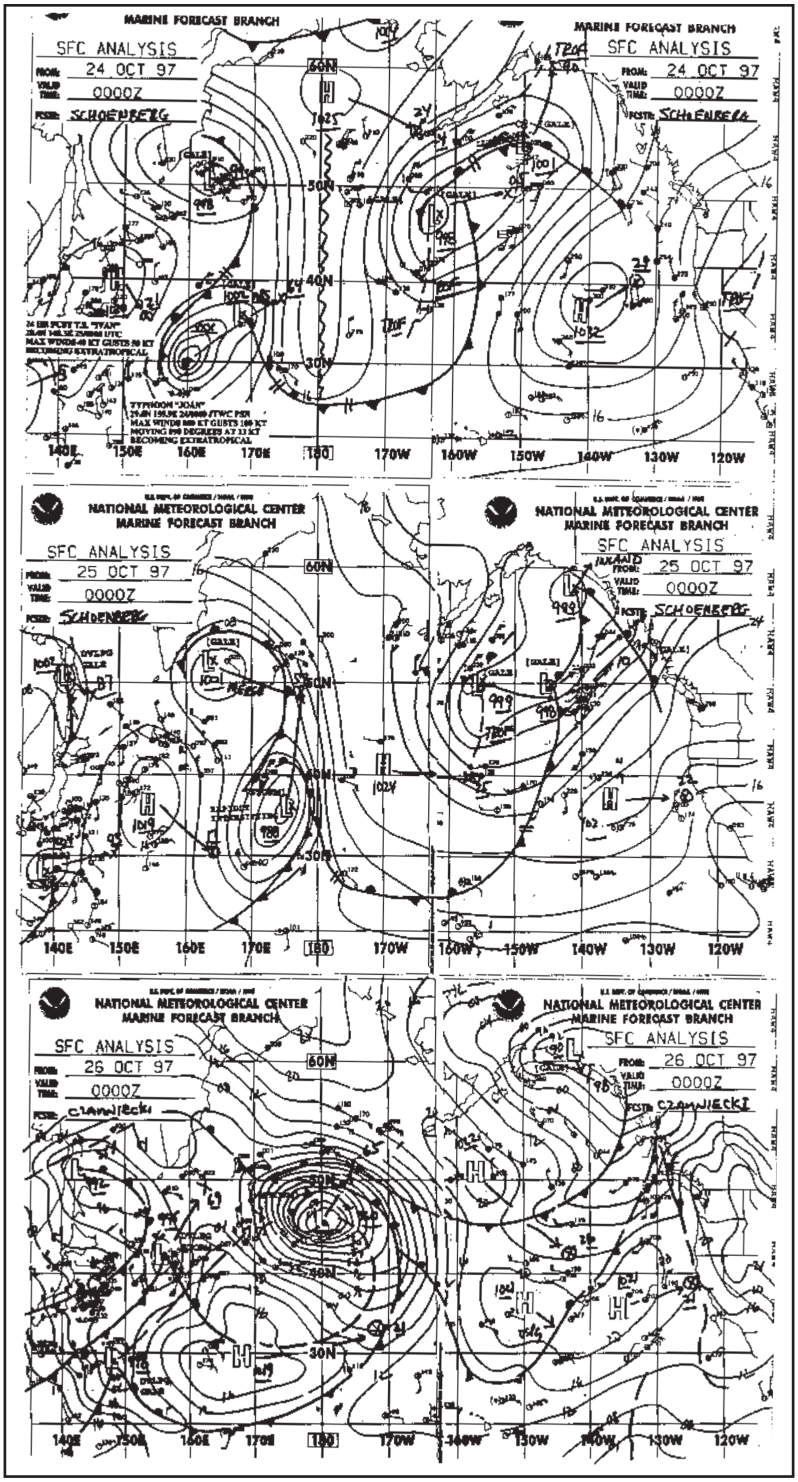

Figure 1. Three-panel display of surface analyses showing Typhoon Joan entering MPC high seas area and becoming extratropical late in October 1997.

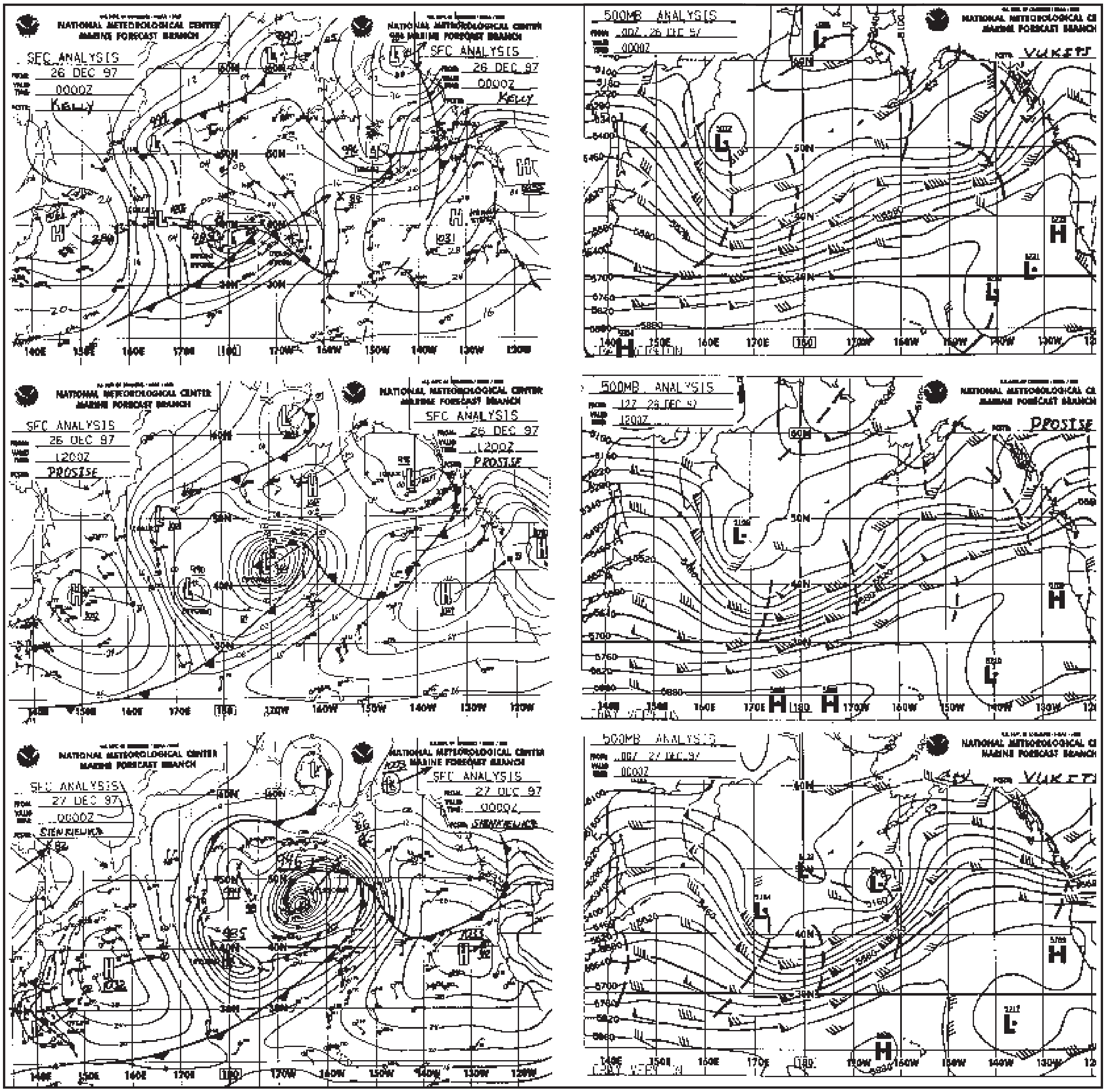

Figure 2. Three-panel display of surface analyses and 500 mb analysis charts depicting development of central North Pacific storm near Christmas 1997.

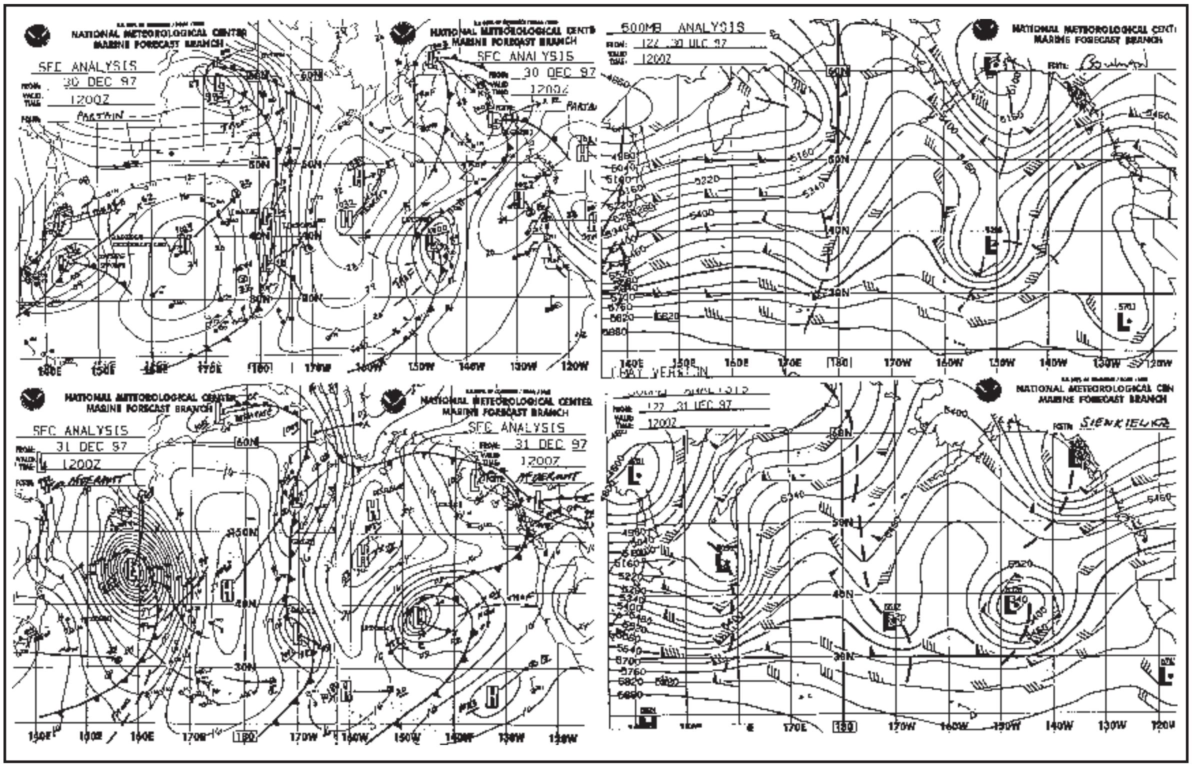

Figure 3. Two-panel display of surface analyses and 500 mb charts depicting development of western North Pacific storm at end of December 1997.

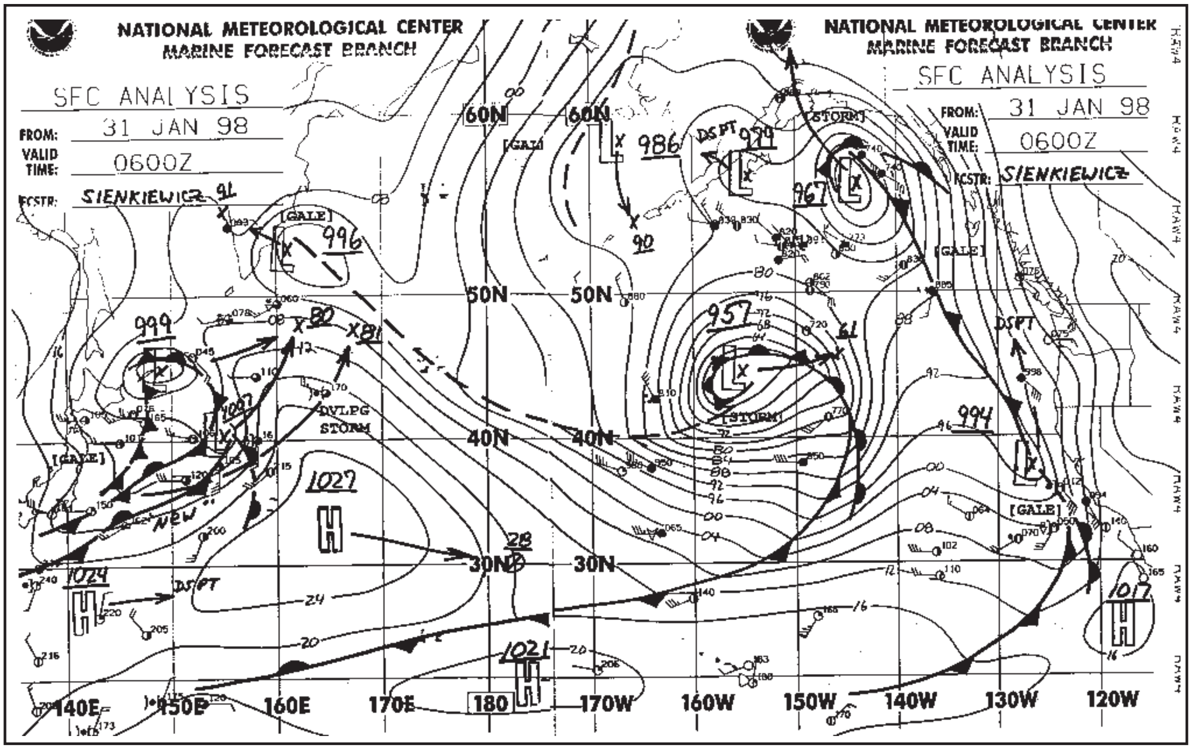

Figure 4. Surface analysis for 06Z January 31, 1998, depicting northward moving storm in eastern Gulf of Alaska approaching Alaska coast.

North Pacific Area

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A blocking high developed in the Bering Sea early in January and kept significant storm activity out of the Bering Sea through much of February. El Niño asserted itself as much of the developments were associated with a strong southern jet stream. January was especially active, and MPC high seas forecasters issued more extratropical storm warnings for winds of hurricane force (64 kt or more) than in any month since January 1995 (when MPC began keeping monthly storm warning statistics). At the end of January, a north-south frontal zone developed off the West Coast. A frontal wave rapidly developed on the 30th off the U.S. Pacific Northwest coast and headed north, slamming into the south coast of Alaska early on the 31st. Figure 4 shows the storm approaching the Alaska coast with a tight pressure gradient developing near the coast.

Six hours prior to map time in Figure 4, off the Queen Charlotte Islands, the **M/V SEA-LAND KODIAK** reported southeast wind 60 kt and building seas of 30 ft. On the evening of the 30th, a 77 ft fishing vessel, the **LA CONTE,** sank after encountering 60 kt wind with hurricane-force gusts and 50 ft seas off the coast of southeast Alaska.

By early February there was increasing El Niño-driven cy-

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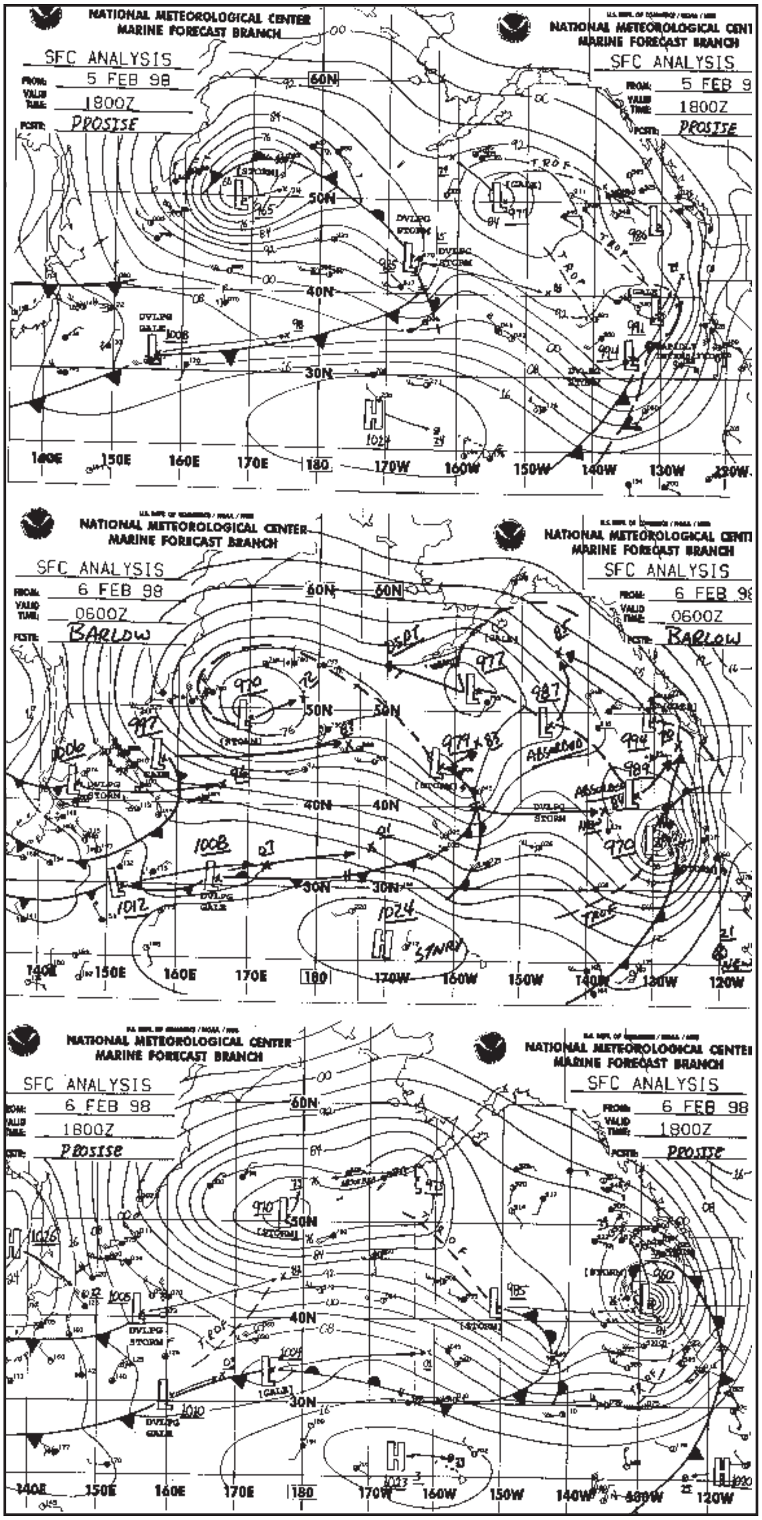

Figure 5. Three-panel display of surface analyses depicting development of West Coast storm February 5-6, 1998.

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clonic activity more directly affecting California waters. The strongest of the lows formed southwest of California on February 5 then rapidly intensified as it moved into the California offshore waters (Figure 5). The **SEA-LAND EAGLE** (**V7AZ8**) reported a 72 kt southeast wind off the central California coast. Seas were reported up to 30 ft in the California offshore waters. Figure 6 is a GOES-9 infrared satellite image of this storm near maximum intensity (with plotted data) with cold topped clouds wrapping all the way around the intense center. The storm subsequently moved north through the Oregon and Washington offshore waters and began to weaken.

Also in early February, a storm associated with the strong southern jet stream developed hurricane force winds well south of the western Aleutians. Figure 7, a surface analysis for 12Z 11 February 1998, shows the storm centered near 37N 170E. A ship (name not known, call sign **4KGV**) south of the center

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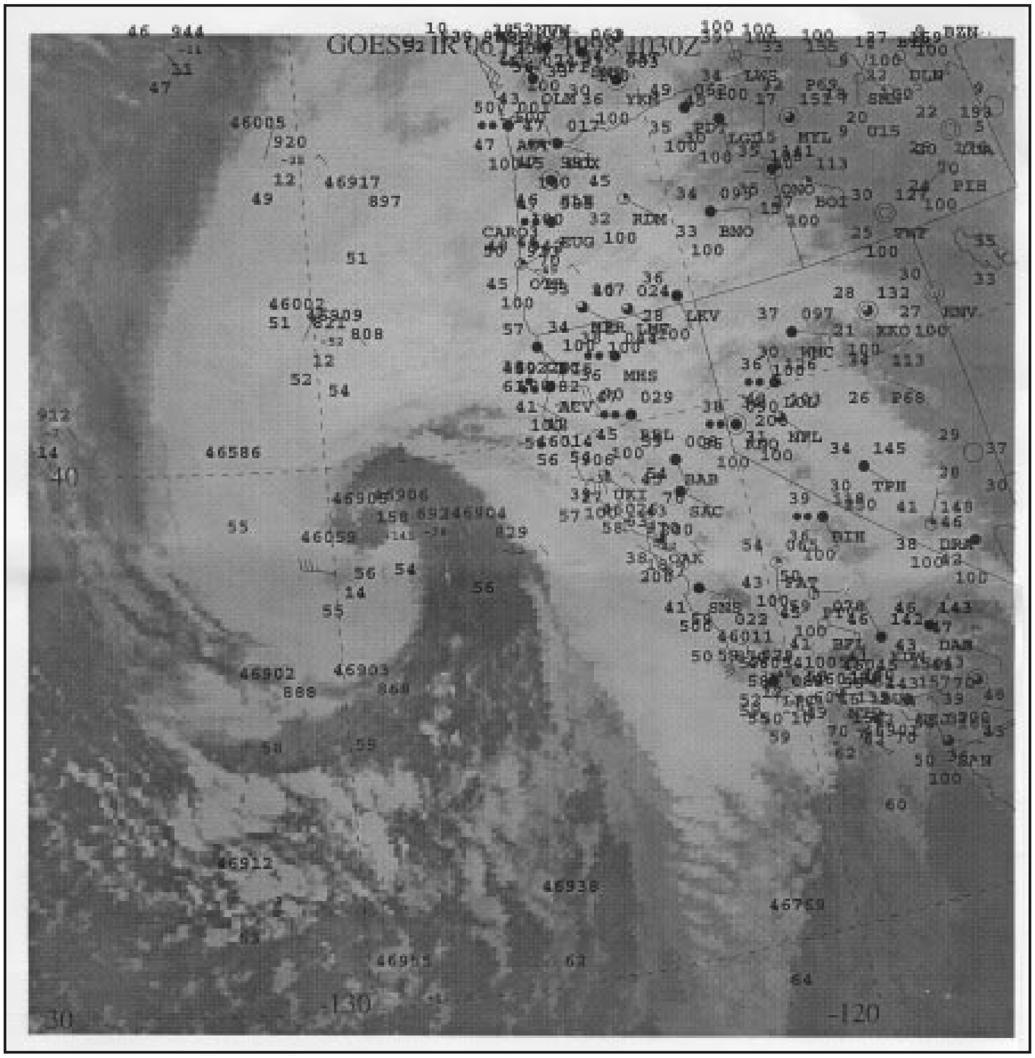

Figure 6. GOES-9 infrared satellite image of storm at 1030Z February 6 off California coast with plotted data

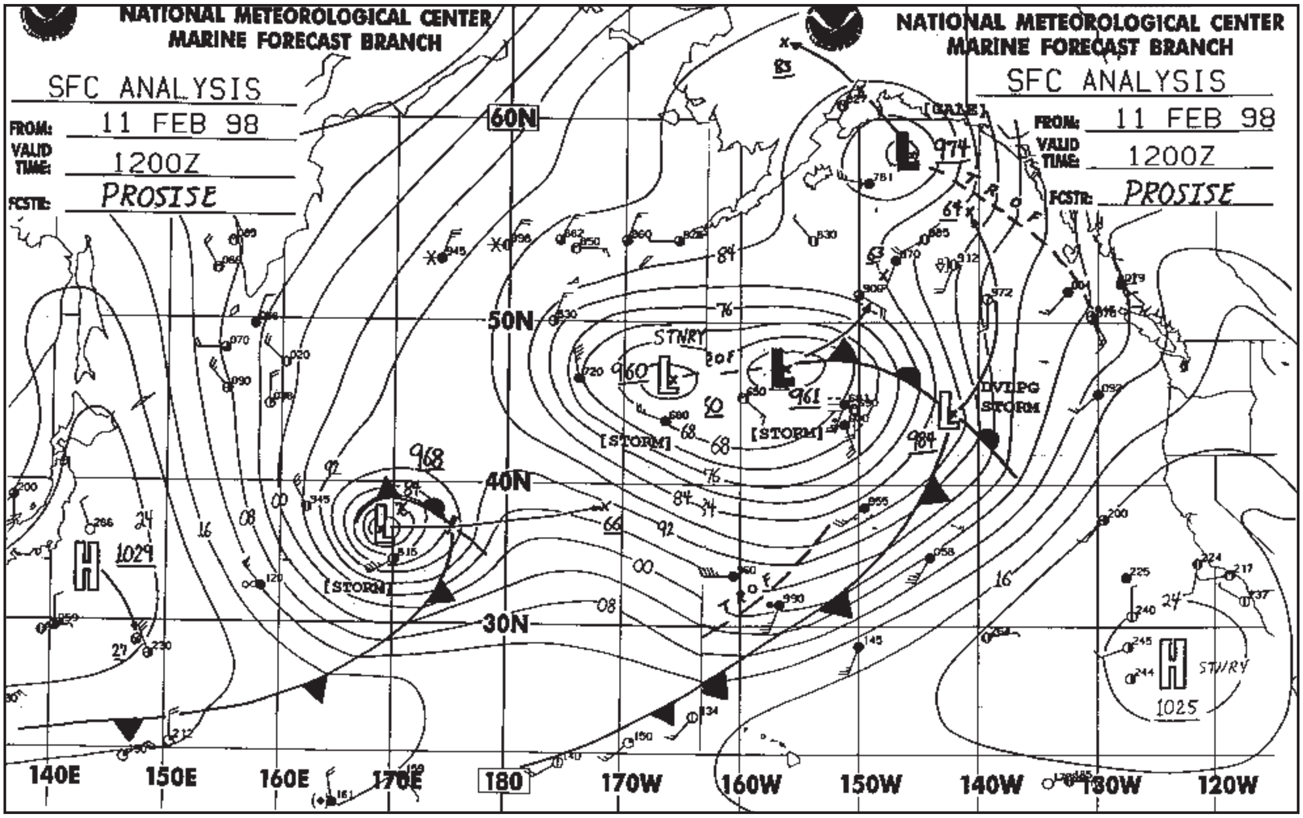

Figure 7. Surface analysis for 12Z February 11 showing storm 37N 170E with 75 kt ship report.

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considered to be a credible observer reported 75 kt wind and 50 ft seas. In March the active southern storm track continued.

By late February, blocking in the Bering Sea weakened and allowed systems to track more north from near Japan. Figure 8 shows the merging of a system coming from south of Japan with a weaker center off northern Japan to form a storm which deepened to 938 mb at the time of the third panel. The third panel is for 18Z rather than 00Z in order to show the system at lowest pressure. This was the most intense system (in terms of central pressure) to form in either ocean during this fall-winter period.

In March the strong southern storm track continued. A storm emerged south of Japan on March 5 with a compact core of hurricane force winds and V-shaped pressure trace more typical of a typhoon. Figure 9 shows the storm southeast of Japan and an accompanying barograph trace from the ship **SEA-LAND RELIANCE.** Note that the storm center passed over the ship accompanied by shifting winds estimated at 120 kt! The pressure trace bottoms out at 970 mb, which is much deeper than the analyzed central pressure. The lowest pressure was observed between synoptic map times, in this case 1555Z. The same ship reported 65 kt wind at the previous analysis time (12Z) when the center was still to the west.

Reference

Sienkiewicz and Chesneau, *Mariners Guide to the 500 Millibar Chart* (Mariners Weather Log, Winter 1995).⚓

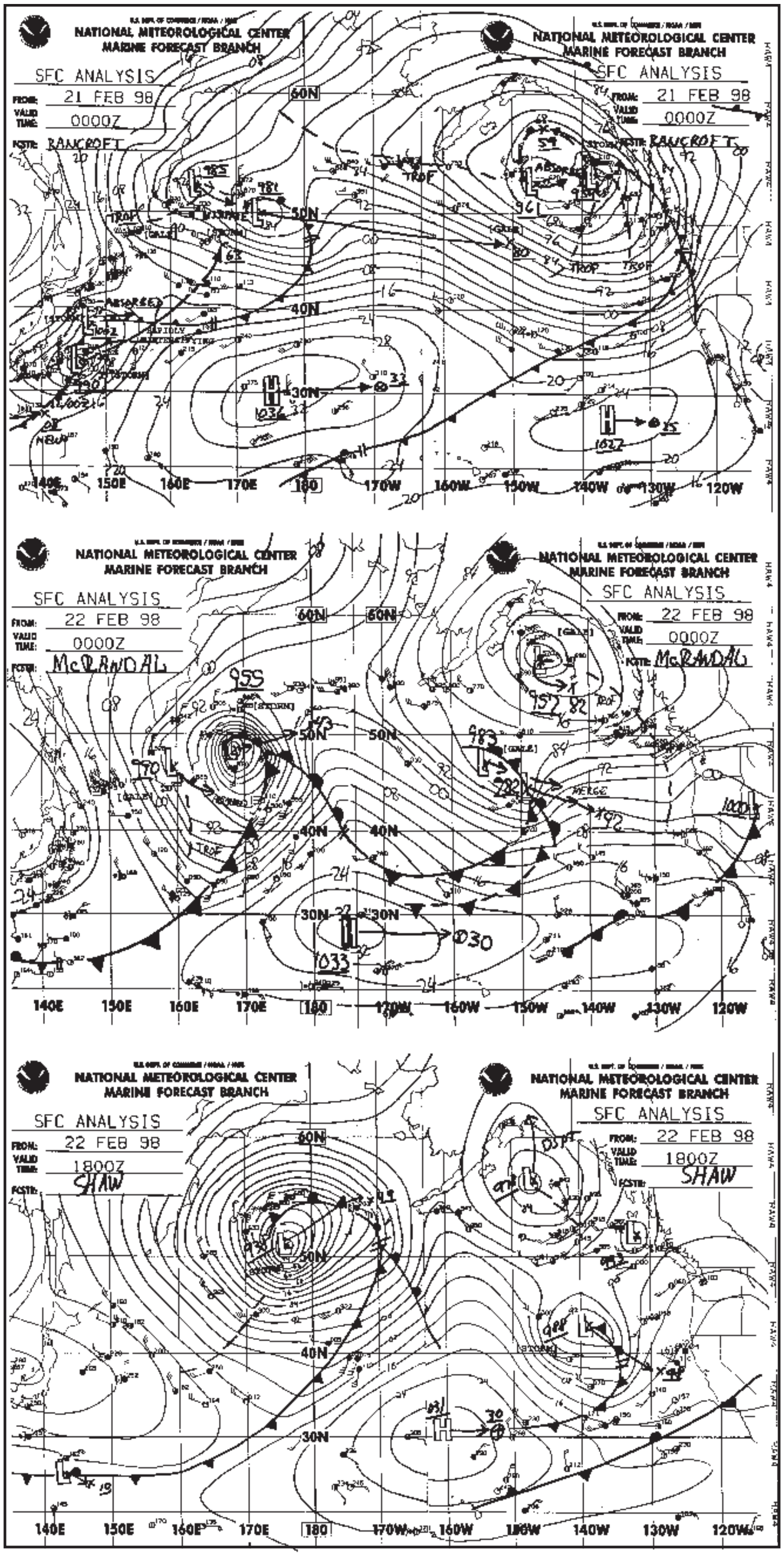

Figure 8. Three-panel display of surface analyses showing development of the most intense storm of the October 1997 to March 1998 period, February 22-23, 1998.

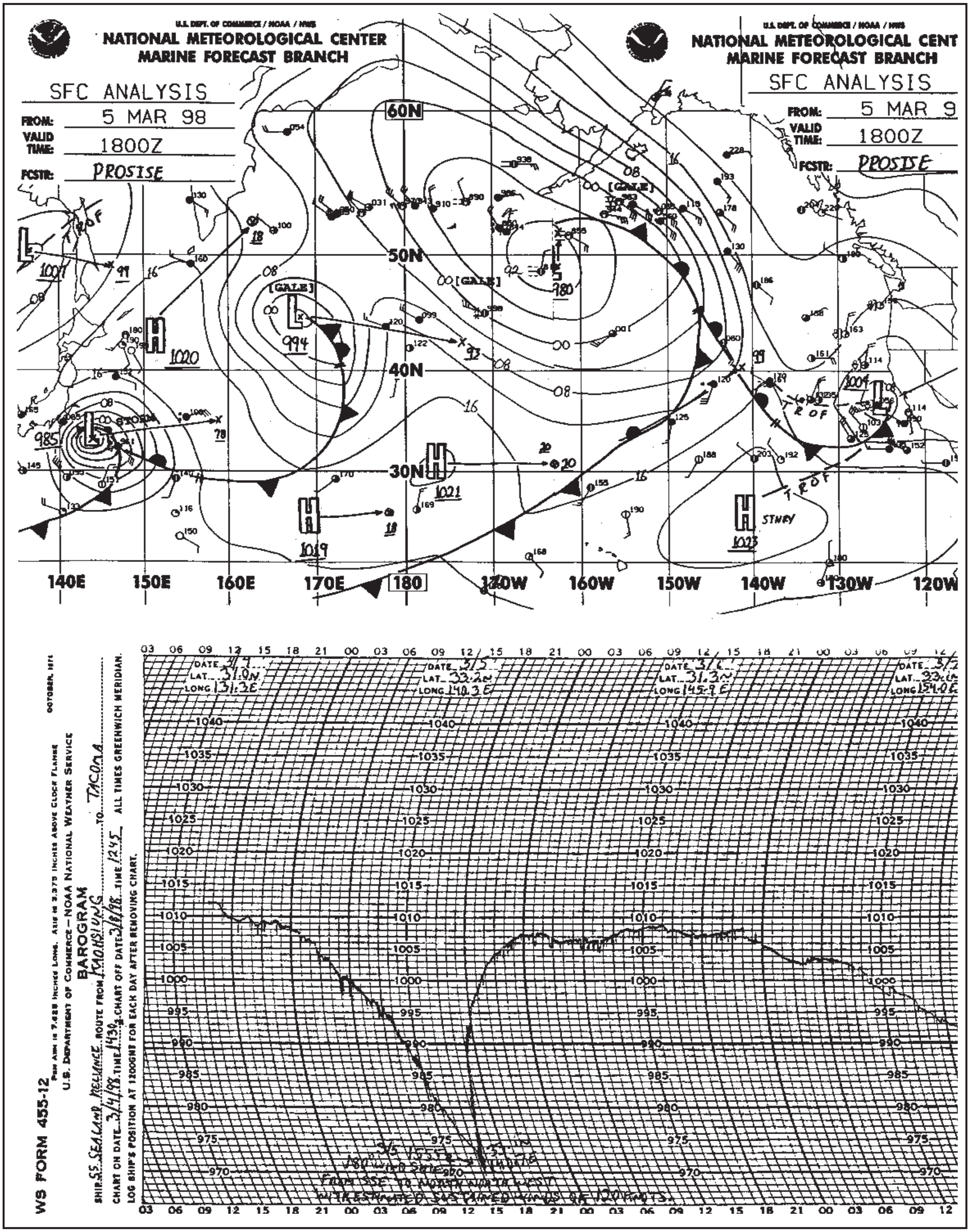

Figure 9. Surface analysis for 18Z March 5, 1998, depicting storm off Japan (top), plus barograph trace from ship which storm center passed over (bottom).

Marine Weather Review
Tropical Atlantic and Tropical East Pacific Areas
January—April 1998

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I. Introduction

El Niño continued its dominance over world weather patterns during the period, including those over the Tropical Prediction Center (TPC) forecast area. Many strong winter storms affected both the Atlantic and the Eastern Pacific areas.

II. El Niño and the TPC Forecast Area

El Niño, the abnormal warming of ocean temperatures in the tropical Pacific west of South America, has global consequences. Many of these are discussed in Kousky (1997). In the TPC area, the best-known effect is the decrease in Atlantic hurricanes during El Niño occurrences. This is occasionally accompanied by more active than normal Eastern Pacific hurricane seasons. However, since El Niño usually peaks during the winter, its strongest effects occur then.

El Niño causes significant changes in atmospheric flow patterns, including creating stronger subtropical jet streams over the west Atlantic and Eastern Pacific. This increases both the number and intensity of winter storms over the Gulf of Mexico, the northwest Caribbean, the western Atlantic south of 35°N, and the eastern Pacific from 25°-35°N east of 150°W. During El Niño events, mariners at subtropical latitudes often encounter gale- and even storm-force winds normally seen much further north.

The strong El Niño of 1982-83 produced a stormy winter in the Gulf of Mexico with strong low pressure systems. Two of these systems had central pressures below 990 mb before moving out of the Gulf. Similar, although weaker, storms occurred over the Gulf during the moderate El Niño of 1986-87. The prolonged weak-to-moderate El Niño of 1991-94 may have helped spawn the Blizzard of ‘93 which had its origin over the western Gulf. The central pressure of this storm reached 976 mb as it passed over Tallahassee, Florida, and then fell further as the storm tracked northeast along the Atlantic seaboard.

Thanks to El Niño, which continues as of the end of the period (Figure 1), the winter of 1997-98

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Tropical Prediction Center

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will also be remembered as a stormy one in the Gulf of Mexico and the adjacent Atlantic.

III. Significant Weather of the Period

A. Tropical Cyclones: No tropical cyclones occurred in either the Atlantic or Pacific TPC forecast areas during the period. This is normal, as only four tropical or subtropical cyclones are known to have occurred in these areas since 1886. Two low-latitude Atlantic gale centers developed organized central convection during some part of their lifetimes. The first, on 9-11 March, did not develop gale-force winds. The second is described below.

B. Other Significant Events: Many significant gale and storm events occurred during the period. Fortunately (or perhaps unfortunately for those caught in them), many of them occurred in observationally rich areas such as the Gulf of Mexico and the Western Atlantic, which allowed accurate sampling and assessment of weather conditions.

1. Atlantic

Storm of 1-4 February: One of the most significant events began on 1 February, when a low pressure system developed in the western Gulf of Mexico in association with a very strong, low latitude upper-level trough. Similar to weaker predecessors, this system moved generally east-northeastward across the Gulf and

Continued on Page 45

NOAA/NWS
Environmental Modeling Center/National Hurricane Center

Reynolds SST Anomaly **Data from 19 APR 98 to 25 APR 98**

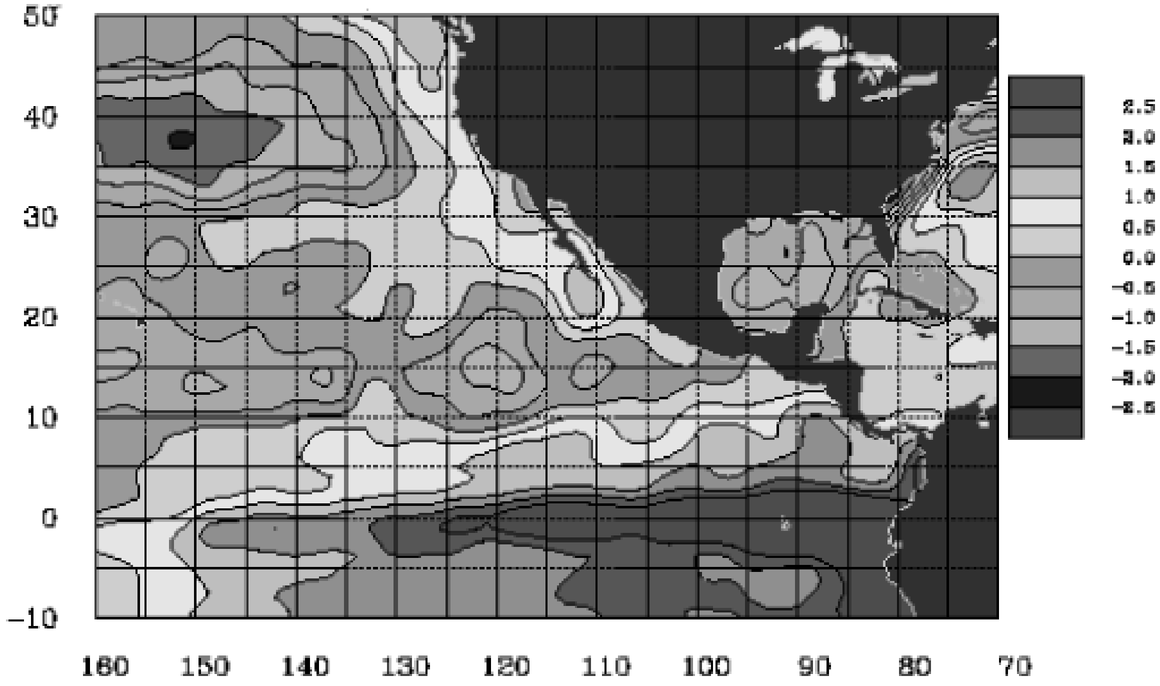

Figure 1. Pacific sea surface temperature anomalies for the period April 19-25, 1998. The color-coded scale is to the right.

Tropical Prediction Center

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adjacent southeast United States. Figure 2 shows the storm near 29°N 86°W at 1815 UTC 3 February with a central pressure of 989 mb. Figure 3 shows the surface analysis of the storm just south of the Florida Panhandle. Both the satellite image and analysis show the system affecting the western Caribbean Sea and the Bahamas. By 4 February, the low had re-formed off the Mid-Atlantic states, moving the worst of the weather north of the TPC area.

This system caused widespread gale to storm-force winds along its path. Ship **WSKD** (name not available) reported winds northwest 55 knots and pressure 995.0 mb near 27°N 86°W at 1800 UTC 3 February. The **NUEVO LEON** reported winds west-northwest 50 knots with seas about 26 feet near 30.5°N 79.6°W at 1800 UTC 4 February. Gale force winds eventually spread across the western Atlantic with winds near 40 knots and seas to 22 feet as the system moved northeastward along the Atlantic Seaboard.

Widespread severe thunderstorms developed on 2 February from the southeast Gulf of Mexico across south Florida and the Florida Straits into the Bahamas and the adjacent Atlantic. Four tornadoes were confirmed over the Florida

Continued on Page 46

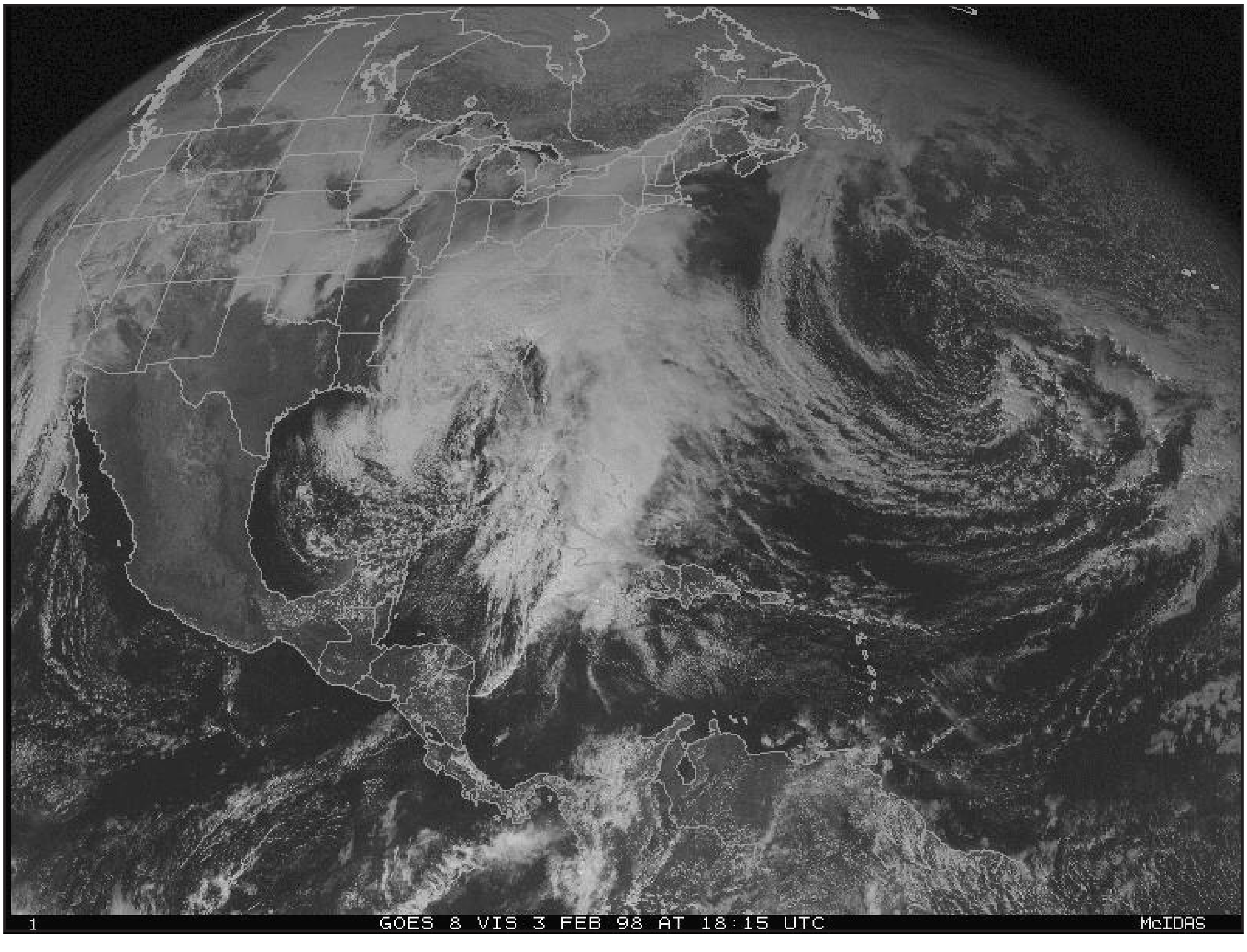

Figure 2. GOES-8 visible satellite image at 1815 UTC 3 February 1998. Image courtesy of the National Climatic Data Center.

Tropical Prediction Center

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Keys and south Florida, and waterspouts likely occurred over the ocean. The Coastal Marine Automated Network (C-MAN) station at Long Key, Florida, reported a gust to 103 kt, while Miami International Airport reported a 90 kt gust near one tornado. The C-MAN station at Sombrero Key, Florida, reported 50 kt sustained winds for 40 minutes as the severe thunderstorms came through.

This severe weather caused one death in the Florida Keys, and several boats were driven aground. The TPC has not received any other reports of marine damage or casualties.

(Note: Jim Lushine, Warning Coordination Meteorologist, of the NWSFO Miami, Florida, contributed the information on the local severe weather.)

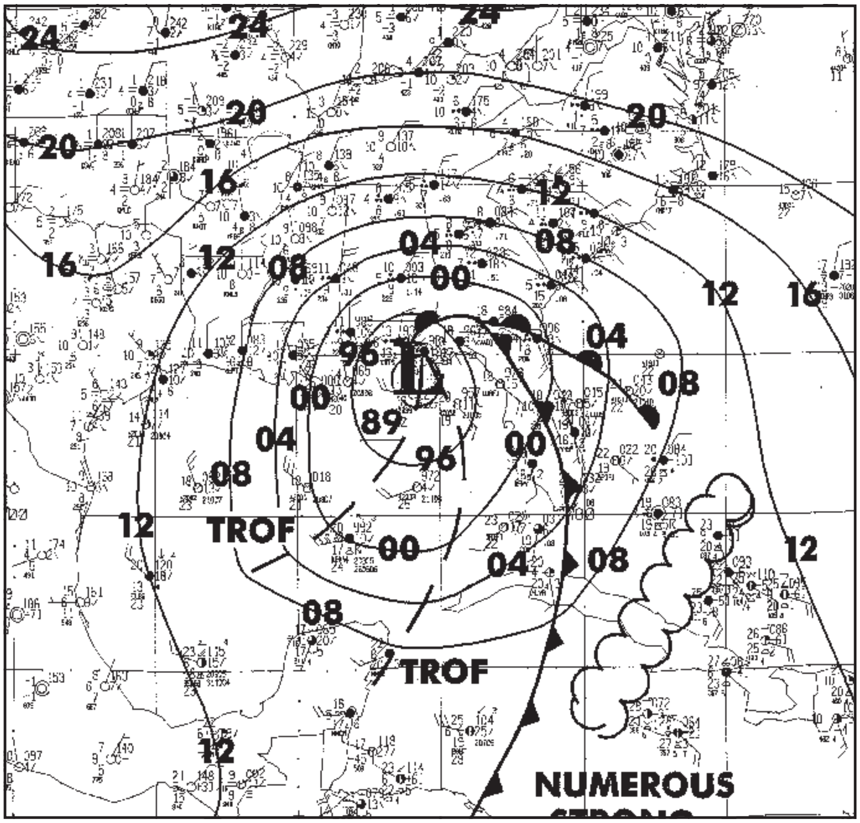

Figure 3. Subsector of TAFB surface analysis at 1200 UTC 3 February 1998.

Storm of 6-8 February: Another Gulf of Mexico low pressure center developed on 6 February moving due east across the Gulf then northeast across south Florida. Numerous thunderstorms accompanied this weather system as well. The low matured into an organized weather feature on 7 February, with the central pressure falling to 993 mb at 31°N 75°W at 1800 UTC. The **AMBASSADOR** and the U. S. Coast Guard cutter **SENECA** each reported winds of 40 kt at several different times in the western Atlantic. The **HOOD ISLAND** reported winds southwest 45 kt with 18 foot wind waves near 28°N 70°W on 8 February. Although the storm center moved north of the TPC area late on 8 February, it continued adversely affecting ship traffic west of about 60°W in the Atlantic for the next few days.

Gales of 15-17 February: Yet another in a series of gale centers formed in the west Gulf of Mexico around 0000 UTC 15 February. It moved northeast and made landfall near New Orleans, Louisiana, early on 16 February with a central pressure near 987 mb. (New Orleans normally reports pressures this low only in hurricanes.) The system then turned north and weakened. A second gale center formed over the Gulf around 1800 UTC 16 February. This system weakened and moved inland 12 hours later between New Orleans and Pensacola, Florida. The combination of the two lows pushed a cold front into the southeast Gulf and adjacent west Atlantic, as shown in Figure 4.

The first low produced gale-force winds over the northeast Gulf of Mexico and the adjacent coast. Buoy 42040 located near 29°N 88°W reported 42 kt sustained winds with gusts to 54 kt near 2200 UTC 15 February. The C-MAN station at Dauphin Island,

Continued on Page 47

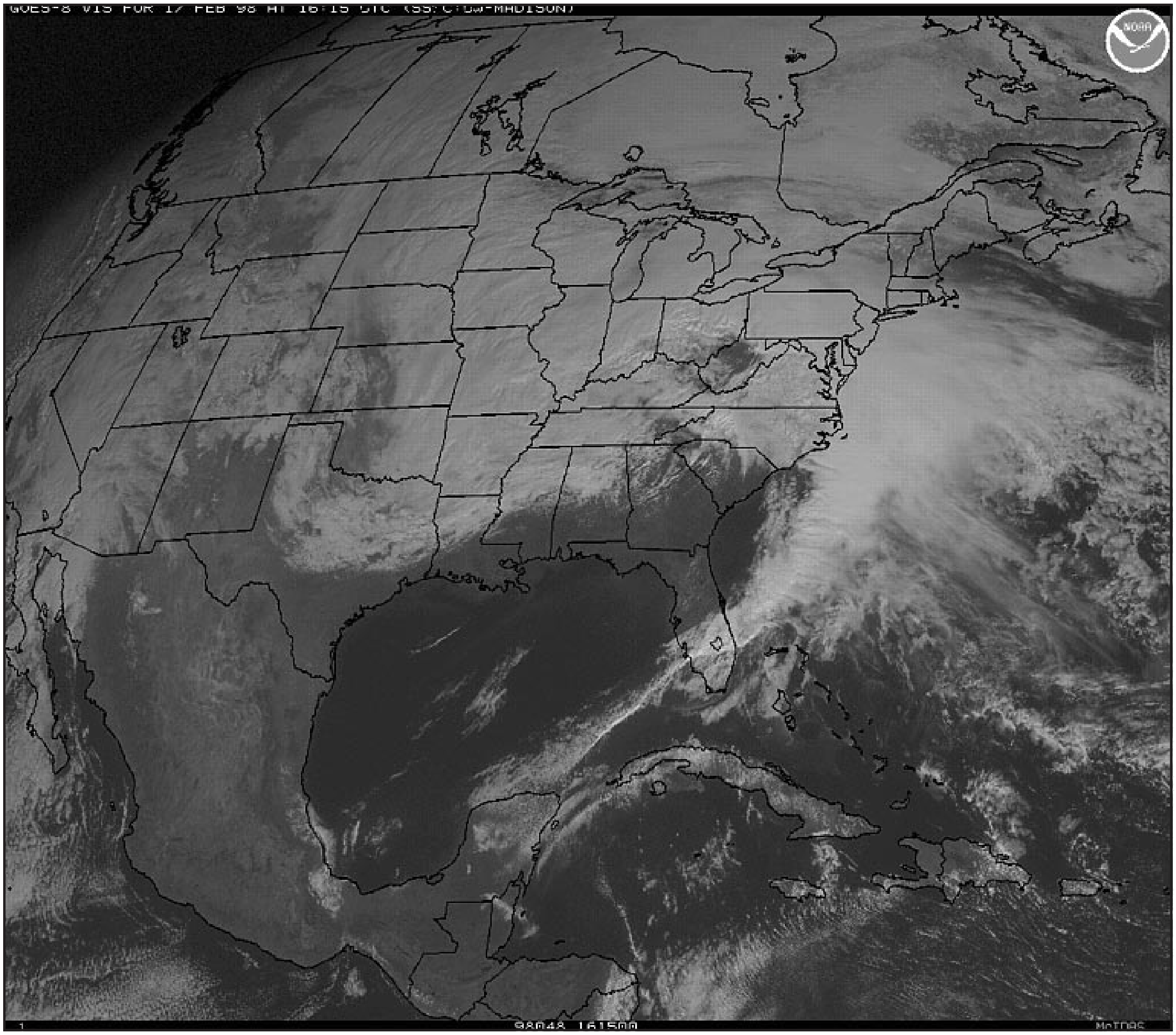

Figure 4. GOES-8 visible image at 1615 UTC 17 February 1998. Image courtesy of the National Climatic Data Center.

Tropical Prediction Center

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Alabama, reported 42 kt sustained winds with gusts to 52 kt near 0000 UTC 16 February. These systems also spread gales into the west Atlantic. Around 0000 UTC 17 February, south to southeast winds were estimated at 35-45 knots with seas near 25 feet over the Atlantic from about 28°N to near 40°N and west of 74°W.

Press reports say that the U. S. Coast Guard launched several search and rescue operations over the northern Gulf on 15-16 February. The TPC has not received any reports of marine damage or casualties.

Gale of 21-24 February: During the period 21-24 February, another strong weather system moved across the Gulf of Mexico and west Atlantic in association with a strong deep layer trough and surface cyclone. Widespread areas of 30-40 knots and seas 15-18 feet

Continued on Page 49

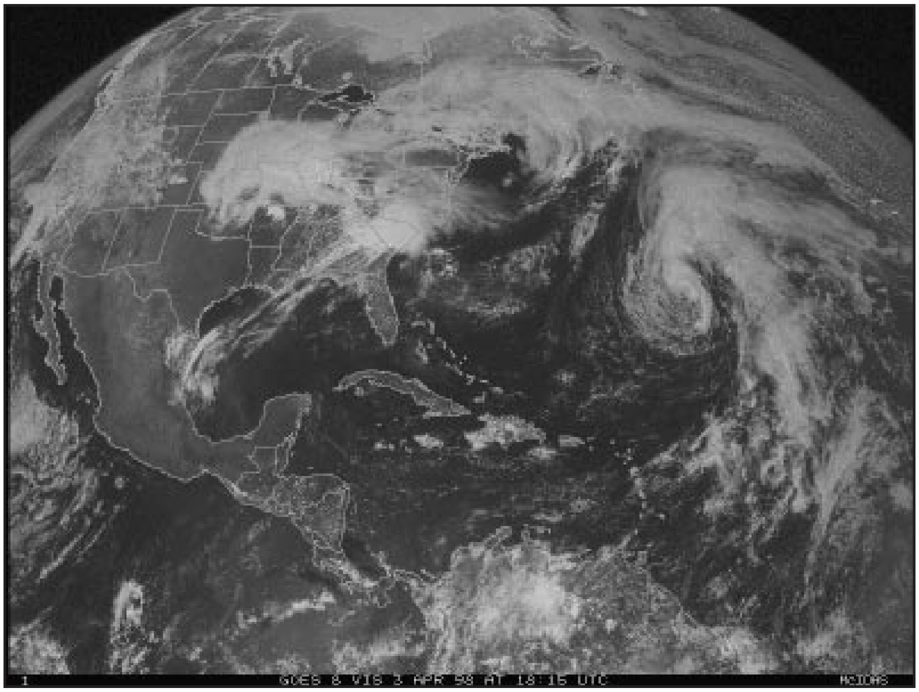

Figure 5. GOES-8 visible image at 1815 UTC 3 April 1998. Image courtesy of the National Climatic Data Center.

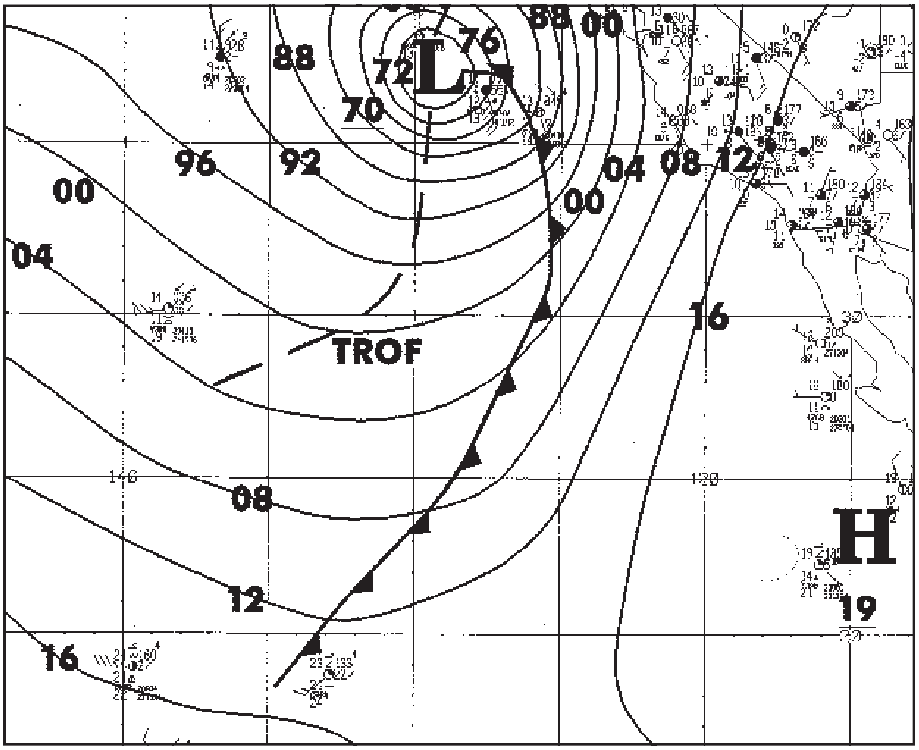

Figure 6. Subsector of TAFB surface analysis at 0600 UTC 6 February 1998.

Tropical Prediction Center

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were reported in the west Atlantic with this system.

Strong thunderstorms ahead of the associated cold front produced the deadliest tornado outbreak in Florida's history late on 22 February and early on 23 February. At least 40 people were reported killed (NWS Southern Topics, March 1998). The severe storms moved off the Florida east coast and may have produced further waterspouts over the Atlantic.

Possible Hybrid Gale, 1-4 April: A deep layer cyclonic circulation developed a 1011 mb surface low on 1 April near 20°N 60°W, which then intensified slowly to at least 1000 mb during the next 2 days. By 1200 UTC 2 April, the surface low deepened to 1005 mb near 24°N 57°W while moving northeast 10-15 knots according to ship reports. Satellite imagery suggested that the low was not only developing due to a vigorous upper cyclonic circulation but also by deep convection near the surface center (Figure 5). This suggests that the low had some tropical characteristics, whereby latent heat release in thunderstorms becomes a significant energy source and helps lower surface pressure. A strong pressure gradient between the low and a high to the north produced estimated surface winds at 40-45 kt at 1200 UTC on 2 April. The low weakened on 3-4 April and accelerated northeastward over the central Atlantic.

Several ships encountered the hybrid low and provided valuable reports to the TPC. The **LASER PACIFIC** reported 36 kt winds at 1200 and 1800 UTC 2 April, with a minimum pressure of 1002.5 mb at 1800 UTC. Ship **OZYH2** passed close to the center near 1500 UTC 2 April, when it reported 36 kt winds and a 1000.1 mb pressure. Other ships in the area reported combined seas as high as 24 ft.

2. Eastern Pacific

TPC's East Pacific area, which extends from the equator to 30°N and east of 140°W, was affected by a series of gale events during the early part of the quarter. Several of these were due to many storm systems passing just north of the forecast area. Others occurred over tropical waters from wind surges across Central America.

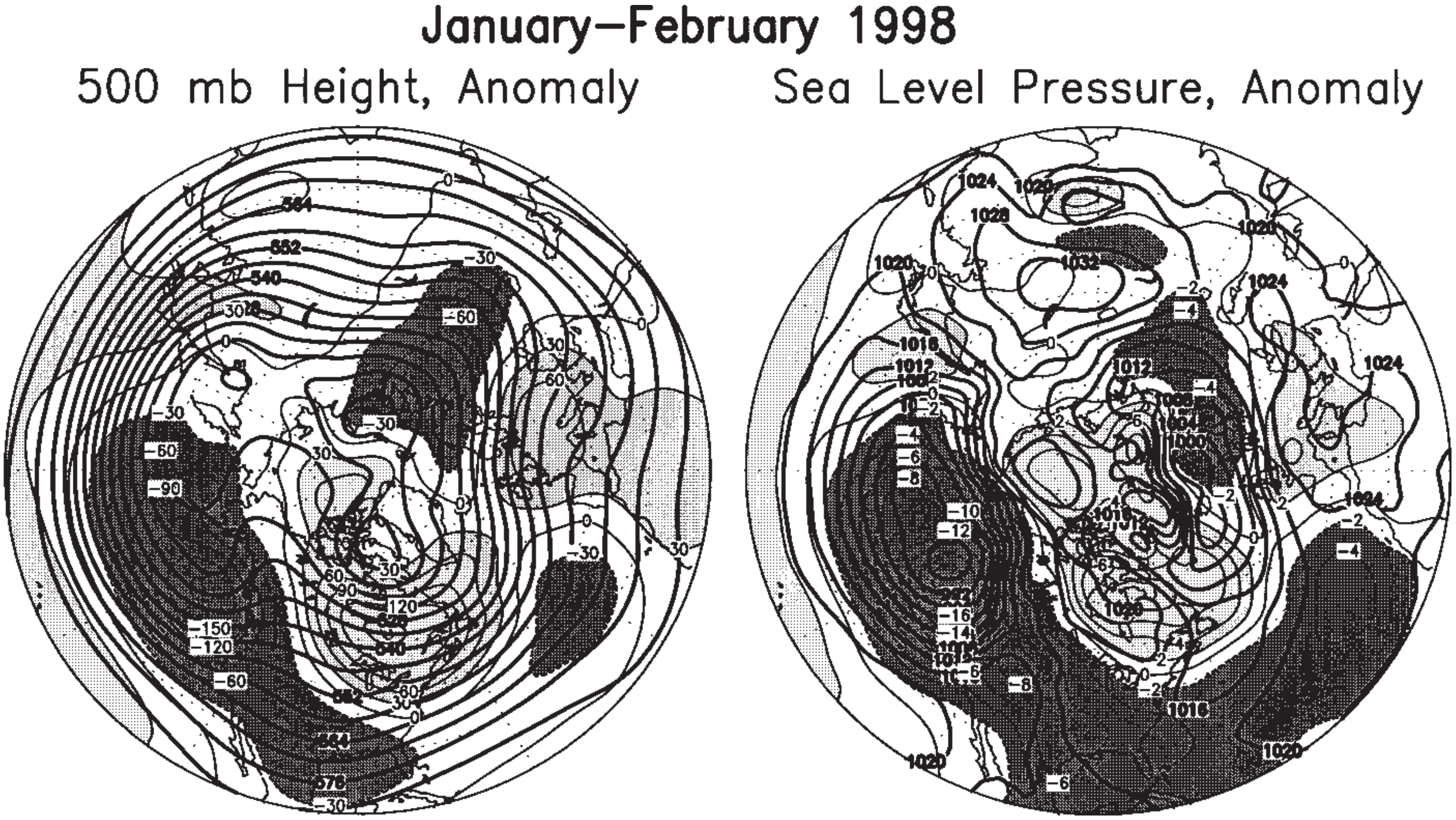
Storms of 20 January - 8 February: A series of events occurred from 20 January to 8 February as storm systems pounded the west coast of the United States. During the period 20-30 January, gale force winds of about 40 knots with seas to at least 18 feet brushed the TPC area north of 25°N. More significant gale conditions occurred during the period 1-8 February. Storm force conditions were experienced in the TPC area as a strong 970 mb storm passed near 37°N 129°W on its way to California and the Baja Peninsula (Figure 6). The **KAUAI** reported combined seas near 35 feet near 29°N 140°W at 0600 UTC 6 February, which is very unusual in the TPC warning area.

Surge of 9-17 March: A surge developed in the Gulf of Tehuantepec on 9 March, with gale force winds developing the next day. Over the next few days, additional surges developed across Central America until by 12 March they covered the area north of 5°N and east of 105°W. At this time, large areas of gales were present in and south of the Gulf of Tehuantepec and in and west of the Gulf of Papagayo. The winds weakened below gale force on 14 March. However, lesser winds continued until 17 March.

The **KOELN EXPRESS** encountered both areas of gales during its track along the west coast of Central America. It reported 40 kt winds south of the Gulf of Tehuantepec at 0000 UTC 11 March and 45 kt winds west of the Gulf of Papagayo at 1200 UTC 12 March.

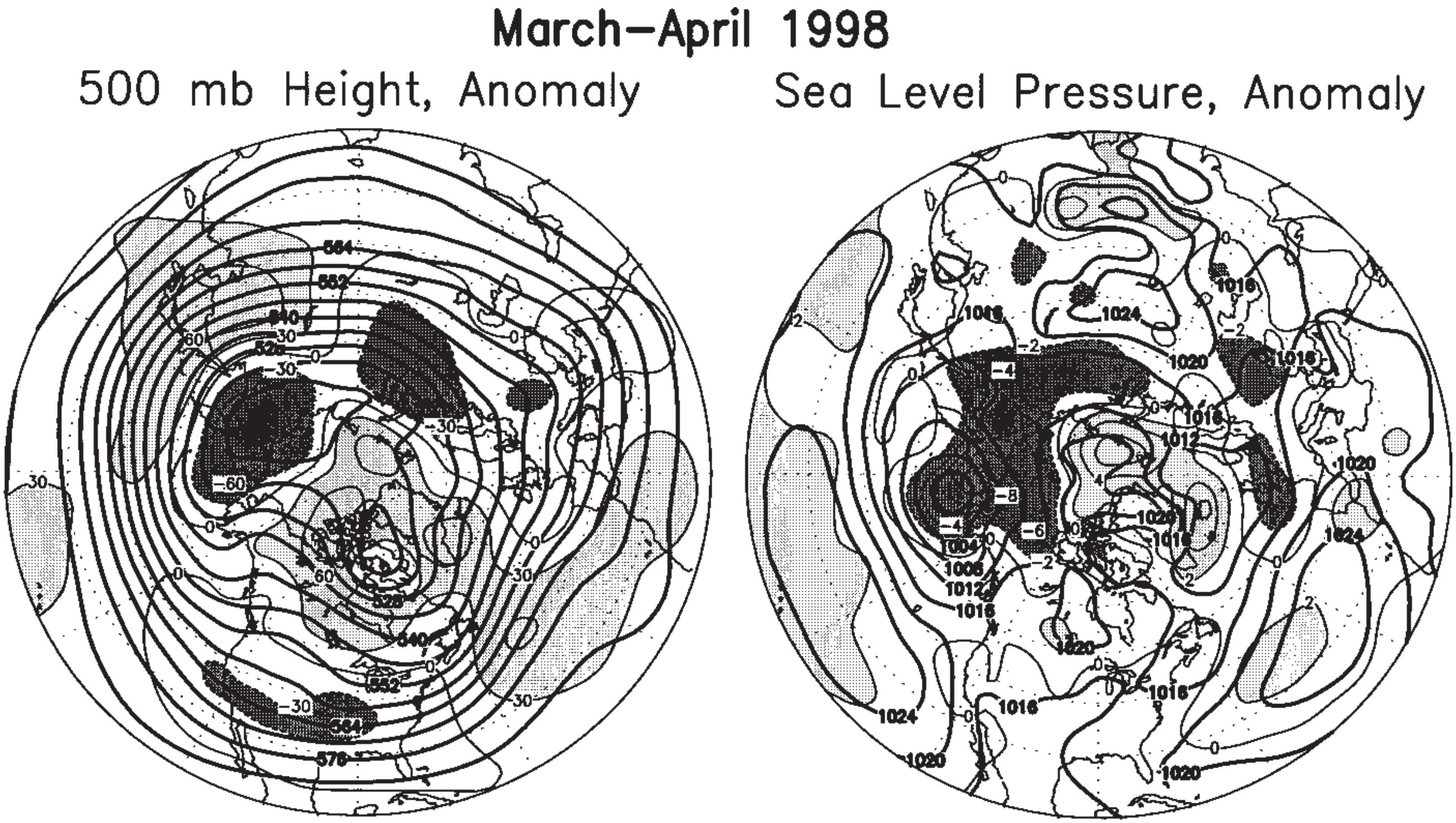
IV. Reference

Kousky, V. E., *Warm (El Niño) Episode Conditions Return to the Tropical Pacific* (Mariners Weather Log, 1997).⚓



The chart on the left shows the seasonal 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 seasonal mean sea level pressure at four 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 two mb above normal, and heavy shading in areas in excess of two mb below normal.



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Voluntary Observing Ship Program

Martin S. Baron
National Weather Service
Silver Spring, Maryland

Reminder About Report Timeliness, Distribution, and Accuracy

Always transmit your observations without delay as soon as possible after you've observed the data. The meteorologist uses your report as real-time data, indicative of current, up-to-date conditions at your vessel. Make your observation as close to the reporting hour as you can. Any transmission problems or difficulties with radio stations should be reported to your PMO and written down in the appropriate space on the back of the B-81 Ships Weather Observations form.

Report arrival times tend to be later at night and for Southern Hemisphere reports. Please make every effort to improve the timeliness of these reports.

Data is most readily available from the main shipping routes in both hemispheres. **There is a chronic shortage of data from coastal waters out 200 miles. (For this reason, 3-hourly reports are requested from U.S. and Canadian waters out 200 miles from shore.)** There is also a widespread shortage of data from the Southern Hemisphere and from the Arctic Ocean. More data is also needed from the tropics and easterly trade wind belt (5-35° N), especially during the Northern Hemisphere hurricane season (May through November). From the North Atlantic and North Pacific oceans, more data is needed at 0600 and 1200 UTC (these are late night and early morning times). If you are operating from a data-sparse area, please report weather regularly.

The three keys to good observing and reporting are: (1) having accurate, properly calibrated equipment; (2) being careful and meticulous when taking and recording the data; and (3) making sure the data is coded in the

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VOS Program

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correct format, using the appropriate code tables and figures, according to WMO Code FM13X, the ships synoptic code.

A PMO should calibrate your barometer and barograph once every three months, and also check your psychrometer during every ship visit. Sea-water thermometers (whether hull-mounted or located in the condenser intake) should be calibrated annually and checked every time your vessel is in the yard for service. If your vessel has an anemometer, it should be calibrated once every six months. Make sure the anemometer is located where the ships superstructure will not interfere with the air motion. When recording dry and wet bulb temperatures, always take your psychrometer to the windward side of the ship. This allows contact with air fresh from the sea which has not passed over the deck prior to your measurement.

Please see the ships code card and NWS Observing Handbook No. 1 for complete explanations of the ships synoptic code.

Remember to Return Your Loaned Equipment

Meteorological equipment sometimes provided to Voluntary Observing Ships (VOS)—such as barometers, barographs, sling psychrometers, true wind wheels, and sea-water bucket thermometers—are loaned to VOS program vessels for the purpose of taking weather observations. Please be aware that the equipment is expensive and hard to replace. If you are no longer taking part in the program, an equipment pick-up, drop-off, or delivery will be needed and greatly appreciated. Please contact any PMO to arrange for the transfer of equipment. Supplies are very limited. Please help ensure that equipment is accounted for and available for new VOS Program recruits.

New PMOs Bob Drummond (Miami) and Derek LeeLoy (Honolulu)

I am pleased to announce that Bob Drummond has been selected as PMO for the port of Miami/Fort Lauderdale, Florida. Bob has nearly 30 years of experience in the field of meteorology and has held many different positions with the NWS. Most recently, from 1993 to 1998, he was hydrometeorological technician at Weather Service Office, Melbourne, Florida. Before that, he was the cooperative program manager for the State of Georgia. Bob enjoys golf (12 handicap) and surfing classic longboards. He is teaching his grandson how to surf.

Derek LeeLoy is the new PMO for Honolulu, Hi. Prior to coming to the NWS he worked at the Naval Ocean System Center as a boat captain/diving supervisor for nine years. He has also worked as a Navy diver with the explosive Ordnance Disposal team.

Derek enjoys deep sea fishing and surfing and owns four boats. He also coaches canoeing. He is married and has four children.

PMO New York Aboard the EMPIRE STATE

Tim Kenefick, PMO New York, was aboard the **EMPIRE STATE**, training ship of the New York State Maritime Academy, from June 22 to July 12. Tim helped educate Cadets about weather at sea and provided training in weather observing and the ship's synoptic code.

PMO Workshop held in Silver Spring

A PMO workshop was held in Silver Spring, Maryland, during the first week of May 1998. It was attended by PMOs, program managers, and specialists from NWS headquarters and regional offices, the SEAS Program Office, the National Climatic Data Center, and the AMVER program. A representative from the Canada VOS program was also present. Over 30 people attended.

This was a valuable and productive meeting. There were many constructive ideas and suggestions for program improvements.

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VOS Program

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You can help make improvements to the VOS program. When the PMO visits your vessel, please remember to discuss the program and make suggestions or recommendations. The PMO will review these and forward them to NWS headquarters in Silver Spring, Maryland, for action. PMOs should try to visit VOS program vessels every three months, as requested by the World Meteorological Organization (WMO).

VOS Program Awards for 1998

I am pleased to announce that 58 Voluntary Observing Ships will receive outstanding performance awards for observations and support during 1998. Congratulations to the ships officers aboard these vessels! The selections were made by PMOs who submitted the names of the very best and most conscientious vessels/shipping companies to NWS headquarters, where the final decisions were made. All Voluntary Observing Ships make important contributions. Regretfully, only a small number of vessels can be honored with an award each year.

VOS Program Vessels Receiving Outstanding Performance Awards for 1997 (Shown with Supervising PMO)

PMO Norfolk
D.G. Columbia, NOAA Ship Ferrel, Mosel Ore, USCGC Tahoma, Sea-Land Performance

PMO San Francisco (Oakland)
Sea Land Enterprise, Ambassador Bridge, Alligator Bravery, LNG Aquarius, Sea-Land Innovator, Overseas Ohio

PMO Cleveland
Str. Medusa Challenger, M.V. Indiana Harbor, Str. Kinsman Independent

PMO Seattle
New Carissa, Elliot Bay, Westward Venture, Westward Halla, Golden Gate Bridge, NOAA Ship Miller Freeman, Sea-Land Mariner

PMO Baltimore
ITB Jacksonville, Agulhas, Columbine, Pride of Baltimore II

PMO New Orleans
Ocean Clipper, R/V Ronald H. Brown, San Antonio, USNS Tippecanoe, NOAA Ship Oregon II

PMO Chicago
Susan W. Hannah, Joseph L. Block, Karen Andrie, Edwin H. Gott

PMO Jacksonville
Sea Lion, Sea-Land Crusader

PMO Los Angeles
Polynesia, Sea-Land Producer, Kauai, Melville, Golden Gate, Delaware Trader, Direct falcon, Direct Kiwi

PMO Miami
Gypsum King, Carnival Destiny, Seaward Johnson, Seaward Crown

PMO Anchorage
USCGC Storis

PMO Newark
Oleander, Majestic Maersk, Marcarrier, Groton

PMO New York
Chelsea, Takayama, SC Horizon, NOAA Ship Delaware II, Chastine Maersk

New Recruits — January through April 1998

During the four-month period ending April 30, 1998, PMOs recruited 64 vessels as weather observers/reporters in the National Weather Service Voluntary Observing Ship Program. Thank you for joining the program.

All Voluntary Observing Ships are asked to follow the worldwide weather reporting schedule—by reporting weather four times daily at 0000, 0600, 1200, and 1800 ZULU or UTC time. The United States and Canada have a 3-hourly weather reporting schedule from coastal waters out 200 miles from shore and from anywhere on the Great Lakes. From these coastal areas, please report weather at 0000, 0300, 0600, 0900, 1200, 1500, 1800, and 2100 ZULU or UTC whenever possible.⚓

National Weather Service Voluntary Observing Ship Program

New Recruits from January 1 to April 30, 1998

NAME OF SHIP	CALL	AGENT NAME	RECRUITING PMO
AGDLEK	OUGV		MIAMI, FL
AL FUNTAS	9KKX	PMO	MIAMI, FL
ARKTIS FUTURE	OXUF2	FILLETE AND GREEN	MIAMI, FL
ARKTIS HOPE	OXUD2	P.O. BOX 165504	MIAMI, FL
BARBICAN SPIRIT	DVFS	PMO	MIAMI, FL
BUNGA ORKID SATU	9MBQ3	MAYAYSIAN INTERNATIONAL SHIPPING CO., INC	SEATTLE, WA
CAPE CHARLES	3EFX5	UNIVAN SHIP MAN. LTD, SUITE 801, 8TH FLR ASIAN HOU	SEATTLE, WA
CARIBBEAN BULKER	C6PL3	VOM MANILA CORP.	NEW ORLEANS, LA
CELEBRATION	ELFT8	CARNIVALCRUISE LINES	NEW ORLEANS, LA
CHIQUITA BREMEN	ZCBC5	GREAT WHITE FLEET	MIAMI, FL
CHIQUITA BRENDA	ZCBE9	GREAT WHITE FLEET	MIAMI, FL
CHIQUITA ELKESCHLAND	ZCBB9	GREAT WHITE FLEET	MIAMI, FL
CHIQUITA FRANCES	ZCBD9	GREAT WHITE FLEET	MIAMI, FL
CHIQUITA JOY	ZCBC2	GREAT WHITE FLEET	MIAMI, FL
CHIQUITA ROSTOCK	ZCBD2		MIAMI, FL
CHITTINAD TRADITION	VTRX	BLUEMARINE SHIPPING AND TRADING	NEW ORLEANS, LA
CONTSHIP AMERICA	3EIP3	STRACHAN SHIPPING COMPANY	HOUSTON, TX
DANIA PORTLAND	OXEH2		MIAMI, FL
DOCK EXPRESS 20	PJRF	J.S. CONNOR AGENCY	BALTIMORE, MD
DRAGOER MAERSK	OXPW2	MAERSK PACIFIC LTD.	LOS ANGELES, CA
EIDELWEISS	3FGE2	FORTUNA NAVIGATION CO., LTD	SEATTLE, WA
ENDURANCE	WAUU	FARRELL LINES INC.	NEW YORK CITY, NY
EUROPA	DLAL	HARRINGTON AND CO	MIAMI, FL
EVER DELIGHT	3FCB8	EVERGREEN MARINE CORP	NEW YORK CITY, NY
EVER DELUXE	3FBE8	EVERGREEN AMERICA	NORFOLK, VA
GERD MAERSK	OZNC2	MAERSK INC - GIRALDA FARMS	NEW YORK CITY, NY
GRAFTON	ZCBO5	AABENRAA SHIPPING AGENCY LTD	BALTIMORE, MD
GRETE MAERSK	OZNF2	MAERSK INC. - GIRALDA FARMS	NEW YORK CITY, NY
IVARAN HUNTER	DNKL	INCHCAPE	NORFOLK, VA
JUNO ISLAND	3FRF7	IINO MARINE SVC. CO.LTD	SEATTLE, WA
LADY MARYLAND	WTV4008	LIVING CLASSROOM FOUNDATION	BALTIMORE, MD
LAIDLY	WDAA	NATIONAL MARINE FISHERIES	BALTIMORE, MD
LEEWARED	3FKM5	NORWEGIAN CRUISE LINE	MIAMI, FL
LYKES EXPLORER	WZJA	LYKES LINES_LIMITED, LLC	NEW ORLEANS, LA
M/V FRANCOIS L.D.	FNEQ	INCHCAPE SHIPPING SERVICES	NORFOLK, VA
MAERSK STAFFORD	MRSS9	MAERSK LINE	MIAMI, FL
MAR CARIBE	ZGUF	CROWLEY AMERICAN TRANSPORT	MIAMI, FL
MEKHANIK MOLDOVANOV	UIKI	FESCO AGENCIES N.A., INC	SEATTLE, WA
MERCHANT PRINCIPAL	VRIO	HARRINGTON	MIAMI, FL
MSC MONICA	3FSU7	MEDITERRANEAN SHIPPING COMPANY (USA)	NEW YORK CITY, NY
MV MIRANDA	3FRO4	KERR NORTON MARINE	NORFOLK, VA
NAUTICAS MEXICO	XCMM	PORT METEOROLOGICAL OFFICER	HOUSTON, TX
NOORDAM	PGHT	PMO	MIAMI, FL
NORDSTRAND	P3NV5	REEDEREI "NORD" KLAUS E. OLDENDORF GMBH	NORFOLK, VA
PACIFIC SELESA	DVCK	PNSL SHIP MANG., SDN.BHD	SEATTLE, WA
PROJECT ARABIA	PJKP	PMO	MIAMI, FL
R/V TIGLAX	WZ3423	R/V TIGLAX, CAPTAIN BELL_U.S.FISH & WILDLIFE	ANCHORAGE, AK
RHAPSODY OF THE SEAS	LAZK4	ROYAL CARIBBEAN CRUISE LINE	MIAMI, FL
SEA LEOPARD	DGZK	CROWLEY AMERICAN TRANSPORT	JACKSONVILLE, FL
SEA PUMA	DHPK	CROWLEY AMERICAN TRANSPORT	JACKSONVILLE, FL
SEA-LAND LIGHTNING	V7AP9	SEALAND SERVICES INC	NEW YORK CITY, NY
SEALAND ARGENTINA	DGVN	SEALAND SERVICE INC	JACKSONVILLE, FL
SEALAND BRAZIL	DGVS	SEALAND SERVICE, INC.	NEW YORK CITY, NY
SEALAND INTREPID	V7BA2	SEA-LAND SERVICE INC.	NORFOLK, VA
SKS TANA	LAZI4	G.M. RICHARDS ENTERPRISES, INC.	NORFOLK, VA
SUMMER BREEZE	ZCBB4	GREAT WHITE FLEET	MIAMI, FL
TAIHO MARU	3FMP6	NAVIX MARINE PTE, LTD	SEATTLE, WA
TMM MEXICO	XCMG	TRANS-AMERICAN STEAMSHIP AGENCY	HOUSTON, TX
TRINITY	WRGL	SABINE TRANSPORTATION	HOUSTON, TX
TROJAN STAR	C6OD7	MANATEE MARINE AGENCY, INC.	BALTIMORE, MD
TUI PACIFIC	P3GB4	REEDEREI NORD KLAUS E. OLDENDORFF	SEATTLE, WA
USCGC JEFFERSON ISLAND	NORW	COMMANDING OFFICER, USCGC JEFFERSON ISLAND	NEW YORK CITY, NY
USCGC KUKUI (WLB-203)	NKJU	COMMANDING OFFIER USCGC KUKUI	SEATTLE, WA
USNS HENSON	NENB	COMMANDING OFFICER	NEW ORLEANS, LA
VAIMAMA	ELTC7	SPCL	SAN FRANCISCO, CA

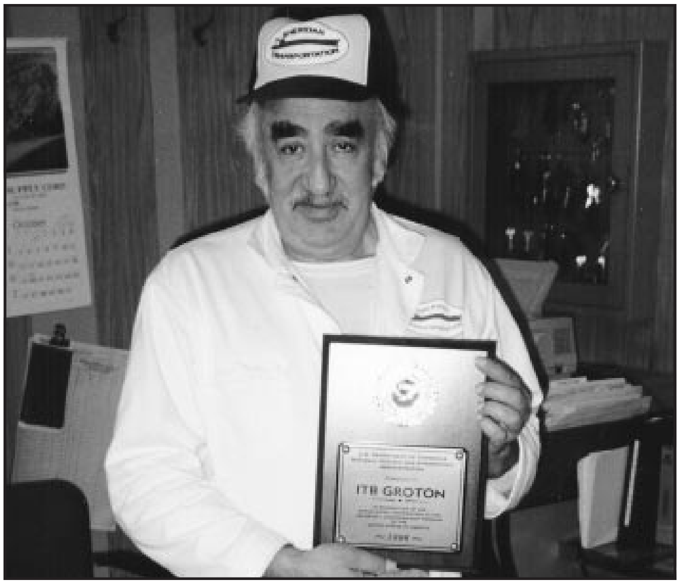
Pete Gibino, PMO Norfolk, prsenting a 1995 VOS award to Capt. Johan Vrolik of the ***OLEANDER*** *(Bermuda Container Line).*

Third Officer Naweed Haseeb Khah and Chief Officer Shahab Uddin on ***M/T MARIA LAURA*** *receiving a VOS program award for outstanding performance.*

Tim Kenefick, PMO New York presenting a 1995 VOS award to Vincent Tabbong, Master, ***ITB GROTON****, Sheridan Transport.*

Pete Gibino (then Newark PMO) presenting a VOS award to Capt. Fraser on the ***ARGONAUT*** *(Farrell Lines).*

Jim McClain presented a 1996 VOS award to Capt. Johansen and Frank Harty (Maersk boarding representative) on the ***MCKINNEY MAERSK****.*



Capt. Vince Tabbong of the ***ITB GROTON*** *(Sheridan Transportation) proudly displays the ship's 1996 VOS Award.*

Tim Kenefick (left), PMO New York, presented a 1996 VOS award to Capt. Johan Vrolik (center) of the ***OLEANDER****. On the right is Dan Smith, NMFS Narragansett.*

Alaska Region Marine Program Activities

Greg Matzen
Marine Program Manager

Alaska Marine Enhancement Program

During 1997, the National Weather Service Alaska Region began a program to focus attention on our marine-related services. We began to maintain a database and track the numbers of Ship Visits, Marine Weather Briefings, MAREPS, and Broadcasts that each Alaska Weather Office performed each month. Using a simple scoring system, we began a program of friendly competition among the weather offices. This scoring system allows us to track the health of a station's marine program. It rewards those sites that are putting in the extra effort to acquire and transmit ship observations, and to make customer outreach and ship visits. Although our number of Alaska Ship Visits are still relatively low, the Alaska Region now has a higher rate of ship visits during the last year than at any other time during the 1990s.

This year, Meteorologist in Charge Leif Lie of WSFO Juneau has initiated a Marine Forecast Verification Program. This program is designed to provide NWS with "real-time" and "after-the-fact" ground truth information from mariners concerning the accuracy of National Weather Service Marine Forecasts.

The M/V TIGLAX, recruited into the VOS program on April 20, 1998, by Larry Hubble, part-time PMO in Anchorage.

Alaska Region PMO Staff Adds Unique Vessel to VOS Program

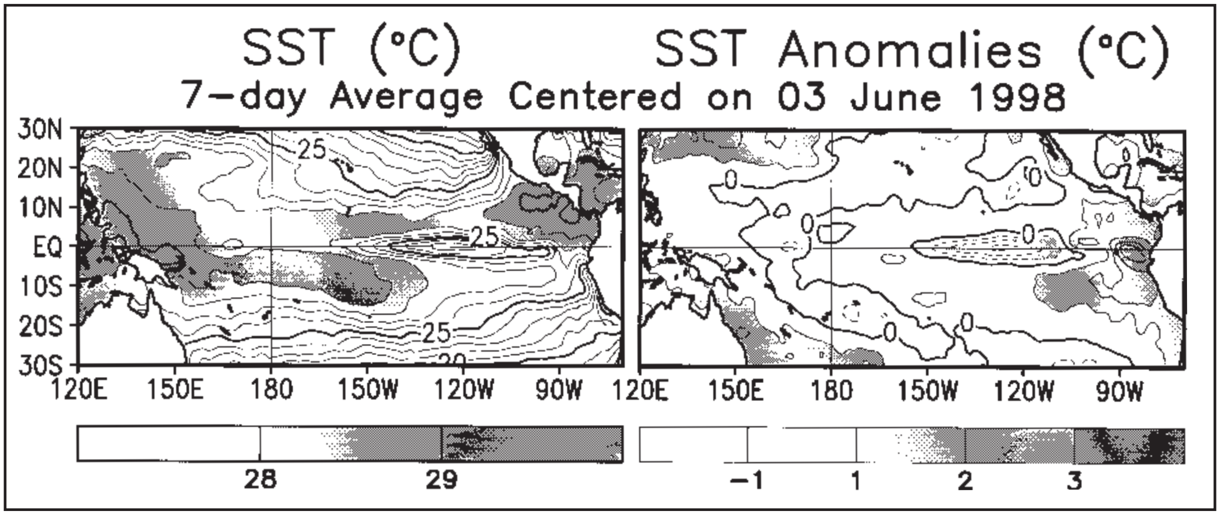
The **M/V TIGLAX** was recruited into the VOS program on April 20 by Larry Hubble, Region Headquarters part-time PMO. The **TIGLAX** was commissioned in July 1987. It is a U.S. Fish and Wildlife research vessel that operates about six months of the year, primarily in the Alaska Maritime National Wildlife Refuge. Its research work takes it anywhere from the Alaska Peninsula to the western Aleutians and north to the Bering Strait. The vessel is 121 feet long and is operated by a crew of six. It can accommodate 16 passengers or researchers. Its home port is Homer, Alaska. The **TIGLAX** will provide VOS observations in areas where sea truth data is very sparse.⚓

El Niño Update

Vernon E. Kousky
Climate Prediction Center
NCEP/NWS/NOAA
Washington, D.C.

The National Centers for Environmental Prediction (NCEP) coupled model and canonical correlation analysis (CCA) forecasts indicate that cooler-than-normal conditions will develop during the summer 1998 and strengthen into a cold episode during the fall 1998 and winter 1998-99. Cold (La Niña) episodes generally feature the opposite impacts to those experienced during warm (El Niño) episodes. If full-fledged cold episode conditions indeed develop during the last half of 1998 we can expect wetter-than-normal conditions to develop over Indonesia and Malaysia, wetter-than-normal conditions over Northeast Brazil (February-May 1999), wetter-than-normal conditions over southern Africa and northern Australia (November 1998-March 1999), and drier-than-normal conditions over southern Brazil, Uruguay, and northeastern Argentina (July-December 1998). Over North America, we can expect wetter-than-normal conditions over the Pacific Northwest and drier-than-normal conditions over the southern tier states. Colder than normal conditions are likely over the northern Plains, upper Midwest, and western/central Canada.

Weekly updates on conditions in the tropical Pacific are available on the Climate Prediction Center website at: **http://nic.fb4.noaa.gov** (click on El Niño, then ENSO Update).⚓



Mean (left) and anomalous (right) sea surface temperatures for the week centered on 3 June 1998. Contour interval is 1°C. Anomalies are departures from the 1950-1979 base period monthly means.

An Important Message About AMVER Communications

To Shipping Companies with Vessels Reporting to AMVER:

The U.S. Coast Guard would like to sincerely thank all ships that support the lifesaving mission of the Automated Mutual-assistance VEssel Rescue (AMVER) system. Last year, this included 12,000 ships of 140 nations.

Many coast radio stations and land earth stations around the world voluntarily relay AMVER reports at no cost to participating ships, but incur a cost to themselves for their support of AMVER. Their continued support is vital to the success of this 40-year-old program, and to improve safety at sea.

To help relieve some of the cost burden to such stations, AMVER has entered into a new arrangement with certain U.S.-based stations to provess AMVER reports electronically. Ships are encouraged to use these stations, especially for reports submitted via CW (Morse Code).

Since April 30, 1998, AMVER has discontinued arrangements with certain non-U.S. stations for relay of CW messages due to the relatively high costs involved. Use of newer technologies at the following stations will substantially reduce the cost burden to those voluntary stations in our network and will help improve the efficiency of AMVER report processing:

KFS KPH WNU WCC
ZSC WLO KLB WSC

These stations can provide information on submitting AMVER reports via HF Email or (in the case of WLO, KLB, WSC, and certain other stations worldwide) provide SITOR servicing of AMVER reports. We encourage ships to take advantage of the reporting efficiencies of Email. Any U.S. or non-U.S. station your ships use can provide information on the AMVER services they provide and applicable costs to ships, if any.

For more information on AMVER reporting, please contact Mr. Rick Kenney, AMVER Maritime Relations, USCG Battery Park Building, New York, NY 10004. Telephone: 212-668-7762. Fax: 212-668-7684.

Compressed message software for Inmarsat-C is now available to make it easy to send either an AMVER report or a VOS weather observation report, or a single combined AMVER-weather message. Both the software and the messages are free of charge to ships. For further information about this method of reporting, please contact Mr. Bill Woodward, NOAA/OAR/AOML Code R/E, SSMC3, Room 11142, 1315 East-West Highway, Silver Spring, MD 20910. Telephone: 301-713-2790 ext. 180. Fax: 301-713-4499.⚓

VOS Cooperative Ship Reports — 4th Quarter 1997

The National Climatic Data Center compiles the tables for the VOS Cooperative Ship Report from radio messages and weather logs. The three columns under the heading “MANUSCRIPT RECEIVED” denote whether or not a form was received for that month (Y/N). The column “Percent Via Radio” has been intentionally omitted due to temporary changes in data sources. The “Total Obs” column remains the total number of unique observations received from all sources.

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, Attn: Dimitri Chappas (704-271-4055 or dchappas@ncdc.noaa.gov).

NAME	TOTAL OBS	MANUSCRIPT RECEIVED		
		OCT	NOV	DEC
1ST LT BALDOMERO LOPEZ	59	N	N	Y
2ND LT. JOHN P. BOBO	42	N	N	N
ADAM E. CORNELIUS	111	N	N	Y
ADVANTAGE	151	N	N	Y
AGDLEK	81	N	N	N
AGULHAS	9	N	N	N
AL FUNTAS	59	N	N	N
ALBEMARLE ISLAND	155	N	Y	Y
ALBERTO TOPIC	118	N	N	N
ALDEN W. CLAUSEN	28	Y	N	N
ALLEGIANCE	98	Y	Y	N
ALLIGATOR BRAVERY	182	Y	Y	Y
ALLIGATOR COLUMBUS	73	N	N	Y
ALLIGATOR GLORY	48	N	Y	Y
ALLIGATOR STRENGTH	183	Y	Y	Y
ALPENA	175	N	N	Y
AMAZON	16	N	N	N
AMBASSADOR BRIDGE	258	Y	N	Y
AMERICAN CONDOR	277	Y	N	Y
AMERICAN CORMORANT	104	N	N	Y
AMERICAN FALCON	80	N	Y	Y
AMERICAN MERLIN	104	N	N	Y
AMERICANA	44	Y	N	N
AMERIGO VESPUCCI	3	N	N	N
ANAHUAC	134	Y	Y	Y
ANASTASIS	45	N	N	N
ANDERS MAERSK	8	N	N	N
ANKERGRACHT	125	N	N	N
ANNA MAERSK	175	Y	Y	Y
APL CHINA	207	N	N	N
APL JAPAN	198	Y	N	Y
APL THAILAND	58	N	N	N
ARABIAN SEA	17	Y	N	N
ARCO ALASKA	38	Y	Y	Y
ARCO CALIFORNIA	18	N	N	N
ARCO FAIRBANKS	16	Y	N	Y
ARCO INDEPENDENCE	20	N	N	N
ARCO JUNEAU	41	Y	N	N
ARCO PRUDHOE BAY	24	N	N	Y
ARCO SAG RIVER	56	Y	N	Y
ARCO SPIRIT	36	N	N	N
ARCO TEXAS	52	N	N	N
ARCTIC OCEAN	205	N	N	N
ARCTIC SUN	137	Y	Y	Y
ARGONAUT	59	Y	N	Y
ARIES	66	Y	Y	N
ARKTIS LIGHT	42	N	Y	N
ARKTIS SPRING	159	Y	Y	Y
ARMCO	219	N	N	Y
ARTHUR M. ANDERSON	376	Y	N	N
ARTHUR MAERSK	169	Y	Y	Y
ATLANTIC	659	N	N	N
ATLANTIC BULKER	62	N	N	N
ATLANTIC CARTIER	60	N	N	N
ATLANTIS	20	N	N	N
AXEL MAERSK	84	Y	Y	N
B. T. ALASKA	118	N	N	Y
BANDA SEAHORSE	255	N	N	N
BARBARA ANDRIE	248	N	Y	Y
BARBICAN SPIRIT	34	N	N	N
BARRINGTON ISLAND	168	Y	Y	Y
BAY BRIDGE	70	Y	Y	N
BERING SEA	83	N	N	N
BERNARDO QUINTANA A	178	Y	Y	Y
BLUE GEMINI	208	Y	Y	Y
BLUE NOVA	44	N	N	N
BOHINJ	136	N	Y	N
BOSPORUS BRIDGE	182	Y	Y	Y
BRIGHT PHOENIX	104	N	N	Y
BRIGHT STATE	48	N	N	Y
BRIGIT MAERSK	107	N	N	N
BROOKLYN BRIDGE	304	Y	Y	N
BRUCE SMART	56	N	N	Y
BUCKEYE	282	Y	N	Y
BUNGA ORKID DUA	72	N	N	N
BUNGA SAGA DUA	18	N	N	N
BUNGA SAGA TIGA	143	N	Y	N
BURNS HARBOR	740	N	Y	Y

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NAME	TOTAL OBS	MANUSCRIPT RECEIVED OCT	NOV	DEC
CABO TAMAR	15	N	N	N
CALCITE II	116	Y	Y	N
CALIFORNIA JUPITER	331	N	N	N
CALIFORNIA PEGASUS	23	N	N	N
CALIFORNIA ZEUS	60	Y	Y	N
CAPE BREEZE	43	N	N	N
CAPE HORN	126	N	Y	Y
CAPT STEVEN L BENNETT	48	N	N	Y
CARIBBEAN BULKER	48	N	N	Y
CARIBBEAN MERCY	13	N	N	N
CARLA A. HILLS	127	N	N	N
CAROLINA	13	N	N	N
CASON J. CALLAWAY	349	N	Y	Y
CELEBES TRES	48	N	N	N
CELEBRATION	92	Y	Y	Y
CELTIC SEA	73	N	Y	Y
CENTURY	3	N	N	N
CENTURY HIGHWAY #2	57	N	N	N
CHARLES E. WILSON	36	N	N	N
CHARLES ISLAND	141	Y	N	N
CHARLES L. BROWN	13	N	N	N
CHARLES LYKES	184	Y	N	Y
CHARLES M. BEEGHLEY	265	N	N	Y
CHARLES PIGOTT	71	Y	N	N
CHELSEA	150	N	Y	Y
CHEMICAL PIONEER	187	Y	N	N
CHESAPEAKE TRADER	293	N	N	N
CHETTINAD GLORY	2	N	N	N
CHEVRON ARIZONA	28	Y	Y	N
CHEVRON ATLANTIC	40	Y	N	N
CHEVRON COLORADO	115	Y	Y	Y
CHEVRON EDINBURGH	73	Y	Y	N
CHEVRON MISSISSIPPI	80	Y	Y	Y
CHEVRON NAGASAKI	99	Y	N	N
CHEVRON PERTH	28	N	N	N
CHEVRON SOUTH AMERICA	174	N	N	N
CHIEF GADAO	90	Y	Y	Y
CHILEAN EXPRESS	10	N	N	N
CHIQUITA BREMEN	123	N	N	N
CHIQUITA BRENDA	221	N	N	N
CHIQUITA ELKESCHLAND	228	N	N	N
CHIQUITA FRANCES	193	N	N	N
CHIQUITA ITALIA	117	N	N	N
CHIQUITA JEAN	121	N	N	N
CHIQUITA JOY	219	N	N	N
CHIQUITA ROSTOCK	146	N	N	N
CHO YANG ATLAS	109	N	N	N
CHOYANG VISION	123	N	Y	Y
CIELO DI FIRENZE	60	N	N	N
CLEVELAND	89	N	N	N
CMS ISLAND EXPRESS	9	N	N	Y
COLUMBIA BAY	21	N	N	N
COLUMBIA STAR	335	N	N	N
COLUMBINE	394	N	N	Y
COLUMBUS AMERICA	198	N	N	N
CONTSHIP AMERICA	111	N	N	N
COPACABANA	76	N	N	N
CORDELIA	38	N	N	N
CORNUCOPIA	88	N	N	N
CORWITH CRAMER	153	Y	Y	Y
COSMOWAY	38	Y	Y	N
COURIER	10	N	N	N
COURTNEY BURTON	431	N	N	Y
COURTNEY L	152	N	N	N
CRISTOFORO COLOMBO	4	N	N	N
CROWN PRINCESS	81	N	N	N
CSAV RELONCAVI	14	Y	N	N
CSK UNITY	16	N	N	N
CSL ATLAS	56	N	N	N
CSL CABO	55	N	N	N
DAISHIN MARU	257	N	N	N
DANIA PORTLAND	84	N	N	N
DAVID Z. NORTON	54	N	N	Y
DAWN PRINCESS	17	N	N	N
DELAWARE TRADER	136	N	N	N
DENALI	99	Y	N	N
DESTINY	225	Y	Y	Y
DG COLUMBIA	321	N	N	Y
DIRCH MAERSK	147	N	Y	Y
DIRECT EAGLE	109	N	N	N
DIRECT FALCON	145	N	N	N
DIRECT KEA	101	N	N	N
DIRECT KIWI	312	N	N	Y
DIRECT KOOKABURRA	104	Y	Y	Y
DOCTOR LYKES	144	N	Y	Y
DORTHE OLDENDORFF	152	Y	N	Y
DRAGOR MAERSK	20	N	N	N
DRYSO	143	Y	N	N
DUCHESS	45	N	N	N
DUHALLOW	198	N	N	N
DUNCAN ISLAND	124	N	N	N
ECSTASY	94	Y	Y	Y
EDELWIESS	479	Y	Y	N
EDGAR B. SPEER	302	Y	N	Y
EDWARD L. RYERSON	51	Y	Y	N
EDWIN H. GOTT	382	Y	Y	Y
EDYTH L	47	N	N	N
ELLEN KNUDSEN	2	N	N	N
ELLIOTT BAY	237	Y	Y	Y
ELTON HOYT II	137	N	N	Y
ENCHANTMENT OF THE SEA	8	N	N	N
ENDEAVOR	11	N	N	N
EQUINOX	29	N	N	N
EVER GAINING	4	N	N	N
EVER GENERAL	23	N	N	N
EVER GENTRY	14	N	N	N
EVER GLOBE	7	N	N	N
EVER GLOWING	1	N	N	N
EVER GOVERN	5	N	N	N
EVER GUEST	6	N	N	N
EVER LAUREL	25	N	N	N
EVER LEVEL	27	N	N	N
EVER REFINE	5	N	N	N
EVER REPUTE	2	N	N	N
EVER RESULT	90	Y	N	N
EVER ROUND	2	N	N	N
EVER ULTRA	52	N	N	N
EVER UNION	27	N	N	N
EVER UNIQUE	56	Y	N	N
EVER UNISON	49	N	N	N
EVER UNITED	33	N	N	N
EXCELSIOR	130	N	N	N
EXPORT PATRIOT	178	N	Y	Y
FANAL TRADER	278	Y	N	Y

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NAME	TOTAL OBS	MANUSCRIPT RECEIVED		
		OCT	NOV	DEC
FANTASY	46	Y	Y	N
FARALLON ISLAND	396	N	N	N
FASCINATION	138	Y	Y	Y
FAUST	208	Y	N	N
FERNCROFT	527	Y	N	Y
FIDELIO	275	N	N	Y
FOREST CHAMPION	36	N	N	N
FOREST TRADER	172	N	N	N
FRANCES HAMMER	259	N	N	N
FRANCES L	45	N	N	N
FRED R. WHITE JR	31	N	N	N
G AND C PARANA	7	N	N	N
GALAXY ACE	8	N	N	N
GALVESTON BAY	244	N	N	N
GEETA	34	N	N	N
GEORGE A. SLOAN	253	Y	Y	Y
GEORGE A. STINSON	132	N	N	Y
GEORGE H. WEYERHAEUSER	202	Y	Y	Y
GEORGE SCHULTZ	142	Y	Y	Y
GEORGIA RAINBOW II	251	N	N	N
GLOBAL MARINER	14	N	Y	N
GLORIOUS SUCCESS	197	N	Y	Y
GLORIOUS SUN	108	Y	Y	N
GOLDEN BELL	50	N	N	N
GOLDEN GATE	287	Y	N	Y
GOLDEN GATE BRIDGE	158	Y	Y	Y
GOPHER STATE	3	N	N	N
GREAT LAND	223	Y	Y	Y
GREEN BAY	113	N	N	Y
GREEN ISLAND	36	N	N	N
GREEN LAKE	177	Y	Y	Y
GREEN MAYA	40	N	N	N
GREEN RAINIER	383	N	N	Y
GREEN RIDGE	17	N	N	N
GREEN SASEBO	92	Y	Y	N
GRETKE OLDENDORFF	148	N	N	Y
GROTON	145	N	Y	N
GUANAJUATO	147	N	N	Y
GUAYAMA	257	N	N	Y
GULF CURRENT	226	N	N	Y
GYPSUM KING	152	N	N	N
H. LEE WHITE	54	N	N	N
HADERA	15	N	N	N
HANJIN BARCELONA	4	N	N	N
HANJIN BREMEN	14	N	N	N
HANJIN ELIZABETH	12	N	N	N
HANJIN FELIXSTOWE	13	N	N	N
HANJIN HONG KONG	13	N	N	N
HANJIN KAOHSIUNG	15	N	N	N
HANJIN LE HAVRE	31	N	N	N
HANJIN OAKLAND	3	N	N	N
HANJIN PORTLAND	32	N	N	N
HANJIN ROTTERDAM	9	N	N	N
HANJIN SHANGHAI	37	N	N	N
HANJIN SINGAPORE	14	N	N	N
HANJIN TOKYO	8	N	N	N
HARBOUR BRIDGE	146	Y	Y	N
HEICON	17	N	N	N
HELVETIA	184	N	N	N
HERBERT C. JACKSON	259	Y	N	Y
HOEGH CLIPPER	5	N	N	N
HOEGH DUKE	17	N	N	N
HOEGH DYKE	28	N	N	N
HOEGH MERIT	39	N	N	N
HOLCK LARSEN	3	N	N	N
HONSHU SILVIA	182	Y	Y	N
HOOD ISLAND	313	N	N	N
HOUSTON	206	N	N	N
HUMACAO	160	N	Y	N
HYUNDAI DISCOVERY	97	N	N	N
HYUNDAI DYNASTY	469	N	N	N
HYUNDAI FIDELITY	220	Y	Y	Y
HYUNDAI FORTUNE	46	N	N	N
HYUNDAI FREEDOM	39	N	N	N
HYUNDAI INDEPENDENCE	126	N	N	N
HYUNDAI LIBERTY	20	N	N	N
IMAGINATION	65	Y	Y	Y
INDIANA HARBOR	285	N	N	Y
INLAND SEAS	10	Y	N	N
INSPIRATION	65	Y	N	Y
IOWA TRADER	46	N	N	N
ISLA DE CEDROS	221	N	N	N
ISLA GRAN MALVINA	27	N	N	N
ISLAND BREEZE	8	N	N	N
ITB BALTIMORE	105	N	Y	Y
ITB MOBILE	183	N	N	N
ITB NEW YORK	63	N	Y	N
IWANUMA MARU	330	Y	Y	Y
J. DENNIS BONNEY	15	N	N	N
JACKLYN M.	176	N	N	Y
JACKSONVILLE	171	N	Y	N
JADE ORIENT	1	N	N	N
JADE PACIFIC	7	N	N	N
JALAGOVIND	21	N	N	N
JAMES N. SULLIVAN	37	N	N	N
JAMES R. BARKER	187	N	N	Y
JOHN G. MUNSON	334	N	Y	N
JOHN J. BOLAND	60	Y	N	N
JOHN YOUNG	24	Y	N	N
JOIDES RESOLUTION	301	Y	N	N
JOSEPH H. FRANTZ	113	N	N	N
JOSEPH L. BLOCK	193	Y	Y	Y
JULIUS HAMMER	184	N	N	N
KAIJIN	1	N	N	N
KANSAS TRADER	56	N	N	N
KAPITAN BYANKIN	235	N	N	Y
KAPITAN KONEV	287	Y	Y	Y
KAPITAN SERYKH	89	Y	Y	N
KAREN ANDRIE	164	Y	N	Y
KAUAI	106	Y	Y	N
KAYE E. BARKER	407	Y	N	Y
KEE LUNG	16	N	N	N
KELLIE CHOUEST	5	Y	N	N
KEN KOKU	181	N	N	N
KEN SHIN	77	N	N	N
KENAI	30	Y	Y	N
KENNETH E. HILL	184	Y	N	Y
KENNETH T. DERR	53	N	N	Y
KINSMAN INDEPENDENT	338	Y	N	Y
KOMET	139	Y	N	Y
KURE	107	Y	Y	Y
LA ESPERANZA	91	N	N	N

Continued on Page 64

Continued from Page 63

NAME	TOTAL OBS	MANUSCRIPT RECEIVED		
		OCT	NOV	DEC
LAUST MAERSK	124	N	Y	Y
LAWRENCE H. GIANELLA	1	N	N	N
LEE A. TREGURTHA	146	N	N	Y
LEGEND OF THE SEAS	5	N	N	N
LIBERTY SPIRIT	29	N	N	N
LIBERTY STAR	33	N	N	N
LIBERTY SUN	168	N	Y	Y
LIBERTY WAVE	29	N	Y	N
LIHUE	129	Y	Y	Y
LINDA OLDENDORF	116	N	N	N
LIRCAY	28	Y	N	N
LNG AQUARIUS	237	N	Y	Y
LNG LEO	67	N	N	N
LNG LIBRA	34	Y	N	N
LNG TAURUS	230	Y	N	N
LNG VIRGO	24	N	Y	Y
LOK PRAGATI	9	N	N	N
LONG BEACH	114	Y	Y	N
LONG LINES	3	N	N	N
LOUIS MAERSK	51	N	Y	Y
LOUISIANA	24	N	N	N
LT ARGOSY	23	N	N	N
LT. ODYSSEY	79	N	N	Y
LTC CALVIN P. TITUS	39	N	N	Y
LUCY OLDENDORFF	37	N	N	N
LUISE OLDENDORFF	144	N	N	N
LURLINE	171	N	Y	Y
LYKES DISCOVERER	162	N	N	Y
LYKES EXPLORER	81	Y	N	Y
LYKES LIBERATOR	56	Y	N	N
LYKES NAVIGATOR	151	Y	Y	Y
M/V FRANCOIS L.D.	1	N	N	N
MAASDAM	6	N	N	N
MACKINAC BRIDGE	187	N	N	N
MADISON MAERSK	213	N	Y	N
MAERSK CALIFORNIA	80	N	N	N
MAERSK RIO GRANDE	137	N	N	N
MAERSK STAFFORD	135	N	N	N
MAERSK SUN	286	Y	N	Y
MAERSK TACOMA	19	N	N	N
MAERSK TENNESSEE	74	N	N	N
MAERSK TEXAS	88	N	N	N
MAGLEBY MAERSK	251	N	Y	N
MAHARASHTRA	19	N	N	N
MAHIMAHI	360	N	N	Y
MAJ STEPHEN W PLESS MP	70	Y	N	Y
MAJESTIC MAERSK	129	N	Y	Y
MANGAL DESAI	4	N	N	N
MANOA	192	Y	Y	Y
MANUKAI	125	Y	Y	Y
MANULANI	118	N	N	Y
MARCARRIER	31	N	N	N
MARCHEN MAERSK	96	Y	N	N
MAREN MAERSK	102	Y	N	N
MARGRETHE MAERSK	144	N	Y	N
MARI BETH ANDRIE	15	N	N	N
MARIE MAERSK	37	N	N	N
MARIT MAERSK	103	N	Y	Y
MARK HANNAH	34	N	Y	N
MARLIN	171	Y	Y	Y
MATHILDE MAERSK	91	Y	Y	N

NAME	TOTAL OBS	MANUSCRIPT RECEIVED		
		OCT	NOV	DEC
MATSONIA	260	Y	Y	Y
MAUI	481	Y	Y	Y
MAURICE EWING	770	N	Y	Y
MAYAGUEZ	251	Y	Y	Y
MAYVIEW MAERSK	74	Y	N	Y
MC-KINNEY MAERSK	11	Y	N	N
MEDALLION	52	N	N	N
MEDUSA CHALLENGER	608	N	N	Y
MELVILLE	315	Y	N	Y
MERCHANT PRINCIPAL	27	N	N	N
MERCURY	102	N	N	N
MERLION ACE	58	Y	N	N
MESABI MINER	291	N	N	N
METTE MAERSK	110	Y	N	N
MICHIGAN	156	Y	N	N
MIDDLETOWN	190	N	N	Y
MING ASIA	73	N	N	N
MING PLEASURE	60	N	N	N
MING PROPITIOUS	99	N	N	N
MITLA	26	N	N	N
MOANA WAVE	34	N	N	N
MOKIHANA	533	Y	Y	Y
MOKU PAHU	111	N	N	Y
MORELOS	216	N	N	N
MORMACSKY	29	N	N	N
MORMACSUN	116	N	N	Y
MOSEL ORE	331	Y	Y	Y
MUNKEBO MAERSK	128	N	Y	Y
MYRON C. TAYLOR	170	Y	N	Y
MYSTIC	88	N	N	N
NADA II	203	Y	Y	Y
NATIONAL DIGNITY	97	N	N	N
NATIONAL HONOR	34	Y	Y	Y
NATIONAL PRIDE	60	N	N	Y
NEDLLOYD HOLLAND	223	Y	N	N
NEDLLOYD MONTEVIDEO	452	N	N	Y
NEGO LOMBOK	129	N	N	N
NELVANA	48	N	N	Y
NEPTUNE RHODONITE	85	N	N	N
NEW CARISSA	125	N	N	N
NEW HORIZON	182	Y	Y	Y
NEW NIKKI	166	Y	Y	Y
NEWARK BAY	286	N	Y	Y
NEWPORT BRIDGE	41	N	N	N
NOAA DAVID STARR JORDA	14	N	N	N
NOAA SHIP ALBATROSS IV	243	N	N	N
NOAA SHIP CHAPMAN	374	Y	Y	N
NOAA SHIP DELAWARE II	279	N	Y	N
NOAA SHIP FERREL	234	N	N	N
NOAA SHIP KA'IMIMOANA	738	Y	N	Y
NOAA SHIP MCARTHUR	157	N	N	N
NOAA SHIP MILLER FREEM	385	Y	Y	N
NOAA SHIP OREGON II	308	N	Y	N
NOAA SHIP RAINIER	125	Y	Y	N
NOAA SHIP T. CROMWELL	220	Y	Y	N
NOAA SHIP WHITING	116	N	N	N
NOBEL STAR	33	N	N	N
NOBLE STAR	175	N	N	Y
NOL AMAZONITE	27	N	N	N
NOMZI	252	Y	N	Y
NOORDAM	37	N	N	N

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NAME	TOTAL OBS	MANUSCRIPT RECEIVED		
		OCT	NOV	DEC
NORD JAHRE TRANSPORTER	21	N	N	N
NORD PARTNER	66	N	Y	N
NORDIC EMPRESS	1	N	N	N
NORDMAX	461	N	N	Y
NORDMORITZ	71	N	N	N
NORTHERN LIGHTS	68	Y	Y	Y
NORWAY	8	N	N	N
NUEVO LEON	134	N	N	N
NUEVO SAN JUAN	183	Y	Y	Y
OCEAN CAMELLIA	360	N	Y	Y
OCEAN CITY	26	N	N	N
OCEAN CLIPPER	359	Y	Y	Y
OCEAN LAUREL	31	N	N	N
OCEAN ORCHID	10	Y	N	N
OCEAN SERENE	210	N	Y	Y
OLEANDER	164	Y	N	N
OLIVEBANK	53	N	N	N
OLIVIA	69	N	N	N
OLYMPIAN HIGHWAY	42	N	N	N
OMI COLUMBIA	186	Y	Y	Y
OOCL AMERICA	96	Y	Y	Y
OOCL CALIFORNIA	197	N	Y	Y
OOCL CHINA	285	N	N	Y
OOCL ENVOY	100	N	N	N
OOCL FAIR	206	N	Y	Y
OOCL FAME	30	Y	N	N
OOCL FIDELITY	98	Y	Y	Y
OOCL FORTUNE	358	Y	N	N
OOCL FRONTIER	24	N	N	N
OOCL HONG KONG	112	Y	Y	N
OOCL INNOVATION	194	Y	N	N
OOCL INSPIRATION	170	N	N	N
ORANGE BLOSSOM	141	N	Y	N
ORIANA	125	N	N	N
ORIENTE GRACE	27	N	N	N
ORIENTE HOPE	203	Y	Y	Y
ORIENTE NOBLE	62	N	Y	N
ORIENTE PRIME	45	Y	Y	N
OURO DO BRASIL	87	N	N	N
OVERSEAS ALASKA	5	N	N	N
OVERSEAS ARCTIC	23	Y	Y	Y
OVERSEAS CHICAGO	9	N	N	N
OVERSEAS HARRIET	11	N	N	N
OVERSEAS JOYCE	238	N	N	N
OVERSEAS JUNEAU	52	Y	N	N
OVERSEAS MARILYN	107	Y	Y	N
OVERSEAS NEW ORLEANS	18	N	N	N
OVERSEAS NEW YORK	138	N	N	N
OVERSEAS OHIO	130	Y	Y	Y
OVERSEAS VIVIAN	13	N	N	N
PACASIA	183	N	N	N
PACDUKE	45	N	N	N
PACIFIC HIRO	18	N	N	N
PACKING	9	N	N	N
PACMERCHANT	17	N	N	N
PACROSE	33	N	N	N
PACSEA	44	N	N	N
PACSTAR	267	Y	N	Y
PAUL BUCK	32	N	N	N
PAUL R. TREGURTHA	476	Y	N	Y
PFC DEWAYNE T. WILLIAM	59	N	N	N
PFC EUGENE A. OBREGON	101	Y	Y	N
PFC JAMES ANDERSON JR	29	N	Y	N
PFC WILLIAM B. BAUGH	93	N	N	Y
PHILADELPHIA	79	N	N	Y
PHILIP R. CLARKE	191	N	N	Y
PHOENIX DIAMOND	48	N	N	N
PINO GLORIA	120	Y	N	Y
PISCES EXPLORER	87	N	N	N
POLAR EAGLE	150	Y	Y	Y
POLYNESIA	265	Y	N	N
POTOMAC TRADER	131	N	N	N
PRESIDENT ADAMS	186	Y	Y	Y
PRESIDENT EISENHOWER	362	N	N	Y
PRESIDENT F. ROOSEVELT	285	N	N	Y
PRESIDENT JACKSON	122	Y	Y	Y
PRESIDENT KENNEDY	168	Y	Y	Y
PRESIDENT POLK	171	Y	Y	Y
PRESIDENT TRUMAN	30	Y	N	Y
PRESQUE ISLE	238	Y	N	Y
PRIDE OF BALTIMORE II	364	N	N	Y
PRINCE OF OCEAN	178	Y	Y	Y
PRINCE OF TOKYO 2	377	N	Y	N
PRINCE WILLIAM SOUND	83	Y	N	N
PROJECT ARABIA	148	N	N	N
PUDONG SENATOR	55	N	N	N
PUERTO CORTES	20	N	N	N
PUSAN SENATOR	40	N	N	N
PVT FRANKLIN J. PHILLI	32	N	N	N
R. HAL DEAN	3	N	N	N
R.J. PFEIFFER	273	Y	Y	Y
RANI PADMINI	5	N	N	N
RAYMOND E. GALVIN	33	Y	N	N
REBECCA LYNN	200	N	Y	Y
RED ROSE	100	Y	Y	N
RESERVE	29	N	N	N
RESOLUTE	85	Y	N	N
RHAPSODY OF THE SEAS	12	N	N	Y
RHINE FOREST	38	Y	N	N
RICHARD G MATTHIESEN	2	N	N	N
RICHARD REISS	30	N	N	N
ROBERT E. LEE	95	N	Y	N
ROGER BLOUGH	484	N	N	Y
ROGER REVELLE	140	N	N	N
RONALD H. BROWN	479	Y	Y	N
ROSITA	5	Y	N	N
ROSSEL CURRENT	313	N	N	N
ROVER	26	N	N	N
ROYAL ETERNITY	175	Y	Y	Y
ROYAL MAJESTY	12	Y	N	N
RUBIN BONANZA	104	Y	N	N
RUBIN KOBE	181	Y	N	N
RUBIN PEARL	333	N	N	Y
RUBIN STELLA	115	N	N	N
RYNDAM	121	N	N	N
S.T. CRAPO	158	N	N	N
SAGA CREST	3	N	N	N
SALOME	45	N	N	N
SAM HOUSTON	44	N	N	N
SAMUEL GINN	12	N	N	N
SAMUEL H. ARMACOST	56	Y	Y	N
SAMUEL L. COBB	11	N	N	Y

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NAME	TOTAL OBS	MANUSCRIPT RECEIVED		
		OCT	NOV	DEC
SAN ANTONIO	147	Y	Y	Y
SAN ISIDRO	58	N	N	N
SAN MARCOS	49	N	N	N
SANKO LAUREL	98	N	N	N
SANKO MOON	2	N	N	N
SANTA CHRISTINA	126	N	N	N
SANTA ISABELLALOON	21	N	N	N
SANTORIN 2	325	N	N	Y
SARAMATI	36	N	N	N
SC HORIZON	138	Y	N	Y
SCHACKENBORG	12	N	N	N
SEA FLORIDA	123	Y	Y	Y
SEA FOX	178	N	N	N
SEA ISLE CITY	138	Y	N	N
SEA JUSTICE	60	N	N	N
SEA LION	671	N	N	Y
SEA LYNX	433	N	N	Y
SEA MARINER	67	N	N	N
SEA NOVIA	65	N	N	Y
SEA PRINCESS	122	N	N	N
SEA RACER	15	N	N	N
SEA TRADE	43	N	N	N
SEA VIGOR	33	N	N	N
SEA WOLF	185	N	N	Y
SEA-LAND CHARGER	206	N	Y	N
SEA-LAND EAGLE	340	N	N	Y
SEABOARD SUN	52	Y	Y	Y
SEABOARD UNIVERSE	54	N	N	Y
SEABREEZE I	27	N	N	N
SEALAND ANCHORAGE	154	Y	Y	Y
SEALAND ATLANTIC	291	N	N	N
SEALAND CHALLENGER	150	Y	Y	Y
SEALAND CHAMPION	151	Y	Y	Y
SEALAND COMET	55	N	N	N
SEALAND CONSUMER	142	N	N	Y
SEALAND CRUSADER	289	N	Y	N
SEALAND DEFENDER	187	Y	Y	N
SEALAND DEVELOPER	142	Y	N	Y
SEALAND DISCOVERY	67	Y	Y	Y
SEALAND ENDURANCE	95	Y	Y	Y
SEALAND ENTERPRISE	395	Y	N	Y
SEALAND EXPEDITION	125	N	Y	N
SEALAND EXPLORER	208	Y	Y	Y
SEALAND EXPRESS	164	Y	Y	Y
SEALAND FREEDOM	170	Y	Y	N
SEALAND HAWAII	326	N	Y	Y
SEALAND INDEPENDENCE	191	Y	Y	Y
SEALAND INNOVATOR	226	Y	Y	N
SEALAND INTEGRITY	198	N	N	N
SEALAND KODIAK	19	N	N	Y
SEALAND LIBERATOR	128	Y	Y	Y
SEALAND MARINER	182	N	N	N
SEALAND MERCURY	170	Y	Y	Y
SEALAND METEOR	138	Y	N	N
SEALAND NAVIGATOR	268	Y	N	Y
SEALAND PACER	44	N	N	N
SEALAND PACIFIC	247	Y	Y	Y
SEALAND PATRIOT	226	Y	N	Y
SEALAND PERFORMANCE	181	N	Y	N
SEALAND PRODUCER	288	Y	N	N
SEALAND QUALITY	59	N	N	N
SEALAND RACER	109	Y	Y	Y
SEALAND RELIANCE	152	Y	Y	Y
SEALAND SPIRIT	204	N	N	N
SEALAND TACOMA	186	N	Y	Y
SEALAND TRADER	174	Y	Y	N
SEALAND VOYAGER	204	Y	Y	Y
SEARIVER BATON ROUGE	25	N	Y	Y
SEARIVER BENICIA	50	Y	N	N
SEARIVER LONG BEACH	18	N	N	Y
SEARIVER NORTH SLOPE	14	N	N	N
SEARIVER SAN FRANCISCO	85	N	N	Y
SEAWIND CROWN	137	Y	Y	N
SENSATION	40	Y	N	N
SEWARD JOHNSON	190	Y	Y	N
SGT WILLIAM A BUTTON	45	Y	N	Y
SGT. METEJ KOCAK	67	N	Y	Y
SHELDON LYKES	64	N	N	Y
SHELLY BAY	145	Y	Y	Y
SHIRAOI MARU	215	Y	Y	Y
SIBOHELLE	1	N	N	N
SIETE OCEANOS	136	Y	Y	N
SINCERE SUCCESS	321	N	N	N
SINGAPORE EXPRESS	1	N	N	N
SKAUGRAN	1	N	N	N
SKOGAFOSS	145	N	N	N
SOKOLICA	84	N	N	N
SOL DO BRASIL	52	N	N	N
SOLAR WING	134	N	N	N
SONG OF AMERICA	7	N	N	N
SONORA	172	N	N	N
SOREN TOUBRO	199	N	N	Y
SOUTH FORTUNE	135	N	Y	Y
SOUTHERN LION	98	N	N	N
SOVEREIGN OF THE SEAS	1	N	N	N
SPLENDOUR OF THE SEAS	1	N	N	N
SPRING GANNET	346	N	N	Y
SPRING WAVE	142	N	N	N
STAR ALABAMA	55	N	N	N
STAR AMERICA	196	Y	N	N
STAR DOVER	8	N	N	N
STAR EAGLE	34	N	N	N
STAR EVVIVA	2	N	N	N
STAR GRAN	122	N	N	Y
STAR HANSA	86	N	N	N
STAR HARDANGER	109	N	N	Y
STAR HERDLA	103	N	Y	Y
STAR HOYANGER	8	N	N	N
STAR SKARVEN	112	Y	Y	Y
STAR SKOGANGER	10	N	N	N
STAR STRONEN	55	N	N	N
STATENDAM	101	N	N	N
STEPHAN J	376	Y	Y	Y
STEWART J. CORT	274	Y	Y	Y
STOLT CONDOR	31	N	N	N
STONEWALL JACKSON	81	Y	Y	Y
STRONG VIRGINIAN	52	N	N	N
SUMMER BREEZE	25	N	N	N
SUN DANCE	42	N	N	N
SUN PRINCESS	87	N	N	N

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NAME	TOTAL OBS	MANUSCRIPT RECEIVED		
		OCT	NOV	DEC
SUNBELT DIXIE	53	Y	N	N
SUSAN W. HANNAH	295	Y	N	N
SVEN OLTMANN	42	N	N	N
TAI HE	96	N	N	N
TAI SHING	48	Y	N	N
TAIKO	6	N	N	N
TAKAYAMA	142	N	N	Y
TALLAHASSEE BAY	22	N	N	N
TANABATA	14	N	N	N
TELLUS	193	N	Y	Y
TEQUI	8	N	N	N
TEXAS	28	N	N	N
TILLIE LYKES	232	Y	Y	Y
TMM OAXACA	175	N	N	N
TOLUCA	1	N	N	N
TONSINA	77	N	N	Y
TORBEN	228	Y	N	Y
TORM FREYA	95	Y	Y	N
TRANSWORLD BRIDGE	157	Y	Y	Y
TRITON	329	Y	Y	Y
TROPIC FLYER	45	N	Y	Y
TROPIC ISLE	20	Y	Y	N
TROPIC JADE	39	Y	Y	Y
TROPIC KEY	106	Y	Y	Y
TROPIC LURE	71	Y	Y	Y
TROPIC MIST	49	N	Y	Y
TROPIC SUN	140	Y	Y	Y
TROPIC TIDE	110	Y	Y	N
TROPICALE	27	N	N	N
TRUST 38	86	N	N	Y
TULSIDAS	8	N	N	N
TURMOIL	13	N	N	N
TYSON LYKES	158	Y	Y	Y
USCGC ACACIA (WLB406)	139	Y	Y	Y
USCGC ACTIVE WMEC 618	336	N	N	Y
USCGC ACUSHNET WMEC 16	72	N	N	N
USCGC ALERT (WMEC 630)	314	N	N	N
USCGC BOUTWELL WHEC 71	280	N	N	Y
USCGC BRAMBLE (WLB 392	2	N	N	N
USCGC CONFIDENCE WMEC6	85	N	N	Y
USCGC DAUNTLESS WMEC 6	33	N	N	N
USCGC DEPENDABLE	2	N	N	N
USCGC DURABLE (WMEC 62	6	N	N	N
USCGC GALLATIN WMEC 72	157	N	N	N
USCGC HAMILTON WHEC 71	5	N	N	N
USCGC HARRIET LANE	60	N	N	N
USCGC JARVIS (WHEC 725	94	Y	Y	N
USCGC KATMAI BAY	28	N	N	Y
USCGC LEGARE	62	Y	N	N
USCGC MACKINAW	23	N	Y	N
USCGC MIDGETT (WHEC 72	166	N	N	N
USCGC MOHAWK WMEC 913	1	N	N	N
USCGC MORGENTHAU	75	Y	N	N
USCGC PLANETREE	145	Y	Y	Y
USCGC POLAR STAR (WAGB	129	N	N	N
USCGC RELIANCE WMEC 61	26	N	N	N
USCGC SEDGE (WLB 402)	20	N	N	N
USCGC SPENCER	49	N	N	N

NAME	TOTAL OBS	MANUSCRIPT RECEIVED		
		OCT	NOV	DEC
USCGC STEADFAST (WMEC	32	Y	Y	N
USCGC STORIS (WMEC 38)	144	N	N	N
USCGC SUNDEW (WLB 404)	19	N	N	N
USCGC SWEETBRIER WLB 4	2	N	N	N
USCGC TAHOMA	169	Y	Y	N
USCGC VALIANT (WMEC 62	38	N	N	N
USCGC VENTUROUS WMEC 6	48	N	N	N
USCGC WOODRUSH (WLB 40	14	N	N	N
USNS ANTARES	11	N	N	N
USNS APACHE (T-ATF 172	116	Y	N	Y
USNS BOWDITCH	164	Y	Y	Y
USNS DENEBOLA	72	N	Y	Y
USNS GILLILAND	123	N	N	N
USNS GUS W. DARNELL	35	N	N	N
USNS HAYES	47	N	N	N
USNS JOHN MCDONNELL (T	50	N	Y	Y
USNS KANAWHA T-AO 196	104	N	N	Y
USNS LARAMIE T-AO 203	26	Y	N	N
USNS PATHFINDER T-AGS	102	Y	Y	Y
USNS POWHATAN TATF 166	142	N	N	N
USNS REGULUS	4	N	N	N
USNS SATURN T-AFS-10	52	Y	N	N
USNS SUMNER	200	Y	N	Y
USNS TIPPECANOE (TAO-1	111	Y	Y	Y
USNS VANGUARD TAG 194	160	N	N	N
VERA ACORDE	27	N	N	N
VICTORIA	4	N	N	N
VIRGINIA	427	Y	Y	Y
VISAYAN GLORY	65	Y	N	N
VIVA	16	N	N	N
WALTER J. MCCARTHY	118	N	N	Y
WAVELET	147	Y	N	N
WECOMA	109	Y	Y	N
WESTWOOD ANETTE	157	Y	Y	Y
WESTWOOD BELINDA	133	N	N	N
WESTWOOD CLEO	111	Y	Y	N
WESTWOOD FUJI	188	Y	Y	Y
WESTWOOD HALLA	558	N	N	Y
WESTWOOD JAGO	82	N	N	N
WESTWOOD MARIANNE	158	N	N	Y
WILFRED SYKES	47	Y	N	N
WILLIAM E. MUSSMAN	90	N	N	Y
WILSON	27	N	N	Y
WOENSDRECHT	100	Y	N	N
WOLVERINE	125	N	N	Y
YUCATAN	114	N	N	N
YURIY OSTROVSKIY	286	Y	Y	Y
ZENITH	24	N	N	N
ZIM AMERICA	94	N	N	N
ZIM ASIA	86	N	N	N
ZIM ISRAEL	64	N	N	N
ZIM ITALIA	191	Y	Y	N
ZIM KOREA	85	N	N	N
ZIM MONTEVIDEO	41	N	N	N
GRAND TOTAL	97,220			

VOS Coop Ship Reports — January-April 1998

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, Attn: Dimitri Chappas (828-271-4055 or dchappas@ncdc.noaa.gov).

SHIP NAME	CALL	PORT	JAN	FEB	MAR	APR	TOTAL
1ST LT ALEX BONNYMAN	WMFZ	New York City	9	0	0	0	9
1ST LT BALDOMERO LOPEZ	WJKV	Jacksonville	0	0	30	54	84
A. V. KASTNER	ZCAM9	Jacksonville	0	61	57	0	118
AALSMEERGRACHT	PCAM	Long Beach	0	24	39	51	114
ACADIA FOREST	D5DI	New Orleans	42	70	0	0	112
ACT 7	GWAN	Newark	0	28	52	57	137
ACT I	GYXG	Newark	0	62	40	75	177
ADAM E. CORNELIUS	WCF7451	Chicago	23	0	5	54	82
ADVANTAGE	WPPO	Norfolk	58	60	29	37	184
AGDLEK	OUGV	Miami	29	7	10	38	84
AGULHAS	3ELE9	Baltimore	121	44	50	126	341
AL SAMIDOON	9KKF	Houston	0	21	93	104	218
AL SHUHADAA	9KKH	Houston	0	97	26	68	191
ALASKA	P3YK3	Houston	1	0	0	0	1
ALBEMARLE ISLAND	C6LU3	Newark	107	40	75	79	301
ALBERNI DAWN	ELAC5	Houston	0	45	23	35	103
ALBERTO TOPIC	ELPG7	Norfolk	0	38	0	41	79
ALDEN W. CLAUSEN	ELBM4	Norfolk	87	41	78	23	229
ALEXANDER VON HUMBOLD	Y3CW	Miami	240	293	374	691	1598
ALKMAN	C6OG4	Houston	0	61	51	51	163
ALLEGIANCE	WSKD	Norfolk	73	38	18	42	171
ALLIGATOR AMERICA	JPAL	Seattle	0	61	45	31	137
ALLIGATOR BRAVERY	3FXX4	Oakland	29	55	46	42	172
ALLIGATOR COLUMBUS	3ETV8	Seattle	99	20	65	23	207
ALLIGATOR FORTUNE	ELFK7	Seattle	0	0	37	35	72
ALLIGATOR GLORY	ELJP2	Seattle	10	5	24	12	51
ALLIGATOR LIBERTY	JFUG	Seattle	0	71	58	56	185
ALLIGATOR STRENGTH	3FAK5	Oakland	35	31	33	66	165
ALMERIA LYKES	WGMJ	Houston	54	32	38	13	137
ALPENA	WAV4647	Cleveland	0	0	0	17	17
ALTAIR	DBBI	Miami	406	491	690	377	1964
AMAZON	S6BJ	Norfolk	9	2	59	47	117
AMBASSADOR BRIDGE	3ETH9	Oakland	63	31	136	42	272
AMERICA STAR	C6JZ2	Houston	0	9	61	59	129
AMERICAN CONDOR	WJRG	Newark	84	0	77	51	212
AMERICAN CORMORANT	KGOP	Jacksonville	0	4	5	16	25
AMERICAN FALCON	KMJA	Jacksonville	0	0	0	24	24
AMERICAN MERLIN	WRGY	Norfolk	26	0	4	17	47
AMERICANA	LADX2	New Orleans	49	12	4	0	65
AMERIGO VESPUCCI	ICBA	Norfolk	16	0	8	8	32
ANAHUAC	ELFV3	Long Beach	45	20	26	3	94
ANASTASIS	9HOZ	Miami	4	3	5	44	56
ANATOLIY KOLESNICHENKO	UINM	Seattle	0	9	9	12	30
ANKERGRACHT	PCQL	Baltimore	71	55	28	31	185
ANNA MAERSK	OYKS2	Long Beach	7	14	21	0	42
AOMORI WILLOW	3FIO6	Seattle	45	11	4	9	69
APL CHINA	V7AL5	Seattle	60	6	81	12	159
APL JAPAN	V7AL7	Seattle	23	14	45	67	149
APL KOREA	WCX8883	Seattle	51	0	54	93	198
APL PHILIPPINES	WCX8884	Seattle	0	32	0	51	83
APL SINGAPORE	WCX8812	Seattle	0	81	0	186	267
APL THAILAND	WCX8882	Seattle	0	319	0	27	346
ARABELLA	S6AH	Miami	0	0	1	0	1
ARABIAN SENATOR	DPUF	Norfolk	0	96	1	0	97
ARCO ALASKA	KSBK	Long Beach	15	11	2	0	28
ARCO CALIFORNIA	WMCV	Long Beach	26	0	0	4	30
ARCO FAIRBANKS	WGWB	Long Beach	7	14	15	9	45
ARCO INDEPENDENCE	KLHV	Long Beach	3	48	12	14	77
ARCO JUNEAU	KSBG	Long Beach	28	12	20	0	60

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SHIP NAME	CALL	PORT	JAN	FEB	MAR	APR	TOTAL
ARCO PRUDHOE BAY	KPFD	Long Beach	3	9	6	9	27
ARCO SAG RIVER	WLDF	Long Beach	0	0	0	32	32
ARCO SPIRIT	KHLD	Long Beach	53	32	17	15	117
ARCO TEXAS	KNFD	Long Beach	24	7	13	11	55
ARCTIC SUN	ELQB8	Long Beach	46	38	27	21	132
ARCTIC UNIVERSAL	4QUL	Baltimore	0	64	80	76	220
ARGONAUT	KFDV	Newark	99	52	60	27	238
ARIES	KGBD	New York City	72	23	0	0	95
ARINA ARCTICA	OVYA2	Miami	105	106	110	100	421
ARKTIS SPRING	OWVD2	Miami	61	46	46	0	153
ARMCO	WE6279	Cleveland	8	0	0	20	28
ARTHUR M. ANDERSON	WE4805	Chicago	89	0	24	66	179
ARTHUR MAERSK	OXRS2	Long Beach	32	0	0	0	32
ATLANTIC	3FYT	Miami	221	204	211	219	855
ATLANTIC BULKER	3FSQ4	Miami	18	12	383	34	447
ATLANTIC CARTIER	C6MS4	Norfolk	23	11	30	30	94
ATLANTIC COMPANION	SKPE	Newark	0	32	16	25	73
ATLANTIC COMPASS	SKUN	Norfolk	0	18	39	31	88
ATLANTIC CONCERT	SKOZ	Norfolk	0	28	19	24	71
ATLANTIC CONVEYOR	C6NI3	Norfolk	0	5	9	5	19
ATLANTIC ERIE	VCQM	Baltimore	0	29	25	9	63
ATLANTIC OCEAN	C6T2064	Newark	0	0	0	21	21
ATLANTIC SUPERIOR	C6BT8	Baltimore	0	5	7	0	12
ATLANTIS	KAQP	New Orleans	0	0	0	79	79
AUCKLAND STAR	C6KV2	Baltimore	0	54	41	57	152
AUSTRAL RAINBOW	WEZP	New Orleans	0	18	16	8	42
AUTHOR	GBSA	Houston	0	18	23	18	59
B. T. ALASKA	WFQE	Long Beach	37	204	47	34	322
BARBARA ANDRIE	WTC9407	Chicago	0	0	42	29	71
BARBICAN SPIRIT	DVFS	Miami	37	5	32	28	102
BARRINGTON ISLAND	C6QK	Newark	68	53	67	69	257
BAY BRIDGE	ELES7	Seattle	21	39	31	29	120
BERING SEA	C6YY	Miami	34	21	216	52	323
BERNARDO QUINTANA A	C6KJ5	New Orleans	54	68	79	36	237
BLUE GEMINI	3FPA6	Seattle	60	56	236	84	436
BLUE HAWK	D5HZ	Norfolk	0	0	19	28	47
BLUE NOVA	3FDV6	Seattle	10	15	1	16	42
BOHINJ	V2SG	Oakland	0	1	5	1	7
BONN EXPRESS	DGNB	Houston	0	629	707	249	1585
BOSPORUS BRIDGE	3FMV3	Oakland	73	16	33	53	175
BP ADMIRAL	ZCAK2	Houston	0	2	1	4	7
BREMEN EXPRESS	9VUM	Norfolk	0	538	239	352	1129
BRIGHT PHOENIX	DXNG	Seattle	67	63	57	57	244
BRIGHT STATE	DXAC	Seattle	77	95	50	52	274
BRIGIT MAERSK	OXVW4	Oakland	24	23	13	22	82
BRISBANE STAR	C6LY4	Seattle	0	9	47	22	78
BRITISH ADVENTURE	ZCAK3	Seattle	0	61	46	57	164
BRITISH RANGER	ZCAS6	Houston	0	41	84	76	201
BROOKLYN BRIDGE	3EZJ9	Oakland	90	30	74	34	228
BRUCE SMART	ELOF4	Oakland	68	8	116	74	266
BT NESTOR	ZCBL4	New York City	0	19	16	13	48
BT NIMROD	ZCBL5	Long Beach	0	2	9	16	27
BUNGA KANTAN	9MYK	Long Beach	0	0	2	0	2
BUNGA ORKID SATU	9MBQ3	Seattle	0	0	12	48	60
BUNGA SAGA DUA	9MBL7	Seattle	3	29	10	0	42
BUNGA SAGA TIGA	9MBM8	Seattle	1	0	0	0	1
BURNS HARBOR	WQZ7049	Chicago	62	0	27	111	200
CALIFORNIA CURRENT	ELMG2	New Orleans	0	0	42	86	128
CALIFORNIA JUPITER	ELKU8	Long Beach	105	54	45	23	227
CALIFORNIA LUNA	3EYX5	Seattle	0	6	0	0	6
CALIFORNIA MERCURY	JGPN	Seattle	0	27	42	29	98
CALIFORNIA PEGASUS	3EPB6	Oakland	5	15	24	9	53
CAPE BREEZE	DUGK	Seattle	42	80	31	21	174
CAPE CHARLES	3EFX5	Seattle	0	11	14	19	44
CAPE HENRY	3ENQ9	Norfolk	0	12	17	17	46
CAPE LAMBERT	KJCJ	Norfolk	1	0	0	0	1
CAPE MAY	JBCN	Norfolk	0	11	20	18	49
CAPE ROGER	VCBT	Norfolk	0	0	0	15	15
CAPT STEVEN L BENNETT	KAXO	New Orleans	48	0	0	288	336
CAPTAIN LEE	ELDT7	Seattle	0	0	0	4	4
CARDIGAN BAY	ZCBF5	New York City	0	57	19	23	99
CARIBBEAN BULKER	C6PL3	New Orleans	25	15	13	255	308
CARIBBEAN MERCY	3FFU4	Miami	25	10	0	0	35
CARLA A. HILLS	ELBG9	Oakland	47	18	6	57	128
CAROLINA	WYBI	Jacksonville	11	0	75	105	191
CASON J. CALLAWAY	WE4879	Chicago	42	0	11	54	107
CELEBES TRES	DYGS	Seattle	0	48	8	40	96

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SHIP NAME	CALL	PORT	JAN	FEB	MAR	APR	TOTAL
CELEBRATION	ELFT8	New Orleans	17	32	9	9	67
CELTIC SEA	C6RT	Miami	26	17	40	0	83
CENTURY	ELQX6	Miami	0	0	1	0	1
CENTURY HIGHWAY #2	3EJB9	Long Beach	22	23	24	27	96
CENTURY HIGHWAY NO. 1	3FFJ4	Houston	0	20	22	23	65
CENTURY HIGHWAY_NO. 3	8JNP	Houston	0	16	22	22	60
CENTURY LEADER NO. 1	3FBI6	Houston	0	44	14	34	92
CHARLES ISLAND	C6JT	Miami	46	47	148	43	284
CHARLES L. BROWN	KNCZ	Jacksonville	0	0	21	0	21
CHARLES LYKES	3EJT9	Baltimore	30	37	113	56	236
CHARLES M. BEEGHLEY	WL3108	Cleveland	8	0	0	1	9
CHARLES PIGOTT	5LPA	Oakland	0	0	114	24	138
CHEMICAL PIONEER	KAFO	Houston	32	75	28	31	166
CHESAPEAKE TRADER	WGZK	Houston	20	112	51	35	218
CHEVRON ARIZONA	KGBE	Miami	0	0	0	19	19
CHEVRON ATLANTIC	C6KY3	New Orleans	0	134	25	59	218
CHEVRON COLORADO	KLHZ	Oakland	5	1	0	0	6
CHEVRON EDINBURGH	VSBZ5	Oakland	70	66	71	5	212
CHEVRON EMPLOYEE PRIDE	C6MC5	Baltimore	71	46	3	2	122
CHEVRON MISSISSIPPI	WXBR	Oakland	56	7	2	29	94
CHEVRON NAGASAKI	A8BK	Oakland	0	10	14	221	245
CHEVRON PERTH	C6KQ8	Oakland	0	0	0	165	165
CHEVRON SOUTH AMERICA	ZCAA2	New Orleans	50	304	31	20	405
CHIEF GADAO	WEZD	Oakland	36	23	61	27	147
CHIQUITA BARU	ZCAY7	Jacksonville	0	44	38	42	124
CHIQUITA BELGIE	C6KD7	Baltimore	0	59	42	49	150
CHIQUITA BREMEN	ZCBC5	Miami	55	42	31	35	163
CHIQUITA BRENDA	ZCBE9	Miami	10	42	54	60	166
CHIQUITA DEUTSCHLAND	C6KD8	Baltimore	0	27	47	32	106
CHIQUITA ELKESCHLAND	ZCBB9	Miami	60	44	45	41	190
CHIQUITA FRANCES	ZCBD9	Miami	63	62	72	65	262
CHIQUITA ITALIA	C6KD5	Baltimore	40	44	22	12	118
CHIQUITA JEAN	ZCBB7	Jacksonville	3	38	51	48	140
CHIQUITA JOY	ZCBC2	Miami	57	32	75	47	211
CHIQUITA NEDERLAND	C6KD6	Baltimore	0	126	64	52	242
CHIQUITA ROSTOCK	ZCBD2	Miami	68	52	69	64	253
CHIQUITA SCANDINAVIA	C6KD4	Baltimore	0	45	47	44	136
CHIQUITA SCHWEIZ	C6KD9	Baltimore	0	29	48	65	142
CHITTINAD TRADITION	VTRX	New Orleans	0	0	0	46	46
CHO YANG ATLAS	DQVH	Seattle	80	17	5	54	156
CHOYANG VISION	9VOQ	Seattle	118	36	37	49	240
CITY OF DURBAN	GXIC	Long Beach	0	92	74	46	212
CLEVELAND	KGXA	Houston	40	71	0	3	114
CMS ISLAND EXPRESS	J8NX	Miami	8	7	0	0	15
COLORADO	KWFE	Miami	0	0	13	6	19
COLUMBIA STAR	WSB2018	Cleveland	0	0	0	17	17
COLUMBIA STAR	C6HL8	Long Beach	0	71	65	72	208
COLUMBINE	3ELQ9	Baltimore	73	59	41	237	410
COLUMBUS AMERICA	ELSX2	Norfolk	45	38	49	58	190
COLUMBUS AUSTRALIA	ELSX3	Houston	0	44	56	36	136
COLUMBUS CALIFORNIA	ELUB7	Long Beach	0	65	73	44	182
COLUMBUS CANADA	ELQN3	Seattle	0	64	83	13	160
COLUMBUS NEW ZEALAND	ELSX4	Newark	0	29	2	0	31
COLUMBUS QUEENSLAND	ELUB9	Norfolk	0	25	19	9	53
COLUMBUS VICTORIA	ELUB6	Long Beach	0	43	90	73	206
CONDOLEEZZA RICE	C6OK	Baltimore	0	48	10	78	136
CONTSHIP AMERICA	3EIP3	Houston	0	20	16	18	54
COPACABANA	PPXI	Norfolk	7	153	0	30	190
CORDELIA	3ESJ3	Long Beach	5	8	12	0	25
CORMORANT ARROW	C6IO9	Seattle	0	0	5	14	19
CORNUCOPIA	KPJC	Oakland	54	4	59	29	146
CORWITH CRAMER	WTF3319	Norfolk	3	0	113	99	215
COSMOWAY	3EVO3	Seattle	13	0	0	8	21
COURIER	KCBK	Houston	4	0	0	0	4
COURTNEY BURTON	WE6970	Cleveland	14	0	4	20	38
COURTNEY L	ZCAQ8	Baltimore	16	10	47	123	196
CPL. LOUIS J. HAUGE JR.	WPHV	Norfolk	96	0	0	0	96
CROWN OF SCANDINAVIA	OXRA6	Miami	0	72	84	89	245
CROWN PRINCESS	ELGH5	Miami	9	0	0	0	9
CSAV RECIFE	DQQO	New York City	0	49	9	0	58
CSAV RELONCAVI	DHGE	Baltimore	1	0	0	0	1
CSL ATLAS	C6IL3	Baltimore	15	6	3	0	24
CSL CABO	D5XH	Seattle	9	59	0	37	105
CSS HUDSON	CGDG	Norfolk	0	0	19	17	36
DAGMAR MAERSK	DHAF	New York City	0	0	27	44	71
DAISHIN MARU	3FPS6	Seattle	94	16	82	86	278
DANIA PORTLAND	OXEH2	Miami	67	32	28	30	157

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SHIP NAME	CALL	PORT	JAN	FEB	MAR	APR	TOTAL
DAWN PRINCESS	ELTO4	Miami	0	0	21	6	27
DELAWARE TRADER	WXWL	Long Beach	63	8	58	162	291
DENALI	WSVR	Long Beach	161	28	31	156	376
DESTINY	3FKZ3	Miami	75	41	78	24	218
DG COLUMBIA	PPSL	Norfolk	349	80	106	58	593
DIRCH MAERSK	OXQP2	Long Beach	57	33	27	27	144
DIRECT EAGLE	C6BJ9	Long Beach	30	50	36	35	151
DIRECT FALCON	C6MP7	Long Beach	73	463	103	61	700
DIRECT KEA	C6MP8	Long Beach	44	78	45	46	213
DIRECT KIWI	C6MP9	Long Beach	50	42	241	18	351
DIRECT KOOKABURRA	C6MQ2	Long Beach	83	48	47	114	292
DOCK EXPRESS 10	PJRO	Baltimore	0	28	43	38	109
DOCK EXPRESS 20	PJRF	Baltimore	0	0	0	19	19
DOCTOR LYKES	3ELF9	Baltimore	45	32	42	72	191
DORTHE OLDENDORFF	ELQJ6	Seattle	45	7	0	47	99
DRAGOR MAERSK	OXPW2	Long Beach	48	1	62	13	124
DUHALLOW	ZCBH9	Baltimore	63	64	42	77	246
DUNCAN ISLAND	C6JS	Miami	206	85	126	69	486
DUSSELDORF EXPRESS	S6IG	Long Beach	0	313	715	652	1680
E.P. LE QUEBECOIS	CG3130	Norfolk	0	0	0	8	8
ECSTASY	ELNC5	Miami	7	17	15	24	63
EDELWIESS	VRUM3	Seattle	57	23	53	56	189
EDGAR B. SPEER	WQZ9670	Chicago	0	0	0	149	149
EDWIN H. GOTT	WXQ4511	Chicago	54	0	0	78	132
EDYTH L	C6YC	Baltimore	18	22	13	31	84
EIDELWEISS	3FGE2	Seattle	0	0	0	17	17
ELATION	3FOC5	Miami	0	0	47	36	83
ELLIOTT BAY	DZFF	Seattle	26	42	46	42	156
ENCHANTMENT OF THE SEAS	LAXA4	Miami	0	5	45	14	64
ENDEAVOR	WAUW	New York City	67	50	43	19	179
ENDURANCE	WAUU	New York City	12	25	13	22	72
ENGLISH STAR	C6KU7	Long Beach	0	58	65	61	184
ENTERPRISE	KUSXXX	New York City	47	0	0	0	47
EQUINOX	DPSC	Baltimore	22	27	0	0	49
EUROPA	DLAL	Miami	0	0	13	0	13
EVER DELUXE	3FBE8	Norfolk	0	0	4	12	16
EVER GAINING	BKJO	Norfolk	2	0	0	1	3
EVER GARLAND	3EOB8	Long Beach	0	0	3	7	10
EVER GENERAL	BKHY	Baltimore	0	0	0	3	3
EVER GLOWING	BKJZ	Long Beach	12	0	0	10	22
EVER GOLDEN	BKHL	Baltimore	24	0	0	9	33
EVER GOODS	BKHZ	Newark	0	0	0	6	6
EVER GOVERN	BKHN	Seattle	0	0	6	0	6
EVER LAUREL	BKHH	Long Beach	4	7	7	4	22
EVER LEVEL	BKHJ	Miami	10	16	0	0	26
EVER RACER	3FJL4	Norfolk	0	0	3	0	3
EVER RESULT	3FSA4	Norfolk	5	0	0	0	5
EVER ROUND	3FQN3	Long Beach	12	0	4	13	29
EVER ULTRA	3FEJ6	Seattle	0	246	270	0	516
EVER UNION	3FFG7	Seattle	17	103	10	30	160
EVER UNIQUE	3FXQ6	Seattle	15	9	56	15	95
EVER UNISON	3FTL6	Long Beach	8	1	1	0	10
EXCELSIOR	V7AZ2	Baltimore	89	47	72	65	273
EXEMPLAR	V7AZ3	Baltimore	0	52	43	0	95
FAIRLIFT	PEBM	Norfolk	0	54	19	32	105
FAIRMAST	PJLC	Norfolk	0	70	47	39	156
FANAL TRADER	VRUY4	Seattle	70	91	66	197	424
FANTASY	ELKI6	Miami	28	18	20	13	79
FARALLON ISLAND	FARIS	Oakland	127	62	118	108	415
FASCINATION	3EWK9	Miami	35	18	24	13	90
FAUST	WRYX	Jacksonville	94	41	117	100	352
FIDELIO	WQVY	Jacksonville	49	24	88	79	240
FLAMENGO	PPXU	Norfolk	0	31	0	0	31
FOREST TRADER	A8GJ	Seattle	3	57	59	89	208
FRANCES HAMMER	KRGC	Jacksonville	26	43	147	21	237
FRANCES L	C6YE	Baltimore	24	21	5	3	53
FRANKFURT EXPRESS	9VPP	New York City	0	18	31	37	86
FRED R. WHITE JR	WAR7324	Cleveland	0	0	0	13	13
FREEPORT EXPRESS	V2AJ5	New York City	0	30	54	30	114
G AND C PARANA	LADC2	Long Beach	15	11	26	15	67
GALVESTON BAY	WPKD	Houston	35	212	63	21	331
GEETA	VRUL7	New Orleans	10	0	15	8	33
GEORGE A. SLOAN	WA5307	Chicago	0	0	0	107	107
GEORGE H. WEYERHAEUSER	C6FA7	Oakland	20	9	86	52	167
GEORGE SCHULTZ	ELPG9	Baltimore	43	32	42	30	147
GEORGE WASHINGTON BRIDGE	JKCF	Long Beach	0	0	83	61	144
GEORGIA RAINBOW II	3ERJ8	Jacksonville	61	16	238	0	315

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SHIP NAME	CALL	PORT	JAN	FEB	MAR	APR	TOTAL
GERD MAERSK	OZNC2	New York City	0	0	28	38	66
GERMAN SENATOR	P3ZZ6	Norfolk	0	3	2	0	5
GLOBAL LINK	WWDY	Baltimore	0	5	6	0	11
GLOBAL MARINER	WWXA	Baltimore	66	35	0	22	123
GLOBAL SENTINEL	WRZU	Baltimore	0	0	9	0	9
GLORIOUS SUCCESS	DUHN	Seattle	0	0	2	0	2
GOLDEN GATE	KIOH	Long Beach	46	2	12	5	65
GOLDEN GATE BRIDGE	3FWM4	Seattle	36	69	52	70	227
GRANDEUR OF THE SEAS	ELTQ9	Miami	0	0	22	24	46
GREAT LAND	WFDP	Seattle	79	48	0	3	130
GREEN BAY	KGTH	Long Beach	18	5	25	161	209
GREEN ISLAND	KIBK	New Orleans	24	154	33	10	221
GREEN LAKE	KGTI	Baltimore	75	47	42	169	333
GREEN MAYA	3ETA5	Seattle	11	10	7	0	28
GREEN RAINIER	3ENI3	Seattle	8	6	9	23	46
GREEN RIDGE	WRYL	Seattle	7	17	31	14	69
GREEN SASEBO	3EUT5	Seattle	0	0	0	3	3
GROTON	KMJL	Newark	98	31	44	41	214
GUANAJUATO	ELMH8	Jacksonville	9	11	48	4	72
GUAYAMA	WZJG	Jacksonville	36	28	106	63	233
GULF CURRENT	ELMF9	New Orleans	94	0	0	0	94
GULL ARROW	C6KB4	Baltimore	0	0	14	0	14
GYPSUM BARON	ZCAN3	Norfolk	0	48	50	0	98
GYPSUM KING	ZCAN2	Miami	67	61	61	0	189
HANJIN BARCELONA	3EXX9	Long Beach	0	2	0	5	7
HANJIN BREMEN	D7YG	Seattle	6	16	0	0	22
HANJIN COLOMBO	3FTF4	Oakland	0	0	6	10	16
HANJIN FELIXSTOWE	D9TJ	Seattle	12	12	6	11	41
HANJIN HONG KONG	DSEL7	Long Beach	0	0	0	57	57
HANJIN KAOHSIUNG	D9TW	Seattle	8	0	0	9	17
HANJIN LE HAVRE	D9SY	Seattle	11	8	9	0	28
HANJIN PORTLAND	3FSB3	Newark	8	10	12	12	42
HANJIN ROTTERDAM	D9SR	Seattle	0	4	1	0	5
HANJIN SEATTLE	D9SF	Seattle	0	0	12	8	20
HANJIN SHANGHAI	3FGI5	Newark	11	11	9	7	38
HANJIN SINGAPORE	D9TX	Long Beach	1	0	0	0	1
HANJIN TOKYO	3FZJ3	New York City	7	0	15	0	22
HANJIN VANCOUVER	D9TK	Long Beach	16	11	15	15	57
HARBOUR BRIDGE	ELJH9	Seattle	76	31	38	33	178
HARMONY ACE	VRUG6	Jacksonville	0	0	14	8	22
HASKERLAND	PENG	Houston	0	40	11	0	51
HEICON	P3TA4	Norfolk	35	40	32	1	108
HEIDELBERG EXPRESS	DEDI	Houston	0	621	715	344	1680
HELVETIA	OXRO2	Jacksonville	0	0	34	0	34
HENRY HUDSON BRIDGE	JKLS	Long Beach	0	84	70	55	209
HERBERT C. JACKSON	WL3972	Cleveland	8	0	0	0	8
HOEGH DRAKE	ZHEN7	Norfolk	0	0	0	48	48
HOEGH DUKE	C6OX3	Norfolk	0	0	0	24	24
HOEGH DYKE	C6OX2	Long Beach	0	22	32	0	54
HOLCK LARSEN	VTFJ	Cleveland	0	0	1	2	3
HOLIDAY	3FPN5	Long Beach	0	0	0	3	3
HONSHU SILVIA	3EST7	Seattle	0	14	11	72	97
HOOD ISLAND	C6LU4	Newark	75	48	34	33	190
HOUSTON	FNXB	Houston	31	18	60	38	147
HOUSTON EXPRESS	DLBB	Houston	0	44	69	67	180
HUMACAO	WZJB	Norfolk	0	0	1	29	30
HUMBERGRACHT	PEUQ	Houston	0	12	3	40	55
HUME HIGHWAY	3EJO6	Jacksonville	0	17	11	7	35
HYUNDAI DISCOVERY	3FFR6	Seattle	46	335	46	49	476
HYUNDAI DYNASTY	P3BA7	Long Beach	55	4	0	0	59
HYUNDAI FIDELITY	DNAG	Long Beach	34	19	0	0	53
HYUNDAI FORTUNE	3FLG6	Seattle	8	7	0	34	49
HYUNDAI FREEDOM	3FFS6	Seattle	12	8	55	0	75
HYUNDAI INDEPENDENCE	3FDY6	Seattle	26	322	20	128	496
HYUNDAI LIBERTY	3FFT6	Seattle	16	16	6	11	49
IGARKA	EKYO	Seattle	0	0	1	0	1
IMAGINATION	3EWJ9	Miami	0	46	21	22	89
INDIAN OCEAN	C6T2063	New York City	95	23	0	35	153
INDIANA HARBOR	WXN3191	Cleveland	0	0	0	64	64
INLAND SEAS	WCJ6214	Chicago	0	0	0	1	1
INSPIRATION	3FOA5	Miami	20	12	16	40	88
IRENA ARCTICA	OXTS2	Miami	102	124	83	88	397
ISLA DE CEDROS	3FOA6	Seattle	98	242	115	291	746
ISLAND BREEZE	C6KP	Miami	0	0	0	12	12
ISLAND PRINCESS	GBBM	Long Beach	0	0	10	1	11
ITB BALTIMORE	WXKM	Baltimore	32	37	46	56	171
ITB MOBILE	KXDB	New York City	0	0	1	48	49

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SHIP NAME	CALL	PORT	JAN	FEB	MAR	APR	TOTAL
ITB NEW YORK	WVDG	Newark	31	24	0	0	55
IVER EXPLORER	PEXV	Houston	0	0	22	20	42
IVER EXPRESS	PEXX	Houston	0	21	9	28	58
IWANUMA MARU	3ESU8	Seattle	105	34	106	119	364
J. DENNIS BONNEY	ELLE2	Baltimore	4	43	41	5	93
J.A.W. IGLEHART	WTP4966	Cleveland	0	0	0	7	7
JACKLYN M.	WCV7620	Chicago	0	0	0	55	55
JACKSONVILLE	WNDG	Baltimore	118	125	41	52	336
JADE ORIENT	ELRY6	Seattle	8	0	0	0	8
JADE PACIFIC	ELRY5	Seattle	10	0	1	0	11
JAHRE SPIRIT	LAWS2	Houston	0	20	20	25	65
JAMES	ELRR6	New Orleans	0	10	14	30	54
JAMES N. SULLIVAN	ELPG8	Baltimore	65	53	0	0	118
JAMES R. BARKER	WYP8657	Cleveland	22	0	0	0	22
JAPAN SENATOR	DNJS	Norfolk	0	25	2	0	27
JEB STUART	WRGQ	Oakland	8	3	4	3	18
JO CLIPPER	PFEZ	Baltimore	0	11	25	12	48
JO ELM	PFFD	Baltimore	0	9	6	22	37
JOHN G. MUNSON	WE3806	Chicago	1	0	7	72	80
JOHN J. BOLAND	WF2560	Cleveland	0	0	0	2	2
JOHN YOUNG	ELNG9	Oakland	65	45	41	73	224
JOIDES RESOLUTION	D5BC	Norfolk	448	13	155	36	652
JOSEPH L. BLOCK	WXY6216	Chicago	0	0	0	12	12
JUBILANT	ELKA7	Jacksonville	0	0	1	18	19
JUBILEE	3FPM5	Long Beach	0	0	0	6	6
JULIUS HAMMER	KRGJ	Jacksonville	44	19	140	23	226
KAHO	WZ2043	Chicago	0	19	0	0	19
KAIJIN	3FWI3	Seattle	0	59	125	132	316
KANSAS TRADER	KSDF	Houston	16	36	14	41	107
KAPITAN BOCHEK	P3NC5	Houston	0	0	3	4	7
KAPITAN BYANKIN	UAGK	Seattle	30	36	26	121	213
KAPITAN GNEZPILOV	UQMF	Seattle	0	29	23	25	77
KAPITAN KONEV	UAHV	Seattle	53	137	48	41	279
KAPITAN MAN	UJCQ	Seattle	0	6	7	0	13
KAPITAN SERYKH	UGOZ	Seattle	5	0	0	0	5
KAUAI	WSRH	Long Beach	149	54	55	63	321
KAYE E. BARKER	WCF3012	Cleveland	0	0	0	16	16
KAZIMAH	9KKL	Houston	0	61	90	69	220
KEN KOKU	3FMN6	Seattle	32	62	79	9	182
KEN SHIN	YJQS2	Seattle	44	35	12	13	104
KENAI	WSNB	Houston	2	0	24	85	111
KENNETH E. HILL	C6FA6	Newark	63	31	56	49	199
KENNETH T. DERR	C6FA3	Newark	68	91	63	101	323
KINSMAN INDEPENDENT	WUZ7811	Cleveland	0	0	0	32	32
KNOCK ALLAN	ELOI6	Houston	0	34	72	57	163
KOELN EXPRESS	9VBL	New York City	0	333	704	664	1701
KOMET	V2SA	Miami	36	0	18	33	87
KURAMA	3EOF7	Newark	0	14	5	1	20
KURE	3FGN3	Seattle	30	30	31	29	120
LA ESPERANZA	3EQV8	Baltimore	4	40	16	8	68
LAUST MAERSK	OXGS2	Seattle	131	32	0	0	163
LAWRENCE H. GIANELLA	WLBX	Norfolk	1	43	5	87	136
LEE A. TREGURTHA	WUR8857	Cleveland	0	0	0	9	9
LEGEND OF THE SEAS	ELRR5	New Orleans	34	29	53	20	136
LIBERTY SEA	KPZH	New Orleans	0	0	0	31	31
LIBERTY SPIRIT	WCPU	New Orleans	23	6	0	0	29
LIBERTY STAR	WCBP	New Orleans	30	23	41	32	126
LIBERTY SUN	WCOB	Houston	22	103	0	0	125
LIBERTY WAVE	KRHZ	Norfolk	0	16	9	30	55
LIHUE	WTST	Seattle	40	53	38	38	169
LILAC ACE	3FDL4	Long Beach	0	14	10	26	50
LINDA OLDENDORF	ELRR2	Baltimore	42	22	0	64	128
LIRCAY	ELEV8	Houston	4	6	1	17	28
LNG AQUARIUS	WSKJ	Oakland	79	83	73	68	303
LNG LEO	WDZB	New York City	217	66	52	23	358
LNG LIBRA	WDZG	New York City	0	10	14	0	24
LNG TAURUS	WDZW	New York City	189	23	29	68	309
LNG VIRGO	WDZX	New York City	74	28	21	11	134
LOA	ELOF7	Long Beach	0	6	5	9	20
LOK PRAGATI	ATZS	Seattle	11	9	7	10	37
LONG BEACH	3FOU3	Seattle	4	152	37	5	198
LONG LINES	WATF	Baltimore	79	21	78	191	369
LOOTSGRACHT	PFPT	Houston	0	2	44	51	97
LOUIS MAERSK	OXMA2	Baltimore	20	53	59	52	184
LT ARGOSY	VTKG	Cleveland	9	0	9	9	27
LT PRAGATI	VVDX	Seattle	0	0	0	15	15
LT. ODYSSEY	VTKB	Cleveland	6	64	0	0	70

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SHIP NAME	CALL	PORT	JAN	FEB	MAR	APR	TOTAL
LUCY OLDENDORFF	ELPA2	Long Beach	2	4	24	24	54
LUISE OLDENDORFF	3FOW4	Seattle	72	50	62	27	211
LURLINE	WLVD	Oakland	71	51	45	32	199
LYKES EXPLORER	WGLA	Norfolk	43	77	28	14	162
M/V FRANCOIS L.D.	FNEQ	Norfolk	50	54	29	47	180
MACKINAC BRIDGE	JKES	Long Beach	47	70	36	75	228
MADISON MAERSK	OVJB2	Oakland	90	7	14	13	124
MAERSK CONSTELLATION	WRYJ	Oakland	185	0	85	44	314
MAERSK ENDEAVOUR	XP4210	Miami	178	144	206	0	528
MAERSK EXPLORER	XP3344	Miami	105	117	104	1	327
MAERSK GANNET	GJLK	Miami	0	0	45	99	144
MAERSK GIANT	OU2465	Miami	231	209	242	227	909
MAERSK RIO GRANDE	ELRJ5	Miami	75	38	18	0	131
MAERSK SOMERSET	MQVF8	New Orleans	0	41	74	62	177
MAERSK STAFFORD	MRSS9	Miami	20	0	21	1	42
MAERSK SUN	S6ES	Seattle	73	199	63	58	393
MAERSK SURREY	MRSG8	Houston	0	0	18	5	23
MAERSK TENNESSEE	WCX3486	Houston	48	60	87	50	245
MAERSK TEXAS	WCX3249	Houston	0	72	0	18	90
MAGLEBY MAERSK	OUSH2	Newark	7	57	30	7	101
MAHARASHTRA	VTSQ	Seattle	3	1	8	4	16
MAHIMAHI	WHRN	Oakland	70	95	91	50	306
MAIRANGI BAY	GXEW	Long Beach	0	60	44	33	137
MAJ STEPHEN W PLESS MPS1	WHAU	Norfolk	0	0	46	0	46
MAJESTIC MAERSK	OUJH2	Newark	13	1	40	8	62
MANHATTAN BRIDGE	3FWL4	Long Beach	0	14	33	17	64
MANOA	KDBG	Oakland	61	73	84	33	251
MANUKAI	KNLO	Oakland	57	77	70	50	254
MANULANI	KNIJ	Oakland	4	79	42	12	137
MARCARRIER	V2VM	Newark	2	4	10	236	252
MARCHEN MAERSK	OWDQ2	Long Beach	118	16	26	111	271
MAREN MAERSK	OWZU2	Long Beach	102	81	91	12	286
MARGARET LYKES	WGXO	Houston	14	85	38	21	158
MARGRETHE MAERSK	OYSN2	Long Beach	108	10	100	11	229
MARI BETH ANDRIE	WUY3362	Chicago	0	0	0	1	1
MARIE MAERSK	OULL2	Newark	126	18	19	15	178
MARIT MAERSK	OZFC2	Oakland	63	24	45	30	162
MARK HANNAH	WYZ5243	Chicago	0	0	0	2	2
MARLIN	6ZXG	New Orleans	0	31	61	42	134
MARSTA MAERSK	OUNO5	Norfolk	0	24	50	13	87
MATHILDE MAERSK	OUUU2	Long Beach	40	53	30	25	148
MATSONIA	KHRC	Oakland	70	95	0	9	174
MAUI	WSLH	Long Beach	64	51	39	59	213
MAURICE EWING	WLDZ	Newark	104	38	81	18	241
MAYAGUEZ	WZJE	Jacksonville	38	35	232	0	305
MAYVIEW MAERSK	OWEB2	Oakland	59	36	11	17	123
MC-KINNEY MAERSK	OUZW2	Newark	81	9	0	17	107
MEDUSA CHALLENGER	WA4659	Cleveland	0	0	0	42	42
MEKHANIK MOLDOVANOV	UIKI	Seattle	0	0	63	90	153
MELBOURNE STAR	C6JY6	Newark	0	25	44	57	126
MELVILLE	WECB	Long Beach	108	112	54	170	444
MERCHANT PREMIER	VROP	Houston	0	31	42	33	106
MERCHANT PRINCE	C6HQ8	Houston	0	34	16	22	72
MERCHANT PRINCIPAL	VRIO	Miami	4	13	8	0	25
MERCURY	3FFC7	Miami	37	19	7	0	63
MERLION ACE	9VHJ	Long Beach	29	21	10	32	92
MESABI MINER	WYQ4356	Cleveland	0	0	0	39	39
METEOR	DBBH	Houston	0	184	205	207	596
METTE MAERSK	OXKT2	Long Beach	110	20	35	20	185
MICHIGAN	WRB4141	Chicago	84	0	0	2	86
MIDDLETOWN	WR3225	Cleveland	6	0	0	14	20
MING ASIA	BDEA	New York City	15	14	9	13	51
MING PLEASURE	BLII	Long Beach	12	13	0	0	25
MING PROPITIOUS	BLIJ	New York City	35	60	39	1	135
MOKIHANA	WNRD	Oakland	58	69	120	57	304
MOKU PAHU	WBWK	Oakland	1	33	43	120	197
MORELOS	PGBB	Houston	288	36	66	31	421
MORMACSKY	WMBQ	New York City	15	10	1	0	26
MORMACSUN	WMBK	Norfolk	22	31	12	3	68
MOSEL ORE	ELRE5	Norfolk	29	28	103	79	239
MSC BOSTON	9HGP4	New York City	0	0	13	4	17
MSC JESSICA	C6BK6	Newark	61	70	156	0	287
MSC NEW YORK	9HIG4	New York City	0	28	18	18	64
MUNKEBO MAERSK	OUNI5	New York City	15	99	25	0	139
MV MIRANDA	3FRO4	Norfolk	0	0	45	139	184
MYRON C. TAYLOR	WA8463	Chicago	0	0	0	23	23
NADA II	ELAV2	Seattle	98	73	100	58	329

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SHIP NAME	CALL	PORT	JAN	FEB	MAR	APR	TOTAL
NAJA ARCTICA	OXVH2	Miami	0	82	138	89	309
NATIONAL DIGNITY	DZRG	Long Beach	11	13	9	26	59
NATIONAL HONOR	DZDI	Long Beach	14	2	20	22	58
NATIONAL PRIDE	DZPK	Long Beach	8	16	10	20	54
NEDLLOYD ABIDJAN	S6BP	Long Beach	74	11	26	0	111
NEDLLOYD DELFT	PGDD	Houston	0	36	46	38	120
NEDLLOYD HOLLAND	KRHX	Houston	50	279	25	33	387
NEDLLOYD MONTEVIDEO	PGAF	Long Beach	52	31	39	40	162
NEDLLOYD RALEIGH BAY	PHKG	Houston	0	39	35	47	121
NEDLLOYD VAN DAJIMA	PGDB	Houston	0	137	49	48	234
NEDLLOYD VAN DIEMEN	PGFE	Long Beach	0	27	36	32	95
NEGO LOMBOK	DXQC	Seattle	32	0	0	0	32
NELVANA	YJWZ7	Baltimore	13	29	29	41	112
NEPTUNE ACE	JFLX	Long Beach	0	0	0	74	74
NEPTUNE RHODONITE	ELJP4	Long Beach	9	16	11	31	67
NESLIHAN	TCTC	Miami	0	0	18	42	60
NEW CARISSA	3ELY7	Seattle	41	35	38	92	206
NEW HORIZON	WKWB	Long Beach	0	0	0	26	26
NEW NIKKI	3FHG5	Seattle	57	50	58	70	235
NEWARK BAY	WPKS	Houston	57	78	50	53	238
NEWPORT BRIDGE	3FGH3	Oakland	18	18	5	14	55
NIEUW AMSTERDAM	PGGQ	Long Beach	0	20	21	1	42
NOAA DAVID STARR JORDAN	WTDK	Seattle	8	36	2	35	81
NOAA SHIP ALBATROSS IV	WMVF	Norfolk	47	664	178	153	1042
NOAA SHIP CHAPMAN	WTED	New Orleans	56	136	82	36	310
NOAA SHIP DELAWARE II	KNBD	New York City	0	62	507	89	658
NOAA SHIP FERREL	WTEZ	Norfolk	0	59	138	96	293
NOAA SHIP KA’IMIMOANA	WTEU	Seattle	66	1011	99	85	1261
NOAA SHIP MCARTHUR	WTEJ	Seattle	0	0	45	36	81
NOAA SHIP MILLER FREEMAN	WTDM	Seattle	0	77	278	196	551
NOAA SHIP RAINIER	WTEF	Seattle	0	0	0	44	44
NOAA SHIP T. CROMWELL	WTDF	Seattle	30	112	65	30	237
NOAA SHIP WHITING	WTEW	Baltimore	0	73	56	195	324
NOBEL STAR	KRPP	Houston	7	0	0	0	7
NOBLE STAR	3FRU7	Seattle	30	20	81	223	354
NOL AMAZONITE	9VBX	Long Beach	0	0	2	0	2
NOL DELPHI	ZCBF6	Houston	0	51	86	64	201
NOL DIAMOND	9VYT	Long Beach	0	18	0	0	18
NOL LAGENO	ZCBF2	New York City	0	46	0	0	46
NOL RISSO	ZCBE6	New York City	0	28	31	32	91
NOL STENO	ZCBD4	New York City	0	27	30	30	87
NOL STENO	ZCBF4	New York City	0	38	48	14	100
NOL ZIRCON	9VOS	Long Beach	0	14	0	0	14
NOLIZWE	MQLN7	New York City	0	104	116	159	379
NOMZI	MTQU3	Baltimore	81	212	93	54	440
NOORDAM	PGHT	Miami	0	0	36	14	50
NORASIA SHANGHAI	DNHS	New York City	0	22	20	18	60
NORDMAX	P3YS5	Seattle	58	50	76	71	255
NORDMORITZ	P3YR5	Seattle	86	83	78	65	312
NORDSTRAND	P3NV5	Norfolk	0	0	62	0	62
NORTHERN LIGHTS	WFJK	New Orleans	0	1	111	64	176
NORWAY	C6CM7	Miami	11	4	0	4	19
NTABENI	3EGR6	Houston	0	42	52	33	127
NUERNBERG EXPRESS	9VBK	Houston	0	642	517	14	1173
NUEVO LEON	XCKX	Houston	45	365	48	69	527
NUEVO SAN JUAN	KEOD	Norfolk	39	57	40	73	209
NYK SEABREEZE	ELNJ3	Seattle	0	7	1	0	8
NYK SPRINGTIDE	S6CZ	Houston	0	3	10	9	22
NYK STARLIGHT	3FUX6	Long Beach	0	25	6	10	41
NYK SUNRISE	3FYZ6	Seattle	0	25	40	40	105
NYK SURFWIND	ELOT3	Seattle	0	19	3	13	35
OCEAN BELUGA	3FEI6	Jacksonville	0	17	48	55	120
OCEAN CAMELLIA	3FTR6	Seattle	57	60	0	21	138
OCEAN CITY	WCYR	Houston	12	28	20	0	60
OCEAN CLIPPER	3EXI7	New Orleans	119	121	36	107	383
OCEAN HARMONY	3FRX6	Seattle	0	43	7	8	58
OCEAN LAUREL	3FLX4	Seattle	24	13	7	9	53
OCEAN LILY	3EQS7	Seattle	0	0	0	21	21
OCEAN SERENE	DURY	Seattle	36	0	67	0	103
OGLEBAY NORTON	WAQ3521	Cleveland	0	0	0	14	14
OLEANDER	PJJU	Newark	157	34	23	0	214
OLIVEBANK	3ETQ5	Baltimore	19	29	1	0	49
OLIVIA	ELRY4	Newark	10	27	0	0	37
OLYMPIAN HIGHWAY	3FSH4	Seattle	14	0	0	0	14
OMI COLUMBIA	KLKZ	Oakland	32	35	34	52	153
OOCL AMERICA	ELSM7	Oakland	41	26	64	41	172
OOCL CALIFORNIA	ELSA4	Seattle	35	27	44	12	118

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SHIP NAME	CALL	PORT	JAN	FEB	MAR	APR	TOTAL
OOCL CHINA	ELSU8	Long Beach	97	40	41	77	255
OOCL ENVOY	ELNV7	Seattle	36	13	29	24	102
OOCL FAIR	ELFV2	Long Beach	172	21	6	58	257
OOCL FIDELITY	ELFV8	Long Beach	34	42	19	30	125
OOCL FORTUNE	ELFU8	Norfolk	21	15	27	39	102
OOCL FREEDOM	VRCV	Norfolk	0	28	19	5	52
OOCL HONG KONG	VRVA5	Oakland	30	26	31	29	116
OOCL INNOVATION	WPWH	Houston	63	165	33	45	306
OOCL INSPIRATION	KRPB	Houston	173	229	73	47	522
OOCL JAPAN	ELSU6	Long Beach	0	68	57	41	166
ORANGE BLOSSOM	ELEI6	Newark	18	17	0	9	44
ORIANA	GVSN	Miami	79	17	51	69	216
ORIENTE GRACE	3FHT4	Seattle	25	30	30	203	288
ORIENTE HOPE	3ETH4	Seattle	49	34	64	16	163
ORIENTE NOBLE	3FVF5	Seattle	6	0	62	26	94
ORIENTE PRIME	3FOU4	Seattle	11	16	12	21	60
OURO DO BRASIL	ELPP9	Baltimore	58	19	16	12	105
OVERSEAS ARCTIC	KLEZ	New Orleans	42	22	1	0	65
OVERSEAS CHICAGO	KBCF	Oakland	71	0	7	44	122
OVERSEAS JOYCE	WUQL	Jacksonville	38	25	131	51	245
OVERSEAS JUNEAU	WWND	Seattle	55	29	0	0	84
OVERSEAS MARILYN	WFQB	Houston	3	0	0	0	3
OVERSEAS NEW ORLEANS	WFKW	Houston	25	85	23	16	149
OVERSEAS NEW YORK	WMCK	Houston	26	18	54	35	133
OVERSEAS OHIO	WJBG	Oakland	78	54	60	64	256
OVERSEAS VIVIAN	KAAZ	Norfolk	2	18	0	0	20
P&O NEDLLOYD CHILE	DVRA	New York City	0	8	8	8	24
PACASIA	ELKM7	Seattle	13	69	21	25	128
PACDUKE	A8SL	Seattle	9	11	0	14	34
PACIFIC ARIES	ELJQ2	Seattle	0	22	0	38	60
PACIFIC SANDPIPER	GDRJ	Miami	0	0	0	83	83
PACIFIC SELESA	DVCK	Seattle	0	0	0	39	39
PACIFIC SENATOR	ELTY6	Long Beach	0	49	23	49	121
PACIFIC WAVE	3EXQ9	Long Beach	0	5	6	1	12
PACKING	ELBX3	Seattle	9	17	0	20	46
PACMERCHANT	5MCB	Seattle	4	4	8	11	27
PACOCEAN	XYLA	Seattle	0	0	0	43	43
PACROSE	YJQK2	Seattle	13	14	12	8	47
PACSEA	XYKX	Seattle	2	8	9	18	37
PACSTAR	XYLB	Seattle	49	34	11	23	117
PARIS	ELTY4	Houston	0	2	0	0	2
PATRIOT STATE	WHBH	Miami	32	38	0	0	70
PAUL BUCK	KDGR	Houston	4	30	4	0	38
PAUL R. TREGURTHA	WYR4481	Cleveland	0	0	0	1	1
PEGASUS HIGHWAY	3FMA4	New York City	0	17	0	16	33
PEGGY DOW	PJOY	Long Beach	0	70	64	52	186
PFC EUGENE A. OBREGON	WHAQ	Norfolk	0	65	0	23	88
PFC JAMES ANDERSON JR	WJXG	Newark	25	51	0	90	166
PHILADELPHIA	KSYP	Baltimore	17	23	11	14	65
PHILIP R. CLARKE	WE3592	Chicago	18	0	0	80	98
PHOENIX DIAMOND	3EGS6	Norfolk	13	10	12	10	45
PIERRE FORTIN	CG2678	Norfolk	0	0	0	92	92
PINO GLORIA	3EZW7	Seattle	19	0	11	15	45
PISCES EXPLORER	MWQD5	Long Beach	18	5	2	18	43
PISCES PIONEER	MWQE5	Long Beach	0	59	56	11	126
POLAR EAGLE	ELPT3	Long Beach	38	42	45	51	176
POLYNESIA	D5NZ	Long Beach	176	74	98	81	429
POTOMAC TRADER	WXBZ	Houston	47	119	33	34	233
POYANG	ELAX2	Long Beach	0	24	13	9	46
PRESIDENT ADAMS	WRYW	Oakland	36	59	486	39	620
PRESIDENT EISENHOWER	KRJG	Long Beach	124	449	39	63	675
PRESIDENT F. ROOSEVELT	KRJF	Long Beach	52	391	52	13	508
PRESIDENT JACKSON	WRYC	Oakland	59	120	45	94	318
PRESIDENT KENNEDY	WRYE	Oakland	50	45	220	61	376
PRESIDENT POLK	WRYD	Oakland	63	82	53	110	308
PRESIDENT TRUMAN	WNDP	Oakland	6	32	38	28	104
PRESQUE ISLE	WZE4928	Chicago	0	0	6	84	90
PRIDE OF BALTIMORE II	WUW2120	Baltimore	188	24	0	34	246
PRINCE OF OCEAN	3ECO9	Seattle	94	80	80	66	320
PRINCE OF TOKYO 2	3EUU6	Seattle	168	0	0	0	168
PRINCE WILLIAM SOUND	WSDX	Long Beach	72	11	33	36	152
PRINCESS OF SCANDINAVIA	OWEN2	Miami	0	2	37	52	91
PROJECT ARABIA	PJKP	Miami	0	0	85	24	109
PROJECT ORIENT	PJAG	Baltimore	0	12	21	32	65
PUDONG SENATOR	DQVI	Seattle	5	20	18	34	77
PUERTO CORTES	C6IM2	Jacksonville	0	24	2	0	26
PUSAN SENATOR	DQVG	Seattle	1	0	0	0	1

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SHIP NAME	CALL	PORT	JAN	FEB	MAR	APR	TOTAL
PVT FRANKLIN J. PHILLIPS WMFW	Norfolk	0	158	0	0	158	
QUEEN ELIZABETH 2	GBTT	New York City	0	48	42	61	151
QUEEN OF SCANDINAVIA	OUSE6	Miami	0	45	59	64	168
QUEENSLAND STAR	C6JZ3	Houston	0	87	88	34	209
R. HAL DEAN	C6JN	Long Beach	34	80	80	0	194
R.J. PFEIFFER	WRJP	Long Beach	54	94	77	254	479
RALEIGH BAY	KRHG	Norfolk	0	0	1	0	1
RANI PADMINI	ATSR	Norfolk	7	0	0	1	8
REBECCA LYNN	WCW7977	Chicago	24	0	0	17	41
REPULSE BAY	MQYA3	Houston	0	35	36	0	71
RESERVE	WE7207	Cleveland	1	0	0	3	4
RESOLUTE	KFDZ	Norfolk	13	184	50	32	279
RHAPSODY OF THE SEAS	LAZK4	Miami	7	3	25	41	76
RIO ENCO	CBRE	Norfolk	0	0	55	0	55
ROBERT E. LEE	KCRD	New Orleans	70	39	21	53	183
ROGER BLOUGH	WZP8164	Chicago	45	0	12	77	134
ROGER REVELLE	KAOU	New Orleans	54	56	32	21	163
RONALD H. BROWN	WTEC	New Orleans	93	182	6	34	315
ROSSEL CURRENT	J8FI6	Houston	7	64	21	1	93
ROYAL ETERNITY	DUXW	Norfolk	58	39	21	56	174
ROYAL PRINCESS	GBRP	Long Beach	0	16	20	43	79
RUBIN BONANZA	3FNV5	Seattle	33	41	64	100	238
RUBIN KOBE	DYZM	Seattle	18	47	82	55	202
RUBIN PEARL	YJQA8	Seattle	68	181	40	23	312
RUBIN STAR	3FIA5	Seattle	4	0	0	0	4
RYNDAM	PHFV	Miami	12	17	11	6	46
SALOME	S6CL	Newark	134	0	0	0	134
SAM HOUSTON	KDGA	Houston	0	10	19	137	166
SAMUEL GINN	C6OB	Oakland	35	18	76	2	131
SAMUEL H. ARMACOST	C6FA2	Oakland	13	33	4	6	56
SAMUEL L. COBB	KCDJ	Oakland	9	10	21	0	40
SAMUEL RISLEY	CG2960	Norfolk	0	717	174	172	1063
SAN ANTONIO	LATN4	New Orleans	53	75	33	101	262
SAN FELIPE	DNEN	New York City	0	8	21	13	42
SAN FERNANDO	DGGD	Houston	0	4	12	29	45
SAN FRANCISCO	DIGF	New York City	0	28	16	11	55
SAN ISIDRO	ELVG8	Norfolk	18	21	44	28	111
SAN MARCOS	ELND4	Jacksonville	15	5	5	17	42
SANKO LAUREL	3EXQ3	Seattle	43	19	20	33	115
SANTA CHRISTINA	3FAE6	Seattle	59	53	86	284	482
SANTORIN 2	P3ZL4	Seattle	105	119	0	219	443
SARAMATI	9VIW	Baltimore	0	13	9	0	22
SC HORIZON	ELOC8	New York City	57	22	19	55	153
SCHACKENBORG	OYUY4	Houston	17	57	38	0	112
SEA FLORIDA	3EKI3	New Orleans	41	35	0	0	76
SEA FOX	KBGK	Jacksonville	8	59	81	3	151
SEA INITIATIVE	DEBB	Houston	0	15	5	31	51
SEA JUSTICE	ELSI4	Seattle	0	0	6	0	6
SEA LEOPARD	DGZK	Jacksonville	0	0	0	13	13
SEA LION	KJLV	Jacksonville	43	39	82	74	238
SEA LYNX	DGOO	Jacksonville	72	43	104	77	296
SEA MARINER	J8FF9	Miami	35	54	65	48	202
SEA MERCHANT	ELQN2	Norfolk	0	0	1	0	1
SEA NOVIA	ELRV2	Miami	12	24	0	0	36
SEA PRINCESS	KRCP	New Orleans	21	0	0	15	36
SEA RACER	ELQI8	Jacksonville	4	3	29	28	64
SEA VIGOR	P3ZH4	Miami	1	0	5	13	19
SEA WISDOM	3FUO6	Seattle	75	99	53	63	290
SEA WOLF	KNFG	Jacksonville	129	31	4	6	170
SEA-LAND CHARGER	V7AY2	Long Beach	92	89	0	0	181
SEA-LAND EAGLE	V7AZ8	Long Beach	17	80	20	19	136
SEA/LAND VICTORY	DIDY	New York City	0	8	3	4	15
SEABOARD SUN	ELRV6	Jacksonville	13	19	18	19	69
SEABOARD UNIVERSE	ELRU3	Miami	14	18	17	11	60
SEABREEZE I	3FGV2	Miami	12	11	11	9	43
SEALAND ANCHORAGE	KGTX	Seattle	69	63	67	59	258
SEALAND ARGENTINA	DGVN	Jacksonville	0	0	0	13	13
SEALAND ATLANTIC	KRLZ	Norfolk	61	125	33	29	248
SEALAND CHALLENGER	WZJC	Newark	19	25	43	1	88
SEALAND CHAMPION	V7AM9	Oakland	51	31	46	65	193
SEALAND COMET	V7AP3	Oakland	101	41	28	34	204
SEALAND CONSUMER	WCHF	Long Beach	70	39	12	41	162
SEALAND CRUSADER	WZJF	Jacksonville	108	182	103	69	462
SEALAND DEFENDER	KGJB	Oakland	56	140	71	104	371
SEALAND DEVELOPER	KHRH	Long Beach	60	102	45	24	231
SEALAND DISCOVERY	WZJD	Jacksonville	69	69	85	64	287
SEALAND ENDURANCE	KGJX	Long Beach	49	61	66	30	206

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SHIP NAME	CALL	PORT	JAN	FEB	MAR	APR	TOTAL
SEALAND ENTERPRISE	KRGB	Oakland	59	40	163	73	335
SEALAND EXPEDITION	WPGJ	Jacksonville	102	47	56	80	285
SEALAND EXPLORER	WGJF	Long Beach	83	56	101	115	355
SEALAND EXPRESS	KGJD	Long Beach	47	122	162	99	430
SEALAND FREEDOM	V7AM3	Seattle	131	162	15	21	329
SEALAND HAWAII	KIRF	Houston	80	74	57	62	273
SEALAND INDEPENDENCE	WGJC	Long Beach	33	109	72	0	214
SEALAND INNOVATOR	WGKF	Oakland	0	18	30	29	77
SEALAND INTEGRITY	WPVD	Houston	144	312	45	108	609
SEALAND INTREPID	V7BA2	Norfolk	0	0	0	23	23
SEALAND KODIAK	KGTZ	Seattle	28	47	32	104	211
SEALAND LIBERATOR	KHRP	Oakland	47	22	26	62	157
SEALAND MARINER	V7AM5	Seattle	88	71	41	0	200
SEALAND MERCURY	V7AP6	Oakland	86	22	43	39	190
SEALAND METEOR	V7AP7	Long Beach	82	49	12	51	194
SEALAND NAVIGATOR	WPGK	Long Beach	120	93	101	91	405
SEALAND PACER	KSLB	Newark	12	15	16	23	66
SEALAND PACIFIC	WSRL	Long Beach	83	3	2	158	246
SEALAND PATRIOT	KHRF	Oakland	75	52	33	81	241
SEALAND PERFORMANCE	KRPD	Norfolk	34	186	59	33	312
SEALAND PRODUCER	WJBJ	Long Beach	22	22	293	97	434
SEALAND QUALITY	KRNJ	Jacksonville	22	76	141	25	264
SEALAND RACER	V7AP8	Long Beach	32	29	0	91	152
SEALAND RELIANCE	WFLH	Long Beach	115	97	144	98	454
SEALAND SPIRIT	WFLG	Oakland	53	211	87	171	522
SEALAND TACOMA	KGTY	Seattle	47	28	47	132	254
SEALAND TRADER	KIRH	Oakland	135	63	90	152	440
SEALAND VOYAGER	KHRK	Seattle	72	108	121	48	349
SEARIVER BATON ROUGE	WAFA	Oakland	14	14	1	6	35
SEARIVER BENICIA	KPKL	Long Beach	33	16	27	11	87
SEARIVER LONG BEACH	WHCA	Long Beach	1	16	7	0	24
SEARIVER NORTH SLOPE	KHLQ	Oakland	0	0	12	10	22
SEARIVER SAN FRANCISCO	KAAC	Oakland	10	5	8	5	28
SEAWIND CROWN	3EIY6	Miami	12	5	7	4	28
SENORITA	LADN4	Miami	1	0	24	48	73
SENSATION	3ESE9	Miami	22	9	19	14	64
SETO BRIDGE	JMQY	Oakland	0	7	52	0	59
SEWARD JOHNSON	WST9756	Miami	0	0	120	101	221
SGT WILLIAM A BUTTON	WJLX	Norfolk	0	0	50	19	69
SGT. METEJ KOCAK	WHAC	Norfolk	10	14	0	0	24
SHELLY BAY	3EKH3	Miami	39	37	36	27	139
SHIRAOI MARU	3ECM7	Seattle	115	76	73	76	340
SIBOHELLE	LAQN4	Norfolk	0	28	10	9	47
SIDNEY STAR	C6JY7	Houston	0	23	54	19	96
SKAUBRYN	LAJV4	Seattle	0	32	31	14	77
SKAUGRAN	LADB2	Seattle	0	26	5	157	188
SKOGAFOSS	V2QT	Norfolk	7	0	0	0	7
SKS TANA	LAZI4	Norfolk	0	9	0	0	9
SOKOLICA	ELIG5	Baltimore	20	20	25	11	76
SOL DO BRASIL	ELQQ4	Baltimore	24	11	5	0	40
SOLAR WING	ELJS7	Jacksonville	19	52	21	43	135
SONG OF AMERICA	LENA3	Miami	0	0	17	15	32
SONORA	XCTJ	Houston	26	330	9	13	378
SOREN TOUBRO	VTFM	Cleveland	33	6	8	1	48
SOUTH FORTUNE	3FJC6	Seattle	0	47	48	0	95
SOUTHERN LION	V7AW8	Long Beach	21	41	20	32	114
SP5. ERIC G. GIBSON	KAKF	Baltimore	0	0	0	5	5
SPLENDOUR OF THE SEAS	LAUS4	Miami	4	2	14	34	54
SPRING GANNET	3EVB3	Seattle	71	52	117	0	240
SPRING WAVE	9VXB	Seattle	79	32	37	14	162
ST BLAIZE	J8FO	Norfolk	0	45	3	44	92
STAR ALABAMA	LAVU4	Long Beach	0	10	12	0	22
STAR AMERICA	LAVV4	Jacksonville	43	32	49	127	251
STAR EAGLE	LAWO2	Houston	25	18	214	22	279
STAR EVVIVA	LAHE2	Jacksonville	4	1	354	22	381
STAR FLORIDA	LAVW4	Houston	0	14	33	24	71
STAR FUJI	LAVX4	Seattle	0	34	14	18	66
STAR GRAN	LADR4	Long Beach	3	42	21	10	76
STAR GRINDANGER	ELFT9	Norfolk	0	1	34	33	68
STAR HANSA	LAXP4	Jacksonville	56	22	50	0	128
STAR HARDANGER	LAXD4	Baltimore	21	42	39	13	115
STAR HERDLA	LAVD4	Baltimore	26	19	23	131	199
STAR HOYANGER	LAXG4	Long Beach	3	0	0	0	3
STAR SKARVEN	LAJY2	Miami	37	0	31	19	87
STAR SKOGANGER	LASS2	Houston	0	0	2	12	14
STAR STRONEN	LAHG2	Houston	33	16	28	51	128
STATENDAM	PHSG	Miami	13	20	34	50	117

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SHIP NAME	CALL	PORT	JAN	FEB	MAR	APR	TOTAL
STELLA LYKES	WGXN	Houston	4	15	208	39	266
STEPAN KRASHENINNIKOV	UYPO	Seattle	0	4	1	5	10
STEPHAN J	V2JN	Miami	130	133	140	167	570
STEWART J. CORT	WYZ3931	Chicago	0	0	31	31	62
STOLT CONDOR	D5VF	Newark	7	4	19	2	32
STONEWALL JACKSON	KDDW	New Orleans	38	9	22	34	103
STRONG CAJUN	WCD6594	Norfolk	36	36	43	0	115
STRONG ICELANDER	WBD9290	Norfolk	66	40	17	0	123
STRONG VIRGINIAN	KSPH	Oakland	275	60	124	60	519
SUMMER BREEZE	ZCBB4	Miami	14	15	10	0	39
SUN DANCE	3ETQ8	Seattle	0	31	13	24	68
SUN PRINCESS	ELSJ2	Miami	13	0	0	0	13
SUNBELT DIXIE	D5BU	Baltimore	19	13	0	16	48
SUNDA	ELPB8	Houston	0	59	65	33	157
SUSAN W. HANNAH	WAH9146	Chicago	144	0	85	7	236
SVEN OLTMANN	V2JP	Miami	33	22	42	32	129
SWAN ARROW	C6CN8	Baltimore	0	1	0	0	1
TAI HE	BOAB	Long Beach	58	38	122	73	291
TAI SHING	BHFR	Seattle	44	37	34	30	145
TAIHO MARU	3FMP6	Seattle	0	0	0	54	54
TAIKO	LAQT4	New York City	1	0	0	5	6
TAKAMINE	LACT5	Jacksonville	0	16	12	12	40
TAKAYAMA	LACQ5	New York City	0	10	38	47	95
TALABOT	LAQU4	Miami	0	0	21	1	22
TAMPA	LMWO3	Long Beach	0	0	0	2	2
TANABATA	LAZO4	Baltimore	0	0	5	7	12
TELLUS	WRYG	Baltimore	96	40	40	49	225
TEPOZTECO II	ZCAZ7	Seattle	0	3	0	16	19
TEQUI	3FDZ5	Seattle	56	116	24	20	216
TEXAS	LMWR3	Baltimore	2	21	15	11	49
TIGER FALCON	DXKP	Seattle	0	2	0	0	2
TILLIE LYKES	WMLH	Houston	40	138	20	44	242
TMM MEXICO	XCMG	Houston	0	31	30	29	90
TMM OAXACA	ELUA5	Houston	0	192	44	34	270
TMM VERACRUZ	ELFU9	Norfolk	0	27	9	22	58
TOBIAS MAERSK	MSJY8	Long Beach	0	0	0	4	4
TOKIO EXPRESS	9VUY	Long Beach	0	186	0	26	212
TOLUCA	3EFY7	Long Beach	67	0	21	379	467
TONSINA	KJDG	Houston	32	10	1	0	43
TORBEN	V2TI	Norfolk	92	11	19	0	122
TORM FREYA	OXDF3	Norfolk	72	22	4	25	123
TOWER BRIDGE	ELJL3	Seattle	8	11	10	13	42
TRADE APOLLO	VRUN7	New York City	0	38	30	26	94
TRANSWORLD BRIDGE	ELJJ5	Seattle	49	62	55	46	212
TRINITY	WRGL	Houston	0	0	0	38	38
TRITON	WTU2310	Chicago	0	0	0	57	57
TROPIC FLYER	J8NV	Miami	24	22	0	0	46
TROPIC ISLE	J8PA	Miami	11	11	10	0	32
TROPIC JADE	J8NY	Miami	11	11	0	0	22
TROPIC KEY	J8PE	Miami	21	5	15	17	58
TROPIC LURE	J8PD	Miami	0	32	30	24	86
TROPIC MIST	J8NZ	Miami	28	34	45	0	107
TROPIC SUN	3EZK9	New Orleans	84	79	85	80	328
TROPIC TIDE	3FGQ3	Miami	43	33	39	36	151
TROPICALE	ELBM9	New Orleans	57	4	7	13	81
TRSL ARCTURUS	MSQQ8	Baltimore	0	71	0	0	71
TRUST 38	3EUY3	Baltimore	17	35	0	0	52
TUI PACIFIC	P3GB4	Seattle	82	45	131	1	259
TURMOIL	9VGL	New York City	10	16	13	8	47
TYSON LYKES	WMLG	Houston	43	58	17	21	139
USCGC ACACIA (WLB406)	NODY	Chicago	9	1	4	10	24
USCGC ACTIVE WMEC 618	NRTF	Seattle	24	106	0	74	204
USCGC ACUSHNET WMEC 167	NNHA	Oakland	14	8	0	0	22
USCGC ALERT (WMEC 630)	NZVE	Seattle	97	26	163	83	369
USCGC BOUTWELL WHEC 719	NYCQ	Seattle	24	0	0	92	116
USCGC DAUNTLESS WMEC 624	NDTS	Houston	7	142	17	3	169
USCGC DEPENDABLE	NOWK	Baltimore	2	10	6	0	18
USCGC DURABLE (WMEC 628)	NRUN	Houston	0	3	0	1	4
USCGC ESCANABA	NNAS	Norfolk	68	195	0	0	263
USCGC GALLATIN WMEC 721	NJOR	New York City	23	65	15	0	103
USCGC HAMILTON WHEC 715	NMAG	Long Beach	0	0	5	1	6
USCGC HARRIET LANE	NHNC	Norfolk	0	20	54	0	74
USCGC JARVIS (WHEC 725)	NAQD	Seattle	2	2	5	0	9
USCGC KATMAI BAY	NRLX	Chicago	20	14	20	0	54
USCGC LEGARE	NRPM	Norfolk	52	147	53	29	281
USCGC MACKINAW	NRKP	Chicago	0	10	3	0	13
USCGC MIDGETT (WHEC 726)	NHWR	Seattle	0	12	152	23	187

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SHIP NAME	CALL	PORT	JAN	FEB	MAR	APR	TOTAL
USCGC MOHAWK WMEC 913	NRUF	Jacksonville	3	0	0	0	3
USCGC PLANETREE	NRPY	Seattle	0	12	2	0	14
USCGC POLAR SEA__(WAGB 1	NRUO	Seattle	0	0	0	15	15
USCGC POLAR STAR (WAGB 1	NBTM	Seattle	1	16	61	257	335
USCGC RELIANCE WMEC 615	NJPJ	Miami	22	3	2	20	47
USCGC SASSAFRAS	NODT	Oakland	28	26	0	0	54
USCGC SEDGE (WLB 402)	NODU	Seattle	3	0	0	0	3
USCGC SENECA	NFMK	Norfolk	25	17	0	52	94
USCGC SHERMAN	NMMJ	Oakland	0	0	0	118	118
USCGC SPENCER	NWHE	Norfolk	16	37	4	4	61
USCGC STEADFAST (WMEC 62	NSTF	Seattle	9	0	42	152	203
USCGC STORIS (WMEC 38)	NRUC	Seattle	19	41	47	98	205
USCGC SUNDEW (WLB 404)	NODW	Chicago	0	0	7	2	9
USCGC SWEETBRIER WLB 405	NODX	Seattle	0	61	0	55	116
USCGC TAHOMA	NCBE	Norfolk	57	0	0	10	67
USCGC TAMPA WMEC 902	NIKL	Norfolk	0	0	67	0	67
USCGC VALIANT (WMEC 621)	NVAI	Miami	0	0	115	0	115
USCGC VENTUROUS WMEC 625	NVES	Oakland	97	8	5	4	114
USCGC VIGOROUS WMEC 627	NQSP	Baltimore	0	169	6	0	175
USCGC WOODRUSH (WLB 407)	NODZ	Seattle	47	0	22	2	71
USNS APACHE (T-ATF 172)	NIGP	Norfolk	31	65	7	66	169
USNS BOWDITCH	NWSW	New Orleans	46	0	0	0	46
USNS GUS W. DARNELL	KCDK	Houston	19	6	14	17	56
USNS HAYES	NRLW	Jacksonville	0	0	46	37	83
USNS HENSON	NENB	New Orleans	0	0	0	71	71
USNS JOHN MCDONNELL (T-A	NJMD	New Orleans	4	71	2	0	77
USNS KANAWHA T-AO 196	NPTD	Norfolk	0	94	0	0	94
USNS MOHAWK (T-ATF 170)	NCRP	Norfolk	0	0	0	14	14
USNS PATHFINDER T-AGS 60	NGKK	New Orleans	54	0	0	0	54
USNS PATUXENT	NPCZ	New Orleans	0	48	103	50	201
USNS SATURN T-AFS-10	NADH	Norfolk	0	18	48	48	114
USNS SIOUX	NJOV	Oakland	39	25	43	107	214
USNS SUMNER	NZAU	New Orleans	72	70	111	88	341
USNS TIPPECANOE (TAO-199	NTIP	New Orleans	47	41	0	0	88
USNS VANGUARD TAG 194	NIDR	Newark	55	28	207	0	290
USNS YUKON (T-AO 202)	NYUK	New Orleans	0	0	0	43	43
VASILTY BURKHANOV	UZHC	Seattle	0	5	4	3	12
VEGA	9VJS	Houston	0	20	12	66	98
VERA ACORDE	3EAG4	Seattle	0	0	9	15	24
VICTORIA	GBBA	Miami	24	2	2	3	31
VIRGINIA	3EBW4	Seattle	46	117	129	7	299
WAVELET	DVDJ	Seattle	97	26	29	9	161
WECOMA	WSD7079	Seattle	10	63	43	64	180
WESTWARD	WZL8190	Miami	0	0	0	56	56
WESTWARD VENTURE	KHJB	Seattle	12	39	114	114	279
WESTWOOD ANETTE	DVDM	Seattle	89	59	73	64	285
WESTWOOD BELINDA	C6CE7	Seattle	428	82	42	46	598
WESTWOOD CLEO	C6OQ8	Seattle	86	34	72	30	222
WESTWOOD FUJI	S6BR	Seattle	40	43	166	162	411
WESTWOOD HALLA	S6BO	Seattle	74	109	68	62	313
WESTWOOD JAGO	C6CW9	Seattle	25	24	29	523	601
WESTWOOD MARIANNE	DVPV	Seattle	8	9	0	0	17
WILFRED SYKES	WC5932	Chicago	0	0	0	11	11
WILLIAM E. CRAIN	ELOR2	Oakland	0	169	47	9	225
WILLIAM E. MUSSMAN	D5OE	Seattle	49	0	4	71	124
WILSON	WNPD	New Orleans	30	0	0	37	67
YUCATAN	XCUY	Houston	5	170	15	10	200
YURIY OSTROVSKIY	UAGJ	Seattle	80	75	76	54	285
ZAGREB EXPRESS	9HPL3	Norfolk	0	14	7	0	21
ZENITH	ELOU5	Miami	2	0	0	0	2
ZIM AMERICA	4XGR	Newark	9	13	25	12	59
ZIM ASIA	4XFB	New Orleans	39	25	30	28	122
ZIM ATLANTIC	4XFD	New York City	0	39	57	64	160
ZIM CANADA	4XGS	Norfolk	0	51	22	17	90
ZIM CHINA	4XFQ	New York City	0	25	25	62	112
ZIM EUROPA	4XFN	New York City	0	15	18	51	84
ZIM IBERIA	4XFP	New York City	0	62	67	45	174
ZIM ISRAEL	4XGX	New Orleans	25	23	60	23	131
ZIM ITALIA	4XGT	New Orleans	62	38	16	70	186
ZIM JAMAICA	4XFE	New York City	0	40	33	11	84
ZIM JAPAN	4XGV	Baltimore	0	41	10	21	72
ZIM KOREA	4XGU	Miami	26	26	48	24	124
ZIM MONTEVIDEO	V2AG7	Norfolk	6	8	4	3	21
ZIM PACIFIC	4XFC	New York City	0	8	19	2	29
ZIM SANTOS	ELRJ6	Baltimore	38	18	35	75	166
ZIM U.S.A.	4XFO	New York City	0	9	2	0	11
Totals	Jan						29,206
	Feb						41,481
	Mar						39,514
	Apr						39,352
Period Total							149,553

Buoy Climatological Data Summary —

4th Quarter 1997 and 1st Quarter 1998

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.

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)
OCTOBER 1997													
41001	34.7N	072.6W	0703	21.7	24.8	1.3	5.9	20/02					1016.9
41002	32.3N	075.2W	0737	23.5	25.9	1.6	4.7	20/09	10.9	NE	28.8	19/18	1016.6
41004	32.5N	079.1W	0731	22.5		1.1	2.7	27/20	10.9	NE	25.8	27/16	1017.0
41008	31.4N	080.9W	0732	22.8	25.2	1.0	2.0	25/02	12.2	NE	25.5	28/01	1017.5
41009	28.5N	080.2W	1469	25.2	26.9	1.3	2.3	09/04	11.4	E	22.5	11/19	1016.3
41010	28.9N	078.5W	1472	25.3	27.2	1.5	2.8	19/16	11.9	NE	29.9	27/22	1016.0
42001	25.9N	089.7W	0733	26.1	28.1	1.4	2.8	15/10	15.4	E	27.6	10/13	1015.5
42002	25.9N	093.6W	0741	25.7	27.4	1.4	4.2	15/10	14.9	SE	31.3	15/01	1014.7
42003	25.9N	085.9W	0733		27.9	1.2	2.6	09/14	13.6	E	24.1	12/16	1015.1
42007	30.1N	088.8W	0738	22.0	24.6	0.9	2.0	13/04	12.7	E	28.4	14/11	1016.5
42035	29.3N	094.4W	0740	23.3	24.7	1.1	2.9	23/23	12.0	E	21.0	30/07	1015.5
42036	28.5N	084.5W	0733	24.7	26.8	1.0	2.3	24/22	12.3	E	29.5	24/18	1017.0
42039	28.8N	086.0W	0727	24.3	26.9	1.1	2.6	24/21	12.2	E	24.5	24/22	1017.0
42040	29.2N	088.3W	0734	23.6	26.2	1.3	3.8	24/14	12.7	N	28.8	24/14	1017.2
44004	38.5N	070.7W	0691	17.5	22.1	1.7	8.2	20/04	13.2	NW	45.7	20/04	1017.2
44005	42.9N	069.0W	0732	10.5	11.5	1.3	5.0	21/05	11.3	W	32.1	27/14	1016.7
44007	43.5N	070.2W	0738	9.9	10.8	0.7	3.4	21/12					1016.5
44008	40.5N	069.4W	0733	13.1	14.6	1.6	7.7	20/10	12.1	N	38.7	20/07	1016.8
44009	38.5N	074.7W	0737	16.0	18.1	1.1	4.0	19/23	13.0	S	31.5	19/18	1017.8
44011	41.1N	066.6W	0728	12.3	12.9	1.9	7.9	20/20	13.7	N	36.3	20/10	1016.4
44014	36.6N	074.8W	0455	20.3	20.8	1.0	5.0	19/20	9.5	NE	33.4	19/17	1019.2
44025	40.3N	073.2W	0702	14.5	16.7	1.1	3.4	20/07	12.5	W	28.4	28/04	1018.3
45001	48.1N	087.8W	0694	6.2	6.9	1.1	4.9	09/20	13.7	SE	34.4	09/15	1014.4
45002	45.3N	086.4W	0727	9.6	11.7	1.1	3.0	31/00	14.3	S	32.6	21/16	1015.3
45003	45.3N	082.8W	0735	9.4	12.0	1.0	2.9	10/11	14.1	S	29.9	14/14	1016.3
45004	47.6N	086.6W	0693	6.8	7.8	1.1	4.3	09/23	13.9	S	32.4	10/03	1015.6
45005	41.7N	082.4W	0659	13.2	15.6	0.6	2.2	26/19	11.8	SW	24.7	27/12	1018.5
45006	47.3N	089.9W	0708	6.4	6.2	0.8	3.1	09/16	11.4	SW	31.5	13/14	
45007	42.7N	087.0W	0735	12.0	14.6	0.9	4.0	27/11	13.5	S	33.2	26/18	1016.1
45008	44.3N	082.4W	0737	10.4	12.7	0.9	3.4	27/10	13.2	S	28.8	27/09	1017.4
45011	43.0N	086.3W	0530	13.7	16.3	0.7	2.4	14/08	12.6	SE	27.6	13/14	1018.7
46001	56.3N	148.2W	0311	7.9	9.6	3.0	5.2	26/12	15.4	W	29.9	26/10	996.6
46002	42.5N	130.3W	0733	14.7	15.8	3.0	10.1	09/07	15.2	SW	37.3	01/22	1017.8
46003	51.9N	155.9W	0728	9.3	10.4	2.7	6.6	02/17	13.7	W	27.0	23/15	1006.2
46005	46.1N	131.0W	0737	13.4	14.1	3.1	9.1	08/15	16.0	NW	37.3	09/01	1014.7
46011	34.9N	120.9W	0735	16.8	17.5	2.1	5.0	07/13	11.2	NW	30.3	07/03	1014.2
46014	39.2N	124.0W	0738	13.4	13.6	2.6	6.4	09/21	11.1	NW	29.3	06/20	1016.4

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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)
46022	40.7N	124.5W	0737	12.9	12.3	2.6	8.4	09/08	11.7	N	31.9	06/15	1017.2
46023	34.7N	121.0W	0732	16.9	17.9	2.2	5.3	06/04	14.1	NW	35.6	06/23	1015.2
46026	37.8N	122.8W	0735	14.1	14.7	2.0	4.9	07/02	10.7	NW	31.3	07/02	1015.5
46029	46.2N	124.2W	0736		15.1	2.6	6.8	30/11	14.0	S	36.3	01/13	1015.3
46030	40.4N	124.5W	0510	12.6	12.3	2.6	6.7	09/19	13.4	N	33.2	06/13	1017.0
46035	56.9N	177.8W	0732	5.9	7.8	2.6	7.2	28/05	18.1	E	37.1	27/20	1014.3
46042	36.8N	122.4W	0578		16.1	2.6	6.3	10/07					1015.4
46045	33.8N	118.5W	0738	19.2	20.2	0.9	3.1	07/10					1012.9
46050	44.6N	124.5W	0718	13.8	14.8	2.8	7.7	09/14	14.2	N	37.5	01/14	1015.6
46054	34.3N	120.5W	0219	17.9	19.3	2.9	4.9	03/08	17.8	NW	35.6	07/03	1011.1
46059	38.0N	130.0W	0738	17.4	18.8	2.9	6.4	04/14	15.3	N	28.2	01/05	1021.3
46060	60.6N	146.8W	1467	6.8	9.7	0.6	2.3	19/16	11.2	NW	33.4	19/19	1003.2
46061	60.2N	146.8W	1426	7.0	10.1	1.4	5.0	29/05	14.5	NW	38.5	19/17	1003.0
46062	35.1N	121.0W	0728	16.9	17.3	2.0	4.7	03/06	12.2	NW	34.6	06/23	1014.5
51001	23.4N	162.3W	0603	26.7	27.8	1.8	2.6	18/23	11.8	NE	21.9	03/16	1017.1
51002	17.2N	157.8W	0738	26.6	27.5	2.2	4.3	28/23	15.1	NE	23.9	28/05	1013.8
51003	19.1N	160.8W	0741	26.9	27.9	2.0	4.1	28/14	11.2	NE	20.4	27/17	1013.3
51004	17.4N	152.5W	0737	26.0		2.2	3.6	07/17	14.4	NE	22.0	17/07	1014.2
51028	0.0N	153.9W	0055	27.7	29.3	2.5	3.4	29/12	10.6	W	22.0	30/05	1009.1
91328	8.6N	149.7E	0556	27.9					4.5	NE	17.5	31/14	1010.4
91343	7.6N	155.2E	0731	27.7									1009.9
91352	6.2N	160.7E	0492	27.4									1011.8
91374	8.7N	171.2E	0736	27.0					4.1	NE	15.4	27/02	1010.0
91377	6.1N	172.1E	0503	27.4									1012.5
91411	8.3N	137.5E	0342	28.2									1010.5
91442	4.6N	168.7E	0732	27.4					9.2	W	28.3	04/21	1010.6
ABAN6	44.3N	075.9W	0740	9.3	14.2				3.2	S	18.1	27/07	1018.6
ALSN6	40.5N	073.8W	0735	14.1		0.8	2.5	20/08	14.2	W	35.8	28/12	1018.4
BLIA2	60.8N	146.9W	1472	5.3					15.6	N	33.6	14/16	1003.9
BURL1	28.9N	089.4W	0731	23.1					14.2	E	37.2	24/12	1016.5
BUZM3	41.4N	071.0W	0734	13.0	16.1	0.7	2.6	28/02	13.9	W	36.1	28/21	1018.5
CARO3	43.3N	124.4W	0737	12.8					12.1	S	39.9	09/12	1017.2
CDRF1	29.1N	083.0W	0737	22.3					8.7	NE	21.1	12/12	1017.1
CHLV2	36.9N	075.7W	0734	17.8	19.9	0.9	3.4	20/03	13.9	NE	35.9	19/15	1018.7
CLKN7	34.6N	076.5W	0737	20.0					9.8	N	24.6	31/17	1019.3
CSBF1	29.7N	085.4W	0735	22.2					6.8	NE	25.5	26/21	1017.5
DBLN6	42.5N	079.4W	0731	11.6					10.3	S	49.6	27/12	1018.3
DISW3	47.1N	090.7W	0736	7.7					11.6	SW	36.2	09/15	1014.0
DPIA1	30.3N	088.1W	0733	21.4	22.9				13.4	N	31.9	24/08	1017.5
DRYF1	24.6N	082.9W	0733	26.5	27.6				12.0	E	24.7	01/13	1015.0
DSLN7	35.2N	075.3W	0739	20.5		1.1	4.3	20/01	11.9	N	38.5	19/20	1017.0
DUCN7	36.2N	075.8W	0732	18.5		0.8	3.0	19/23	11.3	N	36.3	19/19	1019.6
FBIS1	32.7N	079.9W	0733	20.3					7.9	N	19.1	02/04	1018.7
FFIA2	57.3N	133.6W	0735	7.1					13.8	SE	34.7	09/13	1006.0
FPSN7	33.5N	077.6W	0735	21.8		1.0	3.0	27/23	11.5	N	37.6	27/18	1016.8
FWYF1	25.6N	080.1W	0734	26.2	27.5				14.6	E	27.2	13/06	1016.2
GDIL1	29.3N	090.0W	0738	22.5	24.1				11.7	E	28.8	14/13	1017.0
GLLN6	43.9N	076.5W	0734	10.8					13.0	W	45.0	27/15	1018.0
IOSN3	43.0N	070.6W	0737	10.6					11.5	W	33.2	27/10	1016.9
KTNF1	29.8N	083.6W	0738	20.9					7.2	NE	19.6	27/10	1017.0
LKWF1	26.6N	080.0W	0498	26.0	27.2				12.1	NE	23.0	10/01	1016.4
LONF1	24.9N	080.9W	0734	26.2	26.7				11.0	E	21.8	01/17	1015.2
LPOI1	48.1N	116.5W	0734	9.7	12.3				7.1	S	35.9	30/17	1016.1
MDRM1	44.0N	068.1W	0732	9.6					13.3	NW	36.8	27/17	1016.3
MISM1	43.8N	068.9W	0732	9.6					13.7	W	38.2	27/17	1016.4
MLRF1	25.0N	080.4W	0731	26.4	27.8				13.2	E	31.7	13/04	1015.5
MRKA2	61.1N	146.7W	1277	4.2					10.9	NE	29.0	11/10	1005.7
NWPO3	44.6N	124.1W	0737	12.1					11.5	E	37.1	09/15	1016.9
PILM4	48.2N	088.4W	0732	6.1					15.2	NW	41.9	09/19	1015.1
POTA2	61.1N	146.7W	1468	4.0					19.0	NE	33.5	29/06	1004.0
PTAC1	39.0N	123.7W	0734	12.8					9.3	N	26.2	06/19	1016.4
PTAT2	27.8N	097.1W	0732	23.6	25.3				13.4	SE	36.2	10/04	1015.1
PTGC1	34.6N	120.7W	0738	17.1					14.6	N	38.3	07/04	1015.3
ROAM4	47.9N	089.3W	0567	8.3	4.7				15.3	SW	41.1	09/16	1012.0
SANF1	24.5N	081.9W	0734	26.4	27.5				13.6	E	26.7	12/03	1015.2
SAUF1	29.9N	081.3W	0733	23.3	25.2				11.1	E	27.5	15/15	1017.4
SBIO1	41.6N	082.8W	0731	12.7					10.8	SW	31.3	21/21	1017.9
SGNW3	43.8N	087.7W	0734	9.4	8.0				11.0	S	30.9	27/02	1016.9
SISW1	48.3N	122.9W	0736	11.0					11.3	SE	43.1	10/03	1014.6
SMKF1	24.6N	081.1W	0740	26.6	27.8				13.9	E	27.0	12/15	1015.6
SPGF1	26.7N	079.0W	0735	25.7	27.7				9.9	E	21.5	09/18	1017.0
SRST2	29.7N	094.1W	0683	21.5					11.7	SE	27.9	26/05	1016.7
STDM4	47.2N	087.2W	0739	8.2					17.9	SE	42.5	10/02	1014.7
SUPN6	44.5N	075.8W	0735	9.4	14.4				8.7	SW	35.2	27/17	1018.2
THIN6	44.3N	076.0W	0738	9.2									
TPLM2	38.9N	076.4W	0731	15.2	17.7				10.8	S	26.7	16/07	1019.6
TTIW1	48.4N	124.7W	0739	11.7					14.7	E	51.9	10/02	1013.8
VENF1	27.1N	082.5W	0731	23.7	26.3				8.3	NE	27.8	27/18	1017.1
WPOW1	47.7N	122.4W	0735	11.5					10.5	S	36.3	10/00	1015.5

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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	0715	18.8	22.3	1.8	2.3	01/22					1014.3
41002	32.3N	075.2W	0711	20.9	24.9	1.8	5.2	14/12	13.2	W	29.9	02/15	1014.9
41004	32.5N	079.1W	0708	17.3		1.1	2.8	01/09	12.2	W	27.0	01/07	1015.5
41008	31.4N	080.9W	0712	16.8	19.5	0.8	1.8	01/05	11.9	W	22.7	01/06	1016.5
41009	28.5N	080.2W	1426	22.0	24.9	1.1	1.9	09/04	12.0	N	26.6	01/00	1016.2
41010	28.9N	078.5W	1173	22.8	26.0	1.5	3.2	02/13	13.1	W	29.0	02/12	1015.5
42001	25.9N	089.7W	0714	23.8	26.4	1.2	2.6	17/01	13.7	NE	25.1	02/12	1016.4
42002	25.9N	093.6W	0720	23.3	24.9	1.2	3.8	16/11	14.1	SE	30.3	16/12	1015.8
42003	25.9N	085.9W	0713		27.7	1.3	3.1	13/14	14.2	NE	27.8	13/08	1015.6
42007	30.1N	088.8W	0713	15.7	18.5	0.6	1.9	12/17	11.5	NE	26.0	12/16	1016.8
42019	27.9N	095.0W	0552	20.0	23.9	1.3	3.0	10/16	14.0	NE	27.0	15/18	1015.7
42020	26.9N	096.7W	0535	20.7	23.5	1.4	3.6	15/21	13.2	N	28.2	15/18	1014.6
42035	29.3N	094.4W	0718	16.8	18.7	0.9	2.6	05/09	12.5	NE	26.4	12/08	1016.5
42036	28.5N	084.5W	0715	20.0	22.9	1.1	2.6	02/10	12.6	NE	23.5	02/06	1017.3
42039	28.8N	086.0W	0706	19.6	23.3	1.1	2.4	30/22	12.4	NE	24.3	12/14	1017.7
42040	29.2N	088.3W	0710	18.8	22.7	1.1	2.3	12/11	12.3	N	24.9	12/23	1017.5
44004	38.5N	070.7W	0655	15.0	20.2	2.5	8.1	27/18	16.9	W	40.2	27/11	1012.9
44005	42.9N	069.0W	0713	6.5	9.0	2.0	5.9	02/07	15.8	NW	35.9	27/17	1012.5
44007	43.5N	070.2W	0618	5.2	8.7	1.3	7.0	02/06	14.2	NW	31.5	27/18	1012.1
44008	40.5N	069.4W	0714	9.5	11.6	2.3	6.1	02/01	14.8	NW	37.7	27/15	1012.4
44009	38.5N	074.7W	0713	10.6	13.3	1.5	5.2	08/05	15.0	NW	33.0	07/22	1013.7
44011	41.1N	066.6W	0711	9.8	10.8	2.8	8.6	28/00	16.0	NW	39.1	27/22	1012.3
44013	42.5N	070.7W	0461	4.2	9.0	1.0	4.7	15/03	15.3	W	36.1	27/14	1012.2
44025	40.3N	073.2W	0699	9.2	12.8	1.7	5.3	14/16	17.0	W	37.5	27/10	1013.9
45002	45.3N	086.4W	0064	8.1	10.4	0.9	1.6	01/14	12.9	SW	21.6	02/12	993.9
45003	45.3N	082.8W	0076	8.1	8.7	1.0	1.5	02/14	15.1	SW	20.8	02/13	997.9
45007	42.7N	087.0W	0570	3.8	9.9	1.0	2.7	16/02	14.0	W	25.6	17/07	1014.3
45008	44.3N	082.4W	0231	7.0	8.6	0.7	1.4	07/00	12.4	NE	19.6	02/09	1013.4
45011	43.0N	086.3W	0430	2.5	7.4	0.8	2.5	17/11	12.9	NE	26.0	12/08	1017.3
46001	56.3N	148.2W	0712	6.1	7.7	3.3	13.6	09/04	15.9	SE	41.4	09/03	995.7
46002	42.5N	130.3W	0716	13.4	14.8	3.9	11.3	19/05	17.0	S	50.1	19/03	1008.6
46003	51.9N	155.9W	0687	6.0	7.4	3.8	9.8	27/12	17.7	W	38.3	02/08	999.9
46005	46.1N	131.0W	0711	13.7	12.4	3.7	7.7	29/16	16.9	SE	36.7	29/15	1006.7
46011	34.9N	120.9W	0719	16.4	18.0	2.7	6.2	14/13	9.3	NW	27.8	26/10	1014.3
46014	39.2N	124.0W	0715	14.3	15.5	3.0	7.2	14/04	11.6	SE	36.7	19/01	1013.5
46022	40.7N	124.5W	0712	13.4	14.4	3.0	9.5	19/20	12.4	SE	38.7	19/02	1013.4
46023	34.7N	121.0W	0711	16.6	18.2	2.7	6.3	15/06	10.9	NW	28.0	30/16	1015.2
46025	33.8N	119.1W	0243	17.4	18.8	1.4	3.5	27/15	7.0	W	27.8	26/20	1014.5
46026	37.8N	122.8W	0716	14.7	15.9	2.5	5.7	19/23	11.2	NW	31.7	19/04	1013.8
46029	46.2N	124.2W	0718		13.9	2.7	7.7	19/19	14.0	E	35.4	19/11	1011.6
46035	56.9N	177.8W	0684	1.8	4.9	4.6	15.3	29/02	24.8	W	49.2	29/00	992.6
46045	33.8N	118.5W	0247	16.7	18.7	1.2	3.3	26/21	5.8	E	24.1	26/16	1013.7
46050	44.6N	124.5W	0694	12.5	13.2	3.1	10.5	19/14	12.7	S	40.0	19/16	1011.5
46054	34.3N	120.5W	0167	15.7	17.0	2.6	5.1	27/17	10.4	NW	26.8	26/15	1013.1
46059	38.0N	130.0W	0714	16.0	17.4	3.7	8.3	13/14	15.2	W	34.0	18/22	1013.7
46060	60.6N	146.8W	1430	5.5	8.3	0.9	4.4	09/12	15.6	E	42.7	09/07	998.6
46061	60.2N	146.8W	1420	5.7	8.5	2.1	6.6	09/11	17.2	E	44.3	09/06	998.0
46062	35.1N	121.0W	0705	16.4	17.8	2.7	6.1	20/07	10.3	NW	29.0	26/11	1014.4
51001	23.4N	162.3W	0060	23.9	26.0	3.1	4.6	18/12	8.8	NE	27.7	18/08	1014.8
51002	17.2N	157.8W	0716	25.7	26.7	2.3	4.2	26/09	14.3	NE	25.5	26/12	1014.7
51003	19.1N	160.8W	0719	25.6	26.9	2.6	4.4	25/10	13.5	NE	24.2	02/00	1014.4
51004	17.4N	152.5W	0715	25.5		2.5	4.4	30/11	13.4	NE	24.8	25/05	1014.8
51028	0.0S	153.9W	0666	28.4	29.5	1.8	2.9	28/16	7.1	W	21.2	30/22	1010.2
91328	8.6N	149.7E	0532	27.9					6.4	NE	17.5	01/05	1010.9
91343	7.6N	155.2E	0714	28.0									1010.7
91352	6.2N	160.7E	0469	27.8									1012.8
91374	8.7N	171.2E	0717	27.4					5.0	NE	15.8	18/15	1011.6
91377	6.1N	172.1E	0479	27.8									1013.9
91411	8.3N	137.5E	0374	28.5									1010.6
91442	4.6N	168.7E	0715	28.1					6.8	NE	19.5	04/14	1011.5
ABAN6	44.3N	075.9W	0714	2.7	8.3				5.1	S	22.4	22/12	1015.0
ALSN6	40.5N	073.8W	0707	7.7		1.1	3.8	01/23	18.3	W	46.5	27/14	1014.3
BLIA2	60.8N	146.9W	1434	4.5					13.0	NE	33.3	26/19	999.5
BURL1	28.9N	089.4W	0713	17.7					13.9	NE	28.3	29/02	1016.7
BUZM3	41.4N	071.0W	0713	7.3	11.1	1.2	3.9	02/00	19.1	NW	48.8	01/23	1014.4
CARO3	43.3N	124.4W	0712	11.5					9.0	SE	44.5	19/13	1012.9
CDRF1	29.1N	083.0W	0715	16.7					7.3	NE	21.0	30/11	1017.1
CHLV2	36.9N	075.7W	0711	11.7	14.0	1.0	2.9	14/10	15.4	NW	38.0	24/17	1015.2
CLKN7	34.6N	076.5W	0713	14.1					11.0	N	25.9	24/16	1016.9
CSBF1	29.7N	085.4W	0713	16.3					7.2	NE	23.6	03/08	1017.7
DBLN6	42.5N	079.4W	0713	4.6					12.5	SW	35.9	17/08	1014.6
DISW3	47.1N	090.7W	0712	-0.3					12.9	SW	34.8	14/14	1014.2
DPIA1	30.3N	088.1W	0714	14.9	16.6				11.0	N	26.8	03/07	1017.7
DRYF1	24.6N	082.9W	0709	24.3	25.2				12.0	NE	25.1	13/10	1015.5
DSLN7	35.2N	075.3W	0715	15.1		1.2	2.6	02/02	14.8	W	34.8	22/03	1014.3
DUCN7	36.2N	075.8W	0565	13.0		0.8	2.7	14/03	11.7	W	31.4	13/20	1014.8
FBIS1	32.7N	079.9W	0713	14.0					7.2	NW	23.5	13/07	1017.1
FFIA2	57.3N	133.6W	0716	5.4					11.4	SE	36.6	04/23	1006.3
FPSN7	33.5N	077.6W	0711	16.6		1.2	3.9	30/13	14.1	W	34.9	30/12	1014.7

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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)
FWYF1	25.6N	080.1W	0709	24.1	25.7				14.9	NE	29.7	14/05	1016.8
GDIL1	29.3N	090.0W	0714	16.7	18.4				11.2	NE	27.7	02/01	1017.4
GLLN6	43.9N	076.5W	0714	4.3					15.2	NE	39.0	27/03	1014.2
IOSN3	43.0N	070.6W	0715	4.8					17.2	W	42.7	02/02	1012.8
KTNF1	29.8N	083.6W	0716	15.3					7.6	NE	23.1	14/23	1016.9
LKWF1	26.6N	080.0W	0715	22.7	25.2				10.2	NW	22.9	02/16	1016.4
LONF1	24.9N	080.9W	0708	23.8	24.3				11.2	NE	23.3	17/09	1015.7
LPOI1	48.1N	116.5W	0712	5.6	8.4				8.6	NE	23.9	11/08	1017.9
MDRM1	44.0N	068.1W	0709	4.9					19.1	NW	45.0	02/08	1012.5
MISM1	43.8N	068.9W	0708	4.9					18.9	NW	52.9	02/06	1012.3
MLRF1	25.0N	080.4W	0714	24.4	26.1				13.7	N	27.2	25/19	1016.0
MRKA2	61.1N	146.7W	1426	2.1					8.3	NE	22.1	27/00	1001.3
NWPO3	44.6N	124.1W	0709	11.4					10.5	E	43.7	19/16	1012.8
PILM4	48.2N	088.4W	0713	-0.4					13.6	N	38.5	16/23	1012.9
POTA2	61.1N	146.7W	1431	2.1					18.6	SW	29.7	16/07	999.5
PTAC1	39.0N	123.7W	0716	13.3					9.9	SE	34.6	26/17	1013.8
PTAT2	27.8N	097.1W	0612	16.7	19.3				12.2	N	27.8	15/18	1017.6
PTGC1	34.6N	120.7W	0714	16.4					12.1	N	32.7	20/15	1015.5
ROAM4	47.9N	089.3W	0541	-0.5	4.8				15.0	N	38.9	25/06	1013.4
SANF1	24.5N	081.9W	0713	24.4	25.6				14.1	NE	27.2	25/22	1015.8
SAUF1	29.9N	081.3W	0710	17.6	20.1				8.4	NW	24.1	25/10	1017.1
SBIO1	41.6N	082.8W	0711	4.2					12.5	SW	30.2	26/20	1014.5
SGNW3	43.8N	087.7W	0714	1.8	4.7				10.7	W	28.3	27/22	1014.8
SISW1	48.3N	122.9W	0716	9.2					10.6	SE	39.2	23/14	1012.5
SMKF1	24.6N	081.1W	0716	24.4	26.1				14.5	NE	29.1	25/21	1016.1
SPGF1	26.7N	079.0W	0710	23.5	26.0				9.4	E	29.2	02/17	1017.4
SRST2	29.7N	094.1W	0710	14.4					9.1	N	28.3	05/17	1017.9
STDM4	47.2N	087.2W	0711	1.0					15.4	NW	38.2	17/02	1013.1
SUPN6	44.5N	075.8W	0712	2.6	8.4				10.8	NE	28.3	17/11	1014.6
THIN6	44.3N	076.0W	0712	2.8									
TPLM2	38.9N	076.4W	0711	8.4	10.6				11.6	NW	30.8	27/06	1015.9
TTIW1	48.4N	124.7W	0716	10.3					19.7	E	41.3	28/09	1010.9
VENF1	27.1N	082.5W	0716	20.1	21.8				8.7	NE	23.4	07/20	1017.6
WPOW1	47.7N	122.4W	0713	10.3					10.7	S	30.6	28/10	1013.2
DECEMBER 1997													
41001	34.7N	072.6W	0737	16.8	21.6								1011.4
41002	32.3N	075.2W	0736	18.8	22.7	2.5	7.1	30/22	15.1	W	34.0	30/13	1012.0
41004	32.5N	079.1W	0738	15.1		1.4	5.4	15/22	15.0	W	39.1	15/20	1012.9
41008	31.4N	080.9W	0738	13.4	15.5	1.0	4.1	15/19	12.8	W	40.4	15/19	1014.2
41009	28.5N	080.2W	1430	18.8	22.3	1.2	4.2	16/15	12.9	NW	41.4	16/00	1014.7
42001	25.9N	089.7W	0742	20.8	23.9	1.5	5.4	14/20	15.6	NW	38.1	14/20	1015.9
42002	25.9N	093.6W	0742	20.3	23.0	1.5	4.3	27/11	15.2	N	30.9	12/23	1015.8
42003	25.9N	085.9W	0737		27.0	1.7	5.4	29/20	16.7	NW	38.7	29/18	1014.4
42007	30.1N	088.8W	0741	12.5	15.7	0.6	2.0	08/15	12.3	NW	30.5	29/10	1016.0
42019	27.9N	095.4W	0693	17.1	21.2	1.3	3.8	08/02	14.4	N	30.1	26/19	1015.9
42020	26.9N	096.7W	0739	18.4	22.3	1.4	3.7	26/23	13.8	NW	28.8	26/18	1015.7
42035	29.3N	094.4W	0739	13.2	15.4	0.8	3.3	08/02	12.4	NW	30.7	29/07	1016.2
42036	28.5N	084.5W	0738	17.2	20.5	1.3	5.1	30/14	13.2	NW	31.1	30/03	1015.9
42039	28.8N	086.0W	0733	17.0	21.2	1.4	6.5	30/10	13.2	NW	34.6	30/09	1016.3
42040	29.2N	088.3W	0730	16.0	20.9	1.2	3.4	29/11	13.3	N	31.3	29/05	1016.5
44004	38.5N	070.7W	0703	11.0	16.4	2.6	9.4	30/18	17.1	W	34.4	30/18	1010.0
44005	42.9N	069.0W	0045	3.0	7.7	2.6	4.7	02/20	23.4	NW	33.4	02/19	992.7
44007	43.5N	070.2W	0738	1.6	6.3	1.0	4.2	30/08	12.6	W	29.9	30/05	1008.4
44008	40.5N	069.4W	0739	6.0	7.4	2.3	9.2	30/20	15.2	W	35.2	30/20	1008.7
44009	38.5N	074.7W	0736	6.5	9.2	1.3	3.5	30/06	14.3	NW	32.4	01/16	1011.9
44011	41.1N	066.6W	0731	5.8	7.3	2.7	7.8	31/04	16.6	W	35.8	02/18	1007.9
44013	42.4N	070.7W	0739	3.2	6.9	1.0	4.2	30/06	14.4	W	34.2	02/06	1008.1
44025	40.3N	073.2W	0726	5.7	8.8	1.5	5.7	30/03	16.3	W	37.7	30/17	1011.1
46001	56.3N	148.2W	0739	2.4	5.6	4.1	11.7	28/08	17.9	W	38.3	04/19	992.4
46002	42.5N	130.3W	0740	11.7	13.1	4.0	9.5	13/10	16.3	SW	36.3	13/01	1018.1
46003	51.9N	155.9W	0536	2.6	4.9	4.0	11.5	22/11	17.8	W	42.0	22/06	996.5
46005	46.1N	131.0W	0741		11.1	4.3	8.3	13/09	17.4	SW	34.8	13/06	1015.8
46006	40.9N	137.5W	0202	11.6	12.1	3.1	6.4	23/23	12.2	S	21.2	31/14	1028.2
46011	34.9N	120.9W	0742	14.1	16.4	2.7	5.2	01/04	11.7	N	26.6	04/22	1017.4
46014	39.2N	124.0W	0738	13.0	14.6	3.2	5.4	24/20	14.5	NW	33.0	14/02	1018.7
46022	40.7N	124.5W	0737	12.3	13.9	3.2	6.1	24/22	14.5	N	30.9	14/10	1019.5
46023	34.7N	121.0W	0738	14.3	16.2	2.7	5.0	01/02	14.7	N	36.1	06/04	1018.2
46025	33.8N	119.1W	0728	16.0	17.0	1.5	3.9	06/07	11.9	NW	28.2	06/07	1017.4
46026	37.8N	122.8W	0738	12.9		2.6	4.5	05/08	12.9	E	29.0	04/00	1019.1
46035	56.9N	177.8W	0714	-1.7	3.1	3.3	9.6	04/22	19.3	NW	41.0	04/08	1000.5
46045	33.8N	118.5W	0739	15.2	17.1	1.0	2.6	09/00	8.1	E	27.8	22/02	1016.7
46050	44.6N	124.5W	0727	10.7	12.9	3.5	7.9	14/08	12.9	E	37.7	15/22	1019.3
46054	34.3N	120.5W	0707	14.8	16.5	2.6	5.2	22/17	13.9	NW	33.6	06/05	1017.0
46059	38.0N	130.0W	0741	14.0	15.0	3.5	9.4	13/12	15.7	N	35.8	12/20	1012.3
46060	60.6N	146.8W	1470	2.2	7.2	1.2	3.7	19/00	16.3	E	43.9	01/12	992.7
46061	60.2N	146.8W	1473	2.5	7.2	2.6	7.9	19/02	17.5	E	49.5	18/23	992.1

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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)
46062	35.1N	121.0W	0729	14.2	16.3	2.7	5.1	01/00	13.1	N	28.6	04/17	1017.7
51001	23.4N	162.3W	0167		24.1	2.7	5.3	22/17					1020.2
51002	17.2N	157.8W	0742	24.6	25.5	2.9	6.0	04/13	17.7	NE	29.0	04/00	1015.9
51003	19.1N	160.8W	0744	24.4	25.3	2.8	5.3	03/04	15.0	NE	26.4	03/03	1015.9
51004	17.4N	152.5W	0738	24.1		2.9	5.1	03/20	16.5	NE	27.4	03/18	1016.1
51028	0.0S	153.9W	0728	28.1	29.2	2.1	3.0	07/06	9.3	NE	24.7	01/14	1008.2
91328	8.6N	149.7E	0538	27.8					8.0	NE	19.4	14/20	1009.6
91343	7.6N	155.2E	0736	28.0									1009.2
91352	6.2N	160.7E	0486	27.8									1011.3
91374	8.7N	171.2E	0739	27.0					7.0	NE	20.7	11/20	1010.1
91377	6.1N	172.1E	0520	27.4									1012.1
91411	8.3N	137.5E	0320	28.0									1009.9
91442	4.6N	168.7E	0740	28.0					12.7	NE	28.8	10/11	1009.5
ABAN6	44.3N	075.9W	0742	-1.9	4.1				3.9	SW	23.1	11/02	1012.3
ALSN6	40.5N	073.8W	0736	4.4		0.9	4.9	30/05	17.4	W	51.6	30/03	1011.5
BLIA2	60.8N	146.9W	1472	1.5					15.7	NE	46.3	01/14	993.4
BURL1	28.9N	089.4W	0739	14.0					14.7	N	38.6	29/05	1016.0
BUZM3	41.4N	071.0W	0733	3.7	6.7				17.2	W	49.5	30/16	1010.6
CARO3	43.3N	124.4W	0739	9.2					9.1	SE	34.9	16/07	1020.4
CDRF1	29.1N	083.0W	0743	13.8					7.7	NW	30.1	04/09	1015.5
CHLV2	36.9N	075.7W	0744	7.8	10.1	1.0	2.8	28/12	14.3	N	38.0	30/06	1013.5
CLKN7	34.6N	076.5W	0736	10.0					12.6	N	31.7	30/05	1014.9
CSBF1	29.7N	085.4W	0739	13.4					7.9	NW	33.7	30/09	1016.3
DBLN6	42.5N	079.4W	0741	1.5					14.0	SW	31.8	26/23	1012.4
DESW1	47.7N	124.5W	0739	7.0					14.1	SE	40.2	15/23	1023.3
DISW3	47.1N	090.7W	0739	-1.4					11.8	SW	36.1	12/16	1013.3
DPIA1	30.3N	088.1W	0742	11.9	13.5				12.2	NW	28.6	08/16	1016.7
DRYF1	24.6N	082.9W	0737	22.1	23.1				12.1	NW	33.3	15/05	1014.8
DSLN7	35.2N	075.3W	0740	10.7		1.5	3.5	30/12	17.3	N	40.5	23/03	1012.3
DUCN7	36.2N	075.8W	0731	8.4		0.8	2.3	28/04	12.1	W	34.2	28/01	1014.8
FBIS1	32.7N	079.9W	0737	10.8					8.6	W	25.1	15/18	1014.9
FFIA2	57.3N	133.6W	0243	5.8					15.7	SE	38.2	10/20	1004.3
FPSN7	33.5N	077.6W	0740	13.5		1.4	3.9	16/12	16.8	N	41.2	15/19	1012.3
FWYF1	25.6N	080.1W	0741	21.4	23.9				14.6	NW	36.2	14/17	1016.2
GDIL1	29.3N	090.0W	0736	13.3	15.2				11.4	N	30.3	29/08	1016.7
GLLN6	43.9N	076.5W	0738	0.3					15.3	W	38.4	14/10	1011.6
IOSN3	43.0N	070.6W	0739	1.7					15.3	W	39.7	02/15	1008.3
KTNF1	29.8N	083.6W	0738	12.6					8.3	NW	26.6	30/04	1015.2
LKWF1	26.6N	080.0W	0738	19.9	23.5				9.2	S	21.9	24/09	1015.4
LONF1	24.9N	080.9W	0739	21.1	21.3				11.1	N	31.7	30/11	1015.2
LPOI1	48.1N	116.5W	0740	1.6	5.9				7.6	NE	24.3	17/19	1023.9
MDRM1	44.0N	068.1W	0729	1.4					17.8	NW	43.4	14/22	1007.1
MISM1	43.8N	068.9W	0741	1.5					17.3	W	43.8	14/21	1007.1
MLRF1	25.0N	080.4W	0739	21.9	24.2				13.5	S	32.9	14/17	1015.5
MRKA2	61.1N	146.7W	1465	-0.4					9.0	NE	26.7	29/13	995.2
NWPO3	44.6N	124.1W	0741	7.6					10.1	E	46.9	16/06	1020.6
PILM4	48.2N	088.4W	0740	-1.7					13.0	N	32.1	13/01	1013.3
POTA2	61.1N	146.7W	1470	-0.4					16.1	N	33.2	22/20	993.6
PTAC1	39.0N	123.7W	0737	11.7					12.0	N	30.9	22/02	1018.9
PTAT2	27.8N	097.1W	0314	14.6	15.5				11.5	SE	27.2	26/17	1015.6
PTGC1	34.6N	120.7W	0737	13.6					14.1	N	38.7	06/14	1018.2
ROAM4	47.9N	089.3W	0570	-1.6	4.0				14.3	N	36.8	12/14	1012.6
SANF1	24.5N	081.9W	0741	22.2	23.2				13.2	NW	33.9	15/07	1015.3
SAUF1	29.9N	081.3W	0737	14.2	16.2				8.9	NW	31.3	15/22	1015.2
SBIO1	41.6N	082.8W	0729	0.7					12.7	W	31.7	06/17	1013.1
SGNW3	43.8N	087.7W	0739	-0.3	2.4				11.5	W	29.0	10/15	1013.6
SISW1	48.3N	122.9W	0696	7.1					13.6	SE	43.9	15/23	1018.9
SMKF1	24.6N	081.1W	0740	22.2	24.1				14.8	SE	33.9	14/17	1015.6
SPGF1	26.7N	079.0W	0739	21.8	25.0				9.4	NW	33.2	30/12	1016.3
SRST2	29.7N	094.1W	0735	11.3					9.2	NW	28.5	07/23	1017.7
STDM4	47.2N	087.2W	0743	-0.5					15.2	NW	38.2	12/22	1011.9
SUPN6	44.5N	075.8W	0737	-2.1	4.1				9.9	SW	31.1	02/01	1011.8
THIN6	44.3N	076.0W	0737	-1.8									
TPLM2	38.9N	076.4W	0699	5.0	6.3				10.4	NW	31.7	01/15	1014.5
TTIW1	48.4N	124.7W	0741	8.0					17.4	E	41.0	14/11	1017.8
VENF1	27.1N	082.5W	0738	17.7	19.4				11.0	SE	36.5	30/06	1016.5
WPOW1	47.7N	122.4W	0738	7.3					11.4	S	33.3	14/21	1020.3

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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	0738	16.4	21.1								1017.4
41002	32.3N	075.2W	0740	17.7	20.9	2.5	6.7	17/02	14.6	SE	32.1	28/20	1017.6
41004	32.5N	079.1W	0730	14.9		1.6	4.1	27/16	13.1	NE	30.3	28/11	1017.3
41008	31.4N	080.9W	0736	13.3	13.3	1.1	2.3	27/13	11.1	NE	28.8	16/18	1017.8
41009	28.5N	080.2W	1449	19.6	20.8	1.5	3.2	01/07	13.7	SE	28.8	28/10	1017.4
41010	28.9N	078.5W	0966	20.2	23.2	1.9	4.2	28/11	14.7	W	30.5	28/10	1015.3
42001	25.9N	089.7W	0728	20.7	21.8	1.3	3.1	16/04	12.1	E	28.8	15/20	1016.7

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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)
42002	25.9N	093.6W	0737	21.0	22.7	1.3	3.1	27/11					1015.6
42003	25.9N	085.9W	0734		25.8	1.5	3.4	27/21	15.7	E	28.8	07/13	1015.9
42007	30.1N	088.8W	0729	13.4	14.2	0.8	2.0	07/10	11.6	E	31.1	07/09	1016.9
42019	27.9N	095.4W	0284	17.8	20.6	1.0	2.4	31/23	12.7	SE	24.1	22/22	1015.1
42020	26.9N	096.7W	0735	19.5	20.9	1.2	2.5	02/11	12.8	SE	26.0	08/06	1014.4
42035	29.3N	094.4W	0740	14.5	14.5	0.8	1.8	07/16	11.2	E	27.0	07/14	1015.2
42036	28.5N	084.5W	0737	17.0	18.8	1.2	4.3	16/16	12.7	NE	27.2	16/10	1018.0
42039	28.8N	086.0W	0708	17.2	20.1	1.3	4.3	07/17	13.5	E	27.6	16/10	1018.1
42040	29.2N	088.3W	0731	16.4	18.9	1.2	3.0	07/17	13.2	E	30.1	07/12	1017.6
44004	38.5N	070.7W	0704	9.6	10.8	2.6	6.9	29/13	14.2	NW	37.9	28/16	1017.5
44007	43.5N	070.2W	0735	-0.4	4.5	1.5	4.3	29/21	14.6	N	29.0	17/08	1018.6
44008	40.5N	069.4W	0042	0.3		2.8	4.8	02/14	17.3	W	28.4	02/04	1025.1
44009	38.5N	074.7W	0739	6.1	7.1	1.7	7.3	28/18	14.2	NW	46.0	28/13	1017.6
44011	41.1N	066.6W	0729	4.4	5.1	2.9	8.1	21/11	16.6	NW	35.8	17/11	1016.7
44013	42.4N	070.7W	0735	2.0	5.2	1.5	5.1	16/18	14.8	N	31.3	16/18	1017.2
44025	40.3N	073.2W	0671	5.2	7.0	1.7	5.1	28/22	15.0	SW	35.4	28/20	1018.1
46001	56.3N	148.2W	0735	3.2	4.1	3.4	8.1	03/20	15.4	E	34.4	03/16	992.3
46002	42.5N	130.3W	0742	11.1	11.9	4.5	9.6	19/14	19.1	SW	37.7	24/09	1004.0
46003	51.9N	155.9W	0732	2.7	4.3	3.3	6.7	28/15	15.4	NW	31.9	28/12	992.2
46005	46.1N	131.0W	0740		9.9	4.4	9.9	16/18	18.8	SW	37.3	14/20	1000.6
46006	40.9N	137.5W	0742	11.1	11.5	4.8	11.7	18/21	19.6	W	36.3	25/15	1001.9
46011	34.9N	120.9W	0743	13.9	15.5	3.0	8.1	30/14	10.4	NW	27.4	09/20	1016.5
46014	39.2N	124.0W	0741	12.7	14.2	3.5	7.3	19/18	14.1	SE	35.4	29/01	1013.3
46022	40.7N	124.5W	0740	12.4	13.5	3.8	8.1	19/23	16.6	S	35.4	18/12	1011.5
46023	34.7N	121.0W	0734	14.0	15.6	2.9	7.4	30/13	12.4	NW	31.1	31/08	1017.4
46025	33.8N	119.1W	0711	15.3	16.9	1.6	3.8	30/21	8.5	NW	25.3	05/01	1017.0
46026	37.8N	122.8W	0742	12.4		2.8	6.9	19/22	12.4	E	33.4	29/05	1015.7
46035	56.9N	177.8W	0715	-2.0	2.4	3.3	7.0	06/23	21.2	NE	37.5	11/15	1000.1
46045	33.8N	118.5W	0738	14.7	16.7	0.8	1.7	10/16	6.2	W	21.4	29/15	1016.3
46050	44.6N	124.5W	0390	10.1	12.4	3.5	7.5	14/11	16.4	SW	37.5	14/09	1006.9
46054	34.3N	120.5W	0719	14.1	15.6	2.7	6.7	30/13	13.0	NW	28.0	09/20	1016.4
46059	38.0N	130.0W	0739		13.7	4.2	8.4	29/22	16.7	SW	32.4	30/22	
46060	60.6N	146.8W	1469	2.6	6.2	0.8	2.7	31/22	10.3	E	34.6	27/19	997.7
46061	60.2N	146.8W	1464	2.6	5.9	2.0	6.7	31/23	14.9	E	38.7	31/12	996.8
46062	35.1N	121.0W	0720	13.9	15.4	3.0	7.2	20/04	11.0	NW	30.3	31/09	1016.5
51001	23.4N	162.3W	0248		23.7	3.9	8.4	28/20					1016.0
51002	17.2N	157.8W	0739	24.2	25.2	2.8	5.4	29/16	12.3	NE	21.2	18/10	1015.3
51003	19.1N	160.8W	0743	24.0	25.3	3.0	5.6	07/13	8.8	E	23.5	06/09	1014.6
51028	0.0S	153.9W	0724	28.3	29.3	2.4	3.6	13/11	10.3	N	21.8	26/22	1008.3
91328	8.6N	149.7E	0531	27.3					9.2	NE	15.5	09/17	1011.4
91343	7.6N	155.2E	0731	27.3									1010.9
91352	6.2N	160.7E	0452	27.7									1012.7
91374	8.7N	171.2E	0738	26.6					6.6	NE	12.4	17/16	1011.8
91377	6.1N	172.1E	0495	27.2									1013.6
91411	8.3N	137.5E	0324	27.5									1011.5
91442	4.6N	168.7E	0737	27.6					13.9	NE	27.0	02/18	1011.1
ABAN6	44.3N	075.9W	0307	-1.5	2.5				5.9	SW	19.4	04/16	1018.9
ALSN6	40.5N	073.8W	0739	4.4		1.2	4.1	23/22	17.5	NW	38.9	23/19	1018.4
BLIA2	60.8N	146.9W	1478	0.8					18.0	N	43.3	04/01	998.3
BURL1	28.9N	089.4W	0736	14.3					14.0	E	31.6	07/07	1016.7
BUZM3	41.4N	071.0W	0384	1.6	4.1	1.2	3.6	25/01	19.2	N	38.3	28/23	1016.0
CARO3	43.3N	124.4W	0739	10.3					13.0	S	41.8	24/19	1009.4
CDRF1	29.1N	083.0W	0738	15.0					8.3	NE	22.4	16/14	1018.0
CHLV2	36.9N	075.7W	0739	7.9	8.0	1.1	4.2	29/06	16.5	N	48.1	28/21	1018.7
CLKN7	34.6N	076.5W	0739	10.5					11.3	NE	30.2	19/16	1020.0
CSBF1	29.7N	085.4W	0739	13.9					7.1	E	27.6	16/11	1018.4
DBLN6	42.5N	079.4W	0740	1.0					13.1	NE	40.9	10/00	1017.6
DESW1	47.7N	124.5W	0742	7.3					17.5	SE	46.5	17/11	1005.6
DISW3	47.1N	090.7W	0737	-5.0					12.5	W	31.8	09/07	1016.9
DPIA1	30.3N	088.1W	0739	12.8	13.0				11.8	E	31.9	14/06	1017.9
DRYF1	24.6N	082.9W	0732	21.5	21.9				12.4	NE	25.5	02/21	1016.0
DSLN7	35.2N	075.3W	0740	11.4		1.8	5.6	29/06	16.3	N	41.5	29/00	1017.8
DUCN7	36.2N	075.8W	0728	9.1		1.1	3.9	29/02	12.4	N	44.2	28/21	1019.9
FBIS1	32.7N	079.9W	0335	10.4					8.5	NE	24.9	27/05	1020.5
FFIA2	57.3N	133.6W	0447	3.0					16.2	N	29.2	31/14	999.2
FPSN7	33.5N	077.6W	0571	14.5		1.7	3.9	23/11	15.1	SE	38.9	17/02	1018.5
FWYF1	25.6N	080.1W	0738	21.6	23.0				16.5	E	34.6	04/14	1018.0
GDIL1	29.3N	090.0W	0740	14.8	15.8				11.2	E	26.7	08/20	1017.1
GLLN6	43.9N	076.5W	0739	-2.9					13.6	NE	36.3	11/03	1018.6
IOSN3	43.0N	070.6W	0742	0.1					16.6	N	35.7	25/21	1018.0
KTNF1	29.8N	083.6W	0739	13.9					8.7	NE	29.3	07/17	1017.7
LKWF1	26.6N	080.0W	0734	20.6	22.7				12.1	NW	25.7	27/02	1017.7
LONF1	24.9N	080.9W	0736	21.5	21.9				11.4	NE	27.4	16/04	1016.8
LPOI1	48.1N	116.5W	0684	0.7	4.1				8.4	N	29.4	02/02	1012.1
MDRM1	44.0N	068.1W	0734	-0.6					19.5	NE	44.6	24/07	1017.7
MISM1	43.8N	068.9W	0724	-0.7					20.1	NE	47.5	14/10	1017.8
MLRF1	25.0N	080.4W	0736	21.9	23.2				14.7	E	30.2	04/18	1017.1
MRKA2	61.1N	146.7W	1481	-2.3					13.0	NE	43.0	04/02	1000.9
NWPO3	44.6N	124.1W	0426	8.8					14.1	E	37.5	14/17	1008.7
PILM4	48.2N	088.4W	0739	-6.3					13.8	N	34.2	09/15	1018.5
POTA2	61.1N	146.7W	1477	-2.2					26.3	NE	46.5	04/14	998.5

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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)
PTAC1	39.0N	123.7W	0740	11.8					11.7	SE	33.0	04/02	1014.0
PTAT2	27.8N	097.1W	0742	16.6	16.4				11.0	SE	23.5	07/11	1015.2
PTGC1	34.6N	120.7W	0739	13.6					12.5	N	30.0	04/18	1017.7
ROAM4	47.9N	089.3W	0500	-6.7	2.5				14.5	NE	34.3	09/10	1017.9
SANF1	24.5N	081.9W	0737	21.7	22.6				13.6	NE	27.9	01/14	1016.8
SAUF1	29.9N	081.3W	0739	14.9	15.2				8.7	N	28.2	19/23	1018.3
SBIO1	41.6N	082.8W	0735	0.7					12.2	W	33.6	01/22	1016.9
SGNW3	43.8N	087.7W	0742	-2.9	0.5				12.1	W	40.1	08/22	1016.8
SISW1	48.3N	122.9W	0735	6.0					14.7	SE	44.1	14/07	1007.5
SMKF1	24.6N	081.1W	0739	22.0	22.9				15.2	E	29.4	02/16	1017.2
SPGF1	26.7N	079.0W	0646	20.9					12.3	E	30.2	28/06	1017.8
SRST2	29.7N	094.1W	0737	13.6					10.6	SE	25.7	05/00	1017.0
STDM4	47.2N	087.2W	0739	-4.4					14.7	NW	35.2	10/16	1016.5
SUPN6	44.5N	075.8W	0739	-5.3	1.0				9.9	NE	29.1	11/00	1019.4
THIN6	44.3N	076.0W	0337	-2.0									
TPLM2	38.9N	076.4W	0728	5.2	5.1				11.2	S	38.4	28/17	1019.7
TTIW1	48.4N	124.7W	0739	6.4					21.3	E	52.0	11/14	1005.4
VENF1	27.1N	082.5W	0739	17.9	18.8				9.5	NE	25.5	28/03	1018.7
WPOW1	47.7N	122.4W	0737	6.7					12.6	S	32.4	17/15	1008.5
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41001	34.7N	072.6W	0663	16.0	20.7								1010.9
41002	32.3N	075.2W	0663	17.6	20.5	3.0	8.5	05/07	16.9	W	34.0	25/03	1011.0
41004	32.5N	079.1W	0662	14.1		1.7	6.5	17/10	15.2	SW	31.1	23/03	1011.3
41008	31.4N	080.9W	0662	13.0	13.0	1.2	3.5	03/14	12.7	NE	31.7	04/19	1012.1
41009	28.5N	080.2W	1330	18.0	20.2	1.8	5.0	03/09	15.5	NW	36.1	03/06	1012.7
41010	28.9N	078.6W	1326	20.0	22.6	2.6	6.3	03/16	17.4	W	42.9	03/09	1012.2
42001	25.9N	089.7W	0662	20.4	22.2	1.6	5.0	15/14	15.4	NW	36.1	15/14	1012.4
42002	25.9N	093.6W	0668	20.5	22.7	1.6	4.3	03/00					1011.5
42003	25.9N	085.9W	0664		24.9	1.9	6.6	04/07	17.2	NW	38.3	04/00	1011.4
42007	30.1N	088.8W	0656	13.1	14.4	0.9	3.7	15/23	13.8	E	36.9	15/20	1011.8
42019	27.9N	095.4W	0663	17.8	20.4	1.5	4.5	15/06	14.0	N	32.3	15/04	1011.1
42020	26.9N	096.7W	0667	18.9	20.0	1.4	3.5	15/13	12.3	SE	35.4	01/23	1010.8
42035	29.3N	094.4W	0668	14.6	15.2	1.0	2.9	15/10	12.6	SE	33.2	15/08	1011.4
42036	28.5N	084.5W	0669	16.3	18.1	1.5	5.5	04/06	14.2	NW	33.8	15/22	1012.9
42039	28.8N	086.0W	0059	16.5	19.8	2.5	5.4	04/03	20.9	E	34.6	02/13	1008.7
42040	29.2N	088.3W	0665	15.6	17.7	1.6	6.7	15/23	14.6	NW	36.3	15/21	1012.6
44004	38.5N	070.7W	0635	8.8	13.3	3.0	6.1	06/09	17.1	NE	35.4	26/02	1012.1
44007	43.5N	070.2W	0663	1.0	2.7	1.7	5.6	18/23	12.8	N	33.6	18/19	1014.5
44009	38.5N	074.7W	0665	6.2	6.6	1.9	7.4	05/15	14.4	NE	41.6	04/21	1012.5
44011	41.1N	066.6W	0660	3.0	3.5	3.0	7.4	06/01	15.7	NW	36.9	05/20	1011.9
44013	42.4N	070.7W	0664	2.5	3.6	1.7	6.2	24/20	13.5	NW	32.8	05/21	1013.1
44025	40.3N	073.2W	0646	4.8	6.1	1.8	5.7	05/10	15.0	NE	38.7	05/08	1013.9
46001	56.3N	148.2W	0663	3.8	4.0	3.5	6.6	25/02	14.8	NE	30.1	23/20	984.9
46002	42.5N	130.3W	0666	10.0	10.8	5.3	9.1	02/00	19.8	SW	38.9	06/20	1000.9
46003	51.9N	155.9W	0594	2.8	3.9	3.9	10.4	24/09	17.9	NW	31.3	25/00	986.8
46005	46.1N	131.0W	0666		9.3	5.1	8.7	21/22	17.5	SW	39.6	20/12	998.4
46006	40.9N	137.5W	0650	9.8	10.5	5.7	12.5	01/15	20.6	W	35.9	14/12	1001.6
46011	34.9N	120.9W	0669	13.3	14.8	4.2	8.1	02/23	14.1	NW	41.0	03/06	1013.1
46014	39.2N	124.0W	0671	11.8	13.6	4.5	7.7	08/09	15.5	SE	37.5	06/02	1009.5
46022	40.7N	124.5W	0653	11.4	13.3	4.8	8.8	02/16	18.2	SE	40.8	21/06	1007.8
46023	34.7N	121.0W	0664	13.4	14.9	4.4	8.1	03/13	16.8	NW	48.4	06/10	1014.3
46025	33.8N	119.1W	0656	14.7	16.4	2.6	5.3	03/16	13.6	NW	35.9	03/10	1014.3
46026	37.8N	122.8W	0665	12.1		4.0	7.3	03/04	14.8	S	43.9	07/17	1011.4
46035	56.9N	177.8W	0639	-3.1	1.9	2.0	8.6	23/02	16.8	NE	46.6	22/22	992.0
46045	33.8N	118.5W	0666	14.1	16.2				9.8	W	29.5	04/06	1014.1
46054	34.3N	120.5W	0640	13.4	14.8	4.0	6.8	16/10	16.7	NW	39.8	06/11	1013.6
46059	38.0N	130.0W	0669		12.8	5.3	8.6	02/04	18.2	W	36.7	06/09	
46060	60.6N	146.8W	1327	4.2	5.6	0.9	2.6	11/19	11.5	E	34.2	11/18	992.2
46061	60.2N	146.8W	1333	4.4	5.7	2.4	6.8	01/00	16.4	E	36.1	24/08	990.0
46062	35.1N	121.0W	0657	13.3	14.7	4.3	7.2	03/08	15.0	NW	46.4	06/13	1013.4
51001	23.4N	162.3W	0384	22.0	23.1	3.0	6.8	13/20	11.0	E	23.5	21/17	1021.3
51002	17.2N	157.8W	0667	23.9	25.1	2.8	4.7	14/18	15.7	NE	26.0	22/06	1018.7
51003	19.1N	160.8W	0670	23.8	24.8	2.8	4.7	13/00	12.2	NE	22.5	04/22	1018.4
51028	0.0S	153.9W	0651	27.9	28.8	2.4	3.5	08/17	11.9	NE	22.2	12/10	1010.3
91328	8.6N	149.7E	0470	27.2					9.2	NE	15.5	04/00	1012.8
91343	7.6N	155.2E	0662	27.2									1012.3
91352	6.2N	160.7E	0431	27.4									1014.2
91374	8.7N	171.2E	0665	26.7					6.7	NE	13.6	06/16	1013.4
91377	6.1N	172.1E	0450	27.8									1015.3
91411	8.3N	137.5E	0254	27.4									1012.9
91442	4.6N	168.7E	0662	27.7					13.3	NE	20.6	05/12	1012.6
ALSN6	40.5N	073.8W	0668	4.3		1.3	4.8	18/04	17.3	NE	42.1	17/23	1014.2
BLIA2	60.8N	146.9W	1330	3.2					13.0	N	32.6	01/00	993.0
BURL1	28.9N	089.4W	0661	14.1					15.2	E	40.7	03/21	1011.9
BUZM3	41.4N	071.0W	0666	3.0	3.6	1.1	3.3	13/08	16.8	NE	46.9	05/15	1014.4
CARO3	43.3N	124.4W	0664	9.5					11.6	SE	57.0	21/05	1006.1
CDRF1	29.1N	083.0W	0668	14.2					10.0	W	31.1	16/02	1012.9

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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)
CHLV2	36.9N	075.7W	0670	7.8	6.9	1.5	5.1	05/07	17.3	N	38.2	24/16	1012.8
CLKN7	34.6N	076.5W	0668	10.0					13.7	NE	46.2	17/13	1013.6
CSBF1	29.7N	085.4W	0665	13.9					9.7	NW	34.4	04/12	1013.0
DBLN6	42.5N	079.4W	0667	1.3					10.7	NE	30.7	12/21	1016.0
DESW1	47.7N	124.5W	0669	8.4					17.3	SE	44.0	10/14	1003.9
DISW3	47.1N	090.7W	0663	0.1					10.4	SW	33.3	27/19	1014.6
DPIA1	30.3N	088.1W	0666	13.3	13.6				13.4	NW	42.2	15/23	1012.6
DRYF1	24.6N	082.9W	0665	21.2	21.2				13.6	SE	33.1	03/23	1012.1
DSLN7	35.2N	075.3W	0666	10.2		1.9	5.5	06/01	19.8	N	45.2	04/11	1011.3
DUCN7	36.2N	075.8W	0662	9.1		1.3	3.4	04/19	14.6	N	36.5	17/16	1014.0
FBIS1	32.7N	079.9W	0669	11.3					9.9	NE	28.0	15/22	1012.8
FFIA2	57.3N	133.6W	0662	5.1					13.4	N	29.0	08/01	
FPSN7	33.5N	077.6W	0031	17.8		1.3	1.7	28/08	15.1	S	24.1	28/15	1008.4
FWYF1	25.6N	080.1W	0665	21.0	22.3				17.8	SE	51.9	03/01	1014.3
GDIL1	29.3N	090.0W	0664	14.6	15.7				12.2	E	32.5	03/20	1012.5
GLLN6	43.9N	076.5W	0668	-0.7					11.2	NE	29.8	13/03	1016.8
IOSN3	43.0N	070.6W	0668	1.4					15.3	NE	43.2	24/17	1013.9
KTNF1	29.8N	083.6W	0667	13.2					11.0	W	37.2	16/02	1012.4
LKWF1	26.6N	080.0W	0661	19.7	21.9				12.3	W	35.7	03/01	1013.4
LONF1	24.9N	080.9W	0666	21.3	21.5				12.9	SE	33.4	03/00	1013.1
LPOI1	48.1N	116.5W	0668	3.2	4.0				5.9	NE	26.3	13/15	
MDRM1	44.0N	068.1W	0664	0.4					13.2	NE	30.7	05/14	1013.7
MISM1	43.8N	068.9W	0659	0.5					17.4	NE	48.3	25/00	1013.6
MLRF1	25.0N	080.4W	0666	21.5	22.7				15.5	SE	48.5	03/01	1013.5
MRKA2	61.1N	146.7W	1325	1.4					9.2	NE	18.2	20/00	995.1
NWPO3	44.6N	124.1W	0031	10.2					12.4	E	23.4	28/16	1019.8
PILM4	48.2N	088.4W	0667	-0.6					12.3	NE	36.4	26/22	1016.9
POTA2	61.1N	146.7W	1335	1.5					21.5	NE	36.2	07/14	993.0
PTAC1	39.0N	123.7W	0667	10.8					12.7	SE	36.3	07/17	1010.2
PTAT2	27.8N	097.1W	0666	16.5	16.7				11.5	SE	45.5	15/02	1011.6
PTGC1	34.6N	120.7W	0665	13.0					16.3	N	47.5	06/12	1014.5
ROAM4	47.9N	089.3W	0466	-0.4	2.0				12.1	NE	32.6	27/03	1015.2
SANF1	24.5N	081.9W	0667	21.8	21.9				15.1	SE	43.4	02/22	1013.1
SAUF1	29.9N	081.3W	0666	14.8	14.8				10.5	W	26.9	03/07	1013.0
SBIO1	41.6N	082.8W	0662	1.7					8.6	NE	24.7	12/15	1014.7
SGNW3	43.8N	087.7W	0669	1.2	1.8				10.5	N	30.4	27/16	1015.0
SISW1	48.3N	122.9W	0663	8.0					15.2	SE	41.7	21/00	1005.8
SMKF1	24.6N	081.1W	0668	21.8	22.3				16.8	SE	49.4	02/23	1013.5
SPGF1	26.7N	079.0W	0664	20.9					13.8	E	38.0	23/14	1013.0
SRST2	29.7N	094.1W	0662	13.5					10.3	SE	35.7	10/20	1013.2
STDM4	47.2N	087.2W	0670	0.1					13.2	S	33.3	27/16	1015.6
SUPN6	44.5N	075.8W	0667	-1.9	0.7				8.3	NE	23.7	05/13	1017.3
TPLM2	38.9N	076.4W	0664	5.8	5.4				11.9	NW	36.5	25/18	1015.2
TTIW1	48.4N	124.7W	0665	7.9					16.9	E	37.5	21/03	1004.2
VENF1	27.1N	082.5W	0662	17.2	17.9				12.9	NW	34.8	05/01	1014.2
WPOW1	47.7N	122.4W	0665	8.3					10.0	S	34.8	09/02	1006.7
MARCH 1998													
41001	34.7N	072.6W	0736	15.5	19.1								1018.0
41002	32.3N	075.2W	0463	16.8	20.3	2.3	5.4	03/18	16.8	W	30.5	03/13	1017.1
41004	32.5N	079.1W	0725	14.4		1.5	3.8	09/08	12.3	W	31.1	03/04	1017.4
41008	31.4N	080.9W	0737	13.6	14.4	1.0	2.3	09/08	11.3	NE	28.0	12/07	1018.1
41009	28.5N	080.2W	1473	18.8	21.1	1.4	3.4	19/04	14.3	SE	30.7	09/08	1018.2
41010	28.9N	078.6W	1427	19.9	23.0	2.0	4.2	18/16	14.7	E	39.1	19/10	1017.9
42001	25.9N	089.7W	0741	20.7	23.3	1.7	4.2	17/07	16.9	SE	31.3	16/19	1017.1
42002	25.9N	093.6W	0739	20.2	22.1	1.8	5.5	09/01					1015.6
42003	25.9N	085.9W	0738		24.2	1.7	4.3	18/02	16.7	E	38.7	18/01	1016.7
42007	30.1N	088.8W	0739		16.1	0.8	3.2	17/13					1017.2
42019	27.9N	095.4W	0738	18.0	19.4	1.7	4.5	16/05	13.8	SE	32.3	08/17	1014.9
42020	26.9N	096.7W	0736	18.5	19.0	1.7	4.3	16/06	12.7	SE	34.8	08/15	1014.3
42035	29.3N	094.4W	0735	15.6	16.3	1.1	2.7	16/14	12.9	SE	31.1	08/17	1015.4
42036	28.5N	084.5W	0739	16.6	18.6	1.2	4.0	09/16	12.5	E	26.8	08/06	1018.8
42039	28.8N	086.0W	0145	18.9	22.0	2.1	4.4	09/11	17.3	SE	27.0	08/04	1013.0
42040	29.2N	088.3W	0740	15.9	17.8	1.3	3.8	17/17	12.5	SE	29.1	17/18	1018.2
44004	38.5N	070.7W	0712	8.5	11.7	2.0	6.5	10/00	13.6	NW	31.5	22/13	1017.3
44005	42.9N	068.9W	0314	3.8	3.3	2.1	6.1	22/10	16.1	SW	33.4	22/08	1014.2
44007	43.5N	070.2W	0734	1.9	2.8	1.2	4.1	22/14	12.5	S	27.2	09/20	1015.2
44008	40.5N	069.4W	0343	5.9	5.1	2.0	4.9	22/02	14.7	SW	31.1	21/18	1017.0
44009	38.5N	074.7W	0736	6.3	6.7	1.3	4.1	21/10	13.3	S	33.6	21/07	1016.4
44011	41.1N	066.6W	0726	4.0	3.7	2.2	7.4	10/19	13.9	SW	35.0	15/05	1016.3
44013	42.4N	070.7W	0731	3.5	3.5	1.0	6.1	22/11	12.3	S	29.7	22/04	1014.7
44025	40.3N	073.2W	0713	4.9	5.4	1.5	4.6	21/13	14.6	S	35.4	21/13	1016.4
45002	45.3N	086.4W	0689	0.2	3.2	1.2	4.0	09/18	16.1	N	36.3	09/16	1015.9
45005	41.7N	082.4W	0135	9.3	3.1	0.4	1.4	28/17	11.2	S	20.8	28/17	1009.9
45007	42.7N	087.0W	0194	6.5	3.5	0.7	1.5	27/01	12.2	S	25.6	26/01	1008.7
46001	56.3N	148.2W	0734	3.8	4.3	3.3	9.4	30/16	16.2	E	34.4	17/04	1004.4
46002	42.5N	130.3W	0736	9.6	10.6	3.1	6.0	12/22	13.5	S	29.3	21/07	1014.7
46003	51.9N	155.9W	0140	3.5	3.6	3.2	5.1	04/22	15.6	SE	29.5	04/18	1011.7

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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)
46005	46.1N	131.0W	0739		9.2	3.1	6.7	08/09	13.8	NW	31.7	10/09	1013.8
46006	40.9N	137.5W	0703	9.9	10.3	3.4	7.6	12/07	16.6	NW	32.6	12/11	1014.1
46011	34.9N	120.9W	0741	13.0	14.0	2.4	5.3	29/08	11.3	NW	24.9	04/02	1014.6
46013	38.2N	123.3W	0240	11.7	12.8	3.3	5.8	29/02	16.3	NW	31.9	29/00	1012.3
46014	39.2N	124.0W	0743	11.4	12.4	2.7	6.1	29/05	13.3	NW	31.7	28/22	1015.0
46022	40.7N	124.5W	0581	11.5	12.2	2.6	5.7	22/15	13.0	N	33.8	23/11	1015.5
46023	34.7N	121.0W	0733	13.0	14.1	2.5	4.7	29/12	13.6	NW	29.7	28/12	1015.6
46025	33.8N	119.1W	0711	14.6	16.0	1.5	4.0	27/00	9.3	W	29.9	26/14	1014.9
46035	56.9N	177.8W	0731	-0.6	2.1	2.7	6.5	31/09	19.3	N	41.4	31/08	998.6
46045	33.8N	118.5W	0727	14.7	16.0	1.8	3.5	27/02	7.5	W	24.1	28/19	1014.0
46054	34.3N	120.5W	0717	13.2	14.2	2.3	4.6	15/02	14.5	NW	29.7	16/01	1014.5
46059	38.0N	130.0W	0740		12.6	3.2	7.0	13/03	14.3	NW	33.4	28/01	
46060	60.6N	146.8W	1464	3.7	5.3	0.7	2.7	18/08	10.5	E	31.1	17/18	1008.2
46061	60.2N	146.8W	1478	4.0	5.5	1.7	5.6	17/23	12.6	E	37.9	18/02	1005.8
46062	35.1N	121.0W	0727	13.0	13.9	2.4	5.4	26/19	12.2	NW	27.2	26/19	1014.8
51001	23.4N	162.3W	0743	22.6	24.0	2.6	5.7	24/00	10.3	NE	22.6	21/08	1019.9
51002	17.2N	157.8W	0743	24.1	25.1	2.4	4.4	14/22	15.1	NE	25.4	25/11	1017.8
51003	19.1N	160.8W	0743	24.1	25.0	2.4	5.7	14/09	11.9	NE	22.1	25/10	1017.5
51028	0.0N	153.9W	0734	27.3	27.9	2.0	3.3	26/11	11.8	N	19.8	06/01	1010.2
91328	8.6N	149.7E	0517	27.3					8.7	NW	15.5	21/07	1012.0
91343	7.6N	155.2E	0729	27.4									1011.5
91352	6.2N	160.7E	0444	27.7									1013.3
91374	8.7N	171.2E	0738	27.1					6.5	NE	12.9	21/10	1012.6
91377	6.1N	172.1E	0493	28.0									1014.5
91411	8.3N	137.5E	0303	27.9									1012.3
91442	4.6N	168.7E	0730	27.9					12.9	NE	23.8	22/18	1011.9
ABAN6	44.3N	075.9W	0029	17.8	3.4				5.2	S	11.1	30/18	1006.2
ALSN6	40.5N	073.8W	0738	5.4		1.0	4.0	21/15	18.0	S	43.3	09/15	1016.3
BLIA2	60.8N	146.9W	1471	2.7					10.2	NE	27.6	18/10	1008.9
BURL1	28.9N	089.4W	0729	14.8					14.7	SE	38.7	17/07	1017.1
BUZM3	41.4N	071.0W	0738	3.6	6.9	1.2	4.4	10/10	16.8	SW	38.3	12/22	1016.8
CARO3	43.3N	124.4W	0734	9.7					9.7	S	35.5	22/01	1015.6
CDRF1	29.1N	083.0W	0738	15.8					8.8	E	21.9	08/18	1018.6
CHLV2	36.9N	075.7W	0739	8.7	8.0	0.9	2.0	21/07	15.2	S	34.0	09/11	1017.7
CLKN7	34.6N	076.5W	0737	11.7					12.6	SW	35.5	19/15	1019.4
CSBF1	29.7N	085.4W	0737	15.1					8.9	E	28.9	07/20	1018.9
DBLN6	42.5N	079.4W	0733	3.4					13.8	SW	43.7	14/17	1015.3
DESW1	47.7N	124.5W	0730	8.4					11.3	SE	47.1	24/02	1014.0
DISW3	47.1N	090.7W	0734	-1.4					13.2	NE	37.0	30/04	1017.6
DPIA1	30.3N	088.1W	0741	14.4	15.4				13.2	SE	39.1	17/12	1018.2
DRYF1	24.6N	082.9W	0735	20.4	20.3				13.1	N	28.8	18/11	1016.5
DSLN7	35.2N	075.3W	0741	11.7		1.3	2.9	03/19	17.0	SW	44.7	19/21	1017.4
DUCN7	36.2N	075.8W	0720	10.6		0.7	1.5	11/12	12.3	NE	34.7	09/12	1019.2
FBIS1	32.7N	079.9W	0737	12.8					8.9	W	26.2	17/05	1018.7
FFIA2	57.3N	133.6W	0737	4.0					12.4	N	29.3	29/23	
FPSN7	33.5N	077.6W	0733	13.7		1.5	4.5	19/18	15.1	W	36.1	09/23	1017.0
FWYF1	25.6N	080.1W	0736	21.1	23.4				18.1	E	32.8	09/13	1018.6
GDIL1	29.3N	090.0W	0737	15.4	17.6				11.9	SE	28.9	09/02	1017.6
GLLN6	43.9N	076.5W	0734	1.0					13.2	NE	43.7	28/23	1015.3
IOSN3	43.0N	070.6W	0740	3.1					15.8	S	39.6	22/06	1014.8
KTNF1	29.8N	083.6W	0742	14.8					9.3	W	29.3	08/17	1018.2
LKWF1	26.6N	080.0W	0741	19.9	22.8				13.0	NW	27.7	18/10	1018.3
LONF1	24.9N	080.9W	0734	21.2	22.0				13.2	N	30.3	09/14	1017.3
LPOI1	48.1N	116.5W	0735	4.1	4.3				5.1	N	21.9	26/10	
MDRM1	44.0N	068.1W	0730	1.5									1014.8
MISM1	43.8N	068.9W	0727	1.5					18.2	SW	43.3	10/04	1014.5
MLRF1	25.0N	080.4W	0737	21.5	23.4				16.5	E	27.9	18/18	1017.7
MRKA2	61.1N	146.7W	1472	1.3					7.7	NE	17.8	11/14	1010.5
NWPO3	44.6N	124.1W	0737	9.1					9.0	E	29.1	23/16	1015.7
PILM4	48.2N	088.4W	0733	-2.4					12.3	NE	35.0	10/01	1019.0
POTA2	61.1N	146.7W	1476	1.3					17.2	NE	31.5	11/16	1008.7
PTAC1	39.0N	123.7W	0733	10.8					11.2	N	28.7	29/00	1015.1
PTAT2	27.8N	097.1W	0732	17.2	17.8				13.7	SE	33.3	31/09	1015.0
PTGC1	34.6N	120.7W	0729	12.8					14.7	N	33.5	06/15	1016.0
ROAM4	47.9N	089.3W	0537	-2.3	2.1				12.9	NE	32.9	30/05	1018.0
SANF1	24.5N	081.9W	0739	21.5	22.8				16.5	E	27.5	26/01	1017.3
SAUF1	29.9N	081.3W	0734	15.4	16.7				9.1	SE	32.9	09/04	1018.9
SBIO1	41.6N	082.8W	0729	3.6					13.9	NW	38.6	14/11	1014.9
SGNW3	43.8N	087.7W	0739	0.6	3.1				14.5	N	41.0	09/15	1011.7
SISW1	48.3N	122.9W	0734	8.2					10.3	SE	32.9	26/16	1014.9
SMKF1	24.6N	081.1W	0741	21.6	23.3				18.2	E	36.0	18/17	1017.7
SPGF1	26.7N	079.0W	0737	20.8					12.7	E	26.9	20/07	1017.7
SRST2	29.7N	094.1W	0722	14.8					11.8	SE	28.9	29/23	1017.2
STDM4	47.2N	087.2W	0735	-1.2					15.6	N	38.8	09/12	1016.7
SUPN6	44.5N	075.8W	0734	0.7	2.1				8.7	SW	26.9	30/16	1015.5
TPLM2	38.9N	076.4W	0710	7.1	6.5				12.4	S	29.6	10/22	1017.9
TTIW1	48.4N	124.7W	0732	8.0					12.1	E	48.6	24/02	1014.6
VENF1	27.1N	082.5W	0738	17.9	19.6				11.3	E	27.7	09/04	1019.3
WPOW1	47.7N	122.4W	0711	8.2					8.8	S	24.0	26/09	1015.2

Meteorological Services—Observations

U.S. Port Meteorological Officers

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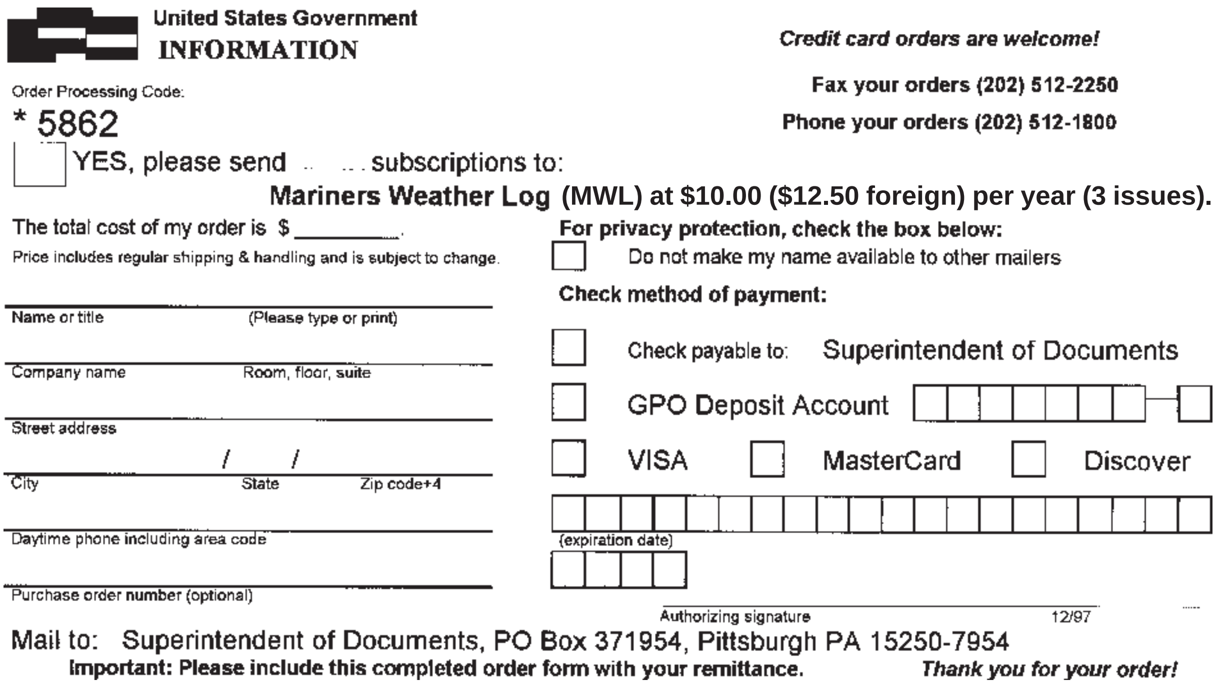

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