# Mariners WEATHER LOG

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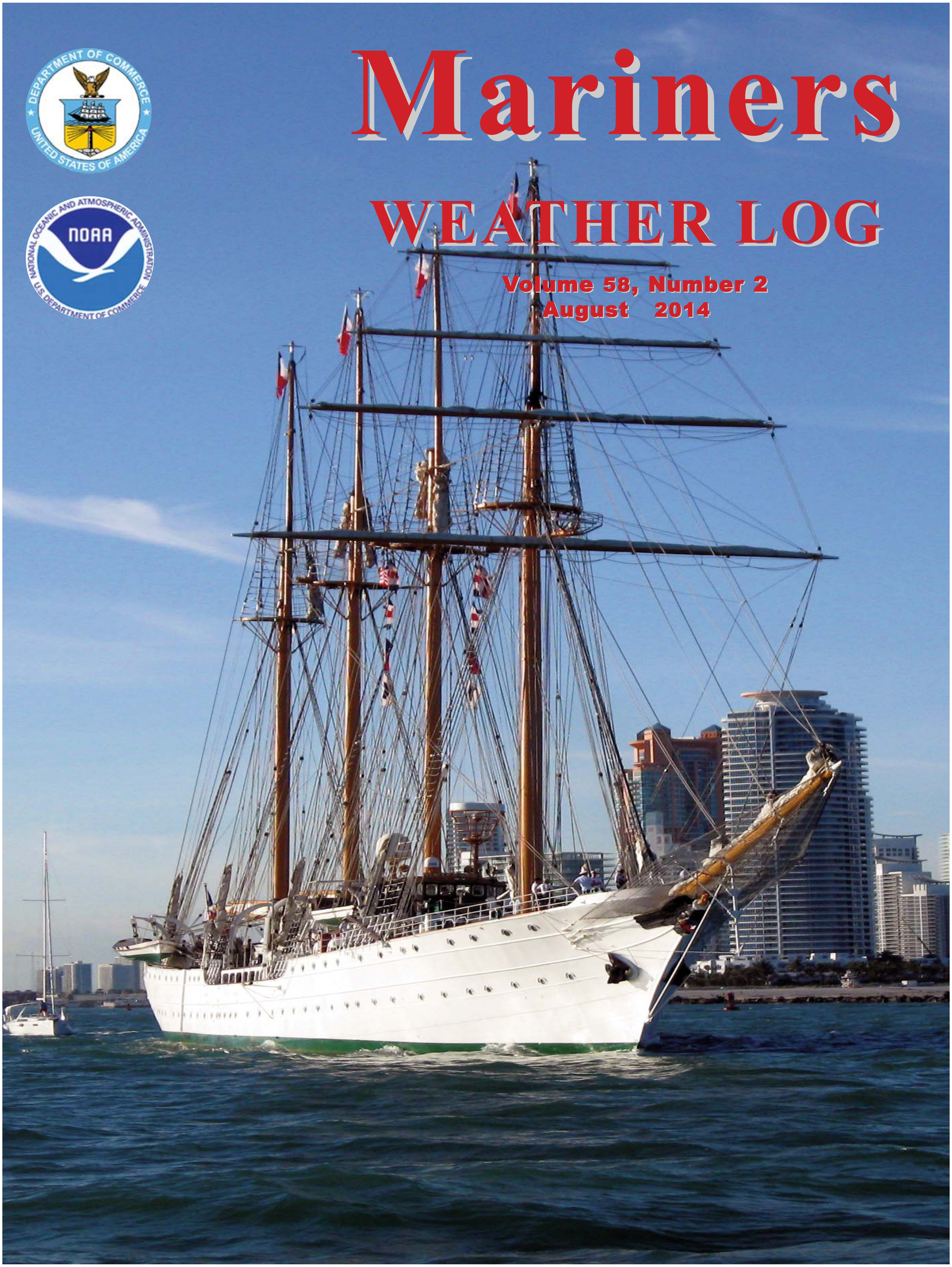
August 2014



Mariners Weather Log

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# From the Editor

Greetings! Welcome to another edition of the Mariners Weather Log.

We are smack dab in the middle of hurricane season and our first named storm of the season, Arthur, occurred on July 1st. Tropical Storm Arthur reached hurricane strength on July 3rd off the coast of South Carolina making for a very soggy 4th of July Independence Day celebration. Hurricane Arthur has become the first hurricane to make landfall in the continental U.S. since hurricane Isaac struck Louisiana on August 28/29th in 2012. With this, I want to remind you that your marine weather observations really do matter. The data we receive from you gets ingested directly into the models, thus you give the National Weather Service a much better confidence in forecasts and analysis…thank you in advance and we count on your participation. For a full complement of hurricane information you can always go to the **National Hurricane Center**. For a full explanation on how the Climate Prediction Center in collaboration with the hurricane experts from the National Hurricane Center and the Hurricane Research Division produce their seasonal outlook you can go to: http://www.cpc.ncep.noaa.gov/products/outlooks/hurricane.shtml.

The United States, Port of Miami Florida, was graced with a visit from the Chilean Navy that arrived on the tall ship **ESMERALDA**. Photographs of the Chilean tall ship **ESMERALDA** were taken by our Miami PMO Dave Dellinger. Dave had the privilege of visiting this magnificent ship and providing them with support, as they are part of the Voluntary Observing Ship program. This ship is amazing with the many sails on the four-masted barquentine tall ship. Chile has proven to be very proactive with their eager participation in the Ship Observations Team and the Voluntary Observing Ship Program. Chile will host the International Port Meteorological Officer Workshop in August of 2015; we look forward to this collaboration.

We have some great articles this issue and I hope you find them informative and interesting. As always, I invite you to send in articles and photographs to share with your shipmates and friends, and I am always open to suggestions. Be safe and remember…only YOU know the weather. Got Weather? Report it!!!

Cheers!

Paula

**On the Cover:** Chilean Navy tall ship **ESMERALDA** at the Port of Miami.

# Mariners Weather Log

**Volume. 58, Number 2, August 2014**

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# The White Lady, La Dama Blanca

*Paula Rychtar*
*Editorial Supervisor*
*Mariners Weather Log*

**ESMERALDA under sail.**
**Courtesy of the Armada de Chile.**

The Chilean ship **ESMERALDA** is a sight to behold. With the four-masted barquentine ship which has 21 sails with a total sail area of 30,829 square feet, there is little wonder why this beautiful ship got the nickname of The White Lady.

Construction on this ship began in Cadiz, Spain in 1946 and she was intended to become Spain's national training ship, but as fate would have it, that did not come to pass. The shipyard in Spain suffered catastrophic explosions during the ship's construction in 1947. This event not only damaged the ship but put the entire shipyard under the threat of bankruptcy. In 1950 Chile and Spain began negotiations; Spain offered to repay debts incurred to Chile as a result of the Spanish Civil War in the form of manufactured products. This included the not yet completed **ESMERALDA**. Chile accepted the offer and the ownership of the **ESMERALDA** was transferred to Chile in 1951.

In June of 1954, the **ESMERALDA** was complete and the society of Cadiz, Spain delivered the ship to the Chilean Representative, Ambassador to Spain, Oscar Salas Letelier. The ship sailed from Cadiz under the command of Captain Horacio CornejoTagle, bound for Las Plamas in Gran Canaria. From there the ship traveled to New Orleans Louisiana, where a distilling plant was installed on the vessel. After New Orleans, the **ESMERALDA** set sail for her final destination. **ESMERALDA** arrived at Valparaiso, Chile on the first of September where the ship was met with much celebration.

Today, the mission of the **ESMERALDA** is to be the training ship for the Chilean Navy. Though ships today in this modern age are propelled with the latest technology and equipment, Chile has chosen a sailboat to enrich the training of its officers. This ship in all its magnificent glory offers an illustrious legacy, traditions, and experiences that only a sailboat such as the **ESMERALDA** can offer. Sailing on such a vessel gives the officers and midshipmen the opportunity to really know the sea, use the tools of their trade in hands on environment offering them the opportunity to experience the craft of naval navigation.

Each year the **ESMERALDA** sets sail for a training cruise with the midshipmen and top seaman from the training school year. With this, they are given the opportunity to demonstrate their skills and dedication towards assuming the responsibilities of being the Representatives of Chile's Naval Service. The **ESMERALDA** sails around the world spreading the warmth and color, a small piece of Chile, giving everyone a taste and insight to their country. I cannot imagine the majesty of this ship as it enters the port with all the officers lining the deck and manning the sails; it must be absolutely spectacular.

**Above: *ESMERALDA* Dockside, Port of Miami, photo by *Dave Dellinger,* VOS PMO Miami.**

In line with Chile's dedication and stewardship for the environment, the Chile Navy has formally agreed to participate in the World Meteorological Organization (WMO) Ship Observations Team / Voluntary Observing Ship Scheme and has recruited their ship the **ESMERALDA** into this program. On her recent worldwide cruise, the **ESMERALDA** sailed from Cozumel, Mexico to the port of Miami, Florida.

LCDR. Alejandro de la Maza of the Valparaiso Meteorological Center (National VOS Focal Point) contacted the U.S. VOS Program and requested a visit to the ship by a local VOS Port Meteorological Officer. Our Miami PMO, Dave Dellinger was more than happy to assist. Dave was able to provide VOS supplies and assist the crew with National Weather Service marine products / forecasts and charts. Dave was also able to take great photos for this article! The **ESMERALDA** sent marine shipboard observations throughout their cruise in efforts to support the VOS scheme.

**From left to right: Corporal Miguel Pulgar, the Met NCO., Dave Dellinger, and Lieutenant Commander Patricio Acevedo, the ship's Operations Officer.**

Looking to the future, in August of 2015, Chile will be sponsoring the Voluntary Observing Ship Scheme / International Port Meteorological Officer Workshop in Valparaiso.

*ESMERALDA*, Port of Miami, photos by *Dave Dellinger,* VOS PMO Miami.

The Valparaiso Meteorological Center and the Chilean Navy are very dedicated to provide support and engage in participation of the Ship Observations Team. I look forward to visiting our friends and colleagues in August and hopefully they will offer up a ride on this beautiful ship.

Chile has two other vessels participating; the Navy Oceanographic Ship **CABO DE HORNOS** which is operating at Easter Island and their transport vessel **AQUILES** which travels to Antarctica.


## Tour the ESMERALDA!

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# The National Weather Service's Experimental National Marine Weather Web Portal

*David S. Soroka*
*Marine and coastal weather services branch*
*Marine Program Manager*

The National Weather Service's (NWS) Experimental National Marine Weather Web Portal: preview.weather.gov/mwp provides observations, forecasts, short and long-fuse warnings and a host of other pertinent meteorological data for mariners on an ESRI / Google based interactive website interface for the entire United States including OCONUS areas.

Before the development of this portal, only region-specific information on marine and coastal conditions had been collected by, stored and disseminated from a wide range of government and academic institutions which included a variety of information types and protocols.

The purpose of this experimental website is to provide our customers and partners a comprehensive web based portal to access forecasts, coastal ocean observations and monitoring activities in one website. The multitude of layers available within the portal will provide a one-stop shop for all weather related needs for mariners, near shore enthusiasts and coastal managers.

Gridded forecast and model data, overlays including sea surface temperatures and nautical charts will provide users the required situational awareness to assist them in making the best decisions possible. The format of the portal will allow for the integration of dynamic data sets that will complement the standard suite of data available from routine NWS products and services and present the data in both graphical and text format.

In addition, the flexible nature of the portal will allow the developer to add further information as the NWS expands its decision support services in the coastal arena to include more refined information and both increased time and spatial resolution.

The portal supports NOAA's Mission Goals of Serving Society's Needs for Weather and Water Information and Supporting the Nation's Commerce with Information for Safe, Efficient, and Environmentally Sound Transportation and fully integrates with the Weather Ready Nation initiative.

# Shipwreck: LEECLIFFE HALL SANK 50 YEARS AGO

*By Skip Gillham*


**Photo: LEECHLIFFE HALL shown transiting the Welland Canal, image courtesy of Jim Kidd.**

The three year old Canadian bulk carrier **LEECLIFFE HALL** was lost a half-century ago. It went down in the St. Lawrence River, about 65 miles east of Quebec City, on September 5, 1964. The inbound freighter had loaded a cargo of iron ore at Sept-Iles, Quebec, and was bound for Lackawanna, New York, when it was struck at #1 hold by the Greek vessel **APOLLONIA**. Foggy conditions prevailed at the time.

With the opening of the St. Lawrence Seaway on April 25, 1959, the nature of Great Lakes shipping changed. Larger ships could now enter and exit the inland seas and new additions to the Canadian fleet were regular occurrences.

While most of this new tonnage was built in Canada, the **LEECLIFFE HALL** was one of the exceptions. It was constructed by Fairfield Shipbuilding and Engineering Ltd. and launched at Port Glasgow, Scotland, on May 18, 1961.

To that date, the 730 foot long carrier was the largest dry cargo ship built in the United Kingdom. The $5 million **LEECLIFFE HALL** sailed for Canada under its own power and arrived at Quebec City on August 23, 1961. After some hull strengthening, added for the transatlantic journey, was removed, the ship was commissioned at Montreal on September 22 and set sail on its maiden voyage for the Hall Corporation of Canada three days later.

**LEECLIFFE HALL** brought a record cargo of 1,030,979 bushels of mixed grain to Quebec City on its first trip and soon settled into regular service carrying iron ore to steel company docks around the Great Lakes. Eastbound, the holds were filled with various grains, much for overseas export, for the run down the lakes and back to the St. Lawrence.

This routine carried on for the rest of the 1961 season, all of 1962-1963 and up until the time of its loss fifty years ago. It had been a profitable investment for the Hall fleet.


**Photo: APOLLONIA – Snell Lock – 1969, image courtesy Daniel C. McCormick**

The owner, celebrating his 40th birthday the previous day, and his family were on board, with guests, for a pleasure cruise at the time of the accident.

After the two ships collided, there was a desperate effort to beach the badly wounded **LEECLIFFE HALL** near St-Joseph-de-la-Rive, Quebec. Passengers and crew took to the lifeboats and the tug Foundation Vibert arrived at the scene to take Leecliffe Hall in tow in an effort to reach safety. The vessel had remained afloat for four hours so three sailors decided to return to the ship to pick up some personal belongings. They were lost when **LEECLIFFE HALL** suddenly sank about seven miles from the crash site. Those in the lifeboats were picked up by a passing yacht, plus two small river freighters and taken to shore.

Salvage was considered, but the extent of the damage was significant. It was decided to dynamite the hull to clear the area of a hazard to navigation and this was carried out in the summer of 1966.

An inquiry found both Masters and Pilots on board at fault for going too fast for the conditions and being off course. All had their certificates suspended for a period of months.

Like **LEECLIFFE HALL**, **APOLLONIA**, the Greek freighter had been built overseas in 1961. It was constructed at Aioi, Japan, and was headed to the Atlantic at the time of the collision.

Despite massive bow damage **APOLLONIA** remained afloat. The ship was repaired at Levis, Quebec, and returned to service. It continued in saltwater trading until being scrapped at Shanghai, China, under a third name of **MAYFAIR** in 1985.

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# On the Genesis of Extreme Waves during Hurricane Ivan

*Professor S. A. Hsu, Louisiana State University,*
*email: sahsu@lsu.edu*

About a decade ago in September 2004, Hurricane Ivan (**Figure 1**) produced an extreme significant wave height (Hs) greater than 21 m (69 ft) (Wang et al., 2005). While there were at least 5 National Data Buoy Center (NDBC) Buoys in the vicinity of Ivan track (**Figure 2**), only station 42040 measured the maximum significant wave height (Hsmax) of approximately 16m. The purpose of this brief note is to provide an explanation of the existence of Hsmax = 21m. According to Hurricane Ivan Advisory number 54A issued by the National Hurricane Center (NHC) at 23Z on September 15 (See **Figure 2** at 16/00Z, which was close to Buoy 42040), the minimum sea-level pressure = 931 hPa, maximum sustained wind = 135 mph (60 m/s), and tropical storm force wind extend up to 290 miles (467 km).


**Figure 1. Hurricane Ivan over the northern Gulf of Mexico on September 15, 2004, (http://catalog.data.gov/dataset/hurricane-ivan-poster-september-15-2004)**

Now, substituting these values into the equation as follows (for derivation, see Hsu, 2014, Equation (6)):

$$
\begin{aligned}
\mathbf{Hsmax} &= \mathbf{0.016 * Vmax * (R34kt)\ 0.5} \\
&= \mathbf{0.016 * 60 * (467) 0.5} \\
&= \mathbf{21\ m}
\end{aligned}
$$

This result is consistent with that suggested by Wang et al. (2005). It is concluded that although there are wave measurements by NDBC, among others, it is only fortuitous to measure the Hsmax. However, on the basis of NHC's advisory once every 6 hours (or more frequent as necessary), one can estimate the potential Hsmax as presented above. In addition, numerical simulations similar to Hurricane Katrina (see Wang and Oey, 2008 ) can be employed.


**Figure 2. Ivan's track over the Gulf of Mexico and its maximum significant wave heights measured at 5 NDBC buoys. For the entire track history (see www.nhc.noaa.gov).**

## References:


Hsu, S. A. (2014), Practical Formulas for estimating winds and waves during a tropical cyclone, Mariners Weather Log, Vol.58, No.1, pp.24-28. Available Online at www.vos.noaa.gov/MWL/201404/MWL_0414.pdf.

Wang, D.W., D.A. Mitchell, W.J. Teague, E. Jarosz and M.S. Hulbert (2005), Extreme waves under Hurricane Ivan, Science, 309, 896.

Wang, D.-P., and L.-Y. Oey (2008), Hindcast of waves and currents in Hurricane Katrina, Bulletin of American Meteorological Society, 89(4), 487-495.

# Hail and Farewell!

*Paula Rychtar*
*Editorial Supervisor*
*Mariners Weather Log*

It is with a bit of sadness that we will be saying good-bye to John Wasserman the Program Manager for the U.S. VOS program. John was such an asset to VOS, he will be truly missed. With other irons in the fire, John has decided to take another position within the National Data Buoy Center working with DART Buoys; a much needed position to be filled here at the NDBC and one that should be a great fit for John. As we say farewell to John and good luck in your new position, we will say HAIL to VOS's new program manager, Steve Pritchett. Steve brings a lot of experience with him as he has been involved for over the past 20 years at NWS head-quarters in managing and working in a number of national programs, such as VOS. This comes after nearly 20 years of working in the field. So it is with great pleasure that I introduce to you and welcome Steve to the Voluntary Observing Ship Program family.

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**Steve Pritchett, VOS Program Manager**

# Mean Circulation Highlights and Climate Anomalies

## January through April 2014

*Anthony Artusa, Meteorologist, Operations Branch,*
*Climate Prediction Center NCEP/NWS/NOAA*

***All anomalies reflect departures from the 1981-2010 base period.***

### January-February 2014

The mid-tropospheric circulation during January featured a persistent zonal wave 2 pattern. This pattern included a strong ridge in western North America and another over most of Greenland and Scandinavia. It also included a moderately strong trough which extended from central Asia to the eastern North Pacific, and another extending from the eastern contiguous U.S. across far southern Greenland to Europe **Figure 1**. The sea level pressure (SLP) pattern broadly resembles the 500 hPa pattern, with several key features being the Aleutian and Icelandic Lows **Figure 2**.

The 500-hPa circulation during February featured above average heights over much of the western North Pacific, the central North Atlantic, and western Russia, and below average heights across much of North America, the high latitudes of the North Atlantic, and central Russia **Figure 3**. As was the case with January, the February SLP pattern broadly resembled its corresponding 500-hPa pattern, with an unusually deep Icelandic low again being a major feature of the monthly climate **Figure 4**.

According to the National Climatic Data Center, many locations throughout the Midwest experienced their top 10 coldest winter, while Detroit had its snowiest winter on record. Persistent cold during winter caused 91 percent of the Great Lakes to be frozen by early March, the second largest ice cover on record. In contrast, California had its warmest and third driest winter on record, very low snowpack, and large precipitation deficits. **Reference 1**.

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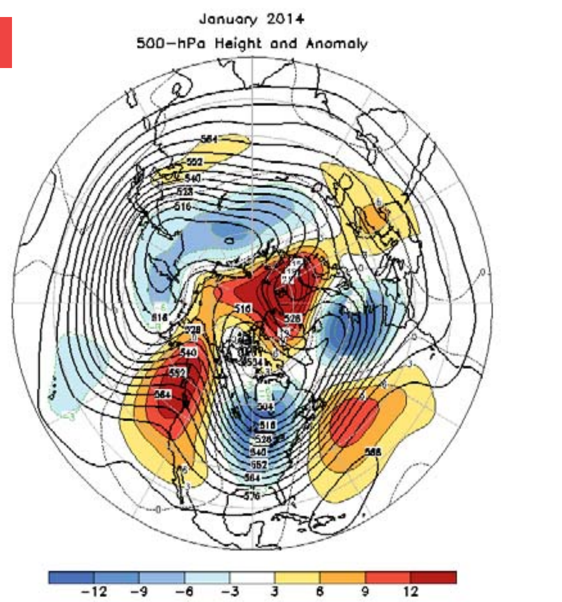


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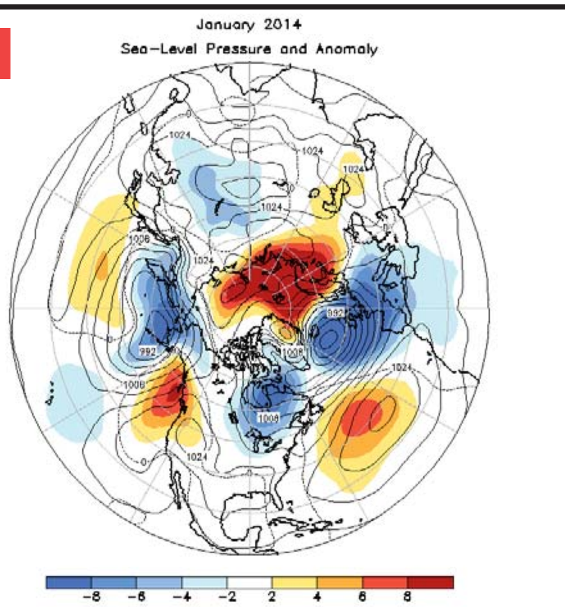


Caption for 500 hPa Heights and Anomalies: Figures 1,3,5,7
Northern Hemisphere mean and anomalous 500-hPa geopotential height (CDAS/Reanalysis). Mean heights are denoted by solid contours drawn at an interval of 6 dam. Anomaly contour interval is indicated by shading. Anomalies are calculated as departures from the 1981-2010 base period monthly means.

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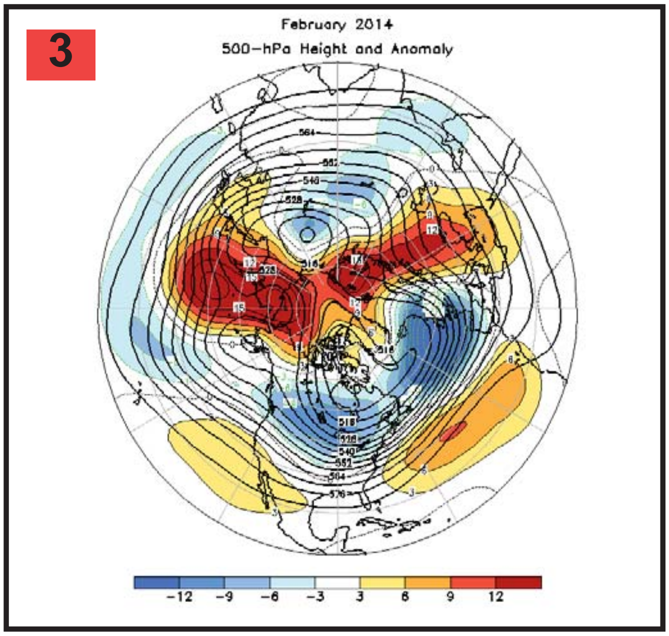


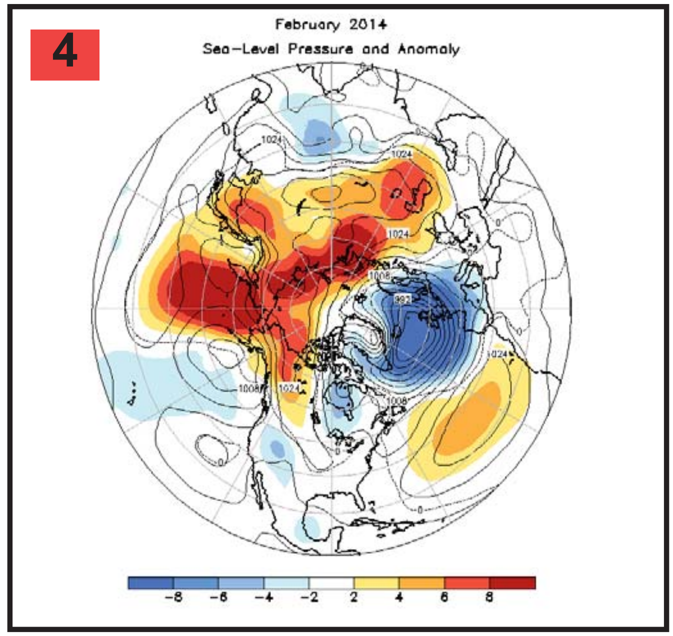


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## The Tropics

Sea surface temperatures (SST) remained near average across the central and eastern equatorial Pacific in January and below average across the eastern Pacific in February. The latest monthly Nino index for the Nino 3.4 region was -0.5C (January) and -0.6C (February). The depth of the oceanic thermocline (measured by the depth of the 20C isotherm) remained close to average across the central and east-central equatorial Pacific (January), and slightly below average across the eastern Pacific (February).

Equatorial low level easterly trade winds remained near average across the central and eastern equatorial Pacific in both January and February, and below average over the western Pacific (February). Tropical convection remained enhanced over the western Pacific, and suppressed over the central equatorial Pacific and western Indonesia (February). Collectively, these oceanic and atmospheric anomalies reflect ongoing ENSO-neutral conditions.

## March - April 2014

The 500-hPa circulation pattern during March featured below-average heights over eastern Canada, the high latitudes of the North Atlantic, and northwestern Russia, and above-average heights over the central North Atlantic, Europe, eastern Asia, and northern Alaska and the Beaufort Sea **Figure 5**. The SLP and Anomaly map for March depicts abnormally low sea level pressure in northwestern Russia and much of Greenland/Iceland **Figure 6**.

The month of April was characterized by below average 500-hPa heights over the central North Pacific, central Canada, and the polar region, and above average heights over Europe and eastern Asia **Figure 7**. The most pronounced features on the SLP and Anomaly map included abnormally low SLP over much of far northern Russia and the Asian side of the Arctic Ocean, the northern North Pacific and Bering Sea, and middle and high latitudes of the North Atlantic **Figure 8**.

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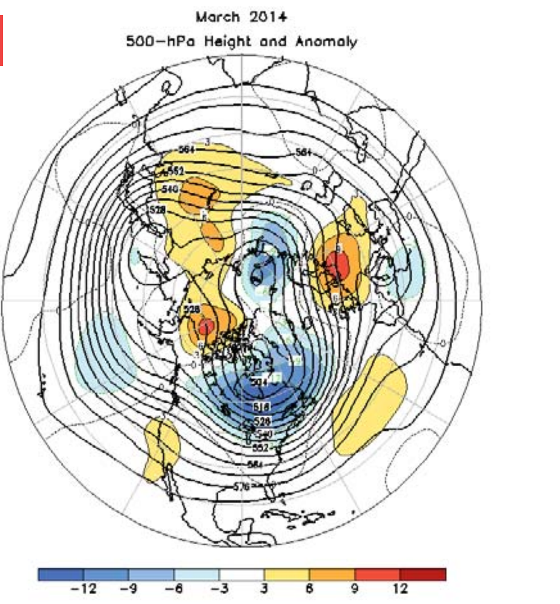


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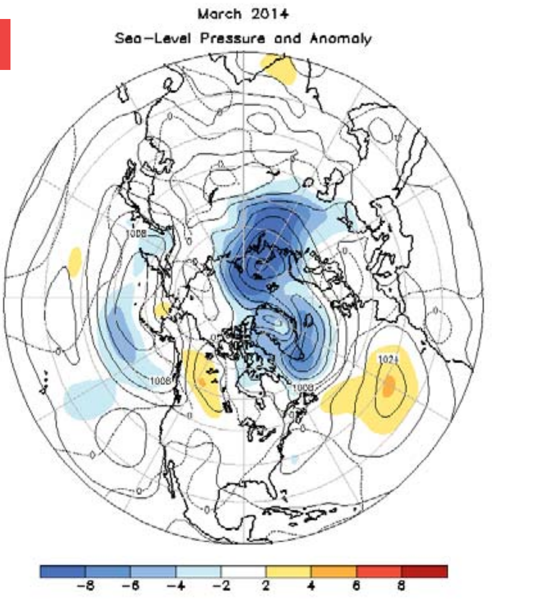


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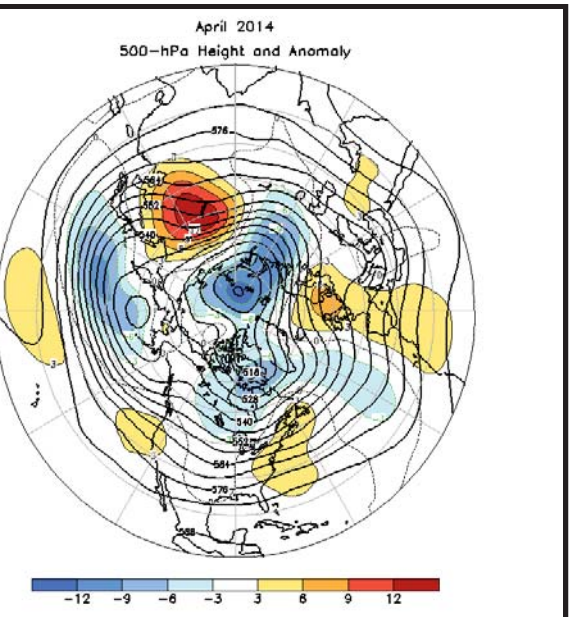


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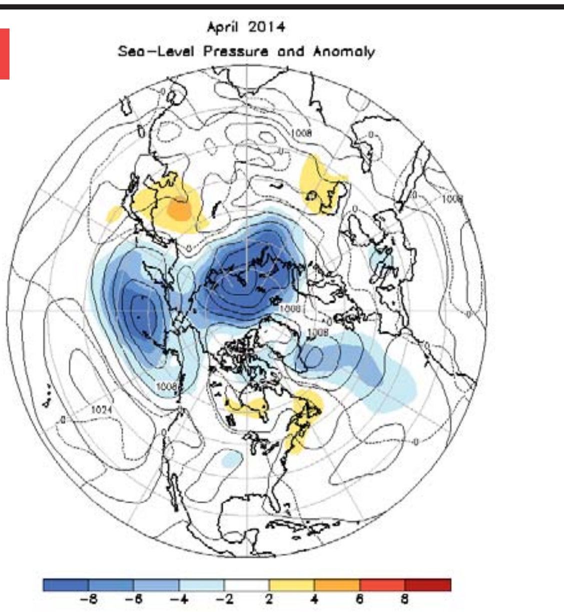


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According to the National Climatic Data Center, a selection of significant weather related events for the March-April period included the coldest March on record for Vermont (5C below average), nearly two-thirds of the Great Lakes remained frozen by early April (impacting commercial shipping), and rains in the Pacific Northwest helped trigger a landslide near Oso, WA, causing at least 30 fatalities **Reference 2**. Alaska was warm and dry in April, contributing to the 6th smallest April snow cover extent on record for the state **Reference 3**.

## The Tropics

ENSO-neutral conditions persisted through March and April 2014. Sea surface temperatures (SST) were below average across the eastern equatorial Pacific and above average over the central Pacific (March), and above average across much of the eastern and central equatorial Pacific (April). The latest monthly Nino indices for the Nino 3.4 region were -0.2C (March) and +0.2C (April). A down welling oceanic Kelvin wave produced a significant subsurface warming across the central and eastern equatorial Pacific during March and April, and the depth of the oceanic thermocline (20C isotherm) was above average across the central and eastern equatorial Pacific. Equatorial low-level easterly trade winds were below average across the Pacific (March) and near-average (April). Tropical convection remained enhanced over the central equatorial Pacific and suppressed across Indonesia and the western Pacific (March), and enhanced over the west-central equatorial Pacific (April).

## References:

1. http://www.ncdc.noaa.gov/sotc/national/2014/2 (February)
2. http://www.ncdc.noaa.gov/sotc/national/2014/3 (March)
3. http://www.ncdc.noaa.gov/sotc/national/2014/4 (April)

Much of the information used in this article originates from the Climate Diagnostics Bulletin archive:
(http://www.cpc.ncep.noaa.gov/products/CDB/CDB_Archive_html/CDB_archive.shtml)

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# Marine Weather Review – North Atlantic Area

## January to April 2014

*By George P. Bancroft*
*Ocean Forecast Branch, Ocean Prediction Center, College Park, MD*
*NOAA National Center for Environmental Prediction*

### Introduction

The winter months of January and February were a continuation of December 2013's active pattern as a series of deep cyclones developed while tracking northeast across the North Atlantic toward the British Isles and Iceland, with one very deep low turning north into the Davis Strait, early in January. During late February and especially in March and April, blocking high pressure became more frequent over the North Atlantic or at high latitudes, causing some of the cyclones to initially strengthen rapidly over the southwestern waters, off the U.S. East Coast, before moving out over the North Atlantic where some stalled or moved erratically. During the four month period twenty-three lows developed hurricane force winds detected by satellite, conventional surface observations, or model data. Seven of these occurred in January, followed by ten in February, five in March and one in April. According to a study based on QuikSCAT winds (VonAhn and Sienkiewicz, 2005), the peak frequency of such cyclones has been found to occur in January. Eight cyclones developed central pressures below 950 hPa, including three in January with central pressures in the 930s. There was no tropical activity to report during this period.

### Significant Events of the Period

#### North Atlantic Storm, January 1-3:

The first and weaker of two hurricane force cyclones that followed similar tracks during the first week of January originated near the U.S. mid-Atlantic coast on December 3st and intensified into a storm over the central North Atlantic waters on the afternoon of January 1st. The cyclone developed hurricane force winds the following night and then a lowest central pressure of 951 hPa west of Ireland near 54N 13W at 0000 UTC on the 3rd. Buoy 62023 (51.4N 7.9W) reported southwest winds of 58 kts with gusts to 71 kts and 8.5 m seas (28 ft) at 1500 UTC on the 3rd, and one hour later a gust of 76 kts and 10.0 m seas (33 ft). The **SHIP** BAREU12 (51N 30W) reported northwest winds of 50 kts and 5.2 m seas (17 ft) at 1800 UTC on the 2nd. The **Maersk Ohio** (KABP) encountered west winds of 45 kts and 7.6 m seas (25 ft) near 52N 43W one hour earlier. The cyclone then weakened to a gale while passing north of the British Isles late on the 3rd. The second part of **Figure 1** shows the weakening low passing east of Iceland on the 4th.

#### North Atlantic Storm, January 3-6:

The development of the deepest cyclone of the period is depicted in **Figure 1**. The complex area of low pressure near the U.S. East Coast consolidated into a hurricane force low with a central pressure as low as 933 hPa over the central North Atlantic over a two day period. The period of most rapid intensification included a drop of 42 hPa in the 24 hour period ending at 1200 UTC January 4th. This is well above the 24 hPa needed for a "bomb" at 60N (Sanders and Gyakum, 1980). **Figure 2** is an infrared satellite image of the storm taken 0715 UTC on the 5th revealing an expansive mature cloud pattern with broad cold topped frontal bands. The central pressure was only beginning to increase by this time. The image also includes two satellite altimeter passes cutting across the south side of the cyclone, revealing seas as high as 18 m (59 ft).

| OBSERVATION | POSITION | DATE/TIME(UTC) | WIND | SEAS(m/ft) |
|---|---|---|---|---|
| BAREU12 (WDD6126) | 53N 42W | 05/0600 | NW 70 | |
| **CL Belgium** (VRVQ9) | 55N 17W | 05/0600 | SE 55 | |
| **Aurora** (ZCDW9) | 47N 6W | 05/1700 | SW 50 | 7.3/24 |
| **Hajai Express** (A8ID9) | 49N 5W | 06/1800 | SW 55 | |
| **Hibernia** (VEP717) | 46.7N 48.7W | 05/0600 | NW 50 | 9.8/32 |
| Buoy 62081 | 51.7N 10.9W | 06/0700 | SW 35 | 13.4/44 |
| Buoy 62023 | 51.4N 7.9W | 06/0800 | SW 50 | 10.7/35 |
| Buoy 62163 | 47.5N 8W | 06/1300 | SW 30 | 12.8/42 |

**Table 1. Selected ship, buoy and platform observations taken during the North Atlantic storm of January 3-6, 2014.**

The scatterometer image in Figure 3 shows a large swath of 50 kts to as high as 80 kts winds on the southwest side of the cyclone, which was centered near the northeast corner of the image at this time and was approaching maximum intensity. Some notable surface observations taken in this storm are listed in Table 1. Hurricane force winds with this system persisted into the night of the 5th. Winds weakened to gale force as the center passed northwest of the British Isles on the afternoon of the 8th and to below gale force as the center passed east of Iceland on the 8th.

**Northwestern Atlantic Storm, January 6-8:**

A primary strong low pressure system tracked northward inland over Quebec as a secondary low formed on the "triple point" where the occluded front, cold and warm fronts meet, as shown in Figure 4. The second part of Figure 4 shows the secondary low at maximum intensity as the primary low to the southwest dissipates. An OSCAT scatterometer pass (Figure 5) returned winds as high as 75 kts in the southeast flow between the occluded front and the southwest Greenland coast, in an area where there is little ship data. To the south, **Hibernia Platform** (VEP717, 46.7N 48.7W) reported south winds of 60 kts at 1500 UTC on the 7th (anemometer height 139 m). Buoy 44139 (44.2N 57.1W) at 0200 UTC on the 8th reported west winds of 37 kts with gusts to 47 kts and 6.0 m seas (20 ft), and seven hours later seas of 9.0 m (30 ft). The cyclone subsequently weakened to a gale by early on the 8th while making a cyclonic loop and then moved north through the Davis Strait on the 9th.

**North Atlantic Storm, January 10-13:**

Low pressure formed about 300 nm southeast of Cape Race 0000 UTC January 10th and, after initially deepening by 32 hPa in the first 24 hour period, continued with more gradual strengthening over the central waters where it developed hurricane force winds on the 11th and early on the 12th. An ASCAT pass from 1227 UTC on the 12th revealed a swath of west winds 50 to 60 kts on the south side of the cyclone, which passed near 57N 24W with a lowest central pressure of 959 hPa near this time. The **Atlantic Companion** (SKPE) reported northwest winds of 55 kts near 56N 34W at 0600 UTC on the 12th. The cyclone weakened late on the 12th and the 13th before becoming absorbed by another low south of Iceland late on the 13th.

**North Atlantic Storm, January 11-14:**

Another cyclone followed close behind the preceding event, tracking across southern Quebec and Labrador late on January 11th and the 12th with central pressure already in the upper 970  hPa and storm force winds. It passed offshore on the 13th and briefly developed hurricane force winds late on the 13th, when an ASCAT (METOP-B) pass from 2114 UTC on the 13th revealed northeast winds 50 to 60 kts on the north side as the center passed south of Greenland. The cyclone center passed near 57N 26W with a lowest central pressure of 963 hPa at 1800 UTC on the 14th before tracking east-southeast toward Great Britain, where it dissipated late on the 16th.

**North Atlantic Storm, January 22-26:**

Low pressure originating near the North Carolina coast at 1800 UTC on January 21st initially rapidly developed over the southwest waters before developing into a hurricane force storm south of Greenland as depicted in **Figure 6**. The central pressure fell 29 hPa in the twenty four hour period ending at 0000 UTC on the 23rd. Buoy 44251 (46.4N 53.4W) reported west winds 45 kts with gusts to 56 kts and 10.0 m seas (33 ft) at 1300 UTC on the 23rd. Buoy 44139 (44.2N 57.1W) reported southwest winds of 49 kts with gusts to 66 kts and 7.0 m seas (23 ft) at 0500 UTC on the 23rd, and 10.0 m seas (33 ft) two hours later. The **Henry Goodrich** platform (YJQN7, 47.5N 48.0W, anemometer height 90 m) reported southwest winds of 94 kts while **Hibernia** (VEP717, 46.7N 48.7W) and **Terra Nova FPSO** (VCXF, 46.4N 48.4W) encountered southwest winds 84 kts and 56 kts, respectively three hours later. Anemometer elevations account for differences in winds, with **Hibernia** highest at 139 m. The ASCAT-B image in **Figure 7** shows a swath of southwest winds 50 to 60 kts on the south side of the cyclone near 57N 40W at that time. The cyclone developed a lowest central pressure of 948 hPa as it approached Iceland late on the 24th before turning toward the southwest and becoming absorbed on the 26th.

**North Atlantic Storm, January 29-February 2:**

Low pressure moved off the southeast U.S. coast early on January 28th, passed south of the Canadian Atlantic provinces as a gale late on the 28th and 29th and then rapidly intensified in the following thirty-six hour period as depicted in **Figure 8**. At 938 hPa, the cyclone became the second deepest of the period and the third low of the month with pressures in the 930 hPa’s. The central pressure fell 44 hPa in the 24 hour period ending at 0600 UTC on the 31st. The infrared satellite image in **Figure 9** shows the cyclone at maximum intensity with an intense circulation involving well defined frontal features with great vertical extent (cold cloud tops). Hurricane force winds with this system lasted from late on the 30th through the night of the 31st with a high resolution ASCAT image from near 1200 UTC on the 31st returning winds of 50 to 70 kts around the south and west sides similar to **Figure 17** for the February 12-15 event. A Jason-2 pass taken during the following night over the south side of the low (**Figure 10**) returned wave heights as high as 19 m (63 ft). Buoy 62023 (51.4N 7.9W) reported west winds of 60 kts and 7.6 m seas (25 ft) at 1000 UTC February 1st and four hours later seas of 8.8 m (29 ft). Buoy 62163 (47.5N 8W) reported seas as high as 11.9 m (39 ft) at 2000 UTC on the 1st. The cyclone then passed over the British Isles before turning north and moving through the Norwegian Sea as a gale on the 2nd.

**Eastern North Atlantic Storm, February 3-5:**

The next development followed a similar track and was almost as deep, taking three days to track from the North Carolina coast to the British Isles, with **Figure 11** showing the low at maximum intensity approaching Ireland. Like its predecessor it deepened by 44 hPa in a 24 hour period prior to reaching maximum intensity. An ASCAT-B high-resolution pass from 1208 UTC on the 4th returned a swath of winds 50 to 70 kts around the south and southwest sides. The **St. Louis Express** (WDD3825) near 51N 13W reported northwest winds of 55 kts and 9.4 m seas (31 ft) at 0500 UTC on the 5th. Buoy 62163 (47.5N 8.4W) reported south winds of 44 kts and 7.5 m seas (25 ft) at 1400 UTC on the 4th, and highest seas 13.5 m (44 ft) at 0500 UTC on the 5th. Buoy 62023 (51.4N 7.9W) came in with southeast winds at 58kts with gusts to 71 kts and 5.5 m seas (18 ft) at 1700 UTC on the 4th, and ten hours later with 9.5 m seas (31 ft). The system then weakened while crossing the British Isles with its winds dropping to below gale force on the 6th east of Iceland.

**North Atlantic Storm, February 4-7:**

Low pressure formed near the U.S. mid-Atlantic coast on the afternoon of the 3rd and followed a more southern track as depicted in **Figure 11** and **Figure 12**. It briefly developed hurricane force winds with a 974 hPa central pressure late on the 5th just prior to the **Figure 12** map time. ASCAT imagery from 1233 UTC on the 5th revealed a small area of 50 kts to as high as 65 kts around the west semicircle of the low. The **Federal Tambo** (V7YW3) reported northwest winds of 50 kts and 7.3 m seas (24 ft) near 40N 23W at 2300 UTC on the 5th. The **St. Louis Express** (WDD3825) encountered west winds of 45 kts and 9.4 m seas (31 ft) near 45N 23W 19 hours later. The cyclone then turned toward the northeast and weakened, with **Figure 13** showing it inland over southern Norway.

**North Atlantic Storm, February 5-9:**

**Figures 12** and **13** show the next developing hurricane force low moving from south of Newfoundland to the eastern waters off Ireland over a 36 hour period. Six hours later it developed a lowest central pressure of 941 hPa. The central pressure fell 40 hPa in the 24 hour period ending at 0000 UTC on the 7th. The ASCAT-B image in **Figure 14** reveals winds as high as 80 kts on the southwest side of the low center which is near the pass edge. The **Atlantic Conveyor** (SCKM) near 54N 26W reported northwest winds of 60 kts and 5.5 m seas (18 ft) at 0000 UTC on the 8th. The **St. Louis Express** (WDD3825) near 42N 27W encountered southwest winds of 50 kts and 10.7 m seas (35 ft) at 0700 UTC on the 7th, and four hours later the same ship reported seas of 13.4 m (44 ft) near 42N 27W. Buoy 62023 (51.4N 7.9W) reported west winds of 60 kts with gusts to 75 kts and 10.5 m (34 ft) at 1500 UTC on the 8th, followed by a peak gust 79 kts one hour later and highest seas of 12.0 m (39 ft) at 1900 UTC on the 8th. The cyclone weakened as it crossed the British Isles and passed north of the islands as a gale on the 9th.

**Northeastern Atlantic Storm, February 11-13:**

The next event consisted of low pressure tracking east-northeast from New England but not rapidly intensifying until it passed east of 35W, when it deepened by 41 hPa in the 24 hour period ending at 1200 **Figure 15** shows the cyclone near maximum intensity on the coast of Ireland. UTC February 12th. The **Norfolk Express** (ZCEI6) near 47N 17W reported west winds of 55 kts and 8.5 m seas (28 ft) at 0400 UTC on the 12th, followed three hours later with a report of seas 10.7 m (35 ft) near 47N 19W. The buoy report from 62023 (51.4N 7.9W) stands out among the others in the area. It reported west winds of 68 kts with gusts to 96 kts and 10.0 m seas (33 ft) at 1300 UTC on the 12th, followed one hour later by a report of seas 11.5 m (38 ft). The cyclone weakened as it passed north of Scotland (**Figure 16**), with its winds diminishing to below gale force on the 14th.

**North Atlantic Storm, February 12-15:**

**Figures 15** and **16** show the next developing hurricane force low following close behind its predecessor. It originated off the southeast U.S. coast late on the 11th and was of similar intensity, reaching 955 hPa over the British Isles. The ASCAT-B image in **Figure 17** shows strong support for hurricane force winds given the presence of wide spread winds of 55 to 60 kts around the south and west sides of the cyclone and low bias of the winds at high wind speeds. The **Southern Horizon** (WDE9588) reported southwest winds of 45 kts and 8.5 m seas (28 ft) near 38N 19W at 0000 UTC on the 14th. Buoy 62023 (51.4N 7.9W) reported west winds of 50 kts with gusts to 61 kts and 8.0 m seas (26 ft) at 0100 UTC on the 15th and highest seas 9.0 m (30 ft) one hour later. Buoy 62163 (47.5N 8.4W) reported highest seas of 13.5 m (44 ft) at 1500 UTC on the 15th. The cyclone passed north of the British Isles on the 15th where its top winds weakened to gale force, and then moved inland over southern Norway by the 16th.

**Western North Atlantic Storm, February 13-16:**

Strong high pressure moved out over the Atlantic by the middle of the month, leading to the next developing low to take a more northern track along the coast before moving out over the North Atlantic (**Figures 15** and **16**). The cyclone developed hurricane force winds as it moved into the Atlantic provinces of Canada, detected by a NOAA P3 aircraft near 42N 62W (E-mail communication, Ref. 6) and also by OceanSAT-2 (OSCAT) data from 0236 UTC on the 15th. The **Amanda** (9HA3164) near 37N 64W encounterd southwest winds of 50 kts and 10.7 m seas (35 ft) at 0000 UTC on the 15th. 12 hours later **Hibernia Platform** (VEP717, 46.7N 48.7W) reported southwest winds of 78 kts at an elevation of 139 m, while **Terra Nova FPSO** (VCXF, 46.4N 48.4W) encountered southwest winds of 62 kts. The cyclone developed a lowest central pressure of 963 hPa near 53N 50W at 1200 UTC on the 15th before beginning to weaken and turn east along 55N. The low dissipated over Great Britain on the 18th.

**North Atlantic Storms, February 15-20:**

This developing cyclone initially followed a track similar to the preceding event, with the low pressure area developing storm force winds while passing near New England late on the 15th and briefly developing hurricane force winds while passing through the Gulf of St. Lawrence on the afternoon of the 16th with the central pressure down to 964 hPa. The **SHIP** H3VU (34N 77W) reported west winds of 55 kts and 6.4 m seas (21 ft) at 1800 UTC on the 15th. **Hibernia Platform** (VEP717) reported southwest winds of 78 kts at 1200 UTC on the 17th.
Buoy 44141 (43.0N 58.0W) reported southwest winds of 49 kts with gusts to 62 kts and 7.5 m seas (25 ft) at 1600 UTC on the 16th, and highest seas 12.5 m (41 ft) three hours later. The system weakened to a gale in the Labrador Sea on the 18th and stalled, but as the cyclone's occluded front approached Greenland it briefly developed hurricane force winds near the Greenland coast the following night. Meanwhile a new low center formed well to the south near 45N 43W at 0600 UTC on the 18th and moved northeast toward Iceland, developing a central pressure down to 960 hPa near 61N 28W at 1200 UTC on the 19th and absorbing the old cyclone. It briefly developed hurricane force winds in the easterly flow as its front approached Iceland on the 19th, as an ASCAT-B pass from 1238 UTC on the 19th showed east winds to 55 kts just south of Iceland. This low in turn became absorbed by another low developing and passing east of the island on the 21st.

**North Atlantic Storms, February 23-27:**

Low pressure originating near the New England coast late on the 21st moved across the Atlantic provinces of Canada the next day and then moved out over the North Atlantic on the 23rd. It briefly developed hurricane force winds on the 24th with a 964 hPa center (**Figure 18**) before weakening and passing north of Scotland early on the 26th (**Figure 18**). An ASCAT-A image for 1237 UTC on the 24th revealed west winds 50 to 60 kts on the south side of the center. At that time a new and stronger hurricane force cyclone appears south of Greenland with a lowest central pressure of 948 hPa (**Figure 18**). It originated near the southern New England coast late on the 23rd, and its central pressure dropped 40 hPa in the 24 hour period ending at 1800 UTC on the 25th. The ASCAT-B image in **Figure 19** returned winds as high as 60 kts south of the center but with limited coverage which may miss the strongest winds especially on the north side. In the first storm, the **Mekhanik Kovtun**

(UHSY) near 50N 16W reported southwest winds of 50 kts at 1800 UTC on the 24th. The **Oriana** (ZCDU9) reported west winds 30 kts but with 14.0 m seas (46 ft) near 45N 9W eighteen hours later. Buoy 62023 (51.4N 7.9W) reported south winds 43 kts with gusts to 53 kts and 5.0 m seas (16 ft) at 1800 UTC on the 24th and a peak gust of 63 kts one hour later, and highest seas 8.0 m (26 ft) at 0900 UTC on the 25th. The stronger cyclone subsequently drifted northeast into the east Greenland waters late on the 27th with winds weakening to gale force, and then dissipated by March 1st.

**Far Eastern Atlantic Storm, February 27-28:**

A small but potent cyclone moved through the southern parts of Ireland and England on the 27th and 28th and affected adjacent waters. It originated near the island of Newfoundland early on the 26th and reached the British Isles in less than two days. The center developed a lowest central pressure of 984 hPa near 52N 7W at 0000 UTC on the 28th. The **Hong Kong Express** (DJAZ2) near 49N 5W encountered west winds of 50 kts at 0000 UTC on the 28th. Buoy 62107 (50.1N 6.1W) reported northwest winds of 50 kts with gusts to 72 kts and 9.0 m seas (30 ft) five hours later. Buoy 62023 (51.4N 7.9W) reported northwest winds of 55 kts with gusts to 68 kts and 6.4 m seas (21 ft) at 0300 UTC on the 28th. The cyclone then weakened in the southern North Sea late on the 28th.

**North Atlantic Storm, February 28-March 3:**

This cyclone originating south of Nova Scotia late on February 27th and developed hurricane force winds over the north central waters on March 1st and 2nd with a central pressure as low as 964 hPa before turning toward the southeast and weakening over the southern British Isles late on the 3rd. An ASCAT-B pass from 1329 UTC March 1st showed a swath of west to southwest winds 50 to 65 kts south of the center. The **SHIP** BATEU06 (49N 11W) reported southwest winds of 50 kts at 2200 UTC on the 2nd. The **Maersk Semarang** (LXSR) near 45N 9W encountered west winds of 45 kts and 10.7 m seas (35 ft) at 0600 UTC on the 3rd. Seven hours later the **Sigas Silvia** (S6ES6) reported northwest winds 35 kts and 14.0 m seas (46 ft).

**North Atlantic Storm, March 6-9:**

This rapidly developing cyclone moved from off the southeast U.S. coast on the 4th northeast to Iceland and developed storm force or higher winds over the central and northeast Atlantic waters. **Figure 20** shows the period of most rapid intensification of this system, when the central pressure dropped 47 hPa in 24 hours. The central pressure reached 946 hPa as the center passed near 59N 23W 1200 UTC on the 8th. An ASCAT-A pass at 2158 UTC on the 7th returned numerous wind barbs in the 50 to 75 kts range and isolated 80 kts in the south semicircle of the cyclone. Some notable ship and buoy observations taken in this event are listed in **Table 2**. The cyclone began to weaken and passed northeast of Iceland early on the 9th.

**North Atlantic Storm, March 8-10:**

This event originated as an area of low pressure in the northeast Gulf of Mexico on March 6th (**Figure 20**). The cyclone developed storm force winds south of the Canadian Atlantic provinces on the 8th and hurricane force winds when passing between Greenland and Iceland on the 10th, when the central pressure reached 953 hPa. An ASCAT image from 2100 UTC on the 10th revealed 50 to 60 kts winds in the southwest flow as the low passes to the north. The cyclone passed north of Iceland shortly thereafter.

**North Atlantic Storm, Greenland Area, March 24-27:**

**Figure 21** depicts low pressure approaching Greenland in the first part of Figure 21 and passing east of Greenland in the second part with hurricane force winds. This is an effect of Greenland tending to induce low pressure trough on its east

| OBSERVATION | POSITION | DATE/TIME(UTC) | WIND | SEAS(m/ft) |
|---|---|---|---|---|
| **Independent Voyager** (A8XY2) | 43N 41W | 07/0000 | S 45 | |
| **Independent Pursuit** (A8MB5) | 45N 44W | 07/0900 | W 45 | |
| **Atlantic Cartier** (SCKB) | 47N 35W<br>47N 36W | 07/1200<br>07/1800 | W 50<br>NW 60 | 8.5/28<br>11.3/37 |
| **Atlantic Companion** (SKPE) | 55N 24W<br>55N 26W | 08/0600<br>08/1200 | SW 55<br>W 60 | |
| **Mary Artica** (BATEU00) | 62N 22W<br>61N 28W | 08/1200<br>09/0000 | E 45<br>NW 45 | |
| Buoy 62105 | 55.0N 13.2W | 08/1400<br>08/2000 | SW 43 G54 | 8.0/26<br>Maximum 12.5/41 |
| Buoy 64045 | 59.1N 11.7W | 08/1800<br>08/2000<br>08/2300 | SW 45 G58<br>Peak gust 69 | 9.0/30<br><br>Maximum 15.0/49 |

**Table 2. Selected ship and buoy observations taken during the North Atlantic storm of March 6-9, 2014.**

or lee side after a cyclone passes to the east and enhancing the pressure gradient near the southern tip of Greenland. The low originated south of Nova Scotia near 40N on the afternoon of the 23rd. This cyclone then passed between Greenland and Iceland on the 27th.

**Southwestern Atlantic Storm, March 25-28:**

This event was the most significant of the period in the southwestern waters, an area of high traffic off the U.S. East Coast. It originated as a wave of low pressure in the Gulf of Mexico on the 24th and Figure 21 depicts the rapid initial intensification over 24 hours, when the pressure dropped 46 hPa. The 500 mb analysis (Figure 22) taken in the middle of this rapid deepening shows a high amplitude short wave trough developing negative tilt, associated with the surface low, and supported by a 500 hPa wind maximum. This is a favorable setup for intensification (Reference 5). The central pressure reached as low as 955 hPa six hours later. The ASCAT-B image in Figure 23 shows extensive coverage of storm force or greater wind barbs with the highest winds showing up as red on the southwest and west sides with winds to 75 kts appearing in a zoomed in version of the imagery. There was a report from Canada of peak wave heights at the buoy 44141 (43.0N 58.0W) of 29.3 m (96 ft) (E-mail communication, Ref. 7). The cyclone subsequently moved north into the Labrador Sea and slowed down while weakening to a gale early on the 29th. Selected observations taken in this storm are listed in Table 3 (next page).

**Northwestern Atlantic Storm, April 9-10:**

This short lived event originated as low pressure inland over southern Quebec on the afternoon of April 8th. The low emerged over the northern Labrador Sea and became quite intense with a central pressure down to 964 hPa at 0600 UTC on the 10th. ASCAT data was not available on the west side with sea ice coverage over the area but ASCAT winds were 30 to 45 kts on the east and southeast sides of the low. The **Antwerpen Express** (DGAF) near 42N 52W and the **Integrity** (WDC6925) near 41N 57W both reported southwest winds of 50 kts at 0600 UTC on the 10th with the latter vessel also reporting seas of 8.2 m (27 ft). The cyclone then weakened and moved north through the Davis Strait on the 11th.

| OBSERVATION | POSITION | DATE/TIME(UTC) | WIND | SEAS(m/ft) |
|---|---|---|---|---|
| SHIP | 49N 58W | 27/0000 | E 63 | |
| **Hamburg Express** (DGXS) | 36N 66W | 26/1200 | SW 55 | 8.8/29 |
| SHIP | 33N 63W | 26/1800 | SW 50 | |
| **Stad Amsterdam** (PECA) | 33N72W | 26/1800 | NW 35 | 11.3/37 |
| Buoy 44137 | 42.3N 62.0W | 26/2300 | | Maximum 11.0/36 |
| Buoy 44150 | 42.5N 64.0W | 26/1400<br>26/2300 | NE 47 G60 | 7.0/23<br>Maximum 9.0 |
| Buoy 44139 | 44.2N 57.1W | 26/2000<br>27/0700 | SE 43 G54 | 7.5/25<br>Maximum 12.5/41 |
| Buoy 44141 | 43.0N 58.0W | 27/0600<br>27/0500 | SW 51 G68 | 15.5/51<br>16.0/53 |
| **Hibernia** (VEP717) | 46.7N 48.7W | 27/0600 | SE 65 | |
| CFL24 | 43.8N 60.6W | 27/1000 | NW 61 | 8.5/28 |

**Table 3. Selected ship, buoy and platform observations taken during the southwestern Atlantic storm of March 25-28, 2014.**

### North Atlantic Storm, April 20-22:

Developing low pressure moved off the southeast U.S. coast early on April 17th and rapidly intensified after passing the island of Newfoundland (**Figure 24**). The central pressure fell 37 hPa in the 24 hour period ending at 1800 UTC on the 20th. The cyclone attained a lowest central pressure of 966 hPa 12 hours later. ASCAT-A data for 1930 UTC on the 18th showed west to northwest winds of 50 kts at the edge of the data free swath at the center of the pass, with the pass likely missing the highest winds. The cyclone then turned east and slowed while drifting along 55N and weakening, and became absorbed by another cyclone passing to the south on the 25th.

### Gale off the U.S. East Coast, April 26-29:

**Figure 25** depicts a small and compact gale force low southeast of Nantucket. It formed on a front over the mid-Atlantic states 24 hours prior and rapidly developed offshore. Figure 25 shows it with its lowest central pressure. A NOAA Fisheries vessel, the **Gordon Gunter** (WTEO), sent an account of fast changing conditions experienced while working 80 nmi from Nantucket. Conditions went from 30 kts and 3 m seas (10 ft) to 60-65 kts sustained winds with gusts to 110 and seas building to 7-9 m seas (25-30 ft) with waves as high as 12 m (40 ft) and near zero visibility within an hour. The heavy weather lasted two hours.

The 25-km ASCAT-A image in **Figure 26** shows just 50 kts near the center with directions appearing to be off. ASCAT is challenged by the scale and such smaller lows are a mystery prediction wise (E-mail communication, Ref. 8). The cyclone subsequently drifted northeast with a slow weakening trend and made a cyclonic loop near 42N 60W late on the 27th and on the 28th before moving southeast and becoming absorbed by a new low forming to the northeast late on the 29th.

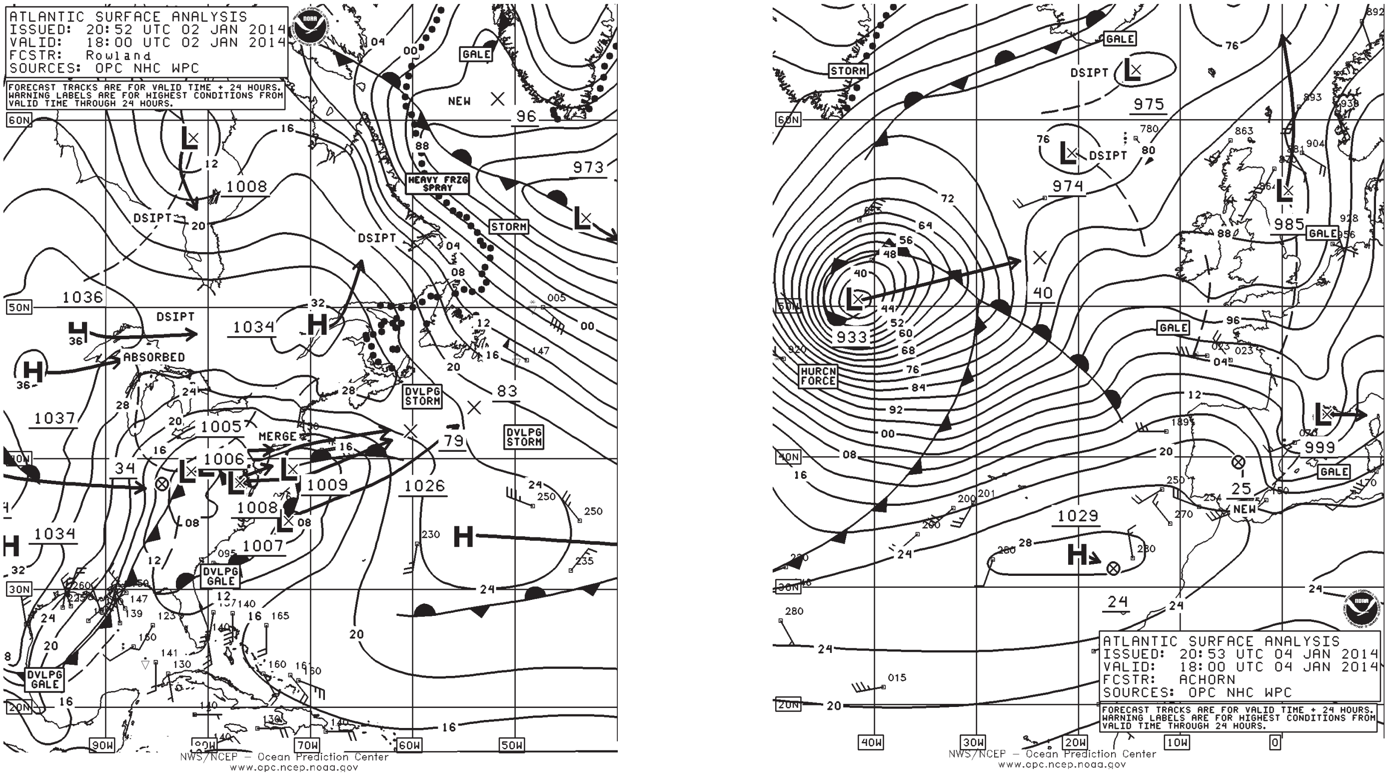


**Figure 1. OPC North Atlantic Surface Analysis charts valid 1800 UTC January 2 (Part 2 – west) and 1800 UTC January 4, 2014 (Part 1 – east). Twenty-four hour forecast tracks are shown with the forecast central pressures given as the last two whole digits in millibars (hPa).**

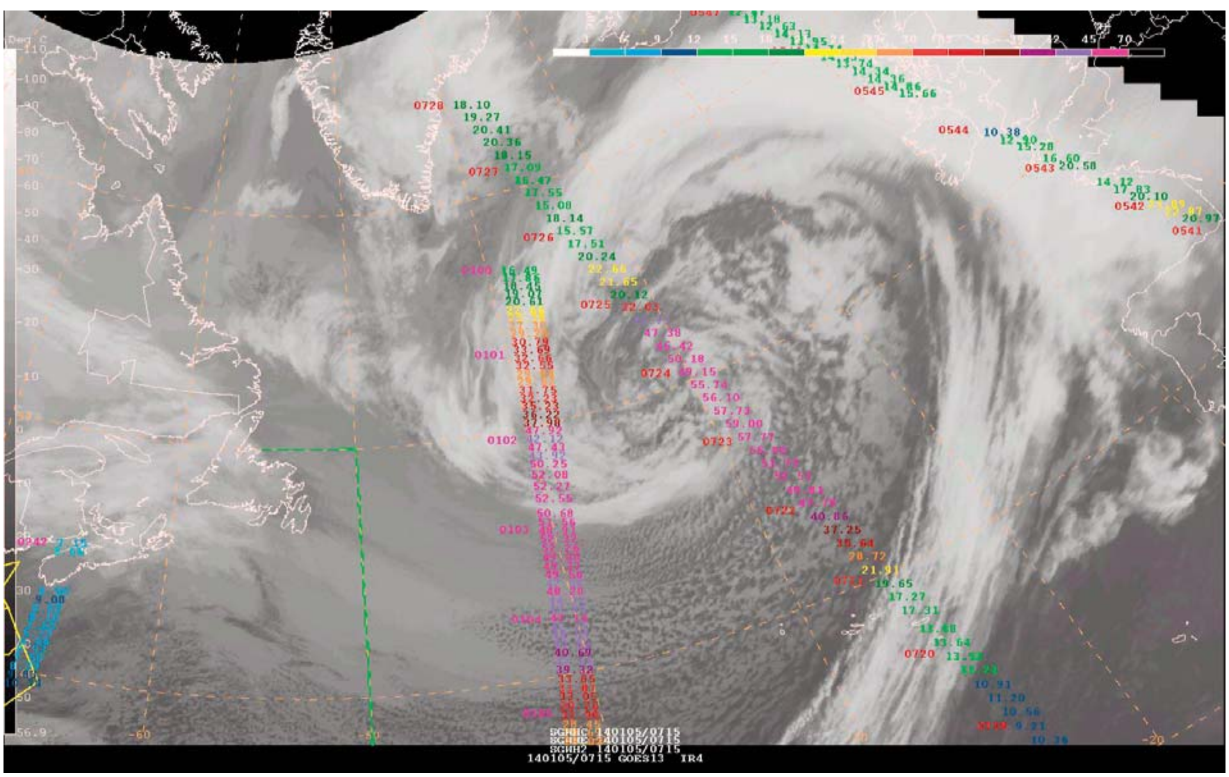


**Figure 2. GOES13 infrared satellite image of the cyclone in the second part of Figure 1 valid 0715 UTC January 5, 2014 or thirteen and one-quarter hours later than the valid time of the second part of Figure 1. Satellite senses temperature on a scale ranging from white (cold) to black (warm) in infrared imagery. Image includes swaths of altimeter data (Jason-2, Cryosat-2 and Altika) consisting of remotely-sensed significant wave heights in feet to two decimal places and times displayed to the left of the tracks (UTC)**

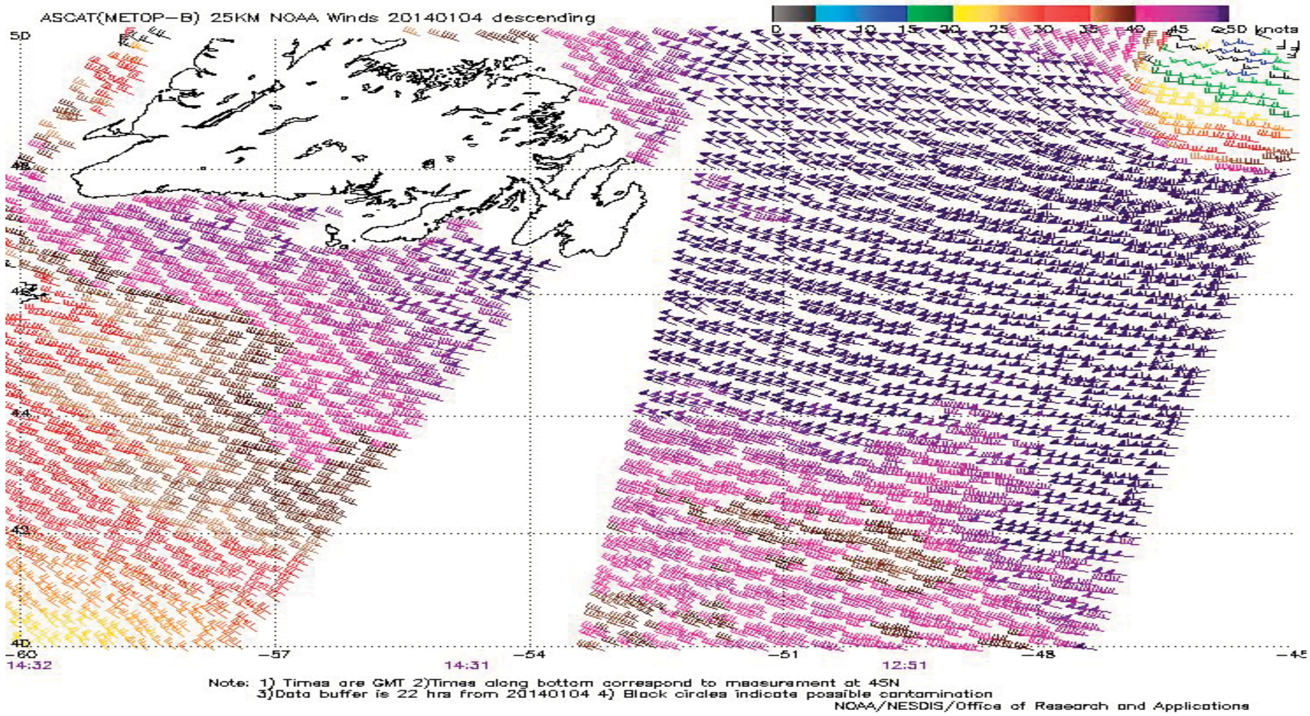


**Figure 3. 25-km ASCAT METOP-B (European Advanced Scatterometer) image of satellite-sensed winds around the southwest side of the cyclone shown in the second part of Figure 1 including portions of two passes valid 1251 UTC and 1432 UTC January 4, 2014. The earlier pass containing the strongest wind retrievals is valid approximately five hours prior to the valid time of the second part of Figure 1. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.**

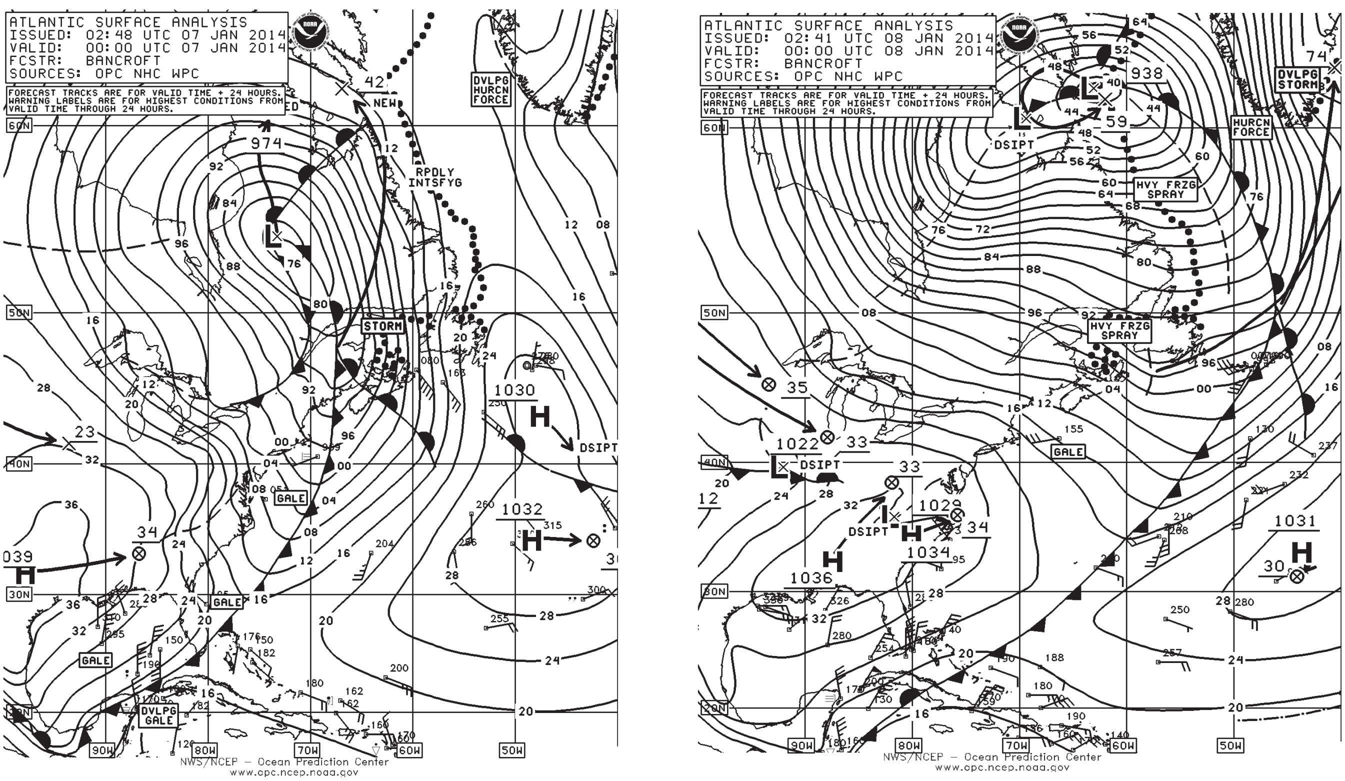


**Figure 4. OPC North Atlantic Surface Analysis charts (Part 2) valid 0000 UTC January 7 and 8, 2014.**

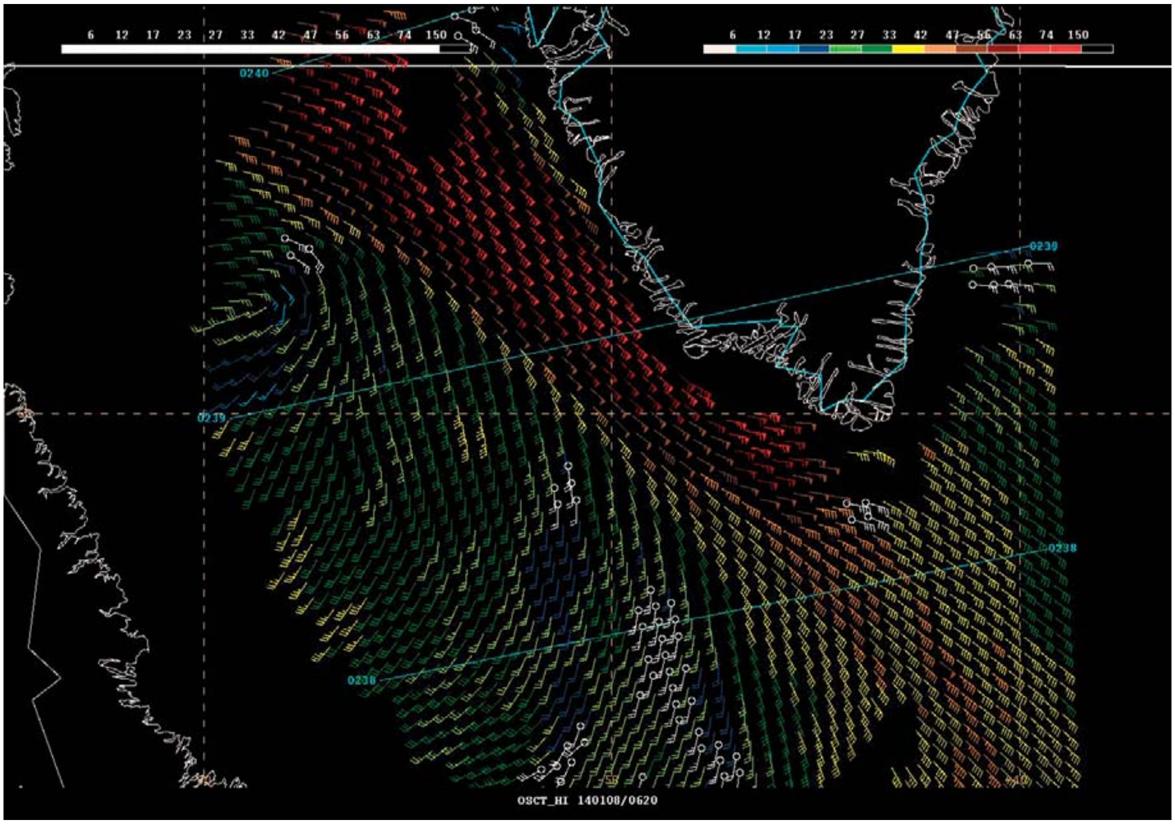


**Figure 5. OSCAT (Indian OceanSat-2 scatterometer) image of satellite-sensed winds around the east side of the cyclone shown in the second part of Figure 4. Land areas displayed include southern Greenland and a portion of the Labrador coast. The valid time of the pass is approximately 0239 UTC January 8, 2014, or about two and one-half hours later than the valid time of the second part of Figure 4. Image includes cross-track time lines of the satellite (four-digit UTC) and a color scale for the wind barbs in the upper right side. White wind barbs indicate possible rain contamination. Satellite data is reprocessed at 25-km resolution by NOAA/NESDIS.**

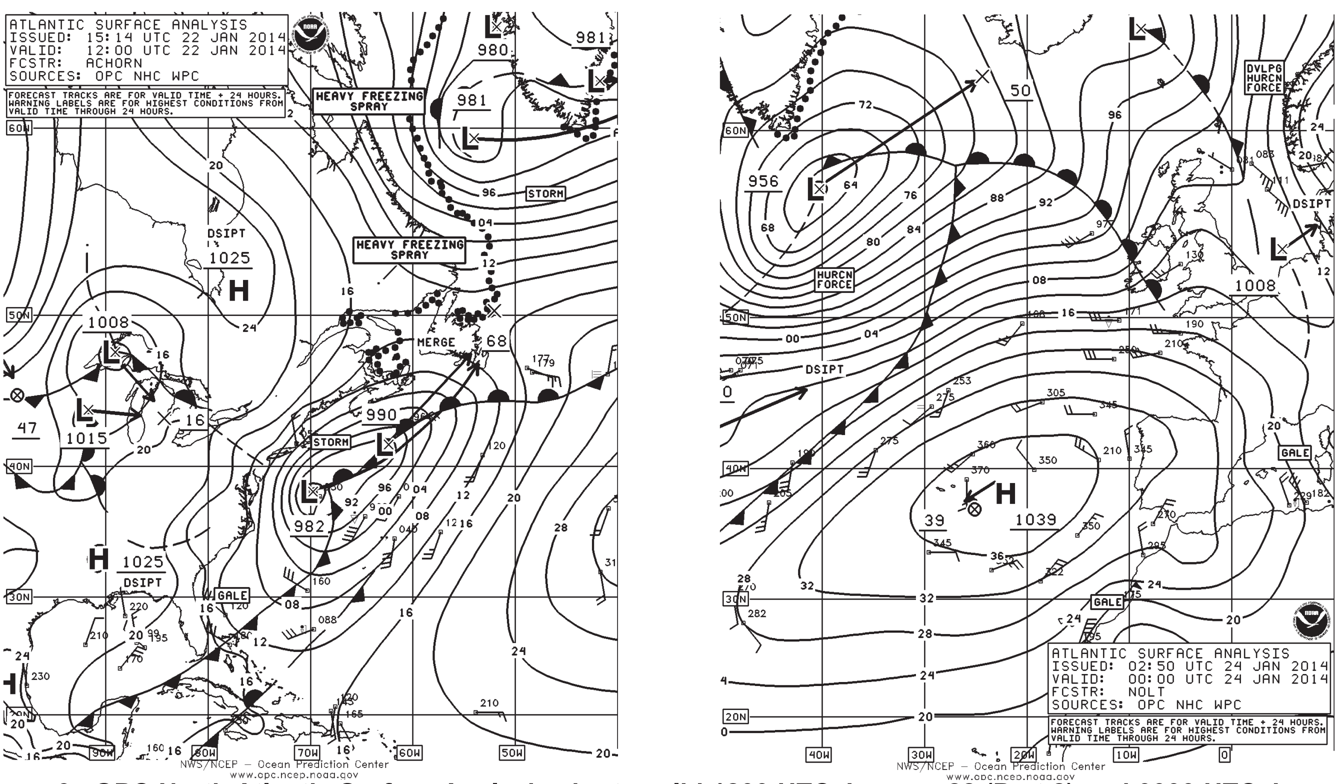


**Figure 6. OPC North Atlantic Surface Analysis charts valid 1200 UTC January 22 (Part 2) and 0000 UTC January 24, 2014 (Part 1).**

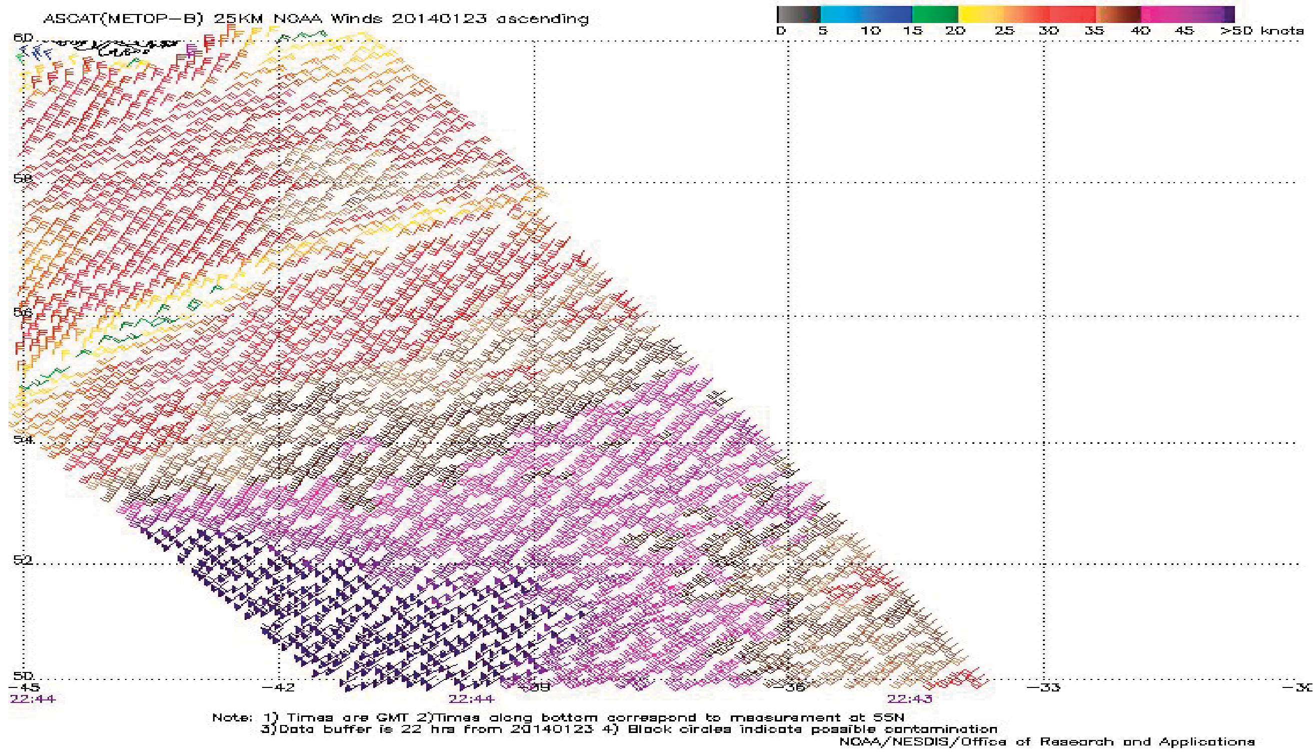


**Figure 7. 25-km ASCAT (METOP-A) image of satellite-sensed winds around the south and west sides of the cyclone shown in the second part of Figure 6. The valid time of the pass is 2244 UTC January 23, 2014 or about one and one-quarter hours prior to the valid time of the second part of Figure 6. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.**

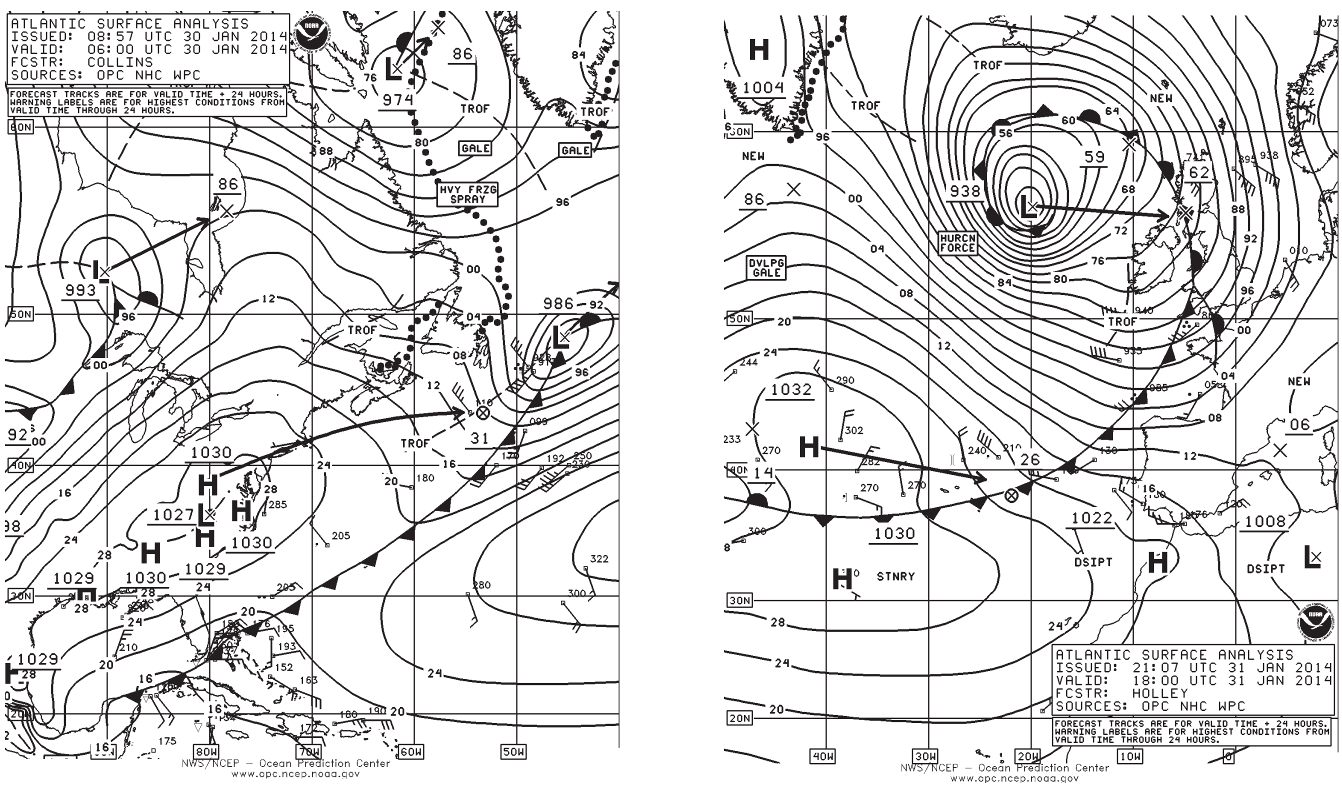


**Figure 8. OPC North Atlantic Surface Analysis charts valid 0600 UTC January 30 (Part 2) and 1800 UTC January 31, 2014.**

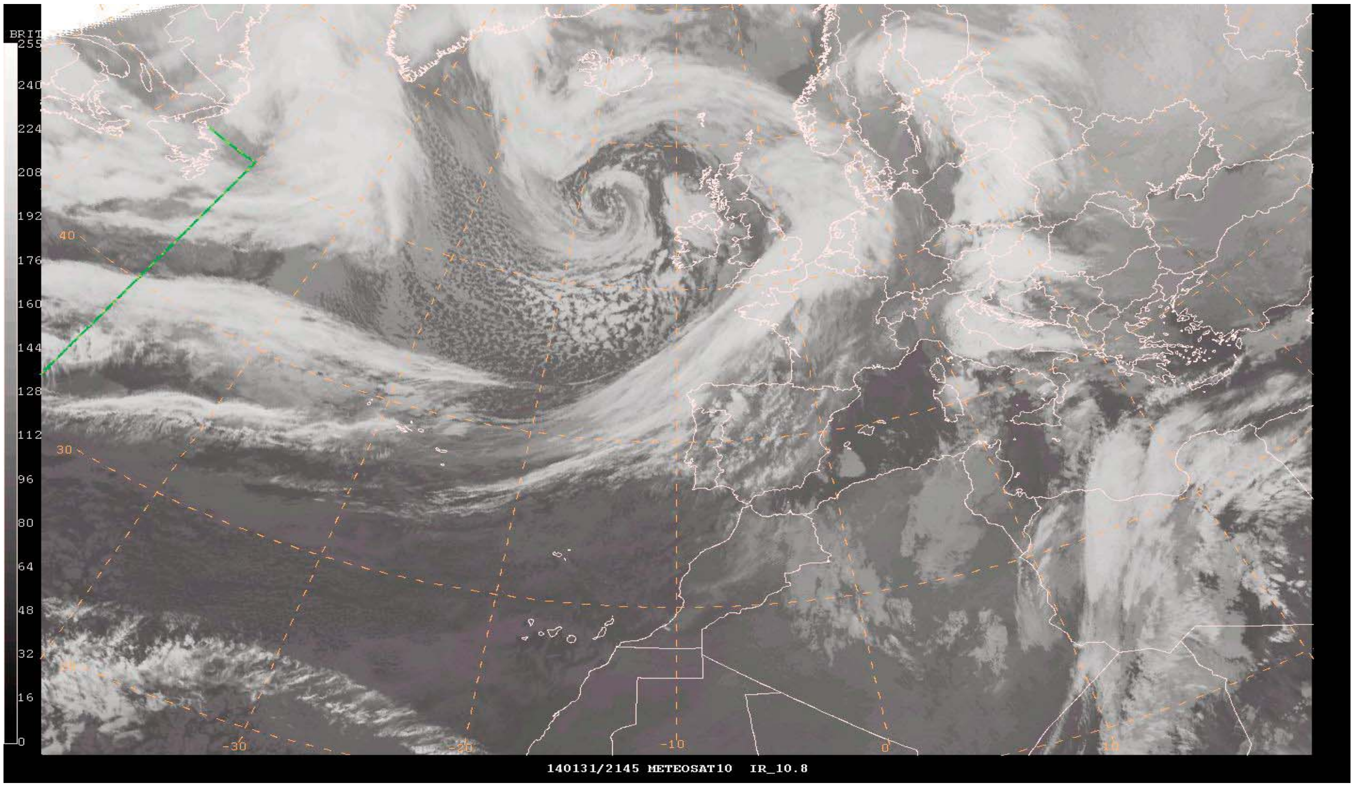


**Figure 9. METEOSAT-10 infrared satellite image of the cyclone in the second part of Figure 8 valid 2145 UTC January 31, 2014, or three and three-quarters hours later than the valid time of the second part of Figure 8.**

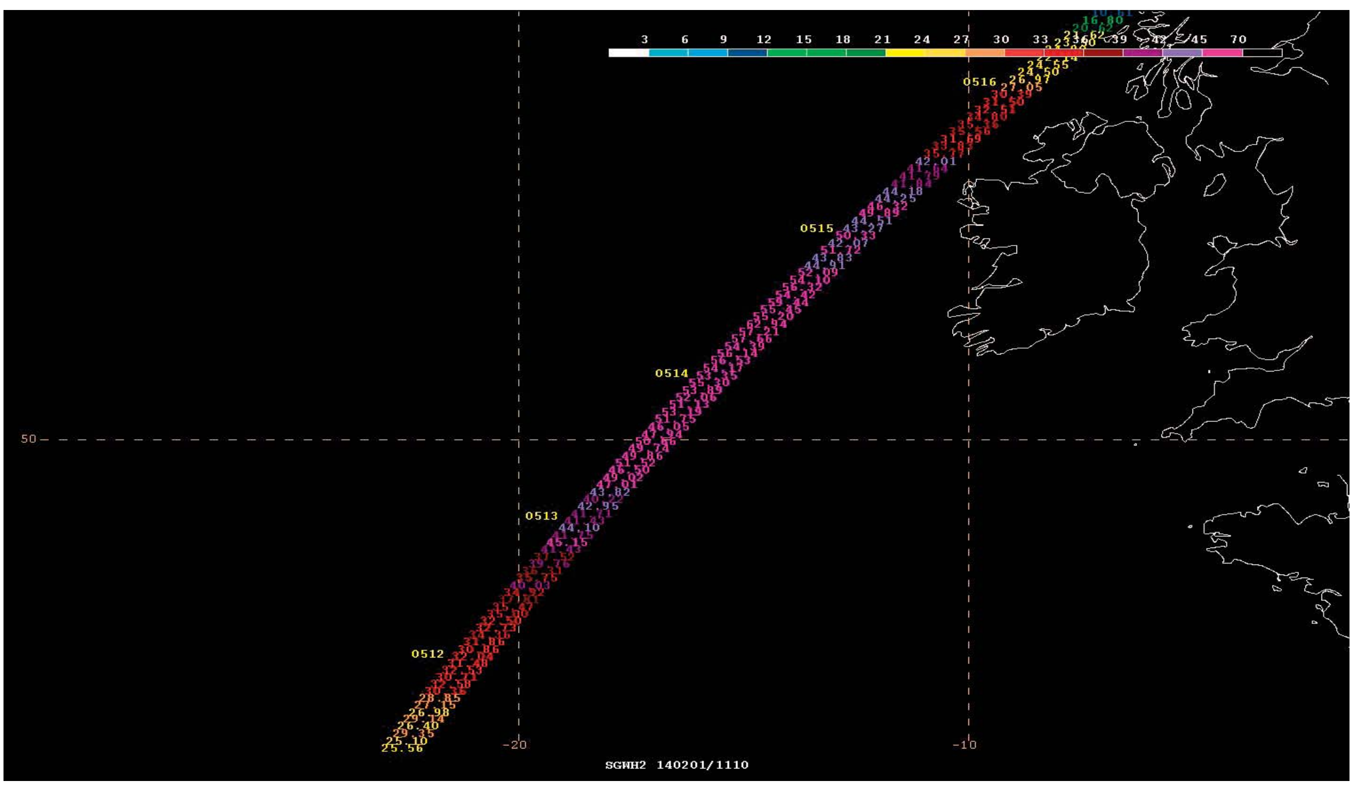


**Figure 10. Jason-2 altimeter data west of the British Isles and France including satellite-sensed significant wave heights in feet to two decimal places along a satellite track with times in UTC displayed to the left of the track. The time in the center of the image, 0514 UTC February 1, 2014, is about eleven and one-quarter hours later than the valid time of the second part of Figure 9. Satellite data reprocessed by NOAA/NESDIS for operational use.**

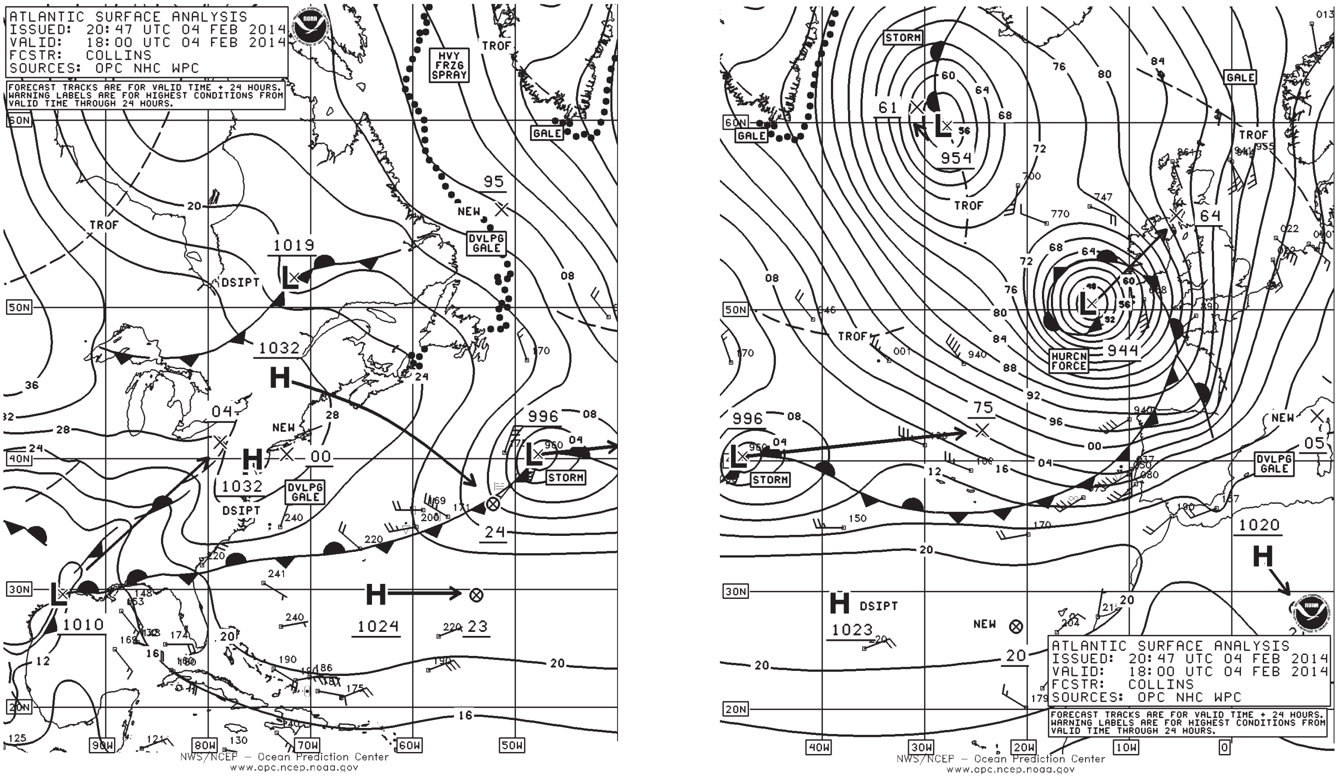


**Figure 11. OPC North Atlantic Surface Analysis chart (Parts 2-west and 1-east) valid 1800 UTC February 4, 2014. The two parts include an overlap area between 40W and 50W.**

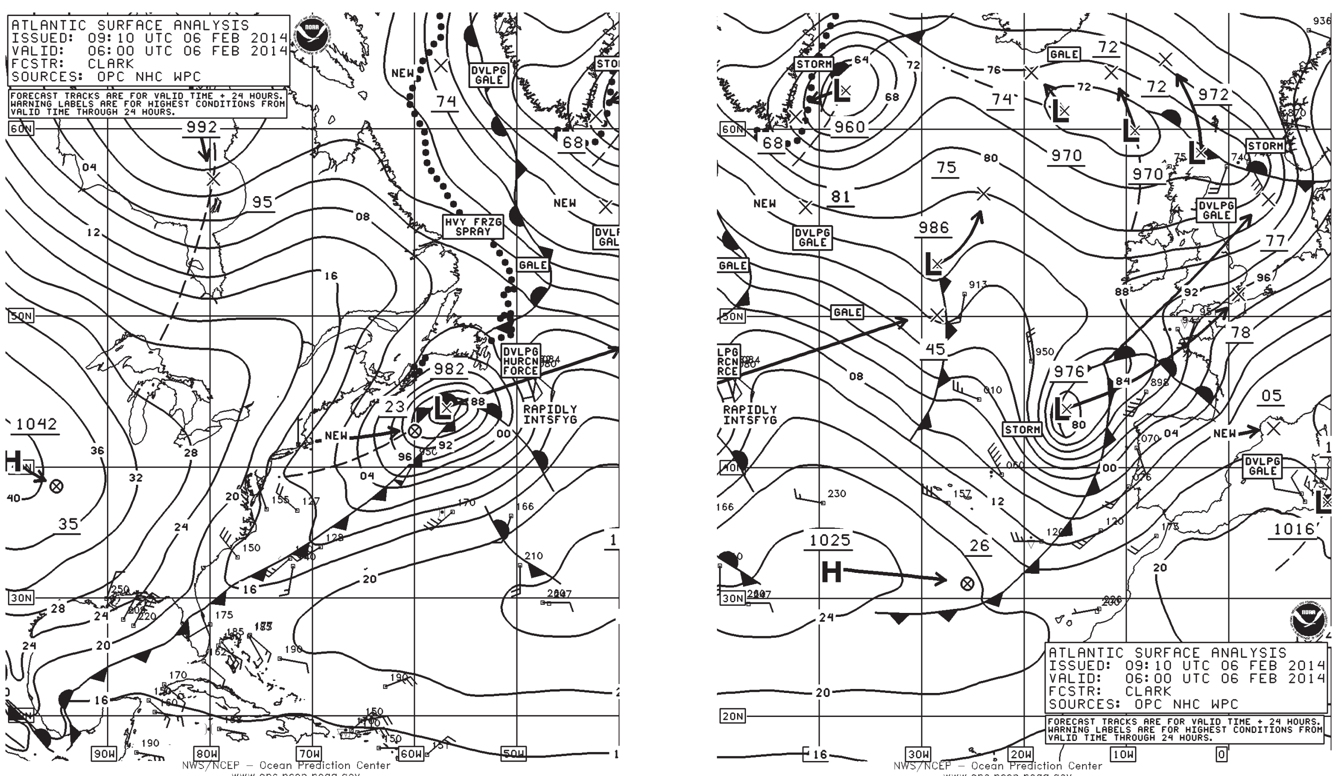


**Figure 12. OPC North Atlantic Surface Analysis chart (Parts 2-west and 1-east) valid 0600 UTC February 6, 2014.**

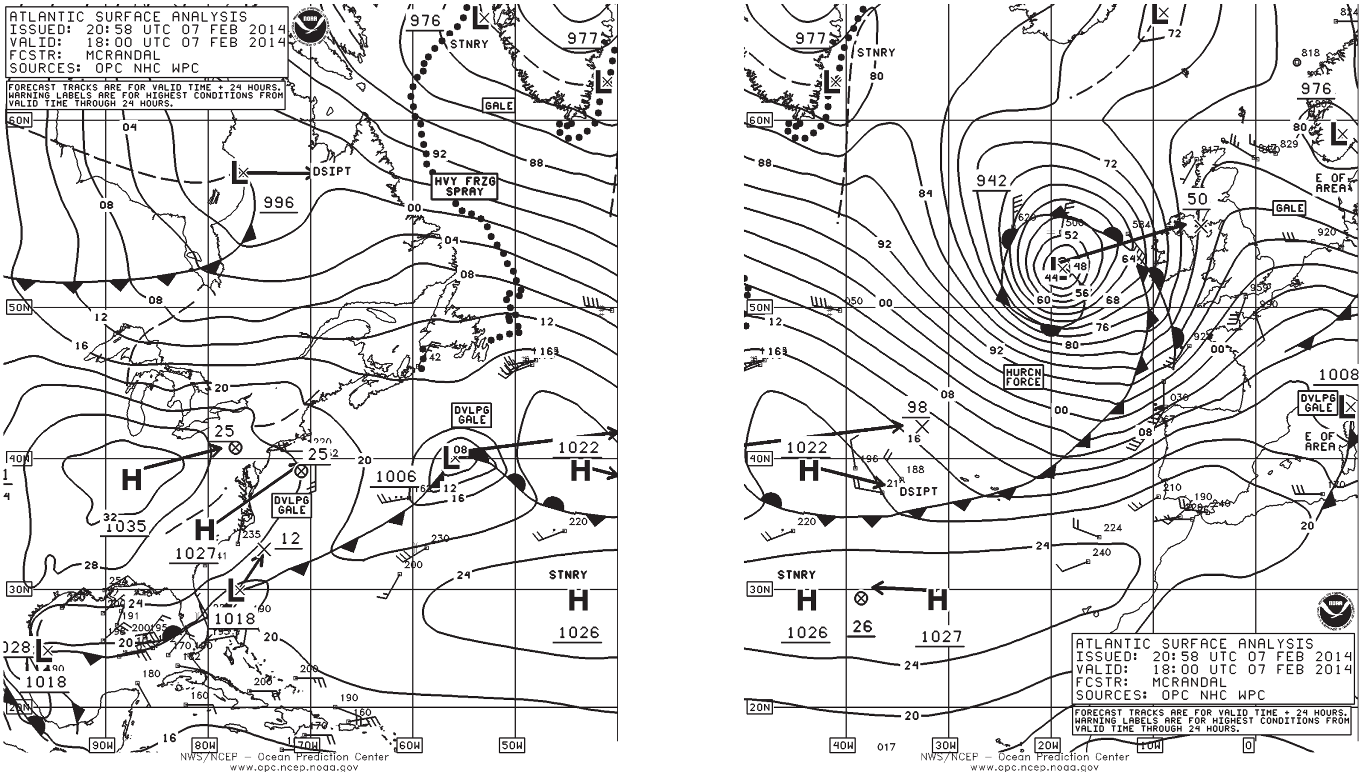


**Figure 13. OPC North Atlantic Surface Analysis chart (Parts 2-west and 1-east) valid 1800 UTC February 7, 2014.**

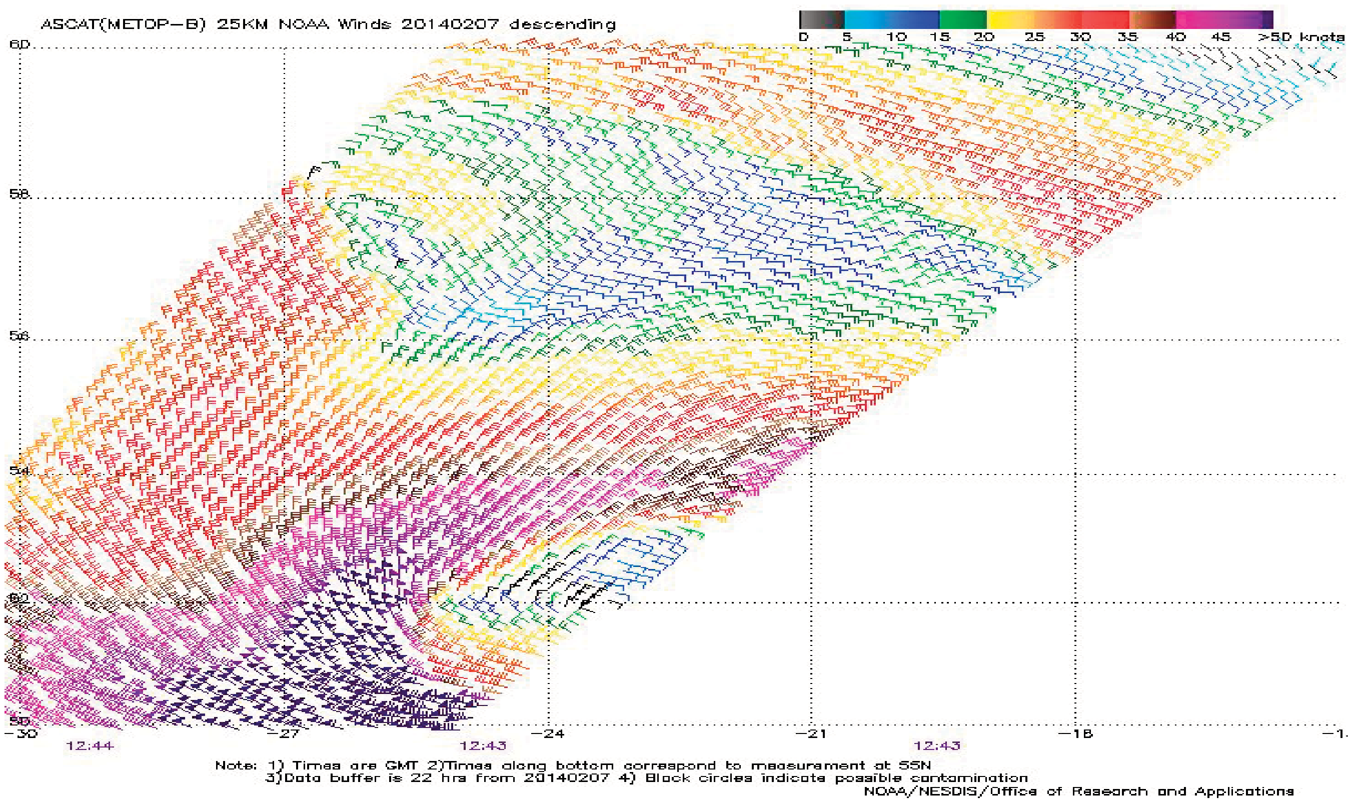


**Figure 14. 25-km ASCAT (METOP-B) image of satellite-sensed winds around the west and north sides of the cyclone shown in the second part of Figure 13. The valid time of the pass is 1243 UTC February 7, 2014, or approximately five and one-quarter hours prior to the valid time of the second part of Figure 13. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.**

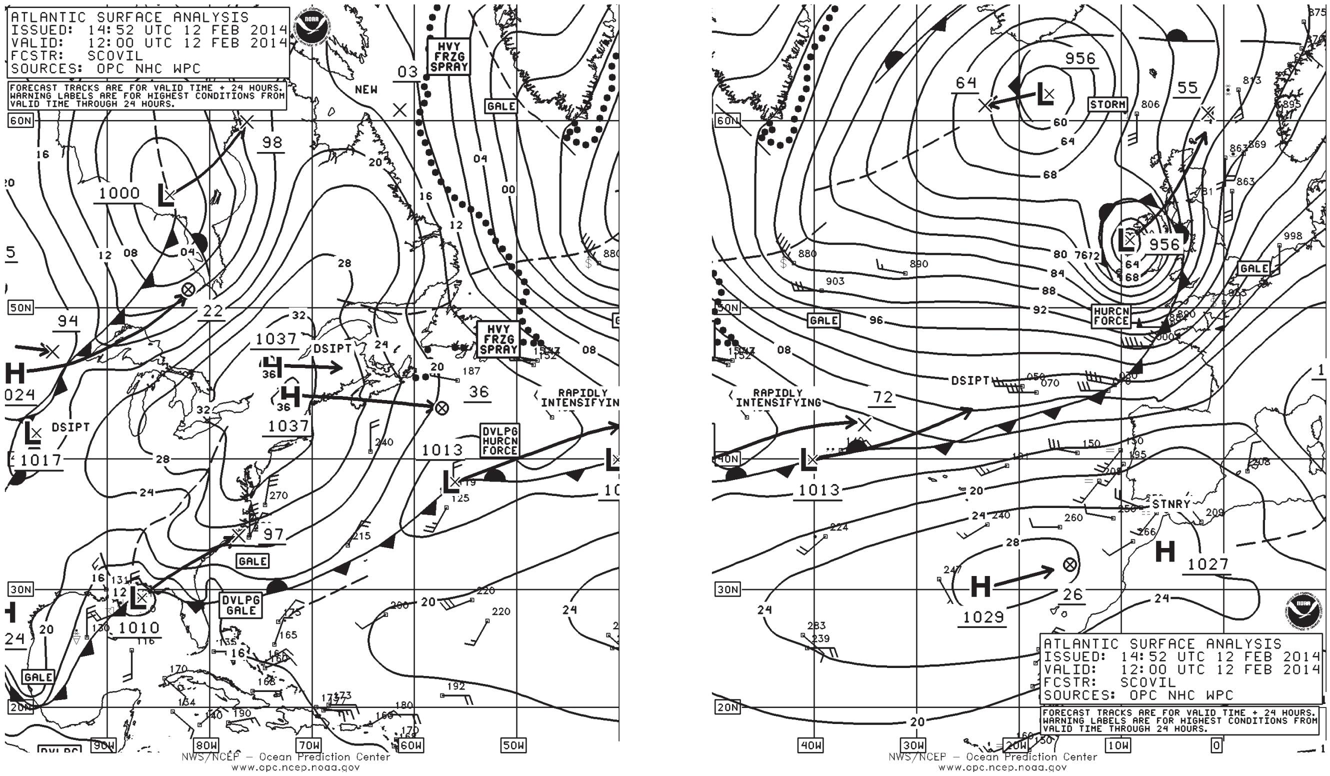


Figure 15. OPC North Atlantic Surface Analysis chart (Parts 2-west and 1-east) valid 1200 UTC February 12, 2014.

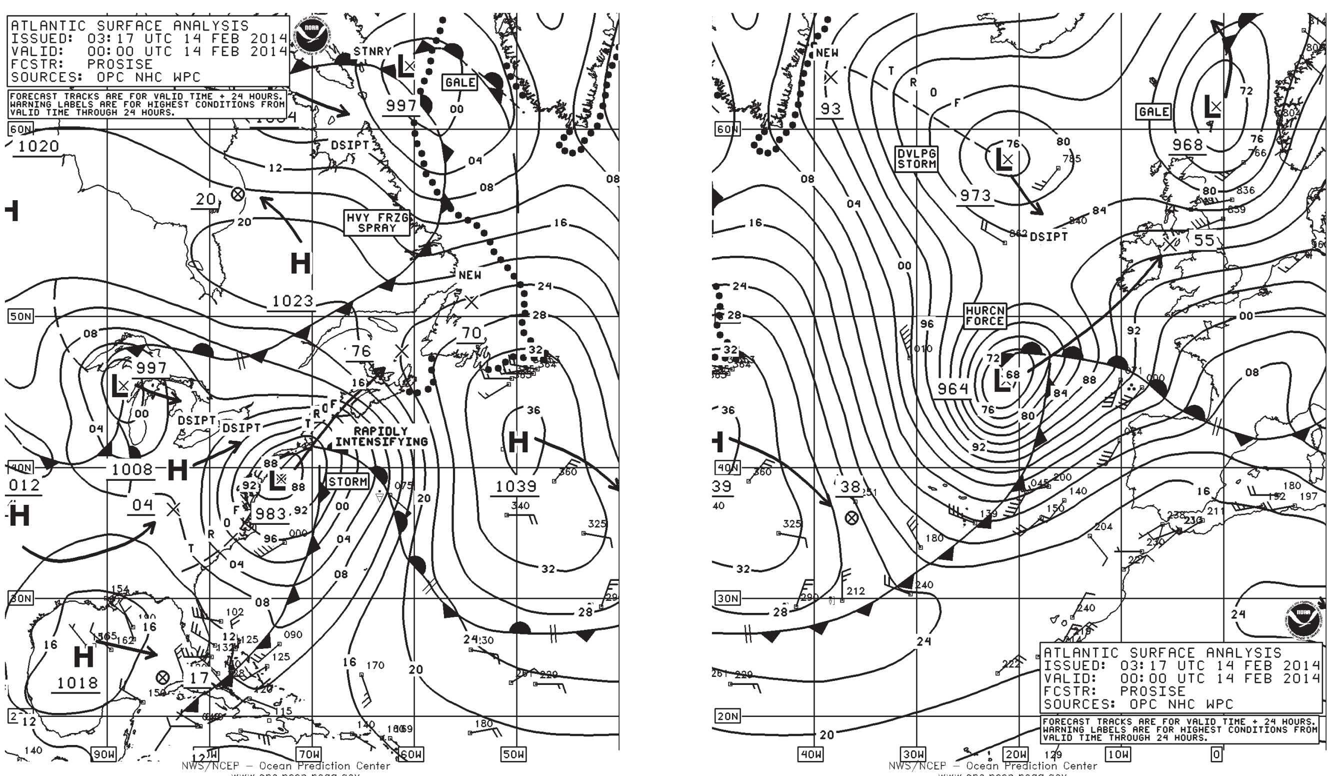


Figure 16. OPC North Atlantic Surface Analysis chart (Parts 2-west and 1-east) valid 0000 UTC February 14, 2014.

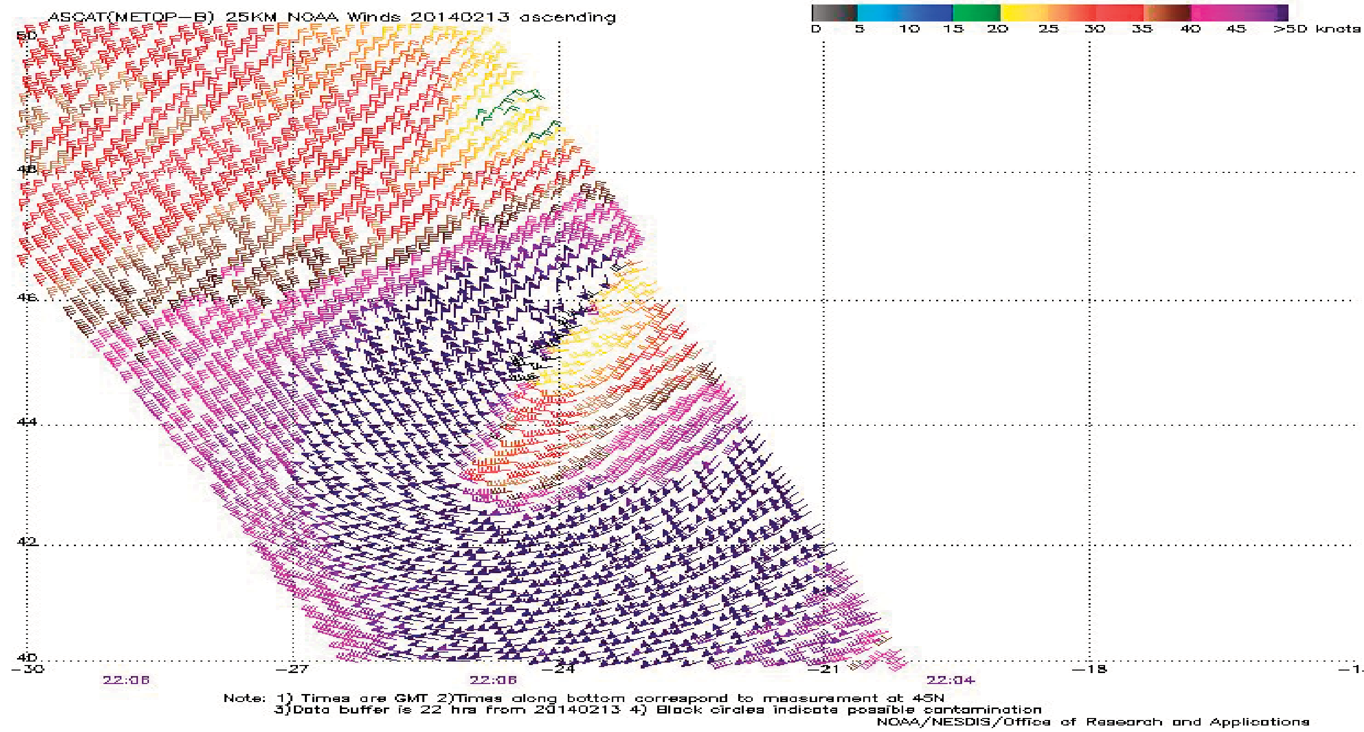


**Figure 17. 25-km ASCAT (METOP-B) image of satellite-sensed winds around the south and west sides of the hurricane-force low shown in Figure 16. The valid time of the pass is 2208 UTC February 13, 2014, or approximately two hours prior to the valid time of Figure 16. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.**

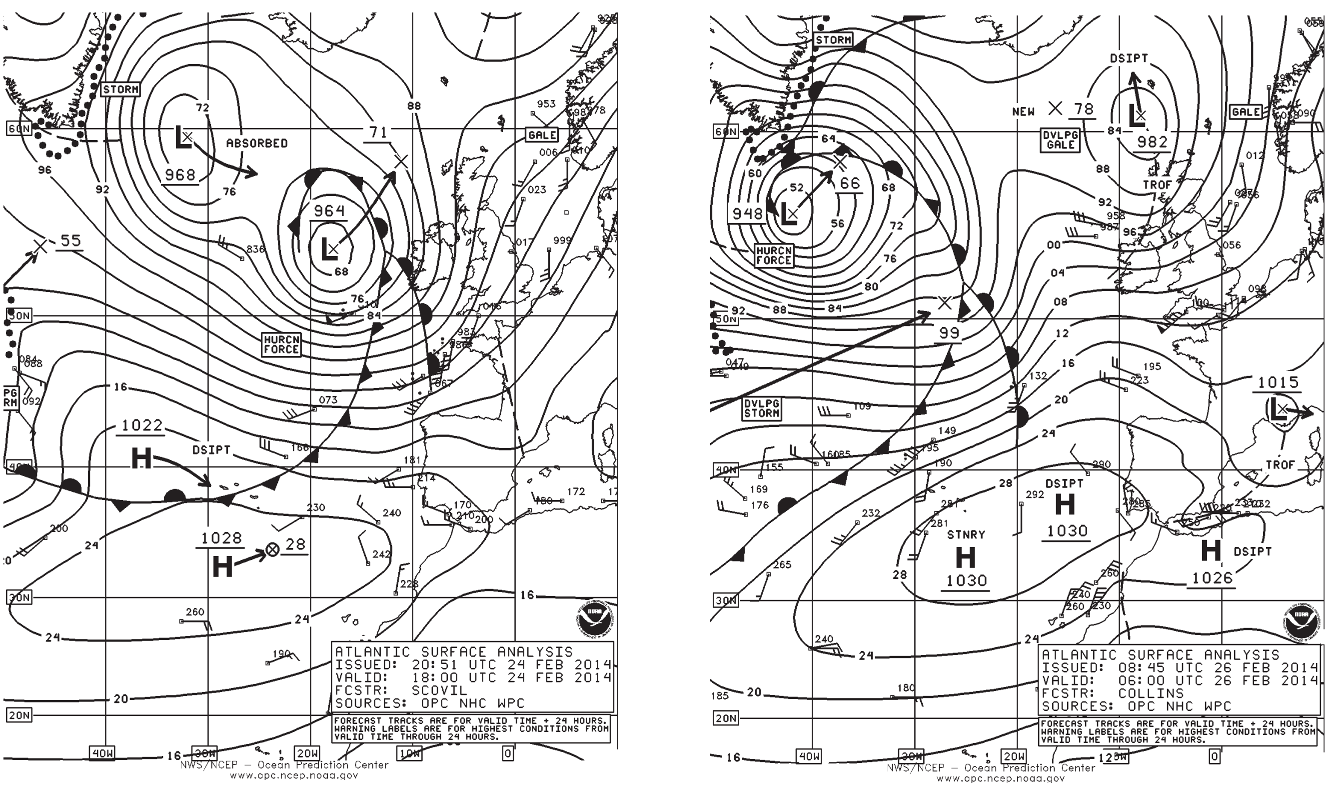


**Figure 18. OPC North Atlantic Surface Analysis charts (Part 1) valid 1800 UTC February 24 and 0600 UTC February 26, 2014.**

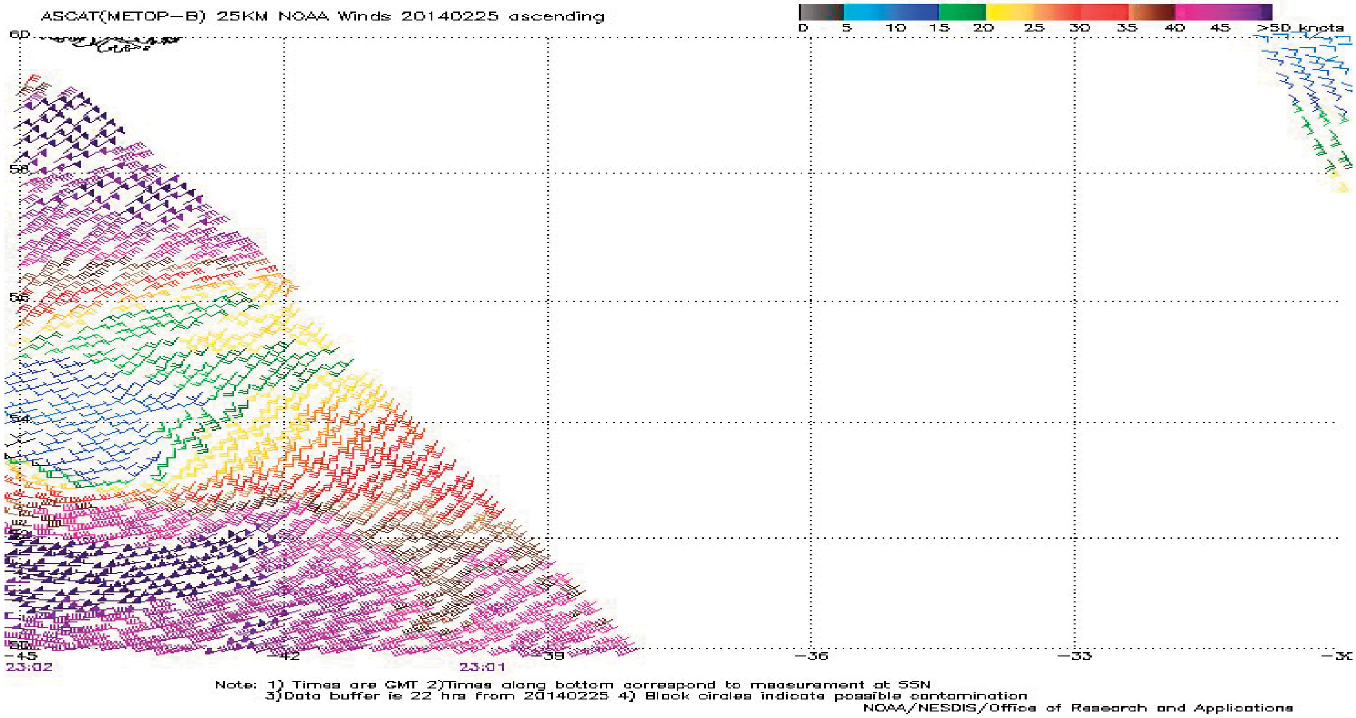


**Figure 19. 25-km ASCAT (METOP-B) image of satellite-sensed winds with partial coverage around the north and south sides of the cyclone shown in the second part of Figure 18. The valid time of the pass is 2302 UTC February 25, 2014, or abouth seven hours prior to the valid time of the second part of Figure 18. The southern tip of Greenland appears at the upper-left corner of the image. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.**

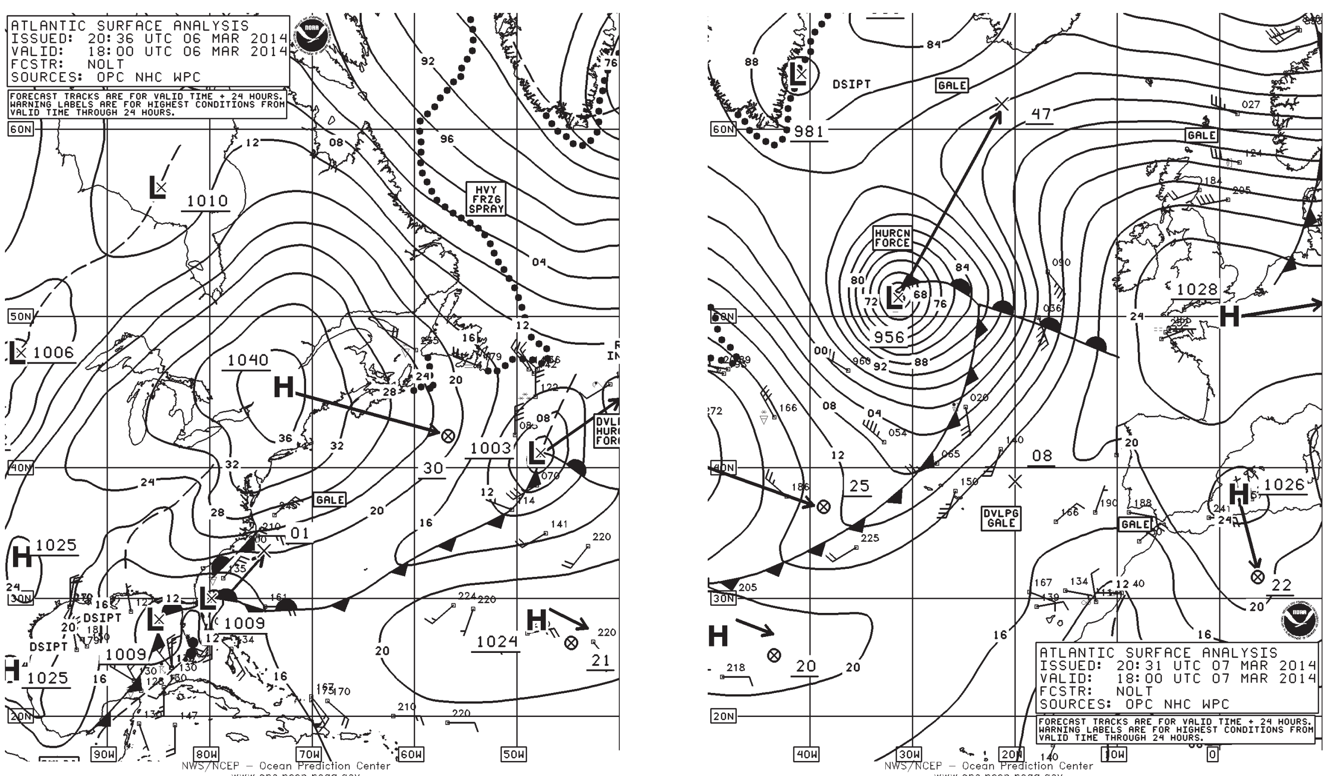


**Figure 20. OPC North Atlantic Surface Analysis charts valid 1800 UTC March 6 (Part 2) and 1800 UTC March 7, 2014 (Part 1).**

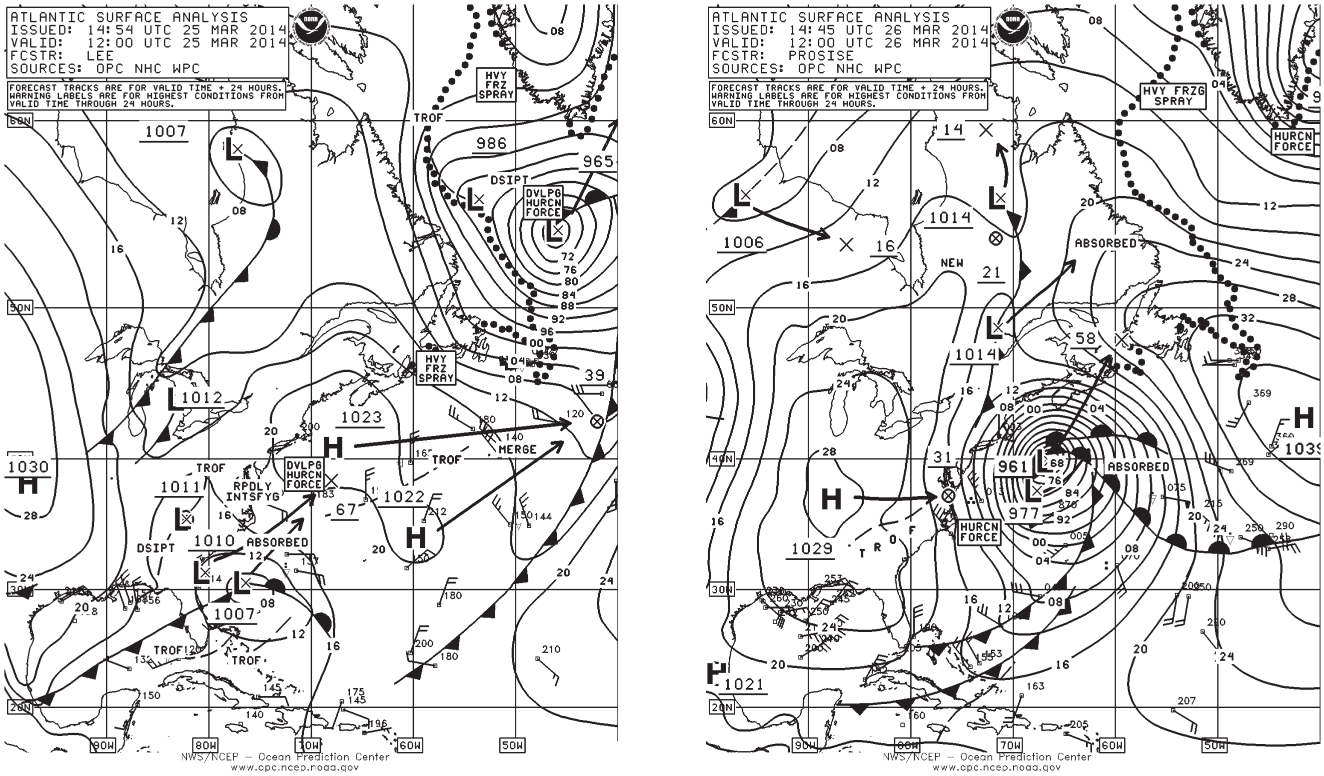


**Figure 21. OPC North Atlantic Surface Analysis charts (Part 2) valid 1200 UTC March 25 and 26, 2014.**

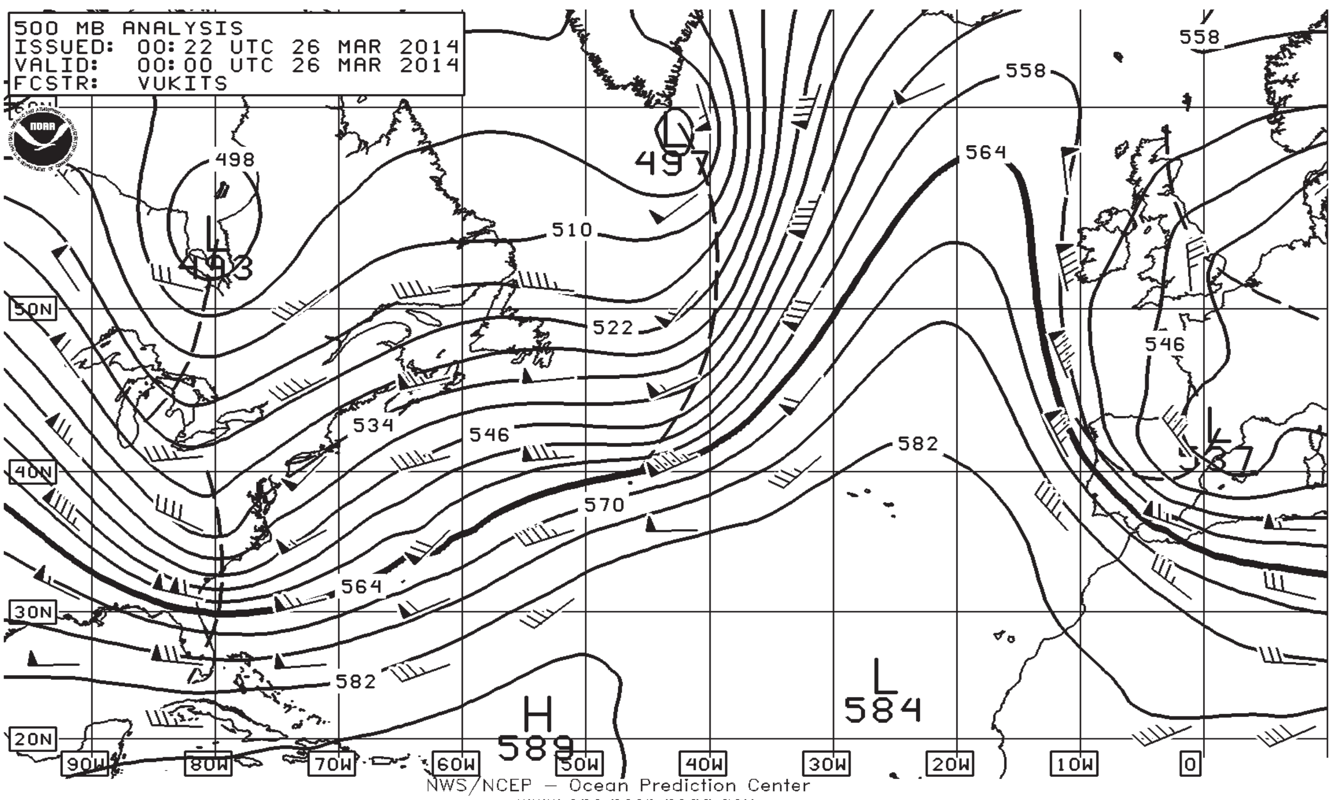


**Figure 22. OPC North Atlantic 500-Millibar (hPa) Analysis valid 0000 UTC March 26, 2014.**

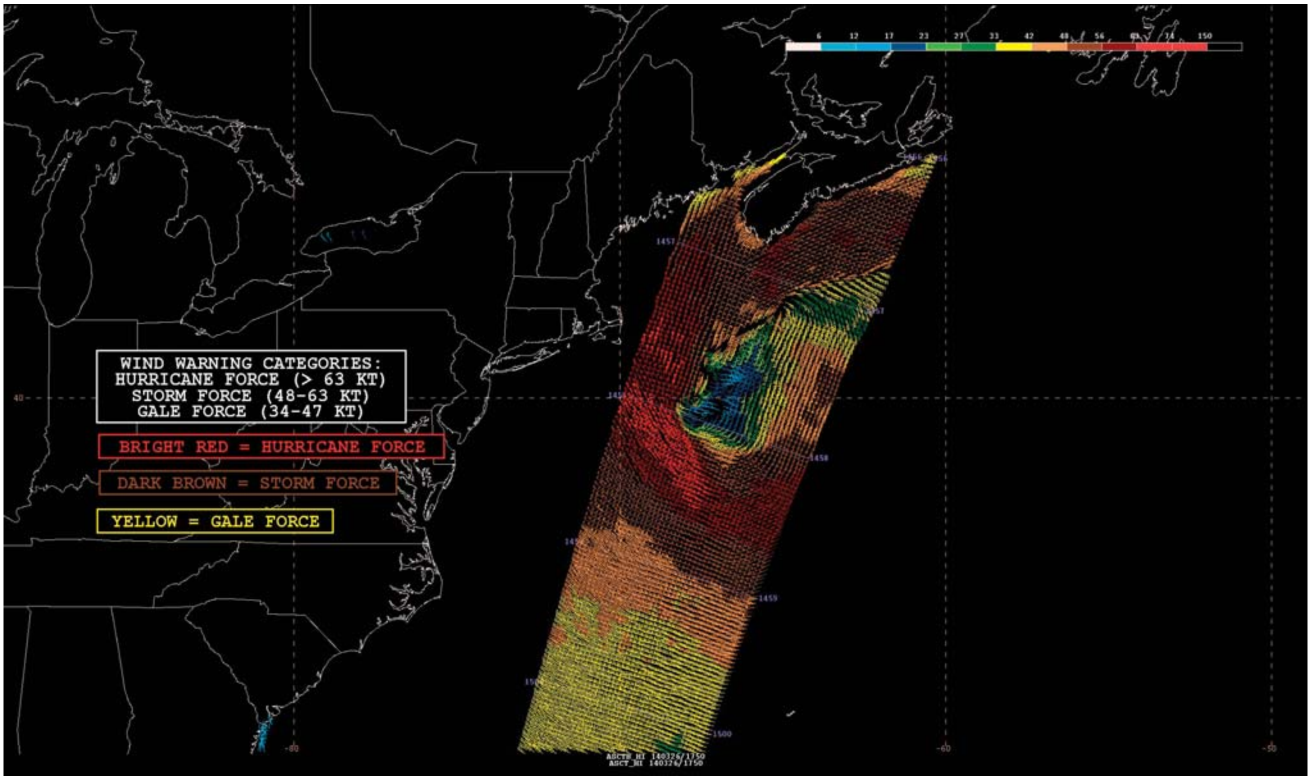


**Figure 23. 25-km ASCAT (METOP-B) image of satellite-sensed winds around the hurricane-force low shown in the second part of Figure 21. The valid time of the pass is approximately 1458 UTC March 26, 2014, or about three hours later than the valid time of the second part of Figure 21. Image includes cross-track time lines of the satellite (four-digit UTC), a color scale for the wind barbs in the upper right side and a legend with wind warning categories on the left. Satellite data reprocessed at 25-km resolution by NOAA/NESDIS. Credit: Timothy Collins (OPC) for the wind warning categories.**

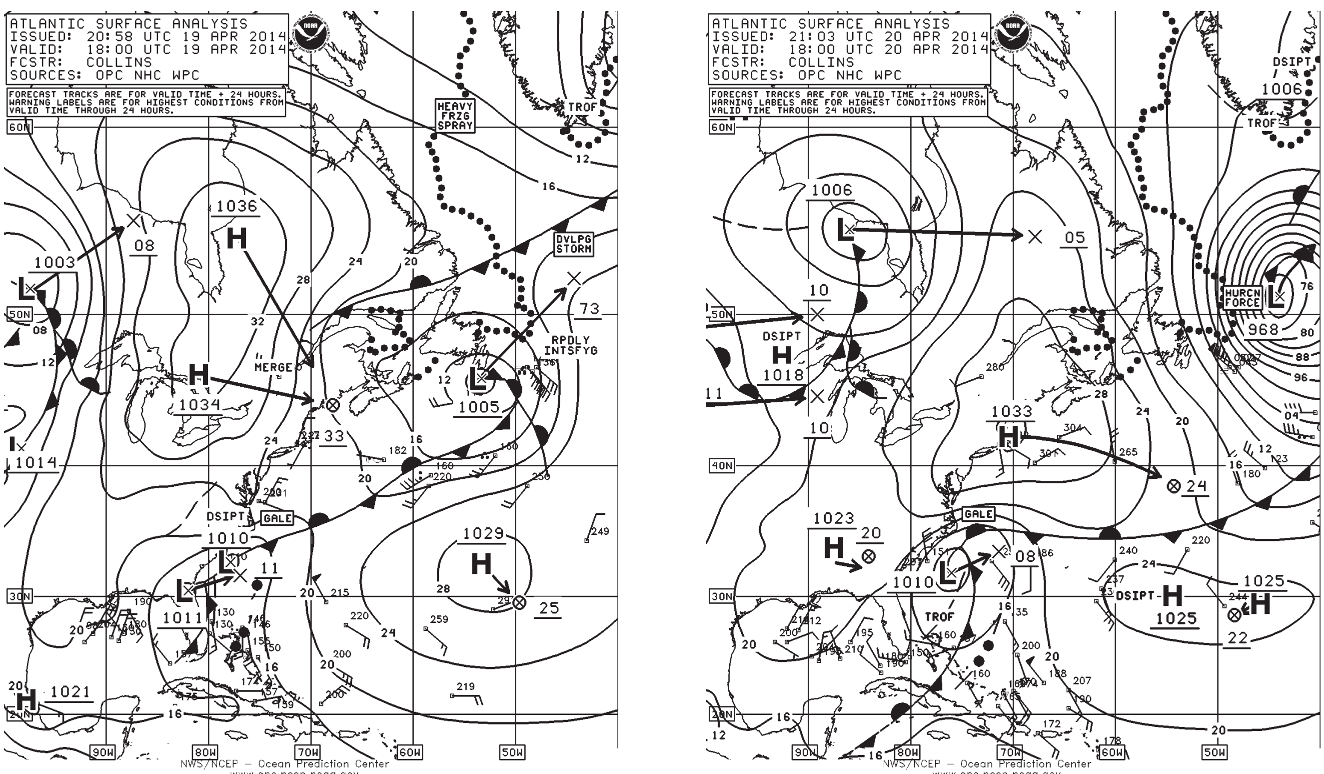


**Figure 24. OPC North Atlantic Surface Analysis charts (Part 2) valid 1800 UTC April 19 and 20, 2014.**

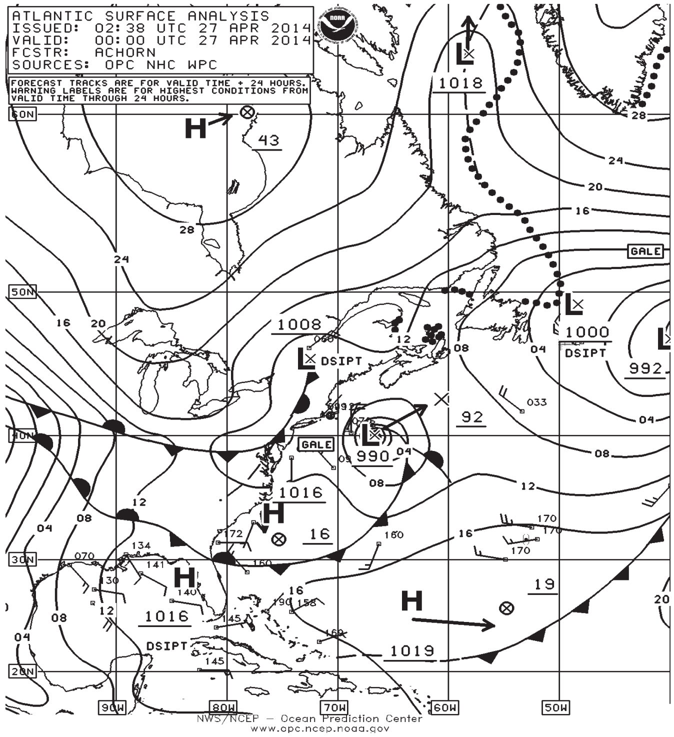


Figure 25. OPC North Atlantic Surface Analysis chart (Part 2) valid 0000 UTC April 27, 2014.

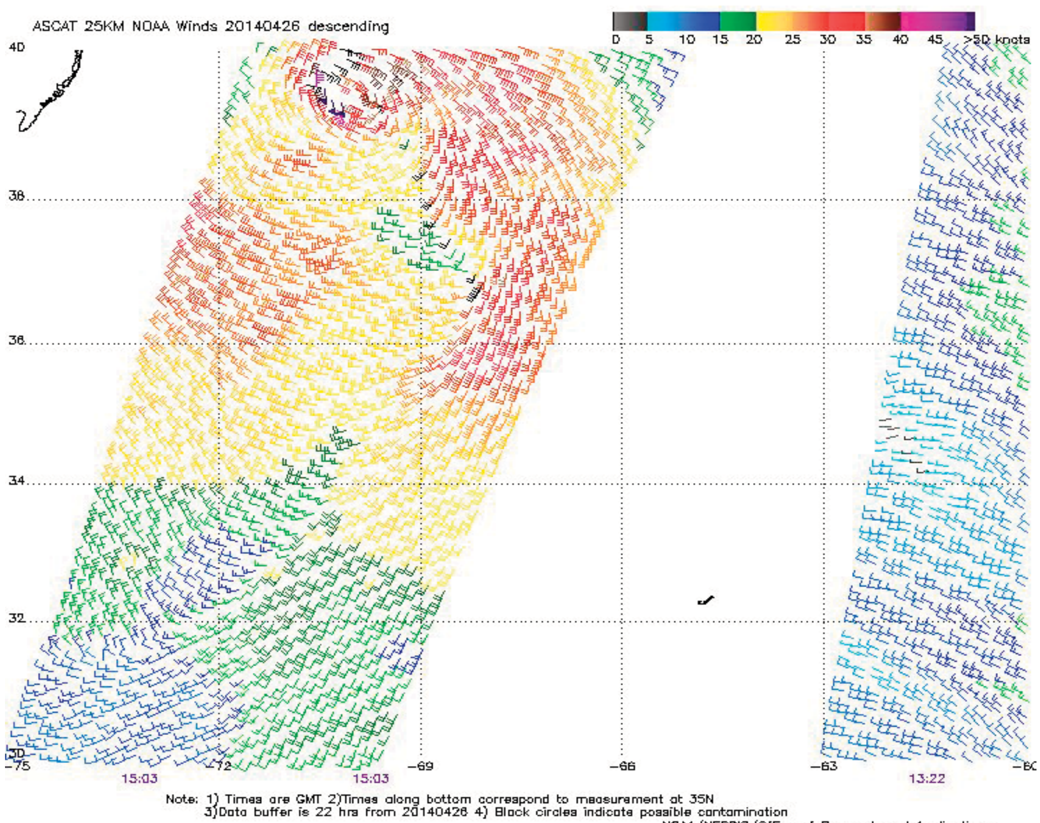


**Figure 26. 25-km ASCAT (METOP-A) image of satellite-sensed winds around the cyclone shown in Figure 25. Retrievals from two passes are shown, 1322 and 1503 UTC April 26, 2014. The valid time of the later pass containing the strongest winds is about nine hours prior to the valid time of Figure 25. A portion of southern New Jersey appears at the upper-left corner of the image. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.**

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1. Sanders, Frederick and Gyakum, John R., Synoptic-Dynamic Climatology of the "Bomb", *Monthly Weather Review*, October 1980.

2. Ocean Surface Winds, http://manati.star.nesdis.noaa.gov/products.php

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5. Sienkiewicz, Joe and Chesneau, Lee, Mariner's Guide to the 500-Millibar Chart, *Mariners Weather Log, Vol. 52, No. 3, December 2008.*

6. E-mail communication, "Flights-update", Feb 15, 2014, Joseph Sienkiewicz confirmation from OSCAT of hurricane force winds in WSW flow (Feb 14) over warm Gulf Stream eddy.

7. E-mail communication, "Peak Wave at 44141 from March 27", Joseph Sienkiewicz from Chris Fogerty, Ph.D, Program Supervisor, Canadian hurricane Centre, Environment Canada, April 3, 2014.

8. E-mail communication, LT Christine Schultz, NOAA Commissioned Corps Technical Operations Coordination Meteorologist, National Weather Service-Ocean Prediction Center, and Joseph Sienkiewicz, Chief Ocean Applications Branch, Ocean Prediction Center , April 30, 2014: "Fast-changing conditions; Account from NOAA ship this weekend, NOAA Fisheries ship Gordon Gunter".

# Marine Weather Review – North Pacific Area

## September 2013 to February 2014

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### Introduction

The weather pattern over the North Pacific was active during the early fall months of September and October as a series of cyclones moved northeast out of the western Pacific near Japan to the Bering Sea or just south the Aleutian Islands to the Gulf of Alaska, with some developing storm force winds. Some of these included former western North Pacific tropical cyclones. Other developing lows moved out of the central or eastern North Pacific toward the Gulf of Alaska. A storm at the end of October that moved into the Bering Sea at the beginning of November was the first one with non-tropical origin to produce hurricane force winds based on analysis using observations, satellite imagery and model data. Later in November and through February increased blocking in the northeastern Pacific or at high latitudes resulted in cyclones coming out of the central and western North Pacific to stall or turn northwest into the Bering Sea or sometimes move west of the Kamchatka Peninsula. The most active month was January, producing six hurricane force lows. Three cyclones developed central pressures as low as 948 hPa, with one each occurring in the months of November to January.

Tropical activity in the northwestern Pacific including cyclones appearing on OPC oceanic surface analyses was concentrated in September and October, with one tropical depression, two tropical storms, four typhoons and two super-typhoons occurring. Of these, four became strong post-tropical (extratropical) lows as they entered the midlatitude westerly's. The most significant of these was Wipha, producing hurricane force winds while moving from near Japan to the western Bering Sea.

## Tropical Activity

### Tropical Storm Man-Yi:

A non-tropical low near 19N 147E at 0000 UTC September 11th  tracked west-northwest and slowly strengthened, developing gale force winds early on the 12th and then becoming upgraded to a tropical storm late on the 12th near 22N 143E with maximum sustained winds 35 kts with gusts to 45 kts. Tropical Storm Man-Yi became strongest when passing south of Japan near 32N 136E early on the 15th with maximum sustained winds 60 kts with gusts to 75 kts. Man-Yi then began to weaken while turning toward the northeast, passing near the east coast of Japan and becoming a post-tropical storm off northern Japan early on the 16th. **Figure 1** shows Man-Yi in extratropical transition to a powerful storm force low near maximum intensity with a central pressure of 962 hPa near the Kamchatka Peninsula. The ASCAT-A image in **Figure 2** shows gale and storm force winds affecting portions of the Sea of Okhotsk and western Bering Sea, with some of the wind barbs, up to 55 kts, indicating actual winds south of the storm center approaching hurricane force due to low bias of ASCAT at higher wind speeds. The **SHIP** UPAB (53N 144E) reported northwest winds of 50 kts and 3.7 m seas (12 ft) at 0600 UTC on the 18th. The cyclone moved north and developed a lowest central pressure of 960 hPa before weakening in the far northwest Bering Sea on the 18th and 19th, where winds diminished to below gale force.

### Typhoon Pabuk:

A non-tropical low with gale force winds moved north along 148E into OPC's radio facsimile Pacific chart area late on September 19th and became a tropical storm with maximum sustained winds of 35 kts near 21N 145E at 0600 UTC on the 21st. Tropical Storm Pabuk moved slowly northwest over the next two days and intensified to a typhoon near 26N 140E at 1200 UTC on the 23rd with maximum sustained winds of 65 kts with gusts to 80 kts. After Pabuk developed a maximum intensity of 90 kts for sustained winds when passing 350 nmi south of Tokyo late on the 24th, the cyclone weakened to a tropical storm late on the 25th and then became post-tropical early on the 26th. Buoy 28401 (32.4N 144.5E) reported southwest winds of 50 kt at 0400 UTC on the 26th. Post-tropical Pabuk then gradually weakened and turned east along 49N, passing south the western and central Aleutian Islands as a gale before turning southeastward and dissipating south of the eastern Aleutians early on the 30th.

**Tropical Storm Sepat:**

A non-tropical low, stationary near 21N 159E on September 26th, began moving northwest on the 27th and became a tropical depression (21W) at 0000 UTC on the 30th near 26N 147E with maximum sustained winds of 30 kts with gusts to 40 kts. Thirty hours later, the cyclone was upgraded to Tropical Storm Sepat near 30N 140E with maximum sustained winds 35 kts with gusts to 35 kts. Sepat then turned toward the north while maintaining this intensity before becoming a post-tropical gale near 36N 142E at 0600 UTC October 2nd. Post-tropical Sepat briefly developed storm force winds with a 995 hPa center near 49N 151E 24 hours later. The **Tokyo Express** (DGTX) encountered south winds of 40 kts near 35N 146E at 1200 UTC on the 2nd. The cyclone then moved into the western Bering Sea as a gale on the 3rd before moving inland over Russia on the 4th.

**Typhoon Fitow:**

A non-tropical low, stationary near 12N 135E late in September, began moving north on the 30th and became a tropical depression (22W) near 14N 133E at 1200 UTC on the 30th and a tropical storm six hours later with maximum sustained winds of 40 kts with gusts to 50 kts. After weakening slightly six hours later, Tropical Storm Fitow strengthened again on October 1st while drifting northwest, reaching an intensity of 60 kts for sustained winds with gusts to 75 kts near 18N 130E at 0000 UTC October 2nd . A vessel using the call sign **SHIP** (23N 127E) reported northeast winds of 50 kts at 1200 UTC October 1st. Fitow had reached the western boundary of the National Weather Service Unified Analysis at that time. The cyclone drifted north and reached typhoon strength early on 3rd before moving west of the area.

**Typhoon Danas:**

A stationary low formed late on October 1st near 17N 150E and developed tropical characteristics late on the 2nd, to become a tropical depression (23W) early on the 3rd and Tropical Storm Danas near 17N 145E at 0600 UTC on the 4th with maximum sustained winds 35 kts with gusts to 45 kts. Danas drifted northwest and continued to strengthen, becoming a typhoon with sustained winds to 65 kts near 19N 140E 1200 UTC on the 5th. Danas developed an intensity of 105 kt for sustained winds with gusts to 130 kts while passing near 24N 131E at 1800 UTC on the 6th. This intensity is at category 3 on the Saffir-Simpson intensity scale (Ref. 4), making Danas a major typhoon. The cyclone passed west of the area shortly thereafter.

**Typhoon Wipha:**

Wipha was already a strengthening typhoon upon passing north of 17N into OPC's radio facsimile oceanic chart area near 18N 138E early on October 12th with maximum sustained winds of 65 kts with gusts to 80 kts. Twenty-four hours later the cyclone developed a peak intensity of 115 kts for sustained winds with gusts to 140 kts near 24N 134E, placing it in a low end category 4 on the Saffir-Simpson scale (highest being 5). A weakening trend and a northeastward turn then set in, along with extratropical transition.

Figure 5 shows Wipha six hours prior to becoming post-tropical and in the second part as a powerful post-tropical low. Wipha was a major event in the northwestern Pacific due to its size, intensity and waves generated. Post-tropical Wipha maintained hurricane force winds until it reached the southern Bering Sea just north of the western Aleutians late on the 17th. The peak intensity of 960 hPa occurred on the morning of the 16th near the central Kurile Islands. The cyclone weakened to a gale near Saint Paul Island but still with a 968 hPa center 0000 UTC on the 19th. Dissipation followed late on October 22nd in the northern Bering Sea. Selected ship reports taken in this event are listed in Table 1.

**Super-Typhoon Francisco:**

A super-typhoon has sustained winds of 130 kts or more. One of two during the fall season, Francisco, moved north into OPC's radio facsimile chart area near 17N 140E at 0600 UTC October 19th at maximum intensity with sustained winds to 140 kts and gusts to 170 kts. This is category 5, the highest on the Saffir-Simpson hurricane scale. Francisco maintained this intensity while moving to 19N 137E over the next 24 hours. The cyclone then began a weakening trend as it became a minimal typhoon while passing west of 130E early on the 23rd and then re-curved northeast into the area as a tropical storm near 27N 131E at 1800 UTC on the 24th with maximum sustained winds 60 kts with gusts to 75 kts. Figure 8 shows Francisco linking with a front to become a 988 hPa post-tropical low over a 24 hour period. The **Westwood Columbia** (C6SI4) reported north winds 45 kts and 7.0 m seas (23 ft) at 0000 UTC on the 26th. Francisco briefly re-intensified to a storm force low on the 27th near the Kurile Islands and then tracked east into the central North Pacific as a gale before becoming absorbed late on the 29th south of the Aleutian Islands.

**Super-Typhoon Lekima:**

Tropical Storm Lekima developed from a stationary non-tropical low near 11N 161E at 1800 UTC October 20th then moved northwest, intensifying to a minimal typhoon 24 hours later near 14N 159E and to a super-typhoon near 18N154E at 1800 UTC on the 22nd with maximum sustained winds of 140 kts with gusts to 170 kts. Lekima remained a super-typhoon until early on the 24th when it began to turn toward the north and then northeast and weaken. The intensity was down to 70 kts for sustained winds near 37N 152E at 0600 UTC on the 26th six hours before becoming a post-tropical hurricane force low six hours later (Figure 8) with fronts. An ASCAT-B image returned southeast winds of 50 kts on the west edge of a 0949 UTC October 26th pass and likely missed higher winds in a gap between passes. The **MSC Malta** (A8GA8) near 34N 160E encountered west winds of 35 kts and 7.0 m seas (23 ft) at 0600 UTC on the 27th. The cyclone moved east and began to weaken on the 26th with winds easing to gale force early on the 27th. After passing 180W the cyclone moved northeast and re-intensified to 968 hPa near Kodiak Island late on the 29th where it briefly developed storm force winds. Post-tropical Lekima then stalled and weakened in the northern Gulf of Alaska on the 30th and 31st and dissipated November 1st.

**Tropical Depression 27W:**

Short-lived T.D. 27W formed near 20N 149E at 0600 UTC October 19th with maximum sustained winds of 25 kts with gusts to 35 kts. The cyclone moved southwest for the first 12 and then turned toward the northwest and dissipated as a remnant low near 25N 143E early on the 20th.

## Other Significant Events of the Period

**Northeastern Pacific Storm, September 5-6:**

Low pressure originating near 39N 164W early on the 4th moved northeast and then turned north through the Gulf of Alaska late on the 5th and on the 6th. Storm force winds occurred on the 6th with the cyclone developing a lowest central pressure of 980 hPa near 55N 153W at 1800 UTC on the 6th.

| OBSERVATION | POSITION | DATE/TIME(UTC) | WIND | SEAS(m/ft) |
|---|---|---|---|---|
| **Amsterdam** (PBAD) | 29N 138E | 13/0000 | NE 40 | |
| **Iver Exporter** (PFBF) | 13N 137E<br>13N 135E | 14/0000<br>14/1200 | W 45<br>W 35 | 8.5/28<br>7.9/26 |
| SHIP | 28N 131E | 14/1800 | NE 45 | |
| SHIP | 29N 132E | 15/0000 | NE 45 | 11.3/37 |
| SHIP | 30N 132E | 15/0300 | N 50 | 8.5/28 |
| SHIP | 31N 132E | 15/0900 | NW 55 | 9.0/30 |
| **Ever Liberty** (9V7960) | 34.5N-130.3E<br>36N 132E | 15/1200<br>16/0000 | N 55<br>N 40 | 2.4/8<br>2.4/8 |
| **Kyoto Express** (DCP12) | 34N 148E<br>34N 147E<br>34N 146E | 15/2100<br>16/0000<br>16/0300 | SE 45<br>S 50<br>SW 50 | <br>10.7/35<br>10.7/35 |
| **Conti Brisbane** (D5BB8) | 32N 133E | 16/0300 | NW 45 | 8.5/28 |
| OZHS2 | 39N 153E | 16/0600 | S 45 | 4.9/16 |
| A8BB2 | 50N 167E | 16/2100 | E 40 | 6.4/21 |
| **APL India** (A8JX7) | 58N 169E<br>57N 164E | 17/1200<br>18/0000 | NE 40<br>NE 30 | 3.0/10<br>10.1/33 |
| **APL China** (WDB3161) | 54N 176W | 19/0000 | NW 45 | 9.0/30 |
| **Vasily Burkhanov** (UGSI) | 62N 179W | 19/1200 | N 45 | |
| Buoy 46070 | 55.1N-175.3E | 18/0500 | | Maximum 8.2/27 |

**Table 1. Selected ship and buoy observations taken during the passage of Typhoon/Post-tropical Wipha.**

**Northeastern Pacific Storm, September 5-6: (cont)**

Storm force winds occurred on the 6th with the cyclone developing a lowest central pressure of 980 hPa near 55N 153W at 1800 UTC on the 6th. ASCAT-B imagery at 2057 UTC on the 6th showed southwest winds as high as 45 kts at the west edge of a pass south of Kodiak Island. The **APL Canada** (A8CG6) near 53N 153W reported west winds of 40 kts and 5.8 m seas (19 ft) at 1800 UTC on the 6th. The cyclone weakened rapidly as it moved onshore near the Kenai Peninsula the following night.

**North Pacific Storm, September 6-9:**

A cyclone slightly deeper than the Gulf of Alaska event mentioned above originated in the Sea of Okhotsk early on September 5th and tracked east between 49N and 51N over the next three days, developing storm force winds and a lowest central pressure of 977 hPa while passing south of the central Aleutian Islands late on the 7th. The cyclone then weakened while turning north into the southeast Bering Sea and then inland over southwest mainland Alaska on the 9th and 10th.

**Northeastern Pacific Storm, September 17-20:**

Figure 9 depicts the development of this storm. A wave of low pressure near 45N 162W at 1800 UTC on the 17th moved northeast while deepening rapidly over the next 24 hours, with the central pressure falling 30 hPa. The cyclone developed a lowest central pressure of 970 hPa near 51N 137W at 0000 UTC on the 20th. Storm force winds occurred over a 36 hour period ending at 0600 UTC on the 20th. At 0900 UTC on the 19th the **Westerdam** (PINX) near 53N 130W reported southeast winds of 60 kts and 4.0 m seas (13 ft). The **Star Princess** (ZCDD6) at 1500 UTC on the 19th and the **Zuiderdam** (PBIG) at 1800 UTC on the 19th observed southeast winds of 60 kts at 55N 132W, with the **Star Princess** also reporting 4.9 m seas (16 ft). The **Amsterdam** (PBAD) near 53N 129W encountered southeast winds 55 kts at 1300 UTC on the 19th. The **MSC Texas** (DCSY2) observed the highest seas, 9.8 m (32 ft) along with northwest winds of 40 kts near 46N 155W at 1200 UTC on the 18th. The cyclone then moved north-northwest and onshore near 60N 140W with winds below gale force early on the 21st.

**North Pacific/ Bering Sea Storm, September 19-24:**

Another rapidly intensifying low originating near 42N 160E at 0000 UTC September 19th moved to near the western Aleutian Islands 24 hours later and then to the eastern Bering Sea in the following 24 hour period, when the central pressure dropped 34 hPa, with the low developing storm force winds at that time. The central pressure dropped as low as 965 hPa near Kodiak Island 12 hours later, making it the deepest low with non-tropical origin in September and October. An ASCAT-B pass from 0656 UTC on the 21st returned winds from the west to northwest up to 50 kts on the eastern edge of the pass south of the Alaska Peninsula. As the cyclone crossed the Gulf of Alaska the winds diminished to gale force early on the 23rd and to below gale force on the 24th.

**Northeast Pacific Storms, September 25-30:**

A low pressure wave moved from northern Japan to the western Bering Sea late on September 24th and on the 25th with gale force winds, and then turned eastward, developing storm conditions when passing near 59N 159W with a 972 hPa central pressure at 1200 UTC on the 27th. The center moved into the northern Gulf of Alaska six hours later with a lowest central pressure of 968 hPa. The cyclone moved across the Gulf of Alaska and stalled near the Queen Charlotte Islands late on the 28th through the 30th while slowly weakening but with winds not dropping to below storm force until the 30th. Additionally, another developing low formed near 49N 156W on the 28th and moved east southeast before turning northeast and briefly developing storm force winds near Vancouver Island with a central pressure as low as 973 hPa late on the 29th before moving inland. At 0300 UTC on the 29th the **Polar Adventure** (WAZV) near 44N 128W reported west winds of 45 kts and, at 2000 UTC that day, 8.2 m seas (27 ft) near 47N 130W. The **USCGC Healy** (NEPP) 56N 154W reported northwest winds of 50 kts and 4.6 m seas (15 ft) at 1200 UTC on the 30th. The **Kennicott** (WCY2920), near 59N 153W, encountered northwest winds of 50 kts at 0900 UTC on the 29th. The drifting buoy 46246 (50N 144.7W), reported seas of 9.4 m (31 ft) at 2300 UTC on the 28th.

**North Pacific Storm, October 30 to November 2:**

A wave of low pressure moved from near Japan on the 29th northeast to the central waters near 45N 172E on the afternoon of the 31st where it developed hurricane force winds (Figure 10 and the ASCAT-B image in Figure 11 showing an area of west winds 50 to 60 kts south of a well defined center). This was the first hurricane force low of the fall season that did not have tropical origins. The cyclone developed a lowest central pressure of 966 hPa 0600 UTC November 1st after which it moved northeast toward the Bering Sea with gradual weakening, with winds diminishing to below gale force in the eastern Bering Sea early on the 2nd. The low dissipated inland on the 3rd.

A vessel using the **SHIP** call sign reported southeast winds of 45 kts near 50N 174W at 1200 UTC on the 1st.

**North Pacific and Bering Sea Storm, November 4-7:**

A complex area of low pressure with multiple centers near Japan early on November 3rd consolidated over the next two days while moving northeast toward the Bering Sea, merging into a single storm center 49N 169E with a 960 hPa center at 1200 UTC on the 5th, with the pressure falling 38 hPa in the preceding 24 hour period. The cyclone developed a lowest central pressure of 948 hPa in the central Bering Sea 24 hours later (**Figure 12**). This, along with two other cyclones occurring later, was the deepest non-tropical cyclone in the North Pacific during the six month period. It was the deepest in a series of cyclones to move through the Bering Sea in the first half of November. The ASCAT-B pass for 2336 UTC on the 5th (**Figure 13**) actually has the higher winds ahead of the Bering occluded front, up to 65 kts, and northwest winds to 55 kts south of the western Aleutians. Shemya Island, a land station, reported northwest winds of 52 kts with gusts to 63 kts at 0751 UTC on the 6th, and a peak gust 69 kts at 0856 UTC on the 6th. St. Paul Research (KEY796, 57N 170W) reported southeast winds of 60 kts at 1800 UTC on the 6th. A vessel with the **SHIP** call sign near 57N 167E, encountered west winds 50 kts at 0000 UTC on the 7th. Buoy 46070 (55.1N 175.3E) reported a maximum significant wave height of 13.4 m (44 ft) at 2000 UTC on the 6th. The cyclone subsequently move north and inland over Russia by early on the 7th but winds over the Bering Sea did not drop to below storm force until the afternoon of the 7th.

**Northeastern Pacific Storm, November 6-7:**

Low pressure formed west of the Oregon offshore waters on the morning of November 6th and moved northeast to Vancouver Island in 24 hours, resulting in a small but potent cyclone producing storm force winds. The lowest pressure in a six hourly analysis was 993 hPa but a drifting buoy 46761 (49.0N 129.3W reported a pressure of 989.6 hPa at 1200 UTC on the 7th.
The **Horizon Anchorage** (KGTX) near 50.5N 130W reported northeast winds of 60 kts at 0900 UTC on the 7th. Buoy 46132 (49.7N 127.9W) reported southeast winds 37 kts with gusts to 49 kts and 5.0 m seas (16 ft) at 0600 UTC on the 7th. The cyclone moved inland later that day.

**Western North Pacific Storm, December 19-23:**

**Figure 15** depicts the low latitude development of this hurricane force low over a 36 hour period. It originated south of Japan late on December 17th. The central pressure fell 36 hPa in the 24 hour period ending at 1200 UTC on the 20th, impressive for such a low latitude development. The ASCAT-A image in **Figure 16** with data missing on the west side does show winds as high as 60 kts south of the center. Rain contamination may be an issue with some wind directions off north of the center. The top winds lowered to storm force early on the 21st as the center drifted northeast, but the central pressures remained around 960 hPa until the 23rd, when the lowest central pressure of 958 hPa was reached, near 48N 170E at 1200 UTC on the 23rd. The **APL India** (A8JX7) near 40N 143E reported north winds of 50 kts and 7.6 m seas (25 ft) at 2100 UTC on the 20th. A vessel with the **SHIP** call sign encountered west winds of 55 kts and 16.5 m seas (54 ft) near 34N 148E at 1500 UTC on the 20th. The **Sea-Land Comet** (WDB9950) near 53N 162E reported northwest winds 45 kts and 9.4 m seas (31 ft) at 0200 UTC on the 23rd. The cyclone moved slowly north into the southern Bering Sea on the 25th, where it dissipated.

**North Pacific Storm, December 24-27:**

Low pressure originating just south of Japan late on December 22nd tracked east-northeast to the central North Pacific on the 25th, where it developed hurricane force winds (**Figure 17**). The ASCAT-B image in Figure 18 valid near the time of the second part of the figure reveals winds as high

as 70 kts on the west side of the center. The cyclone center developed a lowest central pressure of 960 hPa near 47N 178W at 0000 UTC on the 27th, and hurricane force winds lasted until then.
The **APL China** (WDB3161) encountered south winds of 45 kts and 8.5 m seas (28 ft) near 39N 161W at 2100 UTC on the 26th. Weakening set in as the center turned toward the east late on the 26th with the winds diminishing to below gale force late on the 28th when the cyclone turned northeastward. The center became absorbed by another low to the west by the 30th.

**Northwestern Pacific Storm, December 26-29:**

**Figure 19** shows the rapid development of a hurricane force low near the Kurile Islands from a complex of lows over and to the east of Japan over a 24 hour period. The central pressure fell 42 hPa during this period based on the pressure of the low near 40N147E. Six hours later the cyclone developed a lowest central pressure of 948 hPa, the second of three lows of the same intensity. ASCAT-A passes from 27/2310 UTC and 28/1129 UTC showed winds in the east semicircle and the southwest quadrant of the low, respectively, up to 60 kts. The **Lowlands Phoenix** (9HIY9) near 46N 151E reported southwest winds of 45 kts and 9.8 m seas (32 ft) at 0000 UTC on the 28th. Nine hours later the **RDO Concord** (A8TG2) reported northwest winds of 60 kts and 10.1 m seas (33 ft) near 47N 152E. The cyclone subsequently drifted north and then northwest over the Sea of Okhotsk and weakened over the next four days and dissipated late on the 31st.

**Eastern North Pacific Storm, January 1-3:**

A wave of low pressure formed southeast of Japan near 28N 165E late on December 30th and moved rapidly northeast, not developing storm force winds until reaching 160W late on January 1st, where it slowed and drifted east. The cyclone briefly developed hurricane force winds with a 978 hPa center near 40N 159W at 1800 UTC on the 2nd. An ASCAT-A pass from three hours later returned an area of northwest winds 50 to 60 kts on the west side and winds up to 50 kts on the northeast side of the center. The **APL Phillipines** (WCX8884) near 45N 149W encountered southwest winds of 55 kts and 6.1 m seas (20 ft) at 0600 UTC on the 3rd. After reaching a maximum intensity of 972 hPa in terms of central pressure and not winds six hours later, the cyclone drifted east and became absorbed by a gale to the north near the Alaska Peninsula late on the 4th.

**Northwestern Pacific / Bering Sea Storm, January 3-4:**

In this short lived event, low pressure formed near 49N 172E with a 980 hPa central pressure at 0600 UTC on the 3rd and moved into the central Bering Sea eighteen hours later with a lowest central pressure of 957 hPa and storm force winds. The cyclone then turned toward the west and, after briefly reaching hurricane force strength six hours later, weakened and crossed the Kamchatka Peninsula late on the 4th with winds diminishing to below gale force. An ASCAT-A pass from 0952 UTC on the 4th revealed northeast winds up to 55 kts on the north side near the Russian coast.

**Northeastern Pacific Storm, January 9-11:**

A complex of lows well south of Kodiak Island at 1800 UTC on the 9th (**Figure 20**) consolidated into a hurricane force low near 49N 149W with a 976 hPa center 24 hours later, and the second part of **Figure 20** shows the system becoming complex once again. ASCAT-A imagery from 0542 UTC on the 11th reveals an area of northwest winds to 55 kts to the west of the southern low center. The **Kodiak** (KQXZ) near 50N 137W reported southeast winds of 60 kts and 7.3 m seas (24 ft) at 1800 UTC on the 10th. The **CMA CGM Orfeo** (9HA3487) encountered west winds of 50 kts near 43N 140W at 0000 UTC on the 11th. Buoy 46036 (48.4N 133.9W) at 1600 UTC on the 11th reported northwest winds of 41 kts with gusts to 51 kts and 6.5 m seas (21 ft), and five hours later reported highest seas at 8.5 m seas (28 ft). The cyclone then weakened inland over British Columbia later on the 11th.

**North Pacific Storm, January 12-15:**

A new low formed on a front moving off Japan near 35N 142E 0000 UTC on the 12th and moved east-northeast, developing storm force winds late on the 12th and hurricane force winds with a relatively compact 976 hPa cyclone in the central waters near 42N 180W at 1200 UTC on the 14th. A 14/2111 UTC ASCAT-B pass returned a small area of west winds 50 to 60 kts on the southwest side near the pass edge. The cyclone moved northeast while maintaining pressures in the 970s but winds weakened to gale force on the 15th, and the system became absorbed by a new low approaching from the south later that day.

**North Pacific Storm, January 15-19:**

Low pressure originating down near 27N 152E 0000 UTC on the 16th moved northeast and rapidly developed into a hurricane force low eighteen hours later near 36N 167E with a 982-hPa center. Figure 21 shows the relatively compact circulation in the central waters. Figure 23 is an ASCAT-A pass showing a large area of winds 50 to 65 kts on the south and west sides. The cyclone moved northeast and reached a maximum intensity of 956 hPa near 50N 158W at 1200 UTC on the 19th before top winds weakened to storm force six hours later and to gale force early on the 20th.The low turned northwest into the Bering Sea on the 20th and 21st and then dissipated late on the 22nd. The **London Express** (DPLE) near 55N 156W reported east winds of 50 kts at 1200 UTC on the 19th. The **Penang Senator** (DQVH) encountered northeast winds of 50 kts and 10.7 m seas (35 ft) near 54N 159W six hours later. Buoy 46066 (52.8N 155.0W) reported southeast winds 39 kts with gusts to 51 kts and 7.5 m seas (25 ft) at 1800 UTC on the 19th, and highest seas 10.5 m (34 feet) three hours later.

**North Pacific Storm, January 19-21:**

The next significant event followed a track similar to that of the January 15th -19th storm, with Figure 22 showing a somewhat larger and more intense system. It originated as a new low at 27N 144E 1800 UTC on the 17th (Figure 21). An ASCAT-B pass from 20/2049 UTC showed winds 50 to 60 kts in a pattern similar to Figure 23 but may miss higher winds between passes. The cyclone developed a lowest central pressure of 948 hPa near 41N 166W at 1200 UTC on the 21st, the third cyclone with this pressure during the six month period. The **Sea-Land Lightning** (WDB9986) near 49N 163W encountered north winds of 40 kts and 6.7 m seas (22 ft) at 1200 UTC on the 22nd. The cyclone moved northeast and then north along 160W with winds weakening to gale force by the 22nd. The low turned northwest into the Bering Sea on the 23rd and dissipated on the 25th.

**Northwestern Pacific Storm, February 4-6:**

A deep cyclone similar in intensity to the November 9th-11th event moved into the Sea of Okhotsk as depicted in Figure 24. It originated near southern Japan early on the 2nd and moved east before turning north near 150E over the next three days. The central pressure fell 30 hPa in the 24 hour period ending at 1200 UTC on the 5th. The **OOCL Beijing** (VRIB3) reported south winds of 35 kts and 11.6 m seas (38 ft) near 37N 160E at 0000 UTC on the 5th. The **Lutoga** (UFLC), near 49N 147E, reported northwest winds of 50 kts 12 hours later. An ASCAT-A pass valid near 0000 UTC on the 6th showed winds 50 to 65 kts near the edge of the data in the southeast Sea of Okhotsk. The cyclone then moved northwest and dissipated late on the 6th.

**Western North Pacific Storm, February 8-9:**

A low-pressure wave south of Japan near 28N early on the 7th intensified into a hurricane force low near 36N 145E with a 984 hPa at 0000 UTC on the 9th, and the cyclone developed a lowest central pressure of 980 hPa near 39N 148E 12 hours later. An ASCAT-A pass for 09/1042 UTC returned a swath of northwest winds 50 to 60 kts on the southwest side. The cyclone then weakened while moving northeast on the 9th and then turning northwest into the Sea of Okhotsk on the 10th, where it dissipated by the 13th.

## North Pacific Storm, February 26-March 1:

Low pressure originating east of Japan near 37N 156E tracked east-northeast into the central waters 43N 175E at 1200 UTC on the 27th where it developed hurricane force winds and a lowest central pressure of 956 hPa (**Figure 25**). The infrared satellite image in **Figure 27** shows a mature system with an expansive cloud pattern and frontal structure, reflecting some weakening of the system as in **Figure 26**. The ASCAT-B image in **Figure 28** shows winds at least 50 to 55 kts in the southwest semicircle of the cyclone, with the data free gap between passes possibly missing the highest winds. The **Kota Jati** (VRWJ7) near 47N 175E reported northeast winds of 45 kts and 7.0 m seas (23 ft) at 2100 UTC on the 27th. The cyclone subsequently moved slowly east and weakened, with top winds diminishing to gale force early on March 1st.

## Eastern North Pacific Storm, February 27-28:

An intense low developed unusually far south off central California at the end of February with **Figure 26** showing the cyclone at maximum intensity with a central pressure of 969 hPa. It originated as a secondary development on a front near 32N 137W at 1200 UTC on the 27th with its central pressure falling 27 hPa in the next 24 hour period. ASCAT-B imagery with limited coverage showed a small area of north- winds of 50 kts to the west of the center. The **Horizon Enterprise** (KRGB) near 36N 137W reported northwest winds of 45 kts at 0000 UTC March 1st. Six hours later, the **Overseas Anacortes** (KCHV) near 31N 128W reported west winds of 45 kts and 8.8 m seas (29 ft). The cyclone drifted north and weakened over the next two days with its top winds diminishing to below gale force.

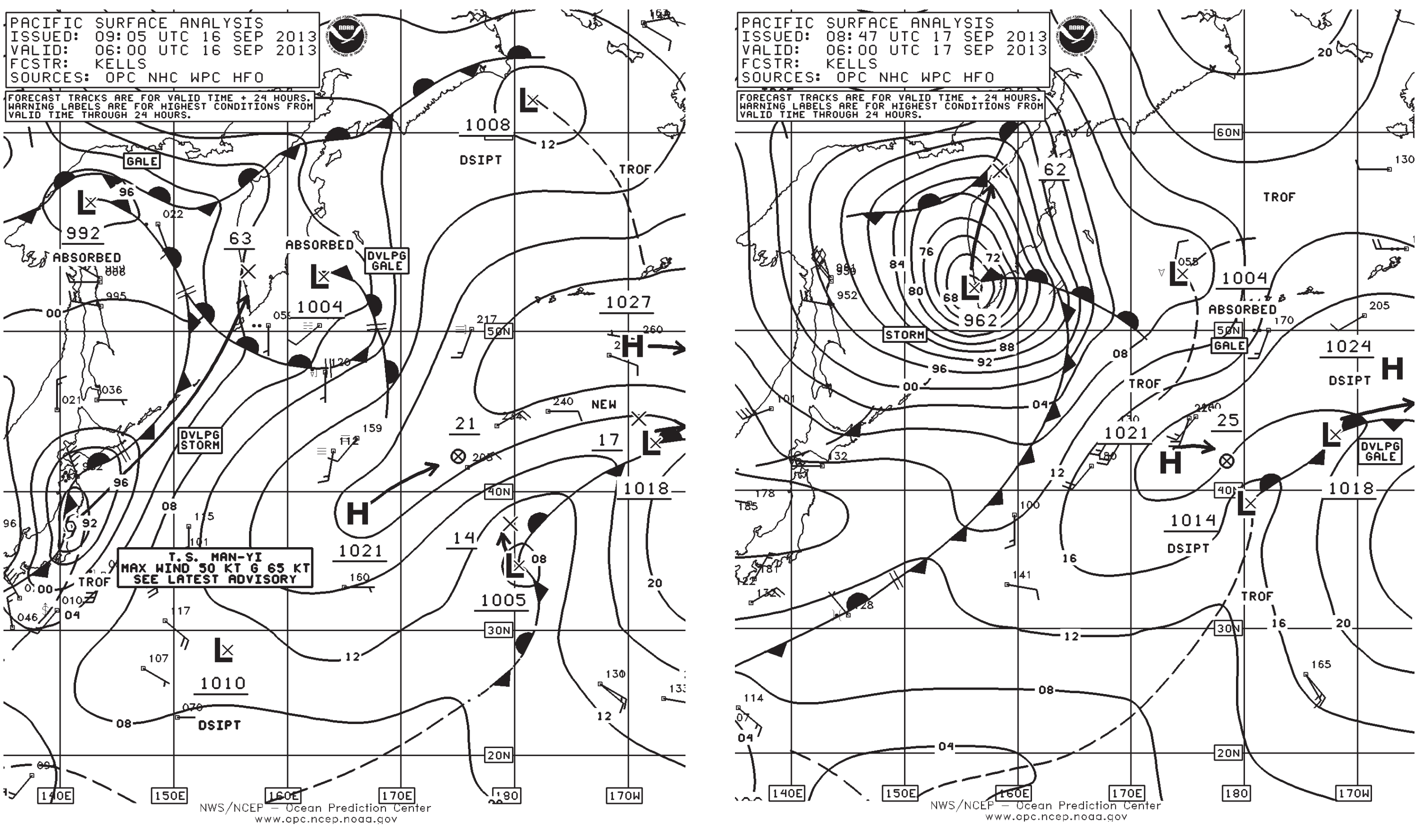


**Figure 1. OPC North Pacific Surface Analysis charts (Part 2 - west) valid 0600 UTC September 16 and 17, 2013. Twenty-four hour forecast tracks are shown with the forecast central pressures given as the last two whole digits in millibars (hPa). Tropical cyclone information appears in text boxes.**

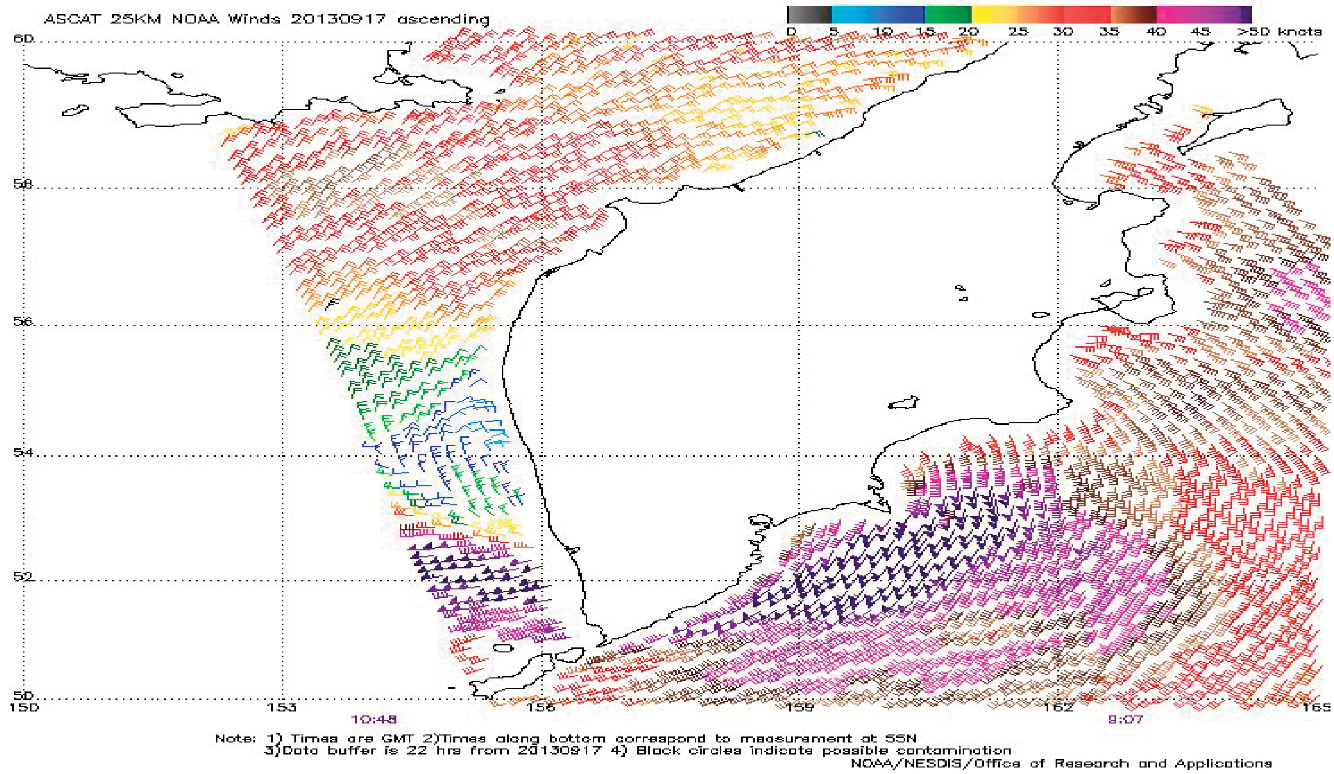


**Figure 2. ASCAT METOP-A (Advanced Scatterometer) image of satellite-sensed winds (25-km resolution) around the cyclone (Post-tropical Man-Yi) shown in the second part of Figure 1. Portions of two passes, 0907 and 1048 UTC September 17, 2013, are displayed. The valid time of the earlier pass is about three hours later than the valid time of the second part of Figure 1. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.**

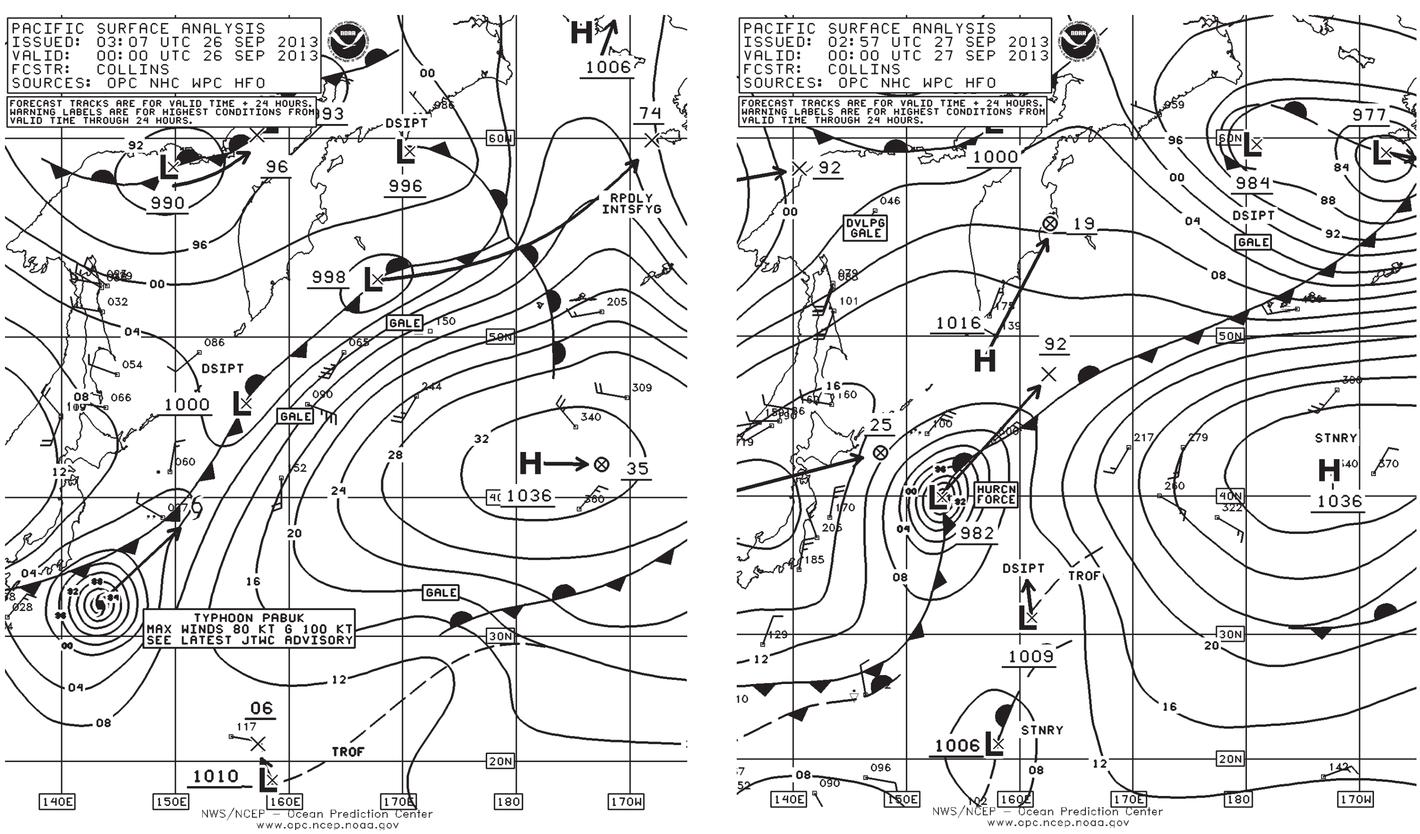


**Figure 3. OPC North Pacific Surface Analysis charts (Part 2) valid 0000 UTC September 26 and 27, 2013.**

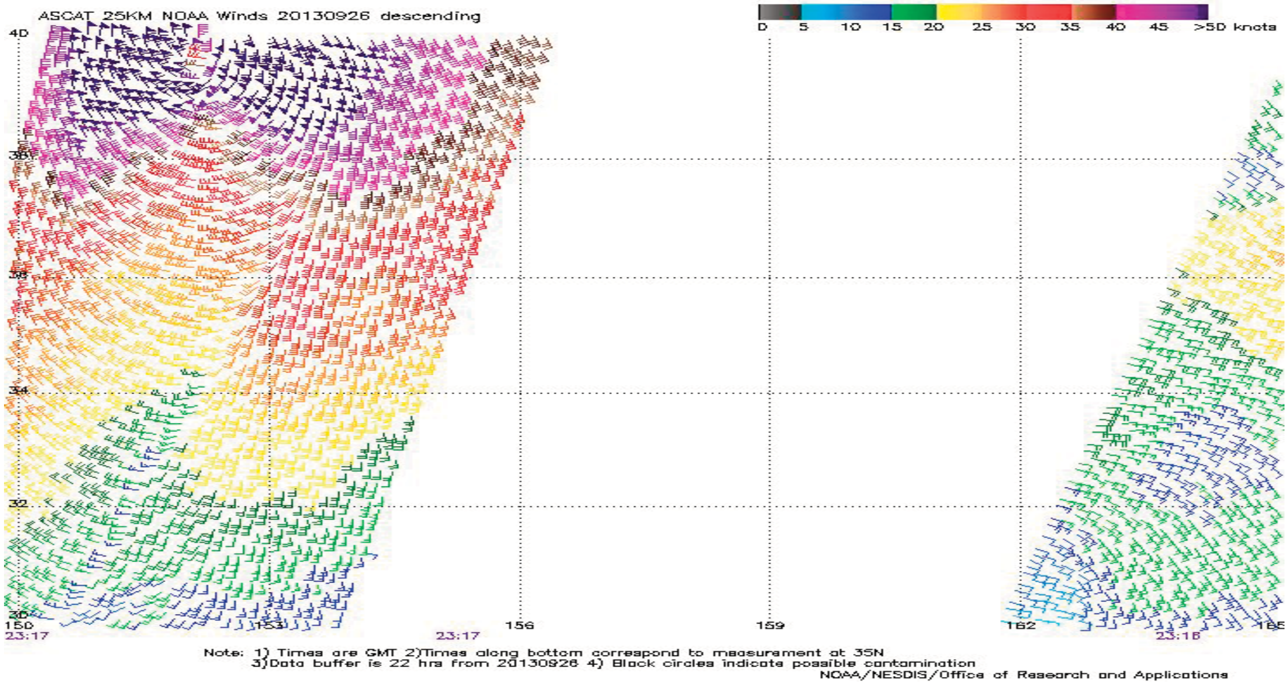


**Figure 4. ASCAT (METOP-A) image of satellite-sensed winds (25-km resolution) around the southern semicircle of the cyclone, post-tropical Pabuk, shown in the second part of Figure 3. The valid time of the pass is 2317 UTC September 26, 2013, or less than one hour prior to the valid time of the second part of Figure 3. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.**

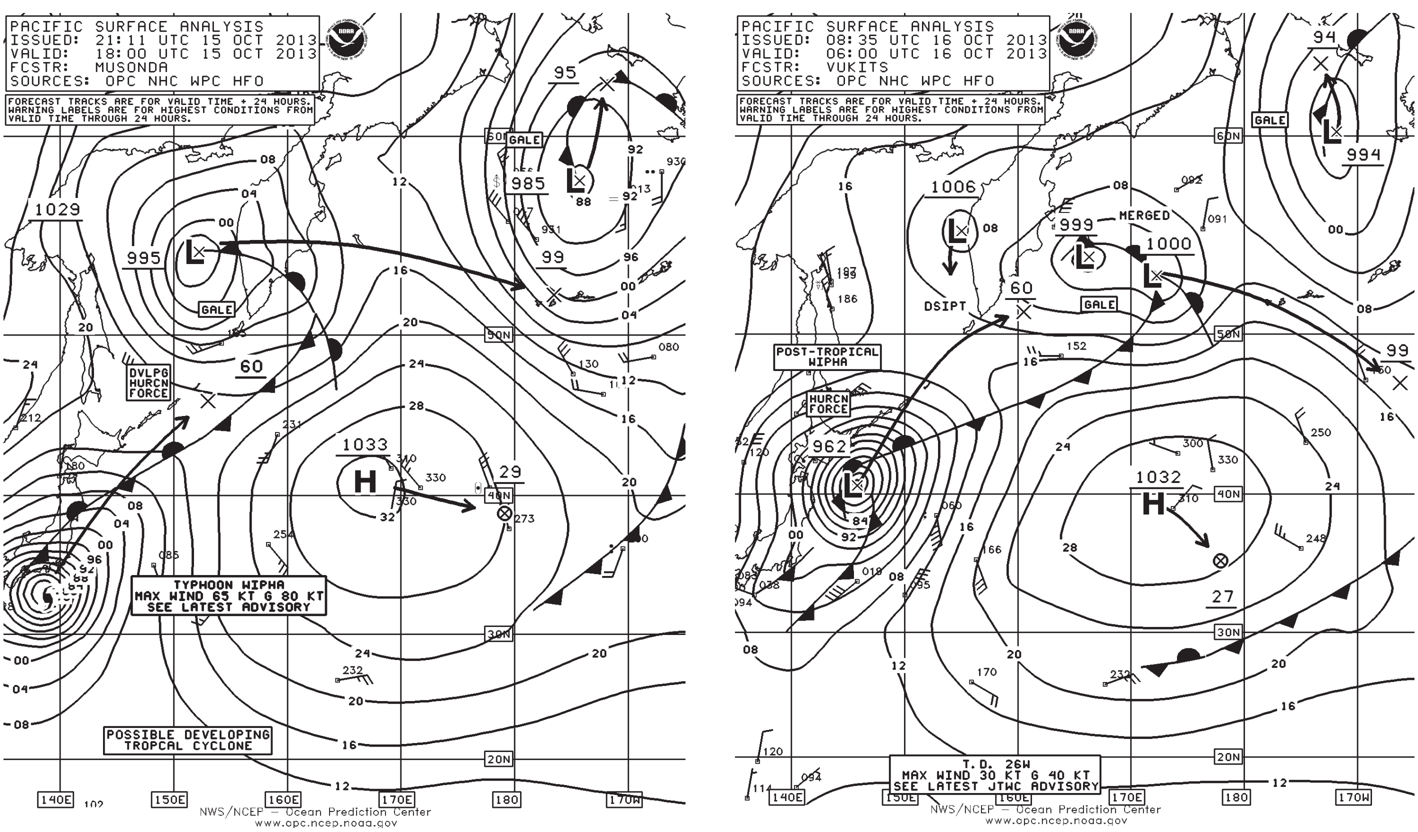


**Figure 5. OPC North Pacific Surface Analysis charts (Part 2) valid 1800 UTC October 15 and 0600 UTC October 16, 2013.**

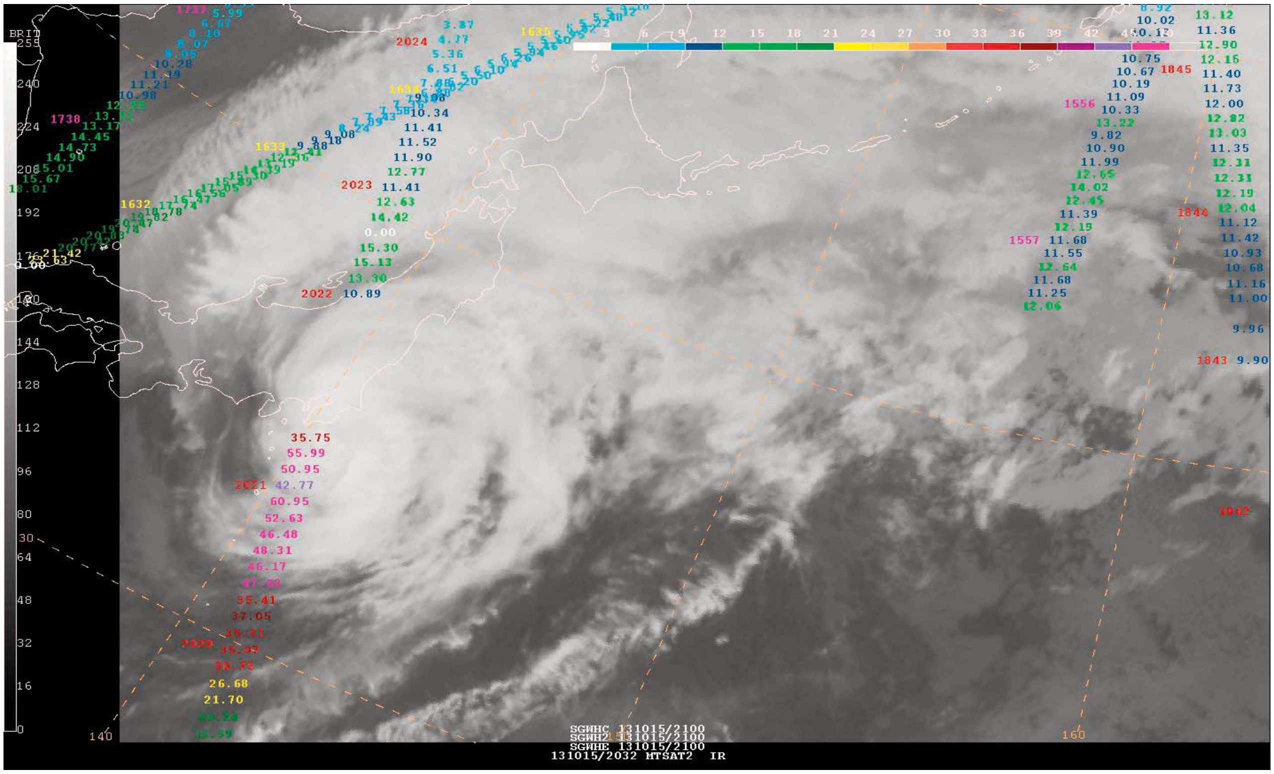


**Figure 6. MTSAT2 infrared satellite image valid 2032 UTC October 15, 2013 or about two and one-half hours later than the valid time of the first part of Figure 5. Satellite senses temperature on a scale from warm (black) to cold (white) in this type of image. Altimeter data is plotted along satellite tracks with significant wave heights in feet plus two decimal places with satellite times (four digit UTC) appearing to the left. Image is reprocessed by NOAA/NESDIS.**

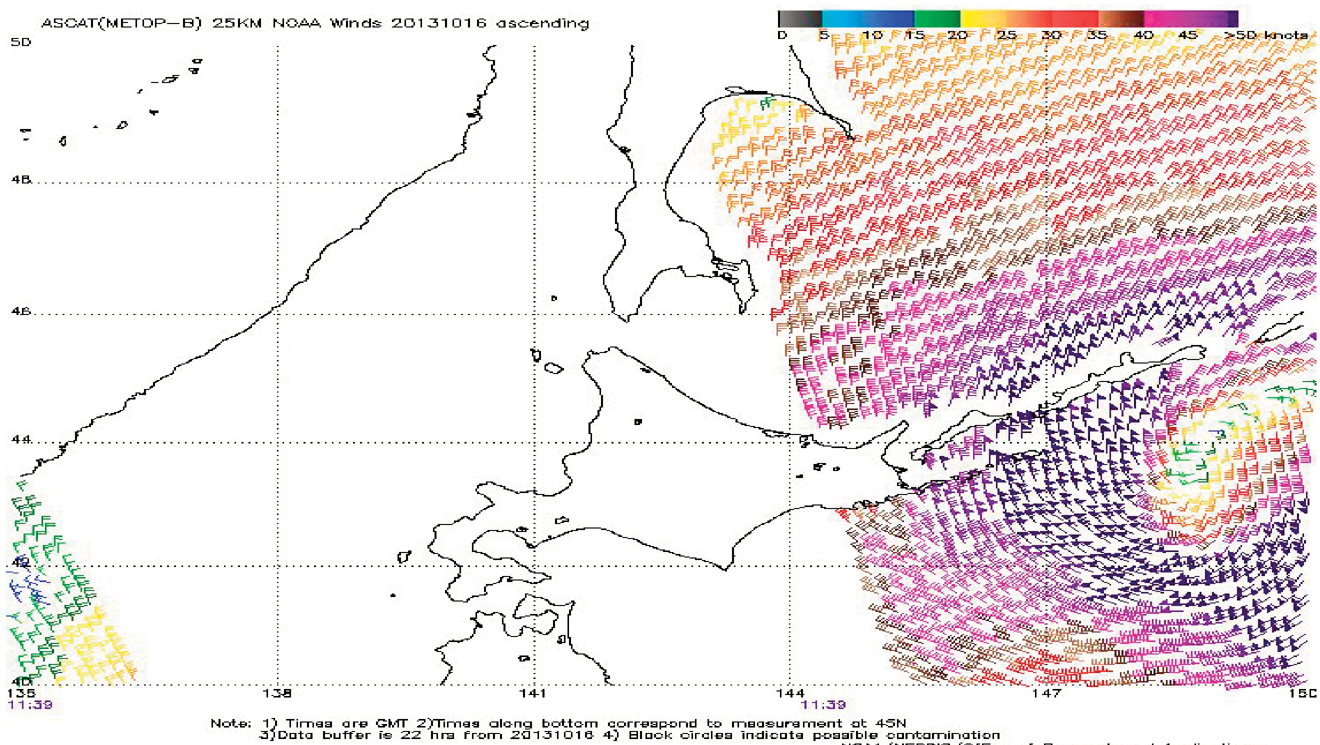


**Figure 7. 25-km ASCAT (METOP-B) image of satellite-sensed winds around the hurricane-force low (post-tropical Wipha) shown in the second part of Figure 5. The valid time of the pass is 1139 UTC October 16, 2013, or about five and one-half hours later than the valid time of the second part of Figure 5. Northern Japan and portions of the Kurile and Sakhalin Islands appear in the image. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.**

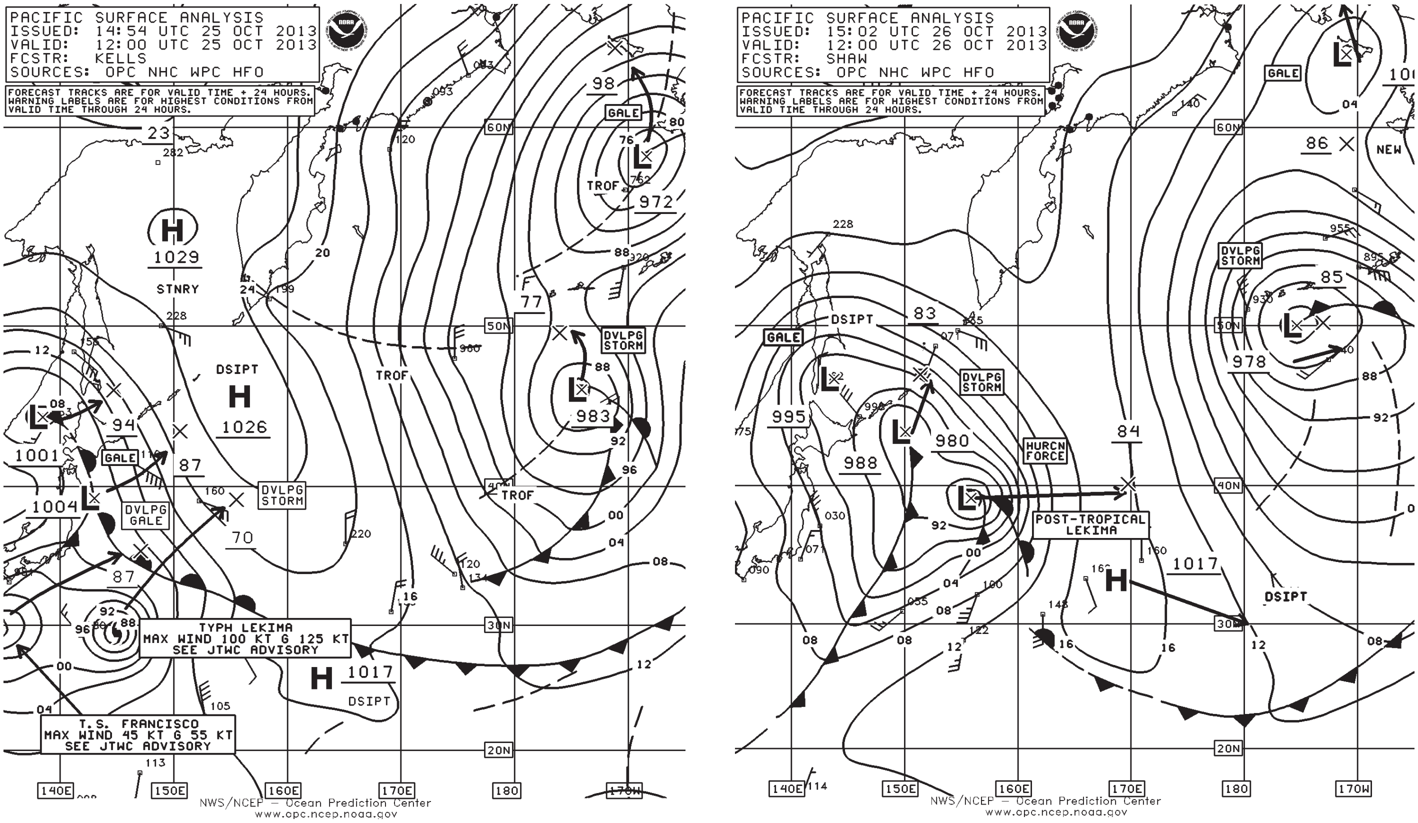


**Figure 8. OPC North Pacific Surface Analysis charts (Part 2) valid 1200 UTC October 25 and 26, 2013.**

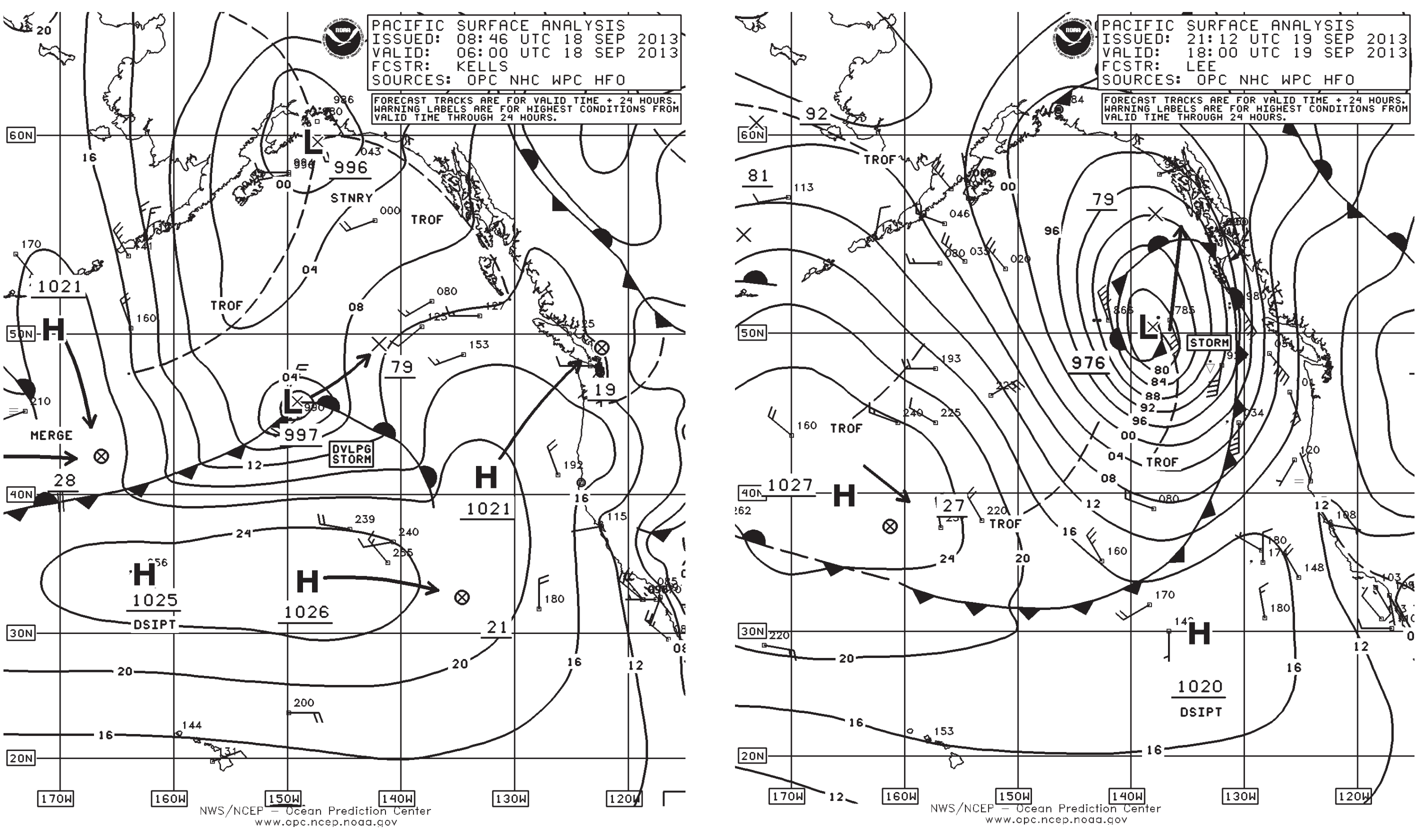


**Figure 9. OPC North Pacific Surface Analysis charts (Part 1-east) valid 0600 UTC September 18 and 1800 UTC September 19, 2013.**

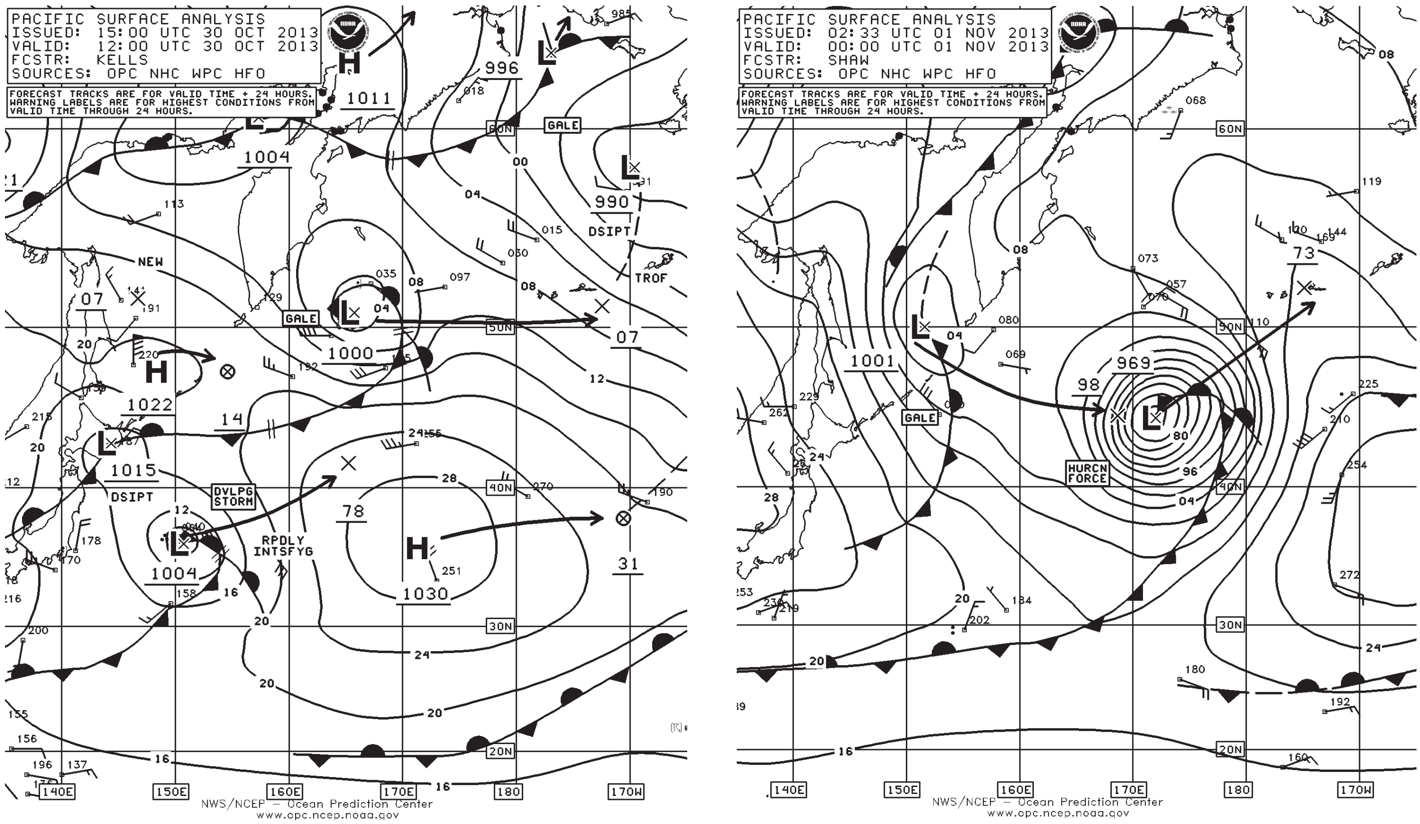


**Figure 10. OPC North Pacific Surface Analysis charts (Part 2) valid 1200 UTC October 30 and 0000 UTC November 1, 2013.**

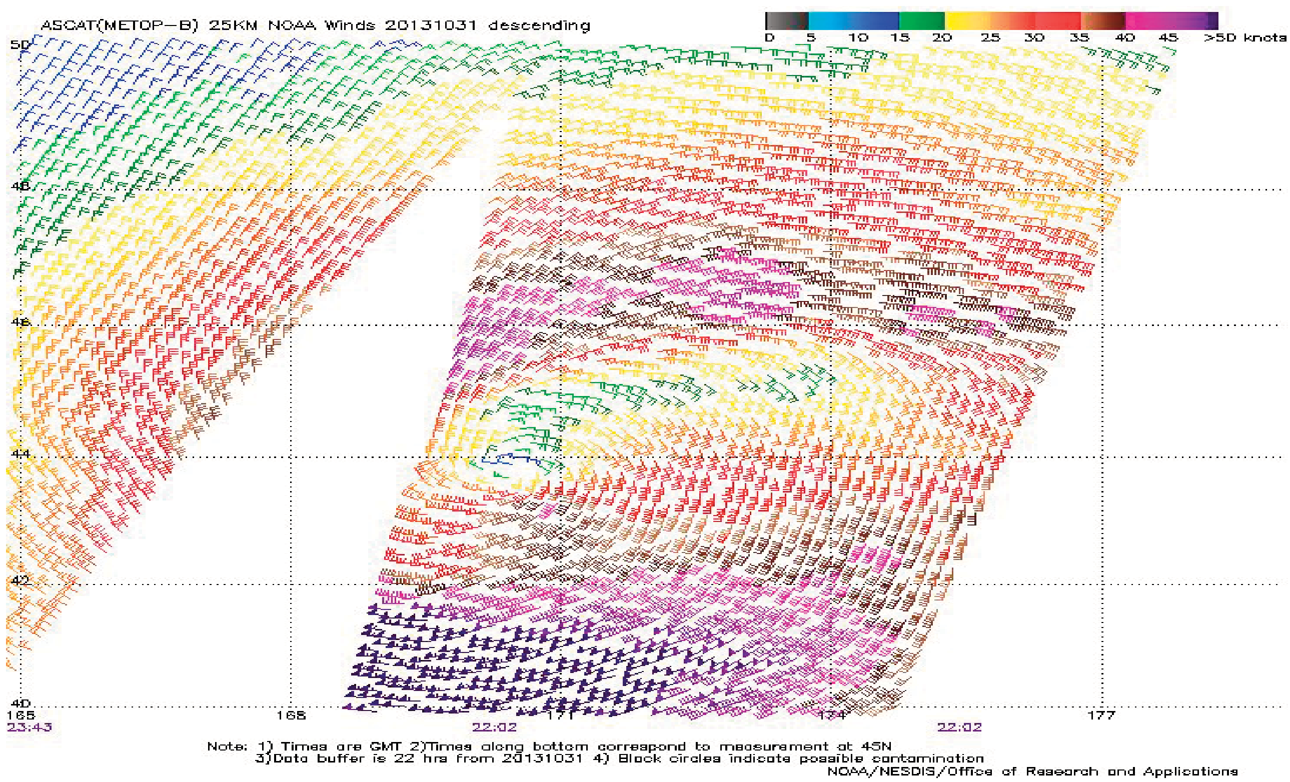


**Figure 11. ASCAT (METOP-B) image of satellite-sensed winds (25-km resolution) around the cyclone shown in the second part of Figure 10. Portions of two passes are shown. The valid time of the earlier pass is 2202 UTC October 31, 2013, or about two hours prior to the valid time of the second part of Figure 10. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.**

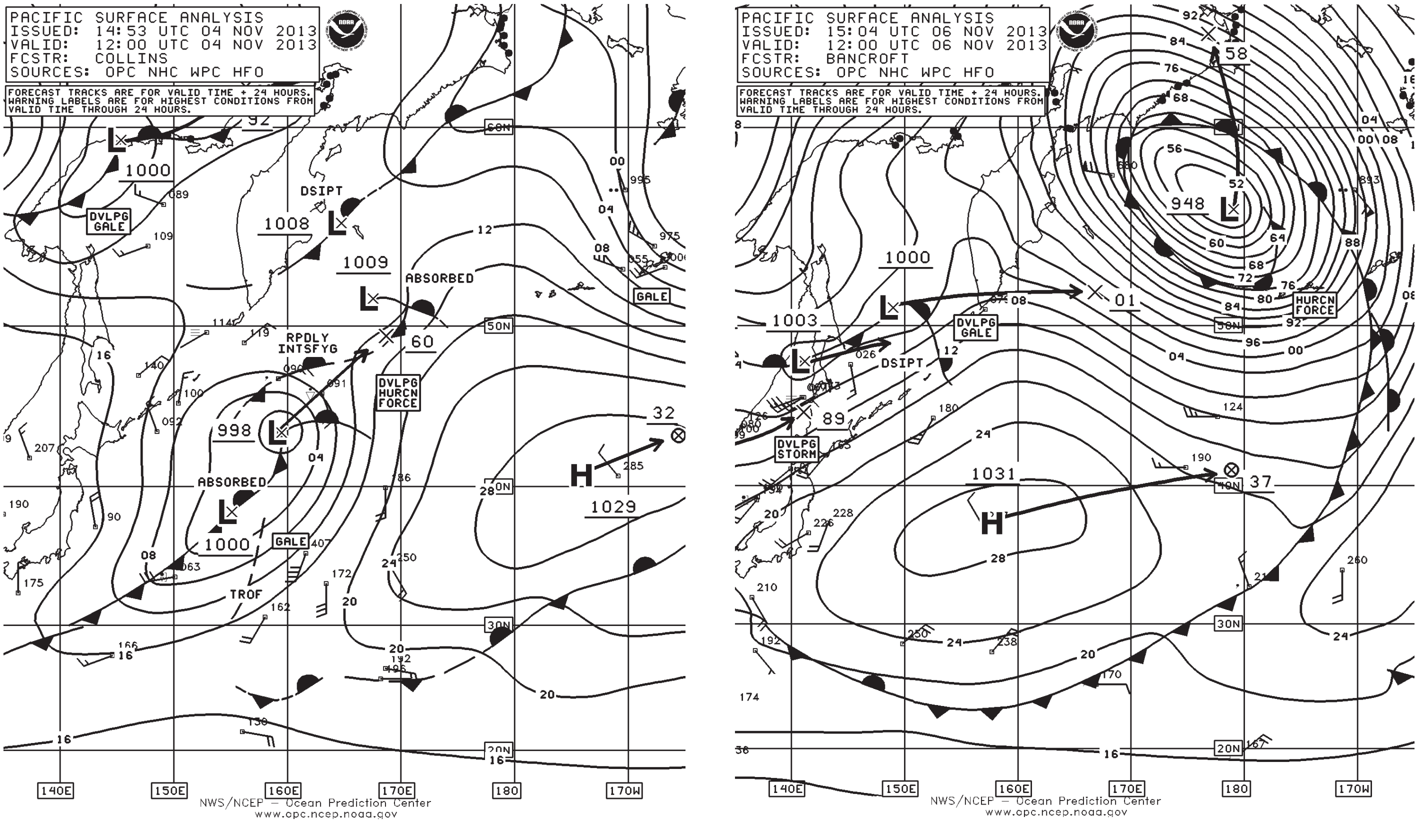


**Figure 12. OPC North Pacific Surface Analysis charts (Part 2) valid 1200 UTC November 4 and 6, 2013.**

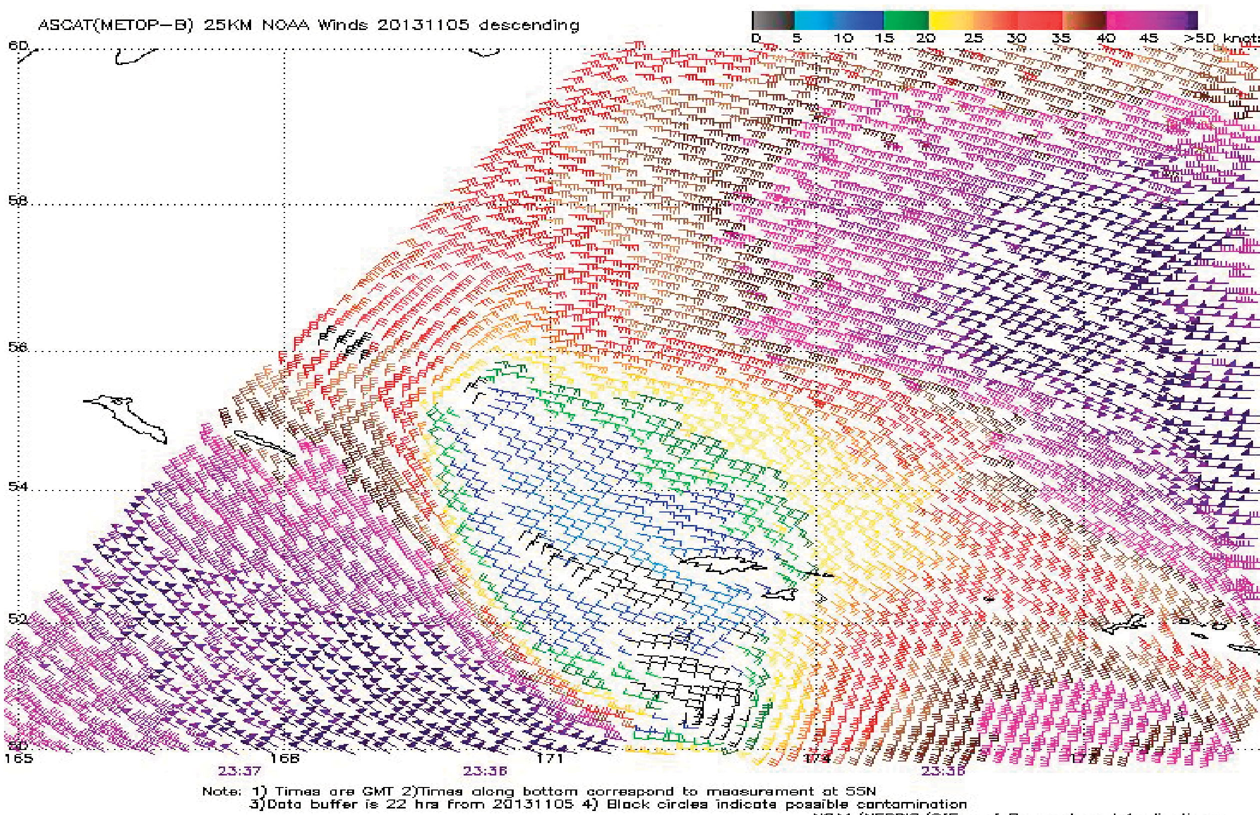


**Figure 13. ASCAT (METOP-B) image of satellite-sensed winds (25-km resolution) around the hurricane-force low shown in the second part of Figure 12. The valid time of the pass is 2336 UTC November 5, 2013 or about twelve and one-half hours prior to the valid time of the second part of Figure 12. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.**

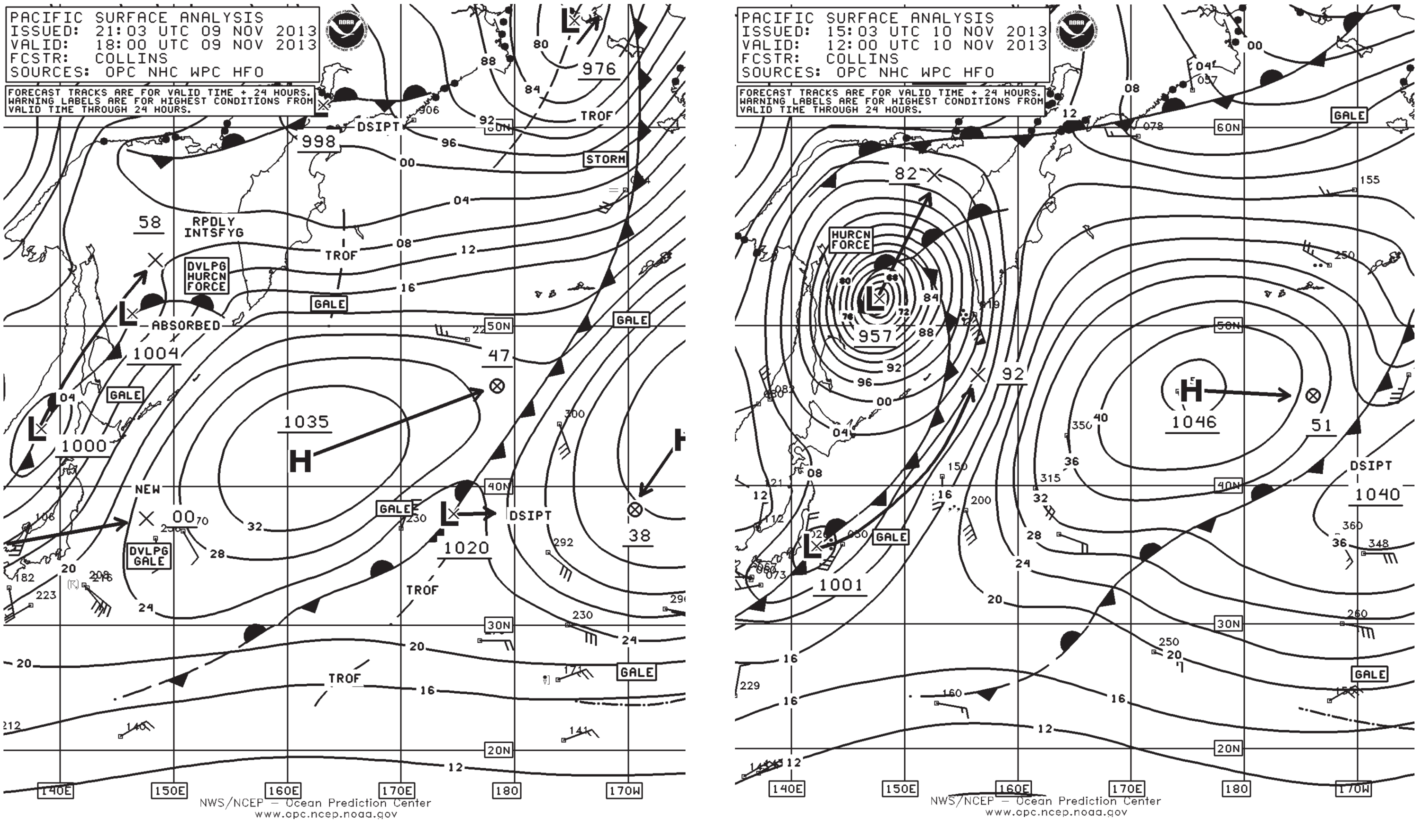


**Figure 14. OPC North Pacific Surface Analysis charts (Part 2) valid 1800 UTC November 9 and 1200 UTC November 10, 2013.**

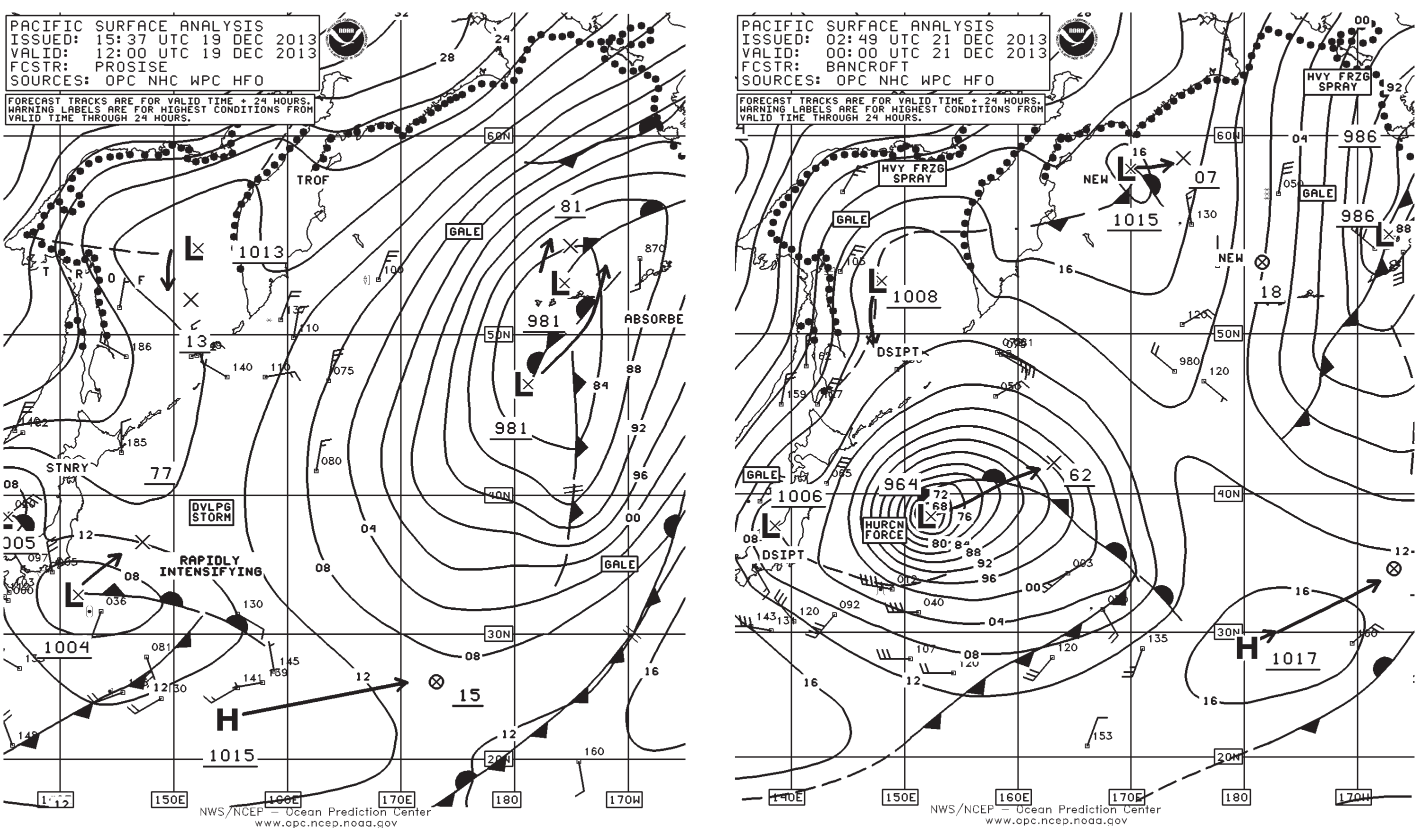


**Figure 15. OPC North Pacific Surface Analysis charts (Part 2) valid 1200 UTC December 19 and 0000 UTC December 21, 2013.**

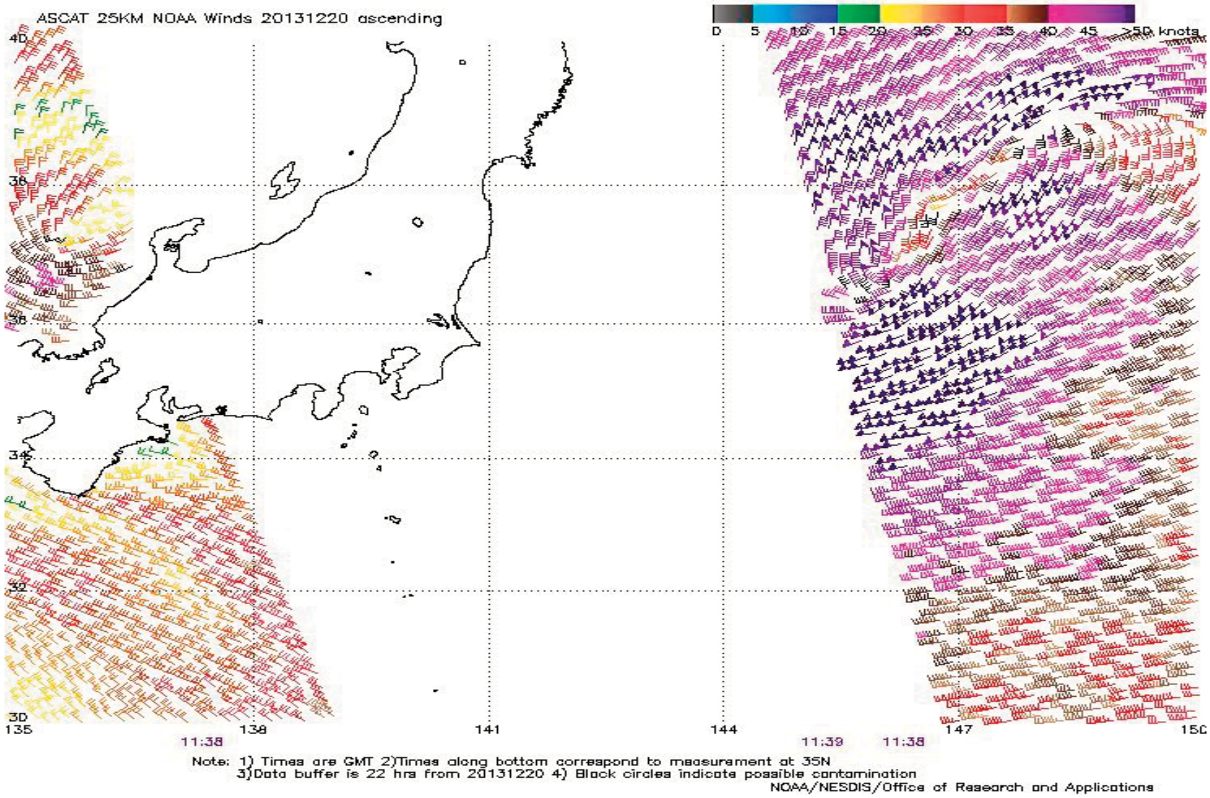


**Figure 16. ASCAT (METOP-A) image of satellite-sensed winds (25-km resolution) around the cyclone shown in the second part of Figure 15. The valid time of the pass is 1138 UTC December 20, 2013 or about twelve and one-half hours prior to the valid time of the second part of Figure 15. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.**

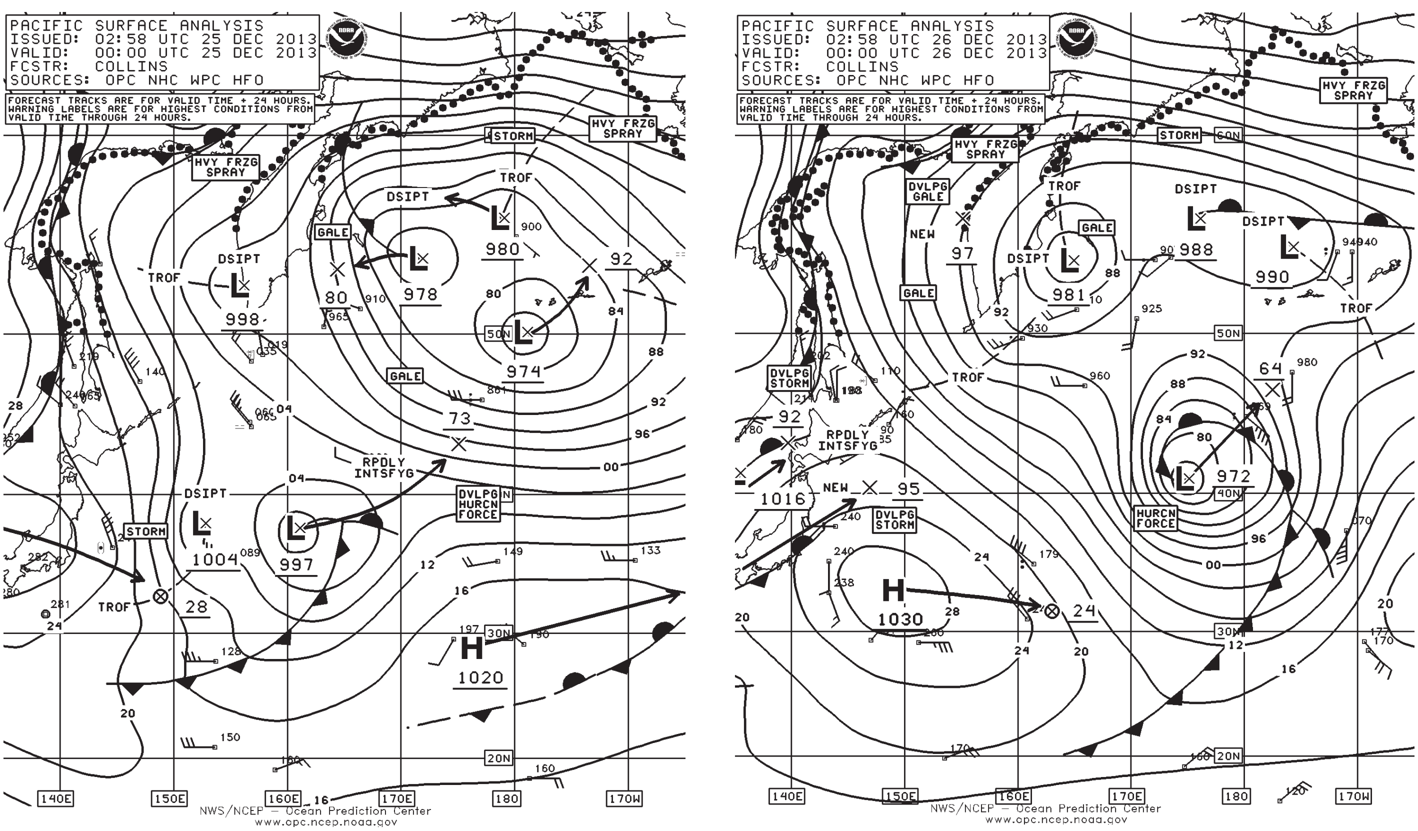


**Figure 17. OPC North Pacific Surface Analysis charts (Part 2) valid 0000 UTC December 25 and 26, 2013.**

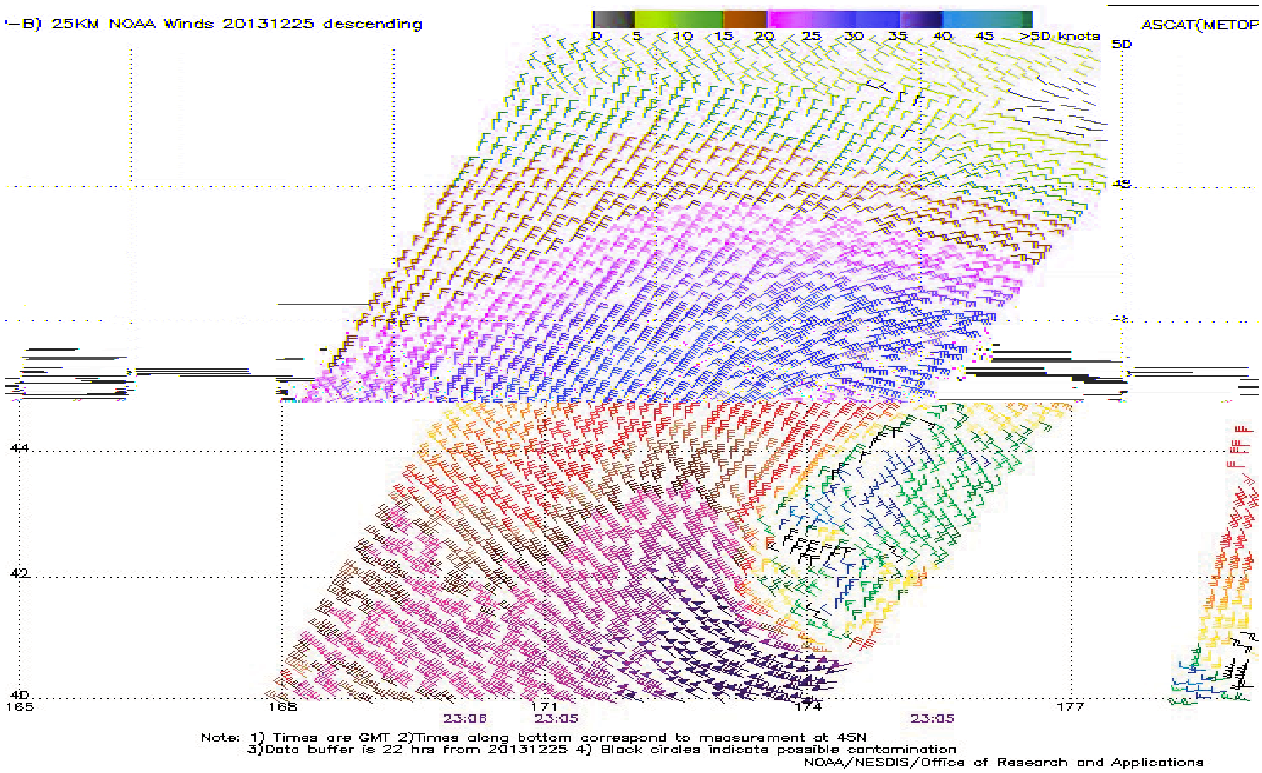


**Figure 18. ASCAT (METOP-B) image of satellite-sensed winds (25-km resolution) around the cyclone shown in the second part of Figure 17. The valid time of the pass is 2305 UTC December 25, 2013 or about one hour prior to the valid time of the second part of Figure 17. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.**

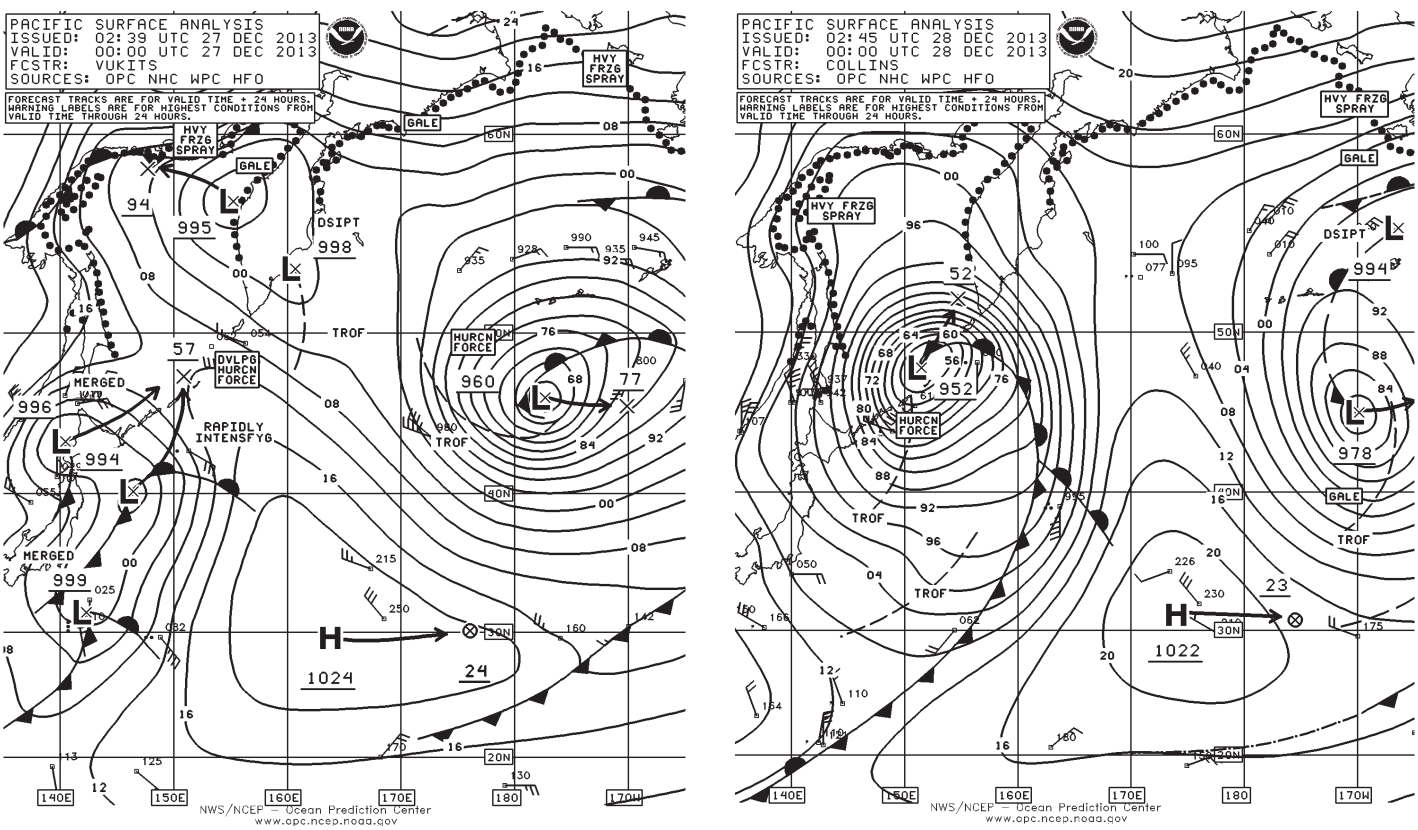


**Figure 19. OPC North Pacific Surface Analysis charts (Part 2) valid 0000 UTC December 27 and 28, 2013.**

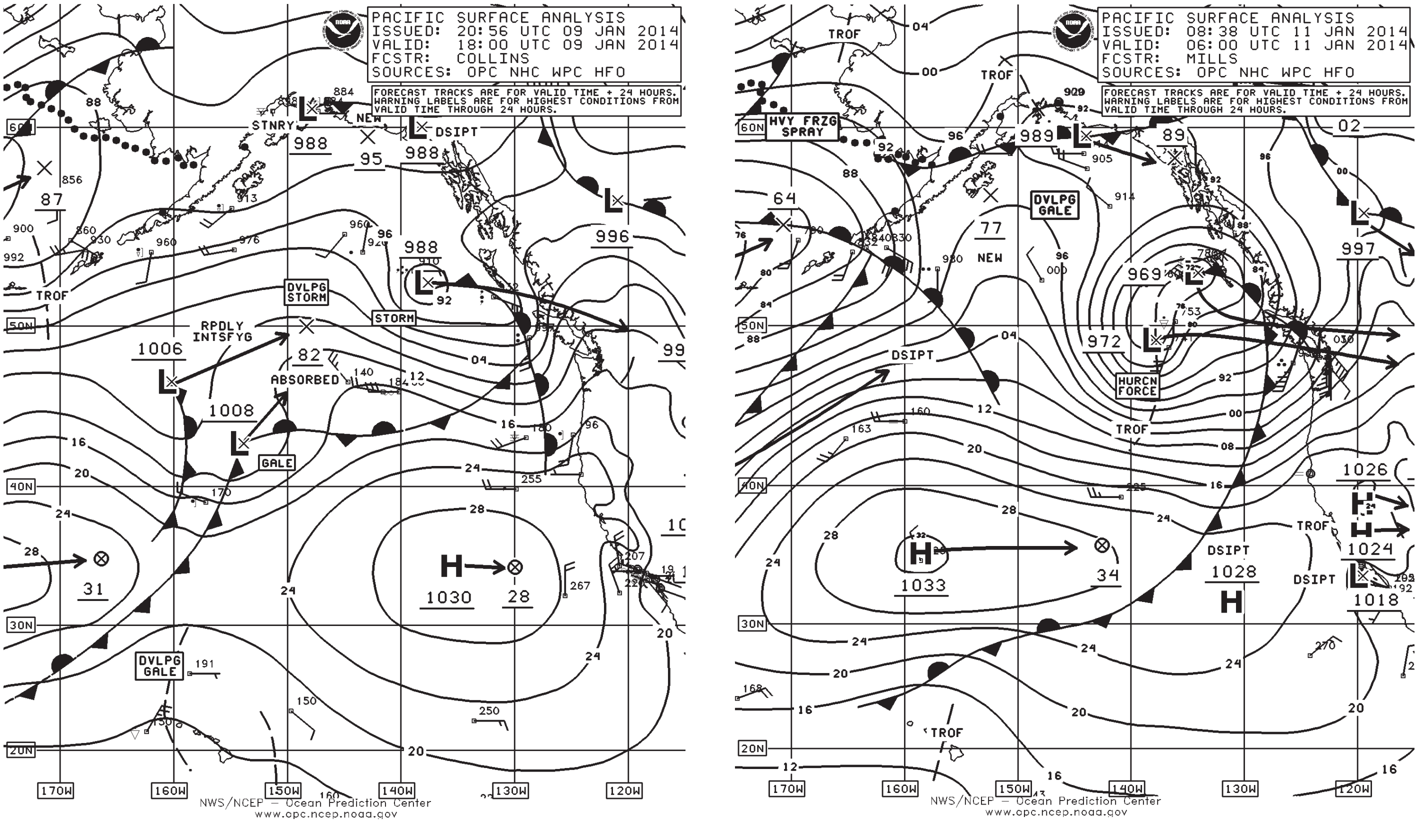


**Figure 20. OPC North Pacific Surface Analysis charts (Part 1) valid 1800 UTC January 9 and 0600 UTC January 11, 2014.**

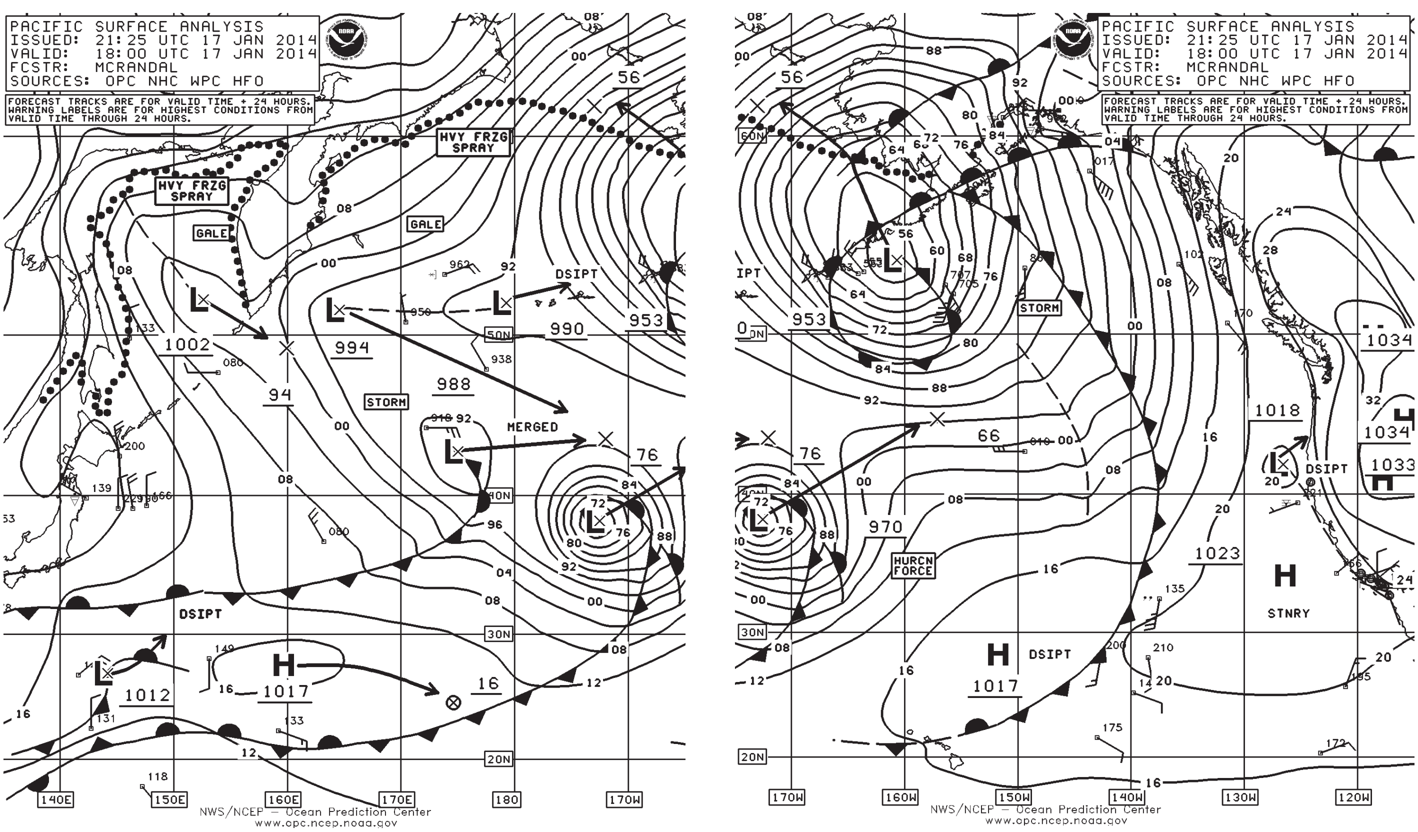


**Figure 21. OPC North Pacific Surface Analysis charts (Part 2-west and Part 1-east) valid 1800 UTC January 17, 2014. The two parts overlap between 165W and 175W.**

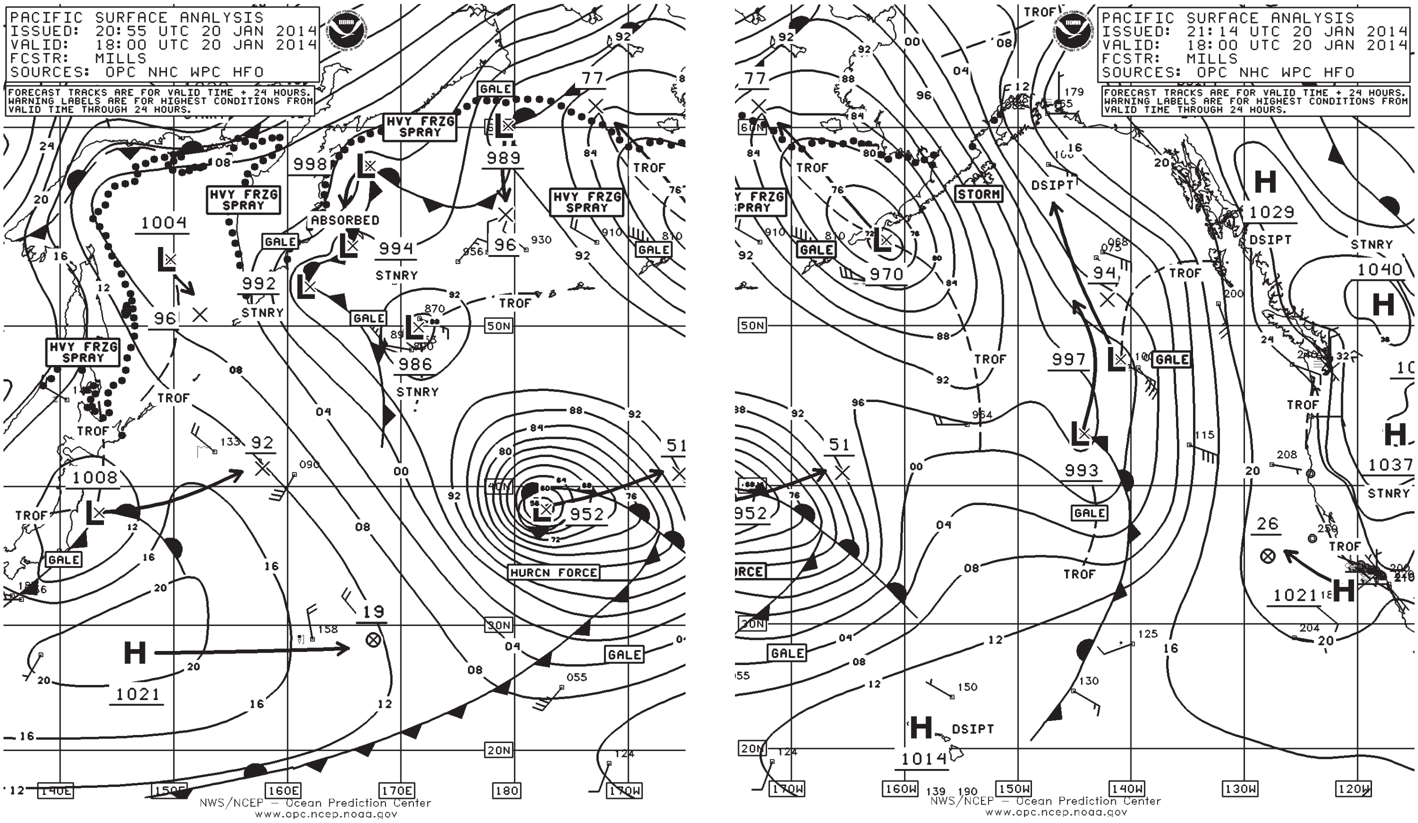


**Figure 22. OPC North Pacific Surface Analysis charts (Part 2-west and Part 1-east) valid 1800 UTC January 20, 2014.**

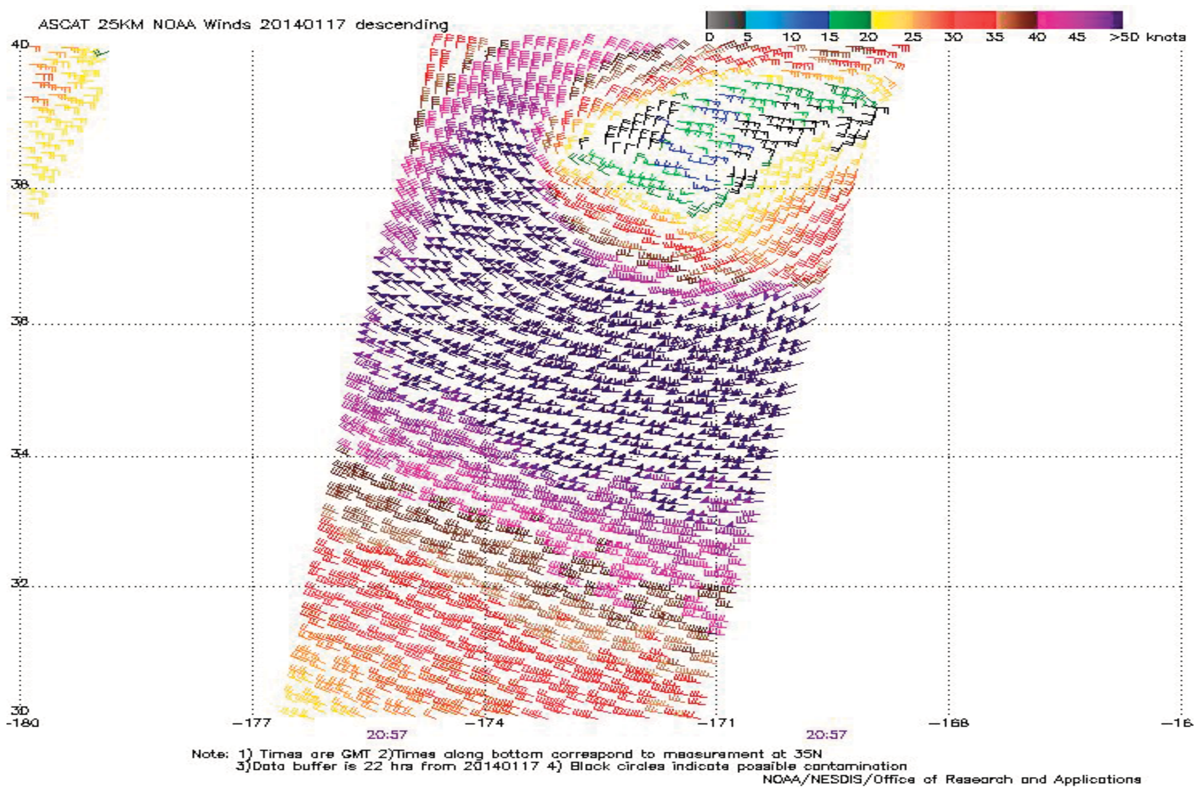


**Figure 23. ASCAT (METOP-A) image of satellite-sensed winds (25-km resolution) around the hurricane-force low shown in Figure 21. The valid time of the pass is 2057 UTC January 17, 2014 or about three hours later than the valid time of Figure 21. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research**

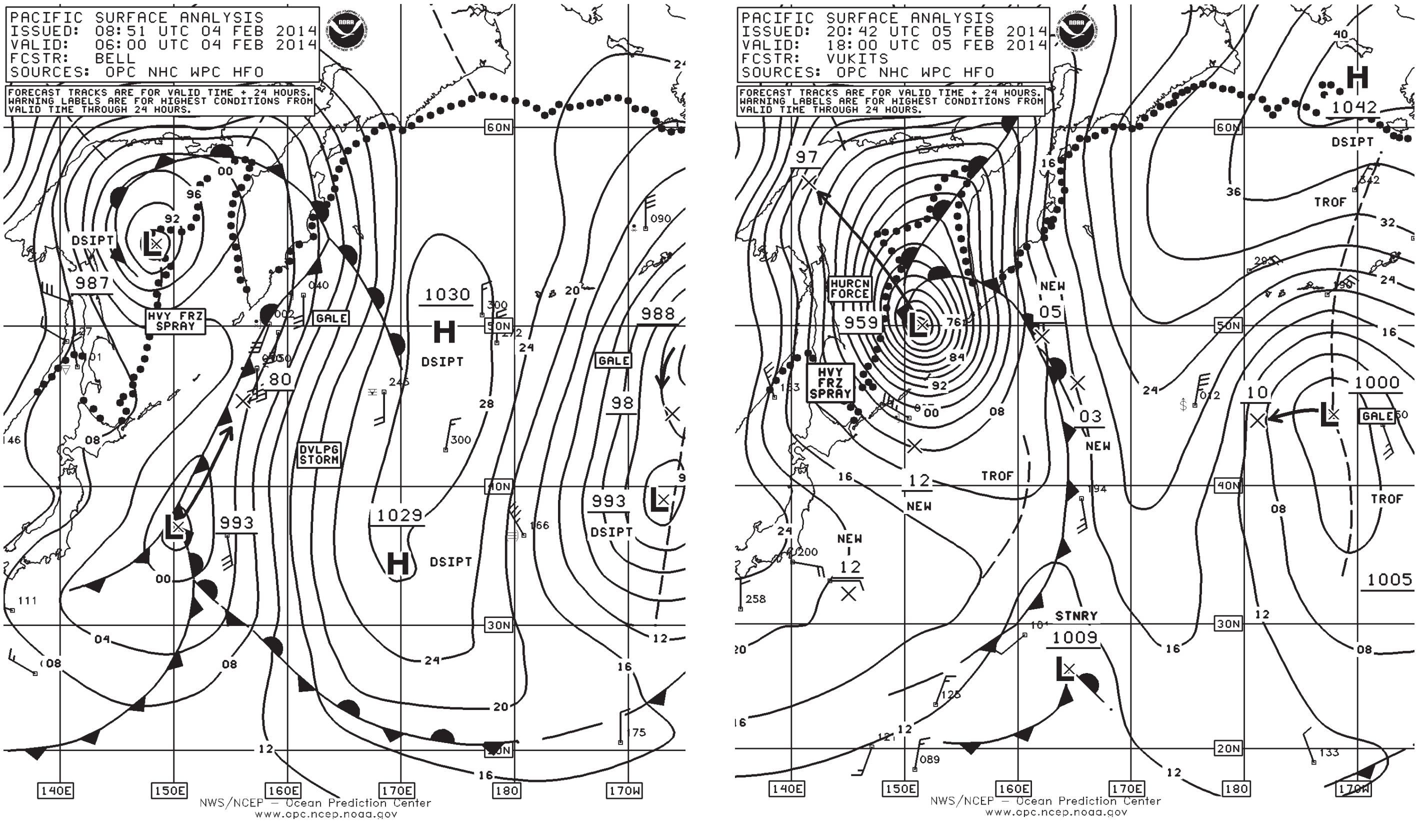


**Figure 24. OPC North Pacific Surface Analysis charts (Part 2) valid 0600 UTC February 4 and 1800 UTC February 5, 2014.**

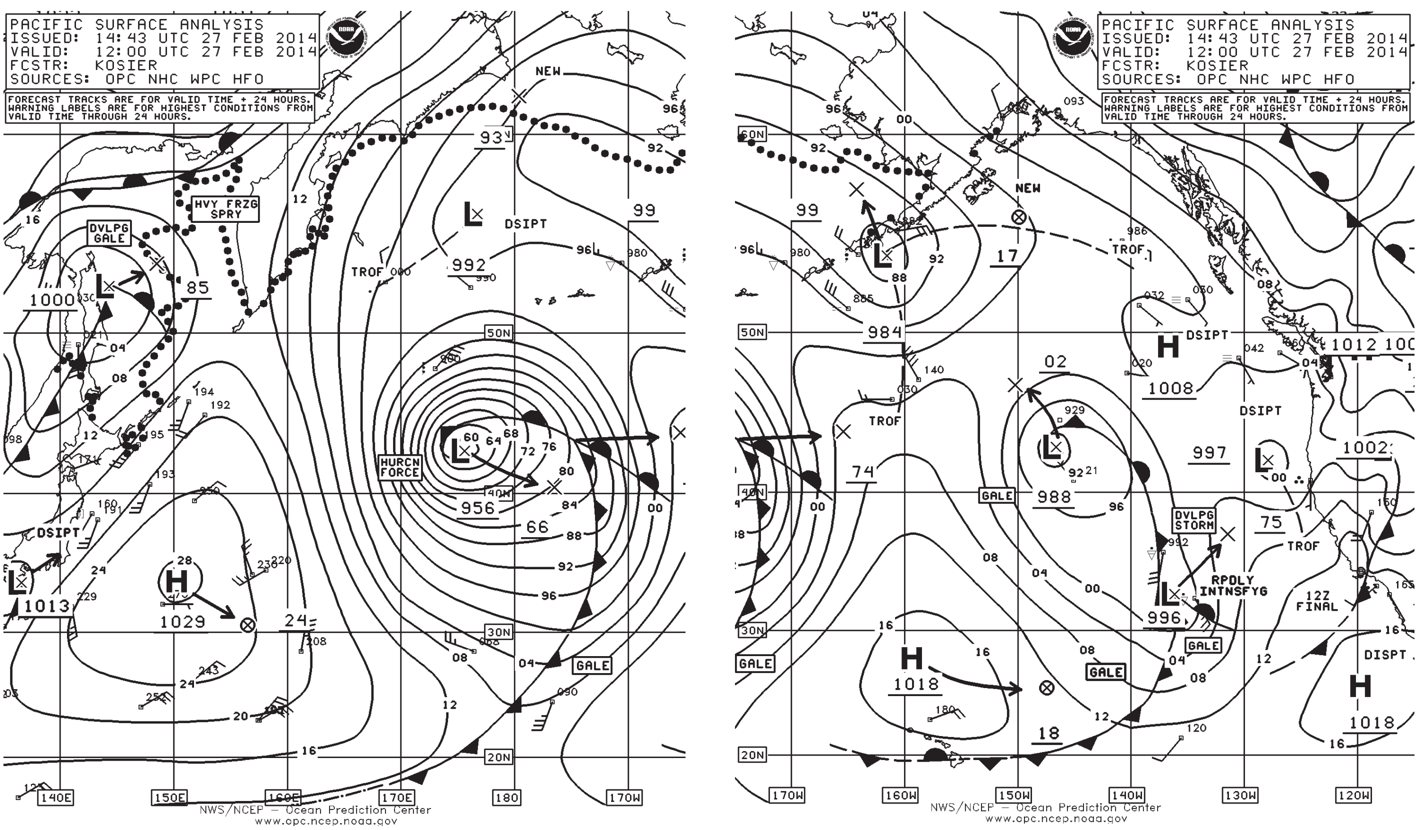


**Figure 25. OPC North Pacific Surface Analysis charts (Parts 1 and 2) valid 1200 UTC February 27, 2014.**

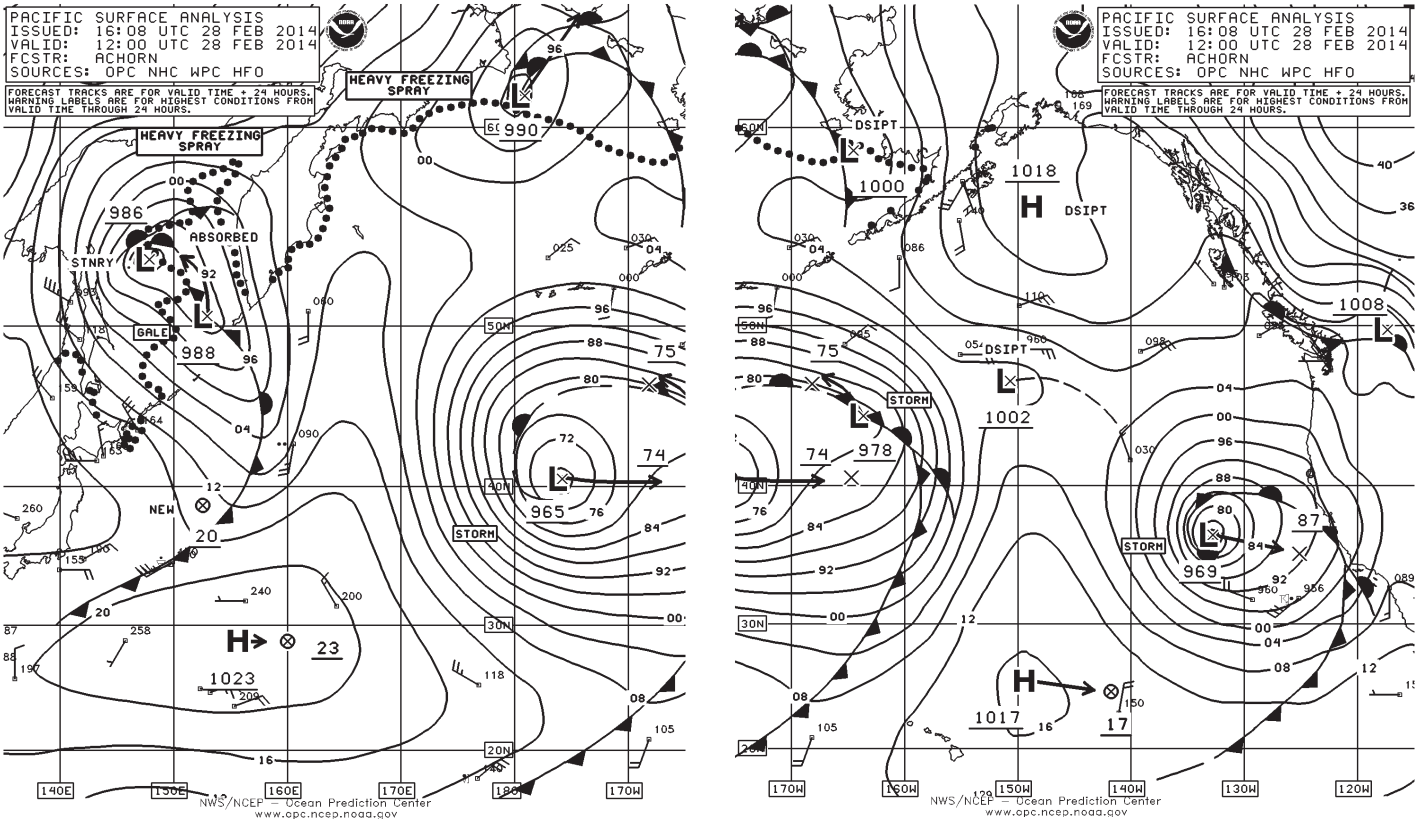


**Figure 26. OPC North Pacific Surface Analysis charts (Parts 1 and 2) valid 1200 UTC February 28, 2014.**

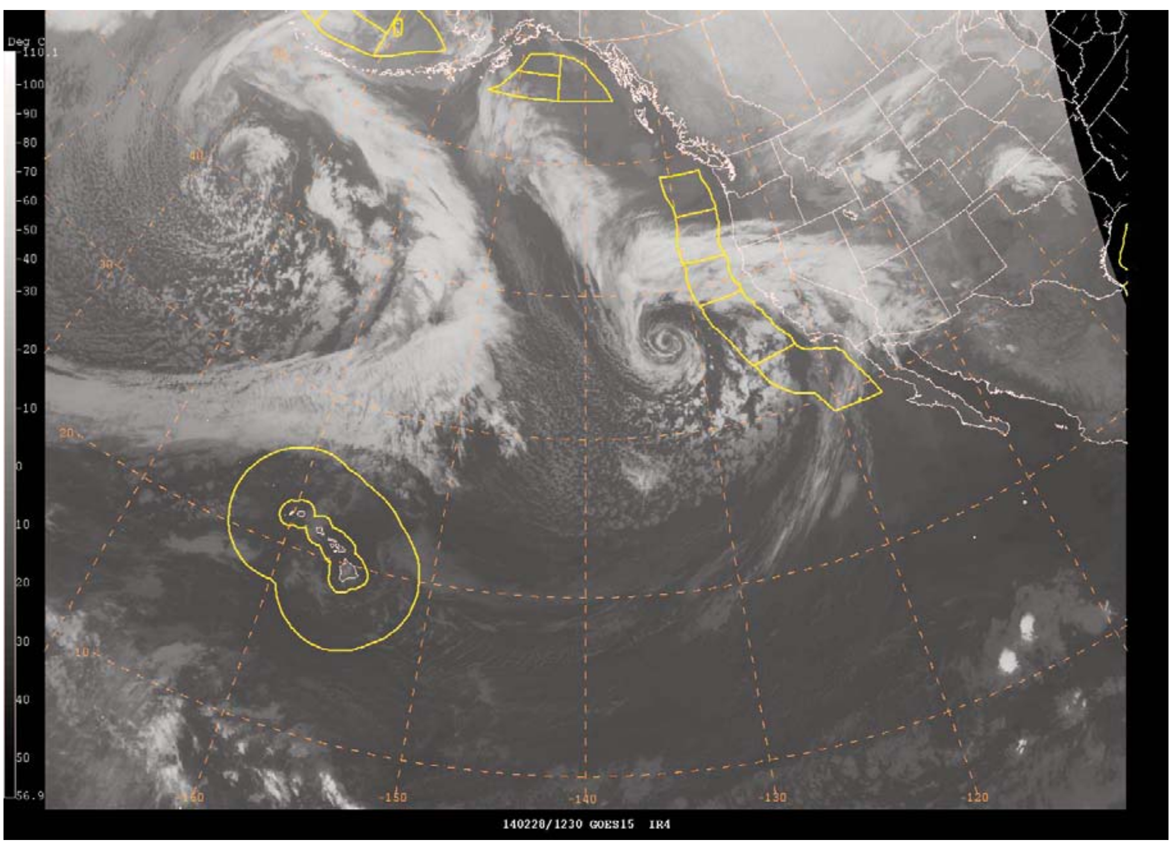


**Figure 27. GOES15 infrared satellite image valid 1230 UTC February 28, 2014 or one-half hour later than the valid time of Figure 26. Satellite senses temperature on a scale from warm (black) to cold (white) in this type of image.**

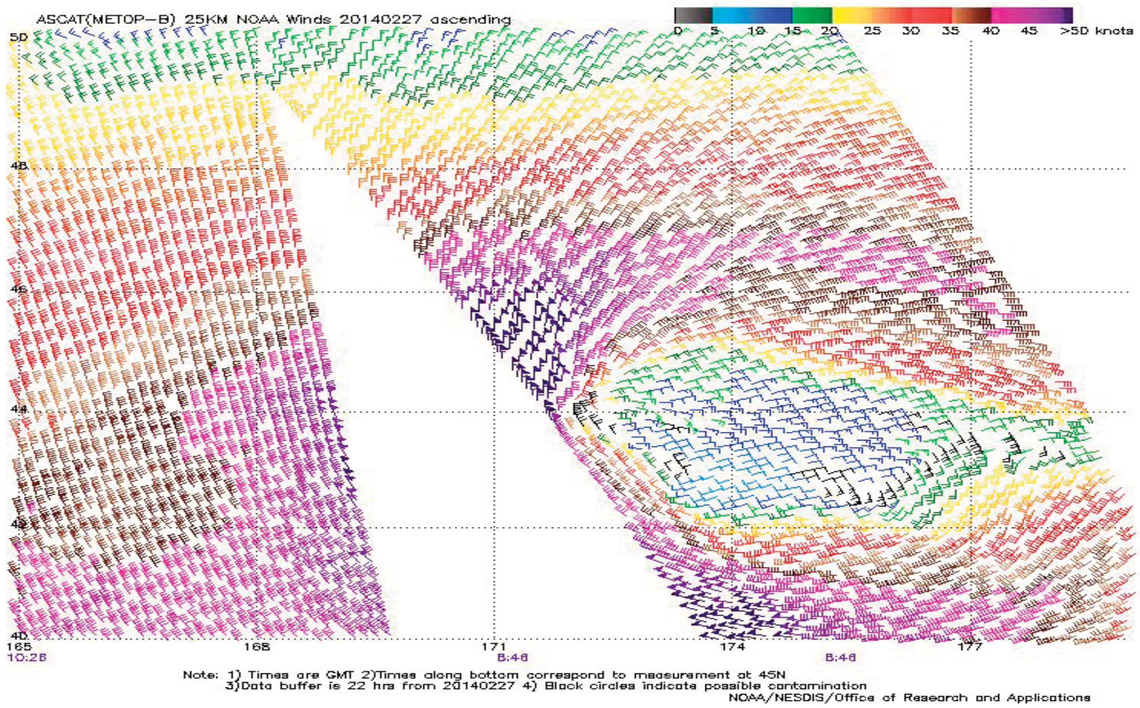


**Figure 28. ASCAT (METOP-B) image of satellite-sensed winds (25-km resolution) around the hurricane-force low shown in Figure 25. The valid time of the pass is 0848 UTC February 27, 2014, orabout three and one-quarter hours prior to the valid time of Figure 25. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.**

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6. E-mail communication, “Flights-update”, Feb 15, 2014, Joseph Sienkiewicz confirmation from OSCAT of hurricane force winds in WSW flow (Feb 14) over warm Gulf Stream eddy.

7. E-mail communication, “Peak Wave at 44141 from March 27”, Joseph Sienkiewicz from Chris Fogerty, Ph.D, Program Supervisor, Canadian hurricane Centre, Environment Canada, April 3, 2014.

8. E-mail communication, LT Christine Schultz, NOAA Commissioned Corps Technical Operations Coordination Meteorologist, National Weather Service-Ocean Prediction Center, and Joseph Sienkiewicz, Chief Ocean Applications Branch, Ocean Prediction Center , April 30, 2014: “Fast-changing conditions; Account from NOAA ship this weekend, NOAA Fisheries ship Gordon Gunter”.

# Tropical Atlantic and Tropical East Pacific Areas

## January through April 2014

*Jessica Schauer and Marshall Huffman*
*Tropical Analysis and Forecast Branch,*
*National Hurricane Center, Miami, Florida*
*NOAA National Centers for Environmental Prediction*

## Tropical North Atlantic Ocean including the Caribbean Sea and the Gulf of Mexico

The TAFB Atlantic High Seas area of responsibility (AOR) extends from 7°N to 31°N west of 35°W, including the Caribbean Sea and Gulf of Mexico. Forty three gale warnings were issued for this area from January through April 2014; with only one storm force wind warning and zero hurricane force wind warnings issued during the period. The 43 warnings issued in the Atlantic basin was the highest number of warnings ever issued by TAFB during a winter season, breaking the previous record number of 35 in 2010. The number of warnings was up from the January through April five year average of 27 warnings. Of the forty three warnings issued, fifteen of these were located in the Gulf of Mexico, sixteen of these were located in the Atlantic Ocean, and eleven were located in the Caribbean Sea.

***Table A-A.*** Non-tropical warnings issued for the Atlantic Ocean between 01 January 2014 and 30 April 2014.

| Onset | Region | Peak Wind | Gale Duration (Storm) | Forcing |
|---|---|---|---|---|
| 01 Jan 0000 UTC | Gulf of Mexico | 35 kts | 12h | Low Pressure |
| 03 Jan 0000 UTC | Gulf of Mexico | 40 kts | 18h | Cold Front |
| 03 Jan 0600 UTC | SW N Atlantic | 40 kts | 12h | Cold Front |
| 05 Jan 0600 UTC | NW Caribbean | 35 kts | 6h | Low Pressure |
| 05 Jan 0600 UTC | Gulf of Mexico | 35 kts | 6h | Trough |
| 06 Jan 0000 UTC | Gulf of Mexico | 40 kts | 36h | Cold Front |
| 06 Jan 1800 UTC | SW N Atlantic | 35 kts | 18h | Cold Front |
| 07 Jan 0000 UTC | NW Caribbean | 35 kts | 18h | Cold Front |
| 09 Jan 0000 UTC | Coast of Colombia | 35 kts | 72h | Pressure Gradient |
| 12 Jan 0600 UTC | Coast of Colombia | 35 kts | 12h | Pressure Gradient |
| 12 Jan 1200 UTC | SW N Atlantic | 35 kts | 12h | Cold Front |
| 12 Jan 1800 UTC | Eastern Atlantic | 45 kts | 36h | Low Pressure |
| 16 Jan 1200 UTC | SW N Atlantic | 35 kts | 12h | Cold Front |
| 22 Jan 0000 UTC | SW N Atlantic | 35 kts | 18h | Cold Front |
| 24 Jan 0600 UTC | Gulf of Mexico | 40 kts | 30h | Cold Front |
| 25 Jan 1800 UTC | SW N Atlantic | 35 kts | 18h | Cold Front |
| 29 Jan 0600 UTC | Gulf of Mexico | 40 kts | 18h | Cold Front |

| | | | | | |
|---|---|---|---|---|---|
| 0 UTC | Coast of Colombia | 35 kts | 12h | Pressure Gradient | 30 Jan 06 |
| 0 UTC | Coast of Colombia | 35 kts | 12h | Pressure Gradient | 31 Jan 06 |
| )0 UTC | Coast of Colombia | 35 kts | 12h | Pressure Gradient | 01 Feb 06 |
| )0 UTC | Gulf of Mexico | 35 kts | 12h | Cold Front | 03 Feb 06 |
| )0 UTC | Gulf of Mexico | 35 kts | 30h | Cold Front | 11 Feb 18 |
| )0 UTC | SW N Atlantic | 35 kts | 30h | Cold Front | 13 Feb 06 |
| )0 UTC | SW N Atlantic | 40 kts | 18h | Cold Front | 15 Feb 12 |
| )0 UTC | Coast of Colombia | 35 kts | 78h | Pressure Gradient | 19 Feb 12 |
| )0 UTC | Gulf of Mexico | 35 kts | 12h | Cold Front | 21 Feb 06 |
| )0 UTC | SW N Atlantic | 35 kts | 12h | Cold Front | 02 Mar 00 |
| )0 UTC | Gulf of Mexico | 35 kts | 36h | Cold Front | 02 Mar 18 |
| )0 UTC | SW N Atlantic | 35 kts | 42h | Cold Front | 08 Mar 06 |
| )0 UTC | Gulf of Mexico | 40 kts | 18h | Cold Front | 12 Mar 12 |
| )0 UTC | SW N Atlantic | 35 kts | 18h | Cold Front | 13 Mar 06 |
| )0 UTC | Gulf of Mexico | 35 kts | 24h | Cold Front | 17 Mar 00 |
| )0 UTC | SW N Atlantic | 35 kts | 12h | Cold Front | 18 Mar 12 |
| )0 UTC | Coast of Colombia | 35 kts | 18h | Pressure Gradient | 20 Mar 06 |
| )0 UTC | SW N Atlantic | 40 kts | 30h | Low Pressure | 25 Mar 06 |

| | | | | |
|---|---|---|---|---|
| 27 Mar 0600 UTC | Coast of Colombia | 35 kts | 54h | Pressure Gradient |
| 09 Apr 0000 UTC | NW Caribbean | 35 kts | 12h | Cold Front |
| 09 Apr 0600 UTC | SW N Atlantic | 35 kts | 18h | Cold Front |
| 11 Apr 0000 UTC | Coast of Colombia | 40 kts | 42h | Pressure Gradient |
| 15 Apr 0000 UTC | Gulf of Mexico | 50 kts | 30h (6hr) | Cold Front |
| 18 Apr 1800 UTC | Gulf of Mexico | 35 kts | 06h | Cold Front |
| 20 Apr 0600 UTC | SW N Atlantic | 35 kts | 12h | Cold Front |
| 30 Apr 1800 UTC | Gulf of Mexico | 35 kts | 12h | Cold Front |

**Table A-A** details the warnings issued in the TAFB Atlantic High Seas AOR from January through April 2014. The first longer duration gale of 2014 occurred in the Gulf of Mexico as a strong cold front swept across the Gulf waters generating gale force conditions on 06 January and 07 January that persisted for 36 hours across western portions of the Gulf. A strong 1042 hPa high pressure system built in slowly from the north behind the cold front analyzed from the central Florida peninsula to the northwestern tip of the Yucatan peninsula as seen in **Figure 1**.

The pressure gradient between the ridge extending southward from the high over the U.S. southern plains into coastal northeast Mexico and the frontal boundary generated gale force winds in the southwestern Gulf. Several ships reported gale force conditions during this event, and these are summarized in **Table A-B**.

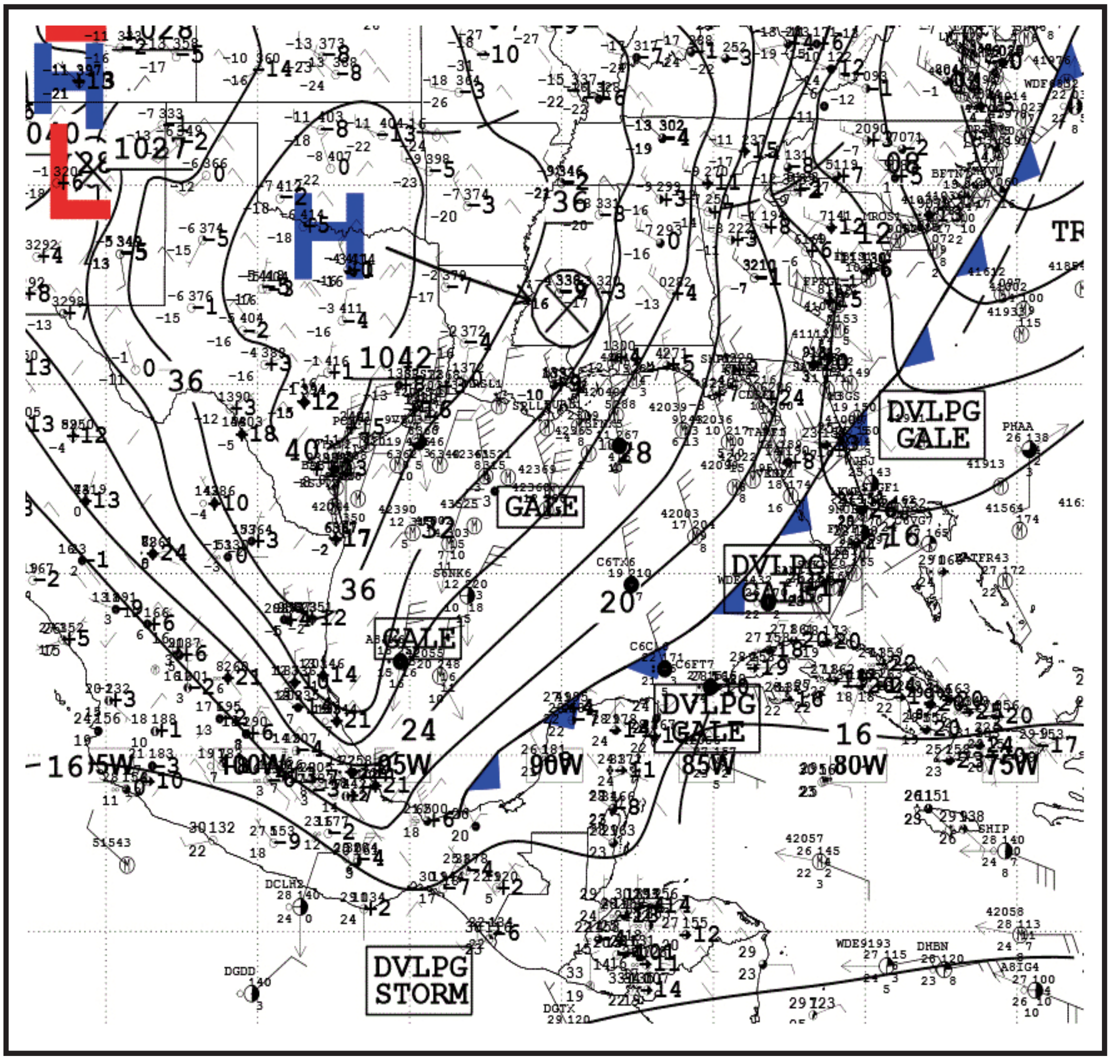


**Figure 1. The NWS Unified Surface Analysis from 1800 UTC 06 Jan 2014. A strong cold front followed by surface ridging building into the basin from the north produced an area of gale force winds with several ship and buoy observations above 34 kts.**

**Table A-B (below)**

***Table A-B.*** Ship observations during the gale warning period beginning 06 January 0000 UTC and ending 07 January 1200 UTC.

| Ship | Call Sign | Wind Speed | Location | Date/Time |
|---|---|---|---|---|
| Eagle Sydney | SFUU | 35 kts | 28.8N 94.3W | 06 Jan 0300 UTC |
| Eagle Tucson | S6NK5 | 40 kts | 28.2N 90.6W | 06 Jan 1200 UTC |
| Overseas Andromar | V7HP4 | 35 kts | 27.9N 94.4W | 06 Jan 1200 UTC |
| Eagle Klang | 9V8640 | 40 kts | 28.8N 89.3W | 06 Jan 1400 UTC |
| Ha Sklenar | C6CL6 | 43 kts | 23.3N 86.9W | 07 Jan 0000 UTC |
| Wh Blount | C6JT8 | 37 kts | 25.9N 90.4W | 07 Jan 0000 UTC |
| Norwegian Jewel | C6TX6 | 42 kts | 22.5N 87.0W | 07 Jan 0200 UTC |
| Carnival Freedom | 3EBL5 | 40 kts | 23.2N 83.4W | 07 Jan 0600 UTC |
| Carnival Destiny | C6FN4 | 50 kts | 24.0N 83.0W | 07 Jan 0800 UTC |
| Carnival Magic | 3ETA8 | 45 kts | 22.3N 86.0W | 07 Jan 0900 UTC |

**Figure 2** shows the 1538 UTC MetOp Advanced SCATerometer (ASCAT-B) pass from 06 January. Note the blue and pink wind barbs indicating 34-45 kts winds in the southwestern Gulf that reached the surface. Warnings were discontinued in the Gulf of Mexico by 1200 UTC 07 January as the cold front moved into the southwest North Atlantic region.

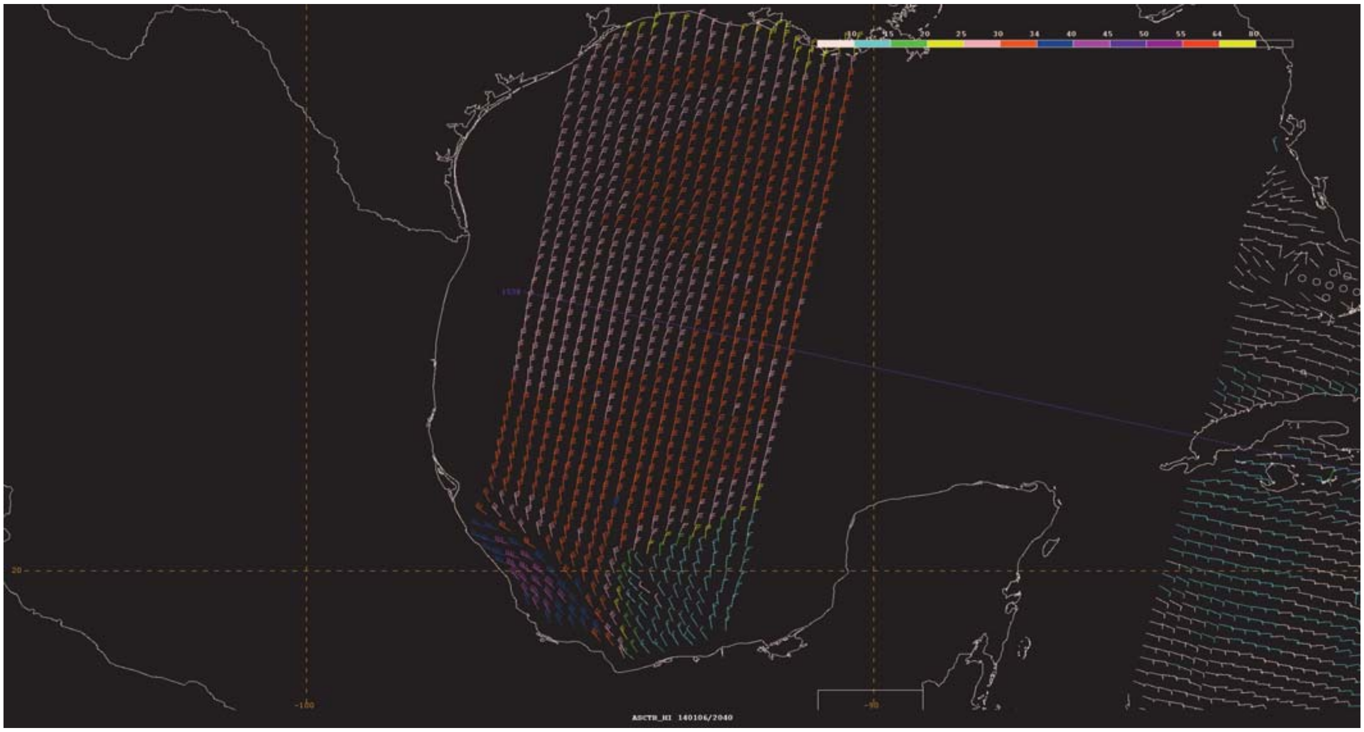

**Figure 2. A scatterometer pass from the MetOp Advanced SCATerometer (ASCAT-B) valid around 1538 UTC 06 January. Note the dark blue and pink wind barbs in the southwestern Gulf of Mexico indicating gale force winds between 34 kts and 45 kts.**

The strongest Gulf of Mexico warning was the only storm force warning that occurred across the basin in the four month period. This storm force warning began at 0000 UTC 15 April and persisted for 30 hours. Of those 30 hours, only 6 hours of storm force conditions were forecast between 1800 UTC 15 April and 0000 UTC 16 April. A strong surface pressure gradient materialized along the east-central coast of Mexico and the southwestern Gulf of Mexico waters after the passage of a cold front. While storm force conditions were limited to a relatively small area across the southwestern Gulf of Mexico as noted in **Figure 3**, five ships reported winds of gale force or greater. In chronological order, the **EAGLE TOLEDO** (S6NK3) reported 41 kts northwest winds near 28.5N 94.5W at 0300 UTC 15 April. Two hours later at 0500 UTC 15 Apr in nearly the same location the **EAGLE BALTIMORE** (9VHG) reported 46 kts north winds. Other vessels impacted by the gale force winds to the north of the storm warned area included the **OVERSEAS TEXAS CITY** (WHED) reporting 40 kts, the **OVERSEAS CASCADE** (WOAG) reporting 48 kts, and the **DEEPWATER CHAMPION** (YJVM9) reporting 35 kts at 1700 UTC near 28.8N 88.2W as the event was nearing termination. Although no storm force observations were reported, **Figure 3** shows the area of gale force and storm force wind barbs offshore of Mexico south of 20N and west of 95W.

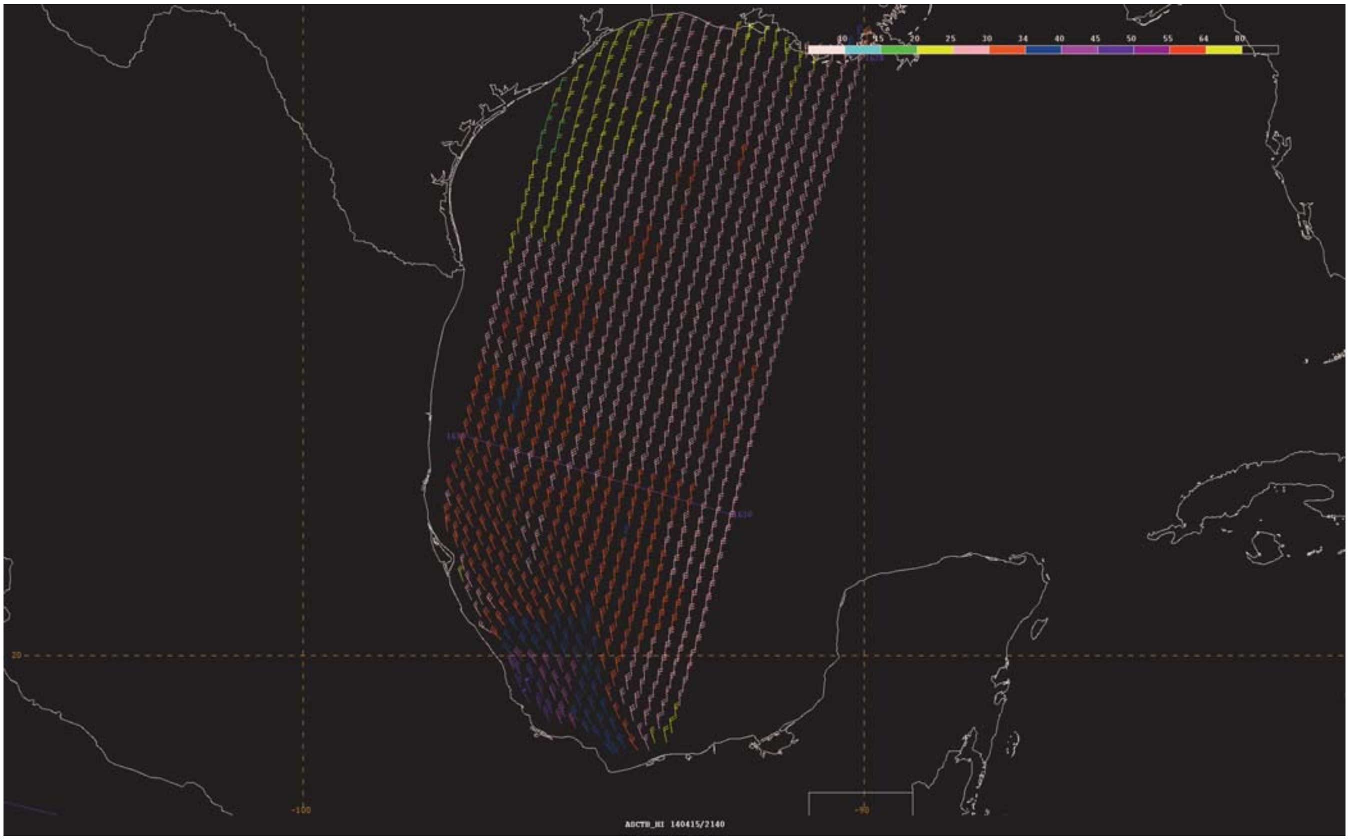

**Figure 3. A scatterometer pass from the MetOp Advanced SCATerometer (ASCAT-B) valid around 1630 UTC 15 April. Note the dark blue, pink, and purple wind barbs in the southwestern Gulf of Mexico indicating gale to storm force winds.**

## Eastern North Pacific Ocean South of 30°N and East of 140°W

The twenty-three events of gale force or stronger winds observed from 01 January 2014 to 30 April 2014 in the eastern North Pacific between 30°N and the equator east of 140°W are cataloged in **Table P-A** (next page). All but two of these warning events were in the Gulf of Tehuantepec. There were 21 occurrences of gale force winds in the Gulf of Tehuantepec, with seven of those events producing winds of storm force. The other gale events were found in the Gulf of Papagayo and across waters north of 25°N, respectively. **Table P-B** catalogs the ship observations of these gale-force or greater events. ***Ship reports received through the Voluntary Observing Ship (VOS) program are a vital source of data in verifying gale and storm events.***

**Gulf of Tehuantepec Gale and Storm Warnings:**

The Tropical Analysis and Forecast Branch (TAFB) at the National Hurricane Center (NHC) has been recording gale-force or greater gap wind events in the Gulf of Tehuantepec since the QuikSCAT satellite began regular wind observations over the region in 1999. The 2013-14 winter season included a record number of these gap wind events in the Gulf of Tehuantepec, including two late-season May events. The thirty-three gap wind events this season broke the previous record of 24 events which occurred both in the 2003-04 and 2011-12 seasons. There were eleven storm-force wind events in 2013-14.

***Table P-A.*** Non-tropical warnings issued for the eastern North Pacific Ocean between 01 January 2014 and 30 April 2014. Storm events are shaded and the duration of the storm warning is in parentheses.

| Onset | Region | Peak Wind Speed | Gale Duration (Storm) | Forcing |
|---|---|---|---|---|
| 31 Dec 1200 UTC | Gulf of Tehuantepec | 35 kts | 30h | Gap |
| 03 Jan 0000 UTC | Gulf of Tehuantepec | 50 kts | 42h (12h) | Gap |
| 06 Jan 1800 UTC | Gulf of Tehuantepec | 55 kts | 54h (24h) | Gap |
| 09 Jan 0600 UTC | Gulf of Tehuantepec | 40 kts | 12h | Gap |
| 14 Jan 1200 UTC | Gulf of Tehuantepec | 50 kts | 60h (12h) | Gap |
| 17 Jan 1800 UTC | Gulf of Tehuantepec | 40 kts | 72h | Gap |
| 22 Jan 0000 UTC | Gulf of Tehuantepec | 50 kts | 30h (6h) | Gap |
| 24 Jan 1200 UTC | Gulf of Tehuantepec | 50 kts | 36h (12h) | Gap |
| 29 Jan 1800 UTC | Gulf of Tehuantepec | 35 kts | 24h | Gap |
| 07 Feb 0600 UTC | Gulf of Tehuantepec | 35 kts | 12h | Gap |
| 08 Feb 1200 UTC | Gulf of Tehuantepec | 35 kts | 6h | Gap |
| 13 Feb 0600 UTC | Gulf of Tehuantepec | 35 kts | 12h | Gap |
| 16 Feb 0600 UTC | Gulf of Tehuantepec | 35 kts | 12h | Gap |
| 27 Feb 1200 UTC | N of 25N W waters | 40 kts | 42h | Low |
| 07 Mar 0600 UTC | Gulf of Tehuantepec | 35 kts | 12h | Gap |
| 13 Mar 1800 UTC | Gulf of Tehuantepec | 45 kts | 24h | Gap |
| 17 Mar 1800 UTC | Gulf of Tehuantepec | 40 kts | 24h | Gap |
| 26 Mar 0600 UTC | Gulf of Tehuantepec | 35 kts | 6h | Gap |
| 30 Mar 0600 UTC | Gulf of Tehuantepec | 35 kts | 30h | Gap |
| 08 Apr 2100 UTC | Gulf of Tehuantepec | 50 kts | 45h (12h) | Gap |
| 10 Apr 0600 UTC | Gulf of Papagayo | 40 kts | 12h | Gap |
| 15 Apr 1800 UTC | Gulf of Tehuantepec | 50 kts | 24h (12h) | Gap |
| 19 Apr 0600 UTC | Gulf of Tehuantepec | 35 kts | 6h | Gap |

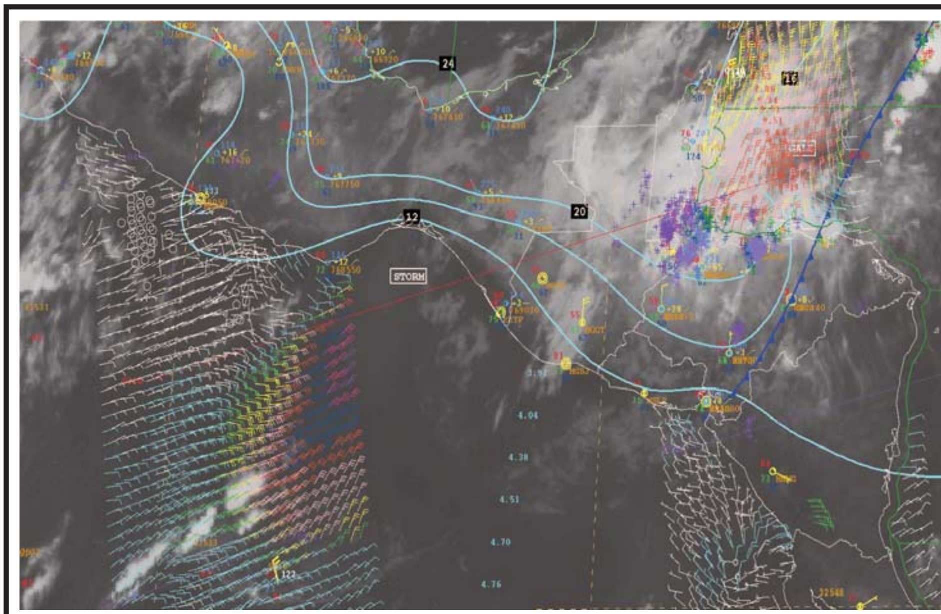


**Figure P-A (left). The National Oceanic and Atmospheric Administration's (NOAA) Geostationary Operational Environmental Satellite East (GOES-E) infrared imagery overlaid with ship and buoy observations, an altimeter pass from the National Aeronautics and Space Administration's (NASA) Jason-2, scatterometer passes from the MetOp Advanced SCATerometers "A" and "B" (ASCAT-A and ASCAT-B), and the Tropical Analysis and Forecast Branch (TAFB) surface analysis valid around 0600 UTC 09 April 2014.**

***Table P-B.*** Ships reporting gale force winds or greater over the eastern North Pacific Ocean between 01 January 2014 and 30 April 2014.

| Ship | Call Sign | Wind Speed | Location | Warning Area | Date/Time |
|---|---|---|---|---|---|
| Carmen | SMGW | 37 kts | 13.6N 94.5W | Gulf of Tehuantepec | 03 Jan 1200 UTC |
| | | 39 kts | 14.2N 95.8W | Gulf of Tehuantepec | 03 Jan 1800 UTC |
| Monte Sarmiento | DCLH2 | 43 kts | 14.4N 95.9W | Gulf of Tehuantepec | 07 Jan 0300 UTC |
| Zim Shanghai | VRGA6 | 35 kts | 14.6N 96.3W | Gulf of Tehuantepec | 07 Jan 2000 UTC |
| Zim Barcelona | 4XIS | 50 kts | 15.1N 95.0W | Gulf of Tehuantepec | 07 Jan 1800 UTC |
| Tokyo Express | DGTX | 50 kts | 15.6N 94.5W | Gulf of Tehuantepec | 07 Jan 1200 UTC |
| | | 45 kts | 15.7N 95.3W | Gulf of Tehuantepec | 07 Jan 1500 UTC |
| Hanjin Mundra | DQVH | 48 kts | 15.8N 95.0W | Gulf of Tehuantepec | 07 Jan 1800 UTC |
| Sally Maersk | OZHS2 | 40 kts | 14.1N 95.3W | Gulf of Tehuantepec | 08 Jan 1200 UTC |
| | | 40 kts | 14.4N 96.0W | Gulf of Tehuantepec | 08 Jan 1500 UTC |
| Atlantis | KAQP | 41 kts | 14.8N 95.5W | Gulf of Tehuantepec | 21 Jan 2200 UTC |
| | | 45 kts | 14.8N 95.3W | Gulf of Tehuantepec | 21 Jan 2300 UTC |
| | | 38 kts | 13.2N 94.1W | Gulf of Tehuantepec | 22 Jan 0800 UTC |
| | | 37 kts | 13.4N 94.3W | Gulf of Tehuantepec | 22 Jan 0700 UTC |
| | | 36 kts | 13.5N 94.4W | Gulf of Tehuantepec | 22 Jan 0600 UTC |
| | | 42 kts | 14.2N 95.0W | Gulf of Tehuantepec | 22 Jan 0200 UTC |
| | | 44 kts | 14.4N 95.1W | Gulf of Tehuantepec | 22 Jan 0100 UTC |
| NYK Rigel | 3FNL8 | 40 kts | 14.2N 95.6W | Gulf of Tehuantepec | 25 Jan 0600 UTC |
| Overseas Anacortes | KCHV | 37 kts | 32.4N 123.5W | N Central Waters | 27 Feb 0500 UTC |
| | | 44 kts | 31.3N 127.5W | N Central Waters | 28 Feb 0300 UTC |
| | | 44 kts | 31.3N 127.2W | N Central Waters | 28 Feb 0100 UTC |
| | | 37 kts | 31.4N 126.9W | N Central Waters | 28 Feb 2100 UTC |
| | | 37 kts | 31.6N 126.4W | N Central Waters | 28 Feb 1800 UTC |
| RDO Concert | A8TH7 | 45 kts | 14.1N 95.3W | Gulf of Tehuantepec | 13 Mar 1700 UTC |
| Island Princess | ZCDG4 | 40 kts | 11.8N 87.7W | Gulf of Papagayo | 10 Apr 0500 UTC |

**Figure P-B. The National Oceanic and Atmospheric Administration's (NOAA) Geostationary Operational Environmental Satellite West (GOES-W) infrared imagery overlaid with altimeter passes from the National Aeronautics and Space Administration's (NASA) Jason-2, the European Space Agency's (ESA) CryoSat-2, and the ALTIKA sensor from the Indian Space Research Organization (ISRO) and the Centre National D'études Spatiales of France (CNES) in addition to scatterometer passes from the MetOp Advanced SCATerometers "A" and "B" (ASCAT-A and ASCAT-B) and the NOAA/NASA/United States Department of Defense WINDSAT sensor aboard the Coriolis satellite valid around 1800 UTC 28 February 2014. The TAFB area of responsibility is found south of 30°N and east of 140°W denoted by the light blue lines.**

This season ranks second in the number of storm-force wind events. The record holder remains the 2006-07 season when 13 storm force wind events occurred. The gap wind events in the Gulf of Tehuantepec were primarily driven by mid-latitude cold frontal passages from the Gulf of Mexico through the narrow Chivela Pass into the Pacific. A strong pressure gradient between high pressure behind the front to the north of the gap wind region and lower pressure associated with the inter-tropical convergence zone (ITCZ) or monsoon trough to the south allowed some of these events to persist for as long as three days. January was the busiest month for wind events in the Gulf of Tehuantepec during the January-April observing period.

Nine ships reported gale force winds in the region during January. Three of these ships, the **ZIM BARCELONA** (4XIS), the **TOKYO EXPRESS** (DGTX), and the **HANJIN MUNDRA** (DQVH), saw storm force winds. A strong late season storm event began 08 April at 2100 UTC. Figure P-A shows the tight pressure gradient analyzed by TAFB over Chivela Pass and scatterometer data observed 45 kts winds (purple wind barbs) well down wind of the Gulf of Tehuantepec around 0600 UTC on 09 April. The cold front that spurred this event later moved southeast through the Gulf of Papagyo.

**Gulf of Papagayo Gale Warning:**

The only gale force wind event in the Gulf of Papagayo during the observing period occurred on the morning of 10 April 2014. 40 kt winds were reported by the Island Princess (ZCDG4) as it moved through the region. As mentioned in the section above, the particularly strong, late-season cold front that brought storm force winds to the Gulf of Tehuantepec a day earlier was responsible for the gale in the Gulf of Papagayo. Gale force winds persisted for 12 hours and were enhanced by early morning drainage flow from the mountains over northern Costa Rica and southern Nicaragua.

**Northern Waters Gale Warning:**

On 27 February 2014, a deep layered low pressure system sent a powerful cold front into the northern portion of the observing area, with gale force winds found northward of 25°N for 42 hours. This strong low pressure system ventured farther south than the climatological mean. It was analyzed as deep as 969 hPa. Figure P-B shows gale force northwest winds (dark blue wind barbs) and seas as high as 5.8m (19 ft) south of 30°N around 1800 UTC on 28 February. The **OVERSEAS ANACORTES** (KCHV) provided several reports of 40-45 kts winds just north of the area between 31°N-32°N. The low eventually weakened and moved northeastward, allowing winds to drop below gale force over the observing area by the early morning hours of 01 March.

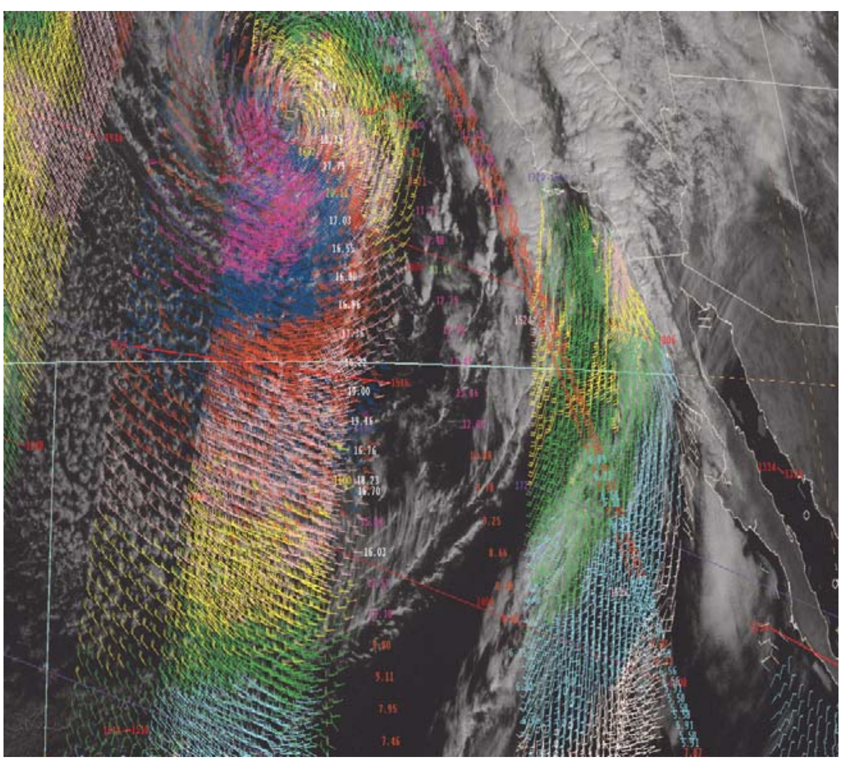

**Figure P-B. The National Oceanic and Atmospheric Administration's (NOAA) Geostationary Operational Environmental Satellite West (GOES-W) infrared imagery overlaid with altimeter passes from the National Aeronautics and Space Administration's (NASA) Jason-2, the European Space Agency's (ESA) CryoSat-2, and the ALTIKA sensor from the Indian Space Research Organization (ISRO) and the Centre National D'études Spatiales of France (CNES) in addition to scatterometer passes from the MetOp Advanced SCATerometers "A" and "B" (ASCAT-A and ASCAT-B) and the NOAA/NASA/United States Department of Defense WINDSAT sensor aboard the Coriolis satellite valid around 1800 UTC 28 February 2014. The TAFB area of responsibility is found south of 30°N and east of 140°W denoted by the light blue lines.**

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### NOAA Weather Radio Network

(1) 162.550 mHz
(2) 162.400 mHz
(3) 162.475 mHz
(4) 162.425 mHz
(5) 162.450 mHz
(6) 162.500 mHz
(7) 162.525 mHz

Channel numbers, e.g. (WX1, WX2) etc. have no special significance but are often designated this way in consumer equipment. Other channel numbering schemes are also prevalent.

The NOAA Weather Radio network provides voice broadcasts of local and coastal marine forecasts on a continuous cycle. The forecasts are produced by local National Weather Service Forecast Offices.

Coastal stations also broadcast predicted tides and real time observations from buoys and coastal meteorological stations operated by NOAA's National Data Buoy Center. Based on user demand, and where feasible, Offshore and Open Lake forecasts are broadcast as well.

The NOAA Weather Radio network provides near continuous coverage of the coastal U.S, Great Lakes, Hawaii, and populated Alaska coastline. Typical coverage is 25 nautical miles offshore, but may extend much further in certain areas.

**U.S. DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
National Data Buoy Center
Building 3203
Stennis Space Center, MS 39529-6000
Attn: Mariners Weather Log