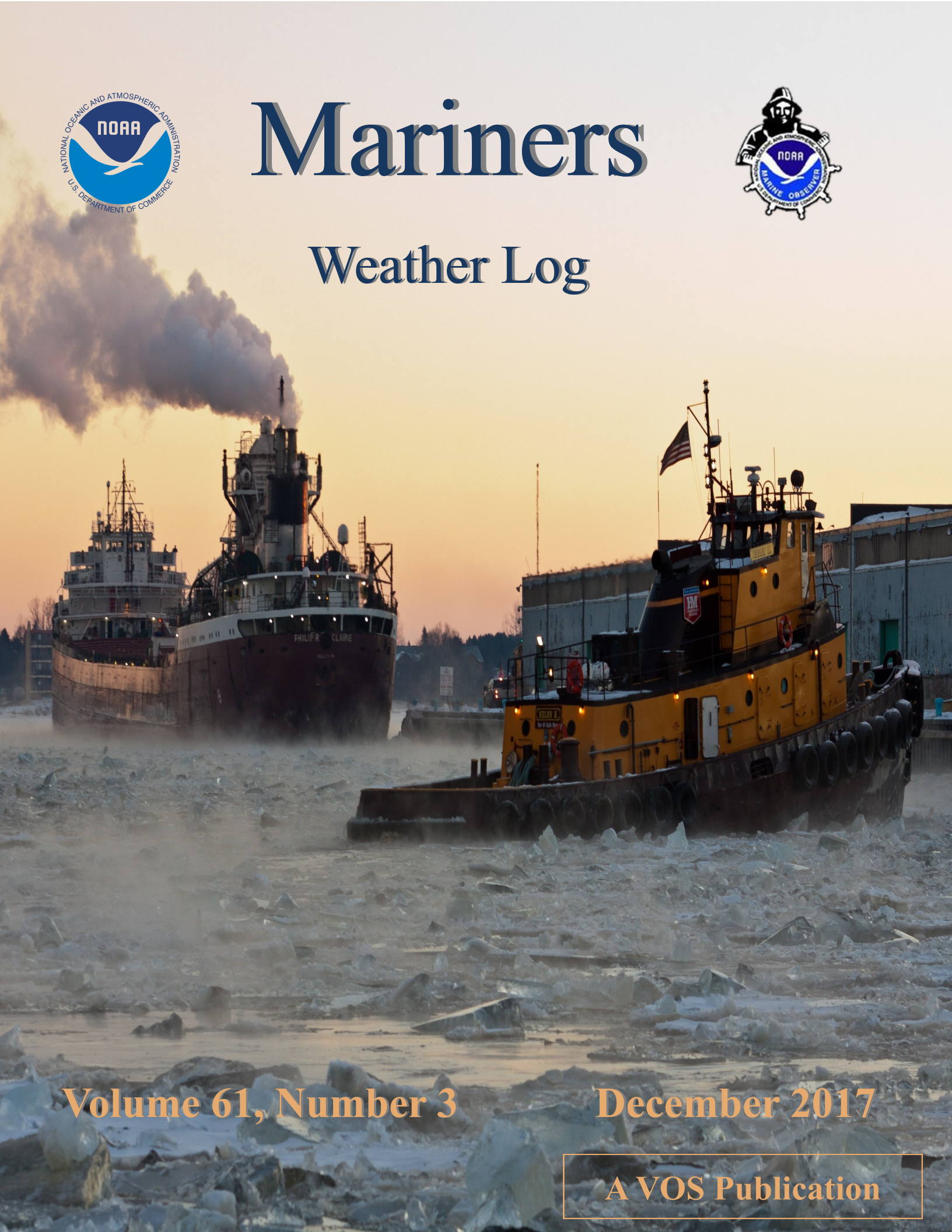
Mariners

Weather Log



Volume 61, Number 3 December 2017

A VOS Publication

Mariners Weather Log

ISSN 0025-3367

U.S. Department of Commerce

Benjamin Friedman

Deputy Undersecretary of Operations
Performing the Duties of Undersecretary of Commerce for Oceans and Atmosphere and NOAA Administrator

National Weather Service

Dr. Louis Uccellini

NOAA Assistant Administrator for Weather Services

Layout and Design
Syneren Technologies Inc.

NTSC Technical Publications Office

SOME IMPORTANT WEB PAGE ADDRESSES:

NOAA
http://www.noaa.gov

National Weather Service
http://www.weather.gov

National Data Buoy Center
http://www.ndbc.noaa.gov

AMVER Program
http://www.amver.com

VOS Program
http://www.vos.noaa.gov

Mariners Weather Log
http://www.vos.noaa.gov/mwl.shtml

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

TURBOWIN e-logbook software
http://www.knmi.nl/turbowin

U.S. Coast Guard Navigation Center
http://www.navcen.uscg.gov/marcomms/

See these Web pages for further links.

Editor's Note

The *Mariners Weather Log* has a wide variety of articles in this issue, reflecting the effects of the hurricanes that hit the U.S. during the past months.

"Making Way for Larger Ships in NJ Ports," by James Luciani, the VOS Port Meteorological Officer for the Port of New York and New Jersey, describes the raising of a bridge in Bayonne, New Jersey, to give increased accessibility to larger merchant ships. Rob Neimeyer, Jacksonville, Florida, has a first-person account of "Hurricane Irma." Related to this is Professor S.A. Hsu's article on "Storm Surge Measurements at Naples, Florida, during Hurricane Irma in 2017," which gives some scientific statistics about the storm. He also has an article describing "Wind-Wave Relation during Hurricane Harvey in 2017."

Also appearing are the regular articles listing the "VOS Program Cooperative Ship Report," the "VOS Program New Recruits," and weather activity reports for the Atlantic and Pacific Oceans NOAA Tropical Analysis and Forecast Branch of the National Hurricane Center, and the National Center for Environmental Prediction provided the Review for Tropical Atlantic and Tropical East Pacific Area for May through August 2017. NOAA National Center for Environmental Prediction and Ocean Prediction Center provided the review of the Marine Weather Review — North Atlantic Area for January to April 2017.

On the cover: The **HELEN H** breaks ice so the **PHILIP R. CLARKE** can tie up for the season on a frigid Janu-ary 15, 2017, morning. Photographer: Bryan Howell.

Mariners Weather Log

Volume 61, Number 3, December 2017

Table of Contents

Voluntary Observing Ship Program

Mike Potochney, VOS Program Manager

I am excited to join the Voluntary Observing Ship (VOS) Program as the Program Manager. I want to thank everyone who has participated in the VOS Program, working to record accurate and timely weather observations. These daily observations are included in the National Weather Service suite of products, weather models, and daily forecasts. The information you provide helps drive alerts and warnings and feeds many of the weather and navigation systems the maritime community uses daily. Those of you who have been ship captains or have worked as part of the crew may have personal experience that drives your understanding of the importance of accurate forecasts and the impact that severe weather can have on safety of life at sea, crew, cargo, and operating costs. In the maritime environment, weather is everyone's business!

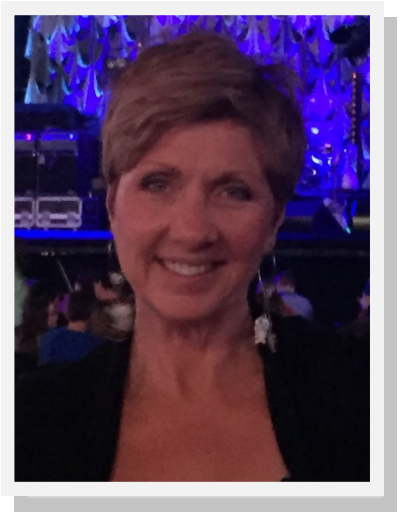
The VOS Program has a long history of dedicated people and partnerships. The Port Meteorological Officers (PMOs) have been working diligently to support the existing ships in the VOS fleet and actively recruiting new ships to provide weather observations. The PMOs work directly with shipping companies, captains, and crew providing equipment, software, and training to enable the tools needed to perform accurate observations. These individuals are the critical link between a ship's crew and the National Weather Service. Please work with the PMOs if you need support or are interested in actively participating in the VOS Program. The VOS contact information is located in the back of the *Mariners Weather Log* and is also available via the VOS Web site at www.vos.noaa.gov.

The VOS Program has recently been moved to NOAA Headquarters in Silver Spring, Maryland. My commitment to the program is to assess and evaluate the current program state, processes, and tools currently employed. The changes that are occurring in the maritime environment related to new technology innovation, cybersecurity, automation, and ongoing resources constraints impact business practices for the shipping industry and the VOS Program. Recommendations will be made on ways to enhance processes, training, tools, and business practices to ensure the VOS Program has continued success and the ability to evolve with our changing business environment.

The PMOs and I are dedicated to ensure that our VOS fleet has the tools, training, and support to generate the highest quality, timely weather observations possible. The best forecast begins with accurate, timely weather observations. If you are not actively participating, I would encourage you to reach out to one of our PMOs for more information and participate as you are the eyes at sea.

VOS Retirements

Paula Rychtar, Editor, *Mariners Weather Log*



Change is good. Change shakes things up, and change makes you breathe different air. With this, I bid a fond farewell to you all. I decided that after my 35-year career working in meteorology and oceanography, it was time for me to jump ship and pursue my second season of my life and retire. I started my career in the U.S. Navy, way back in 1979. I thought I was going to be stuck as a secretary, like my sisters. I graduated high school, and I gave it a try; I hated the tasks, the stereotype, taking dictation and typing with carbon copies (anyone remember all that horrible stuff?) and the final toll: I told the boss man to make his own coffee, and I ran off and joined the Navy. In the Navy, we ALL make the coffee! Best decision I ever made, and I look back on my Navy days with such admiration.

On a snarky note, you gotta love it when "women" were not capable of being on a ship, so said the men in charge. So my sea duty was Bermuda, darn the bad luck. I have been in the field of meteorology and oceanography before computers or programs made things so accessible and immediate.

I have seen so much change, yet there still needs to be a more level playing field in the workforce.
I had great opportunities, and I hold so many wonderful memories. I was:

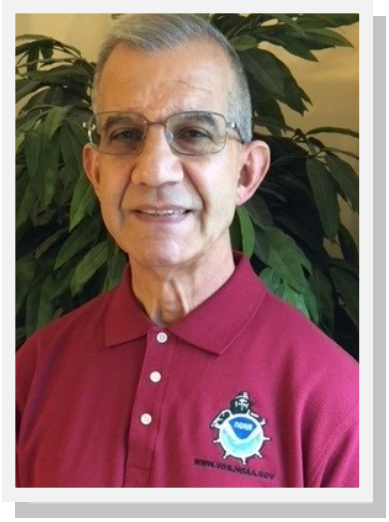
1. Placed in charge of air shows and provided weather briefings to the Blue Angels.
2. Charged with directing squadrons of Navy F18 pilots providing mission support.
3. Sailed with Massachusetts Maritime Academy to teach the cadets VOS.
4. Dropped bathythermographs off the **OLEANDER.**
5. Provided double T- 30 second-pibal readings in White Sands Missile Range (anyone remember double T's???).
6. Participated in Weather Radar, Radiosonde launches (*before* computers; anyone remember the big green monster?)

Over the last 8 years or so, I have had the privilege to work with some of the smartest folks working in the NWS Marine programs, the JCOMM Ship Observations Team, WMO, and the many countries who are engaged in this important data collection effort. I worked with good friends and colleagues, who I will miss. I know I will stay in touch with some; time has a way of filtering things.

I write this on my newly purchased Hunter 33-foot sailboat passing through the Gulf of Mexico. We just passed Pensacola, Florida, and we are hoping to get home Saturday or Sunday, but maybe not! Our sailboat's name will be *Apogee*, and this will be one of my full-time obsessions, replacing my VOS Operations Manager plate of varied goodies. I am now putting into practice all things I instructed and shared among the marine community.

VOS Retirements

Peter Gibino, PMO Norfolk



I will be retiring December 31, 2017, from the NWS after 22 years and 8 months of service. This will be my second retirement, since I retired from the U.S. Navy as a Senior Chief Aerographer's Mate, with 26 years of service in June 1995.

I have been the Norfolk Port Meteorological Officer (PMO) since June 1997 and had three previous positions within the NWS. I worked as a weather observer at Norfolk International Airport and Huntington, West Virginia. Then I was chosen as the Newark PMO, where I received training from Timothy Kenefick, who is now the Charleston PMO. I transferred to Norfolk, Virginia, after the position opened in June 1997, with the retirement of the previous PMO, Marty Bonk.

The PMOs and supervisors are dedicated to the continuous success of the VOS program. There is work going on behind the scenes to improve our program. Our operational supervisor ensures that the computer database is current and that we all have access to the ship information we need. Research on new equipment and plans on implementing new instruments for collecting weather data on ships are in the making.

PMOs have been going out on training cruises with the Maine Maritime Academy, teaching cadets meteorology and how to take weather observations. They have also assisted the National Ocean Service (NOS) with the deployment and collection of data from Expendable Bathythermographs (XBTs) and assisted with the loading of Drifter Buoys and other equipment. I have had the experience of working with the NOS as previously described.

It has been a privilege to work with the captains and mates on numerous ships in advancing the VOS program. I have also enjoyed the comradery amongst the PMOs, even though separated by port distances; we are all working towards one goal in assisting the ship's within the VOS program. I would also like to mention the late Robert Luke who was the previous Program Manager at Bay St. Louis, Mississippi. I served with him and Jim Luciani, the New York PMO, on the **USS GEORGE WASHINGTON (CVN-73).**

Making Way for Larger Ships in NJ Ports

James Luciani, PMO New York

An important event has taken place for eastern U.S. ports as the Bayonne Bridge Raising Project nears its completion. The raising is almost 6 months ahead of schedule and will allow ships 9500 TEU or greater access to the Port of Newark and Port Elizabeth. This is good news for all the major East Coast ports, since these larger ships were not going to call on the East Coast ports until this project to raise the auto deck of the bridge saw its completion.

I remember the planning stages of the project, where I attended a New York Harbor operations meeting, where the DOT provided a brief on how the project would unfold. Officials discussed building two new lanes above the old deck first, then how they would dismantle the old road deck and lower it into barges below the bridge. Once the lower deck was completely dismantled, construction of the final two lanes would commence, completing the rehab.

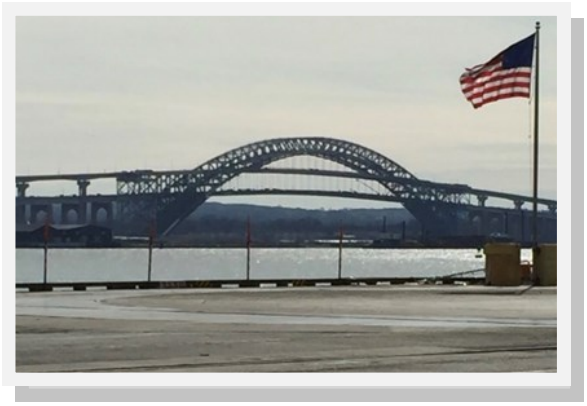


Figure 1: Image taken by NY PMO 17 February 2017

The DOT representative explained that the plan was to do the majority of the work from 10 p.m to 5 a.m. to minimize the impact to drivers. The barges for the dismantled bridge collection would need to clear the channel before each low tide. The DOT representative's response was, "At exactly what time does low tide take place?" The participants noted that times are not at the same time every day. The final takeaway for DOT was that this was not their typical project and that flexibility was the name of the game, a fact that was taken to heart in view of the reduced time required to complete the project.

The original clearance from the bridge was 151 feet, which necessitated using NOAA PORTS data to ensure larger vessels passed under the bridge at the lowest tide, with their folding masts and stacks in the down position. When the project is completed, the new clearance will be 215 feet. The historical importance of the arch bridge played a major role in the decision to raise the road deck rather than build a new bridge.

"Initially, the bridge was planned for motor vehicles, bicycles, and pedestrians only. Accordingly, a way to engineer a single span across the Kill Van Kull for motor vehicles. However, the suspension scheme was abandoned when the Port Authority commissioners insisted that considerations be

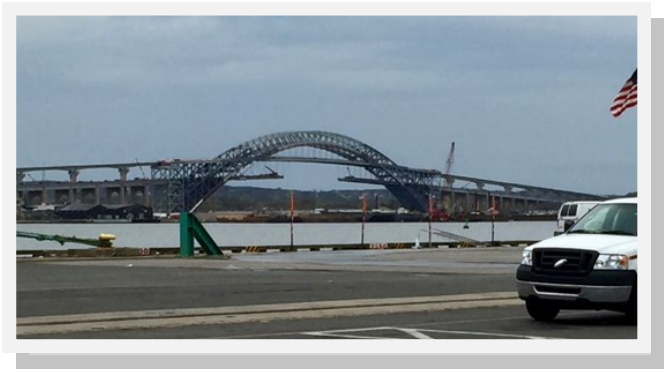


Figure 2: Image from APM term on 27 April 2017

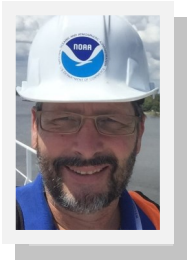
made for at least two rail-transit tracks to be added at some future date. (Studies showed that adapting a suspension design for rail traffic would be cost prohibitive.) With rail traffic in mind, the bridge's chief designer, Othmar H. Ammann, began developing a scheme that spanned the Kill Van Kull with a single, innovative, arch-shaped truss. As with the suspension-bridge scheme, Ammann worked on the arch design in partnership with architect Cass Gilbert. The arch bridge that emerged promised to be a remarkably efficient solution, well suited to the site from both engineering and aesthetic standpoints.

Once constructed, the truss was the world's longest. To this day, "[t]he truss stands as one of the world's most elegant arches, made of a sleek and modulated form of high-strength alloy steel." (Rastorfer)

The beauty of this project is that a major piece of architectural history was preserved and the modern-day needs of the maritime industry were addressed in one innovative action. So to all the captains and crews of these modern behemoths, New York and New Jersey welcome you!

Sources

"History." *Port Authority of New York & New Jersey*. N.p., n.d. Web. 03 May 2017.



Hurricane Irma

Rob Neimeyer, PMO Jacksonville

Hurricane Irma affected me as she swept up the southern and west coast of Florida.

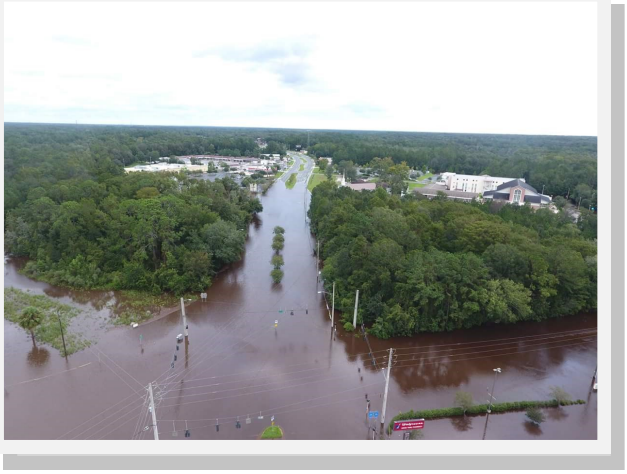
Personal Impacts at Home:

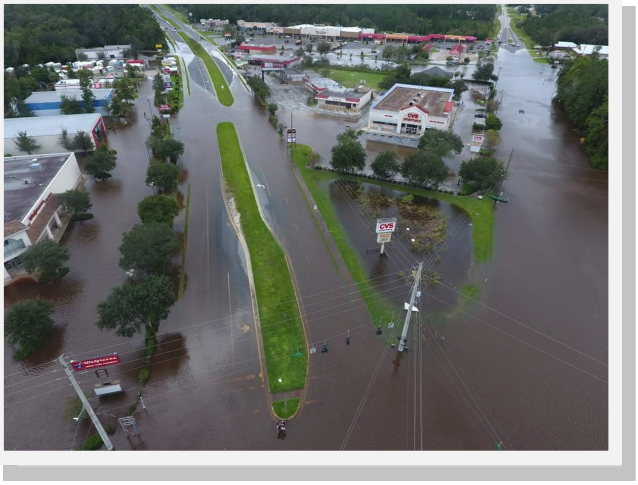
My home sets on a navigable river/creek called Black Creek, which flows into the St. Johns River and extends from Central Florida up to Jacksonville, Florida, where it finally spills out into the Atlantic. Ocean tides affect the St. Johns River, and subsequently, they influence the creek/river on which my home sets.

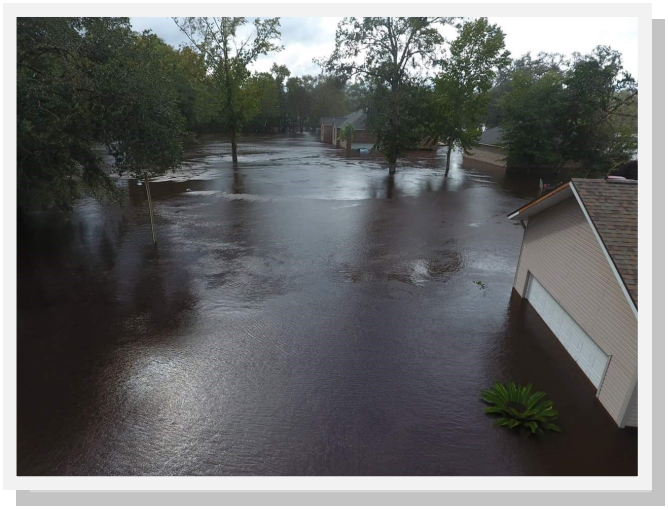
Prior to the arrival of Hurricane Irma, North Florida had experienced high levels of rainfall. This saturated the area and run-off drainage along with northeasterly wind flow into the St. Johns River and had begun to influence Black Creek days ahead of Irma's arrival. The highest historical crest for Black Creek dated back to 1919 and was measured at 25.3 feet. The creek surpassed the record set in 1919, due to the great influences of Hurricane Irma, and rose to a new record height of 28.5 feet.

I was fortunate to have purchased a home that is at least another 10 feet above where the water rose to during Hurricane Irma. However, my home is positioned at the highest level in the area, leaving 85 percent of my surrounding neighbors directly affected by flood waters within their homes. Water did rise across and around my property, leaving my wife and me trapped within the home for 4 days without power (generator broke the first day). The water levels on the streets far exceeded our ability to drive out for any reason. If we had to leave the home, we would have had to wade through chest-high water that was contaminated and contained dangerous debris, as well as insects and venomous reptiles, making it unsafe.

I was fortunate that my property sustained little damage, but I did have several trees fall away from the house and actually had a large wood deck resting upon the outbuilding near the creek. As of today, I have still not designed a plan to remove it, due to its size and weight.

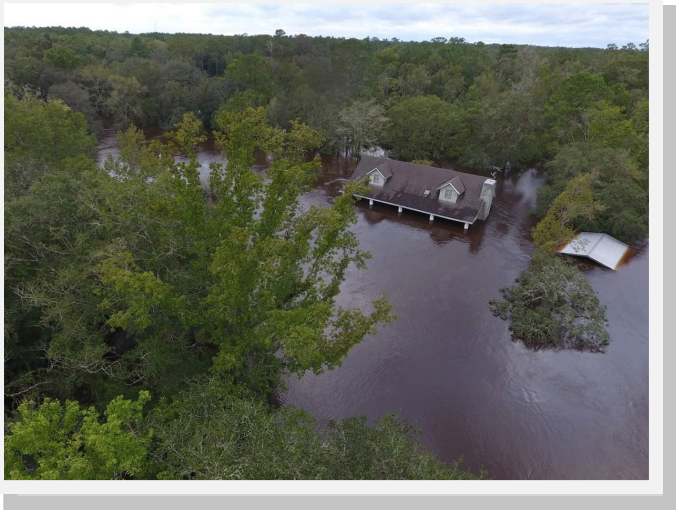






Impacts at the Office:

As with all NWS offices in the path of the storm, preparations were underway to ensure that the office was prepared 100 percent, both operationally and logistically (particularly regarding employees and families). At the office, it was “all hands on deck.” I assisted the office by filling in on the Hydrometeorology Testbed (HMT) desk and assisting the Upper Air program as a certified Upper Air expert. Several days prior to the arrival of Hurricane Irma, our office was tasked to double the normal amount of Upper Air soundings with which I was actively assisting each day. I had also assisted with preparing the office by purchasing food and water for all members of the team if we were confined in the office for extended periods. I was originally scheduled to remain in the office during the entire storm and assisting as needed; however, due to the rising waters of Black Creek, I felt that I should request to remain with my family throughout the storm and was released from the office approximately 6 hours prior to the storm’s arrival. No ships were allowed into Jacksonville Ports.



Neighborhood Damage:

The neighborhoods saw extensive damage due to the flood waters and numerous trees that fell on several homes and power lines. The most vivid memories were those of the homes destroyed by the flood and the families/friends affected. I actually paddled out into the flood waters to check on my neighbors who were trapped in their homes and to also ensure that my neighbors’ empty homes were not being looted.

National Weather Service VOS Program New Recruits:

January 1, 2017, through September 30, 2017

Ship Name	Call Sign	PMO	Recruit Date
ALBANY SOUND	VRXM4	Anchorage	22-Jul-17
APL ESPLANADE	S6LT4	Los Angeles	15-Aug-17
APL MEXICO CITY	9V9926	Norfolk	18-Aug-17
ASKLIPIOS	D5NX3	New York City	30-Aug-17
BILBAO BRIDGE	VRHY6	New York City	30-Aug-17
BUDAPEST BRIDGE	VRIZ5	New York City	15-Aug-17
CLYDE S. VANENKEVORT	WDJ4194	Duluth	11-Jul-17
CSCL BRISBANE	VRBJ9	Anchorage	18-Aug-17
DEEPWATER PONTUS	V7BE5	Houston	1-Aug-17
ELCIE	WDF2656	Baltimore	28-Sep-17
EMILIUS	9V2909	Anchorage	26-Aug-17
EMPRESS OF THE SEAS	C6CM8	Miami	31-Jul-17
EVER LAUREL	9V9287	New York City	3-Aug-17
EVER LOADING	2HDG4	New York City	11-Sep-17
FRONTENAC	VGNB	Duluth	1-Jul-17
ILLUSION (AWS)	WBA4557	Anchorage	23-Aug-17
LISA ANN 2 (AWS)	WDB3573	Anchorage	23-Aug-17
MAERSK SELETAR	WTAA	New York City	8-Aug-17
MAERSK SENTOSA	WSEP	New York City	26-Sep-17
MARCH	V7HZ5	New Orleans	14-Jul-17
MOL BRILLIANCE	VRNL2	Anchorage	25-Aug-17
MOL GLIDE	VRJF2	Anchorage	1-Sep-17
MOUNT HIKURANGI	VRMC8	Anchorage	26-Sep-17
MSC ANTIGUA	VRLC3	Charleston	1-Aug-17
OCEAN RELIANCE	WADY	Anchorage	5-Jul-17
SEABOARD AMERICA	5BAW3	New Orleans	12-Jul-17
STAR LOUISIANA	V7SD8	New Orleans	13-Sep-17
TIWAI POINT	VRFS8	Anchorage	18-Aug-17
WHITEFISH BAY	CFN6287	Duluth	2-Aug-17
WISDOM ACE	3FGZ8	Norfolk	17-Jul-17

Tropical Atlantic and Tropical East Pacific Areas

May through August 2017

Jorge Aguirre-Echevarria and Dan Mundell
Tropical Analysis and Forecast Branch, National Hurricane Center, Miami, Florida
NOAA National Center for Environmental Prediction

Atlantic Ocean including the Caribbean Sea and the Gulf of Mexico

There were eight nontropical cyclone gales that occurred between 1 May and 31 August 2016 in the area of high-seas-forecast responsibility (7°N to 31°N, west of 35°W, including the Caribbean Sea and Gulf of Mexico) of the National Hurricane Center's (NHC's) Tropical Analysis and Forecast Branch (TAFB). For the second year in a row, the Caribbean Sea basin had the most gales for this time period, the same amount as last year.

Table 1. Nontropical cyclone warnings issued for the subtropical and tropical Atlantic Ocean, including the Gulf of Mexico and Caribbean Sea between 1 May and 31 August 2017.

Onset	Region	Peak Wind Speed	Gale Duration	Weather Forcing
06 UTC 4 May	Gulf of Mexico	40 kt	54 h	Pressure Gradient
06 UTC 19 Jun	Gulf of Mexico	35 kt	12h	Pressure Gradient
12 UTC 18 Jun	Caribbean Sea	35 kt	30h	Low Pressure
18 UTC 20 Jun	Caribbean Sea	35 kt	12h	Pressure Gradient
12 UTC 1 Jul	Caribbean Sea	35 kt	30h	Pressure Gradient
00 UTC 19 Jul	Caribbean Sea	35 kt	6h	Pressure Gradient
18 UTC 5 May	SW N Atlantic	35 kt	24h	Pressure Gradient
00 UTC 19 Jul	SW N Atlantic	35 kt	6 h	Pressure Gradient

Gulf of Mexico Gale Warning

The gale with the longest duration during this time period occurred from 4–6 May in the Gulf of Mexico behind an unusually strong late-season cold front. The cold front moved over the warm Gulf of Mexico sea surface temperatures (SST) followed by cold air advection as high pressure anchored by a 1023-hPa high over northwestern Texas built southward across the region. The cold front extended from a 1001-hPa low near the Arkansas/Tennessee border southwestward to inland northeast Mexico at 1200 UTC 4 May (Figure 1). A gale warning was issued at 0600 UTC 4 May for frequent gusts to gale force behind the front as the cold air advection over the warm sea surface temperatures led to atmospheric boundary-layer instability resulting in NW gale-force winds in the range of 30–40 kt.

Only 3 hours later, ship **BLS ADVANCE** (ELXX9), just south of the Texas/Louisiana border, reported northwest winds of 35 kt. At 0239 UTC 5 May, ship **OREGON II** (WTDO), located near 26N86W, reported northerly winds of near 35 kt, and just a little over 4 hours later, the ship **EAGLE SYDNEY** (3FUU), located over the western Gulf waters near 24N93W, reported north winds of 35 kt, and the ship **OVERSEAS CASCADE** (WOAG), located near 30N88W, reported northwest winds of 40 kt. Later that day, the ship **SEABULK TRADER** (KNJK), located near 27.5N91W, reported northwest winds of about 35 kt at 2100 UTC. (Figure 2 Note the solid area of minimal gale-force winds (red and blue color) over the NE Gulf of Mexico with 20- to 30-kt winds to the east and southeast of the gale winds.)

These ship observations were valuable to forecasters in confirming the presence of the gale-force winds. (Figure 3) A few hours after the 0212 UTC ASCAT pass, the high pressure weakened to 1017 hPa going into the early morning hours of 6 May, allowing for the tight pressure gradient behind the front to slacken, but it was still tight enough to support minimal gale-force northwest winds over the far northeast Gulf waters. (Figure 4) As a consequence, the winds diminished to below gale threshold by 1200 UTC on 6 May.

Caribbean and Gulf of Mexico Gale Warning

A pair of tropical waves that had moved through the eastern and central Caribbean Sea during the early part of June became absorbed into a broad area of low pressure that began to take form on 16 June over the northwestern Caribbean Sea, Yucatan Peninsula, and northwestern Cuba. As Atlantic high pressure ridged southwestward towards the north-central and northwestward Caribbean through the next couple of days, the pressure gradient tightened significantly to the east of the

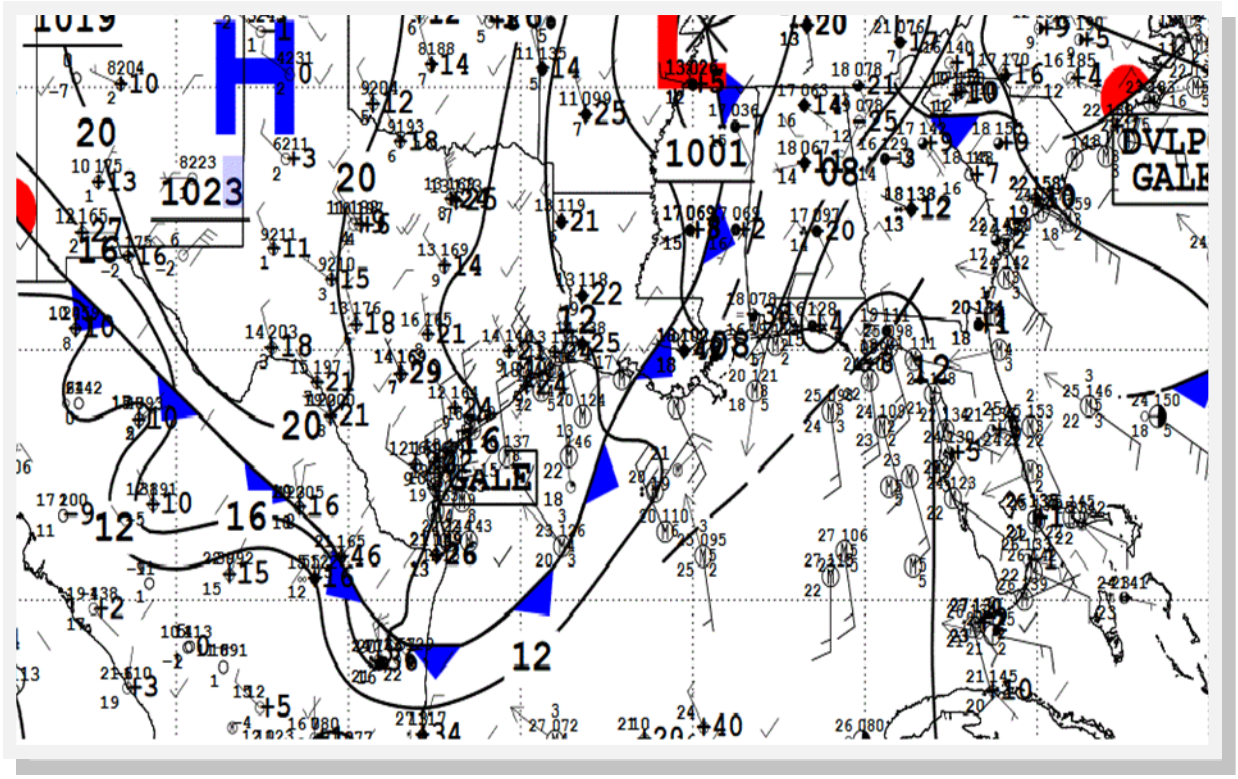


Figure 1. NWS Unified Service Analysis (USA) map from 1200 UTC 4 May showing the cold front across the NW Gulf with gale-force NW-to-N winds behind it.

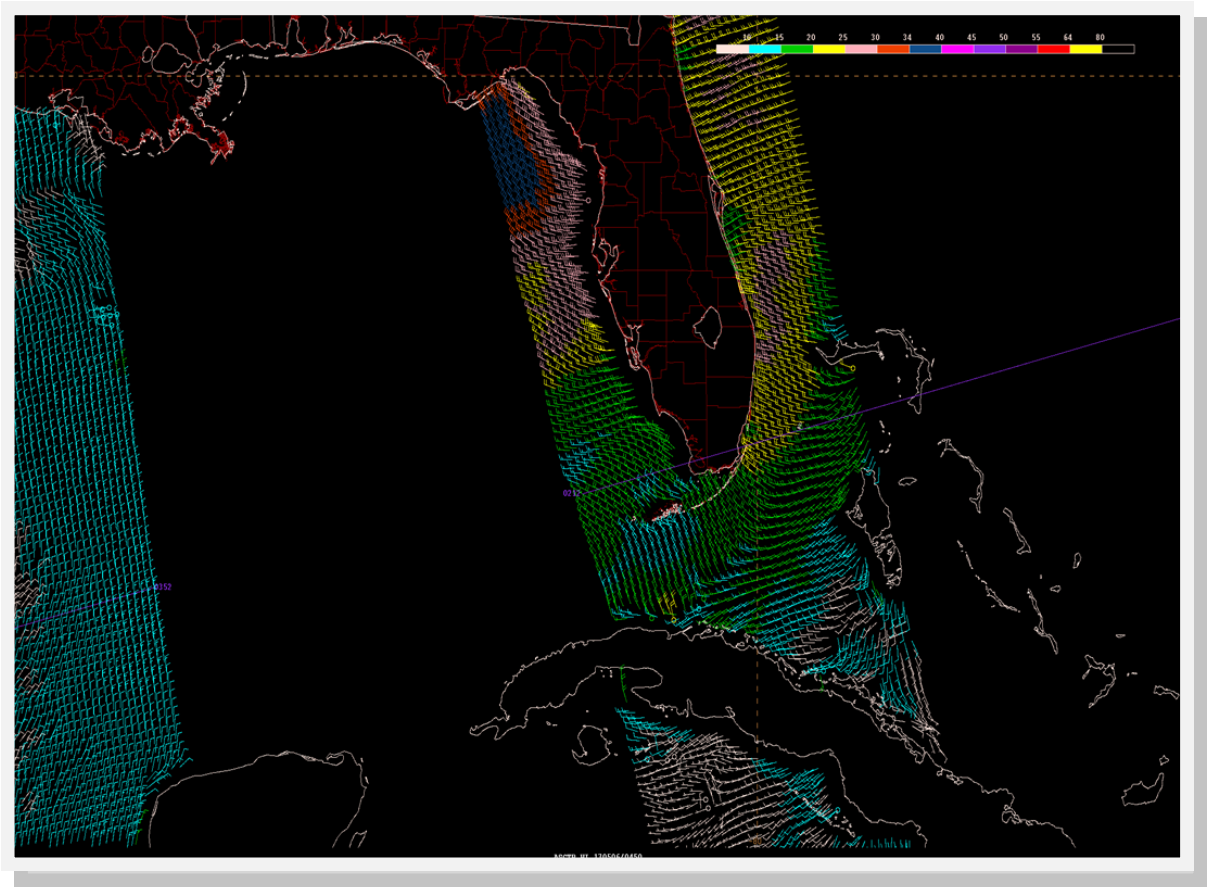


Figure 2. METOP-A Advanced Scatterometer (ASCAT) wind retrieval at 0212 UTC 6 May. Note the solid area of minimal gale-force winds (red and blue color) over the NE Gulf of Mexico with 20- to 30-kt winds to the east and southeast of the gale winds.

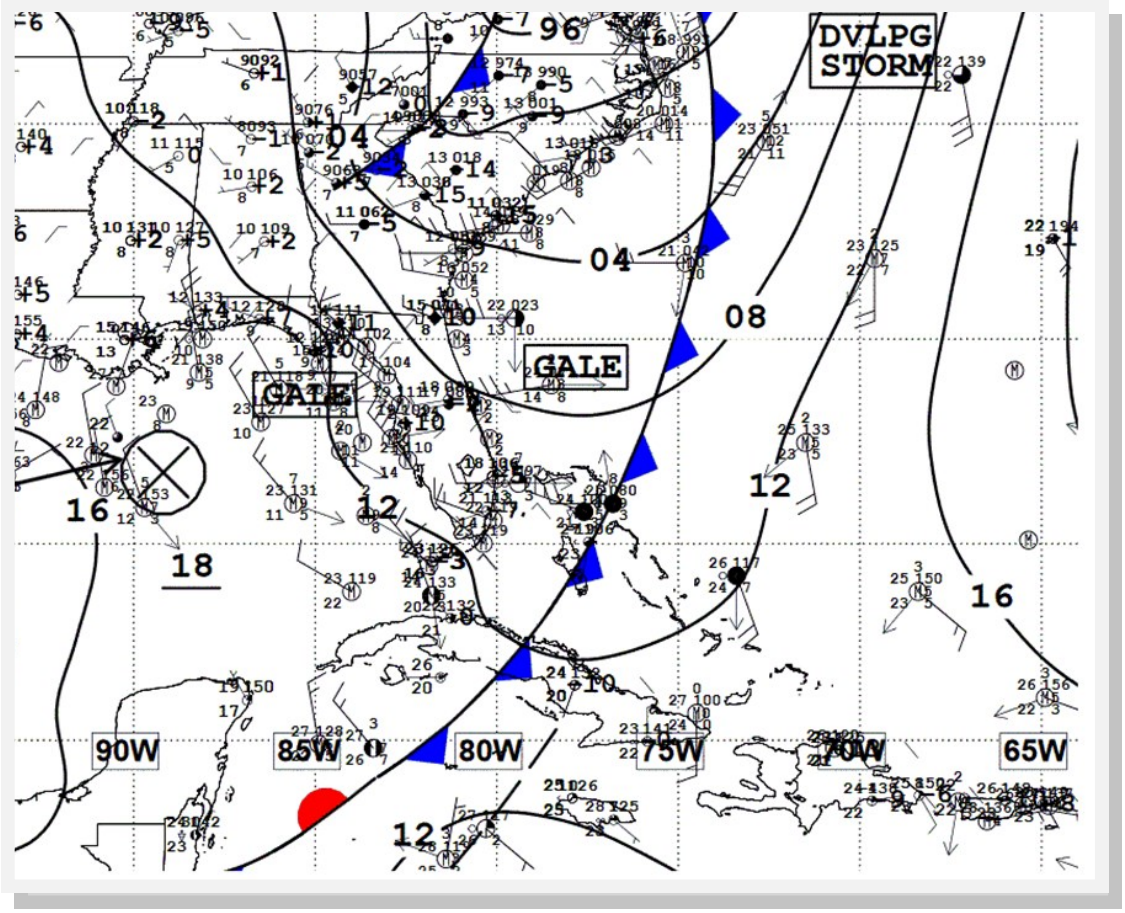


Figure 3. NWS Unified Surface Analysis (USA) map from 0600 UTC 6 May highlighting the area of gale-force winds over the NE Gulf of Mexico.

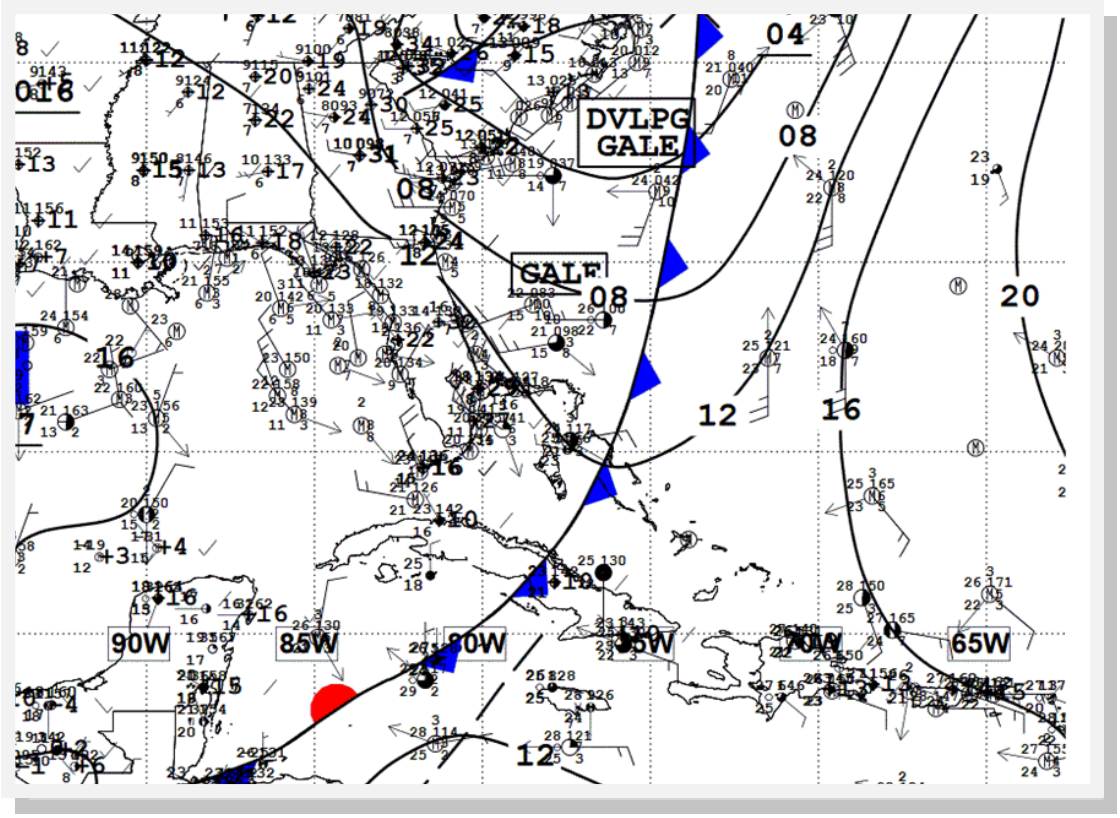


Figure 4. NWS Unified Surface Analysis (USA) map from 1200 UTC 6 May. Note the lax isobaric spacing over the eastern Gulf of Mexico.

broad low mainly to the north of 19N and between 81W and 83W. This prompted the issuance of a gale warning for a portion of the northwest Caribbean beginning at 1200 UTC 18 June, at which time a 1006-hPa low was analyzed just northeast of Belize. (Figure-5 . Note the southeast to south gale-force winds in the range of 30–35 kt (marked in red and blue_ embedded within winds of 20–30 kt). By 1200 UTC 19 June, the 1005-hPa low and associated broad low pressure had shifted farther northwest to inland the northern Yucatan Peninsula as another 1005-hPa low formed north of the Yucatan Peninsula over the Gulf of Mexico near 23N89W along a trough axis that connected both lows. The broad low pressure still encompassed a portion of the northwest Caribbean Sea at that time. (Figure 6. Note the east-to-southeast gale-force winds in the range of 30–35 kt (marked in red and blue) over the southeastern Gulf waters to the east of the trough axis). A gale warning was issued at 0600 UTC 19 June for the southeastern Gulf waters as now the tight pressure gradient was affecting that portion of the Gulf of Mexico. By 1800 UTC 19 June, the gale warning was allowed to expire for the Caribbean affected waters. It was replaced by Potential Tropical Cyclone-Three warnings for the Gulf of Mexico affected waters. The system became Tropical Storm Cindy on the following day.

May Gale in the Southwest North Atlantic

As described above under Gulf of Mexico, a late-season cold front moved across the Gulf of Mexico to the Atlantic waters offshore the Florida peninsula by late in the day on 5 May. The attendant deep low-pressure system was analyzed on 1200 UTC 5 May over West Virginia, with the associated cold front stretching southward to just offshore the southeastern United States coast and to inland central Florida. (Figure 7.) At that time, developing gale conditions were forecast to begin at 1800 UTC 5 May for strong westerly winds with frequent gusts to gale force across the far northern waters of TAFB's southwest North Atlantic forecast zone behind the front north of 29N, as the broad cyclonic flow associated with the aforementioned low pressure funneled a cooler air mass southward across warm sea surface temperatures present over the TAFB forecast waters. This provided the favorable ingredients needed to mix stronger winds from aloft down to the surface.

By 1200 UTC on 6 May, the cold front had pushed eastward to along a position from near 31N69W south-southwestward to central Cuba and to the northwestern Caribbean Sea where it became stationary. (Figure 4. Also of note in the analysis is the occurrence of fresh-to-strong southerly winds east of the front). The ship **CARNIVAL PRIDE** (H3VU) reported estimated southwest winds of 35 kt near 29N80W at 0000 UTC on 6 May and around 35 kt near 31N80W at 0600 UTC on 6 May. Just 4 hours later, the ship **OASIS OF THE SEAS** (C6XS7) reported south to southwest winds of 35 kt near 25N74W, with combined seas to 11 ft (3.5 m). In addition, further evidence of the ongoing strong to gale-force winds was captured in the MetOP-B Advanced Scatterometer (ASCAT) pass from 1438 UTC 6 May. (Figure 8) The pass highlighted an extensive area of west-to-northwest 20- to 30-kt winds to the east of the Florida peninsula north of Bahamas with a solid area of embedded 30- to 35-kt winds over a portion of the northwest waters in the TAFB southwest North Atlantic forecast zones north of about 28N and west of 78W. Between 1200 UTC and 1800 UTC 6 May, westerly winds behind the front began to diminish in response to a weakening of the pressure gradient. This weakening trend allowed for the gale-force winds to diminish below gale force by 1800 UTC 6 May.

Other Caribbean Gales

Other than the gale-force winds related to the broad low pressure that occurred over the northwestern Caribbean Sea during June, there were three other gales in the favorable climatological area of strongest trade winds over a portion of the southwest Caribbean Sea to the coasts of Colombia and northwestern Venezuela between 1 May and 31 August. Two of these events were rather short lived, one of 12 hours in duration during the month of June and the other of 6 hours in duration during the month of July The longest lived of the events lasted for 30 hours. This event that began at 1200 UTC 1 July and was confined from 11N to 13N between 73W and 77W included the Gulf of Venezuela. The pressure gradient between a narrow Atlantic high-pressure ridge with axis roughly along 28N and the typical climatological low pressure over the Colombian basin along with further reinforcement from tropical waves passing through the Caribbean resulted in minimal gale-force NE to E 30- to 35-kt winds with seas in the range of 9 to 14 ft (2.7 to 4.2 m) across that part of the SW Caribbean. *(*Figure 9 Note the tight gradient spacing just north of the coasts of Colombia and Venezuela between the 1016-hPa and 1012-hPa isobars). Gales that occur over this portion of the Caribbean, which include waters near the coast of Colombia and the Gulf of Venezuela, can impact many mariners due to the heavy ship traffic that traverses these waters, especially given that the port of Cartagena in Colombia has a recent history of being one of the top five busiest in the Caribbean Sea in handling containerized ship cargo. This gale ended at 1800 UTC 2 July when the ridge weakened just enough to relax the culprit tight-pressure gradient.

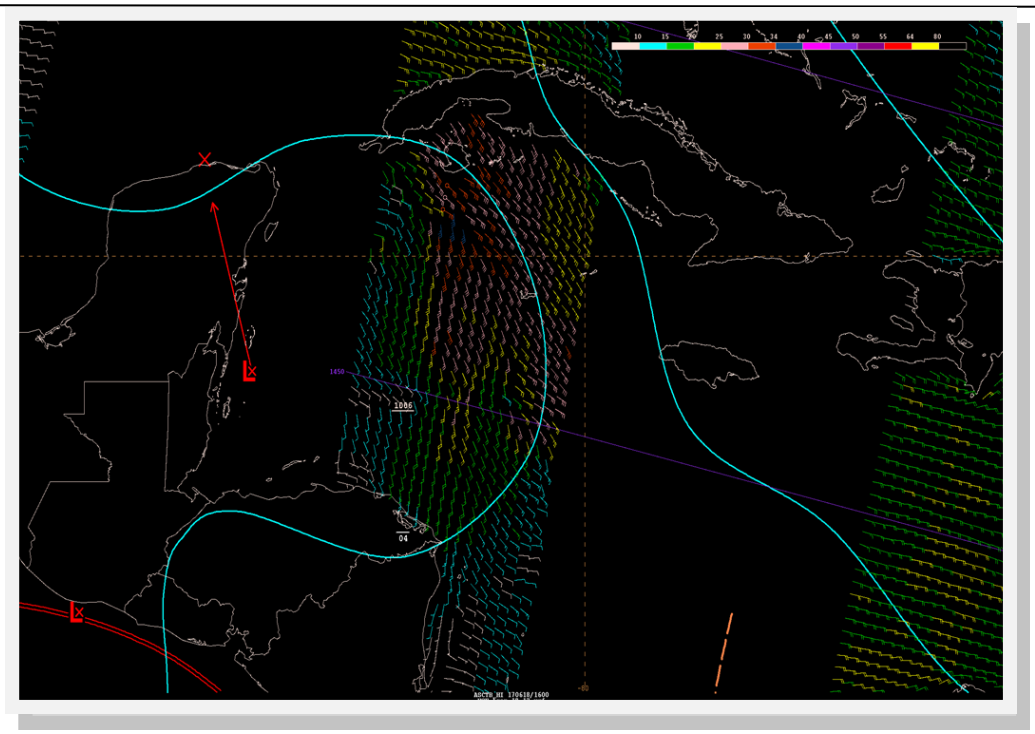


Figure 5. METOP-B Advanced Scatterometer (ASCAT) wind retrieval at 1450 UTC 18 June with the NWS Unified Surface Analysis (USA) map from 1200 UTC 18 June superimposed. Note the southeast-to-south gale-force winds in the range of 30–35 kt marked in red and blue embedded within winds of 20–30 kt.

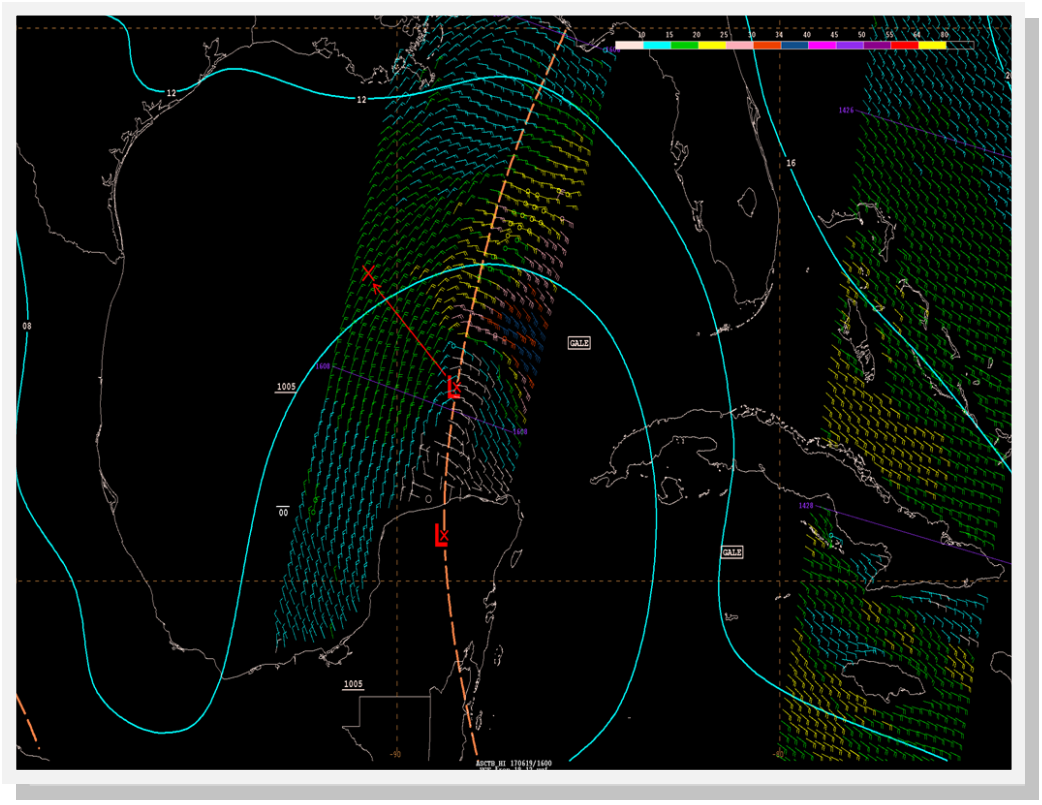


Figure 6. METOP-B Advanced Scatterometer (ASCAT) wind retrieval at 1608 UTC 19 June with the NWS Unified Surface Analysis (USA) map from 1200 UTC 19 June superimposed. Note the east-to-southeast gale-force winds in the range of 30–35 kt marked in red and blue over the southeastern Gulf waters to the east of the trough axis.

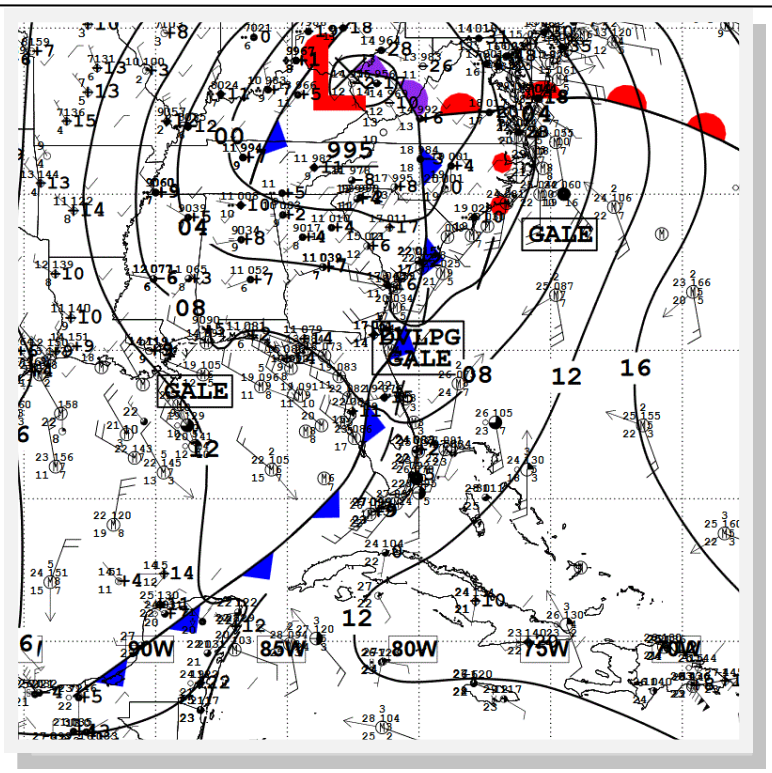


Figure 7. NWS Weather Service Unified Surface Analysis (USA) map from 1200 UTC 5 May. Note the very tight pressure gradient and cold air mass over the southeastern U.S. advancing towards the western Atlantic waters.

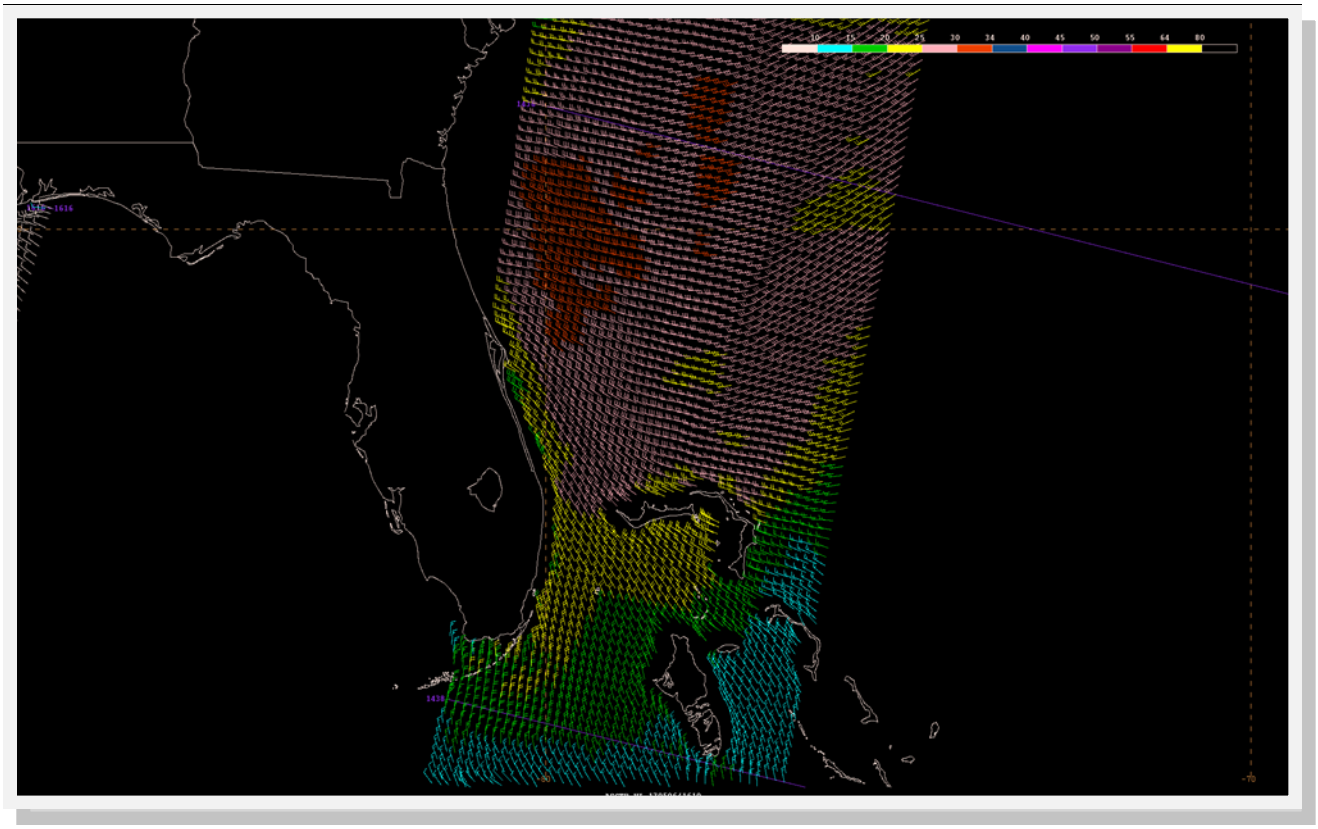


Figure 8. The MetOP-B Advanced Scatterometer (ASCAT) pass from 1438 UTC 6 May highlighted an extensive area of west to northwest 20- to 30-kt winds to the east of the Florida peninsula north of Bahamas with a solid area of embedded 30- to 35-kt winds over a portion of the northwest waters in the TAFB Southwest North Atlantic forecast zones north of about 28N and west of 78W.

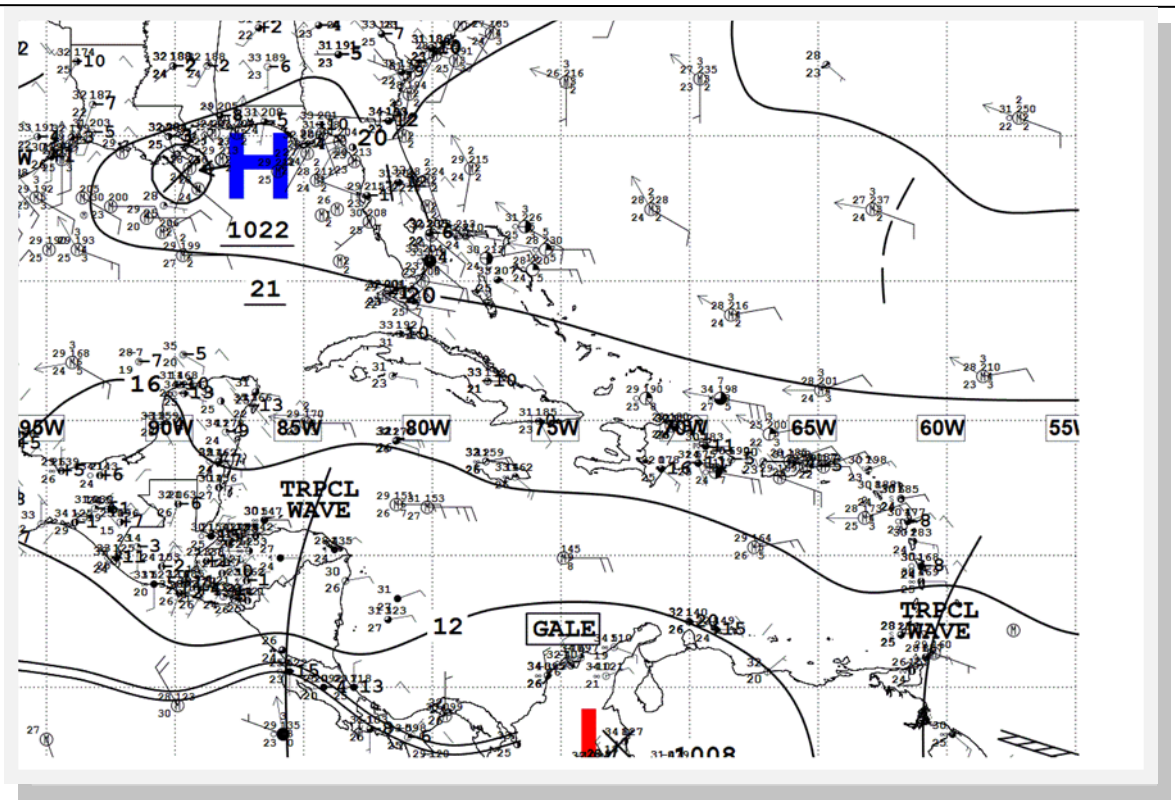


Figure 9. NWS Unified Surface Analysis (USA) from 1800 UTC 1 July. Note the tight gradient spacing just north of the coasts of Colombia and Venezuela between the 1016-hPa and 1012-hPa isobars.

Eastern North Pacific Ocean

Scatterometer data primarily documented not associated with tropical cyclones May through August 2017. Table 2 provides details on these gale winds.

Table 2. Nontropical cyclone warnings issued for the subtropical and tropical eastern North Pacific between 1 May and 31 August 2017.

Onset	Region	Peak Wind Speed	Gale Duration	Weather Forcing
0300 UTC 05 May	Gulf of Tehuantepec	40 kt	33 hr	Pressure Gradient
0600 UTC 07 May	Gulf of California	40 kt	6 hr	Pressure Gradient
1800 UTC 23 Aug	Pacific Ocean	35 kt	60 hr	Pressure Gradient

A gale warning was also issued at 1800 UTC 11 Aug after a ship observation of 38 kt from the tanker **FLORIDA VOYAGER** (WDF4764) near 20N 108W indicated gale-force winds were present, even though a surface low was in the early stages of development from the midlevel remnants of Atlantic Hurricane Franklin, which made landfall a day earlier in eastern Mexico, as the circulation emerged off the west coast of Mexico. The first advisory on Tropical Storm Jova by the National Hurricane Center at 0300 UTC 12 August later superseded this gale warning.

Strong northerly winds behind a cold front across the western Gulf of Mexico typically initiated late-season Gulf of Tehuantepec wind events. This strong flow advects cold air southward, and funneling effects are most pronounced across the Isthmus of Tehuantepec. This was the case for the gale warning issued for the Gulf of Tehuantepec in May 2017.

Strong high pressure behind a cold front reaching the Bay of Campeche in the Gulf of Mexico and a broad monsoon trough across the eastern North Pacific produced a tight pressure gradient across southern Mexico resulting in gale-force northerly winds in the southern Gulf of Mexico on 4 May, then developing later that night in the Gulf of Tehuantepec. High pressure behind the front persisted over southern Mexico through the morning of 6 May before slowly shifting eastward and weakening. As a result, a very tight pressure gradient remained across the Tehuantepec region for nearly 2 days, supporting gale-force winds from 0300 UTC on 5 May until 1200 UTC 6 May.

Forecasters expected the gale to begin around 0600 UTC on 5 May, but an ASCAT scatterometer pass over the area at 0410 UTC was able to identify the onset of gale-force winds (Figure 10) a few hours earlier. No ship observations or scatterometer data were available during the time of expected peak winds around 40 kt later that morning, but another ASCAT scatterometer pass at 1621 UTC 6 May was able to confirm that winds in the Gulf of Tehuantepec were below gale force the next day.

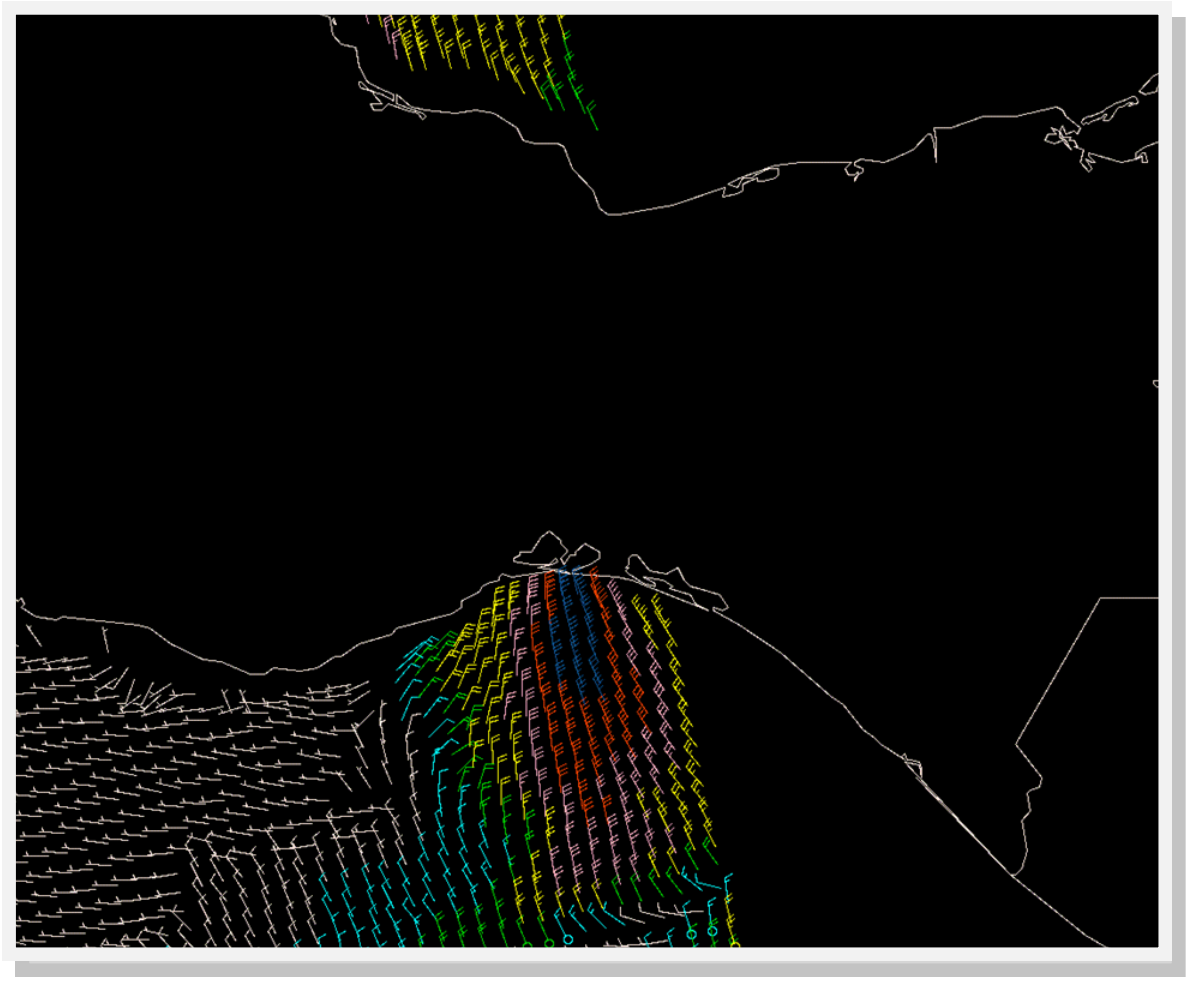


Figure 10. METOP-B Advanced Scatterometer (ASCAT) pass at 0410 UTC 5 May 2017 depicts the onset of gale-force winds near the coast of Mexico in the Gulf of Tehuantepec. Highest northerly winds of 33–37 kt (in purple) are shown within 30 nmi of the Isthmus of Tehuantepec.

A cold front in northwest Mexico induced a late-season high-wind event in the northern Gulf of California on 6 and 7 May. West coast cold fronts reaching the Gulf of California can often produce strong winds, both in the southwesterly direction preceding the front and from the north to northwest behind it. This area is prone to funneling wind effects through gaps in the rough terrain of Baja California when the wind direction is west or southwest near San Felipe. It is believed that brief episodes of near-gale or gale-force winds may be more common in the Gulf of California during strong cold frontal passages than indicated from high-resolution global model forecasts. However, the lack of observations, both from land stations and ocean-going vessels, makes it difficult to confirm the location and frequency of gale-force winds without timely scatterometer data. In this instance, a surface observation from Los Morritos (30.6N 114.6W) of 26 kt with gusts to 31 kt at 0100 UTC and an ASCAT METOP-B pass at 0420 UTC on 7 May (Figure 11) were used to identify 40-kt winds near 30.5N 114W, which prompted the issuance of a gale warning at 0600 UTC 7 May that lasted for 6 hours.

A distinctive characteristic of tropical cyclones in the Eastern North Pacific Ocean is that, after encountering colder sea surface temperatures, typically north of 25N, they tend to lose all deep convection, causing the winds to rapidly diminish, resulting in a transition to what is called a posttropical remnant low. In nearly all instances, winds are already below the 34-kt threshold for tropical storms and gale warnings when this reclassification occurs. In the case of Tropical Storm Kenneth in August, a strong subtropical high-pressure system in close proximity to the remnant low supported a tight pressure gradient and gale-force winds mainly in the northern semicircle for another 60 hours after the final advisory was issued on Kenneth, a duration that was very unusual for a tropical low without significant convection (Figure 12).

Scatterometer data was crucial in identifying the duration and areal extent of the gale-force winds associated with the remnant low of Kenneth as it meandered between 135W and 137W from 23 August until 26 August (Figure 13). The gale warning was discontinued at 0600 UTC on 26 August, and an ASCAT pass later that day at 1828 UTC confirmed that winds northwest of the center had diminished below gale force.

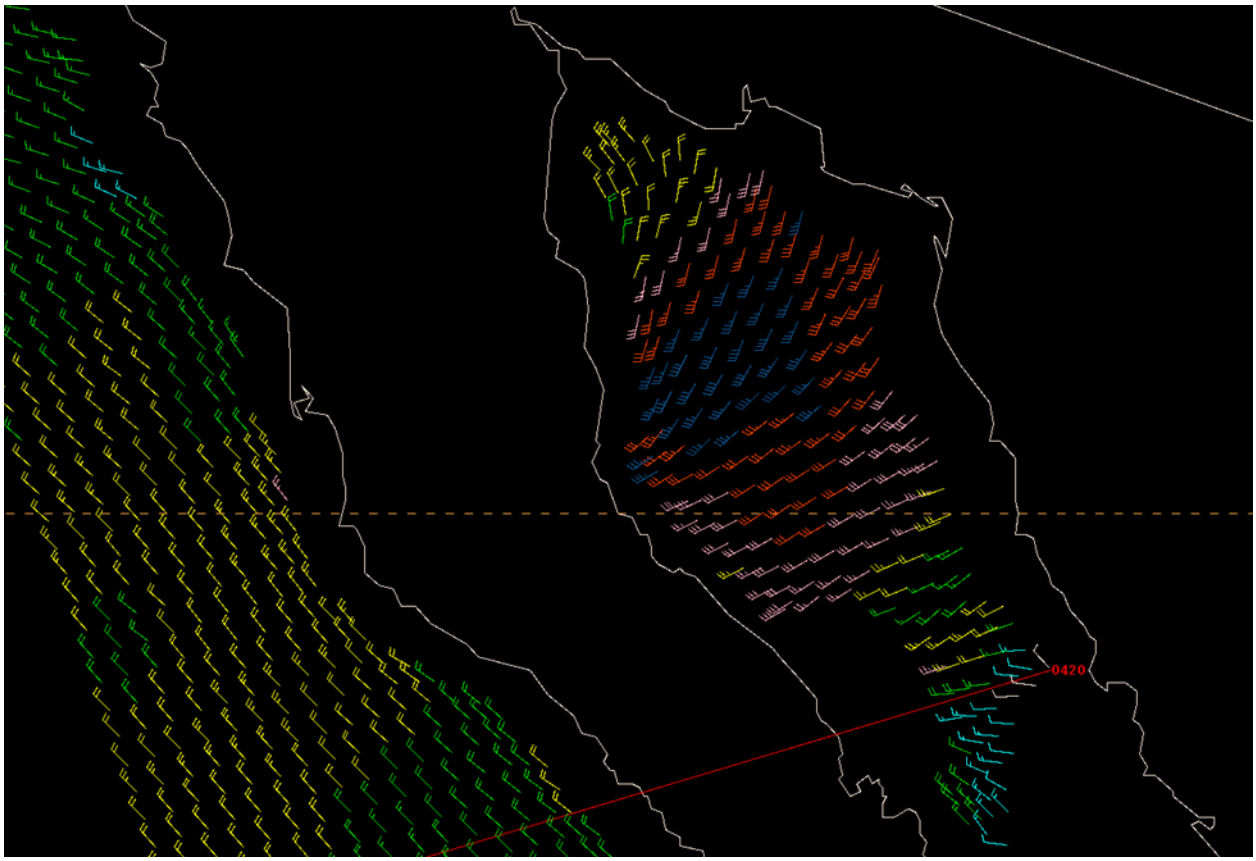


Figure 11. This METOP-A Advanced Scatterometer (ASCAT) pass at 0420 UTC 7 May 2017 captured the gale-force southwesterly winds in the northern Gulf of California near peak intensity ahead of a strong Pacific cold front. A swath of 30- to 40-kt winds (in blue and red) are evident south of the front, and strong north-to-northwest winds are north of the front near the mouth of the Colorado River.

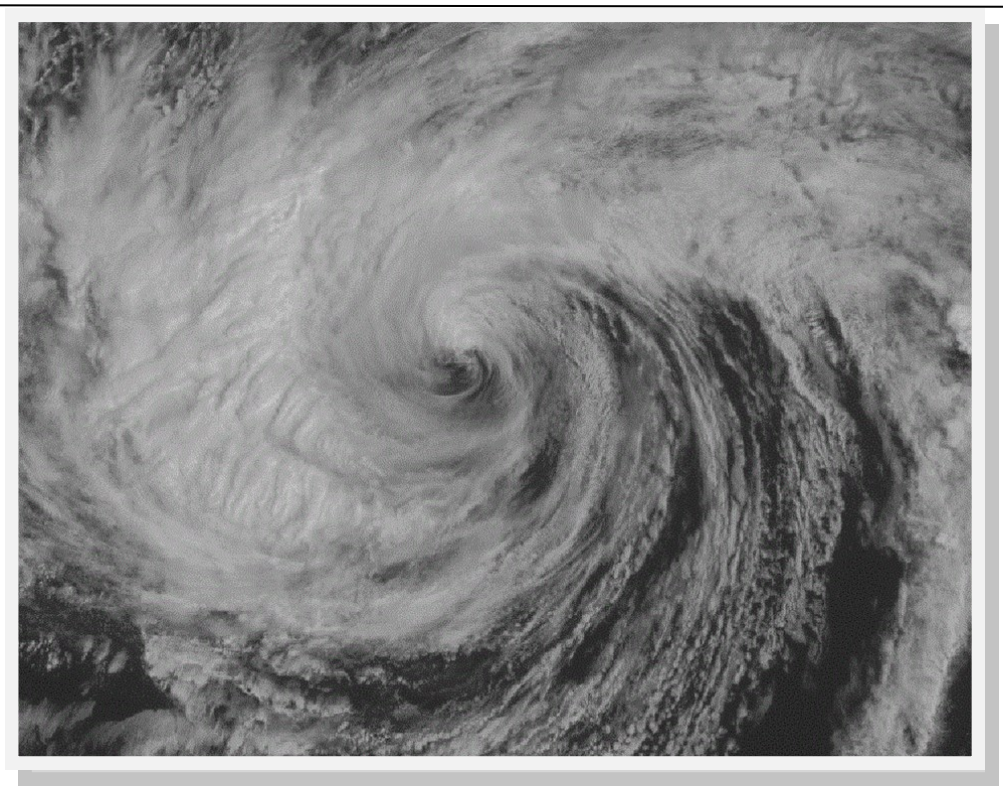


Figure 12. This GOES-15 (GOES West) visual satellite image at 1900 UTC 23 August 2017 shows the lack of deep convection near the center of Tropical Storm Kenneth 2 hours prior to being declared a posttropical cyclone by the National Hurricane Center. The well-organized low-level structure of the remnant low and a tight pressure gradient in its northern semicircle allowed the remnants of Kenneth to maintain gale-force winds even without the benefit of strong convection for another 60 hours afterwards.

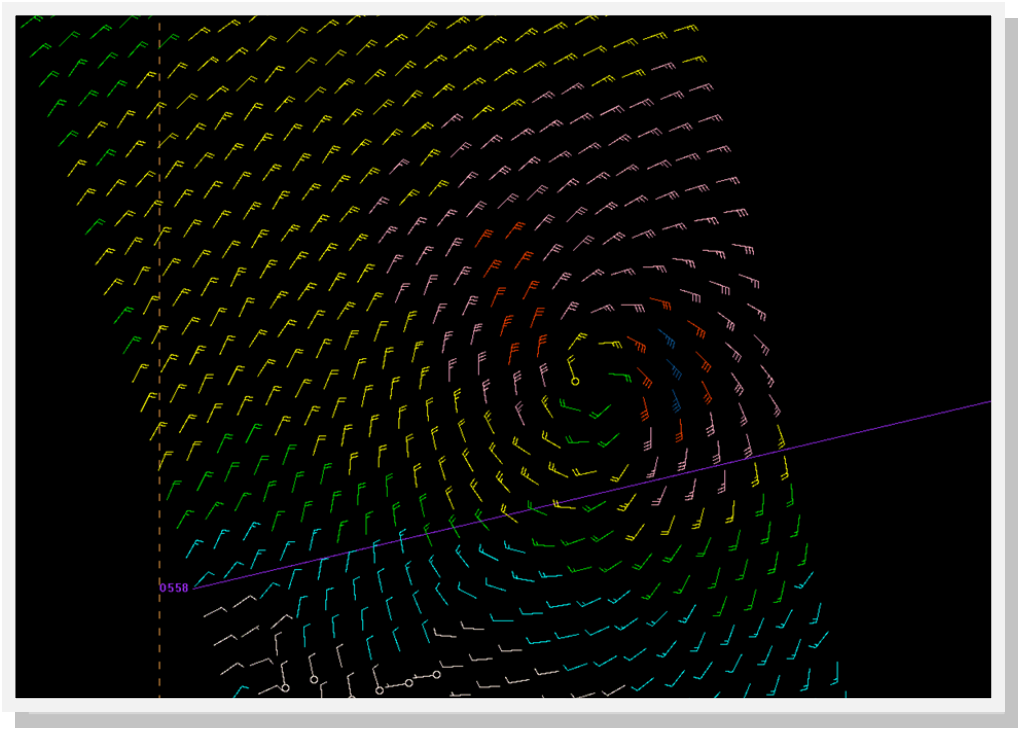


Figure 13. METOP-B Advanced Scatterometer (ASCAT) pass at 0558 UTC 24 August 2017 indicated gale-force winds were still present east of the remnant low center of Kenneth in the eastern Pacific, along with near-gale-force winds in the northwest quadrant, about 12 hours after the last advisory on the tropical cyclone was issued by the National Hurricane Center.

MARINE WEATHER REVIEW — NORTH ATLANTIC AREA

January to April 2017

George P. Bancroft
NOAA National Center for Environmental Prediction/ Ocean Prediction Center
College Park, Maryland

Introduction

The author considers this 4-month period the second half of the heavy-weather season when hurricane-force lows are most likely. January is normally the most active month in North Atlantic (VonAhn and Sienkiewicz, 2005). This year January produced 11 hurricane-force lows, the most during the 4-month period, but two fewer than in December 2016 (as mentioned in the previous issue of Mariner's Weather Log (August 2017)). February and March brought eight and nine such events, respectively. The numbers dropped sharply late in the season to two in April, as is often the case. The period featured mainly a progressive pattern of developing cyclones moving from southwest to northeast across the North Atlantic toward Greenland and Iceland, passing north of the British Isles with some of the cyclones stalling or moving erratically upon reaching the Labrador Sea or east Greenland waters before weakening. Two smaller hurricane-force systems that took a more southern track south of the British Isles appear in this article. The deepest cyclones occurred in February and early March when three of the lows developed central pressures below 950 hPa.

Tropical cyclones are rare during this period, but like 2016, a tropical cyclone formed well before the official start of the Atlantic hurricane season on June 1 (Tropical Storm Arlene). Arlene was only the second tropical cyclone ever detected in the month of April, with Ana in 2003 being the first (Reference 4).

Tropical Activity

Tropical Storm Arlene was originally a strong extratropical cyclone that formed over the southwestern waters in mid-April as one of two April events, described below. It gradually weakened while drifting east-southeast and, after losing frontal features late on April 18, was classified as Subtropical Depression on the next day while it turned toward the north, drawn into the circulation of a larger extratropical low to the west. The cyclone became a tropical depression by 0000 UTC on the 20th and then Tropical Storm Arlene 6 hours later, reaching peak intensity of 45 kt near 39N 43W at 0000 UTC on the 21st. Arlene was a short-lived cyclone, with Figure 1 showing Arlene being pulled into the cold side of the extratropical low to the south. Arlene became posttropical 6 hours later and dissipated near 32N 47W later on the next day. The **COLOMBO EXPRESS** (DIHC) near 40N 50W reported northeast winds of 45 kt and 6.7-meter seas (22 feet) at 1200 UTC on April 21. The **CELEBRITY ECLIPSE (**9HXC9) near 35N 55W encountered north winds of 45 kt at 1900 UTC on the 21st. The same ship reported 7.3-meter seas (24 feet) along with north winds of 40 kt near 36N 52W 8 hours later.

Other Significant Events of the Period

North Atlantic Storms, January 7–11: Two strong cyclones developed in close succession early in January, with the stronger of the pair

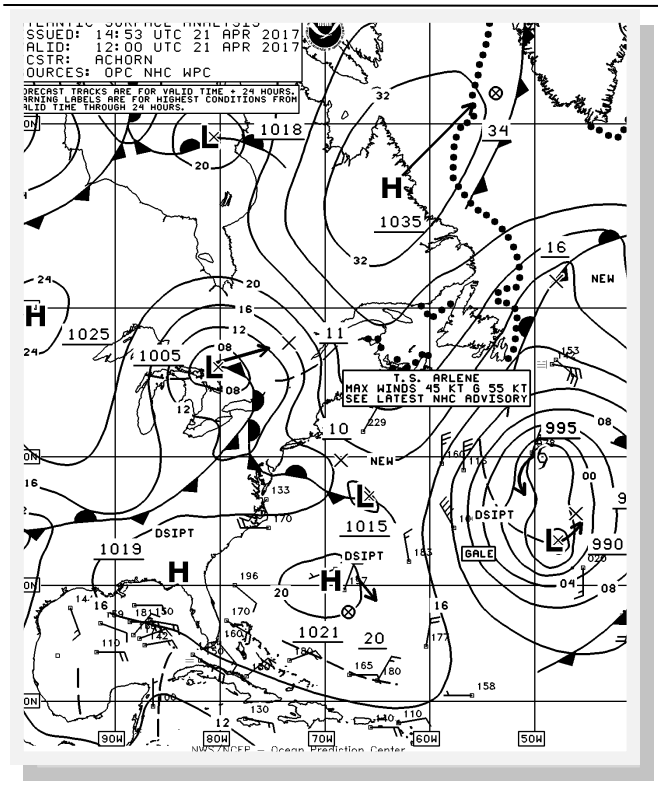


Figure 1. OPC North Atlantic Surface Analysis Chart (Part 2 — west) valid 0600 UTC April 21, 2017. The 24-hour forecast tracks appear with the forecast central pressures given as the last two whole digits in millibars (hPa), except for tropical cyclones. Text boxes contain tropical cyclone information.

originating off the mid-Atlantic coast of the U.S. early on the 6th. It took slightly more than 2 days to cross the Atlantic and approach Iceland, where it developed a lowest central pressure of 970 hPa and hurricane-force winds near 61N 22W at 0000 UTC on the 9th. Its compact circulation and winds appeared similar to winds appearing in the scatterometer image of the Bay of Biscay storm in early February (Figure 13). It then turned toward the east and weakened, passing north of the British Isles early on the 10th, with its top winds lowered to gale force. The second event originated near the southeast U.S. coast early on the 7th and moved northeast, developing storm-force winds 12 hours later and again in the Labrador Sea on the 9th with a central pressure of 984 hPa. The cyclone briefly developed hurricane-force winds near southern Greenland at 1800 UTC on the 9th and again 24 hours later in the east Greenland waters. An ASCAT-B image from 1428 UTC on the 10th with limited data showed west winds of 50 kt southwest of the cyclone's center. The system then turned eastward late on the 10th and dissipated south of Iceland early on the 12th.

English Channel Storm, January 12: This small and compact cyclone formed in 6 hours on a front approaching the British Isles and northwest France from the west early on January 12 and developed into a small, but intense, 983-hPa low at 1800 UTC on the 12th. The ship **BATFR14** (49.5N 2W) reported northwest winds of 65 kt at that time, while the **PHILADELPHIA EXPRESS** (49N 6W) encountered northwest winds of 50 kt and 7.3-meter seas (24 feet). Buoy 62305 (50.4N 0W) reported northwest winds of 55 kt with gusts to 67 kt and 3.0-meter seas (10 feet) 2 hours later. Buoy 62103 (49.9N 2.9W) reported winds of 46 kt with gusts to 57 kt and 2.7-meter seas (9 feet) at 1700 UTC on the 12th, followed by a peak gust 64 kt 1 hour later and seas up to 3.4 meters (11 feet) at 0700 UTC on the 13th. This event was short lived, with the cyclone quickly moving inland over northern France by the 13th.

North Atlantic Storm, January 13–15: A developing frontal wave moved from the Gulf of St Lawrence early on 13 January and developed storm-force winds over the Labrador Sea late that day and briefly hurricane-force winds with a 974 hPa pressure near 55N 51W at 1200 UTC on the 14th. Its lowest pressure of 968 hPa appeared near the east Greenland coast at 0600 UTC on the 15th. An ASCAT-B image from 1445 UTC on the 14th showed wind retrievals of 50 to 55 kt to the south of the cyclone, but with limited data coverage. The cyclone subsequent weakened north of the area late on the 15th.

North Atlantic Storms, January 16–19: Two strong cyclones developed in close succession in the central waters in mid-January and with similar intensities. The first appears as a

hurricane-force low on the edge of the chart in the first part of Figure 2. It originated near Cape Hatteras at 0000 UTC 15 January and developed a lowest central pressure of 978 hPa as it turned northeast to 51N 34W as a storm-force low. The **CHICAGO EXPRESS** (DCUJ2) reported north winds of 40 kt at 0600 UTC on the 17th, near 42N 45W. The ASCAT data in Figure 3 shows a compact circulation with winds 50 to 60 kt south of the center. The cyclone that followed early on the 20th subsequently absorbed the system. The second part of Figure 2 shows its replacement, a secondary development on a frontal system trailing from the Newfoundland low the previous day. It developed a lowest central pressure of 981 hPa over the central Atlantic at 0000 UTC on the 19th before beginning a slow weakening trend; it later passed northwest of Iceland on the 21st.

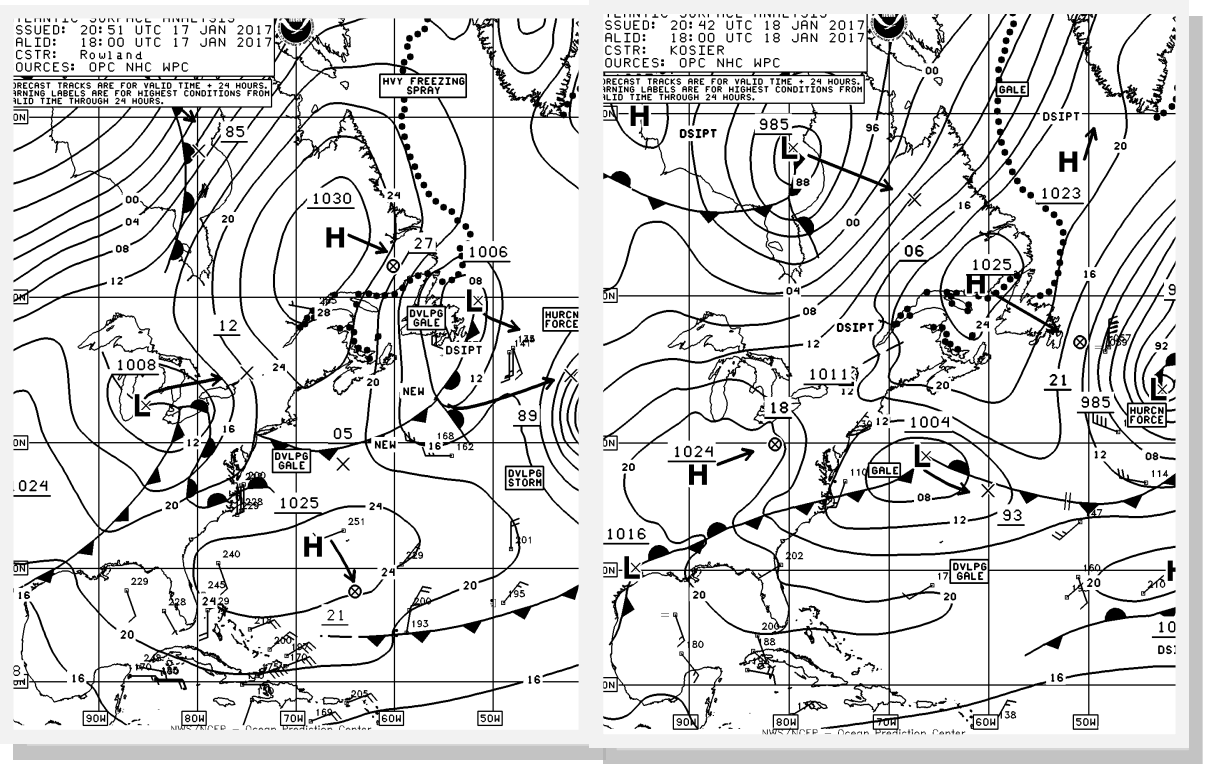


Figure 2. OPC North Atlantic Surface Analysis Charts (Part 2) valid 1800 UTC January 17 and 18, 2017.

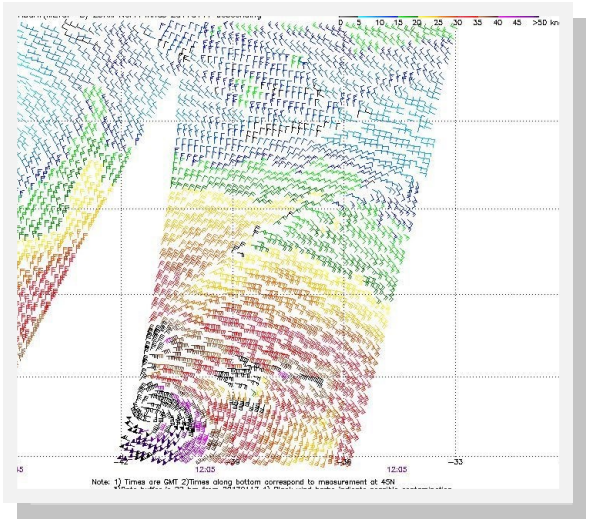


Figure 3. The 25-km ASCAT METOP-B (European Advanced Scatterometer) image of satellite-sensed winds around the cyclone shown in the first part of Figure 2. The valid time of the pass is 1205 UTC January 17, 2017, or about 6 hours prior to the valid time of the first part of Figure 2. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.

North Atlantic Storm, Greenland area, January 20–25: This was the first deep cyclone of the period with central pressures below 960 hPa. It originated as the frontal wave of low pressure off the coast of the U.S. seen in Figure 2. It tracked east-northeast over the next 3 days to the central waters before turning more north toward Greenland. Figure 4 shows subsequent development over 2 days as it developed a maximum intensity of 953 hPa and hurricane-force winds.

Figure 5 is a scatterometer image showing a swath of northwest wind retrievals of 50 to as high as 60 kt on the southwest side of the centered located east of Greenland. The system stalled and developed multiple centers late on the 24th with top winds weakening to storm force by the 25th. The **IRENA ARTICA** (BATEU05) near 61N 47W reported west winds of 50 kt at 0100 UTC on the 24th. Late on the 25th, a consolidated center drifted east and dissipated southwest of Iceland on the 27th.

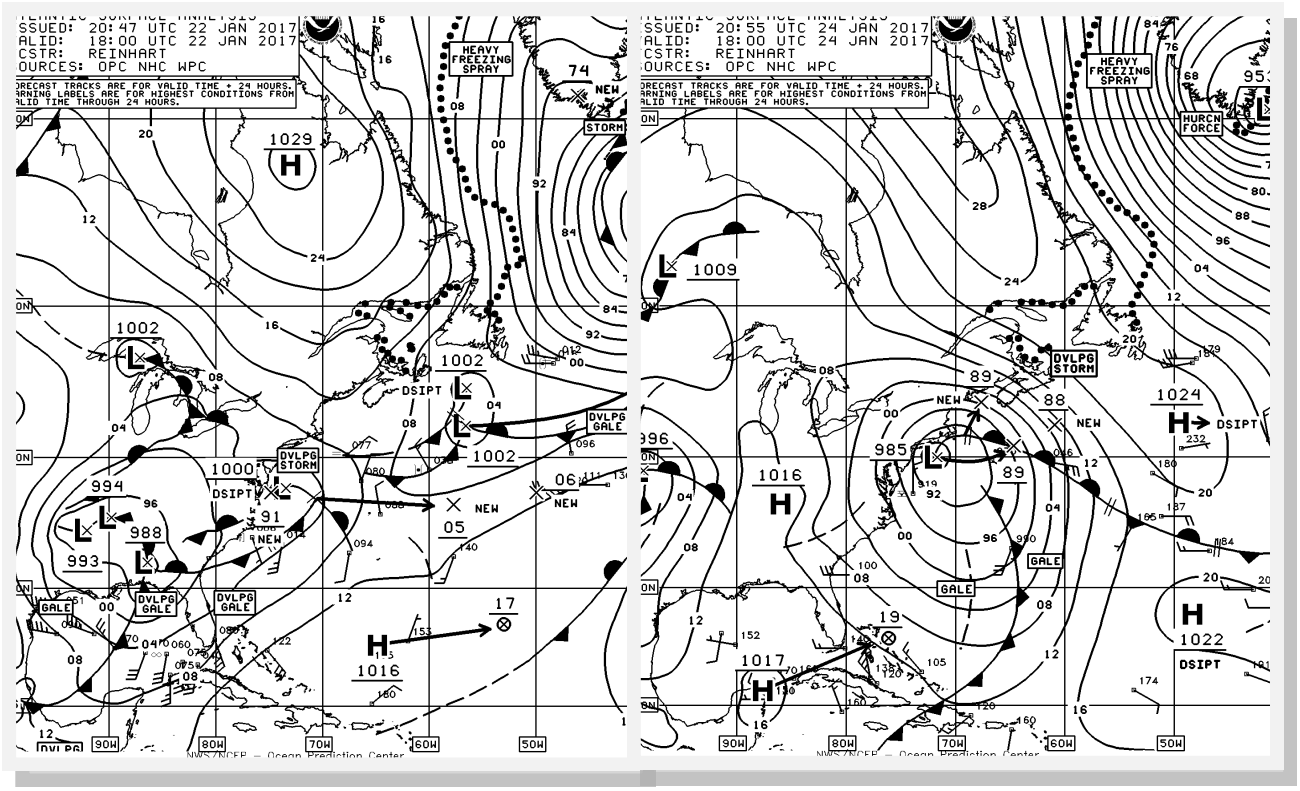


Figure 4. OPC North Atlantic Surface Analysis Charts (Part 2) valid 1800 UTC January 22 and 24, 2017.

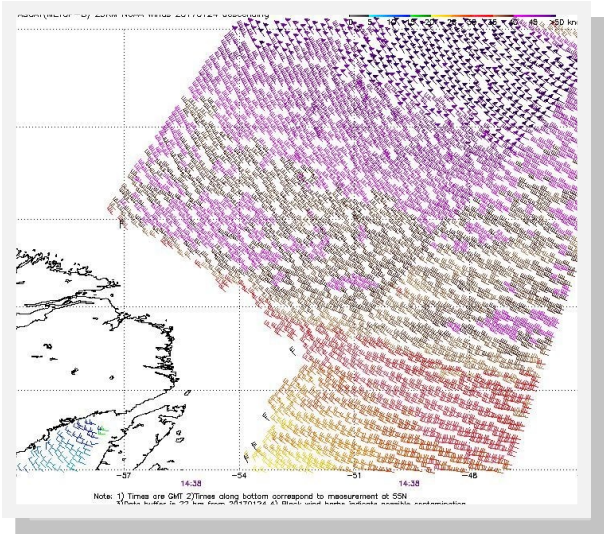


Figure 5. The 25-km ASCAT (METOP-B) image of satellite-sensed winds around the south side of the cyclone shown in the second part of Figure 4. The valid time of the pass is 1438 UTC January 24, 2017, or about 3.5 hours prior to the valid time of the second part of Figure 4. Parts of Newfoundland and Labrador appear in the lower left side of the image. Image is courtesy of NOAA/ NESDIS/ Center for Satellite Application and Research.

Northwestern Atlantic Storm, January 27–28: This developing cyclone tracked west of the previous cyclone of January 20–25 as depicted in Figure 6. Originating as a low-pressure wave in the Gulf of Maine at 1800 UTC January 26, the cyclone intensified rapidly (by 32 hPa) in the next 24-hour period and could be considered a "bomb" (Sanders and Gyakum, 1980). Figure 6 shows the final 24 hours of development to maximum intensity. The ASCAT retrievals in Figure 7 reveal a swath of east winds to 60 kt between an occluded front and southern Greenland (just off the northeast edge of the image. Although intense, this event was short lived, with the cyclone weakening rapidly over northeast Canada late on the 28th and the 29th.

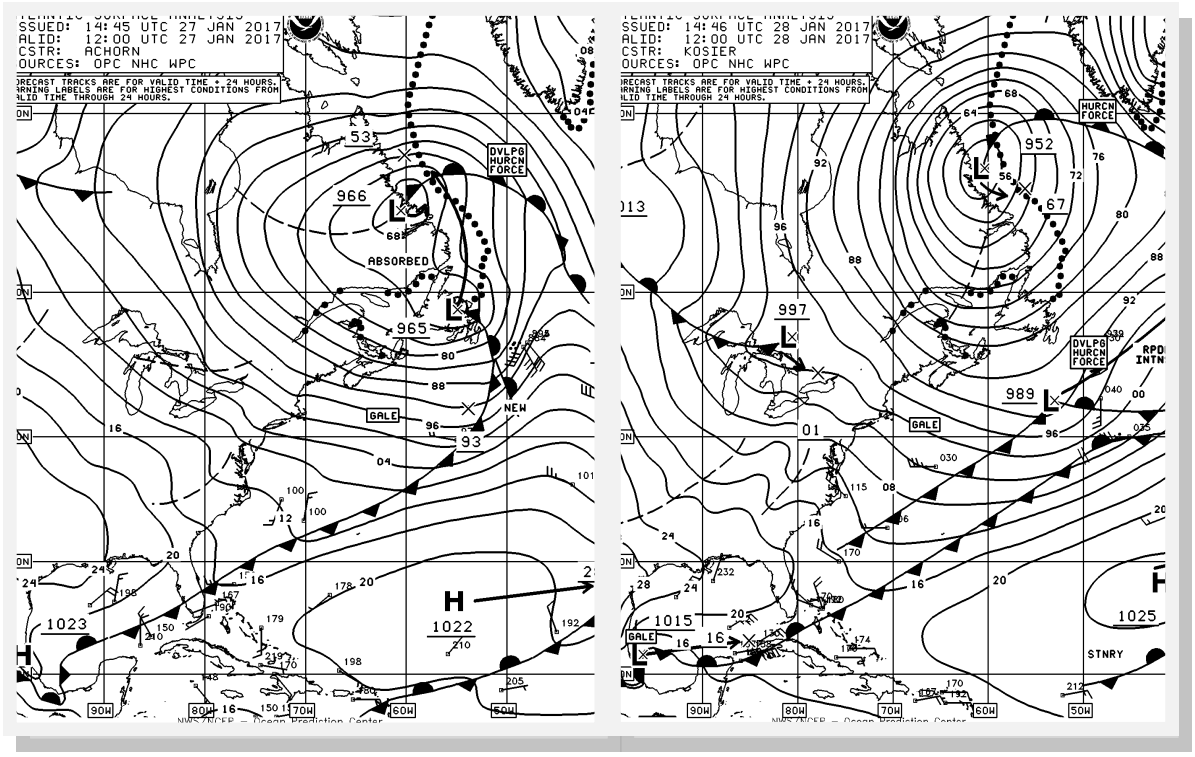


Figure 6. OPC North Atlantic Surface Analysis Charts (Part 2) valid 1200 UTC January 27 and 28, 2017.

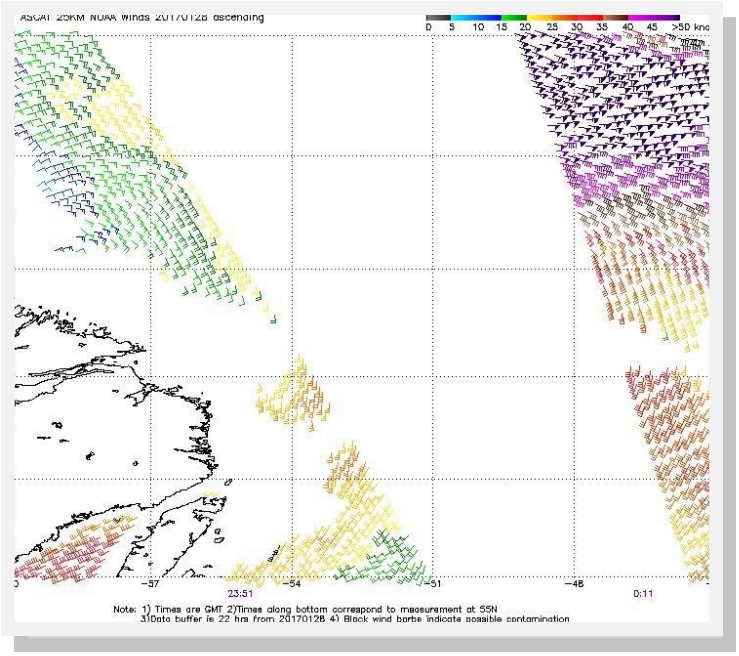


Figure 7. The 25-km ASCAT (METOP-A) image of satellite-sensed winds around the cyclone appear in the second part of Figure 6. The valid time of the pass containing the strongest wind retrievals is 0011 UTC January 28, 2017, or approximately 12 hours prior to the valid time of the second part of Figure 6. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.

North Atlantic Storms, January 28–February 2: Three intense cyclones developed in close succession at the end of January, developing similar intensities in the upper 950s or low 960s hPa and tracking northeast toward Iceland and Greenland. The first one was relatively short lived and originated as the 989-hPa low-pressure wave south of Newfoundland as depicted in the second part of Figure 6. It quickly developed storm-force winds 12 hours later and then briefly became a hurricane-force low near 51N 38W at 0600 UTC on the 29th. An ASCAT overpass available 6 hours later revealed a swath of west to southwest winds of 50 to 60 kt to the south of a well-defined circulation center. The cyclone developed a lowest central pressure of 960 hPa near 53N 34W at 1800 UTC on the 29th. A second cyclone passing to the east the next day absorbed it. This second storm then developed hurricane-force winds and a lowest central pressure of 958 hPa while passing west of Iceland on the 31st (Figure 8). The ASCAT-B data in Figure 10 reveal northeast wind retrievals of 50 to 60 kt between Greenland and Iceland to the north of this cyclone. The cyclone made a cyclonic loop between Greenland and Iceland over the next 4 days while weakening, and then dissipated south of Iceland on February 4. Figure 8 depicts the third developing cyclone passing south of Newfoundland. It originated near the mid-Atlantic coast of the U.S. 24 hours earlier. Hurricane-force winds accompanied this system from late on the 31st until early on February 2. Figure 9 shows this cyclone at maximum intensity as it made a turn northward toward Iceland. Figure 11 shows ASCAT wind retrievals of 50 to as high as 70 kt on the south side of this cyclone. The **FAUST** (SLKQ) near 54N 18W reported northeast winds of 65 kt at 0000 UTC February 2. The **CHICAGO EXPRESS** (DCUJ2) near 50N 27W encountered northwest winds of 50 kt at 2100 UTC on the 1st. Buoy 62029 (48.8N 12.4W) reported west winds of 39 kt with gusts to 51 kt and seas of 11.9 meters (39 feet) at 1300 UTC on the 2nd, followed by a peak gust of 58 kt 1 hour later. The cyclone subsequently moved west of Iceland late on the 3rd, where it turned toward the southwest before dissipating south of Greenland on February 6.

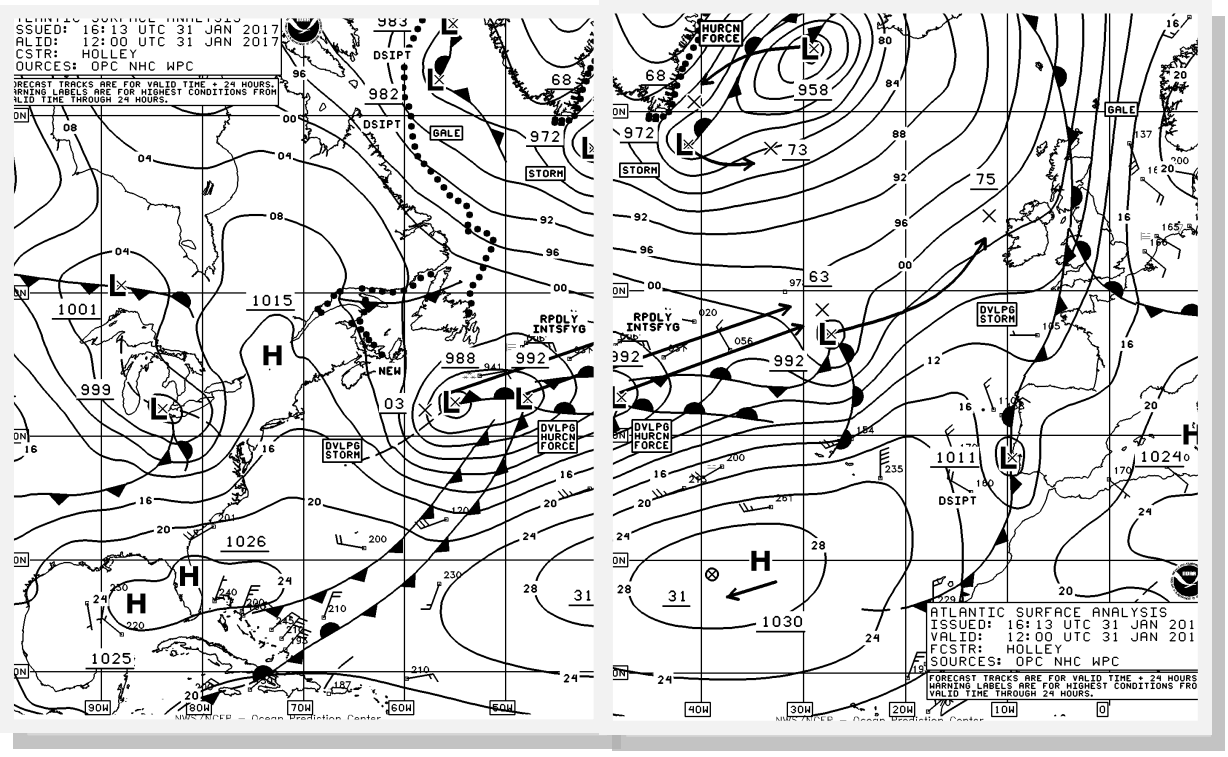


Figure 8. OPC North Atlantic Surface Analysis Chart (Parts 2 — west and 1 — east) valid 1200 UTC January 31, 2017. The two parts have an overlap area between 40W and 50W.

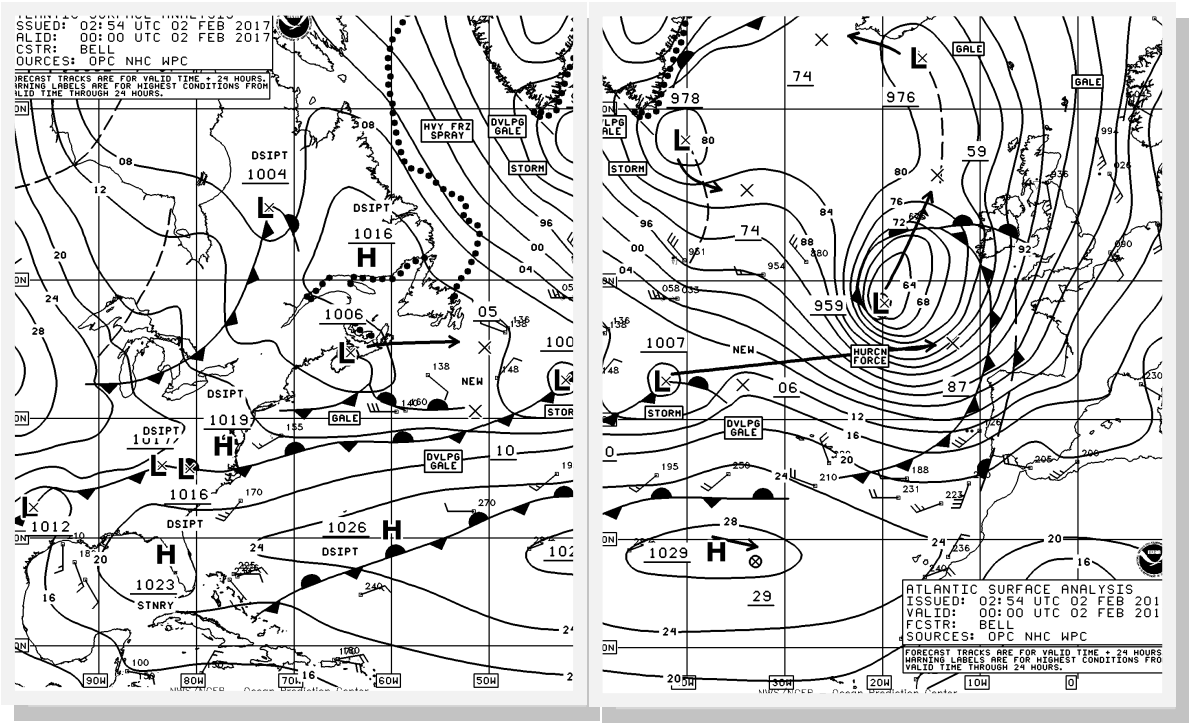


Figure 9. OPC North Atlantic Surface Analysis Chart (Parts 2 — west and 1 — east) valid 0000 UTC February 2, 2017.

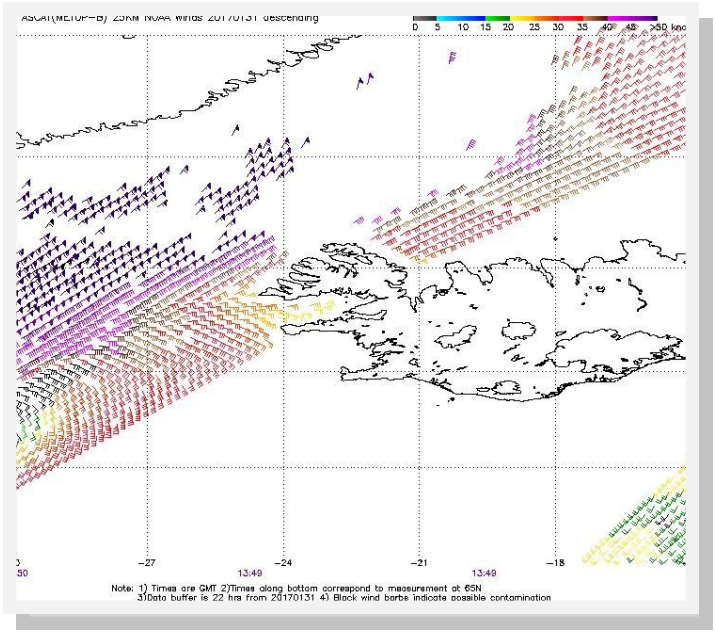


Figure 10. The 25-km ASCAT (METOP-B) image of satellite-sensed winds around the east side of the cyclone shown in Figure 8. The valid time of the pass is 1349 UTC January 31, 2017, or about 1.75 hours later than the valid time of Figure 14. Image is courtesy of NOAA/ NESDIS/ Center for Satellite Application and Research.

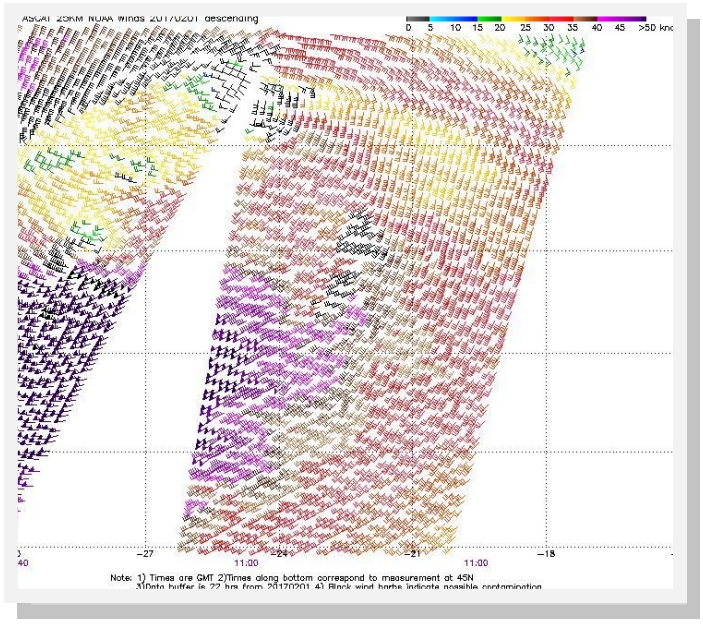


Figure 11. The 25-km ASCAT (METOP-A) image of satellite-sensed winds around the cyclone shown in Figure 9. Portions of two passes are shown (1100 UTC and 1240 UTC February 1, 2017), with the later pass containing the strongest wind retrievals having a valid time of about 11.25 hours prior to the valid time of the second part of Figure 9. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.

Eastern Atlantic/ Bay of Biscay Storm, February 2–4: A new low formed southeast of Newfoundland near 42N 49W early on February and raced east across the North Atlantic, developing storm-force winds over the central waters 24 hours later and briefly hurricane-force winds with its compact circulation at 0000 UTC on the 4th before moving inland, as depicted in Figures 12 and 13. The **SAGA CREST** (VRWR7) near 47N 4W reported west winds of 45 kt and 9.8-meter seas (32 feet) at 1400 UTC on the 3rd. A full 4 hours later, the **YORKTOWN EXPRESS** (WDD6127) 44N 13W encountered west winds of 55 kt and 8.2-meter seas (27 feet). Buoy 62001 (45.2N 5.0W) reported west winds of 52 kt with gusts to 67 kt at 0200 UTC on the 4th, and highest seas of 10.1 meters (33 feet) 1 hour later.

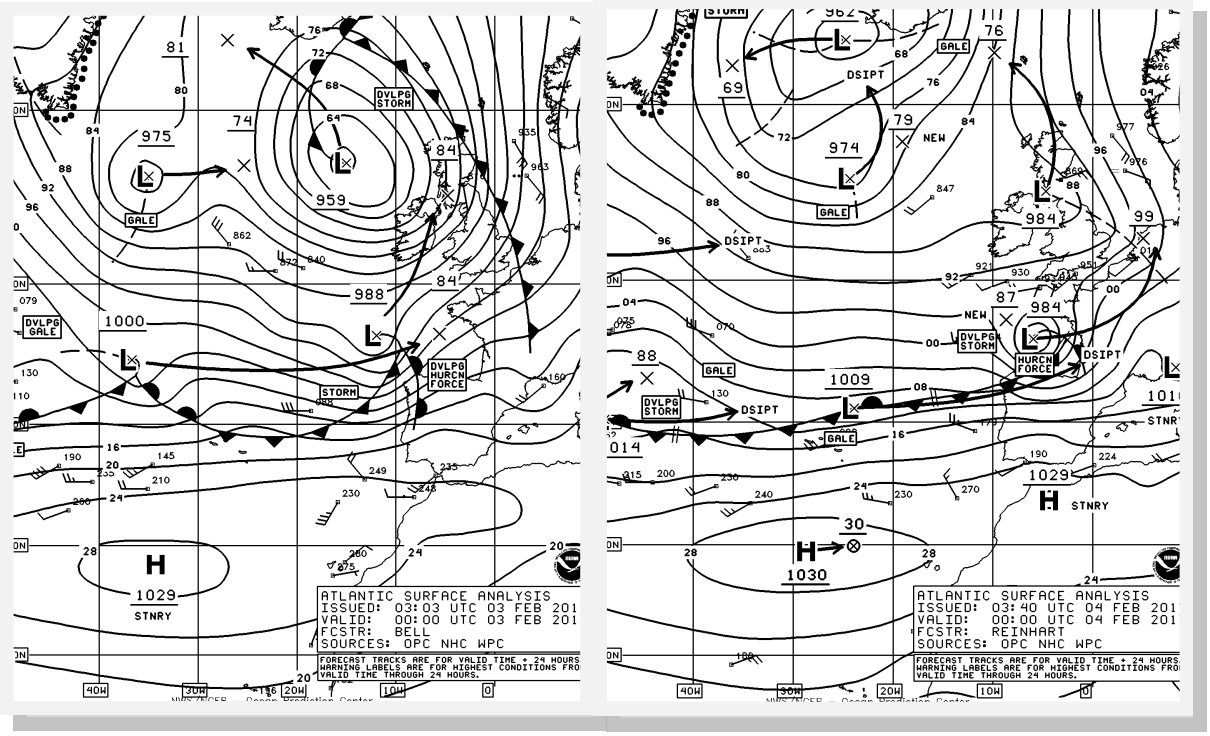


Figure 12. OPC North Atlantic Surface Analysis Charts (Part 1) valid 0000 UTC February 3 and 4, 2017.

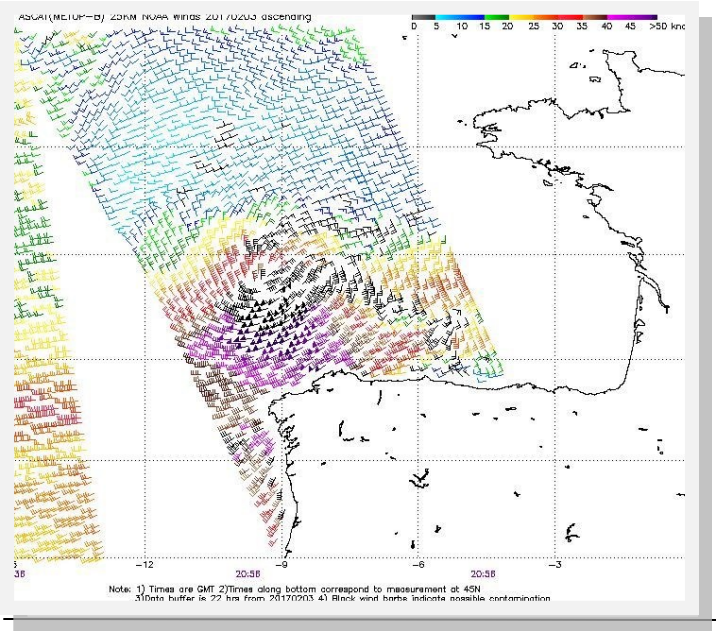


Figure 13. The 25-km ASCAT (METOP-B) image of satellite-sensed winds around the cyclone shown in the second part of Figure 12. The valid time of the pass is 2056 UTC February 3, 2017, or about 2 hours prior to the valid time of the second part of Figure 12. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.

North Atlantic Storm, February 4–7: The development of this intense hurricane-force low over a 36-hour period appears in Figure 14. It originated near the North Carolina coast on February 3 and was one of two cyclones of the period to intensify at more than twice the rate for a meteorological "bomb" at 60N (Sanders and Gyakum, 1980). The central pressure fell 52 hPa in the 24-hour period ending at 1800 UTC on February 5. The lowest central pressure of 932 hPa (27.52 inches) was the lowest pressure in a nontropical North Atlantic cyclone since the 928-hPa cyclone near Iceland in late December 2015. The ASCAT winds in Figure 15 indicate a well-developed intense circulation with retrievals of at least 50 kt surrounding the cyclone and winds as high as 80 kt on the south side, the highest seen in a cyclone during the 4-month period. The **CL BELGIUM** (VRVQ9) near 48N 47W reported southwest winds of 64 kt and 9.1-meter seas (30 feet) at 0300 UTC on the 7th. The **ATLANTIC CONVEYOR** (SCKM) encountered northwest winds of 60 kt and 8.5-meter seas (28 feet) near 51N 44W 9 hours later. A weakening trend followed over the next 36 hours as the cyclone passed west of Iceland.

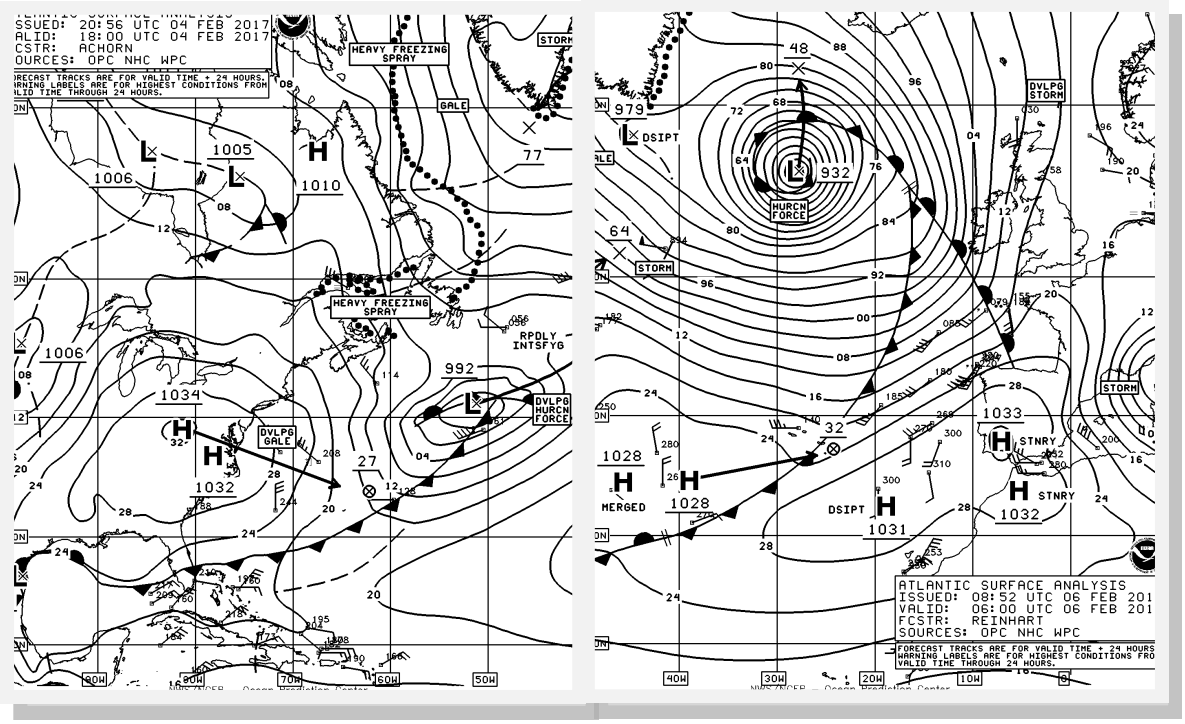


Figure 14. OPC North Atlantic Surface Analysis Charts valid 1800 UTC February 4 (Part 2) and 0600 UTC February 6, 2017 (Part 1).

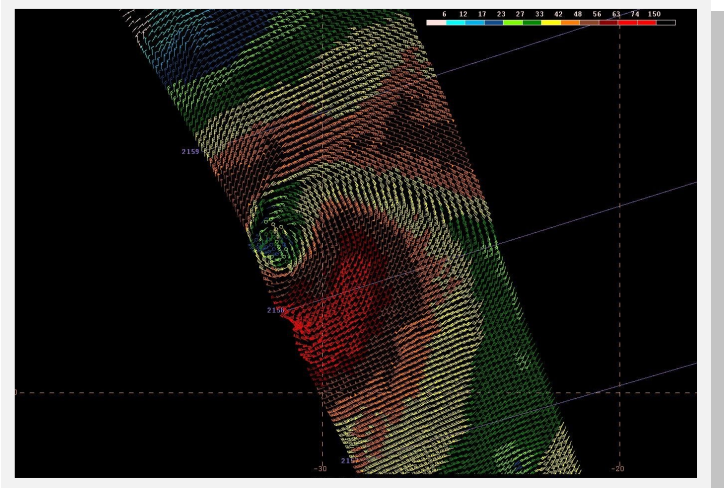


Figure 15. The 25-km ASCAT (METOP-B) image of satellite-sensed winds around the north and east sides of the cyclone shown in the second part of Figure 14. Cross-track timelines appear in the image, labeled in UTC. A color scale for the wind barbs appears at the top of the image. The 2158 UTC timeline near the center of the image is about 8 hours prior to the valid time of the second part of Figure 14. Image is courtesy of NOAA/ NESDIS/ Center for Satellite Application and Research.

North Atlantic Storm, February 5–8: As the previous event was approaching maximum strength, a new low formed south of Nova Scotia late on the 5th and quickly developed storm-force winds while approaching Newfoundland the following night, with briefly hurricane-force winds near 54N 42W with a central pressure of 962 hPa at 1200 UTC on the 7th. The central pressure fell 38 hPa in the 24-hour period ending at 0000 UTC on the 7th. This cyclone was similar in intensity to that of the three storms of the January 28–February 2 period. The cyclone weakened upon reaching the east Greenland waters by the 9th.

Western North Atlantic Storm, February 9–11: Low pressure moving off the mid-Atlantic coast of the U.S. early on 9 February briefly developed hurricane-force winds later that day while passing near 42N 66W with a 975 hPa central pressure and over Nova Scotia 6 hours later. An ASCAT pass from 0038 UTC on the 10th showed an area of southwest winds of 50 to 55 kt at the edge of the pass, near 39N 65W, on the south side of the cyclone. The cyclone developed a lowest central pressure of 968 hPa in the Gulf of St. Lawrence the following morning. The **NORWEGIAN GEM** (C6VG8) near 31N 70W reported southwest winds of 45 kt at 1600 UTC on the 9th. Buoy 44137 (42.3N 62.0W) reported southwest winds of 47 kt with gusts to 60 kt at 0500 UTC on the 10th, with maximum seas 10.0 meters (33 feet) 3 hours later. **THEBAUD PLATFORM** (CFO383, 43.8N 60.6W) reported southwest winds of 49 kt with gusts to 66 kt at 0700 UTC on the 10th, with a peak gust 68 kt 1 hour later. The system then moved across the Labrador Sea on the 10th and dissipated near Greenland the next day.

Southwestern North Atlantic Storms, February 12–15: A pair of cyclones with hurricane-force winds developed over the southwestern waters in OPC's offshore and high-seas areas. The first of these was a small and compact system that briefly developed hurricane-force winds with a 992-hPa center south of Newfoundland at 1800 UTC on the 12th (Figure 16), after moving off the southern New England coast late on the 11th. It then weakened to a subgale-force low late on the 13th and later dissipated off the coast of Morocco on the 16th. The development of a stronger coastal low over a 24-hour period is depicted in Figure 16. Figure 17 shows wind retrievals of at least 50 kt both east and west of the cyclone, strongest in the Gulf of Maine. The **INDEPENDENT VOYAGER** (A8XY2) near 39N 72W reported northwest winds of 59 kt at 1800 UTC on the 13th. The **AM GHENT** (A8ZA8) near 46N 58W encountered east winds of 55 kt at 2300 UTC on the 13th. Buoy 44011 (41.1N 66.6W) reported maximum seas of 9.0 meters (30 feet) at 2000 UTC on the 13th. **MATINICUS** C/MAN (43.2N 68.8W) reported north winds of 51 kt with gusts to 59 kt at 1400 UTC on the 13th, with a peak gust of 65 kt 2 hours later. The cyclone subsequently passed south of Newfoundland on the 14th with a weakening trend and dissipated over the central Atlantic by the 16th.

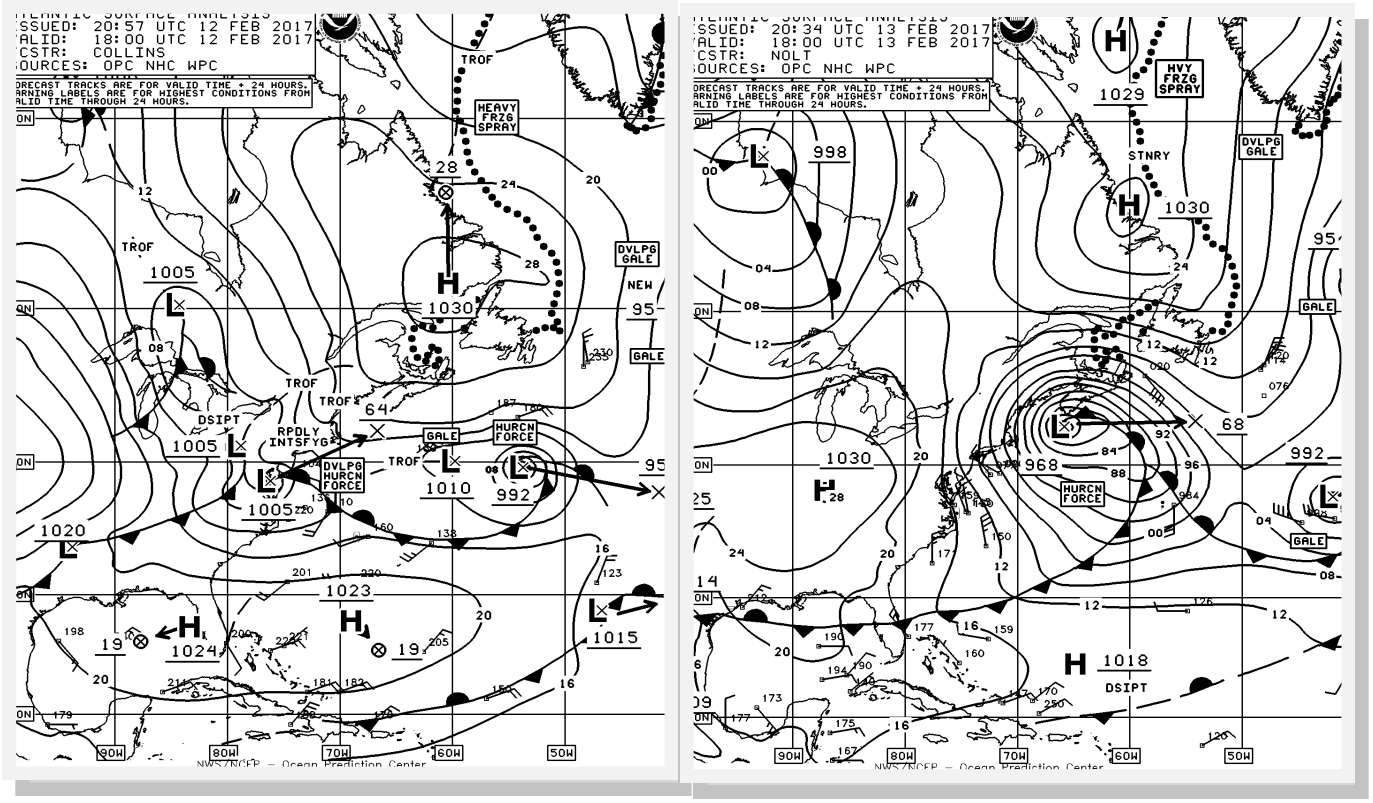


Figure 16. OPC North Atlantic Surface Analysis Charts (Part 2) valid 1800 UTC February 12 and 13, 2017.

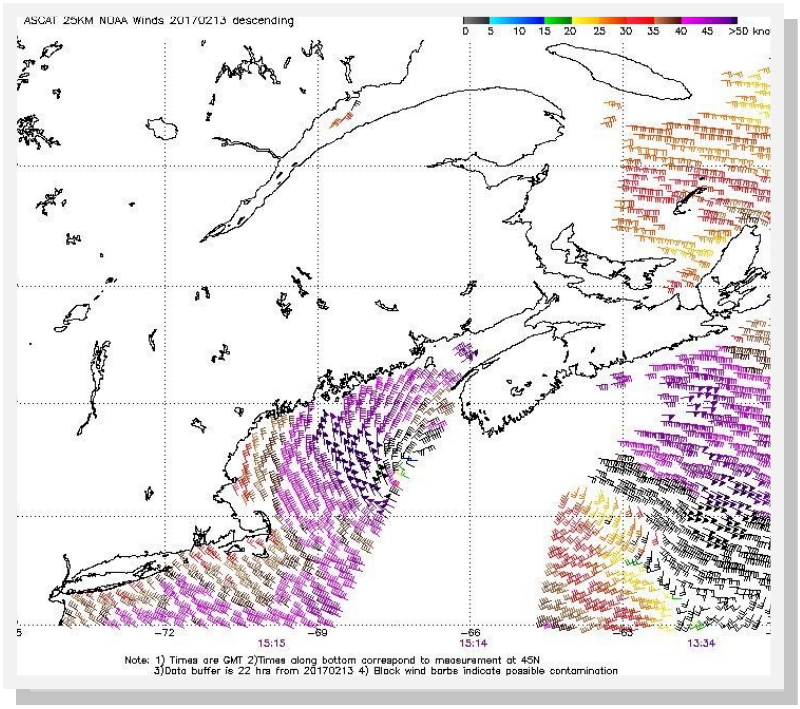


Figure 17. The 25-km ASCAT (METOP-A) image of satellite-sensed winds around the cyclone shown in the second part of Figure 16. Portions of two passes are shown (1334 UTC and 1515 UTC February 13, 2017), with the valid time of the later pass 2.75 hours prior to the valid time of the second part of Figure 16. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.

Western North Atlantic Storm, February 17 –19: A new low with storm-force winds formed near 41N 52W at 1200 UTC on the 17th and moved north, briefly developing hurricane-force winds in the Labrador Sea 24 hours later, and registering 6 hours later a lowest central pressure of 968 hPa near 59N 55W. An ASCAT-B overpass detected east to southeast winds near the southwest Greenland coast at 1421 UTC on the 18th. The **RESOLVE** (WCZ5535) encountered south winds of 40 kt with 5.8-meter seas (19 feet) near 36N 43W at 0000 UTC on the 18th. The cyclone then stalled later that day and became absorbed by a new cyclone forming to the east on the 20th.

North Atlantic Storm, Greenland area, February 23–26: Low pressure originating near the Grand Banks early on February 23 became a complex system 6 hours later, which then consolidated into a large cyclone with a lowest central pressure of 939 hPa east of Greenland over a 36-hour period as shown in Figure 18. This was the second most intense cyclone of the period. The central pressure fell 36 hPa in the 24-hour period ending at 0000 UTC on the 25th. The cyclone generated a significant tip jet later on the 25th, a swath of northwest winds extending off the southern tip of Greenland. The ASCAT data in Figure 19 show wind retrievals in this tip jet of up to 70 kt. The **IRENA ARTICA** (BATEU05) near 61N 49W reported northwest winds of 50 kt at 0500 UTC on the 26th. The cyclone then looped southwest and then southeast, weakening rapidly the next day while accelerating east, with winds diminishing to gale force late on the 26th.

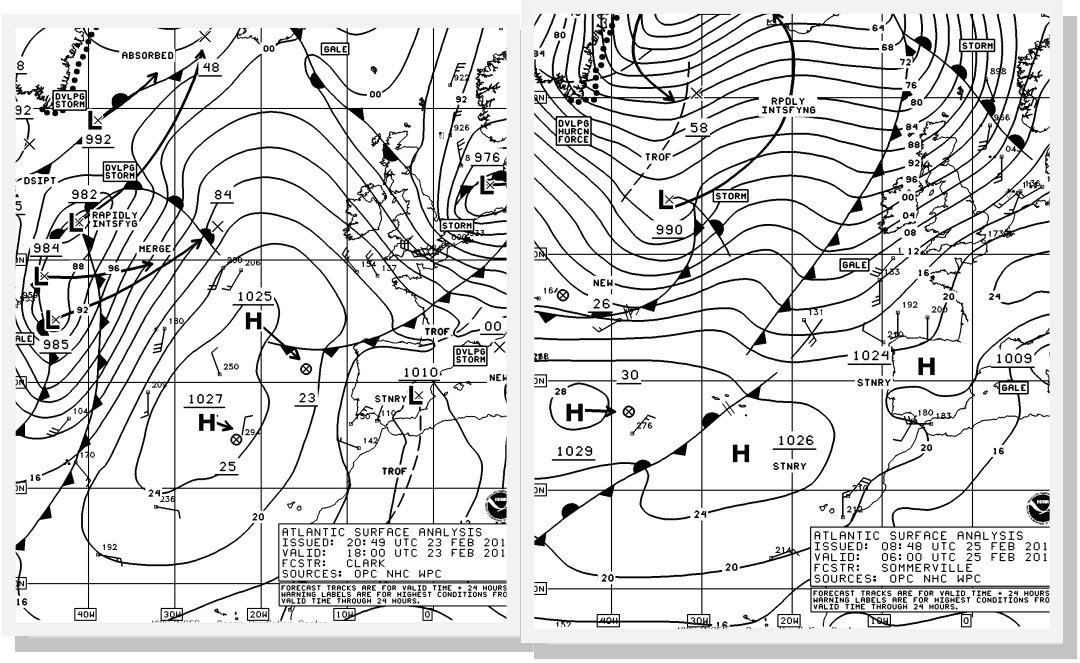


Figure 18. OPC North Atlantic Surface Analysis Charts (Part 1) valid 1800 UTC February 23 and 0600 UTC February 25, 2017.

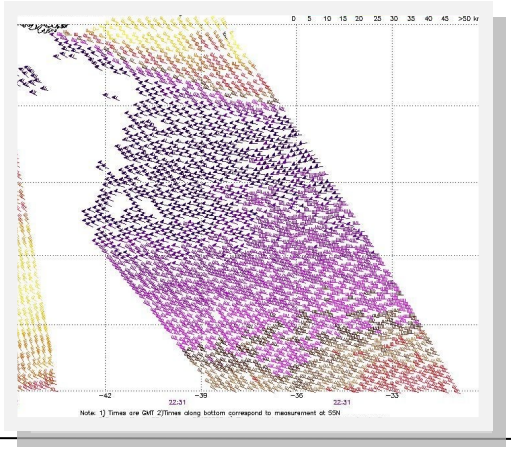


Figure 19. The 25-km ASCAT (METOP-A) image of satellite-sensed winds around the south side of the cyclone shown in the second part of Figure 18. The valid time of the pass containing the strongest wind retrievals is 2231 UTC February 25, 2017, or approximately 16.5 hours later than the valid time of the second part of Figure 18. Image is courtesy of NOAA/ NESDIS/ Center for Satellite Application and Research.

Northwest Atlantic Storm, February 26–27: This short-lived event originated over southern New England 0000 UTC on 26 February and developed storm-force winds near the Labrador coast 24 hours later and briefly hurricane-force winds with a 959-hPa center in the Davis Strait early on the 27th. An ASCAT pass from 1518 UTC on the 27th returned an area of southeast winds 50 to 60 kt off the west coast of Greenland. The cyclone then weakened rapidly the following night.

Northwest Atlantic Storm, March 2–5: A cyclone similar in intensity to the previous event originated over the Canadian Atlantic provinces on March 2, then moved out over the eastern Labrador Sea on the 3rd, where it developed hurricane-force winds and a central pressure as low as 957 hPa late on the 3rd. An ASCAT-B pass from 2301 UTC March 3, valid when the cyclone center was near 54N 48W at maximum intensity, revealed winds 50 to 60 kt south of the center and also as east winds displaced to the north and associated with an occluded front. It stalled there through the 4th before moving south across Newfoundland on the 5th, and then southeast of Newfoundland on the 6th. Another cyclone forming to the east on the 7th absorbed it. The **MODU HENRY GOODRICH** (YJQN7, 46.7N 48.0W) reported west winds of 55 kt at 2100 UTC on the 3rd, with seas as high as 8.5 meters (28 feet) 3 hours later.

North Atlantic Storms, March 9–14: A cyclone originating in the central waters near 47N 34W at 1800 UTC on the 8th moved north and stalled near 58N 36W, where it briefly developed hurricane-force winds and a lowest central pressure of 969 hPa at 1800 UTC on the 10th, and then weakened to a gale 24 hours later (Figure 20). Dissipation followed late on the 11th with the approach of the stronger cyclone from the southwest. A second cyclone of similar intensity originating as the 1004-hPa gale-force low in the southwest waters at 1800 UTC on the 11th (Figure 20) developed storm-force winds in the central Atlantic the following day and then briefly hurricane-force winds with a 968-hPa center near Iceland at 0000 UTC on the 14th (Figure 22). At 2118 UTC on the 13th, an ASCAT (METOP-B) pass revealed a swath of west winds 50 to 60 kt south of Iceland, just south of the cyclone's center. The cyclone then passed northeast of Iceland by the 15th.

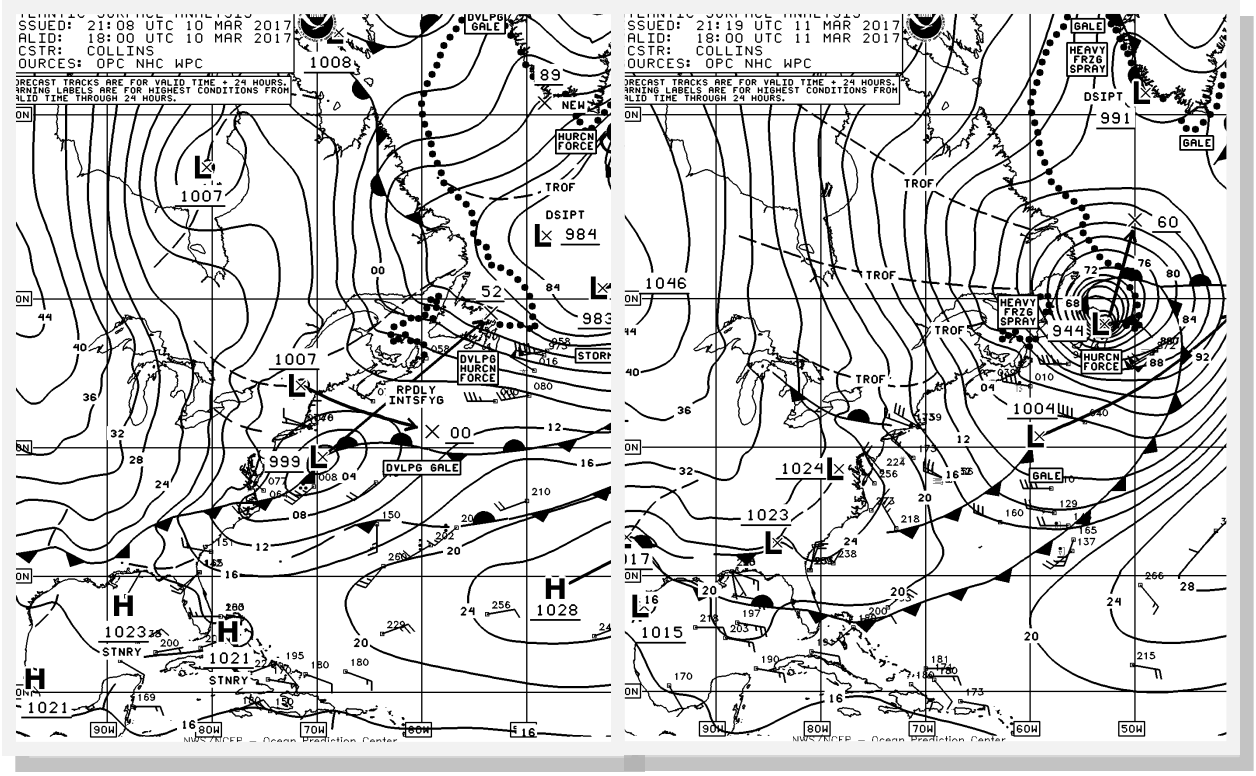


Figure 20. OPC North Atlantic Surface Analysis Chart (Part 2) valid 1800 UTC March 10 and 11, 2017.

North Atlantic Storm, March 10–14: This cyclone rapidly intensified after moving off the U.S. mid-Atlantic coast on the morning of March 10 (Figure 20). The central pressure fell 55 hPa in the 24-hour period ending at 1800 UTC on the 11th, more than 2 hPa per hour on average. The 500-hPa analysis in Figure 21 was early in the period of rapid intensification and shows a short-wave trough rounding the base of an upper trough and supported by a 100-kt jet at 500 mb. More information on the use of the 500-mb chart appears in Reference 5. Some notable observations taken during this event appear in Table 1. The cyclone subsequently maintained hurricane-force winds through the following night while beginning a weakening trend and moving over the Labrador Sea, passed east of Greenland on the 13th, and then dissipated while approaching Iceland by the 14th.

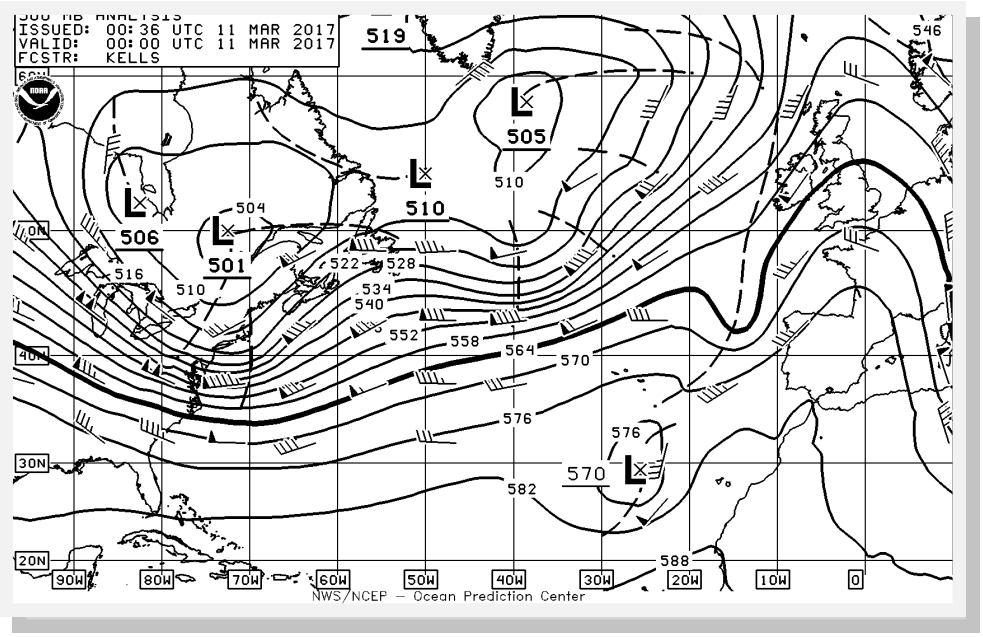


Figure 21. OPC 500-millibar analysis valid at 0000 UTC March 11, 2017. The chart is computer generated with short-wave troughs (dashed lines) manually added.

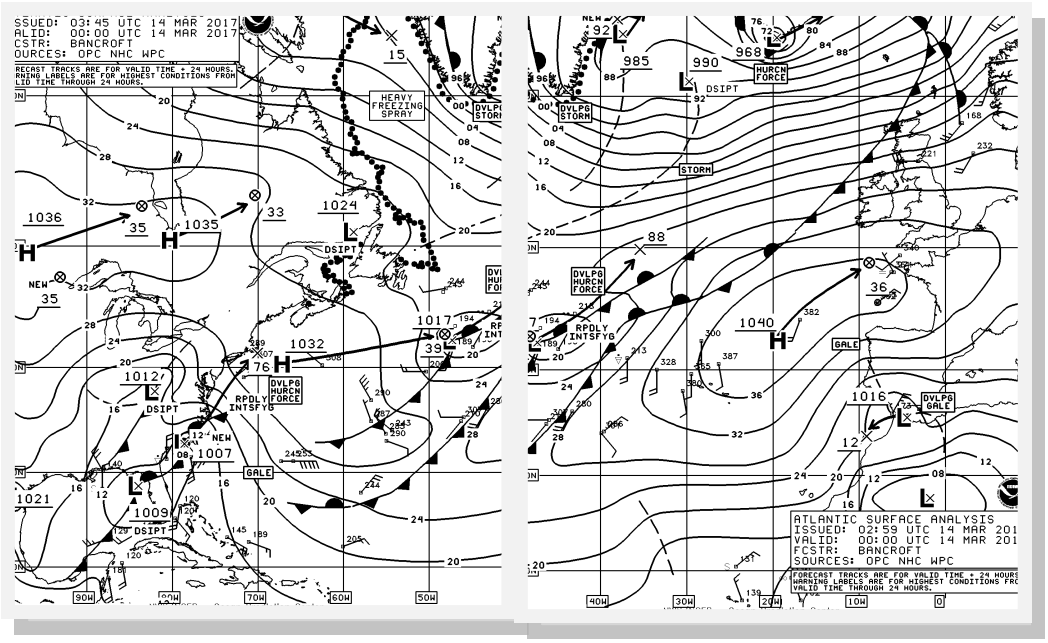


Figure 22. OPC North Atlantic Surface Analysis Chart (Parts 2 and 1) valid 0000 UTC March 14, 2017.

Coastal and North Atlantic Storms, March 13–15: The U.S. East Coast storm originated as a frontal wave of low pressure near the South Carolina coast, while another wave of low pressure well to the northeast over the central waters rapidly intensified while moving northeast at 0000 UTC on the 14th (Figure 22). The coastal low briefly developed hurricane-force winds while passing near 38N 75W 12 hours later, as its central pressure fell 21 hPa. By 0000 UTC on the 15th, it developed a lowest central pressure of 976 hPa on the New England coast. At the same time, the central Atlantic system developed hurricane-force winds with its relatively compact circulation near 50N 35W (Figures 23 and 24). An ASCAT (METOP-A) pass from 1517 UTC on the 14th revealed an area of 50- to 60-kt southerly wind retrievals at the edge of the pass off the mid-Atlantic coast, near the Gulf Stream associated with the coastal low. The coastal low then weakened inland on March 15 and dissipated in the Gulf of St. Lawrence late on the 16th, while the central Atlantic system dissipated west of Ireland late on the 15th as a new low developed to the north. Table 2 lists some observations taken during these two events.

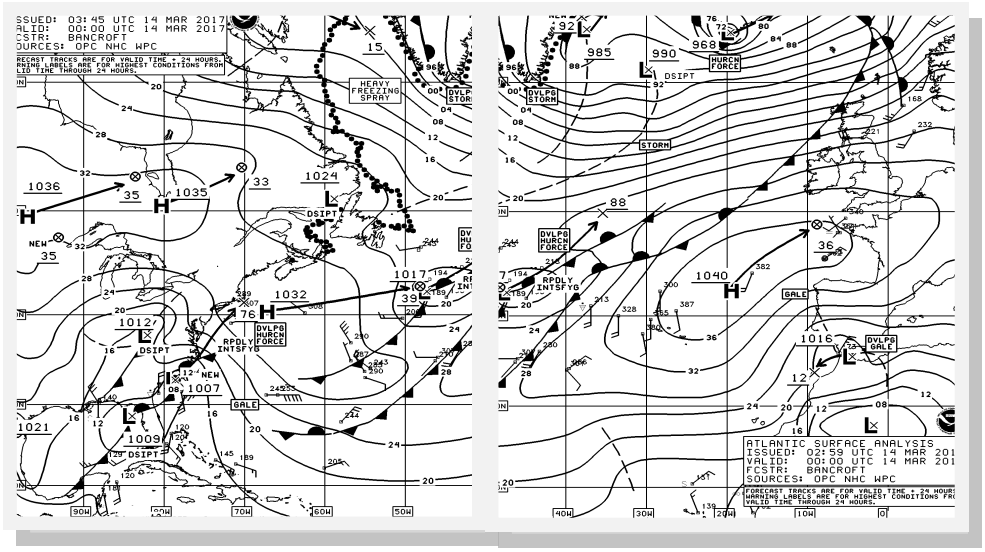


Figure 22. OPC North Atlantic Surface Analysis Chart (Parts 2 and 1) valid 0000 UTC March 14, 2017.

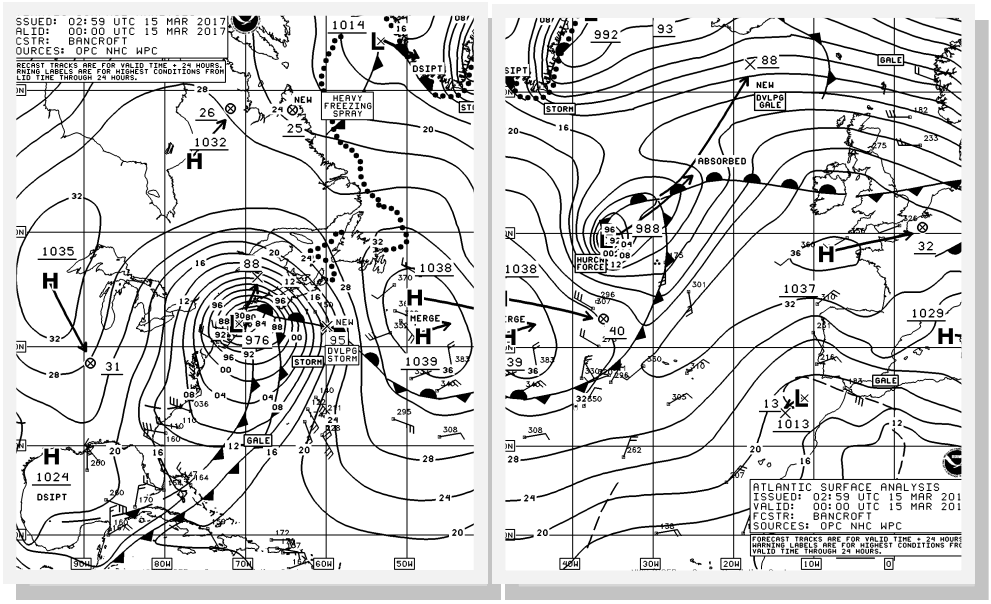


Figure 23. OPC North Atlantic Surface Analysis Chart (Parts 2 and 1) valid 0000 UTC March 15, 2017.

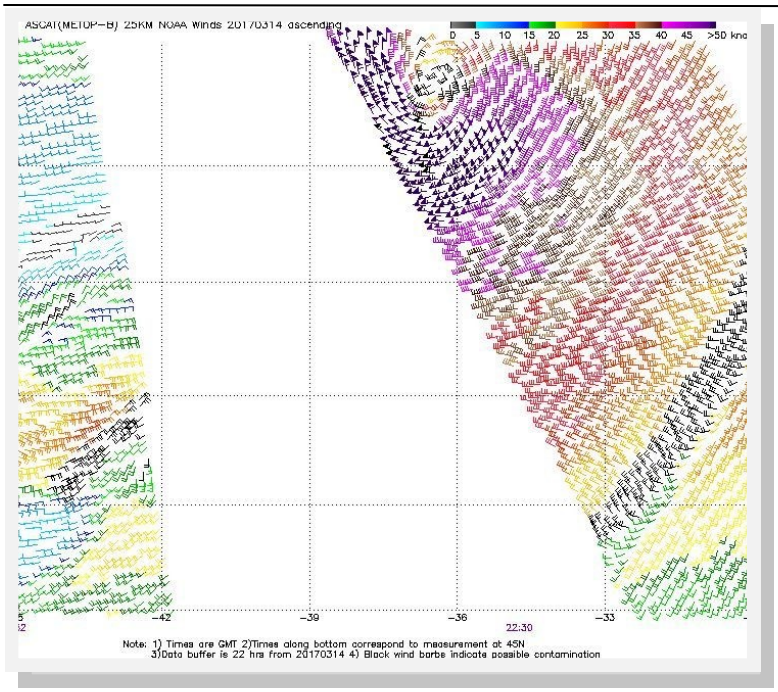


Figure 24. The 25-km ASCAT (METOP -B) image of satellite-sensed winds around the cyclone in the central North Atlantic shown in Figure 23. The valid time of the pass is 2230 UTC March 14, 2017, or 1.5 hours prior to the valid time of Figure 23. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.

Table 1. Selected Ship, Buoy and Platform Observations Taken during the Passage of the North Atlantic Storm of March 10–14, 2017.

OBSERVATION	POSITION	DATE/TIME(UTC)	WIND	SEAS (m/ft)
ZIM QINGDAO (A8IZ2)	44N 58W	11/1200	NW 70	11.3/37
INDEPENDENT VOYAGER (A8XY2)	42N 54W	11/1200	SW 65	10.4/34
BATEU06	46N 54W	11/1600	W 60	
MODU HENRY GOODRICH (YJQN7)	46.7N 48.0W	12/0000	SW 50	9.4/31
TERRA NOVA (VCXF)	48.4N 48.4W	11/1800 12/0300	SW 65 SW 55	 8.2/27
Buoy 44251	46.4N 53.4W	11/1500 11/1600	SW 50 G72 SW 50 G70	5.2/17 7.0/23
Buoy 44139	44.2N 57.1W	 11/1500	W 49 G62	4.5/15 6.5/21

Table 2. Selected Ship, Buoy, Platform, and C/MAN Station Observations Taken during the Passage of the Coastal and North Atlantic Storms Of March 13–15, 2017.				
OBSERVATION	**POSITION**	**DATE/TIME(UTC)**	**WIND**	**SEAS (m/ft)**
LIBERTY PASSION (WLPI)	42N 70W	14/1800	NE 50	11.3/37
9V7645	41N 66W	15/0100	SE 40	7.0/23
BREMEN EXPRESS (DHBN)	40N 71W	14/1800	E 45	7.0/23
ZDNC5	46N 41W	15/0600	W 40	
Thebaud Platform (CFO383)	43.9N 60.2W	15/0400	SE 47 G54	9.4/31
Matinicus Rock (MISM1)	43.8N 68.8W	14/2200	NE 56 G62 Peak gust 75	
Isles of Shoals (IOSN3)	43.0N 70.5W	14/2000	NE 51 G61	
Buoy 44024	42.3N 65.9W	14/2300	SE 37 G45	7.0/23 Maximum 10.0/33
Buoy 44011	41.1N 66.6W	15/0700		Maximum 9.5/31
Buoy 44005	43.2N 69.1W	15/0900		Maximum 7.5/25
Buoy 41025	35.0N 75.4W	14/0700	S 41 G51	5.5/18
Buoy 44066	39.6N 72.6W	14/1300 14/1900	E 35 G45	4.0/13 Maximum 7.0/23
Buoy 44025	40.3N 73.2W	14/1400 14/1700	E 39 G49	4.5/15 Maximum 6.0/20

North Atlantic Storm, Greenland Area, March 22–24: This cyclone quickly developed on a front associated with a primary storm center in the Davis Strait over a 12-period as depicted in Figure 25. ASCAT scatterometer data from passes at 1200 UTC and 1342 UTC March 23 showed a swath of southwest wind retrievals of 50 to 55 kt south and southeast of the cyclone's center. Significant wave heights detected by two satellite-based altimeters (Figure 26) revealed wave heights as high as 44.5 feet (13.5 meters) near 63N 30W. To the east, a station on the west coast of Iceland (TFGSK, 64N 23W) reported maximum seas of 9.8 meters (32 feet). The cyclone was short lived, as it subsequently moved northeast and passed northwest of Iceland as a gale the following day.

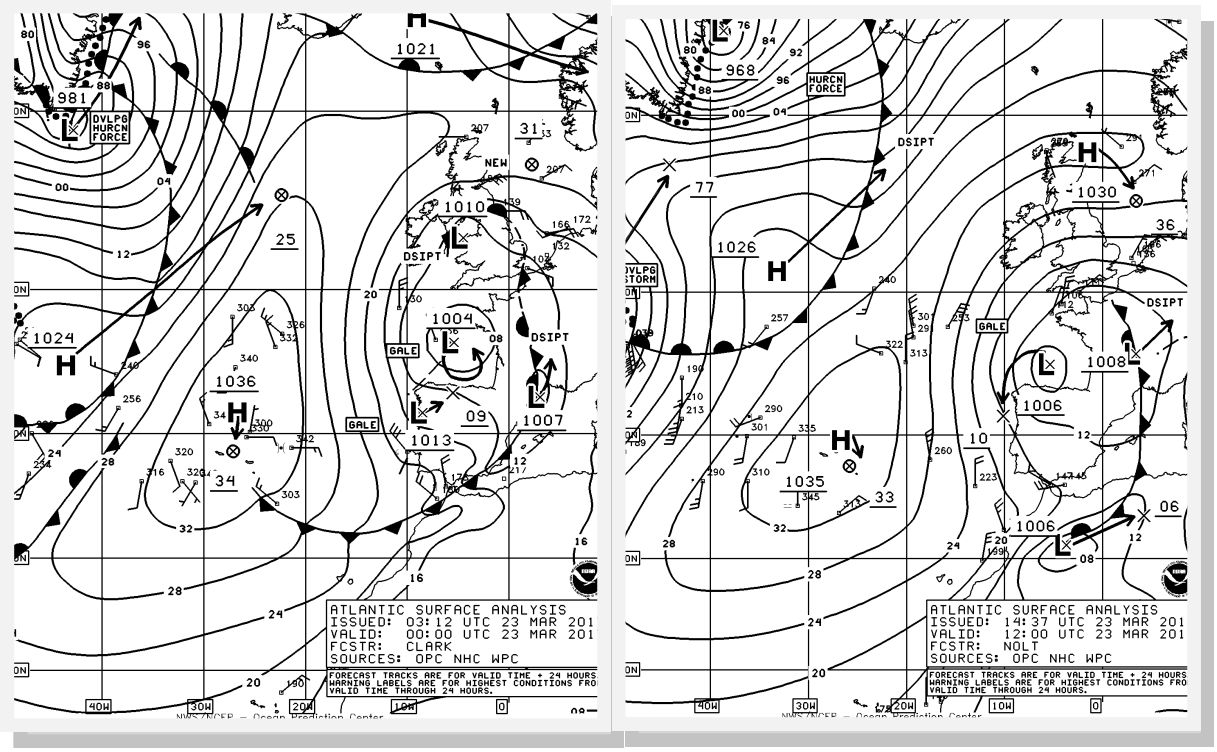


Figure 25. OPC North Atlantic Surface Analysis Charts (Part 1) valid 0000 UTC and 1200 UTC March 23, 2017.

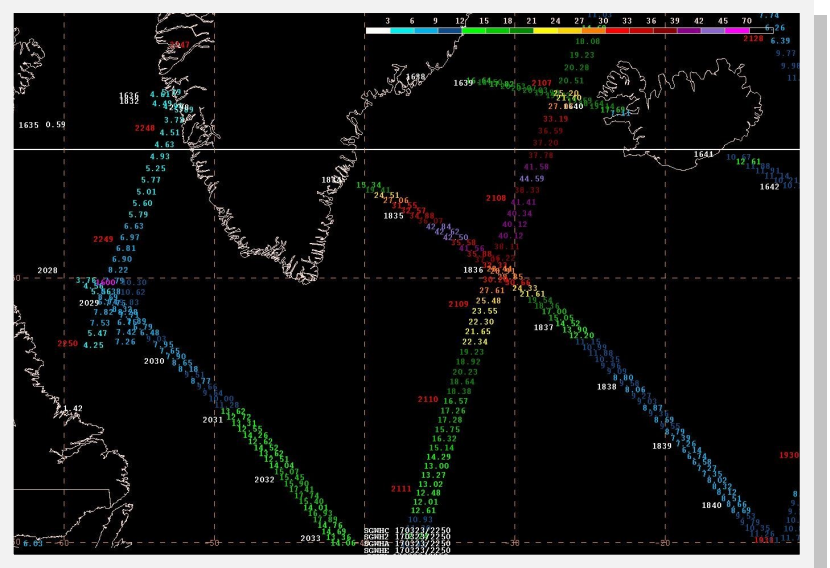


Figure 26. Remotely sensed significant wave heights (in feet to two decimal places) along satellite tracks from the Jason 3, Cryosat, and AltiKa satellite altimeters. The times of the satellite overpasses (UTC) appear to the left of the swaths. The time in the center of the image, 2109 UTC March 23, 2017, is about 9 hours later than the valid time of the second part of Figure 25. A color scale for wave heights appears at the top of the image. NOAA/ NESDIS reprocessed the satellite data for operational use.

North Atlantic Storm, March 25–29: The rapid development of this cyclone over a 36-hour period is depicted in Figure 27. It originated as a wave of low pressure over New England early on March 25. The central pressure fell 38 hPa in the 24-hour period ending at 0600 UTC on the 27th. The second part of Figure 27 shows the cyclone at maximum intensity. A vessel with the **SHIP** identifier reported northwest winds of 45 kt and 9.0-meter seas (30 feet) near 44N 48W at 1800 UTC on the 26th, followed by a report of northwest 68 kt and 12.5-meter seas (41 feet) 18 hours later. The **MODU HENRY GOODRICH** (46.7N 48.1W) reported northwest winds of 69 kt and 10.4-meter seas (34 feet) at 2100 UTC on the 27th. The **SEAROSE FPSO** (VOXS, 46.7N 48.0W) encountered northwest winds of 50 kt and the same wave heights, 10.4 meters, at 1800 UTC on the 27th. The cyclone subsequently weakened to a gale in the central Atlantic by 1200 UTC on the 29th and dissipated near Great Britain April 1.

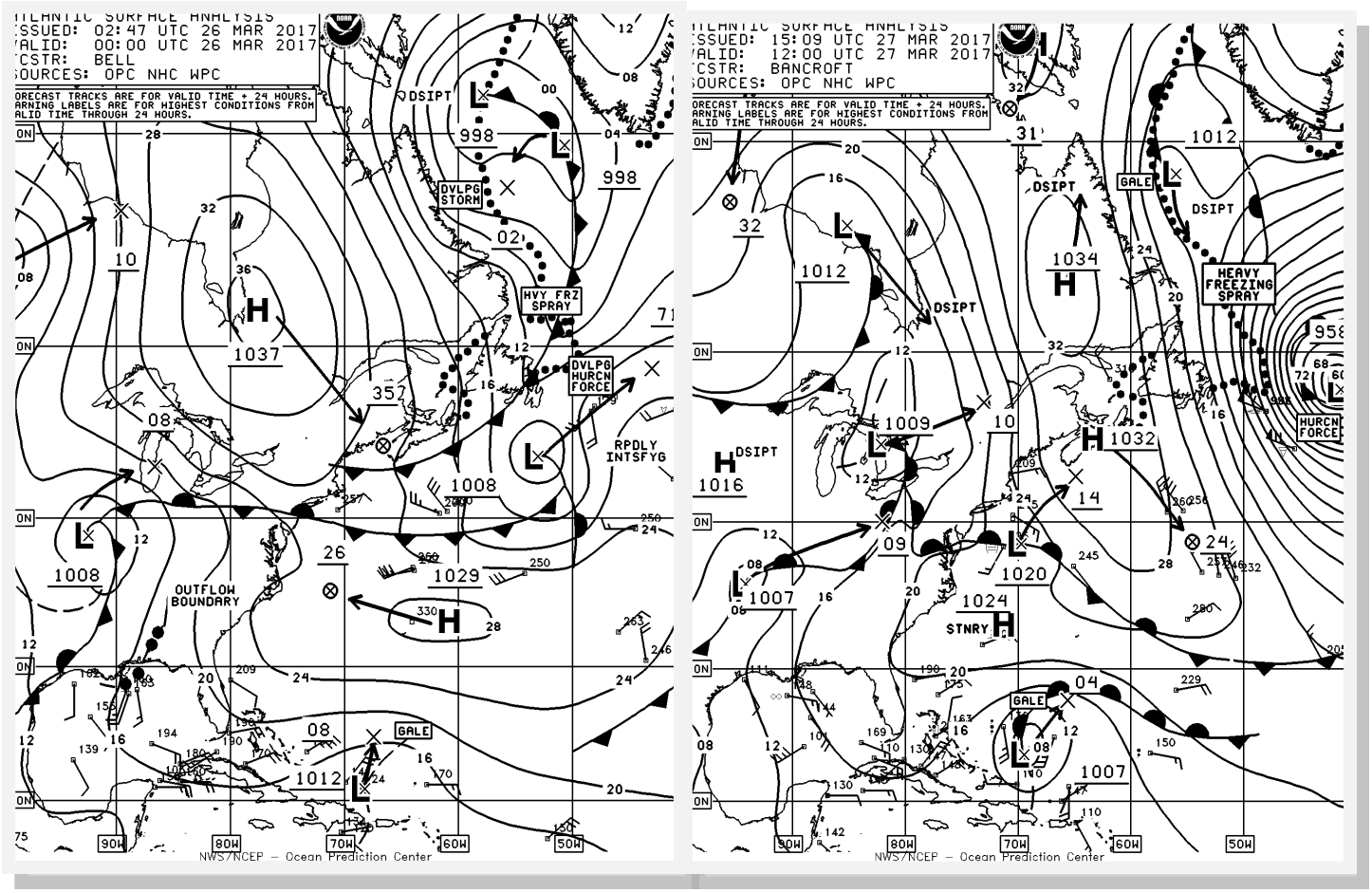


Figure 27. OPC North Atlantic Surface Analysis Charts (Part 2) valid 0000 UTC March 26 and 1200 UTC March 27, 2017.

North Atlantic Storm, March 30–April 1: The development of this intense low from the merging of a storm well south of Newfoundland and a weaker low-pressure wave near Nova Scotia over a 36-hour period is depicted in Figure 28. The lowest central pressure of 964 hPa occurred 6 hours later. The ASCAT-A image in Figure 29 shows a swath of northwest wind retrievals south of Newfoundland, on the west side of the cyclone. The **AM GHENT** (A8ZA8) near 42N 43W reported southwest winds of 50 kt and 7.0-meter seas (23 feet) at 1000 UTC April 1. The **ATLANTIC CONVEYOR** (SCKM) near 39N 62W encountered seas of 9.0 meters (30 feet) along with northwest winds of 36 kt at 1200 UTC on the 31st. **THEBAUD PLATFORM** (CFO383, 43.9N 60.2W) reported northwest winds of 51 kt (with gusts to 61 kt) at 1500 UTC March 30. Buoy 44139 (44.2N 57.1W) reported northwest winds of 37 kt (with gusts to 49 kt) at 0800 UTC on the 31st and maximum seas 7.5 meters 8 hours later. The cyclone then weakened over the central Atlantic on April 1 as a new cyclone formed to the northeast and dissipated south of Iceland on April 3.

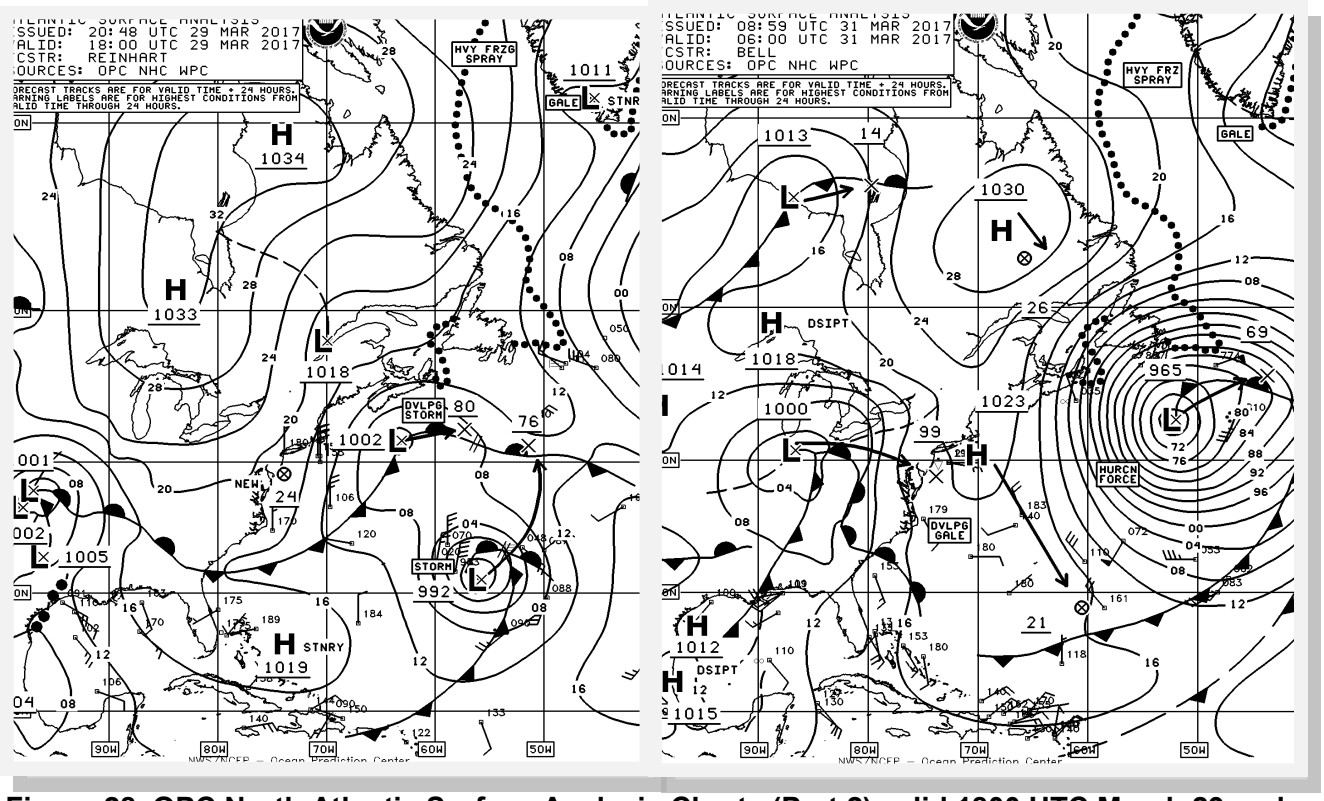


Figure 28. OPC North Atlantic Surface Analysis Charts (Part 2) valid 1800 UTC March 29 and 0600 UTC March 31, 2017.

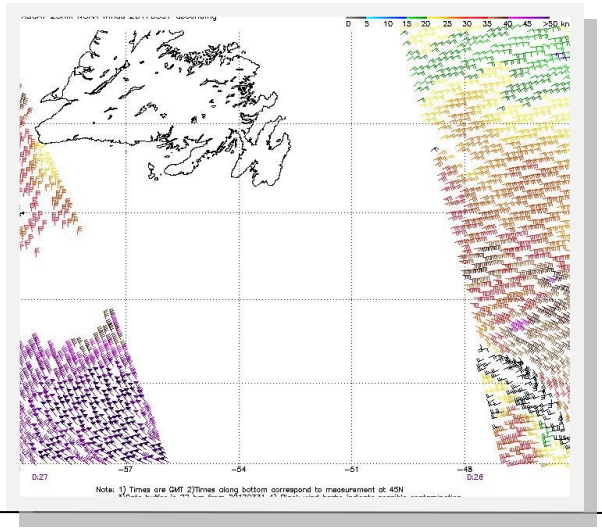


Figure 29. The 25-km ASCAT (METOP-A) image of satellite-sensed winds around the cyclone shown in the second part of Figure 28. The valid time of the pass is 0027 UTC March 31, 2017, or approximately 5.5 hours prior to the valid time of the second part of Figure 28. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.

North Atlantic Storms, April 15–17: Two hurricane-force lows formed at nearly the same time in mid-April, first in the southern waters on April 16 and by 1200 UTC the next day near the east coast of Greenland (Figure 30). The southern storm originated from a wave of low pressure on a front near 39N 54W at 0600 UTC on the 15th and briefly was analyzed by OPC as a hurricane-force low at 1800 UTC on the 16th. The **ARNOLD MAERSK** (OXES2) near 41N 55W reported north winds of 50 kt at 2300 UTC April 15. The same ship encountered north winds of 45 kt and 7.9-meter seas (26 feet) at 1800 UTC that day. This cyclone, after initially weakening, eventually transitioned into Tropical Storm Arlene, described near the beginning of this article. The hurricane-force low near Greenland originated over the Grand Banks early on the 15th and did not develop storm-force winds until approaching Greenland late on the 16th. The cyclone then weakened to a gale-force low the following night.

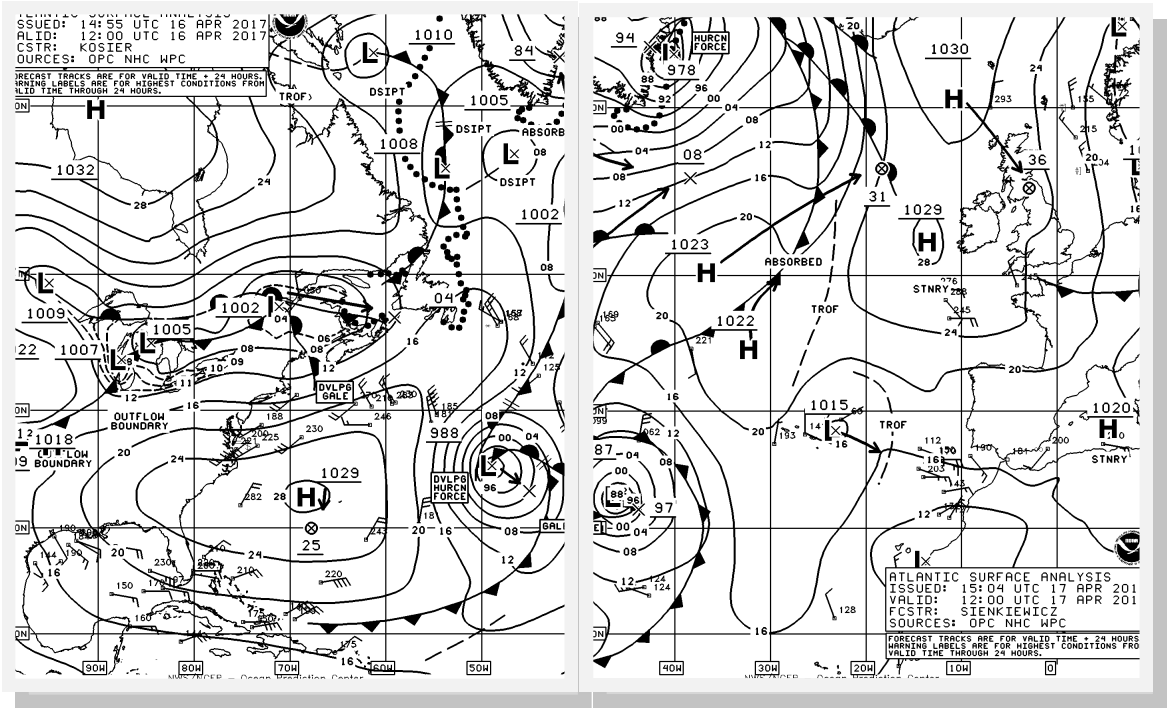


Figure 30. OPC North Atlantic Surface Analysis Charts valid 1200 UTC April 16 (Part 2) and 1200 UTC April 17, 2017 (Part 1).

References for the North Atlantic

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/datasets/ASCATData.php.

3. VonAhn, Joan and Sienkiewicz, Joe, "Hurricane Force Extratropical Cyclones Observed Using QuikSCAT Near Real Time Winds," *Mariners Weather Log,* Vol. 49, No. 1, April 2005.

4. Cangialosi, John P., National Hurricane Center, 5 July 2017, "Tropical Cyclone Report, Tropical Storm Arlene." Available online at http://www.nhc.noaa.gov/data/tcr/AL012017_Arlene.pdf.

5. Sienkiewicz, Joe and Chesneau, Lee, "Mariner's Guide to the 500-Millibar Chart," *Mariners Weather Log,* December 2008.

6. http://metoc.ndbc.noaa.gov/web/guest/jtwc/frequently-asked-questions.

7. Bancroft, G., "Marine Weather Summary, North Pacific and North Atlantic Areas," *Mariners Weather Log,* August 2017.

MARINE WEATHER REVIEW — NORTH PACIFIC AREA

January to April 2017

George P. Bancroft
NOAA National Center for Environmental Prediction/ Ocean Prediction Center
College Park, Maryland

Introduction

The weather pattern over the North Pacific was most active in January and March, which produced six and five hurricane-force systems, respectively. February and April featured three and two such events, respectively. These numbers were reduced from the seven such events that occurred in December 2016 (Reference 7). A study performed in 2005 (Reference 3) based on QuikSCAT winds found that hurricane-force lows on average peak in December in the North Pacific. Some of the significant cyclones tracked east-northeast from near Japan, while others, including the deepest cyclones of the period, turned north and stayed in the western waters. Two cyclones developed central pressures below 950 hPa (one each in January and February) and were western-Pacific events.

One tropical cyclone formed during the 4-month period and appeared on OPC's oceanic radiofacsimile charts (Muifa in late April), during what is normally a less-active period in the western North Pacific.

Tropical Activity

Tropical Storm Muifa: Tropical Depression 03W formed from a nontropical low well south of Japan near 12N 136E at 0000 UTC 25 April, with maximum sustained winds of 25 kt, which increased to 30 kt 6 hours later while the cyclone drifted north. The cyclone became Tropical Storm 03W near 13N 135E at 0000 UTC April 26 with maximum sustained winds of 40 kt. It continued a northward drift while maintaining this intensity and was given the name Muifa 24 hours later. The Joint Typhoon Warning Center (JTWC) in Honolulu issues warnings for northwestern Pacific tropical systems, but does not name them (JTWC public Web site, Reference 6). Tropical Storm Muifa then weakened to a minimal tropical storm with 35-kt sustained winds near 16N 135E at 0600 UTC on the 27th, and then to a remnant low 6 hours later. The remains of Muifa then dissipated and became a trough early on April 28.

Significant Events of the Period

Western North Pacific Storm, January 7–11: Two western North Pacific cyclones developed hurricane-force winds simultaneously early in January (Figure 1). The stronger of the two systems was the western cyclone, originating south of Japan near 31N as a gale late on January 7 and intensifying into a hurricane-force cyclone near 36N 148E, with a 972-hPa central pressure at 0600 UTC on the 9th. The central pressure fell 30 hPa in the 24-hour period ending at 0000 UTC on the 9th. This would certainly qualify the rapidly intensifying low as a "bomb" (Sanders and Gyakum, 1980). The ASCAT-B scatterometer winds in Figure 2 reveal winds as high as 65 kt south of the center and even wind retrievals of up to 50 kt on the north and east sides. Hurricane-force winds with this low persisted through 1800 UTC on the 10th, or at least 36 hours according to analyzed intensities ("hurricane force" labels) from OPC. The lowest central pressure was 963 hPa near 40N 155E at 0000 UTC on the 10th. The **RYOFU MARU** (JGQH) near 31N 141E reported west winds of 40 kt and 8.5-meter seas (28 feet) at 1500 UTC 8 January, followed 3 hours later by a report of east winds of 45 kt from the **APL KOREA** (WCX8883) near 48N 159E. A masked **SHIP** reporting near 32N 150E encountered west winds of 50 kt and 7.3-meter seas (24 feet) at 0000 UTC on the 9th. A weakening trend set in early on the 10th, and the winds weakened to gale force with the center near 40N 173E at 1800 UTC on the 11th. A larger cyclone to the northeast absorbed this cyclone the next day.

Western North Pacific Storm, January 8–10: The cyclone developing to the east in Figure 1 originated as a new open wave of low pressure near 39N 162E at 0600 UTC 8 January, and intensified to hurricane force with a 984-hPa central pressure near 42N 176E 24 hours later. The second part of Figure 1 shows the cyclone at maximum intensity 6 hours later. Its compact circulation produced ASCAT winds as high as 60 kt just south of the well-defined center (Figure 3). The cyclone subsequently drifted east and weakened rapidly, with its winds diminishing to gale force the following night. Dissipation followed early on the 11th, near 44N 161W.

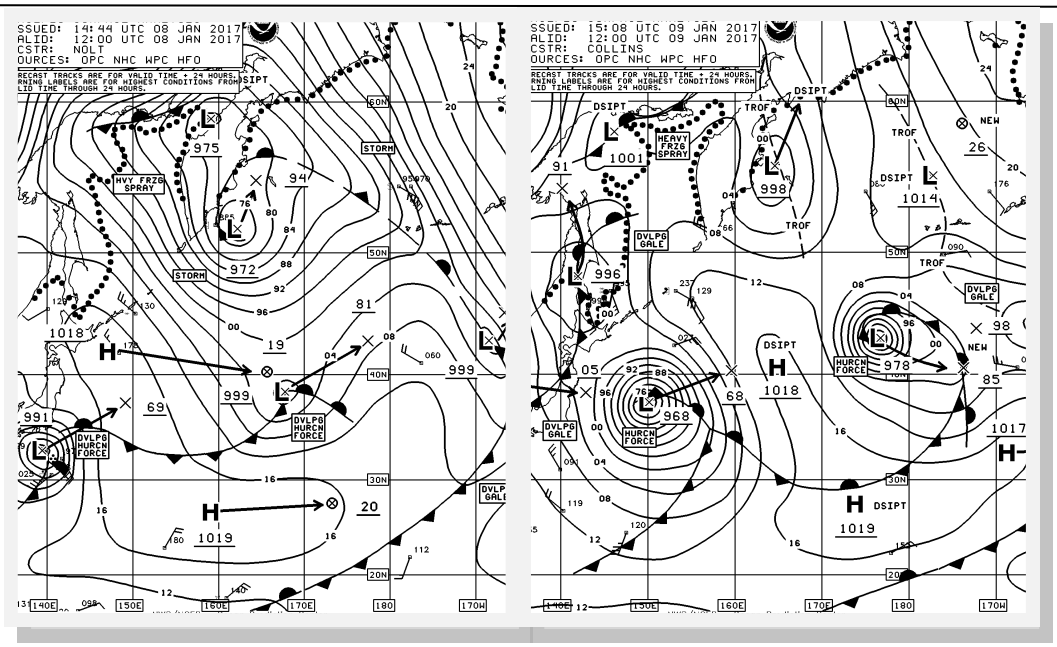


Figure 1. OPC North Pacific Surface Analysis Charts (Part 2 — west) valid 1200 UTC January 8 and 9, 2017. The 24-hour forecast tracks appear with the forecast central pressures given as the last two whole digits in millibars (hPa).

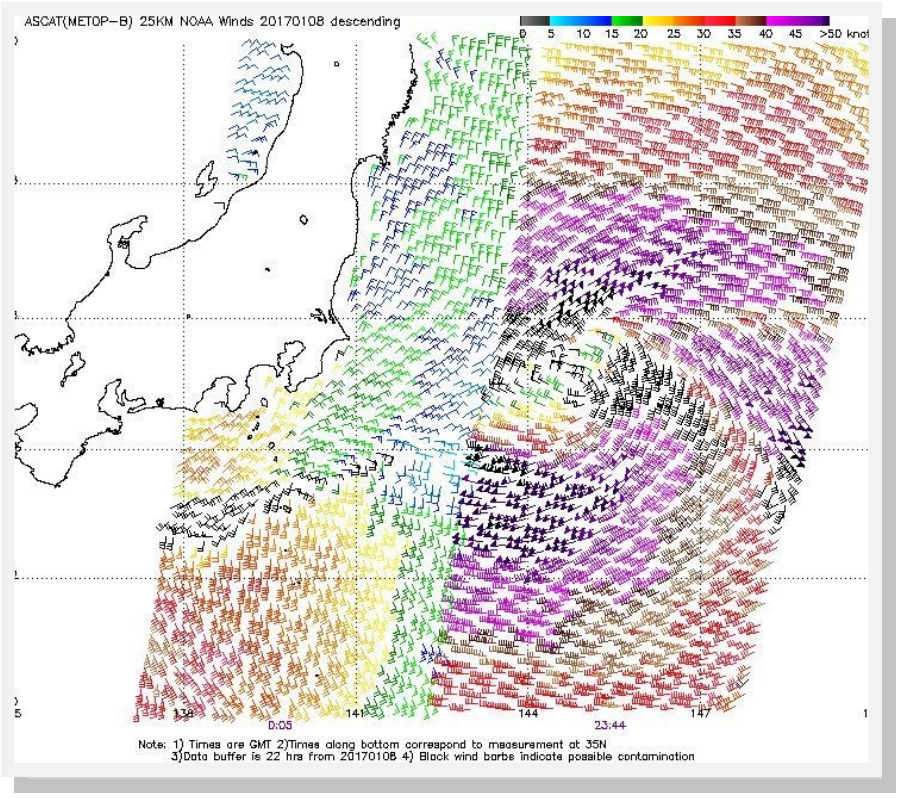


Figure 2. The 25-km ASCAT METOP-B (European Advanced Scatterometer) image of satellite-sensed winds around the cyclone shown in the second part of Figure 1. Portions of two overpasses appear, with the valid time of the pass containing the strongest wind retrievals 2344 UTC January 8, 2017, or about 12.25 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.

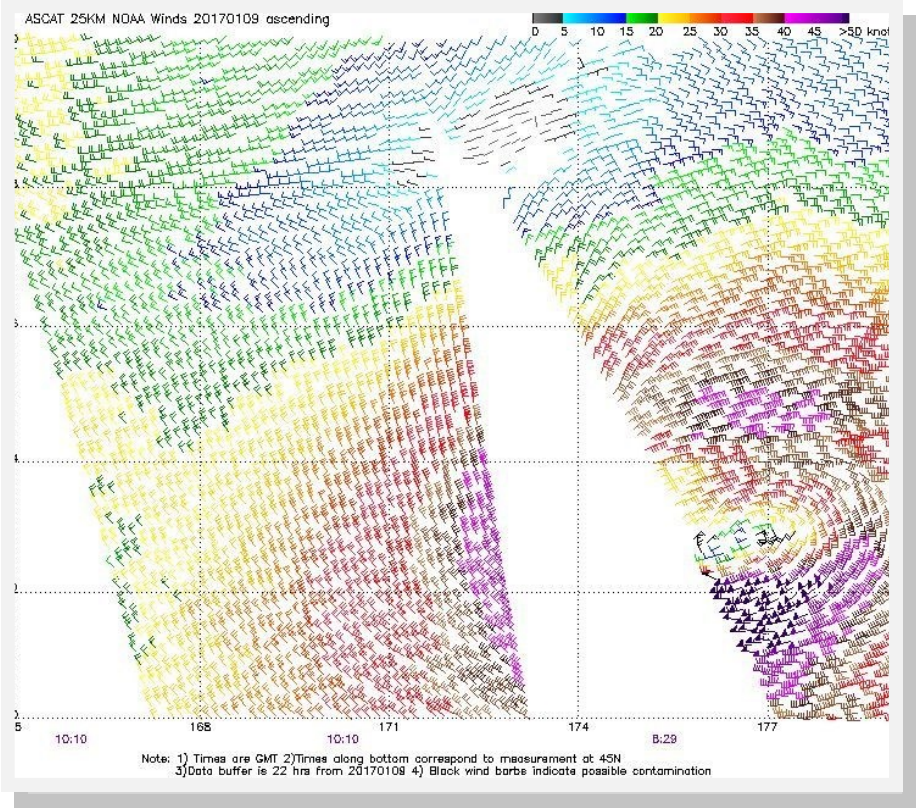


Figure 3. The 25-km ASCAT (METOP-A) image of satellite-sensed winds around the cyclone shown in the second part of Figure 14. Portions of two overpasses appear, with the valid time of the pass containing the strongest wind retrievals 0829 UTC January 9, 2017, or 3.5 hours prior to the valid time of the second part of Figure 1. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.

North Pacific Storm, January 13–16: This cyclone originated east of Japan near 34N 158E early on 12 January and moved east, developing storm-force winds in the central waters near 37N 170W at 1200 UTC on the 14th with a 976-hPa central pressure and hurricane-force winds 24 hours later near 46N 157W, with the pressure down to 964 hPa. An ASCAT-A pass from 0804 UTC on the 15th revealed a large circulation with a swath of west winds 50 to 60 kt south of the center. As the cyclone turned northeast toward the Gulf of Alaska, it developed a lowest central pressure of 963 hPa near 54N 149W at 0000 UTC on the 16th, but top winds had lowered to storm force. Buoy 46246 (50.0N 145.2W) reported highest seas of 11.5 meters (38 feet) at 0200 UTC on the 16th. A full 5 hours later, the buoy 46183 (53.6N 131.1W) reported southeast winds of 39 kt with gusts to 51 kt and 6.0-meter seas (20 feet). At 1600 UTC on the 16th, there was a report of south winds of 39 kt with gusts to 47 kt and 7.5-meter seas (25 feet) from the buoy 46185 (52.4N 129.8W). The cyclone subsequently weakened near the southern coast of Alaska on the 17th.

Eastern North Pacific Storms, January 17–23: Two cyclones of similar intensity, in the low 970s hPa, developed in close succession in late January in the central and eastern waters, with the second developing hurricane-force winds. The first originated as a secondary development on a front associated with another cyclone in the western Pacific at 0000 UTC January 18 and developed storm-force winds and a lowest central pressure of 971 hPa 12 hours later near 41N 177W. An ASCAT pass from 0821 UTC January 19 showed west to northwest winds of 50 to 55 kt on the edge of the pass on the south side of the cyclone. The system tracked east-northeast and weakened to a gale as it approached the Washington and Oregon offshore waters with a 982-hPa center early on the 21st (Figure 4). Buoy 46006 (40.8N 137.4W) reported west winds of 43 kt with gusts to 58 kt and 12.0-meter seas (39 feet) at 1800 UTC on the 20th, a peak gust of 62 kt 1 hour later and maximum seas 13.0 meters (43 feet) at 2200 UTC that day. Buoy 46059 (38.1N 129.9W) reported west winds of 35 kt with gusts to 49 kt and 9.5-meter seas (31 feet) at 0300 UTC 21 January,

with maximum seas of 12.0 meters 3 hours later. The cyclone subsequently turned toward the northwest and became absorbed by a second cyclone, which moved northeast and replaced it 36 hours later (Figures 4 and 5). The second cyclone originated near 40N 159W at 1200 UTC on the 20th and tracked east, rapidly intensified after passing 145W, and developed a lowest central pressure of 970 hPa and hurricane-force winds near 43N 129W at 0600 UTC on the 22nd. The central pressure fell 28 hPa in the 24-hour period ending at that time. The ASCAT-B image in Figure 6 shows wind retrievals of 50 to 60 kt on the east side of the cyclone at the edge of a pass (and may miss stronger winds). The **Alaskan Legend** (WDD2074) near 42N 128W reported southwest winds of 50 kt and 7.9-meter seas (26 feet) at 0900 UTC on the 22nd. The **POLAR ENTERPRISE** (WRTF) near 43N 126W encountered south winds of 55 kt and 7.0-meter seas (23 feet) 2 hours later. Buoy 46002 (42.6N 130.5W) reported maximum seas of 11.0 meters (36 feet) at 1000 UTC on the 21st. The cyclone then stalled near 46N 131W on the 22nd with its top winds weakening to storm force, followed by a southeastward movement with further weakening over the following 2 days. The cyclone dissipated off southern California late on the 24th.

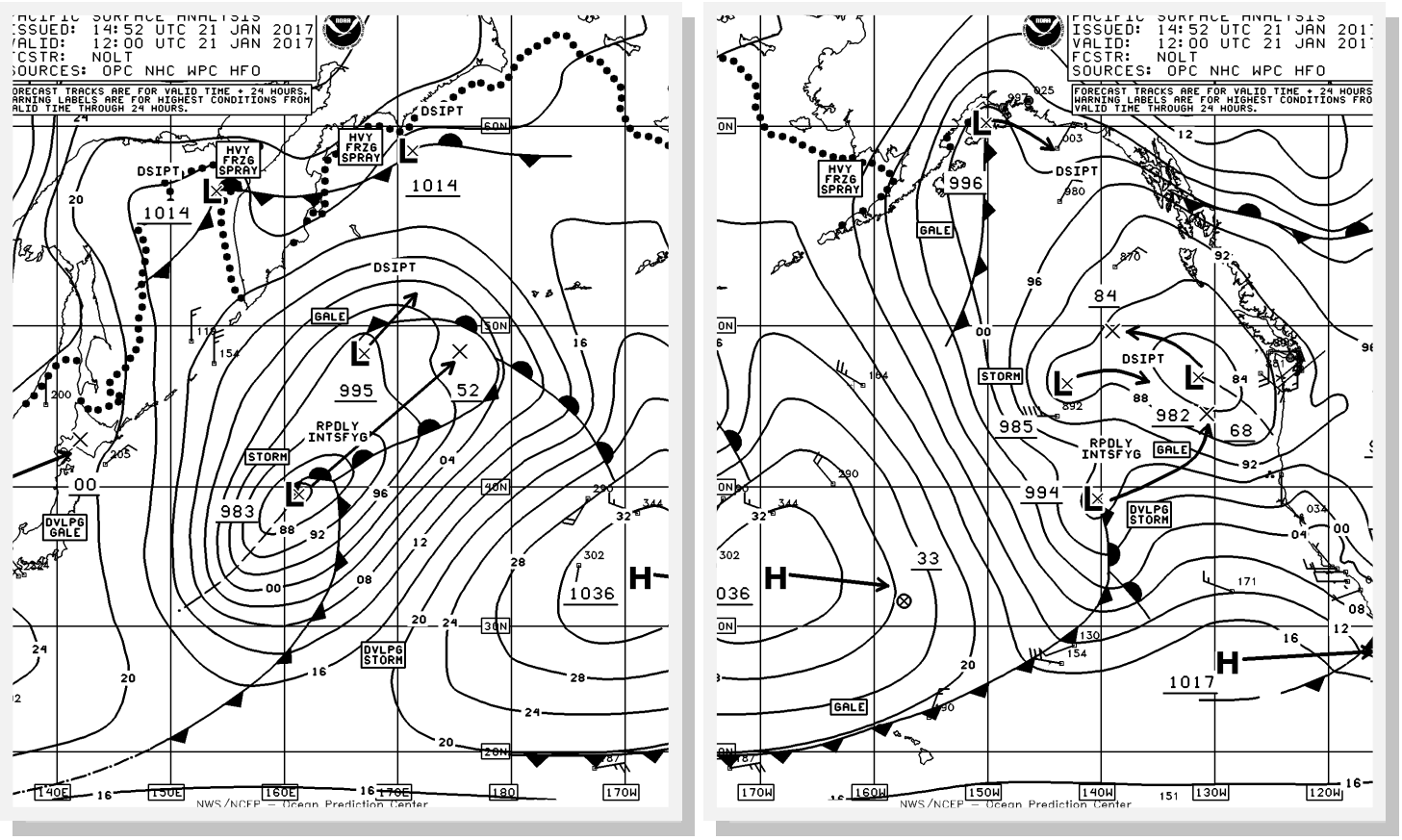


Figure 4. OPC North Pacific Surface Analysis Chart (Parts 2 — west and 1 — east) valid 1200 UTC January 21, 2017. The two parts overlap between 165W and 175W.

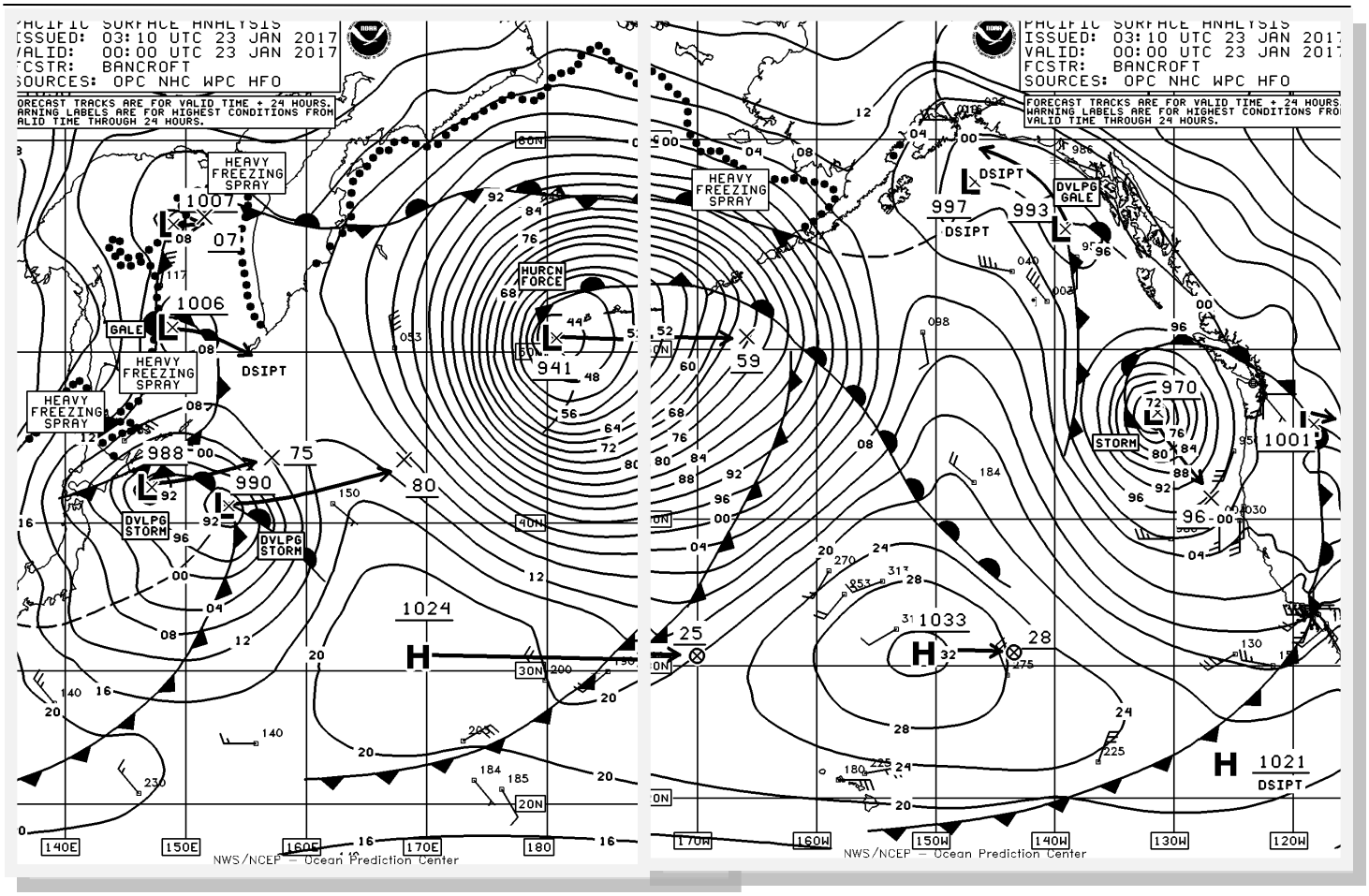


Figure 5. OPC North Pacific Surface Analysis Chart (Parts 2 — west and 1 — east) valid 0000 UTC January 23, 2017. The two parts overlap between 165W and 175W.

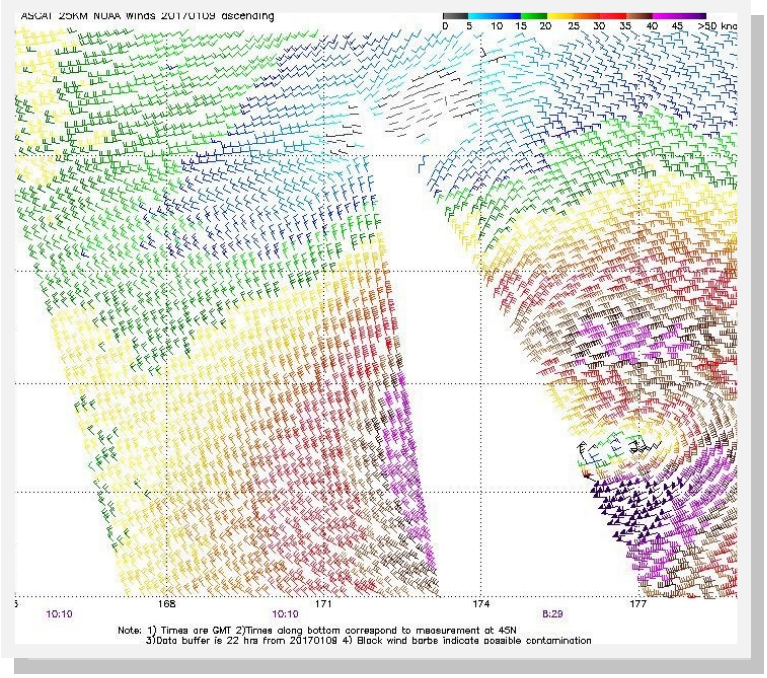


Figure 6. The 25-km ASCAT (METOP-B) image of satellite-sensed winds around the cyclone shown in Figure 4. Portions of two overpasses appear, with the valid time of the pass containing the strongest wind retrievals 0451 UTC January 22, 2017, or about 17 hours later than valid time of Figure 4. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.

North Pacific/Bering Sea Storm, January 19–24: A complex low-pressure system in the western waters consolidated into one intense cyclone, the deepest of the period in the North Pacific, over a 36-hour period as depicted in Figures 4 and 5. It originated near Japan late on the 19th, already strengthening to storm force. The central pressure fell 32 hPa in the 24-hour period ending at 1200 UTC January 22. ASCAT imagery such as in Figure 7 indicated strongest wind retrievals of up to 60 kt north of the occluded front in the Bering Sea. Hurricane-force winds with this system lasted at least 36 hours, from 1200 UTC on the 22nd to 0000 UTC on the 24th, based on OPC surface analysis. The **SEAFREEZE ALASKA** (WDE7203) reported southeast winds of 65 kt near 54.7N 171W at 1800 UTC on the 22nd. A full 6 hours later, the **APL THAILAND** (WCX8882) encountered northeast winds of 60 kt and 6.7-meter seas (22 feet) near 57N 179E, while the **ARKLOW SPIRIT** (EIOF4) reported north winds of 45 kt and 11.3-meter seas (37 feet) at 50N 177E. Buoy 46035 (57.0N 177.7W) reported northeast winds of 40 kt with gusts to 47 kt at 0500 UTC on the 23rd, a peak gust of 52 kt 2 hours prior, and maximum seas of 11.6 meters (38 feet) at 0600 UTC on the 23rd. The cyclone subsequently weakened while moving northeast over the next 2 days and dissipated near the coast of southwestern Alaska by the 25th.

Western North Pacific/Bering Sea Storm, January 29–February 1: Figure 8 shows the development of this western cyclone over a 26-hour period. The cyclone developed hurricane-force winds with a central pressure of 966 hPa near 42N 159E at 0000 UTC January 31. The central pressure fell 33 hPa in the 24-hour period ending at that time. An ASCAT-B pass from 0025 UTC on the 31st revealed a swath of north winds 50 to 55 kt at the edge of the pass and likely missed higher winds. The lowest central pressure was 958 hPa at 0000 UTC February 1 with the cyclone near 48N 167E, but top winds had weakened to storm force by then. The **MAERSK STRALSUND** (A8KW2) near 46N 161E reported east winds of 50 kt at 0200 UTC on the 31st. The **APL PHILIPPINES** (WCX8884) near 54N 167E encountered south winds of 45 kt and 9.0-meter seas (30 feet) at 0000 UTC February 2. The cyclone subsequently weakened in the far western Bering Sea late on the 1st and dissipated near the Kamchatka Peninsula by early on the 2nd.

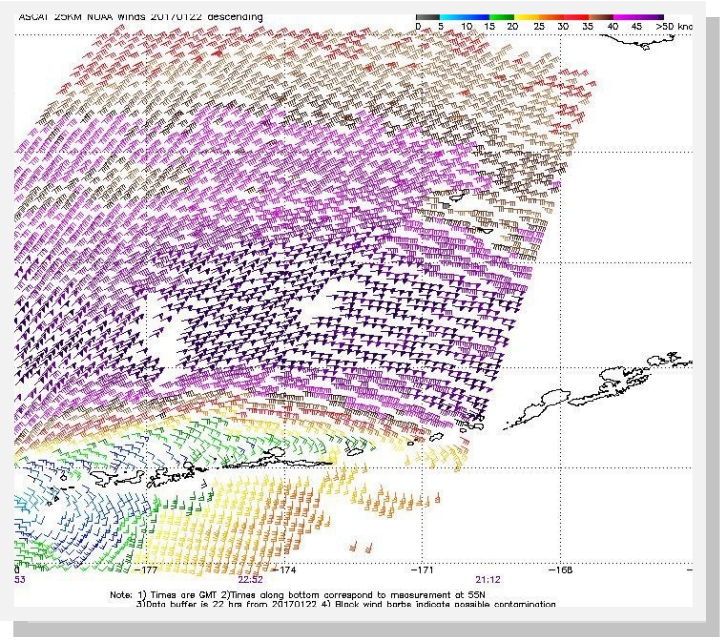


Figure 7. The 25-km ASCAT (METOP-A) image of satellite-sensed winds around the northeast side of the cyclone shown in Figure 5. Portions of two overpasses appear, with the valid time of the later pass 2252 UTC January 22, 2017, or about 1 hour prior to the valid time of Figure 5. The central and eastern Aleutian Islands appear across the lower portion of the image. Image is courtesy of NOAA/ NESDIS/ Center for Satellite Application and Research.

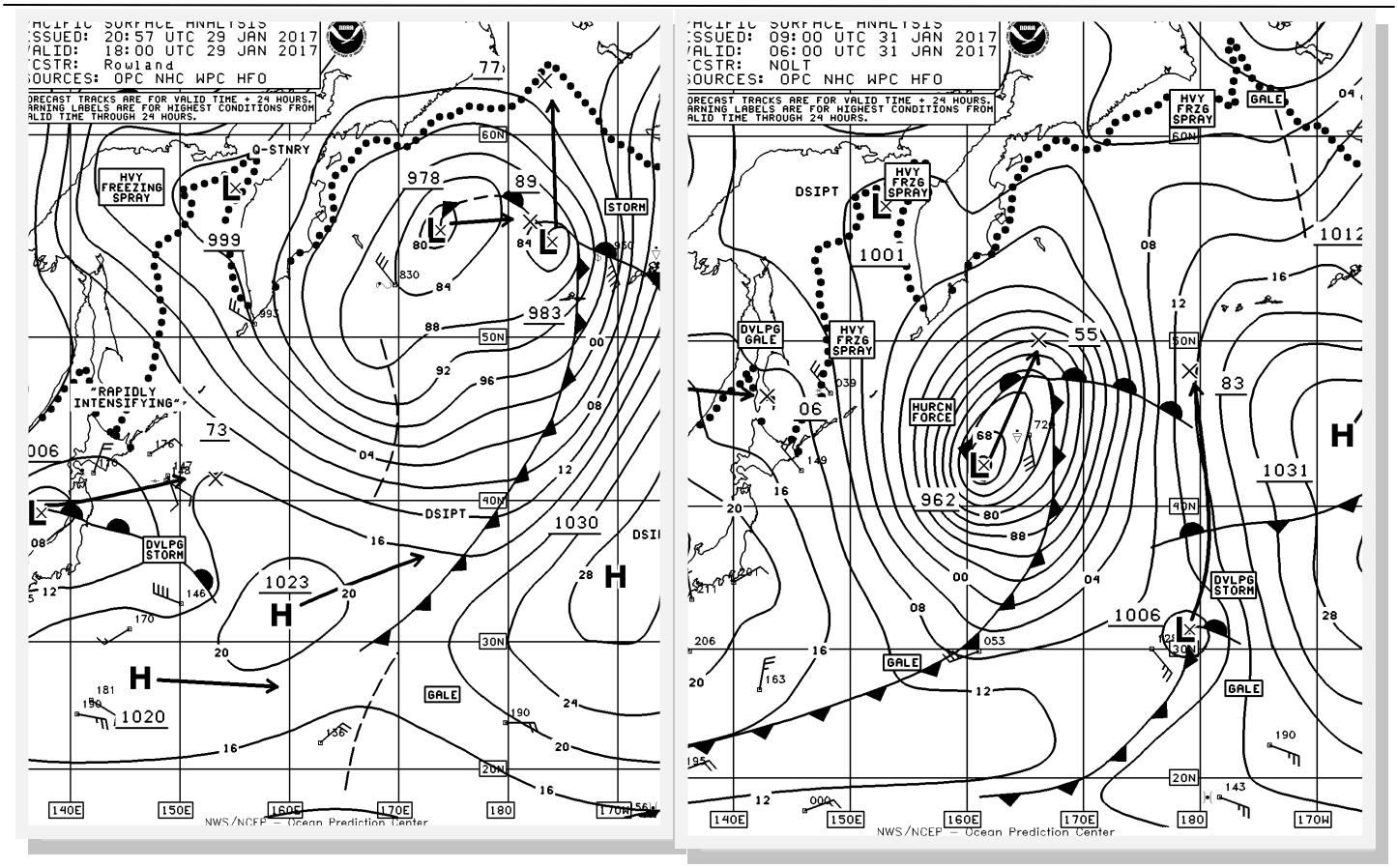


Figure 8. OPC North Pacific Surface Analysis Charts (Part 2) valid 1800 UTC January 29 and 0600 UTC January 31, 2017.

Eastern North Pacific Storm, February 15–18: Low pressure originating southeast of Japan late on February 14 moved rapidly east-northeast over the next 2 days and developed storm-force winds near 39N 168W at 0000 UTC on the 17th and hurricane-force winds with a lowest pressure of 976 hPa near 42N 162W 12 hours later. An ASCAT-B pass from 1950 UTC on the 17th revealed an area of west-to-southwest winds of 50 to 60 kt south of the low center at the edge of the pass. The **MOUNT OWEN** VRDU6) near 40N 153W reported west winds of 45 kt and 9.8-meter seas (32 feet) at 2100 UTC on the 17th. Hurricane-force winds accompanied the system through 0000 UTC on the 18th. The cyclone then weakened while moving east, with winds diminishing to gale force on the 18th and then became absorbed late on the 19th.

North Pacific/Bering Sea Storm, February 18–21: A new low near Japan at 0000 UTC February 18 moved northeast and rapidly intensified after 24 hours. It developed storm-force winds near 40N 167E at 1200 UTC on the 19th and hurricane-force winds 18 hours later when the low center passed near 49N 174E with a 958-hPa central pressure. The pressure fell 36 hPa during the preceding 24-hour period, and the lowest pressure of 954 hPa occurred 6 hours later. Figure 9 shows this cyclone at 1800 UTC on the 20th as it turned westward and began to weaken. The **APL KOREA** (WCX8883) near 53N 175W encountered east winds of 50 kt and 7.9-meter seas (26 feet) at 1200 UTC on the 20th. Buoy 46070 (55.1N 175.2E) reported maximum seas of 11.5 meters (38 feet) at 1900 UTC on the 20th.

Western North Pacific/Bering Sea Storm, February 20–23: A complex low-pressure system near Japan at 1800 UTC February 20 consolidated into an intense 948-hPa hurricane-force cyclone over a 48-hour period, as depicted in Figure 9, while also absorbing the existing Bering Sea storm. The second part of Figure 9 shows the cyclone at maximum intensity, making it the second most intense of the period in terms of central pressure. The infrared satellite image of the cyclone at maximum intensity (Figure 10) reveals a well-defined intense circulation near the center and broad frontal features, with the cold cloud tops implying great vertical extent of the system. The scatterometer data in Figure 11 shows an extensive area of wind retrievals in the 50- to as high as 60-kt range north of the cyclone's occluded front and extending to at least 60N. The **ITAL LUNARE** (ICE5) reported north winds of 60 kt and 11.9-meter seas (39 feet) near

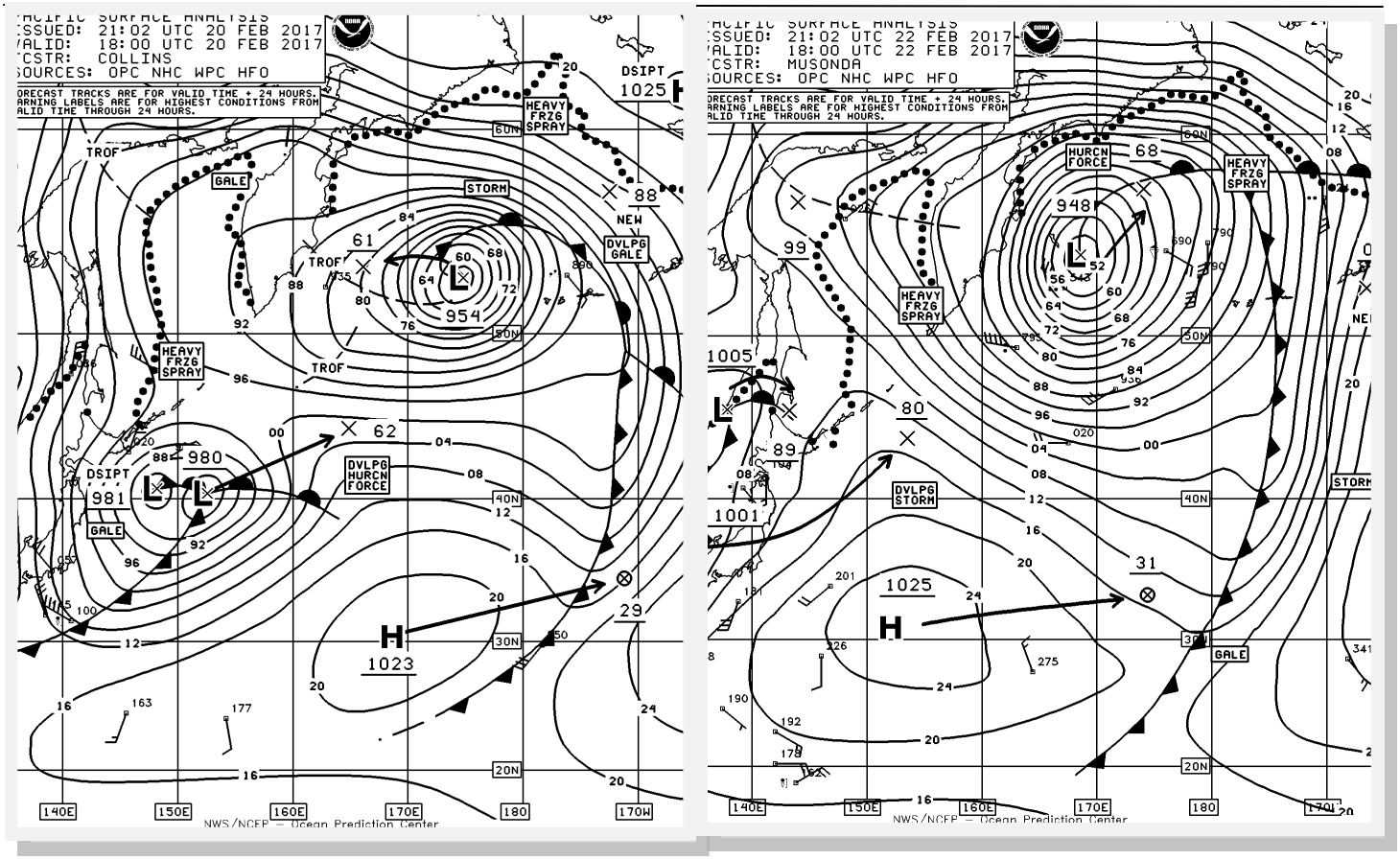


Figure 9. OPC North Pacific Surface Analysis Charts (Part 2) valid 1800 UTC February 20 and 22, 2017.

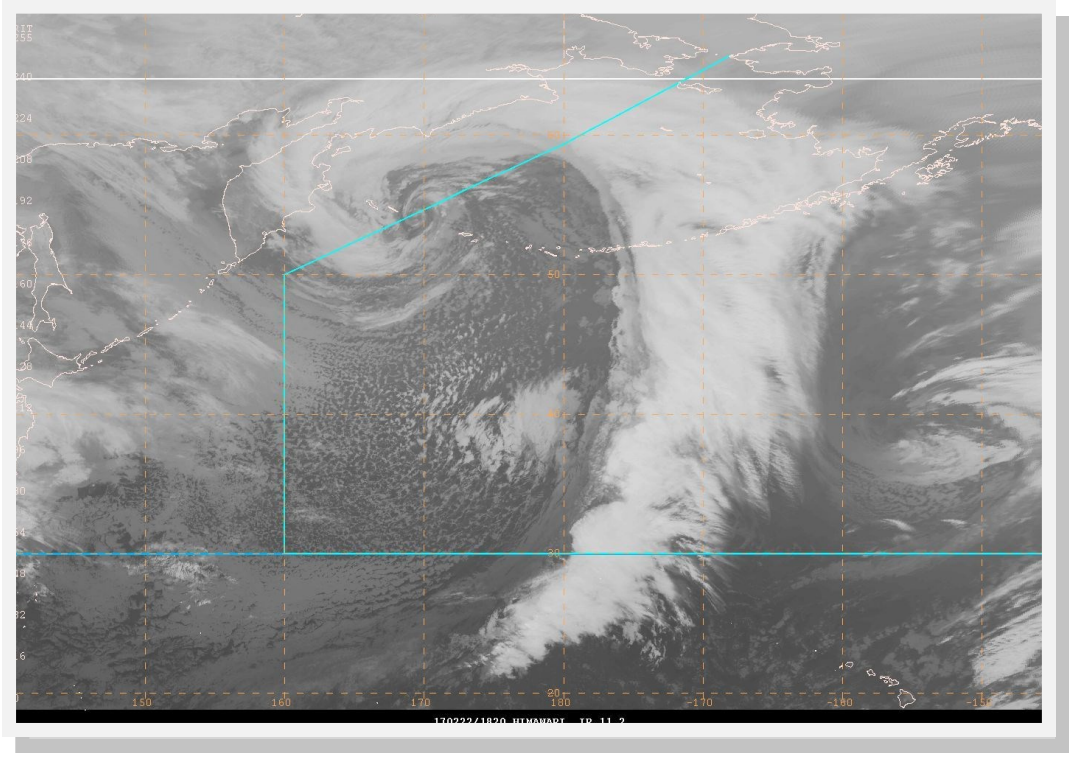


Figure 10. Himawari infrared satellite image valid 1820 UTC February 22, 2017. The satellite senses temperature on a scale from black (warm) to white (cold) in this type of imagery. The valid time of the image is 20 minutes later than the valid time of the second part of Figure 9.

53N 166E at 0100 UTC on the 23rd. The **FEDERAL SPRUCE** (V7WT3) near 53N 166E encountered northwest winds of 53 kt and 7.9-meter seas (26 feet) at 2100 UTC on the 22nd. The cyclone subsequently moved northeast and weakened to a gale-force low by 1800 UTC on the 23rd and dissipated near the Bering Strait late on the 24th.

Western North Pacific Storm, February 28–March 3: Low pressure originating from well south of Japan near 28N early on February 26 moved east-northeast and gradually strengthened, developing storm-force winds with a 1000-hPa center near 32N 163E at 0600 UTC March 1, and 18 hours later, it briefly developed hurricane-force winds with the center at 992 hPa near 32N 171E. An ASCAT(METOP-B) pass from 2228 UTC March 1 showed a swath of northerly winds of 50 to 60 kt at the edge of the pass and may miss higher wind retrievals. The **SAN CLEMENTE** (D5GN4) near 35N 174W reported southeast winds of 45 kt and 6.7-meter seas (22 feet) at 0000 UTC on the 3rd. The cyclone developed a lowest central pressure of 982 hPa near 34N 180W at 0000 UTC on the 3rd with storm-force winds. The cyclone weakened to a gale late on the 3rd while drifting northeast, and it dissipated the next day.

Western North Pacific Storm, March 14–15: This small but potent and short-lived hurricane-force low formed as a possible redevelopment southeastward of a low-pressure area moving over central Japan on March 14 (Figure 12). It formed at 0000 UTC on the 15th to the west of the existing storm farther offshore and developed hurricane-force winds 6 hours later. ASCAT winds in an 1103 UTC March 15 pass showed winds 50 to 60 kt in the west semicircle. The pattern of wind retrievals actually looks similar to Figure 16 for the March 26–30 event in that area. As the new cyclone drifted southeast, its top winds weakened to storm force 12 hours later, and then the cyclone was absorbed later on the 15th. The **LNG DREAM** (C6VO5) near 37N 142E reported north winds of 50 kt and seas 5.8 meters (19 feet) at 2300 UTC on the 14th. The **G. SYMPHONY** (3FCJ9) near 31N 143E encountered northwest winds of 45 kt at 0300 UTC on the 15th.

Western North Pacific Storm, March 20–25: A low with gale-force winds tracked east-northeast just south of Japan on March 20, developed storm-force winds just southeast of Japan the following night, and hurricane-force winds 12 hours later, with a 970-hPa center

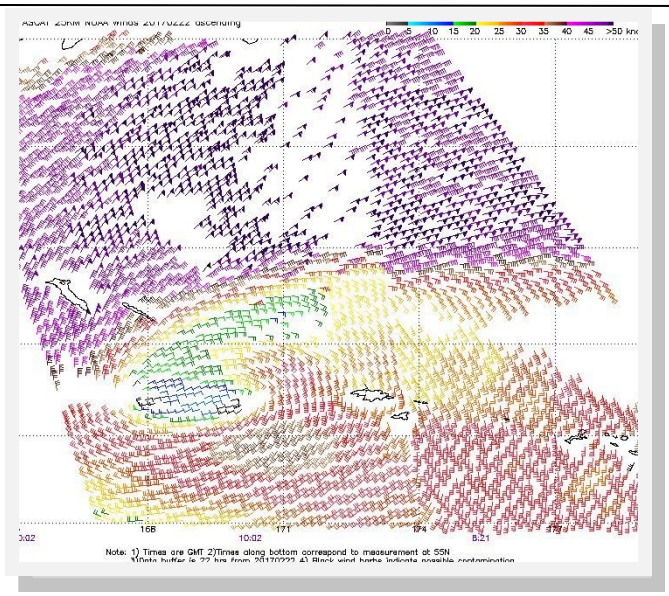


Figure 11. The 25-km ASCAT (METOP-A) image of satellite-sensed winds around the cyclone shown in the second part of Figure 9. Portions of two overpasses appear, with the valid time of the pass containing the strongest wind retrievals 1002 UTC February 22, 2017, or about 8 hours prior to the valid time of the second part of Figure 9. Image is courtesy of NOAA/NESDIS/ Center for Satellite Application and Research.

near 35N 150E. The central pressure fell 30 hPa in the 24-hour period ending at 0000 UTC on the 22nd. Figure 13 depicts the initial development of this cyclone. An ASCAT-B pass in Figure 14 reveals a swath of west-to-northwest winds 50 to 55 kt on the south and southwest sides, and even some 50-kt retrievals to the north of the center. The lowest central pressure of 962 hPa came later, as the cyclone moved northeast to 45N 177E at 0600 UTC on the 24th. The **THEODOR OLDENDORFF** (9HA3251) near 55N 180W encountered east winds of 60 kt and 7.3-meter seas (24 feet) at 1900 UTC on the 24th. The **PEACEFUL SEAS** (D5EY7) near 54N 175W reported east winds of 40 kt and the same sea conditions 3 hours later. The cyclone subsequently drifted north with slow weakening through the 25th, then turned southwest, and dissipated south of the western Aleutian Islands late on the 26th.

North Pacific Storm, March 24–26: Following on the heels of the preceding storm, another cyclone formed southeast of Japan near 33N 147E at 0000 UTC March 24 and tracked east-northeast, developing storm-force winds with a 992-hPa center near 37N 166E by 0600 UTC on the 25th and hurricane-force winds with a 978-hPa center passing over the central waters near 43N 178W at 0000 UTC on the 26th. An ASCAT(METOP-B) pass from 2228 UTC March 25 revealed a rather

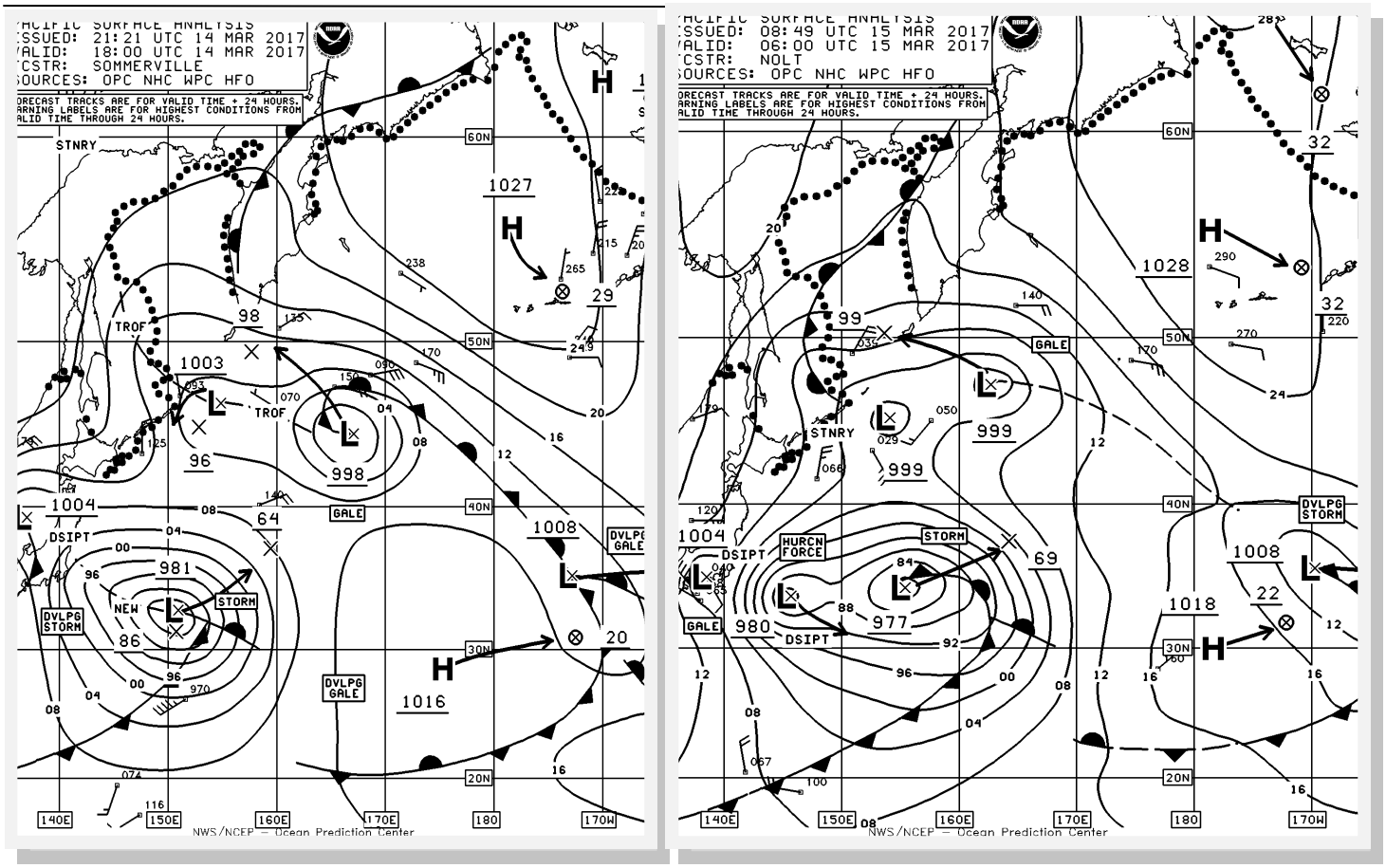


Figure 12. OPC North Pacific Surface Analysis Charts (Part 2) valid 1800 UTC March 14 and 0600 UTC March 15, 2017.

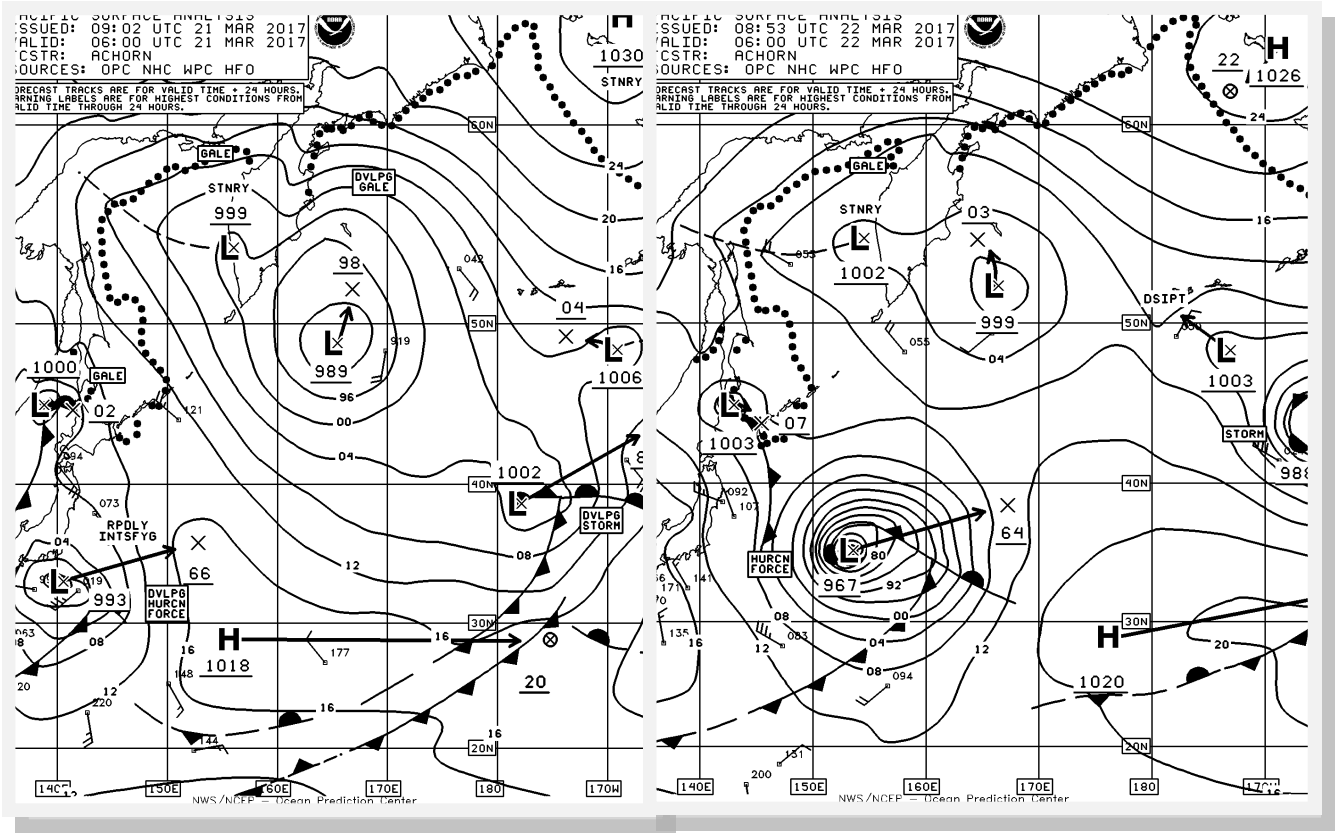


Figure 13. OPC North Pacific Surface Analysis Charts (Part 2) valid 0600 UTC March 21 and 22, 2017.

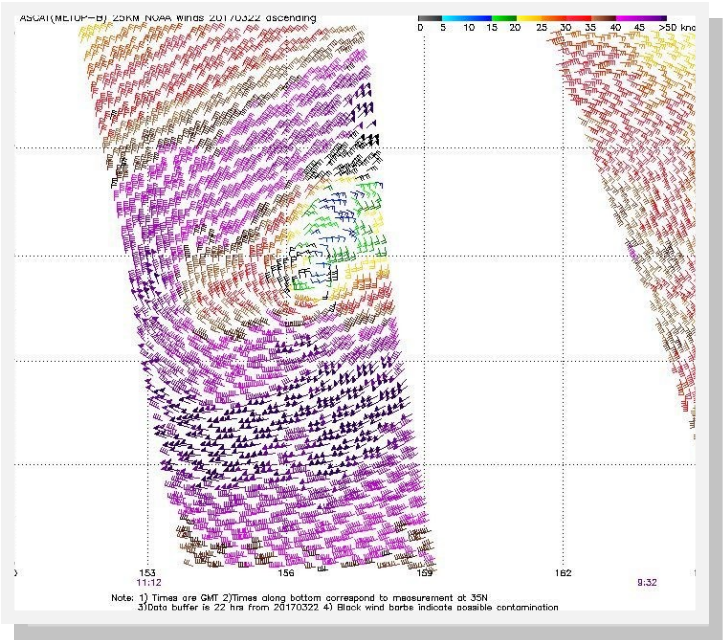


Figure 14. The 25-km ASCAT (METOP-B) image of satellite-sensed winds around the cyclone shown in the second part of Figure 13. Portions of two overpasses appear, with the valid time of the pass containing the strongest wind retrievals 1112 UTC March 22, 2017, or about 5.25 hours later than the valid time of the second part of Figure 13. Image is courtesy of NOAA/ NESDIS/ Center for Satellite Application and Research.

compact circulation with a well-defined center and a swath of satellite-detected westerly winds 50 to 60 kt south of the cyclone's center. Hurricane-force conditions continued to at least 06Z on the 26th or 6 hours later, when the cyclone developed a lowest central pressure of 973 hPa. Gradual weakening set in thereafter as the system turned more northeast and stalled near 50N 165W by the 27th with top winds lowered to gale force. Dissipation followed 2 days later.

North Pacific Storm, March 26–30: This cyclone developed rapidly over a 24-hour period from a complex low-pressure system near Japan early on March 26, as depicted in Figure 15. The central pressure dropped 24 hPa in the 24-hour period ending at 1200 UTC on the 27th. Figure 16 shows wind retrievals in the west semicircle of the cyclone of 50 to 60 kt when it was still newly developed and relatively compact. Hurricane-force winds with this system persisted through at least 1800 UTC on the 27th as determined by OPC's surface analysis. The **NORTHWEST SWAN** (ZCDJ9) near 33N 140E reported west winds of 51 kt at 1800 UTC on the 26th. The **APL SAIPAN** (WDJ2573) encountered west winds of 55 kt near 32N 147E at 1100 UTC the next day. The cyclone subsequently moved northeast over the next 2 days and increased in size, while its central pressure dropped to as low as 966 hPa when the center passed near 46N 171W at 0600 UTC March 30, while maintaining winds to storm force. It then dissipated as a trough on the 30th as a new low formed to the northeast and moved toward the Gulf of Alaska.

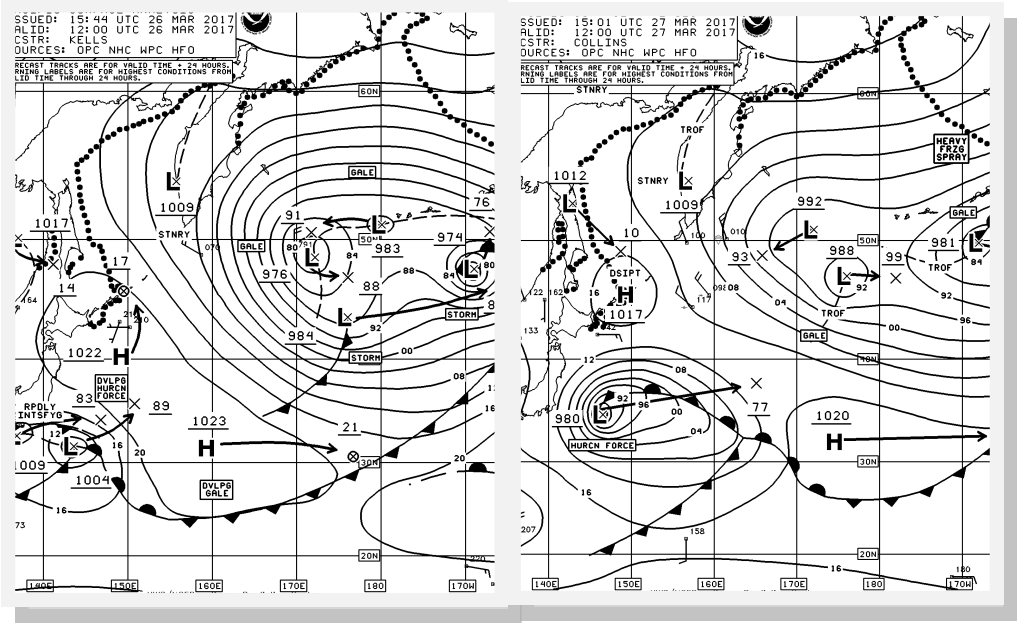


Figure 15. OPC North Pacific Surface Analysis Charts (Part 2) valid 1200 UTC March 26 and 27, 2017.

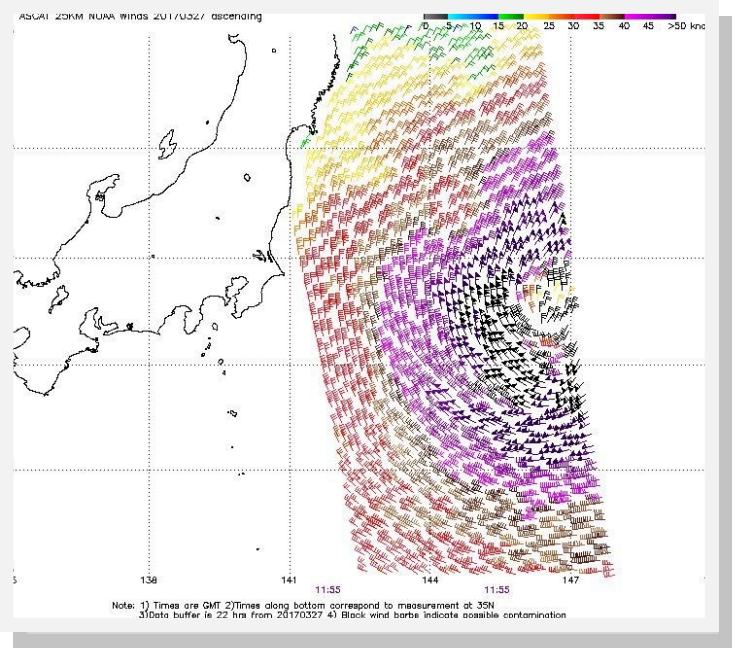


Figure 16. The 25-km ASCAT (METOP-A) image of satellite-sensed winds around the south and west sides of the cyclone shown in the second part of Figure 15. The valid time of the pass is 1155 UTC March 27, 2017, or approximately the valid time of the second part of Figure 15. Image is courtesy of NOAA/ NESDIS/ Center for Satellite Application and Research.

Eastern North Pacific Storm, April 1–4: One of two hurricane-force cyclones in April, this one originated as a secondary development on a front associated with a primary low center, near 35N 154E at 0600 UTC March 31, and tracked east-northeast, rapidly intensifying after passing 175W (Figure 17). The cyclone developed storm-force winds near 39N 170W at 0000 UTC April 2 with a 998-hPa center, and hurricane-force winds 12 hours later near 44N 164W with a 981-hPa central pressure. The central pressure fell 28 hPa in the 24-hour period ending at 1800 UTC on the 2nd, when the center developed a 976-hPa central pressure, near 47N 159W. An ASCAT-B pass from 2120 UTC on the 2nd revealed a swath of west-to-southwest winds of 50 to 55 kt on the south side of the cyclone. The ship **HHLR** (54N 139W) reported southeast winds of 60 kt and 8.8-meter seas (29 feet) at 1700 UTC April 3. The **COSCO EXCELLENCE** (VRJT8) near 53N 160W encountered north winds of 50 kt at 1200 UTC on the 3rd. Buoy 46207 (50.9N 129.9W) reported east winds of 43 kt with gusts to 56 kt at 2000 UTC on the 4th and maximum seas of 9.0 meters (30 feet) 2 hours later. Buoy 46147 (51.8N 131.2W) reported southeast winds 41 kt with gusts to 52 kt at 2200 UTC on the 4th and maximum seas 10.5 meters (34 feet) 1 hour later. Augustine Island (AUGA2, 59.4N 153.2) reported northeast winds of 45 kt with gusts to 52 kt at 0000 UTC on the 4th and a peak gust of 63 kt 3 hours later. The cyclone's top winds weakened to storm force early on the 3rd as the system slowed down and then stalled in the Gulf of Alaska late on the 3rd and on the 4th, before another system passing to the east the following night absorbed it.

Storm in the Far West (Sea of Okhotsk), April 10–14: The rapid development of this cyclone in the far western waters over a 26-hour period is shown in Figure 18. The central pressure fell 28 hPa in the 24-hour period ending at 0000 UTC April 13. The 952-hPa central pressure made it the most intense of the March and April period in the North Pacific. The ASCAT image (Figure 19) covering the southwest side of the cyclone shows an area of west winds 50 to 55 kt. The **VOLENDAM** (PCHM) near 34N 138E reported west winds of 50 kt and 4.9-meter seas (16 feet) at 2200 UTC on the 11th. The ship **DSCL4** (46N 159E) encountered east winds of 45 kt and 6.4-meter seas (21 feet) at 1200 UTC on the 12th. The cyclone maintained hurricane-force strength for another 6 hours before weakening as it moved slowly east. Its winds weakened to gale force as it moved into the western Bering Sea on the 14th, where it continued weakening before moving north and inland by the 16th.

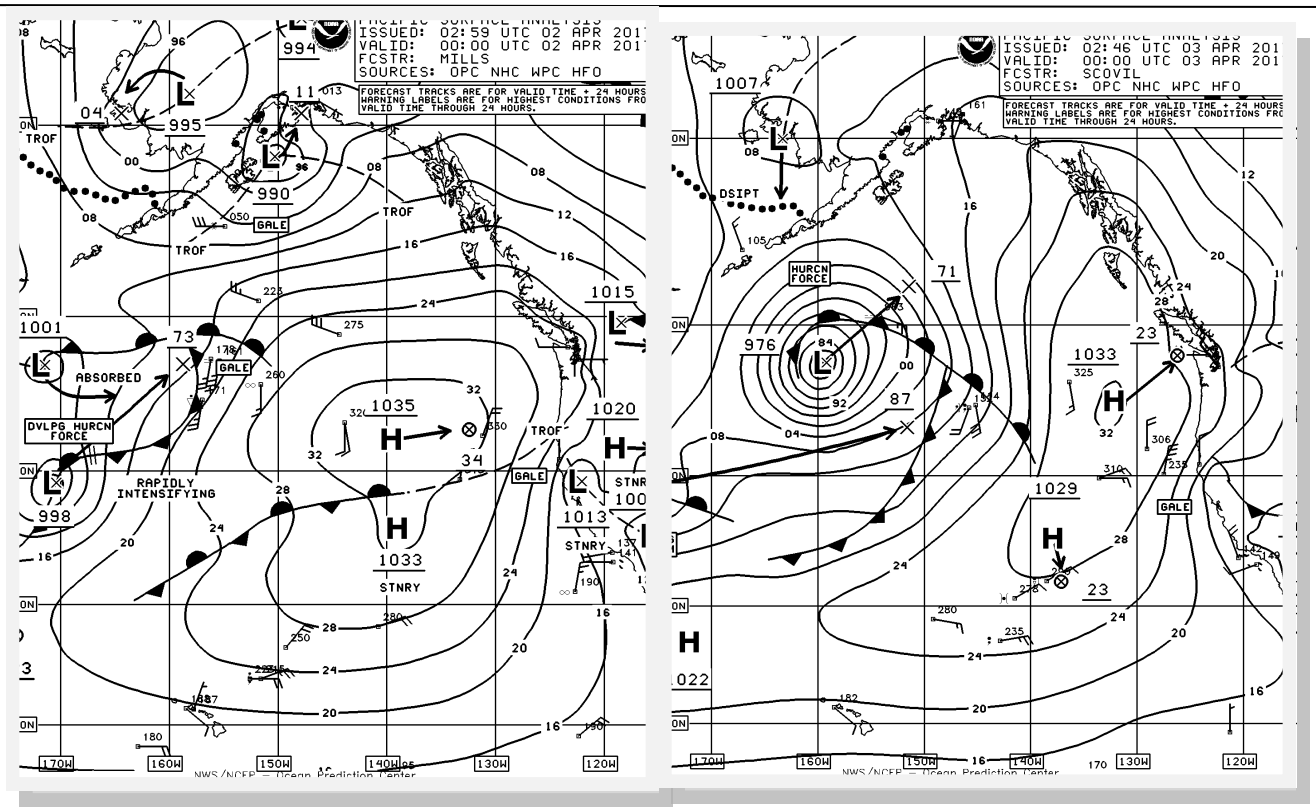


Figure 17. OPC North Pacific Surface Analysis Charts (Part 1) valid 0000 UTC April 2 and 3, 2017.

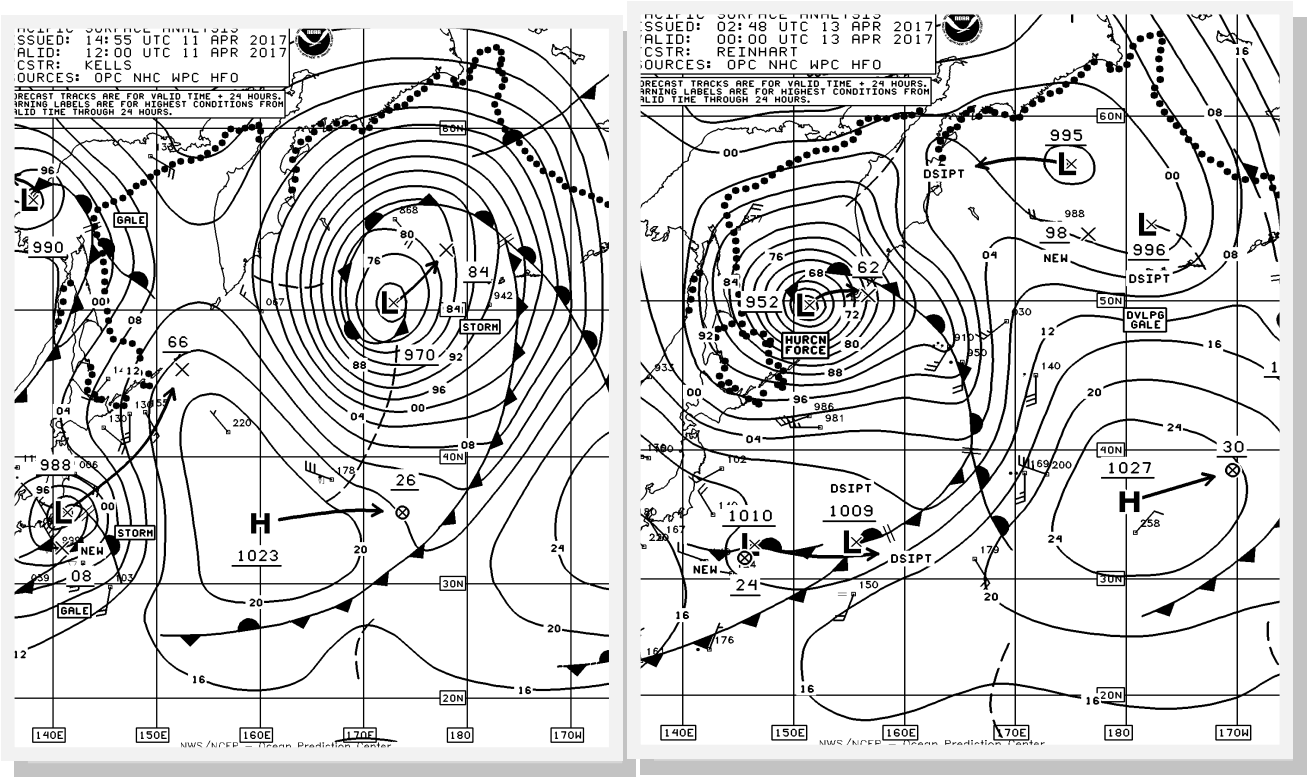


Figure 18. OPC North Pacific Surface Analysis Charts (Part 2) valid 1200 UTC April 11 and 0000 UTC April 13, 2017.

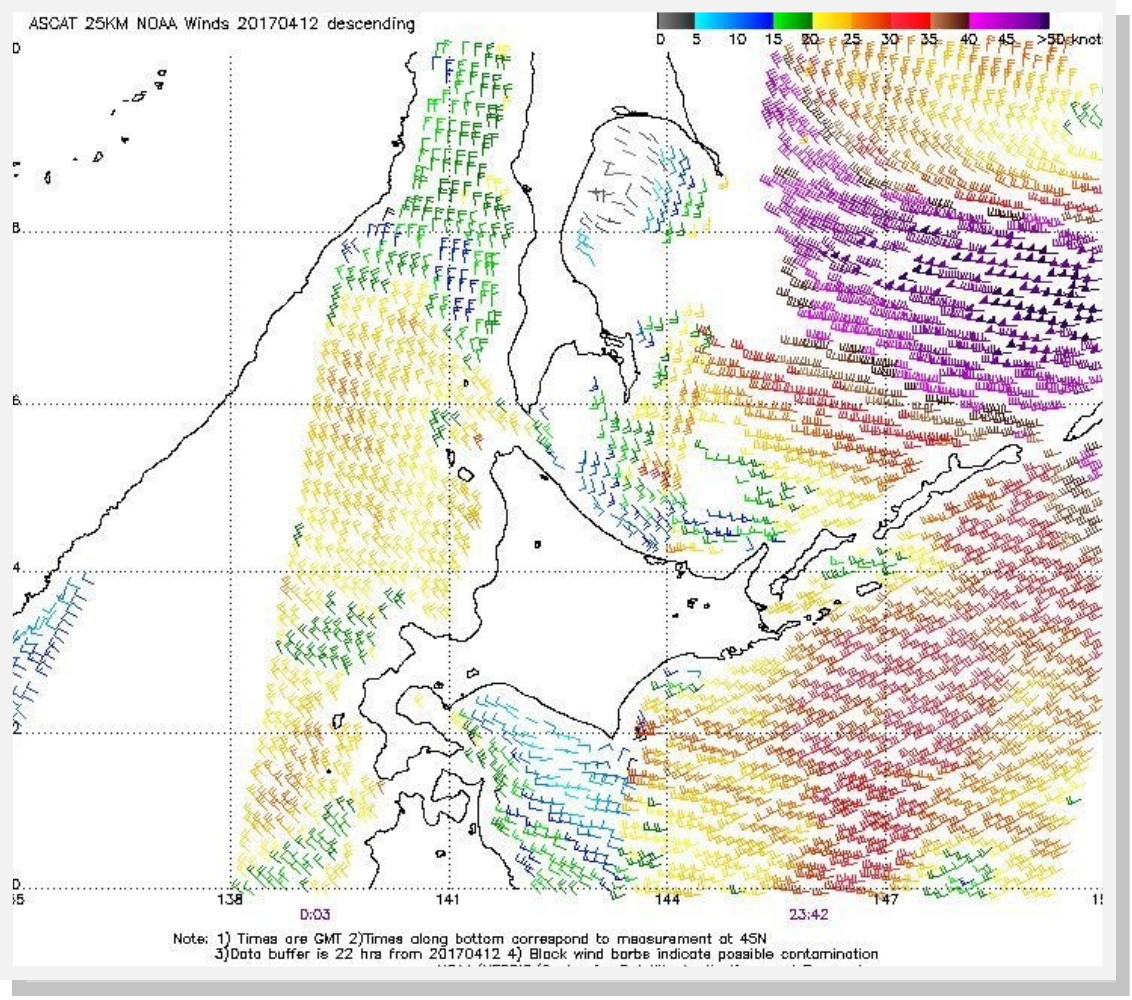


Figure 19. The 25-km ASCAT (METOP-A) image of satellite-sensed winds around the southwest side of the cyclone shown in the second part of Figure 18. Portions of two overpasses appear, with the valid time of the pass containing the strongest wind retrievals 2342 UTC April 12, 2017, or about 0.25 hour prior to the valid time of the second part of Figure 18. The southern Kuril Islands, northern Japan. and southern Sakhalin Island appear in the image. Image is courtesy of NOAA/ NESDIS/ Center for Satellite Application and Research.

Mean Circulation Highlights and Climate Anomalies

May–August 2017

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

All anomalies reflect departures from the 1981–2010 base period.

May–June 2017

The 500-hPa mean circulation during May 2017 featured positive height anomalies across the western contiguous U.S. (CONUS), western and northern Canada, Greenland, Western Europe, and central Asia. Negative height anomalies prevailed across the U.S. Upper Great Lakes region, the central North Atlantic, and northwest Russia (**Figure 1**). Over the North Atlantic, the anomaly pattern projected onto the strong negative phase of the North Atlantic Oscillation (NAO, –1.7), which is also clearly depicted by the corresponding Sea-Level Pressure (SLP) and Anomaly Map (**Figure 2**).

During June, the 500-hPa circulation was characterized by above-average heights over the western CONUS, southern Europe, and north-central Asia and below-average heights over the high latitudes of both the North Pacific and North Atlantic (also over northwest Russia) (**Figure 3)**. The corresponding SLP and Anomaly Map emphasize the below-average SLP anomaly that extends from the Norwegian Sea across Scandinavia to northwest Russia (**Figure 4)**.

The Tropics

Sea surface temperatures (SSTs) were near average in the central equatorial Pacific and above average in the eastern Pacific during May, which reversed sign in June. The monthly Niño index values for the Niño 3.4 region was +0.5C (May) and +0.6C (June). The depth of the oceanic thermocline (measured by the depth of the 20C isotherm) and subsurface temperatures were close to long-term averages over the central and eastern Pacific during the 2-month period. Equatorial low-level and upper-level winds were also near average across most of the Pacific basin. Tropical convection was suppressed over the central equatorial Pacific and enhanced across the western equatorial Pacific. Collectively, these oceanic and atmospheric anomalies reflect ENSO-neutral conditions.

Two tropical storms formed over the Atlantic basin during this time, both in June. The first one, Bret, formed about 200 km southeast of Trinidad near the Venezuelan coast and tracked briefly into the southeastern Caribbean Sea, before falling apart due to sufficient southerly wind shear. The second storm, Cindy, formed over the Gulf of Mexico and made landfall a short time later in southwestern Louisiana, hampered by dry-air entrainment and moderate-to-strong wind shear. Cindy's peak sustained winds reached 50 kts.

July–August 2017

The July circulation pattern featured above-average 500-hPa heights over the high latitudes of the North Pacific, the western CONUS, and central Asia (**Figure 5**). Below-average heights were noted over the polar region, the Gulf of Alaska, and over Scandinavia. The SLP and Anomaly Map generally reflected the midtropospheric height-anomaly pattern (**Figure 6**).

The mean 500-hPa circulation during August 2017 was characterized by above-average heights over the central North Pacific, eastern Siberia, the western CONUS, northern Canada, much of Europe, and western Russia (**Figure 7**). Below-average heights were observed across the Gulf of Alaska, the north-central CONUS, northwestern Europe, the polar region, and northern Japan. The SLP and Anomaly Map generally mirrored the midtropospheric pattern (**Figure 8**).

The Tropics

SSTs remained near-average across most of the equatorial Pacific during the July–August period. The monthly Nino indices for the Niño 3.4 region dropped noticeably from +0.4C (July) to -0.2C (August). The depth of the oceanic thermocline was near average in the central and eastern Pacific (July) and below average in the eastern Pacific (August). Corresponding subsurface temperatures were 0–1C above average in July, becoming 1–2C below average in August. Low-level trade winds were enhanced over the western equatorial Pacific, and upper-level winds were close to long-term averages during both months. Deep convective cloudiness and thunderstorm activity were enhanced over the western Pacific and Maritime Continent in July. During August, enhanced convection

was noted over the Maritime Continent and suppressed over the western and central equatorial Pacific. Collectively, these oceanic and atmospheric anomalies reflect ENSO-neutral conditions, trending more towards what is typically associated with a cold event (La Niña), rather than a warm event (El Niño).

The tropics were active over the western North Pacific, the eastern North Pacific, and the Atlantic basins. The most notable tropical cyclone in the Western Hemisphere during this time was Hurricane Harvey, which developed on 17 August and became the first major hurricane (category 3 or greater) to make landfall in the U.S. since Wilma in 2005. Harvey moved across the Windward Islands, the Caribbean Sea, the Yucatan Peninsula, the Bay of Campeche, and eventually into Texas and Louisiana over nearly a 2-week period. Soon after rapid intensification to a category-4 hurricane over the Bay of Campeche on 25 August, Harvey brought an unprecedented amount of rain (1.0–1.3 meters) and flooding to portions of eastern Texas. After meandering near the Texas Coast for 3–4 days, Harvey made its third and final landfall in Louisiana on 29 August before becoming extratropical. Highest sustained winds with Harvey were 115 kts, and minimum central pressure was 938-hPa (**Reference 1**).

References:

1. http://weather.unisys.com/hurricane/atlantic/2017/

Much of the information used in this article originates from the Climate Diagnostics Bulletin archive.

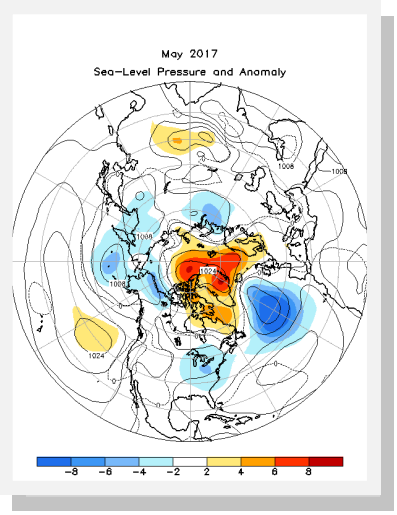


Figure 2. Northern Hemisphere mean and anomalous sea-level pressure (CDAS/Reanalysis). Mean values are denoted by solid contours drawn at an interval of 4 hPa. The anomaly contour interval is indicated by shading. Anomalies are calculated as departures from the 1981–2010 base-period monthly means.

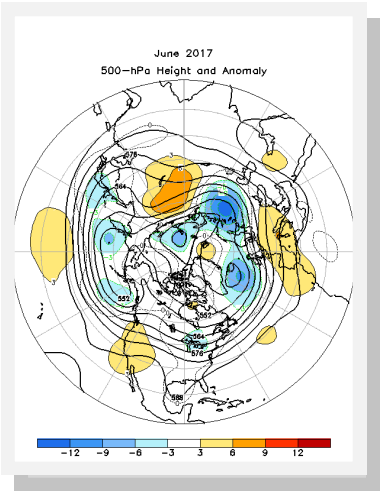


Figure 3. Northern Hemisphere mean and anomalous 500-hPa geopotential height (CDAS/Reanalysis). Mean heights are denoted by solid contours drawn at an interval of 6 dam. The anomaly-contour interval is indicated by shading.

Anomalies are calculated as departures from the 1981–2010 base period monthly means.

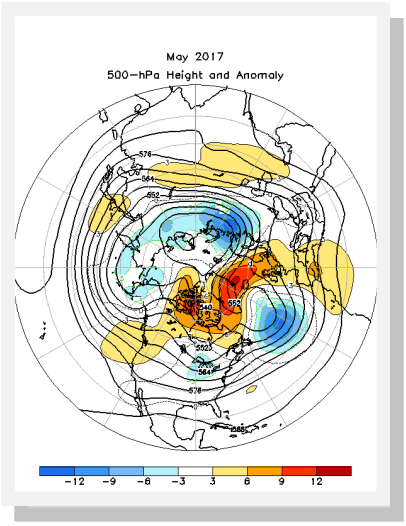


Figure 1. Northern Hemisphere mean and anomalous 500-hPa geopotential height (CDAS/Reanalysis). Mean heights are denoted by solid contours drawn at an interval of 6 dam. The anomaly-contour interval is indicated by shading.

Anomalies are calculated as departures from the 1981–2010 base period monthly means.

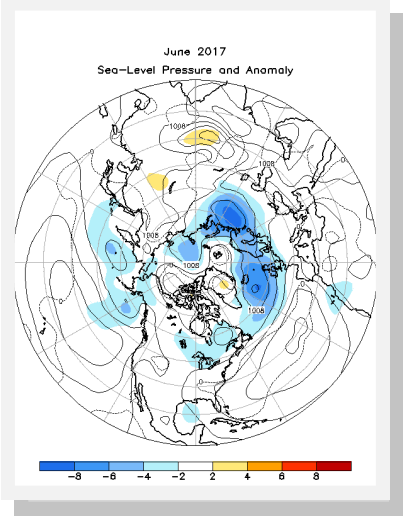


Figure 4. Northern Hemisphere mean and anomalous sea-level pressure (CDAS/Reanalysis). Mean values are denoted by solid contours drawn at an interval of 4 hPa. The anomaly contour interval is indicated by shading. Anomalies are calculated as departures from the 1981–2010 base-period monthly means.

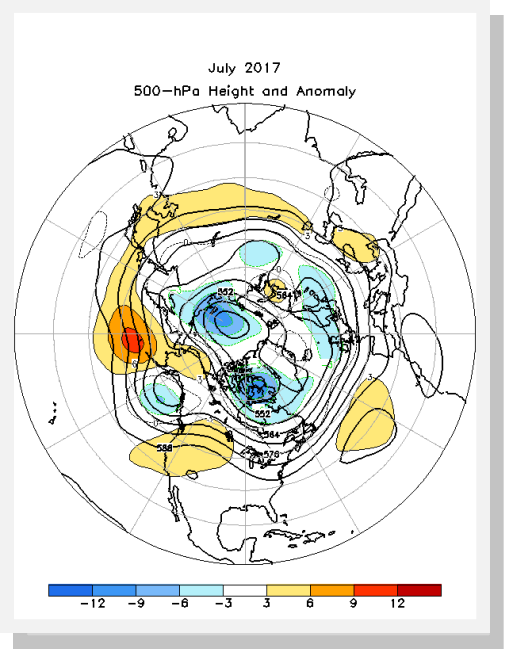


Figure 5. Northern Hemisphere mean and anomalous 500-hPa geopotential height (CDAS/Reanalysis). Mean heights are denoted by solid contours drawn at an interval of 6 dam. The anomaly-contour interval is indicated by shading.

Anomalies are calculated as departures from the 1981–2010 base period monthly means.

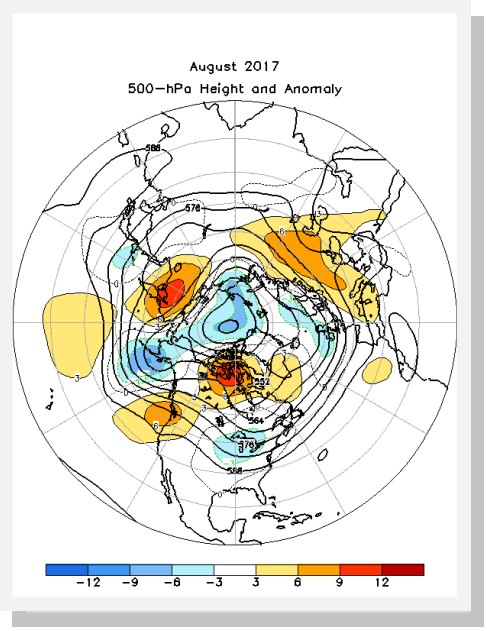


Figure 7. Northern Hemisphere mean and anomalous 500-hPa geopotential height (CDAS/Reanalysis). Mean heights are denoted by solid contours drawn at an interval of 6 dam. The anomaly-contour interval is indicated by shading.

Anomalies are calculated as departures from the 1981–2010 base period monthly means.

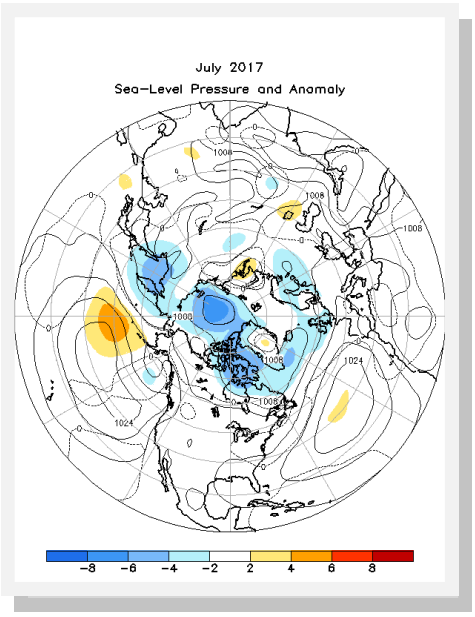


Figure 6. Northern Hemisphere mean and anomalous sea-level pressure (CDAS/Reanalysis). Mean values are denoted by solid contours drawn at an interval of 4 hPa. The anomaly contour interval is indicated by shading. Anomalies are calculated as departures from the 1981–2010 base-period monthly means.

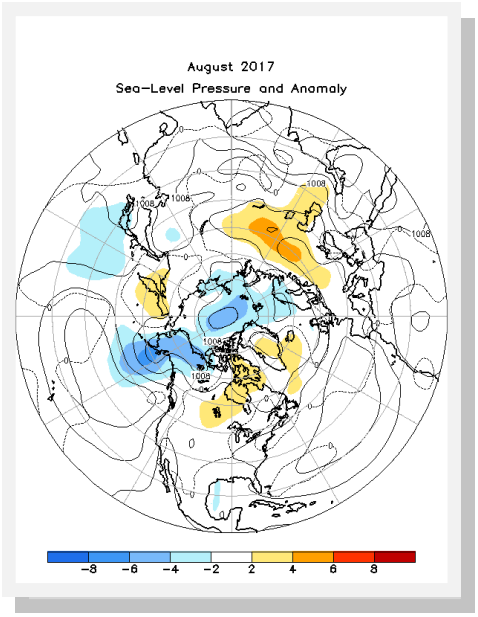


Figure 8. Northern Hemisphere mean and anomalous sea-level pressure (CDAS/Reanalysis). Mean values are denoted by solid contours drawn at an interval of 4 hPa. The anomaly contour interval is indicated by shading. Anomalies are calculated as departures from the 1981–2010 base-period monthly means.

Wind-Wave Relation during Hurricane Harvey in 2017

Professor S. A. Hsu, Louisiana State University

From 00 UTC on 23– 31 August 2017, when Hurricane Harvey was over the western Gulf of Mexico and adjacent coastal regions, the National Data Buoy Center (NDBC) maintained 3 data buoys, namely, 42019, 42020, and 42035, on the continental shelf off the Texas coast (see www.ndbc.noaa.gov). The purpose of this brief report is to present the relation between wind speed at 5 m, U5, and its gust, U_{gust}, measurements, as well as to investigate the relation between the wind speed at 10 m, U10, and wave parameters including significant wave height, H_s, and peak or dominant wave period, T_p.

Figure 1 shows the relation between the wind speed at 5 m and its gust. This relation is used to adjust the measured U5 to U10 according to those formulas provided in the April 2017 issue of this journal by the author.

$$P = 0.5\ (G - 1) = 0.5\ (1.22 - 1) = 0.11, \qquad (1)$$

With a correlation coefficient, R = 0.99, and

$$U10 = U5\ (10/5)^{0.11} = 1.1\ U5. \qquad (2)$$

Figure 2 indicates that

$$U10 = 36\ H_s/T_p. \qquad (3)$$

Because Equation (3) is the same as Equation (8b) as presented by the Author in the April 2017 issue of this journal during Hurricane Matthew in 2016 over the Caribbean Sea, Equation (3) is thus recommended for operational use if one accepts the high correlation coefficient, R = 0.87.

Acknowledgment: Appreciation goes to the NDBC for providing the datasets used in this research note.

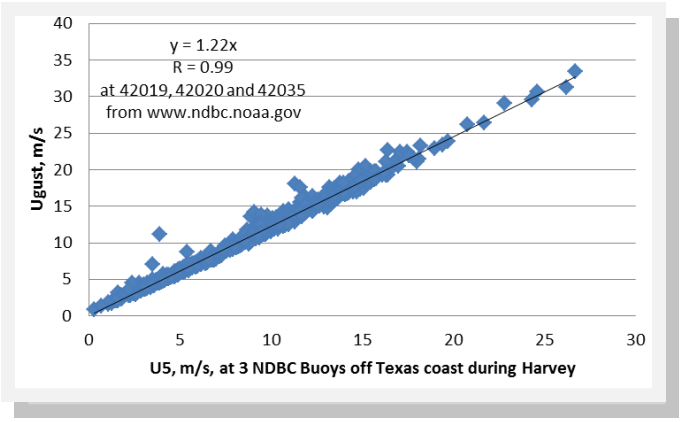


Figure 1. Relation between wind gust and sustained wind speed at 3 NDBC Buoys off the Texas coast during Hurricane Harvey.

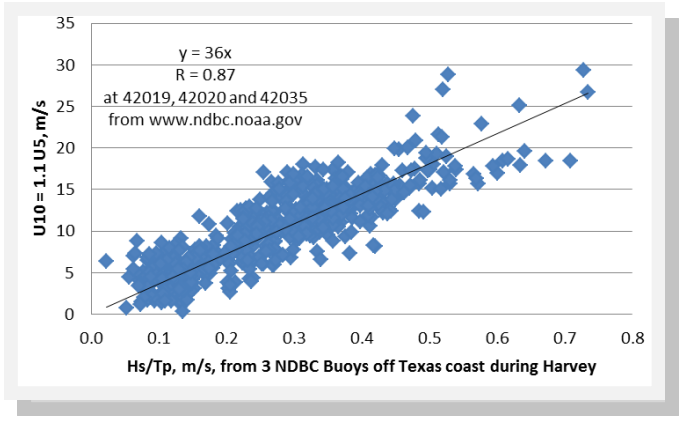


Figure 2. Relation between U10 and H_s/T_p at 3 NDBC Buoys off the Texas coast during Hurricane Harvey.

Storm Surge Measurements at Naples, Florida, during Hurricane Irma in 2017

Professor S. A. Hsu, Louisiana State University

Storm surge is an abnormal rise in water level above the astronomical tides (see, e.g., Hsu, 2013). This topic is important to marine meteorologists as well as oceanographers, coastal geologists, city planners, and emergency managers. According to the National Hurricane Center (see http://www.nhc.noaa.gov/archive/2017/al11/al112017.update.09101941.shtml?), the center of Hurricane Irma made landfall near Naples, Florida, at 3:35 pm LST on 10 September 2017, as a Category-3 hurricane. Analyses of meteorological and water-level measurements made by the National Ocean Service (https://tidesandcurrents.noaa.gov/stationhome.html?id=8725110) at Naples (see also http://www.ndbc.noaa.gov/station_page.php?station=npsf1) appear in **Figures 1–4**. **Figure 1** shows that there were nearly 70-mb drop in barometric pressure (from 1010 to 940 mb) during a period of 40 hours, resulting that wind speeds increased from 5 to 29 kts and gusts from 6 to 37 m/s (**Figure 2**). **Figure 3** indicates that before the arrival of Irma's eye; wind direction was persistently easterly, and after its passage, westerly winds prevailed.

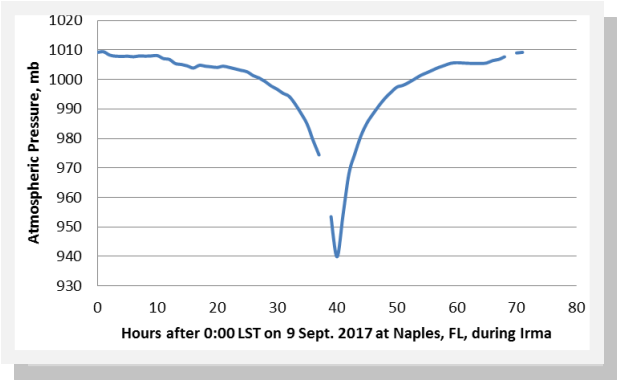


Figure 1: Atmospheric pressure dropped from approximately 1010 to 940 mb in 40 hours (hour 40 is for 16:00 LST on 10 September 2017) at Naples, Florida, during the passage of Irma.

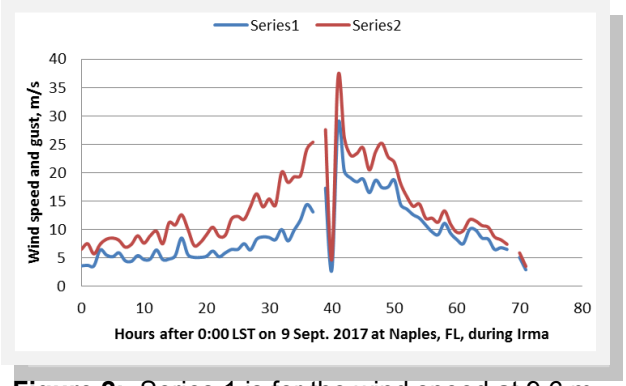


Figure 2: Series 1 is for the wind speed at 9.6 m above mean sea level, and Series 2 is for the wind gust at Naples during Irma.

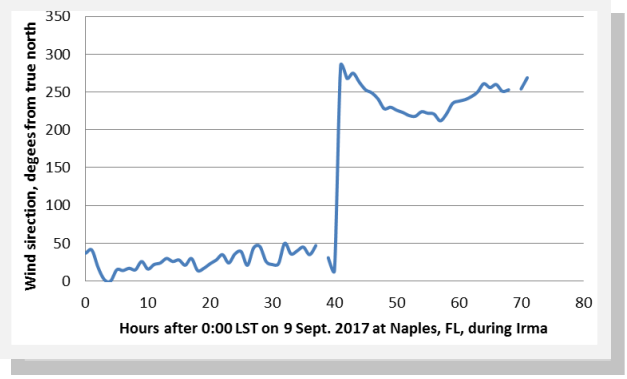


Figure 3: Wind direction for Irma at Naples during the passage of Irma.

Figure 4 presents characteristics of storm surge, depicting negative surge that prevailed when the wind blew from land to the sea, whereas positive surge occurred when the wind direction switched from sea to land. Detailed analyses of the 6-minute water-level data reveal that it changed from negative 0.856 m at 10:06 to positive 2.168 m at 18:06 LST on the 10th. An approximately 3-m (or 10-foot) storm surge occurred during an 8- hour period. Since the average wind speed between 17:00 and 18:00 from the west was 24.5 m/s, the storm surge is also estimated to be 3 m using $S = 0.005\ V^2$ following Hsu (2013), where S is the storm surge in meters and V is the wind speed in m/ s. The conclusion is that the storm surge as measured at Naples, Florida, during Hurricane Irma in 2017, can be explained physically by the wind-stress forcing.

Reference:
Hsu, S. A. (2013) Storm surge in New York during Hurricane Sandy in 2012: a verification of the wind-stress relation. *Boundary-Layer Meteorology* **148,** 593-598.
Acknowledgments: Datasets provided by the National Ocean Service and the National Data Buoy Center are greatly appreciated.

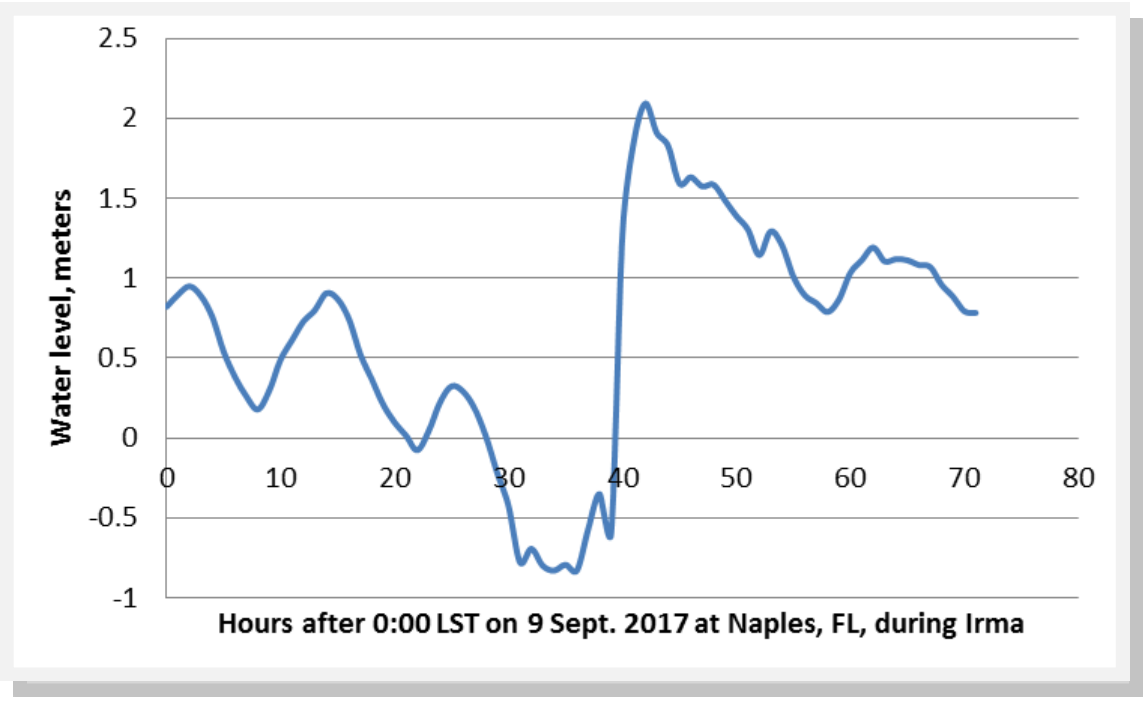


Figure 4: Characteristics of water-level change at Naples during the passage of Irma.

VOS Program Cooperative Ship Report:

January 1, 2017, through September 30, 2017

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
ADRIAN MAERSK	OXLD2	I	New York City	4	1	0	2	0	0	0	0	0	7
ADVENTURE OF THE SEAS	C6SA3	A	Miami	0	74	62	58	14	0	0	0	0	208
ALASKA MARINER	WSM5364	A	Anchorage	12	0	12	0	0	19	16	24	5	88
ALASKA TITAN	WDE4789	A	Anchorage	19	12	14	26	6	8	26	8	5	124
ALASKAN EXPLORER	WDB9918	A	Anchorage	15	34	20	18	21	21	64	9	13	215
ALASKAN FRONTIER	WDB7815	A	Anchorage	5	0	0	0	17	21	0	2	0	45
ALASKAN LEADER	WDB7198	A	Anchorage	0	3	1	0	1	0	0	0	0	5
ALASKAN LEGEND	WDD2074	A	Anchorage	64	59	147	63	126	75	17	2	0	553
ALASKAN NAVIGATOR	WDC6644	A	Anchorage	124	24	24	32	67	181	183	89	28	752
ALBANY SOUND	VRXM4	A	Anchorage	2	7	1	2	5	0	15	17	14	63
ALBERT MAERSK	OUOW2	I	New York City	0	0	0	0	0	0	0	0	0	0
ALERT	WCZ7335	A	Anchorage	2	0	9	6	2	1	2	0	2	24
ALGOLAKE	VCPX	A	Duluth	16	0	3	41	26	10	13	25	32	166
ALGOMA DISCOVERY	CFK9796	A	Duluth	0	0	0	0	28	43	39	20	9	139
ALGOMA GUARDIAN	CFK9698	A	Duluth	0	0	0	31	43	48	71	3	13	209
ALGOMA MARINER	CFN5517	A	Duluth	14	0	2	3	32	14	1	18	12	96
ALGOMA SPIRIT	CFN4309	A	Duluth	0	0	0	0	78	51	60	92	99	380
ALGOWAY	VDFP	A	Duluth	0	0	0	0	2	7	6	6	9	30
ALLIANCE FAIRFAX	WLMQ	A	Jacksonville	51	17	56	33	46	18	31	30	32	314
ALLIANCE NORFOLK	WGAH	A	Jacksonville	0	0	0	18	1	22	20	0	7	68
ALLIANCE ST LOUIS	WGAE	A	Charleston	0	0	29	24	42	7	0	12	24	138
ALLURE OF THE SEAS	C6XS8	A	Miami	55	30	17	12	36	29	29	34	28	270
ALPENA	WAV4647	A	Duluth	14	0	0	9	30	35	45	25	60	218
AM GHENT	A8ZA8	A	Anchorage	145	347	597	596	626	432	7	0	0	2750
AMERICAN CENTURY	WDD2876	A	Duluth	26	0	42	190	237	306	265	187	130	1383
AMERICAN INTEGRITY	WDD2875	A	Duluth	13	0	0	5	6	0	18	10	0	52
AMERICAN MARINER	WQZ7791	A	Duluth	10	0	5	109	75	23	129	60	20	431
AMERICAN NO. 1	WCD7842	A	Anchorage	0	0	0	0	4	0	3	1	15	23
AMERICAN SPIRIT	WCX2417	A	Duluth	0	0	6	59	35	5	43	46	57	251
AMSTERDAM	PBAD	A	Anchorage	165	170	146	166	166	88	129	120	140	1290
ANDROMEDA VOYAGER	C6FZ6	A	Anchorage	55	43	63	5	2	18	16	0	3	205
ANTWERPEN	VRBK6	A	Anchorage	40	15	20	10	3	0	0	0	0	88
APL BELGIUM	WDG8555	A	Los Angeles	38	33	39	20	31	21	18	15	16	231
APL CHINA	WDB3161	A	Los Angeles	141	132	213	210	219	31	103	135	199	1383
APL ESPLANADE	S6LT4	A	Los Angeles	0	0	0	0	0	0	0	27	42	69
APL GUAM	WAPU	A	Anchorage	52	63	50	31	34	34	32	32	18	346
APL HOLLAND	9VKQ2	A	Charleston	0	0	0	0	0	17	10	28	7	62
APL HOUSTON	9V9921	A	Los Angeles	19	19	19	23	2	1	0	0	1	84
APL KOREA	WCX8883	A	Los Angeles	90	62	50	42	36	50	35	74	67	506
APL MEXICO CITY	9V9926	A	Norfolk	3	4	3	4	1	0	0	0	1	16
APL PHILIPPINES	WCX8884	A	Los Angeles	23	49	30	63	57	44	40	43	42	391

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
APL SAIPAN	WDJ2573	A	Anchorage	0	6	40	53	55	83	107	74	67	485
APL SAVANNAH	9V9919	A	New Orleans	1	1	0	9	19	6	3	6	0	45
APL SINGAPORE	WCX8812	A	Los Angeles	61	61	62	49	124	18	7	7	6	395
APL THAILAND	WCX8882	A	Los Angeles	181	52	169	70	95	105	286	280	310	1548
APPALOOSA	V7CH8	A	New Orleans	1	0	3	0	0	0	32	0	0	36
AQUARIUS VOYAGER	C6UC3	A	Jacksonville	87	30	24	40	55	45	56	79	49	465
ARCTIC BEAR	WBP3396	A	Anchorage	0	0	0	1	8	0	0	0	0	9
ARCTIC TITAN	WDG2803	A	Anchorage	19	13	16	7	17	6	20	15	16	129
ARCTURUS VOYAGER	C6YA7	A	Anchorage	75	80	78	58	132	143	43	9	31	649
ARI CRUZ	WDG9588	A	Anchorage	0	0	0	0	0	0	1	0	3	4
ARIES VOYAGER	C6UK7	A	Anchorage	75	33	27	32	34	28	35	50	14	328
ARNOLD MAERSK	OXES2	A	New Orleans	77	84	23	25	9	1	0	0	0	219
ASIA ENERGY	C6AX4	A	Anchorage	64	91	61	16	33	36	81	129	275	786
ASKLIPIOS	D5NX3	A	New York City	0	0	0	0	0	0	0	0	2	2
ATLANTIC BRAVE	D5LQ8	A	New Orleans	66	11	17	33	14	13	26	3	59	242
ATLANTIC BREEZE	VRDC6	A	Anchorage	0	0	0	0	0	0	0	14	0	14
ATLANTIC CARTIER	SCKB	A	Norfolk	2	0	4	4	7	0	0	0	0	17
ATLANTIC EXPLORER (AWS)	WDC9417	A	Anchorage	0	0	0	0	0	0	78	165	24	267
ATLANTIC FRONTIER	VRDJ7	A	Anchorage	0	0	0	97	85	14	0	0	0	196
ATLANTIC GEMINI	VRDO9	A	Anchorage	18	9	1	0	1	0	0	0	0	29
ATLANTIC GRACE	VRDT7	A	Anchorage	0	0	0	1	0	0	0	0	0	1
ATLANTIC HURON	VCQN	A	Duluth	0	0	16	49	40	43	51	5	11	215
ATLANTIS (AWS)	KAQP	A	Anchorage	730	660	735	715	737	683	0	35	697	4992
ATTENTIVE	WCZ7337	A	Anchorage	1	0	0	1	3	0	6	0	0	11
AURORA	WYM9567	A	Anchorage	28	2	4	146	175	150	136	45	51	737
AVIK	WDB7888	A	Anchorage	0	0	0	0	6	13	9	3	6	37
AWARE	WCZ7336	A	Anchorage	3	0	2	5	3	0	4	2	0	19
APL SAIPAN	WDJ2573	A	Anchorage	0	6	40	53	55	83	107	74	67	485
APL SAVANNAH	9V9919	A	New Orleans	1	1	0	9	19	6	3	6	0	45
APL SINGAPORE	WCX8812	A	Los Angeles	61	61	62	49	124	18	7	7	6	395
APL THAILAND	WCX8882	A	Los Angeles	181	52	169	70	95	105	286	280	310	1548
APPALOOSA	V7CH8	A	New Orleans	1	0	3	0	0	0	32	0	0	36
AQUARIUS VOYAGER	C6UC3	A	Jacksonville	87	30	24	40	55	45	56	79	49	465
ARCTIC BEAR	WBP3396	A	Anchorage	0	0	0	1	8	0	0	0	0	9
ARCTIC TITAN	WDG2803	A	Anchorage	19	13	16	7	17	6	20	15	16	129
ARCTURUS VOYAGER	C6YA7	A	Anchorage	75	80	78	58	132	143	43	9	31	649
ARI CRUZ	WDG9588	A	Anchorage	0	0	0	0	0	0	1	0	3	4
ARIES VOYAGER	C6UK7	A	Anchorage	75	33	27	32	34	28	35	50	14	328
ARNOLD MAERSK	OXES2	A	New Orleans	77	84	23	25	9	1	0	0	0	219
ASIA ENERGY	C6AX4	A	Anchorage	64	91	61	16	33	36	81	129	275	786
ASKLIPIOS	D5NX3	A	New York City	0	0	0	0	0	0	0	0	2	2

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
AYESHA	V7LC9	A	Baltimore	39	13	0	0	0	0	0	0	0	52
AZAMARA JOURNEY	9HOB8	A	Anchorage	0	0	0	0	0	0	0	15	44	59
BADGER	WBD4889	A	Duluth	0	0	0	0	28	92	116	74	28	338
BAIE ST. PAUL	CFN6120	A	Duluth	0	0	0	0	0	0	0	0	13	13
BALTIC COUGAR	V7AA2	A	Anchorage	0	0	0	2	0	0	0	0	0	2
BARRINGTON ISLAND	C6QK	A	Miami	12	12	27	19	25	27	38	18	14	192
BERGE NANTONG	VRBU6	A	Anchorage	11	2	35	3	58	72	48	61	8	298
BERGE NINGBO	VRBQ2	A	Anchorage	0	0	42	55	13	33	13	0	0	156
BERING LEADER	WDC7227	I	Anchorage	0	6	12	1	0	0	0	0	0	19
BERING TITAN	WDI6469	A	Anchorage	16	26	9	13	15	22	17	20	19	157
BERLIAN EKUATOR	HPYK	A	Anchorage	1	5	0	0	4	2	0	1	0	13
BILBAO BRIDGE	VRHY6	I	New York City	0	0	0	0	0	0	0	0	0	0
BISMARCK SEA	WDE5016	A	Anchorage	4	5	4	12	0	0	0	0	0	25
BLUEFIN	WDC7379	A	Seattle	53	85	86	67	19	82	50	96	75	613
BRILLIANCE OF THE SEAS	C6SJ5	A	Miami	37	8	2	28	36	54	58	39	31	293
BROTONNE BRIDGE	VRHO2	A	New York City	0	0	0	30	7	22	1	70	43	173
BUDAPEST BRIDGE	VRIZ5	A	New York City	0	0	0	0	0	0	0	9	8	17
BURNS HARBOR	WDC6027	A	Duluth	0	0	11	43	40	19	23	47	35	218
CAFER DEDE	V7PR8	A	New York City	0	0	13	42	18	14	1	4	0	92
CALIFORNIA VOYAGER	WDE5381	A	New Orleans	19	20	37	26	6	15	1	0	0	124
CALUMET	WDE3568	A	Duluth	141	0	0	4	14	12	38	70	24	303
CAPE MORETON	VRGG6	A	Anchorage	0	26	26	0	32	11	0	0	32	127
CAPRICORN VOYAGER	C6UZ5	A	Anchorage	3	0	30	44	78	31	16	5	20	227
CAPT. HENRY JACKMAN	VCTV	A	Duluth	0	0	2	1	2	12	2	0	23	42
CARNIVAL BREEZE	3FZO8	A	Houston	19	43	33	16	30	43	18	13	22	237
CARNIVAL CONQUEST	3FPQ9	A	Miami	91	93	66	88	60	71	46	58	72	645
CARNIVAL DREAM	3ETA7	A	New Orleans	15	67	139	124	17	41	13	3	45	464
AYESHA	V7LC9	A	Baltimore	39	13	0	0	0	0	0	0	0	52
AZAMARA JOURNEY	9HOB8	A	Anchorage	0	0	0	0	0	0	0	15	44	59
BADGER	WBD4889	A	Duluth	0	0	0	0	28	92	116	74	28	338
BAIE ST. PAUL	CFN6120	A	Duluth	0	0	0	0	0	0	0	0	13	13
BALTIC COUGAR	V7AA2	A	Anchorage	0	0	0	2	0	0	0	0	0	2
BARRINGTON ISLAND	C6QK	A	Miami	12	12	27	19	25	27	38	18	14	192
BERGE NANTONG	VRBU6	A	Anchorage	11	2	35	3	58	72	48	61	8	298
BERGE NINGBO	VRBQ2	A	Anchorage	0	0	42	55	13	33	13	0	0	156
BERING LEADER	WDC7227	I	Anchorage	0	6	12	1	0	0	0	0	0	19
BERING TITAN	WDI6469	A	Anchorage	16	26	9	13	15	22	17	20	19	157
BERLIAN EKUATOR	HPYK	A	Anchorage	1	5	0	0	4	2	0	1	0	13
BILBAO BRIDGE	VRHY6	I	New York City	0	0	0	0	0	0	0	0	0	0
BISMARCK SEA	WDE5016	A	Anchorage	4	5	4	12	0	0	0	0	0	25
BLUEFIN	WDC7379	A	Seattle	53	85	86	67	19	82	50	96	75	613

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
CARNIVAL ECSTASY	H3GR	A	Miami	6	10	111	93	110	100	88	58	108	684
CARNIVAL ELATION	3FOC5	A	Jacksonville	33	9	16	0	0	1	1	1	0	61
CARNIVAL FANTASY	H3GS	A	New Orleans	4	1	23	10	32	31	42	90	98	331
CARNIVAL FASCINATION	C6FM9	A	Jacksonville	12	1	6	1	26	10	83	48	117	304
CARNIVAL FREEDOM	3EBL5	A	Houston	80	72	76	74	82	111	82	62	61	700
CARNIVAL GLORY	3FPS9	A	Miami	49	66	29	37	14	4	0	45	77	321
CARNIVAL IMAGINATION	C6FN2	A	Los Angeles	61	42	24	6	0	0	0	24	53	210
CARNIVAL INSPIRATION	C6FM5	A	Los Angeles	26	54	0	1	63	69	45	29	10	297
CARNIVAL LEGEND	9HA3667	A	Miami	178	231	295	363	209	78	188	106	87	1735
CARNIVAL LIBERTY	HPYE	A	Jacksonville	7	12	15	24	13	21	47	53	121	313
CARNIVAL MAGIC	3ETA8	A	Jacksonville	60	25	35	5	42	45	48	111	86	457
CARNIVAL MIRACLE	H3VS	A	Seattle	41	8	7	6	13	7	10	34	54	180
CARNIVAL PARADISE	3FOB5	A	Miami	7	0	83	59	30	21	8	223	133	564
CARNIVAL PRIDE	H3VU	A	Jacksonville	22	0	10	66	114	107	95	85	78	577
CARNIVAL SENSATION	C6FM8	A	Miami	6	1	9	35	88	78	60	12	99	388
CARNIVAL SPLENDOR	3EUS	A	Anchorage	238	133	53	35	13	22	35	28	31	588
CARNIVAL SUNSHINE	C6FN4	A	Jacksonville	20	0	91	65	44	38	28	57	60	403
CARNIVAL TRIUMPH	C6FN5	A	New Orleans	0	43	2	21	32	19	23	10	24	174
CARNIVAL VALOR	H3VR	A	Houston	0	0	12	24	43	37	10	27	24	177
CARNIVAL VICTORY	3FFL8	A	Miami	42	23	23	18	20	38	17	20	98	299
CAROLINE MAERSK	OZWA2	A	Seattle	22	0	1	1	45	88	0	11	12	180
CASON J. CALLAWAY	WDH7556	A	Duluth	7	0	12	38	21	36	117	45	13	289
CASTOR VOYAGER	C6UZ6	A	Anchorage	19	87	21	3	0	0	2	15	41	188
CELEBRITY CONSTELLATION	9HJB9	A	Miami	0	61	196	72	58	75	82	108	130	782
CELEBRITY ECLIPSE	9HXC9	A	Miami	135	296	416	426	243	208	247	341	374	2686
CELEBRITY EQUINOX	9HXD9	A	Miami	46	51	165	329	372	450	314	289	257	2273
CARNIVAL ECSTASY	H3GR	A	Miami	6	10	111	93	110	100	88	58	108	684
CARNIVAL ELATION	3FOC5	A	Jacksonville	33	9	16	0	0	1	1	1	0	61
CARNIVAL FANTASY	H3GS	A	New Orleans	4	1	23	10	32	31	42	90	98	331
CARNIVAL FASCINATION	C6FM9	A	Jacksonville	12	1	6	1	26	10	83	48	117	304
CARNIVAL FREEDOM	3EBL5	A	Houston	80	72	76	74	82	111	82	62	61	700
CARNIVAL GLORY	3FPS9	A	Miami	49	66	29	37	14	4	0	45	77	321
CARNIVAL IMAGINATION	C6FN2	A	Los Angeles	61	42	24	6	0	0	0	24	53	210
CARNIVAL INSPIRATION	C6FM5	A	Los Angeles	26	54	0	1	63	69	45	29	10	297
CARNIVAL LEGEND	9HA3667	A	Miami	178	231	295	363	209	78	188	106	87	1735
CARNIVAL LIBERTY	HPYE	A	Jacksonville	7	12	15	24	13	21	47	53	121	313
CARNIVAL MAGIC	3ETA8	A	Jacksonville	60	25	35	5	42	45	48	111	86	457
CARNIVAL MIRACLE	H3VS	A	Seattle	41	8	7	6	13	7	10	34	54	180
CARNIVAL PARADISE	3FOB5	A	Miami	7	0	83	59	30	21	8	223	133	564
CARNIVAL PRIDE	H3VU	A	Jacksonville	22	0	10	66	114	107	95	85	78	577
CARNIVAL SENSATION	C6FM8	A	Miami	6	1	9	35	88	78	60	12	99	388

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
CELEBRITY MILLENNIUM	9HJF9	A	Anchorage	213	116	72	91	137	123	138	147	102	1139
CELEBRITY REFLECTION	9HA3047	A	Miami	117	97	132	173	163	151	166	182	174	1355
CELEBRITY SILHOUETTE	9HA2583	A	Miami	32	180	258	271	205	94	65	72	183	1360
CELEBRITY SOLSTICE	9HRJ9	A	Seattle	54	34	99	108	66	278	195	105	160	1099
CELEBRITY SUMMIT	9HJC9	A	Miami	10	172	77	64	108	81	79	67	61	719
CHARLES ISLAND	C6JT	A	Miami	19	14	21	30	16	0	11	0	0	111
CHARLESTON EXPRESS	WDD6126	A	Houston	76	68	28	15	39	72	91	61	70	520
CHUKCHI SEA	WDE2281	A	Anchorage	1	0	2	5	2	5	8	6	2	31
CLIPPER TRITON	3FSC3	A	Anchorage	0	0	0	0	0	0	66	12	0	78
CLYDE S. VANENKEVORT	WDJ4194	A	Duluth	0	0	0	0	0	0	2	1	1	4
CMB PAULE	VRJF3	A	New Orleans	0	0	0	14	4	7	3	0	0	28
COASTAL NAVIGATOR	WCY9686	A	Seattle	0	0	2	0	1	3	6	5	2	19
COASTAL NOMAD	WDC6439	A	Anchorage	8	6	9	5	8	8	6	13	7	70
COASTAL PROGRESS	WDC6363	A	Anchorage	16	4	11	6	9	8	14	9	4	81
COASTAL TRADER	WSL8560	A	Anchorage	0	8	9	11	4	0	1	12	0	45
COASTAL VENTURE	WDF3647	A	Charleston	0	0	0	0	0	0	0	0	0	0
COLUMBINE MAERSK	OUHC2	A	Norfolk	13	0	0	0	8	23	0	0	0	44
CORNELIA MAERSK	OWWS2	A	New York City	0	0	0	0	2	10	0	45	7	64
CORWITH CRAMER	WTF3319	A	Anchorage	0	0	0	5	4	0	0	0	0	9
COSCO DEVELOPMENT	VRIZ9	A	Anchorage	45	38	21	23	54	69	36	111	69	466
COSCO EXCELLENCE	VRJT8	A	Anchorage	38	46	56	62	35	0	0	26	44	307
COSCO FAITH	VRJL6	A	Anchorage	68	55	35	34	40	9	7	2	27	277
COSCO FORTUNE	VRKE9	A	Anchorage	50	56	69	29	11	2	12	22	1	252
COSCO INDONESIA	VRHE3	A	New York City	10	24	1	0	11	15	13	2	61	137
COSCO JAPAN	VRFX5	A	New York City	76	55	1	0	0	1	2	12	7	154
COSCO KOREA	VRGH3	A	New York City	112	76	28	22	22	20	19	17	30	346
COSCO MALAYSIA	VRGV9	A	New York City	0	0	13	43	51	111	92	61	83	454
CELEBRITY MILLENNIUM	9HJF9	A	Anchorage	213	116	72	91	137	123	138	147	102	1139
CELEBRITY REFLECTION	9HA3047	A	Miami	117	97	132	173	163	151	166	182	174	1355
CELEBRITY SILHOUETTE	9HA2583	A	Miami	32	180	258	271	205	94	65	72	183	1360
CELEBRITY SOLSTICE	9HRJ9	A	Seattle	54	34	99	108	66	278	195	105	160	1099
CELEBRITY SUMMIT	9HJC9	A	Miami	10	172	77	64	108	81	79	67	61	719
CHARLES ISLAND	C6JT	A	Miami	19	14	21	30	16	0	11	0	0	111
CHARLESTON EXPRESS	WDD6126	A	Houston	76	68	28	15	39	72	91	61	70	520
CHUKCHI SEA	WDE2281	A	Anchorage	1	0	2	5	2	5	8	6	2	31
CLIPPER TRITON	3FSC3	A	Anchorage	0	0	0	0	0	0	66	12	0	78
CLYDE S. VANENKEVORT	WDJ4194	A	Duluth	0	0	0	0	0	0	2	1	1	4
CMB PAULE	VRJF3	A	New Orleans	0	0	0	14	4	7	3	0	0	28
COASTAL NAVIGATOR	WCY9686	A	Seattle	0	0	2	0	1	3	6	5	2	19
COASTAL NOMAD	WDC6439	A	Anchorage	8	6	9	5	8	8	6	13	7	70
COASTAL PROGRESS	WDC6363	A	Anchorage	16	4	11	6	9	8	14	9	4	81

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
COSCO PHILIPPINES	VRGM7	A	New York City	59	52	24	36	38	42	28	31	108	418
COSCO PRINCE RUPERT	VRID6	A	New York City	11	40	21	7	63	50	39	60	45	336
COSCO THAILAND	VRHM2	A	Anchorage	74	68	25	25	10	25	19	9	7	262
COSCO VIETNAM	VRID5	A	New York City	0	0	0	25	46	42	37	15	21	186
COSTA FORTUNA	IBNY	A	Miami	42	0	0	0	0	0	217	166	50	475
CROSS POINT	WDA3423	A	Anchorage	0	0	0	4	1	0	5	2	2	14
CRYSTAL MARINE	9VIC4	A	Anchorage	0	0	0	0	82	142	140	31	19	414
CRYSTAL SERENITY	C6SY3	A	Anchorage	83	61	86	83	100	60	115	341	221	1150
CRYSTAL SUNRISE	9V2024	A	Anchorage	61	58	22	7	19	33	0	0	0	200
CS GLOBAL SENTINEL	KGSU	A	Seattle	26	62	50	14	0	3	2	0	0	157
CS RELIANCE	V7CZ2	A	Baltimore	10	9	0	4	3	7	0	0	0	33
CSCL AFRICA	VRBI3	A	New York City	0	7	26	14	0	0	6	6	28	87
CSCL BRISBANE	VRBJ9	A	Anchorage	0	0	0	0	0	0	0	448	687	1135
CSCL MANZANILLO	VRFO2	A	Anchorage	0	0	0	0	0	0	0	69	29	98
CSCL MELBOURNE	VRBI8	A	Anchorage	0	0	26	7	9	0	0	0	0	42
CSCL OCEANIA	VRBI2	A	New York City	52	34	23	16	9	43	104	94	76	451
CSCL ZEEBRUGGE	VRCS2	A	Anchorage	0	0	0	0	0	0	0	5	40	45
CSL ASSINIBOINE	VCKQ	A	Duluth	0	0	0	0	0	0	0	36	1	37
CSL LAURENTIEN	VCJW	A	Duluth	0	0	0	10	12	0	30	23	5	80
CSL NIAGARA	VCGJ	A	Duluth	0	0	0	0	0	0	0	0	18	18
CSL ST-LAURENT	CFK5152	A	Duluth	0	0	0	0	0	0	1	0	20	21
DARYA MA	VRJH5	A	Anchorage	0	0	0	1	12	0	0	0	0	13
DEEPWATER PONTUS	V7BE5	A	Houston	0	0	0	0	0	0	0	31	4	35
DEPENDABLE	V7DI6	A	Baltimore	0	0	1	13	24	74	58	24	9	203
DIANE H	WUR7250	A	Anchorage	0	0	0	0	0	2	1	2	5	10
DISCOVERER CLEAR LEADER	V7MO2	A	Houston	111	59	123	120	123	119	124	124	118	1021
DISCOVERER INSPIRATION	V7MO3	A	Houston	3	3	5	3	0	0	17	5	0	36
COSCO PHILIPPINES	VRGM7	A	New York City	59	52	24	36	38	42	28	31	108	418
COSCO PRINCE RUPERT	VRID6	A	New York City	11	40	21	7	63	50	39	60	45	336
COSCO THAILAND	VRHM2	A	Anchorage	74	68	25	25	10	25	19	9	7	262
COSCO VIETNAM	VRID5	A	New York City	0	0	0	25	46	42	37	15	21	186
COSTA FORTUNA	IBNY	A	Miami	42	0	0	0	0	0	217	166	50	475
CROSS POINT	WDA3423	A	Anchorage	0	0	0	4	1	0	5	2	2	14
CRYSTAL MARINE	9VIC4	A	Anchorage	0	0	0	0	82	142	140	31	19	414
CRYSTAL SERENITY	C6SY3	A	Anchorage	83	61	86	83	100	60	115	341	221	1150
CRYSTAL SUNRISE	9V2024	A	Anchorage	61	58	22	7	19	33	0	0	0	200
CS GLOBAL SENTINEL	KGSU	A	Seattle	26	62	50	14	0	3	2	0	0	157
CS RELIANCE	V7CZ2	A	Baltimore	10	9	0	4	3	7	0	0	0	33
CSCL AFRICA	VRBI3	A	New York City	0	7	26	14	0	0	6	6	28	87
CSCL BRISBANE	VRBJ9	A	Anchorage	0	0	0	0	0	0	0	448	687	1135
CSCL MANZANILLO	VRFO2	A	Anchorage	0	0	0	0	0	0	0	69	29	98

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
DISNEY DREAM	C6YR6	A	Jacksonville	48	62	78	59	40	54	119	16	58	534
DISNEY FANTASY	C6ZL6	A	Jacksonville	0	7	1	1	0	6	55	48	8	126
DISNEY MAGIC	C6PT7	A	Jacksonville	3	30	4	5	1	0	0	0	0	43
DISNEY WONDER	C6QM8	A	Miami	119	69	48	31	75	25	22	0	108	497
DOMINATOR	WBZ4106	A	Anchorage	23	56	35	0	0	22	77	18	0	231
DREW FOSS	WYL5718	A	Anchorage	0	0	0	0	0	11	17	2	2	32
DUNCAN ISLAND	C6JS	A	Miami	27	19	21	22	23	14	5	10	43	184
EAGLE ATLANTA	S6TE	A	Houston	0	0	42	61	221	43	0	0	70	437
EAGLE STAVANGER	3FNZ5	A	Houston	0	0	0	0	0	9	99	152	121	381
EAGLE SYDNEY	3FUU	A	New Orleans	0	0	44	11	11	82	38	12	15	213
EAGLE TAMPA	S6NK6	A	Houston	0	82	77	205	209	39	42	42	27	723
EAGLE TUCSON	S6NK5	A	Houston	0	0	0	19	28	24	30	14	12	127
ECLIPS	V7BP2	I	New York City	0	0	0	3	4	0	0	0	0	7
EDGAR B. SPEER	WDH7562	A	Duluth	1	0	33	137	114	24	143	127	79	658
EDWIN H. GOTT	WDH7558	A	Duluth	84	0	4	112	167	137	214	64	142	924
ELCIE	WDF2656	A	Baltimore	0	0	0	0	0	0	0	0	0	0
EMILIUS	9V2909	A	Anchorage	0	0	0	0	0	0	7	73	109	189
EMPIRE STATE	KKFW	A	New York City	0	0	0	0	111	119	150	66	22	468
EMPRESS OF THE SEAS	C6CM8	A	Miami	0	0	0	0	5	80	48	50	1	184
ENCHANTMENT OF THE SEAS	C6FZ7	A	Miami	30	29	40	41	30	45	85	9	0	309
ENDEAVOR (AWS)	WCE5063	A	New York City	103	182	526	81	611	715	721	738	705	4382
ENDURANCE	WDE9586	A	Baltimore	58	60	76	80	44	61	57	60	91	587
ENDURANCE	WDF7523	A	Anchorage	15	0	15	0	10	0	15	18	0	73
EOT SPAR	WDH8097	A	Jacksonville	1	0	0	21	45	35	28	26	14	170
EURODAM	PHOS	A	Miami	89	138	168	116	65	48	7	5	70	706
EVER DAINTY	9V7951	A	Baltimore	0	0	0	0	2	0	9	1	30	42
EVER DEVOTE	9V7954	A	New York City	0	9	0	0	17	20	9	16	8	79
DISNEY DREAM	C6YR6	A	Jacksonville	48	62	78	59	40	54	119	16	58	534
DISNEY FANTASY	C6ZL6	A	Jacksonville	0	7	1	1	0	6	55	48	8	126
DISNEY MAGIC	C6PT7	A	Jacksonville	3	30	4	5	1	0	0	0	0	43
DISNEY WONDER	C6QM8	A	Miami	119	69	48	31	75	25	22	0	108	497
DOMINATOR	WBZ4106	A	Anchorage	23	56	35	0	0	22	77	18	0	231
DREW FOSS	WYL5718	A	Anchorage	0	0	0	0	0	11	17	2	2	32
DUNCAN ISLAND	C6JS	A	Miami	27	19	21	22	23	14	5	10	43	184
EAGLE ATLANTA	S6TE	A	Houston	0	0	42	61	221	43	0	0	70	437
EAGLE STAVANGER	3FNZ5	A	Houston	0	0	0	0	0	9	99	152	121	381
EAGLE SYDNEY	3FUU	A	New Orleans	0	0	44	11	11	82	38	12	15	213
EAGLE TAMPA	S6NK6	A	Houston	0	82	77	205	209	39	42	42	27	723
EAGLE TUCSON	S6NK5	A	Houston	0	0	0	19	28	24	30	14	12	127
ECLIPS	V7BP2	I	New York City	0	0	0	3	4	0	0	0	0	7
EDGAR B. SPEER	WDH7562	A	Duluth	1	0	33	137	114	24	143	127	79	658

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
EVER DIADEM	9V7955	A	New York City	92	88	101	81	84	81	32	0	0	559
EVER EAGLE	ZNZH6	A	Seattle	0	0	0	0	2	1	14	17	11	45
EVER ELITE	VSJG7	A	Los Angeles	85	6	53	76	58	49	27	14	0	368
EVER EXCEL	VSXV3	A	Los Angeles	0	0	0	0	0	0	87	51	76	214
EVER LADEN	3FXM3	A	Charleston	11	3	22	5	0	0	0	0	0	41
EVER LAMBENT	2FRE8	A	New York City	26	29	18	12	23	7	21	9	25	170
EVER LAUREL	9V9287	A	New York City	13	1	0	6	4	5	0	43	4	76
EVER LAWFUL	9V9288	A	New York City	1	6	7	0	0	1	23	25	15	78
EVER LEADING	2FRK8	A	Norfolk	0	0	0	0	0	0	89	25	69	183
EVER LEARNED	2GNG3	A	Norfolk	0	49	36	34	77	45	14	0	0	255
EVER LEGACY	9V9290	A	New York City	11	37	47	43	47	52	44	53	36	370
EVER LEGEND	9V9724	A	New York City	0	0	0	0	0	0	0	0	2	2
EVER LEGION	9V9725	A	New York City	2	16	12	11	26	27	32	20	26	172
EVER LIBERAL	2HDG2	A	New York City	4	22	42	19	3	11	7	15	19	142
EVER LIFTING	2ILJ7	A	New York City	8	6	9	5	7	9	24	11	16	95
EVER LISSOME	2HDG3	A	New York City	0	25	4	6	49	48	38	36	47	253
EVER LIVEN	BKIE	A	New York City	0	0	0	30	26	18	21	14	21	130
EVER LIVING	9V9791	A	Norfolk	13	26	25	40	38	41	39	27	4	253
EVER LOADING	2HDG4	A	New York City	0	0	0	0	0	0	0	0	0	0
EVER LOGIC	BKIF	A	New York City	0	0	0	0	4	12	5	4	5	30
EVER LOVELY	9V9793	A	Charleston	1	0	0	0	0	0	10	10	10	31
EVER LUCENT	9V9792	I	Norfolk	6	0	0	0	0	0	0	0	0	6
EVER LUCID	BKIY	A	New York City	20	0	0	33	29	41	25	19	8	175
EVER LUNAR	BKKF	A	New York City	18	13	0	26	22	26	13	8	21	147
EVER SALUTE	3ENU5	A	Anchorage	0	0	0	12	8	1	0	0	0	21
EVER SHINE	MJKZ4	A	Anchorage	6	0	0	15	10	14	12	0	0	57
EVER STEADY	3EHT6	A	Anchorage	9	16	43	35	33	57	52	49	1	295
EVER DIADEM	9V7955	A	New York City	92	88	101	81	84	81	32	0	0	559
EVER EAGLE	ZNZH6	A	Seattle	0	0	0	0	2	1	14	17	11	45
EVER ELITE	VSJG7	A	Los Angeles	85	6	53	76	58	49	27	14	0	368
EVER EXCEL	VSXV3	A	Los Angeles	0	0	0	0	0	0	87	51	76	214
EVER LADEN	3FXM3	A	Charleston	11	3	22	5	0	0	0	0	0	41
EVER LAMBENT	2FRE8	A	New York City	26	29	18	12	23	7	21	9	25	170
EVER LAUREL	9V9287	A	New York City	13	1	0	6	4	5	0	43	4	76
EVER LAWFUL	9V9288	A	New York City	1	6	7	0	0	1	23	25	15	78
EVER LEADING	2FRK8	A	Norfolk	0	0	0	0	0	0	89	25	69	183
EVER LEARNED	2GNG3	A	Norfolk	0	49	36	34	77	45	14	0	0	255
EVER LEGACY	9V9290	A	New York City	11	37	47	43	47	52	44	53	36	370
EVER LEGEND	9V9724	A	New York City	0	0	0	0	0	0	0	0	2	2
EVER LEGION	9V9725	A	New York City	2	16	12	11	26	27	32	20	26	172
EVER LIBERAL	2HDG2	A	New York City	4	22	42	19	3	11	7	15	19	142

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
EVER STRONG	9V5282	A	Seattle	0	0	0	6	0	0	0	0	0	6
EVER SUMMIT	3EKU3	A	Anchorage	7	5	34	62	41	0	18	0	0	167
EVER SUPERB	3EGL5	A	Anchorage	0	0	0	0	0	0	0	0	11	11
EVER ULYSSES	9V7962	A	Anchorage	0	0	15	12	9	7	7	3	2	55
EVER UNIQUE	9V7959	A	Seattle	0	0	0	14	7	0	0	0	0	21
EVER UNITED	9V7957	A	Seattle	0	0	0	0	6	65	55	92	4	222
EVER USEFUL	3FCC9	I	Anchorage	10	11	3	1	0	0	0	0	0	25
EVER UTILE	3FZA9	I	Seattle	0	0	7	0	0	0	0	0	0	7
EVERGREEN STATE	WDE4430	A	San Francisco	4	2	3	5	15	5	7	4	7	52
EXCALIBUR	ONCE	A	Houston	18	43	36	1	1	0	0	4	49	152
EXCEL	ONAI	A	Houston	42	86	115	89	57	37	42	16	0	484
EXCELSIOR	ONCD	A	Houston	0	0	0	59	64	31	81	87	44	366
EXPLORER OF THE SEAS	C6SE4	A	Jacksonville	109	50	114	105	103	74	49	59	19	682
EXPRESS	ONFL	A	Houston	43	24	49	56	51	29	41	46	27	366
FAIRWEATHER	WDB5604	A	Anchorage	3	0	0	0	1	1	0	1	1	7
FEDERAL BERING	V7NB6	A	Anchorage	0	0	0	0	0	0	0	0	34	34
FEDERAL HUDSON	V7RE9	I	Anchorage	14	0	0	3	0	0	0	0	0	17
FEDERAL KIVALINA	V7RF2	A	Anchorage	0	0	0	9	12	11	10	0	0	42
FEDERAL TAMBO	V7YW3	A	Anchorage	0	0	0	0	0	0	0	16	6	22
FEDERAL TIBER	V7YW2	A	Anchorage	0	0	0	0	1	0	0	6	13	20
FEDERAL YUKINA	VRHN7	A	Anchorage	0	0	0	5	50	0	0	0	0	55
FISH HAWK	WDF2995	A	Anchorage	0	0	0	10	12	13	17	17	25	94
FLORIDA	WFAF	A	Houston	0	2	2	0	0	0	0	2	19	25
FLORIDA VOYAGER	WDF4764	A	New Orleans	0	0	0	18	38	29	37	47	48	217
FREEDOM	WDB5483	A	Jacksonville	48	30	6	31	31	25	19	0	0	190
FREEDOM OF THE SEAS	C6UZ7	A	Miami	18	0	14	50	26	27	1	0	24	160
FRITZI N	A8PQ4	A	Anchorage	0	0	0	0	0	0	65	27	0	92
EVER STRONG	9V5282	A	Seattle	0	0	0	6	0	0	0	0	0	6
EVER SUMMIT	3EKU3	A	Anchorage	7	5	34	62	41	0	18	0	0	167
EVER SUPERB	3EGL5	A	Anchorage	0	0	0	0	0	0	0	0	11	11
EVER ULYSSES	9V7962	A	Anchorage	0	0	15	12	9	7	7	3	2	55
EVER UNIQUE	9V7959	A	Seattle	0	0	0	14	7	0	0	0	0	21
EVER UNITED	9V7957	A	Seattle	0	0	0	0	6	65	55	92	4	222
EVER USEFUL	3FCC9	I	Anchorage	10	11	3	1	0	0	0	0	0	25
EVER UTILE	3FZA9	I	Seattle	0	0	7	0	0	0	0	0	0	7
EVERGREEN STATE	WDE4430	A	San Francisco	4	2	3	5	15	5	7	4	7	52
EXCALIBUR	ONCE	A	Houston	18	43	36	1	1	0	0	4	49	152
EXCEL	ONAI	A	Houston	42	86	115	89	57	37	42	16	0	484
EXCELSIOR	ONCD	A	Houston	0	0	0	59	64	31	81	87	44	366
EXPLORER OF THE SEAS	C6SE4	A	Jacksonville	109	50	114	105	103	74	49	59	19	682
EXPRESS	ONFL	A	Houston	43	24	49	56	51	29	41	46	27	366

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
FRONTENAC	VGNB	A	Duluth	0	0	0	0	0	0	2	7	0	9
G. L. OSTRANDER	WCV7620	A	Duluth	2	0	0	12	5	58	44	64	59	244
G3 MARQUIS	XJBO	A	Duluth	0	0	0	18	12	26	21	10	51	138
GENCO CLAUDIUS	V7SY6	A	Anchorage	83	2	0	19	0	0	0	24	76	204
GENCO HADRIAN	V7QN8	A	Anchorage	0	11	17	17	24	17	26	27	20	159
GENCO TITUS	VRDI7	A	Anchorage	36	25	0	0	34	0	9	15	2	121
GENERAL RUDDER	WTAU	A	Houston	0	0	0	0	0	56	22	7	0	85
GEORGE N	A8PQ5	A	Anchorage	21	159	82	28	7	41	56	64	15	473
GLEN CANYON BRIDGE	3EFD9	A	Norfolk	44	42	51	61	23	15	56	14	3	309
GOLDEN BEAR	WDL2000	A	San Francisco	0	0	0	17	71	31	27	17	0	163
GRANDEUR OF THE SEAS	C6SE3	A	Jacksonville	3	9	2	1	1	0	1	0	0	17
GREAT REPUBLIC	WDH7561	A	Duluth	0	0	0	22	24	14	10	9	14	93
GREEN BAY	WDI3177	A	Jacksonville	1	12	33	1	34	5	4	0	31	121
GREEN COVE	WDG5660	A	Baltimore	0	0	15	15	0	0	0	0	22	52
GREEN LAKE	WDDI	A	Jacksonville	36	17	0	4	69	64	71	48	23	332
GREEN RIDGE	WZZF	A	Jacksonville	15	28	9	8	4	0	57	98	74	293
GRETCHEN H	WDC9138	A	Anchorage	0	1	1	1	5	0	2	0	0	10
GUARDIAN	WBO2511	A	Anchorage	2	4	2	8	8	0	16	2	0	42
GUARDSMAN	WBN5978	A	Anchorage	0	1	2	0	0	8	5	15	11	42
H A SKLENAR	C6CL6	A	Houston	139	0	0	0	0	0	0	10	16	165
H. LEE WHITE	WZD2465	A	Duluth	5	0	0	43	95	118	135	110	92	598
HALIFAX EXPRESS	VRMW7	A	New Orleans	18	27	26	34	1	26	7	17	0	156
HARMONY OF THE SEAS	C6BX8	A	Miami	0	2	1	2	0	1	36	32	7	81
HC MELINA	V2FR2	A	Norfolk	0	0	0	0	0	0	0	0	0	0
HENRY GOODRICH	YJQN7	A	Houston	204	201	210	190	209	205	222	214	222	1877
HERBERT C. JACKSON (AWS)	WL3972	A	Duluth	235	0	274	720	708	718	743	633	140	4171
HOEGH CHIBA	LAVD7	A	Jacksonville	8	26	34	25	31	25	19	9	25	202
FRONTENAC	VGNB	A	Duluth	0	0	0	0	0	0	2	7	0	9
G. L. OSTRANDER	WCV7620	A	Duluth	2	0	0	12	5	58	44	64	59	244
G3 MARQUIS	XJBO	A	Duluth	0	0	0	18	12	26	21	10	51	138
GENCO CLAUDIUS	V7SY6	A	Anchorage	83	2	0	19	0	0	0	24	76	204
GENCO HADRIAN	V7QN8	A	Anchorage	0	11	17	17	24	17	26	27	20	159
GENCO TITUS	VRDI7	A	Anchorage	36	25	0	0	34	0	9	15	2	121
GENERAL RUDDER	WTAU	A	Houston	0	0	0	0	0	56	22	7	0	85
GEORGE N	A8PQ5	A	Anchorage	21	159	82	28	7	41	56	64	15	473
GLEN CANYON BRIDGE	3EFD9	A	Norfolk	44	42	51	61	23	15	56	14	3	309
GOLDEN BEAR	WDL2000	A	San Francisco	0	0	0	17	71	31	27	17	0	163
GRANDEUR OF THE SEAS	C6SE3	A	Jacksonville	3	9	2	1	1	0	1	0	0	17
GREAT REPUBLIC	WDH7561	A	Duluth	0	0	0	22	24	14	10	9	14	93
GREEN BAY	WDI3177	A	Jacksonville	1	12	33	1	34	5	4	0	31	121
GREEN COVE	WDG5660	A	Baltimore	0	0	15	15	0	0	0	0	22	52

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
HON. JAMES L. OBERSTAR (AWS)	WL3108	A	Duluth	374	0	10	586	738	719	742	740	647	4556
HONOR	WDC6923	A	Baltimore	1	14	5	7	26	12	7	2	4	78
HOOD ISLAND	C6LU4	A	Miami	17	14	24	27	22	15	21	12	33	185
HORIZON ENTERPRISE	KRGB	A	Seattle	78	58	70	63	83	73	57	89	101	672
HORIZON PACIFIC	WSRL	A	Seattle	63	46	51	41	0	0	71	50	34	356
HORIZON RELIANCE	WFLH	A	Los Angeles	0	1	0	20	40	35	35	36	44	211
HORIZON SPIRIT	WFLG	A	Los Angeles	0	0	0	0	28	36	33	0	0	97
HOUSTON	KCDK	A	New Orleans	4	1	23	10	1	0	0	0	0	39
HOVDEN SPIRIT	V7UT7	A	Anchorage	0	0	0	15	34	9	8	6	21	93
HUNTER	WBN3744	A	Anchorage	3	10	1	0	0	1	3	2	5	25
HYDRA VOYAGER	C6AB8	A	Anchorage	11	18	64	47	12	7	8	8	18	193
IBRAHIM DEDE	V7QW6	A	New York City	4	11	0	2	5	18	45	2	1	88
ILLUSION (AWS)	WBA4557	A	Anchorage	0	0	0	0	0	0	8	141	25	174
INDEPENDENCE II	WGAX	A	Baltimore	49	23	45	47	38	53	28	58	22	363
INDEPENDENCE OF THE SEAS	C6WW4	A	Miami	10	36	39	2	0	0	0	0	4	91
INDIANA HARBOR	WXN3191	A	Duluth	3	0	1	22	9	19	15	30	12	111
INLAND SEAS	WCJ6214	A	Duluth	0	0	0	0	2	1	3	17	15	38
INTEGRITY	WDC6925	A	Baltimore	22	20	45	30	0	0	1	0	48	166
INTEGRITY	WDD7905	A	Anchorage	1	1	46	1	124	16	117	62	45	413
ISLA BELLA	WTOI	A	Jacksonville	43	61	72	66	56	57	42	42	76	515
IVER FOSS	WYE6442	A	Anchorage	0	0	0	0	0	7	0	1	0	8
JAKARTA EXPRESS	VRBR5	I	New York City	0	0	0	0	8	0	0	0	0	8
JAMES BAY	VRLU4	A	Anchorage	0	11	4	0	14	11	15	11	21	87
JAMES L. KUBER	WDF7020	A	Duluth	62	0	0	114	225	194	202	108	154	1059
JAMES R. BARKER (AWS)	WYP8657	A	Duluth	296	0	291	717	613	720	740	743	645	4765
JEAN ANNE	WDC3786	A	Los Angeles	3	0	3	7	7	10	21	12	0	63
INDEPENDENCE II	WGAX	A	Baltimore	49	23	45	47	38	53	28	58	22	363
HON. JAMES L. OBERSTAR (AWS)	WL3108	A	Duluth	374	0	10	586	738	719	742	740	647	4556
HONOR	WDC6923	A	Baltimore	1	14	5	7	26	12	7	2	4	78
HOOD ISLAND	C6LU4	A	Miami	17	14	24	27	22	15	21	12	33	185
HORIZON ENTERPRISE	KRGB	A	Seattle	78	58	70	63	83	73	57	89	101	672
HORIZON PACIFIC	WSRL	A	Seattle	63	46	51	41	0	0	71	50	34	356
HORIZON RELIANCE	WFLH	A	Los Angeles	0	1	0	20	40	35	35	36	44	211
HORIZON SPIRIT	WFLG	A	Los Angeles	0	0	0	0	28	36	33	0	0	97
HOUSTON	KCDK	A	New Orleans	4	1	23	10	1	0	0	0	0	39
HOVDEN SPIRIT	V7UT7	A	Anchorage	0	0	0	15	34	9	8	6	21	93
HUNTER	WBN3744	A	Anchorage	3	10	1	0	0	1	3	2	5	25
HYDRA VOYAGER	C6AB8	A	Anchorage	11	18	64	47	12	7	8	8	18	193
IBRAHIM DEDE	V7QW6	A	New York City	4	11	0	2	5	18	45	2	1	88
ILLUSION (AWS)	WBA4557	A	Anchorage	0	0	0	0	0	0	8	141	25	174
INDEPENDENCE II	WGAX	A	Baltimore	49	23	45	47	38	53	28	58	22	363

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
JENNY N	A8PQ7	A	Anchorage	554	46	25	6	11	148	330	527	651	2298
JEWEL OF THE SEAS	C6FW9	A	Miami	19	40	36	33	7	1	3	0	0	139
JOHN G. MUNSON	WDH7557	A	Duluth	0	0	0	0	15	26	14	14	58	127
JOHN J. BOLAND	WZE4539	A	Duluth	3	0	0	39	19	14	4	7	33	119
JONATHAN SWIFT	A8SN5	A	New York City	90	61	43	68	66	38	16	39	45	466
JOSCO JINZHOU	VRLE3	I	Anchorage	0	0	0	2	0	0	0	0	0	2
JOSEPH L. BLOCK	WXY6216	A	Duluth	285	0	0	11	15	0	1	0	0	312
JOYCE L. VANENKEVORT	WDB9821	A	Duluth	0	0	12	35	5	0	0	1	0	53
JUPITER EXPRESS	V7XY7	A	Anchorage	0	0	0	0	0	15	21	17	7	60
JUSTINE FOSS	WYL4978	A	Anchorage	40	26	23	6	3	13	1	0	0	112
KAMBOS	3ESY5	A	New Orleans	7	6	38	16	8	5	8	3	0	91
KAPRIJKE	ONIK	A	Houston	41	86	114	135	129	107	67	87	74	840
KAREN ANDRIE	WBS5272	A	Duluth	14	1	0	2	2	0	2	4	0	25
KAROLINE N	A8PQ8	A	Anchorage	19	15	115	99	103	89	123	139	60	762
KAUAI	WSRH	A	Seattle	0	0	0	0	0	0	16	1	1	18
KAYE E. BARKER (AWS)	WCF3012	A	Duluth	290	3	163	717	738	720	741	742	665	4779
KENDAL	C6XE9	A	Anchorage	14	15	4	12	12	13	60	331	346	807
KENNICOTT	WCY2920	A	Anchorage	0	0	0	3	7	17	13	2	8	50
KESWICK	C6XE5	A	Anchorage	16	15	36	21	128	226	298	445	424	1609
KILO MOANA	WDA7827	A	Honolulu	56	34	0	0	15	39	27	45	14	230
KONINGSDAM	PBGJ	A	Miami	269	195	85	62	82	89	64	27	7	880
LAKE DOLPHIN	ONHA	A	Anchorage	7	8	296	246	30	0	329	164	368	1448
LAURENCE M. GOULD (AWS)	WCX7445	A	Seattle	744	573	743	719	744	351	653	742	718	5987
LECONTE	WZE4270	A	Anchorage	0	0	24	7	7	3	0	2	1	44
LEE A. TREGURTHA (AWS)	WUR8857	A	Duluth	382	0	293	717	738	683	559	744	645	4761
LEO VOYAGER	C6AB7	A	Seattle	9	7	9	4	1	9	0	0	0	39
LIBERTY	KLIG	A	Baltimore	0	34	69	66	40	21	35	21	0	286
LIBERTY EAGLE	WHIA	A	Houston	3	53	72	58	25	97	47	56	43	454
JENNY N	A8PQ7	A	Anchorage	554	46	25	6	11	148	330	527	651	2298
JEWEL OF THE SEAS	C6FW9	A	Miami	19	40	36	33	7	1	3	0	0	139
JOHN G. MUNSON	WDH7557	A	Duluth	0	0	0	0	15	26	14	14	58	127
JOHN J. BOLAND	WZE4539	A	Duluth	3	0	0	39	19	14	4	7	33	119
JONATHAN SWIFT	A8SN5	A	New York City	90	61	43	68	66	38	16	39	45	466
JOSCO JINZHOU	VRLE3	I	Anchorage	0	0	0	2	0	0	0	0	0	2
JOSEPH L. BLOCK	WXY6216	A	Duluth	285	0	0	11	15	0	1	0	0	312
JOYCE L. VANENKEVORT	WDB9821	A	Duluth	0	0	12	35	5	0	0	1	0	53
JUPITER EXPRESS	V7XY7	A	Anchorage	0	0	0	0	0	15	21	17	7	60
JUSTINE FOSS	WYL4978	A	Anchorage	40	26	23	6	3	13	1	0	0	112
KAMBOS	3ESY5	A	New Orleans	7	6	38	16	8	5	8	3	0	91
KAPRIJKE	ONIK	A	Houston	41	86	114	135	129	107	67	87	74	840
KAREN ANDRIE	WBS5272	A	Duluth	14	1	0	2	2	0	2	4	0	25

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
LIBERTY GLORY	WADP	A	Houston	57	48	30	57	50	62	38	21	35	398
LIBERTY GRACE	WADN	A	Houston	0	0	0	0	0	0	78	29	17	124
LIBERTY OF THE SEAS	C6VQ8	A	Houston	0	0	0	26	37	36	53	59	44	255
LIBERTY PASSION	WLPI	A	Charleston	0	18	14	0	51	15	22	36	2	158
LIBERTY PRIDE	KRAU	A	Charleston	55	32	46	50	37	55	47	36	39	397
LISA ANN 2 (AWS)	WDB3573	A	Anchorage	0	0	0	0	0	0	38	142	108	288
LOIS H	WTD4576	A	Anchorage	0	0	0	1	0	2	1	0	0	4
LONGVIEW LOGGER	VRDK7	A	Anchorage	27	40	47	44	20	25	11	24	1	239
LOWLANDS PHOENIX	9V5327	A	Anchorage	8	24	22	0	0	0	0	1	6	61
MAASDAM	PFRO	A	Miami	185	169	156	285	206	138	68	55	383	1645
MAERSK ATLANTA	WNTL	A	Charleston	17	43	18	0	31	39	36	3	0	187
MAERSK CHICAGO	WMCS	A	Norfolk	23	13	0	3	15	20	24	20	36	154
MAERSK COLUMBUS	WMCU	A	Norfolk	25	0	14	43	21	15	20	4	29	171
MAERSK DENVER	WMDQ	A	New York City	21	3	21	0	3	10	2	6	53	119
MAERSK DETROIT	WMDK	A	Norfolk	3	5	16	22	4	0	26	67	66	209
MAERSK HARTFORD	WMHA	A	New York City	25	8	19	63	29	0	26	30	23	223
MAERSK HEIWA	9V9746	A	Anchorage	1	1	0	4	0	3	0	0	0	9
MAERSK IDAHO	WKPM	A	Baltimore	0	0	0	17	29	33	45	27	29	180
MAERSK IOWA	KABL	A	Norfolk	26	35	72	51	13	53	50	49	63	412
MAERSK KENSINGTON	WMKN	A	Charleston	85	64	65	55	96	81	84	23	1	554
MAERSK KENTUCKY	WKPY	A	Norfolk	9	23	17	38	66	56	60	45	42	356
MAERSK KINLOSS	WMKA	A	New York City	16	0	17	0	0	46	12	12	20	123
MAERSK KOTKA	CQHT	A	Charleston	0	0	0	0	1	57	39	12	0	109
MAERSK MEMPHIS	WMMK	A	Charleston	34	53	31	45	14	41	76	23	51	368
MAERSK MONTANA	WCDP	A	Norfolk	30	30	48	30	42	30	49	45	10	314
MAERSK NIAGARA	VREO9	A	Anchorage	43	34	2	42	35	47	34	33	15	285
MAERSK OHIO	KABP	A	New York City	72	134	196	205	143	93	50	56	36	985
LIBERTY GLORY	WADP	A	Houston	57	48	30	57	50	62	38	21	35	398
LIBERTY GRACE	WADN	A	Houston	0	0	0	0	0	0	78	29	17	124
LIBERTY OF THE SEAS	C6VQ8	A	Houston	0	0	0	26	37	36	53	59	44	255
LIBERTY PASSION	WLPI	A	Charleston	0	18	14	0	51	15	22	36	2	158
LIBERTY PRIDE	KRAU	A	Charleston	55	32	46	50	37	55	47	36	39	397
LISA ANN 2 (AWS)	WDB3573	A	Anchorage	0	0	0	0	0	0	38	142	108	288
LOIS H	WTD4576	A	Anchorage	0	0	0	1	0	2	1	0	0	4
LONGVIEW LOGGER	VRDK7	A	Anchorage	27	40	47	44	20	25	11	24	1	239
LOWLANDS PHOENIX	9V5327	A	Anchorage	8	24	22	0	0	0	0	1	6	61
MAASDAM	PFRO	A	Miami	185	169	156	285	206	138	68	55	383	1645
MAERSK ATLANTA	WNTL	A	Charleston	17	43	18	0	31	39	36	3	0	187
MAERSK CHICAGO	WMCS	A	Norfolk	23	13	0	3	15	20	24	20	36	154
MAERSK COLUMBUS	WMCU	A	Norfolk	25	0	14	43	21	15	20	4	29	171
MAERSK DENVER	WMDQ	A	New York City	21	3	21	0	3	10	2	6	53	119

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
MAERSK PEARY	WHKM	A	Houston	108	84	74	15	16	5	35	27	29	393
MAERSK PITTSBURGH	WMPP	A	New York City	40	40	47	46	28	42	3	44	31	321
MAERSK SELETAR	WTAA	A	New York City	0	0	0	0	0	0	0	15	28	43
MAERSK SEMARANG	D5MK9	A	Charleston	0	0	0	0	0	0	0	0	0	0
MAERSK SENTOSA	WSEP	A	New York City	0	0	0	0	0	21	19	4	9	53
MAERSK UTAH	9V3588	A	Norfolk	0	0	0	0	0	0	0	0	0	0
MAERSK WILMINGTON	3EXT3	I	New York City	0	3	2	0	0	0	0	0	0	5
MAGNOLIA STATE	KGNQ	A	Charleston	0	0	0	0	0	0	0	0	0	0
MAHIMAHI	WHRN	A	Los Angeles	0	7	28	10	6	2	0	0	0	53
MAIA H	WYX2079	A	Anchorage	0	0	0	1	0	0	3	0	0	4
MAINE TRADER	9HZX7	F		0	0	0	0	0	0	14	8	10	32
MAJESTY OF THE SEAS	C6FZ8	A	Jacksonville	22	28	12	61	6	50	57	38	10	284
MALASPINA	WI6803	A	Anchorage	0	0	0	1	3	0	0	1	1	6
MALOLO	WYH6327	A	Anchorage	0	0	0	7	16	12	3	0	0	38
MANITOWOC	WDE3569	A	Duluth	0	0	0	0	23	91	141	142	89	486
MANOA	KDBG	A	Los Angeles	20	7	0	0	0	0	3	9	0	39
MANUKAI	WRGD	A	Los Angeles	14	33	25	26	34	42	29	46	30	279
MANULANI	WECH	A	Los Angeles	28	23	37	17	20	5	1	4	0	135
MARCH	V7HZ5	A	New Orleans	0	0	0	0	0	0	25	29	32	86
MARCUS G. LANGSETH (AWS)	WDC6698	A	Anchorage	743	444	535	719	731	706	740	738	683	6039
MARINE EXPRESS	3FHX2	A	Anchorage	0	0	0	0	0	0	0	15	10	25
MARJORIE C	WDH6745	A	Los Angeles	9	16	20	8	2	7	7	5	11	85
MATANUSKA	WN4201	A	Anchorage	0	1	4	8	28	30	22	2	8	103
MATSON ANCHORAGE	KGTX	A	Anchorage	39	22	8	45	65	51	79	85	51	445
MATSON KODIAK	KGTZ	A	Anchorage	53	55	61	33	35	37	46	27	15	362
MATSON NAVIGATOR	WPGK	A	Los Angeles	54	19	35	51	65	0	0	0	0	224
MATSON TACOMA	KGTY	A	Anchorage	49	52	41	24	26	22	21	24	82	341
MAERSK PEARY	WHKM	A	Houston	108	84	74	15	16	5	35	27	29	393
MAERSK PITTSBURGH	WMPP	A	New York City	40	40	47	46	28	42	3	44	31	321
MAERSK SELETAR	WTAA	A	New York City	0	0	0	0	0	0	0	15	28	43
MAERSK SEMARANG	D5MK9	A	Charleston	0	0	0	0	0	0	0	0	0	0
MAERSK SENTOSA	WSEP	A	New York City	0	0	0	0	0	21	19	4	9	53
MAERSK UTAH	9V3588	A	Norfolk	0	0	0	0	0	0	0	0	0	0
MAERSK WILMINGTON	3EXT3	I	New York City	0	3	2	0	0	0	0	0	0	5
MAGNOLIA STATE	KGNQ	A	Charleston	0	0	0	0	0	0	0	0	0	0
MAHIMAHI	WHRN	A	Los Angeles	0	7	28	10	6	2	0	0	0	53
MAIA H	WYX2079	A	Anchorage	0	0	0	1	0	0	3	0	0	4
MAINE TRADER	9HZX7	F		0	0	0	0	0	0	14	8	10	32
MAJESTY OF THE SEAS	C6FZ8	A	Jacksonville	22	28	12	61	6	50	57	38	10	284
MALASPINA	WI6803	A	Anchorage	0	0	0	1	3	0	0	1	1	6
MALOLO	WYH6327	A	Anchorage	0	0	0	7	16	12	3	0	0	38

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
MATSONIA	KHRC	A	Los Angeles	52	14	20	51	25	6	0	0	3	171
MAUNALEI	KFMV	A	Los Angeles	38	24	17	2	6	37	44	46	32	246
MAUNAWILI	WGEB	A	Los Angeles	21	23	7	19	49	28	19	13	52	231
MEHUIN	A8SG8	I	Charleston	23	18	0	0	0	0	0	0	0	41
MESABI MINER (AWS)	WYQ4356	A	Duluth	0	0	0	310	744	718	739	736	642	3889
MIDNIGHT SUN	WAHG	A	Seattle	12	4	6	21	34	24	2	37	40	180
MIKE O'LEARY	WDC3665	A	Anchorage	0	0	0	0	7	7	27	10	16	67
MINERAL BEIJING	ONAR	A	Anchorage	17	4	2	3	0	15	18	29	30	118
MINERAL BELGIUM	VRKF5	A	Anchorage	22	30	21	39	15	4	0	14	11	156
MINERAL CLOUDBREAK	VRLA6	A	Anchorage	108	56	45	69	14	88	117	123	83	703
MINERAL DALIAN	ONFW	A	Anchorage	82	51	27	53	36	39	43	10	24	365
MINERAL DRAGON	ONFN	A	Anchorage	124	70	25	0	3	13	37	70	63	405
MINERAL FAITH	VRKS4	I	Anchorage	22	66	104	0	0	0	0	0	0	192
MINERAL KYOTO	ONFI	A	Anchorage	42	62	28	83	52	32	2	4	29	334
MINERAL NEW YORK	ONGI	A	Anchorage	32	67	50	69	49	42	26	6	6	347
MINERAL NINGBO	ONGA	A	Anchorage	0	13	36	36	21	31	87	81	268	573
MINERAL NOBLE	ONAN	A	Anchorage	54	15	12	23	28	23	56	41	23	275
MINERAL TIANJIN	ONBF	A	Anchorage	82	69	16	20	24	36	49	50	42	388
MOKIHANA	WNRD	A	Los Angeles	4	42	53	59	59	53	43	24	20	357
MOL BRAVO	VRNJ2	I	New York City	0	0	1	2	0	0	0	0	0	3
MOL BRILLIANCE	VRNL2	A	Anchorage	0	0	0	0	1	30	16	14	19	80
MOL EMISSARY	VRFX6	A	New Orleans	0	0	0	0	0	1	62	41	26	130
MOL GLIDE	VRJF2	A	Anchorage	0	0	0	0	0	0	50	67	82	199
MOL MANEUVER	V7VC5	A	Charleston	0	0	0	0	5	0	4	0	5	14
MOUNT HIKURANGI	VRMC8	A	Anchorage	0	0	0	6	1	2	0	0	12	21
MOUNT OWEN	VRDU6	A	Anchorage	0	107	126	83	65	68	77	27	37	590
MSC ANTIGUA	VRLC3	A	Charleston	0	0	0	0	0	0	0	0	0	0
MATSONIA	KHRC	A	Los Angeles	52	14	20	51	25	6	0	0	3	171
MAUNALEI	KFMV	A	Los Angeles	38	24	17	2	6	37	44	46	32	246
MAUNAWILI	WGEB	A	Los Angeles	21	23	7	19	49	28	19	13	52	231
MEHUIN	A8SG8	I	Charleston	23	18	0	0	0	0	0	0	0	41
MESABI MINER (AWS)	WYQ4356	A	Duluth	0	0	0	310	744	718	739	736	642	3889
MIDNIGHT SUN	WAHG	A	Seattle	12	4	6	21	34	24	2	37	40	180
MIKE O'LEARY	WDC3665	A	Anchorage	0	0	0	0	7	7	27	10	16	67
MINERAL BEIJING	ONAR	A	Anchorage	17	4	2	3	0	15	18	29	30	118
MINERAL BELGIUM	VRKF5	A	Anchorage	22	30	21	39	15	4	0	14	11	156
MINERAL CLOUDBREAK	VRLA6	A	Anchorage	108	56	45	69	14	88	117	123	83	703
MINERAL DALIAN	ONFW	A	Anchorage	82	51	27	53	36	39	43	10	24	365
MINERAL DRAGON	ONFN	A	Anchorage	124	70	25	0	3	13	37	70	63	405
MINERAL FAITH	VRKS4	I	Anchorage	22	66	104	0	0	0	0	0	0	192
MINERAL KYOTO	ONFI	A	Anchorage	42	62	28	83	52	32	2	4	29	334

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
MINERAL NEW YORK	ONGI	A	Anchorage	32	67	50	69	49	42	26	6	6	347
MINERAL NINGBO	ONGA	A	Anchorage	0	13	36	36	21	31	87	81	268	573
MINERAL NOBLE	ONAN	A	Anchorage	54	15	12	23	28	23	56	41	23	275
MINERAL TIANJIN	ONBF	A	Anchorage	82	69	16	20	24	36	49	50	42	388
MOKIHANA	WNRD	A	Los Angeles	4	42	53	59	59	53	43	24	20	357
MOL BRAVO	VRNJ2	I	New York City	0	0	1	2	0	0	0	0	0	3
MOL BRILLIANCE	VRNL2	A	Anchorage	0	0	0	0	1	30	16	14	19	80
MOL EMISSARY	VRFX6	A	New Orleans	0	0	0	0	0	1	62	41	26	130
MOL GLIDE	VRJF2	A	Anchorage	0	0	0	0	0	0	50	67	82	199
MOL MANEUVER	V7VC5	A	Charleston	0	0	0	0	5	0	4	0	5	14
MOUNT HIKURANGI	VRMC8	A	Anchorage	0	0	0	6	1	2	0	0	12	21
MOUNT OWEN	VRDU6	A	Anchorage	0	107	126	83	65	68	77	27	37	590
MSC ANTIGUA	VRLC3	A	Charleston	0	0	0	0	0	0	0	0	0	0
MSC POESIA	3EPL4	A	Miami	0	0	0	0	0	0	0	0	0	0
MSC STELLA	H8PA	A	New Orleans	0	0	0	12	1	0	0	0	0	13
MSC TAMARA	3EOC	I	New Orleans	0	0	0	0	0	0	0	0	0	0
MUSTAFA DAYI	TCZF2	A	New York City	0	0	0	0	0	0	0	17	21	38
MV GEYSIR	WDF3296	A	Norfolk	0	0	51	16	0	3	61	0	0	131
NACHIK	WDE7904	A	Anchorage	0	0	0	0	17	14	7	0	0	38
NANUQ	WDF2026	A	Anchorage	0	0	0	0	1	0	0	0	1	2
NATHANIEL B. PALMER (AWS)	WBP3210	A	Seattle	743	671	711	720	744	715	742	741	718	6505
NATIONAL GLORY	WDD4207	A	Houston	0	25	48	41	49	48	33	40	24	308
NAVIGATOR OF THE SEAS	C6FU4	A	Miami	18	13	11	3	32	4	16	5	0	102
NEIL ARMSTRONG (AWS)	WARL	A	Anchorage	0	311	731	717	734	698	228	658	707	4784
NEPTUNE VOYAGER	C6FU7	A	New Orleans	6	0	14	3	45	71	4	0	29	172
NEVZAT KALKAVAN	TCMO2	A	New York City	11	7	30	34	41	30	34	35	15	237
NIEUW AMSTERDAM	PBWQ	A	Miami	209	351	295	199	102	75	176	193	219	1819
NILEDUTCH OSPREY	V7AP5	A	New York City	0	0	0	0	33	17	17	27	14	108
NOAA BELL M. SHIMADA (AWS)	WTED	A	Seattle	304	435	220	446	227	0	162	391	288	2473
NOAA FAIRWEATHER (AWS)	WTEB	A	Anchorage	0	0	0	0	0	369	641	427	365	1802
NOAA FERDINAND R. HASSLER (AWS)	WTEK	A	Norfolk	38	212	504	4	0	0	0	22	14	794
NOAA HENRY B. BIGELOW (AWS)	WTDF	A	New York City	0	332	401	479	277	190	303	3	0	1985
NOAA HI'IALAKAI (AWS)	WTEY	A	Honolulu	0	279	121	378	47	287	16	61	2	1191
NOAA NANCY FOSTER (AWS)	WTER	A	Charleston	0	0	0	329	422	210	329	287	51	1628
NOAA OREGON II (AWS)	WTDO	A	New Orleans	0	1	40	429	576	22	0	0	0	1068
NOAA OSCAR DYSON (AWS)	WTEP	A	Anchorage	167	218	536	192	664	532	365	615	499	3788
NOAA OSCAR ELTON SETTE (AWS)	WTEE	A	Honolulu	0	0	340	253	333	74	490	592	574	2656
NOAA PISCES (AWS)	WTDL	A	New Orleans	0	0	22	296	237	126	66	23	12	782
NOAA RAINIER (AWS)	WTEF	A	Seattle	0	0	0	97	112	116	167	415	166	1073
NILEDUTCH OSPREY	V7AP5	A	New York City	0	0	0	0	33	17	17	27	14	108
NOAA BELL M. SHIMADA (AWS)	WTED	A	Seattle	304	435	220	446	227	0	162	391	288	2473
NOAA FAIRWEATHER (AWS)	WTEB	A	Anchorage	0	0	0	0	0	369	641	427	365	1802
NOAA FERDINAND R. HASSLER (AWS)	WTEK	A	Norfolk	38	212	504	4	0	0	0	22	14	794
NOAA HENRY B. BIGELOW (AWS)	WTDF	A	New York City	0	332	401	479	277	190	303	3	0	1985
NOAA HI'IALAKAI (AWS)	WTEY	A	Honolulu	0	279	121	378	47	287	16	61	2	1191
NOAA NANCY FOSTER (AWS)	WTER	A	Charleston	0	0	0	329	422	210	329	287	51	1628
NOAA NANCY FOSTER (AWS)	WTER	A	Charleston	0	0	0	329	422	210	329	287	51	1628

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
NILEDUTCH OSPREY	V7AP5	A	New York City	0	0	0	0	33	17	17	27	14	108
NOAA BELL M. SHIMADA (AWS)	WTED	A	Seattle	304	435	220	446	227	0	162	391	288	2473
NOAA FAIRWEATHER (AWS)	WTEB	A	Anchorage	0	0	0	0	0	369	641	427	365	1802
NOAA FERDINAND R. HASSLER (AWS)	WTEK	A	Norfolk	38	212	504	4	0	0	0	22	14	794
NOAA HENRY B. BIGELOW (AWS)	WTDF	A	New York City	0	332	401	479	277	190	303	3	0	1985
NOAA HI'IALAKAI (AWS)	WTEY	A	Honolulu	0	279	121	378	47	287	16	61	2	1191
NOAA NANCY FOSTER (AWS)	WTER	A	Charleston	0	0	0	329	422	210	329	287	51	1628
NOAA OREGON II (AWS)	WTDO	A	New Orleans	0	1	40	429	576	22	0	0	0	1068
NOAA OSCAR DYSON (AWS)	WTEP	A	Anchorage	167	218	536	192	664	532	365	615	499	3788
NOAA OSCAR ELTON SETTE (AWS)	WTEE	A	Honolulu	0	0	340	253	333	74	490	592	574	2656
NOAA PISCES (AWS)	WTDL	A	New Orleans	0	0	22	296	237	126	66	23	12	782
NOAA RAINIER (AWS)	WTEF	A	Seattle	0	0	0	97	112	116	167	415	166	1073
NOAA RONALD H. BROWN (AWS)	WTEC	A	Charleston	668	441	588	76	624	706	459	540	0	4102
NOAA SHIP GORDON GUNTER (AWS)	WTEO	A	New Orleans	0	24	0	0	536	403	577	473	229	2242
NOAA SHIP OKEANOS EXPLORER (AWS)	WTDH	A	New York City	199	561	554	418	430	0	564	588	526	3840
NOAA SHIP REUBEN LASKER (AWS)	WTEG	A	Los Angeles	409	0	234	511	554	527	590	557	295	3677
NOAA THOMAS JEFFERSON (AWS)	WTEA	A	Norfolk	0	0	0	0	0	0	414	633	214	1261
NOORDAM	PHET	A	Anchorage	272	232	218	119	97	286	264	137	58	1683
NORDICA	OJAE	A	Seattle	0	0	0	0	0	2	3	1	0	6
NORFOLK	WDI3067	A	Charleston	0	0	0	0	0	0	0	0	0	0
NORTH STAR	KIYI	A	Seattle	3	4	3	1	48	39	31	23	32	184
NORTHERN VICTOR	WCZ6534	A	Anchorage	0	14	9	16	2	0	0	0	0	41
NORTHWEST SWAN	ZCDJ9	A	Anchorage	46	50	32	2	51	101	72	50	46	450
NORWEGIAN BREAKAWAY	C6ZJ3	A	New York City	61	51	36	37	30	160	201	158	116	850
NORWEGIAN DAWN	C6FT7	A	New Orleans	284	372	389	370	294	102	452	575	343	3181
NORWEGIAN ESCAPE	C6BR3	A	Miami	36	36	51	30	0	47	82	57	65	404
NORWEGIAN GEM	C6VG8	A	Jacksonville	130	113	225	210	144	94	33	71	24	1044
NORWEGIAN GETAWAY	C6ZJ4	A	Miami	34	102	53	28	12	0	0	0	0	229
NORWEGIAN JADE	C6WK7	A	Miami	134	71	124	118	47	26	7	76	27	630
NORWEGIAN JEWEL	C6TX6	A	Jacksonville	179	0	176	223	122	56	102	56	2	916
NORWEGIAN PEARL	C6VG7	A	Anchorage	423	83	328	405	440	509	447	445	340	3420
NORWEGIAN SKY	C6PZ8	A	Miami	0	0	22	22	17	7	0	25	46	139
NORWEGIAN SPIRIT	C6TQ6	A	Jacksonville	62	2	137	58	107	26	145	222	62	821
NORWEGIAN STAR	C6FR3	A	Anchorage	44	0	49	66	63	50	24	3	2	301
NORWEGIAN SUN	C6RN3	A	Miami	418	316	332	243	236	338	402	332	101	2718
NUNANIQ	WRC2049	A	Anchorage	0	0	0	1	1	0	0	0	0	2

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
NYK ATHENA	HPDY	A	Anchorage	7	9	22	16	12	31	19	24	47	187
NYK NEBULA	3ENG6	A	Charleston	1	0	20	12	23	13	14	9	3	95
NYK RUMINA	9V7645	A	New York City	112	80	46	15	10	18	0	0	0	281
NYK TRITON	3FUL2	A	Los Angeles	60	8	0	15	8	20	4	31	64	210
OASIS OF THE SEAS	C6XS7	A	Jacksonville	71	15	24	19	6	8	65	42	46	296
OCEAN CRESCENT	WDF4929	A	Houston	52	53	47	48	50	75	43	45	58	471
OCEAN FREEDOM	WDF9323	A	Houston	0	0	0	0	18	4	0	4	5	31
OCEAN GIANT	WDG4379	A	Jacksonville	9	0	0	0	0	16	42	20	16	103
OCEAN GLORY	KOGH	A	Charleston	29	10	31	55	62	2	0	4	0	193
OCEAN HOPE 3	WDF2354	A	Anchorage	0	0	1	1	0	0	0	0	0	2
OCEAN MARINER	WCF3990	A	Anchorage	0	0	0	0	2	11	0	0	7	20
OCEAN NAVIGATOR	WSC2552	A	Anchorage	0	0	5	8	0	0	0	0	5	18
OCEAN RANGER	WAM7635	A	Anchorage	0	0	0	0	0	25	21	1	1	48
OCEAN RELIANCE	WADY	A	Anchorage	0	0	0	0	0	3	11	1	46	61
OCTAVIA	V7HB6	A	New York City	0	0	0	0	63	50	37	5	8	163
OLEANDER	V7SX3	A	New York City	38	36	36	32	31	30	35	29	30	297
OLIVE L. MOORE	WDF7019	A	Duluth	0	0	0	0	0	1	1	24	8	34
OOSTERDAM	PBKH	A	Anchorage	100	77	148	101	138	153	119	66	22	924
ORANGE BLOSSOM 2	D5DS3	A	New York City	3	5	22	22	30	19	10	26	29	166
ORANGE OCEAN	D5DS2	A	New York City	12	1	10	0	33	26	26	65	65	238
ORANGE SKY	ELZU2	A	New York City	0	39	36	20	65	25	7	31	67	290
ORANGE STAR	A8WP6	A	New York City	69	6	15	12	1	5	100	74	73	355
ORANGE SUN	A8HY8	A	New York City	72	14	96	56	73	56	21	33	10	431
ORANGE WAVE	ELPX7	A	New York City	0	0	0	0	0	0	0	32	16	48
ORE ITALIA	VRPY6	A	Anchorage	110	386	674	317	189	248	231	165	186	2506
OREGON VOYAGER	WDF2960	A	New Orleans	66	11	9	0	3	21	4	7	1	122
ORIENTAL QUEEN	VRAC9	A	Anchorage	4	19	30	27	29	5	4	4	0	122
OTAGO HARBOUR	VRNI7	A	Anchorage	0	0	0	4	30	23	41	42	6	146
OURO DO BRASIL	ELPP9	A	Baltimore	50	72	82	47	54	72	55	74	64	570
OVATION OF THE SEAS	C6BX9	A	Anchorage	36	39	23	40	63	36	13	20	59	329
OVERSEAS ANACORTES	KCHV	A	Miami	31	17	15	11	9	2	23	7	8	123
OVERSEAS BOSTON	WJBU	A	Anchorage	17	44	3	2	28	41	23	15	0	173
OVERSEAS CASCADE	WOAG	A	Houston	12	12	17	29	62	66	15	8	3	224
OVERSEAS CHINOOK	WNFQ	A	Houston	1	7	24	0	7	2	2	3	0	46
OVERSEAS HOUSTON	WWAA	A	Miami	0	0	1	0	4	0	0	9	8	22
OVERSEAS LONG BEACH	WAAT	A	Jacksonville	8	8	11	10	12	6	9	1	7	72

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
OVERSEAS LOS ANGELES	WABS	A	Seattle	102	81	16	142	37	74	68	6	31	557
OVERSEAS MARTINEZ	WPAJ	A	Anchorage	6	13	9	11	11	0	8	15	18	91
OVERSEAS NIKISKI	WDBH	A	Houston	18	21	15	1	4	3	0	0	2	64
OVERSEAS SANTORINI	WOSI	A	Houston	0	0	7	21	10	44	4	44	24	154
OVERSEAS TAMPA	WOTA	A	Houston	1	0	0	0	3	5	2	0	0	11
OVERSEAS TEXAS CITY	WHED	A	Houston	22	23	26	34	27	31	27	61	13	264
PACIFIC FREEDOM	WDD9283	A	Anchorage	2	0	2	0	32	53	42	60	61	252
PACIFIC LOGGER	VRWL4	A	Anchorage	0	0	0	0	6	12	11	13	17	59
PACIFIC RAVEN	WDD9278	A	Anchorage	2	0	0	0	5	10	45	47	38	147
PACIFIC SANTA ANA	A8WI3	A	Houston	22	14	0	6	1	28	58	37	44	210
PACIFIC SHARAV	D5DY4	A	Houston	35	29	40	23	46	43	10	29	20	275
PACIFIC STAR	WDD3686	A	Anchorage	0	0	0	1	0	0	0	0	0	1
PACIFIC WOLF	WDD9286	A	Anchorage	0	10	11	7	2	5	4	5	4	48
PANDALUS	WAV7611	A	Anchorage	0	0	0	0	6	18	7	7	0	38
PARAMOUNT HAMILTON	2CWB2	A	Houston	0	0	95	69	93	10	0	0	0	267
PARAMOUNT HATTERAS	2CWB5	A	Houston	0	0	0	0	0	0	6	6	0	12
PATRIOT	WAIU	A	Charleston	42	16	29	16	5	53	32	14	18	225
PAUL GAUGUIN	C6TH9	A	Anchorage	66	51	57	89	4	0	31	34	80	412
PAUL R. TREGURTHA (AWS)	WYR4481	A	Duluth	181	0	345	470	712	720	703	744	646	4521
PERLA DEL CARIBE	KPDL	A	Jacksonville	35	27	9	30	35	32	44	68	43	323
PERSEVERANCE	WDE5328	A	Anchorage	2	0	3	0	1	0	0	0	0	6
PHILADELPHIA EXPRESS	WDC6736	A	Houston	82	56	60	44	66	90	50	15	47	510
PHILIP R. CLARKE	WDH7554	A	Duluth	14	0	14	72	34	24	52	34	12	256
POLAR ADVENTURE	WAZV	A	Seattle	8	8	53	81	48	18	14	0	0	230
POLAR CLOUD	WDF5296	A	Anchorage	5	5	6	0	3	3	0	4	8	34
POLAR DISCOVERY	WACW	A	Seattle	17	17	28	9	13	25	14	13	9	145
POLAR ENDEAVOUR	WCAJ	A	Seattle	25	40	34	0	0	5	20	29	27	180
POLAR ENTERPRISE	WRTF	A	Seattle	47	59	58	53	49	44	60	72	24	466
POLAR RANGER	WDC8652	A	Anchorage	0	0	0	0	2	7	6	4	0	19
POLAR RESOLUTION	WDJK	A	Seattle	15	19	7	20	16	16	58	43	21	215
POLAR STORM	WDE8347	I	Anchorage	0	6	5	0	0	0	0	0	0	11
POLAR VIKING	WDD6494	A	Anchorage	0	0	0	0	10	14	23	1	5	53
PORT ALICE	VRIC6	A	Anchorage	12	12	14	15	7	30	7	25	15	137
PREMIUM DO BRASIL	A8BL4	A	Baltimore	29	32	55	38	33	36	10	26	20	279
PRESQUE ISLE	WDH7560	A	Duluth	30	0	0	56	180	69	0	69	51	455
PRINSENDAM	PBGH	A	Miami	124	141	100	71	122	93	59	74	41	825

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
PSU EIGHTH	9V6346	I	Anchorage	0	0	0	1	0	0	0	0	0	1
QUANTUM OF THE SEAS	C6BH8	A	New York City	113	55	0	0	20	61	31	42	25	347
R J PFEIFFER	WRJP	A	Los Angeles	60	57	63	52	49	49	51	54	54	489
R/V KIYI	KAO107	A	Duluth	0	0	0	0	13	33	46	0	0	92
RADIANCE OF THE SEAS	C6SE7	A	Anchorage	238	388	96	2	8	39	16	8	39	834
REDOUBT	WDD2451	A	Anchorage	0	0	0	0	0	26	0	0	0	26
REGATTA	V7DM3	A	Seattle	4	9	50	28	16	14	0	0	0	121
RESOLVE	WCZ5535	A	Baltimore	27	21	18	27	15	34	28	25	14	209
RESPONDER	V7CY9	A	Baltimore	4	49	49	19	26	92	59	37	1	336
RHAPSODY OF THE SEAS	C6UA2	A	Miami	32	27	7	21	16	0	31	16	11	161
ROBERT C. SEAMANS	WDA4486	A	Anchorage	0	0	11	16	19	26	0	0	0	72
ROBERT GORDON SPROUL (AWS)	WSQ2674	A	Los Angeles	736	273	729	718	744	719	740	743	705	6107
ROGER BLOUGH	WDH7559	A	Duluth	46	0	22	168	169	83	229	296	271	1284
ROGER REVELLE (AWS)	KAOU	A	Los Angeles	572	672	736	617	736	713	711	742	365	5864
RONALD N	A8PQ3	A	Anchorage	36	35	18	10	13	13	33	33	17	208
RT. HON. PAUL J. MARTIN	VGFJ	I	Duluth	0	0	0	3	0	0	1	0	0	4
RTM DAMPIER	9V2775	A	Anchorage	490	649	733	515	510	164	676	440	587	4764
RTM DHAMBUL	9V2783	A	Anchorage	28	35	20	13	0	10	10	1	22	139
RTM DRAKE	9V2779	A	Anchorage	172	305	312	273	280	431	388	246	288	2695
SABINE	V7UU6	A	Baltimore	153	75	79	17	0	2	0	18	5	349
SAGA ADVENTURE	VRBL4	A	Anchorage	58	54	18	2	41	29	15	6	12	235
SAGA ANDORINHA	VRMV6	A	Anchorage	0	0	26	5	10	20	30	26	16	133
SAGA CREST	VRWR7	A	Anchorage	102	5	59	33	40	0	43	82	96	460
SAGA DISCOVERY	VRBR8	A	Seattle	14	20	6	1	0	0	0	0	0	41
SAGA FRAM	VRLL3	A	Anchorage	0	0	0	0	0	0	0	1	138	139
SAGA FRIGG	VRLK7	A	Anchorage	150	90	225	19	29	0	6	0	0	519
SAGA FRONTIER	VRCP2	A	Anchorage	0	0	0	0	20	35	59	186	0	300
SAGA FUTURE	VRKX8	A	Anchorage	16	0	0	46	37	5	4	3	1	112
SAGA MONAL	VRZQ9	A	Anchorage	2	0	0	79	45	40	72	144	2	384
SAGA MORUS	VRZQ8	A	Anchorage	0	0	0	21	29	40	113	65	66	334
SAGA NAVIGATOR	VRDA4	A	Anchorage	43	38	59	41	43	72	70	87	25	478
SAGA ODYSSEY	VRDU9	A	Anchorage	314	260	491	243	84	73	17	2	0	1484
SAGA PIONEER	VRED4	A	Anchorage	0	0	36	5	4	0	0	0	0	45
SAGA SPRAY	VRWW5	A	Anchorage	34	79	75	0	26	9	0	5	0	228
SAGA TUCANO	VRVP2	A	Anchorage	113	197	175	151	184	238	301	220	293	1872
SAGA WAVE	VRYO7	A	Anchorage	0	46	63	27	88	29	77	57	0	387

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
SAGA WIND	VRUR7	A	Anchorage	16	3	0	0	0	0	28	51	31	129
SAIPEM 7000	C6NO5	A	Anchorage	0	0	0	0	0	0	119	97	0	216
SAKURA OCEAN	3FRC8	A	New Orleans	0	0	0	1	25	68	0	40	8	142
SALLY RIDE	WSAF	A	Seattle	0	10	40	19	0	0	0	527	703	1299
SAM LAUD	WZC7602	A	Duluth	9	0	0	0	0	0	0	0	3	12
SAMSON MARINER	WCN3586	A	Anchorage	1	0	0	0	5	6	1	11	3	27
SAMUEL DE CHAMPLAIN	WDC8307	A	Duluth	13	0	6	5	13	21	12	19	2	91
SAN SABA	V7UT8	A	Anchorage	0	0	0	0	0	0	18	5	0	23
SANDRA FOSS	WYL4908	A	Anchorage	0	0	0	0	0	16	3	1	2	22
SEA HAWK	WDD9287	A	Anchorage	8	2	1	0	7	8	0	15	0	41
SEA PRINCE	WYT8569	A	Anchorage	0	0	0	0	5	25	62	66	67	225
SEA VOYAGER	WCX9106	A	Anchorage	16	16	14	12	18	9	23	25	15	148
SEA-LAND COMET	9V3292	A	Los Angeles	0	0	0	0	0	0	0	0	0	0
SEABOARD AMERICA	5BAW3	A	New Orleans	0	0	0	0	0	0	22	31	25	78
SEABOURN QUEST	C6YZ5	A	Miami	0	0	6	30	7	1	0	0	43	87
SEABOURN SOJOURN	C6YA5	A	Anchorage	40	86	143	77	46	15	2	183	108	700
SEABULK ARCTIC	WCY7054	A	Miami	5	16	25	27	11	5	22	46	31	188
SEABULK TRADER	KNJK	A	Miami	26	32	37	33	31	19	0	1	0	179
SEAFREEZE AMERICA	WDH8281	A	Anchorage	10	15	27	26	28	15	21	22	23	187
SEASPAN CHIWAN	VRBH3	A	Anchorage	24	16	3	4	14	16	0	0	0	77
SEASPAN FELIXSTOWE	VRBH8	A	Seattle	3	1	34	51	32	0	0	0	0	121
SEASPAN RIO DE JANEIRO	VRCR9	A	Anchorage	28	13	30	34	24	16	0	6	3	154
SEASPAN SAIGON	VRBT7	I	New York City	0	0	14	17	19	15	0	0	0	65
SECRETO	9V2732	A	Anchorage	1	9	0	0	0	0	18	108	83	219
SEOUL TRADER	9HA3782	A	Los Angeles	0	0	0	0	0	0	0	0	0	0
SESOK	WDE7899	A	Anchorage	0	0	0	1	9	8	3	4	3	28
SEVEN SEAS EXPLORER	V7QK9	A	Anchorage	131	94	128	141	65	55	47	44	48	753
SEVEN SEAS MARINER	C6VV8	A	Jacksonville	224	328	31	27	30	1	32	21	23	717
SEVEN SEAS NAVIGATOR	C6ZI9	A	Miami	547	142	76	96	35	6	29	17	10	958
SEVEN SEAS VOYAGER	C6SW3	A	Anchorage	281	93	0	169	215	385	374	246	390	2153
SHANDONG DA CHENG	VRRB5	A	Anchorage	733	276	337	455	597	423	653	663	694	4831
SHANDONG DA DE	9V9128	A	Anchorage	91	29	68	52	23	46	51	8	0	368
SIANGTAN	9V9832	A	Seattle	37	21	14	29	57	22	17	28	13	238
SIGAS SILVIA	S6ES6	A	Anchorage	432	192	15	1	1	2	0	0	0	643
SIKU	WCQ6174	A	Anchorage	0	0	0	74	184	133	115	175	149	830
SIKULIAQ (AWS)	WDG7520	A	Anchorage	597	626	604	689	719	719	740	700	703	6097

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
SS MAUI	WSLH	A	Seattle	62	29	55	44	47	64	59	55	55	470
ST LOUIS EXPRESS	WDD3825	A	Houston	87	64	122	171	35	86	164	73	35	837
ST. CLAIR	WZA4027	A	Duluth	0	0	0	0	0	0	20	23	5	48
STACEY FOSS	WYL4909	A	Anchorage	0	0	0	0	0	0	24	15	15	54
STAR FUJI	LAVX4	A	Seattle	0	0	0	0	0	0	0	0	5	5
STAR GRIP	LADQ4	A	Charleston	12	9	0	3	0	2	9	5	7	47
STAR HERDLA	LAVD4	A	New Orleans	0	0	47	31	6	0	51	28	45	208
STAR HIDRA	LAVN4	A	Baltimore	12	31	2	38	3	0	0	5	0	91
STAR ISFJORD	LAOX5	A	New Orleans	0	11	2	7	29	25	7	25	40	146
STAR ISMENE	LANT5	A	New Orleans	0	0	0	0	0	0	0	0	9	9
STAR ISTIND	LAMP5	A	Seattle	0	0	0	8	6	8	0	0	0	22
STAR JAPAN	LAZV5	A	Seattle	7	17	27	7	7	30	26	42	24	187
STAR JAVA	LAJS6	A	Baltimore	1	3	0	0	1	0	4	5	11	25
STAR JUVENTAS	LAZU5	A	Baltimore	19	17	9	11	9	4	1	12	0	82
STAR KILIMANJARO	LAIG7	A	Anchorage	9	14	39	5	60	21	26	82	52	308
STAR KINN	LAJF7	A	Anchorage	0	0	0	8	51	14	3	88	71	235
STAR KIRKENES	LAHR7	A	New Orleans	19	0	0	28	0	0	12	13	5	77
STAR KVARVEN	LAJK7	A	Seattle	47	52	73	15	31	5	14	5	0	242
STAR LIMA	LAPE7	A	Jacksonville	24	19	5	6	0	2	8	0	0	64
STAR LINDESNES	LAQJ7	A	Jacksonville	20	0	41	56	24	13	40	20	95	309
STAR LIVORNO	LAQM7	A	Houston	12	7	0	61	44	16	24	12	30	206
STAR LOUISIANA	V7SD8	A	New Orleans	9	15	15	21	35	6	0	0	18	119
STAR LUSTER	LAQO7	A	Anchorage	5	0	0	21	2	78	83	50	42	281
STAR LYGRA	V7FA7	A	Anchorage	0	1	33	63	30	24	0	0	0	151
STAR MINERVA	V7GR8	A	Jacksonville	22	30	25	24	31	51	55	37	25	300
STATE OF MAINE	WCAH	A	New York City	0	0	0	0	43	62	46	1	0	152
STELLAR VOYAGER	C6FV4	A	New Orleans	37	18	21	18	30	9	43	45	18	239
STEWART J. CORT (AWS)	WDC6055	A	Duluth	332	0	238	707	738	719	606	743	632	4715
SUNSHINE STATE	WDE4432	A	Miami	18	10	3	2	25	32	3	8	27	128
SUPERSTAR GEMINI	C6LG5	A	Anchorage	48	52	38	47	37	21	22	31	24	320
SUPERSTAR LIBRA	C6DM2	A	Anchorage	116	105	124	114	120	112	119	108	101	1019
SUSAN MAERSK	OYIK2	A	Seattle	0	58	99	29	18	40	0	0	0	244
TAKU WIND	WDI9036	I	Anchorage	0	11	0	0	0	0	0	0	0	11
TALISMAN	LAOW5	A	Jacksonville	60	6	27	34	30	13	37	22	26	255
TAMESIS	LAOL5	I	Norfolk	0	0	0	0	0	0	0	0	0	0
TAN'ERLIQ	WDF2025	A	Anchorage	0	0	0	0	0	0	0	1	1	2

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
TANGGUH HIRI	C6XC2	A	Anchorage	44	81	114	133	64	95	92	71	51	745
THUNDER BAY	CFN6288	A	Duluth	20	0	0	13	5	13	11	45	23	130
TIGLAX	WZ3423	A	Anchorage	0	0	0	0	6	1	6	2	0	15
TIM S. DOOL	VGPY	A	Duluth	0	0	6	14	19	22	5	20	36	122
TIME BANDIT	WDH2111	I	Anchorage	5	0	0	0	0	0	0	0	0	5
TIWAI POINT	VRFS8	A	Anchorage	0	0	0	0	0	0	0	122	40	162
TROPIC CARIB	J8PE3	A	Miami	63	103	115	114	163	108	123	117	115	1021
TROPIC EXPRESS	J8QB8	A	Miami	47	39	35	39	46	53	47	36	67	409
TROPIC JADE	J8NY	A	Miami	40	33	19	7	53	74	13	111	182	532
TROPIC LURE	J8PD	A	Miami	36	19	60	70	95	91	112	103	40	626
TROPIC MIST	J8NZ	A	Miami	41	37	39	56	32	57	44	51	43	400
TROPIC NIGHT	J8NX	A	Miami	25	79	84	107	95	114	114	96	157	871
TROPIC OPAL	J8NW	A	Miami	128	89	107	57	77	57	122	128	121	886
TROPIC PALM	J8PB	A	Miami	67	46	80	71	70	66	51	50	97	598
TROPIC SUN	J8AZ2	A	Miami	125	96	93	61	39	61	62	49	39	625
TROPIC TIDE	J8AZ3	A	Miami	24	81	86	97	74	94	85	54	101	696
TROPIC UNITY	J8PE4	A	Miami	94	104	136	125	88	76	84	75	101	883
TS KENNEDY	KVMU	A	New York City	104	78	0	0	0	0	0	0	19	201
TUG DEFIANCE	WDG2047	A	Duluth	19	0	0	26	120	89	70	142	113	579
TUG DOROTHY ANN (AWS)	WDE8761	A	Duluth	0	126	519	592	735	715	742	744	472	4645
TUG MICHIGAN	WDF5344	A	Duluth	32	20	11	16	47	104	68	36	25	359
TUG SPARTAN	WDF5483	A	Duluth	0	0	2	0	12	15	1	0	2	32
TUSTUMENA	WNGW	A	Anchorage	55	44	26	0	0	0	0	8	3	136
TYCO DECISIVE	V7DI7	A	Baltimore	0	0	0	68	64	10	26	2	94	264
U. S. INTREPID	WDE2670	A	Anchorage	0	0	0	1	0	0	0	0	0	1
USCGC HEALY	NEPP	A	Seattle	0	0	0	0	23	6	54	41	41	165
USCGC HEALY (AWS)	NWS0003	I	Seattle	0	0	0	0	0	0	0	0	0	0
USCGC MACKINAW	NBGB	A	Duluth	1	0	0	0	0	0	6	1	0	8
VALDEZ RESEARCH (AWS)	WXJ63	A	Anchorage	743	671	743	720	744	720	738	673	706	6458
VEENDAM	PHEO	A	Miami	288	344	182	63	50	78	75	27	9	1116
VERMONT TRADER	9HYN7	A	Charleston	0	0	0	0	0	65	49	66	39	219
VISION OF THE SEAS	C6SE8	A	Miami	0	0	0	8	1	6	13	0	0	28
VOLENDAM	PCHM	A	Anchorage	661	664	512	469	358	203	154	300	345	3666
W. H. BLOUNT	C6JT8	A	New Orleans	52	57	65	76	54	40	23	34	37	438
WALTER J. MCCARTHY JR.	WXU3434	A	Duluth	16	0	0	20	53	31	38	27	47	232
WASHINGTON	WDI5795	A	Anchorage	0	0	6	22	57	70	90	80	61	386

Ship Name	Call Sign	Status	PMO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
WASHINGTON EXPRESS	WDD3826	A	Houston	18	10	66	144	58	9	0	90	85	480
WESTERDAM	PINX	A	Miami	98	104	83	44	43	43	83	73	46	617
WESTERN MARINER	WRB9690	I	Anchorage	2	0	0	0	0	0	0	0	0	2
WESTERN NAVIGATOR	WDE6616	A	Anchorage	0	0	0	0	0	0	2	33	5	40
WESTERN RANGER	WBN3008	A	Anchorage	20	0	0	5	0	0	0	24	31	80
WESTWOOD COLUMBIA	C6SI4	A	Seattle	2	22	25	14	43	41	17	23	30	217
WESTWOOD OLYMPIA	C6UB2	A	Seattle	15	7	2	0	0	1	2	26	15	68
WESTWOOD RAINIER	C6SI3	A	Seattle	34	34	32	33	52	17	12	13	19	246
WHITEFISH BAY	CFN6287	A	Duluth	0	0	0	0	0	0	0	10	0	10
WHITTIER RESEARCH (AWS)	KXI29	A	Anchorage	744	672	743	720	744	720	740	673	706	6462
WILFRED SYKES (AWS)	WC5932	A	Duluth	0	0	0	441	619	668	741	738	576	3783
WISDOM ACE	3FGZ8	A	Norfolk	0	0	0	0	0	0	0	0	0	0
XPEDITION	HC2083	A	Anchorage	9	5	0	9	19	14	5	21	16	98
YM ULTIMATE	V7IK7	A	Charleston	201	199	78	140	51	77	72	39	103	960
YORKTOWN EXPRESS	WDD6127	A	Houston	41	39	36	39	19	19	34	26	61	314
YUHSAN	H9TE	A	Anchorage	17	13	37	49	53	54	44	55	14	336
YUYO SPIRITS	3FNF4	A	Anchorage	0	0	0	0	0	0	0	7	45	52
ZAANDAM	PDAN	A	Anchorage	45	87	247	431	491	357	234	188	145	2225
ZIM SAN DIEGO	A8SI7	A	New York City	0	0	22	43	54	19	61	67	75	341
ZIM SHANGHAI	VRGA6	A	New York City	26	25	20	20	17	26	26	28	30	218
ZIM YOKOHAMA	A8MY4	A	Charleston	0	0	0	0	0	15	31	7	8	61
ZUIDERDAM	PBIG	A	Anchorage	155	119	62	164	93	101	65	92	108	959

Points of Contact

U.S. Port Meteorological Officers

HEADQUARTERS

Michael W. Potochney
NOAA – Voluntary Observing Ship Program Manager
National Weather Service Headquarters
Office of Observations
1325 East-West Highway
Room 4162
Silver Spring, MD 20910
Office: (301) 427-9644
E-mail: michael.potochney@noaa.gov

ATLANTIC PORTS

David Dellinger, PMO Miami, Florida
National Weather Service, NOAA 2550
Eisenhower Blvd
Suite 312
Port Everglades, FL 33316
Tel: (954) 463-4271
Cell: (954) 295-2084
Fax: (305) 229-4553
E-Mail: pmomia@noaa.gov

Robert Niemeyer, PMO Jacksonville, Florida
National Weather Service, NOAA
13701 Fang Road
Jacksonville, FL 32218-7933
Tel: (904) 741-5186, ext.117
Fax: (904) 741-0078
E-Mail: pmojax@noaa.gov

Tim Kenefick, PMO Charleston, South Carolina
NOAA Coastal Services Center
2234 South Hobson Avenue
Charleston, SC 29405-2413
Tel: (843) 709-0102
Fax: (843) 740-1224
E-Mail: pmochs@noaa.gov

Peter Gibino, PMO Norfolk, Virginia (Retired)
National Weather Service, NOAA 104
Hemlock Court
Yorktown, VA 23693-4544
Tel: (757) 617-0897
E-Mail: pmonor@noaa.gov

Lori Evans, PMO Baltimore, Maryland
National Weather Service, NOAA
P. O. Box 3667
Frederick, MD 21705-3667
For UPS/FEDEX delivery:
5838 Shookstown Road
Frederick, MD 21702
Tel: (443) 642-0760
Fax: (410) 633-4713
E-Mail: pmobal@noaa.gov

Jim Luciani, PMO New York, New York
New York/New Jersey
National Weather Service, NOAA
110 Main St., Suite 201
South Amboy NJ 08879
Tel: (908) 217-3477
Fax: (732) 316-7643
E-Mail: pmonyc@noaa.gov

GREAT LAKES PORTS

Ron Williams, PMO Duluth, Minnesota
National Weather Service, NOAA
5027 Miller Trunk Highway
Duluth, MN 55811-1442
Tel: (218) 729-0651
Fax: (218) 729-0690
E-Mail: pmoglakes@noaa.gov

GULF OF MEXICO PORTS

Rusty Albaral
PMO New Orleans, Louisiana
62300 Airport Rd.
Slidell, LA 70460-5243
Tel: (985) 649-0469
Cell: (504) 289-2294
Fax: (985) 649-2907
E-Mail: pmomsy@noaa.gov

Chris Fakes, PMO
National Weather Service, NOAA
1353 FM646, Suite 202
Dickinson, TX 77539
Tel: (281) 534-2640 Ext. 277
Fax: (281) 534-4308
E-Mail: pmohou@noaa.gov

PACIFIC PORTS

Vacant, PMO Honolulu, Hawaii Ocean Services Program Coordinator National Weather Service Pacific Region HQ 1845 Wasp Blvd., Bldg. 176
Honolulu, HI 96818
Tel: (808) 725-6016
Fax: (808) 725-6005
E-Mail:

Timothy Harris, PMO Los Angeles, California
National Weather Service, NOAA
501 West Ocean Blvd., Room 4480
Long Beach, CA 90802-4213
Tel: (562) 980-4090
Fax: (562) 436-1550
E-Mail: pmolax@noaa.gov

VACANT
PMO Oakland/San Francisco, California
National Weather Service, NOAA
1301 Clay Street, Suite 1190N
Oakland, CA 94612-5217
Tel: (510) 637-2960
Fax: (510) 637-2961
E-Mail: pmooak@noaa.gov

Matt Thompson, PMO Seattle, Washington
National Weather Service, NOAA
7600 Sand Point Way, N.E.,
BIN C15700
Seattle, WA 98115-6349
Tel: (206) 526-6100
Fax: (206) 526-6904
E-Mail: pmosea@noaa.gov

ALASKA AREA PORT

Larry Hubble, Anchorage, Alaska
National Weather Service Alaska Region
222 West 7th Avenue #23
Anchorage, AK 99513-7575
Tel: (907) 271-5135
Fax: (907) 271-3711
E-Mail: pmoanc@noaa.gov

U.S. Coast Guard AMVER Center

Ben Strong
AMVER Maritime Relations Officer,
United States Coast Guard
Battery Park Building
New York, NY 10004
Tel: (212) 668-7762
Fax: (212) 668-7684

AOML SEAS PROGRAM MANAGER

Dr. Gustavo Goni
AOML
4301 Rickenbacker Causeway
Miami, FL 33149-1026
Tel: (305) 361-4339
Fax: (305) 361-4412

DRIFTER PROGRAM MANAGER

Dr. Rick Lumpkin
AOML/PHOD
4301 Rickenbacker Causeway
Miami, FL 33149-1026
Tel: (305) 361-4513
Fax: (305) 361-4412

ARGO PROGRAM MANAGER

Dr. Claudia Schmid
AOML/PHOD
4301 Rickenbacker Causeway
Miami, FL 33149-1026
Tel: (305) 361-4313
Fax: (305) 361-4412

GLOBAL DRIFTER PROGRAM

Shaun Dolk
AOML/PHOD
4301 Rickenbacker Causeway
Miami, FL 33149-1026
Tel: (305) 361-4546
Fax: (305) 361-4366

NORTHEAST ATLANTIC SEAS REP.

Jim Farrington
SEAS Logistics/AMC
439 West York Street
Norfolk, VA 23510
Tel: (757) 441-3062
Fax: (757) 441-6495

SOUTHEAST ATLANTIC SEAS REP.

Francis Bringas
AOML/GOOS Center
4301 Rickenbacker Causeway
Miami, FL 33149-1026
Tel: (305) 361-4316
Fax: (305) 361-4412

OTHER PORT METEOROLOGICAL OFFICERS USEFUL CONTACTS:

www.jcomm.info/pmos

Intergovernmental Oceanographic Commission:

http://www.ioc-unesco.org/

Useful contacts in the IOC:

http://ioc-unesco.org/index.php?option=com_oe&task=viewGroupRecord&groupID=126

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), 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 Weather Service
1325 East-West Highway
Silver Spring, MD 20910-3283
Attn: Mariners Weather Log