Mariners

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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

AMVER/SEAS e-logbook software
upgrade pending

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.

From the Editor

Paula M. Rychtar

Greetings and welcome to the December issue of the Mariners Weather Log. This issue ushers in the Holiday Season and the end of another year as well as the end of another hurricane season. I hope this issue finds all in good spirits, safe and sound.

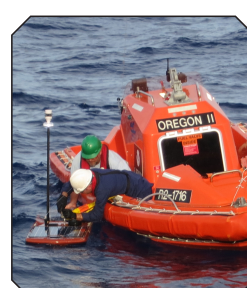
If you read my last editors note, I touched on the importance of marine weather observations for the accuracy of forecasts, environmental studies and improving guidance towards better hurricane forecast tracks; this in turn is part of the equation for seasonal hurricane outlooks. Now that hurricane season is finally over, we can reflect on hurricane season 2013. In May of 2013, the initial hurricane outlook that was issued turned out extremely different from the actual outcome. NOAA is continuously dealing with the cause and effect of climate change and predicting hurricane seasons is no different. Looking back at 2013, it was predicted that our season would be "active or extremely active". We were expected a 70 percent likelihood of 13 to 20 named storms, of which 7 to 11 could become hurricanes, including 3 to 6 major hurricanes. As it turns out, this year was the sixth least active season in the Atlantic Ocean since 1950. 13 named storms formed in the Atlantic and only two, Ingrid and Humberto, became hurricanes which neither achieved category 3 status or higher. My point is this; our forecasters are equipped with sophisticated equipment and data analysis that uses climatology and ocean temperature patterns that are shared by scientists all over the world in a collaborative effort. We collect critical atmosphere and oceanographic data to use in state of the art models to improve worldwide weather and climate prediction. Even though we have all this at hand, sometimes still won't achieve the predicted outcome. Maybe it is because with so many variables to consider our models are not able to gauge things properly? Maybe gaps in the data availability due to data sparse areas give model guidance too much weight? That is where you, the marine weather observers enter the picture. With all this technology at hand, the fact remains that it is vital to gather accurate and timely marine weather observations for all of this to actually work. NOAA along with the international science community shares a growing concern of climate change. This is yet one more reason to never discount the importance of VOS participants sending in marine observations data. NOAA is working with partners worldwide not only to build a climate smart nation but a climate smart world. I urge you all to visit http://www.noaa.gov/climate.html and see where you fit into the equation. You will see that VOS is an intricate part of NOAA's efforts in identifying climate pattern changes and improving forecasting ability. For the record, I am happy that the initial outlook for the hurricane season 2013 was not as predicted and we got through the season with minimal activity.

2013 may have been one of the least active in hurricane history, but tragically others were not so lucky. Early November Super Typhoon Haiyan devastated the Philippines. Haiyan had maximum sustained winds at landfall at 195 mph with gusts above 220 mph leaving a path of death and destruction that will not soon be forgotten. This was one of the strongest tropical cyclones in recorded history. In this upcoming holiday season, please keep the people of the Philippines in your thoughts and prayers.

As always, drop me a line or send in article ideas and photos. I am open to suggestions and look forward to hearing from you!

~Paula

On the cover:
LTJG Brian Adornato, Navigation Officer, and Fisherman James Rhue retrieving the glider back to the ship



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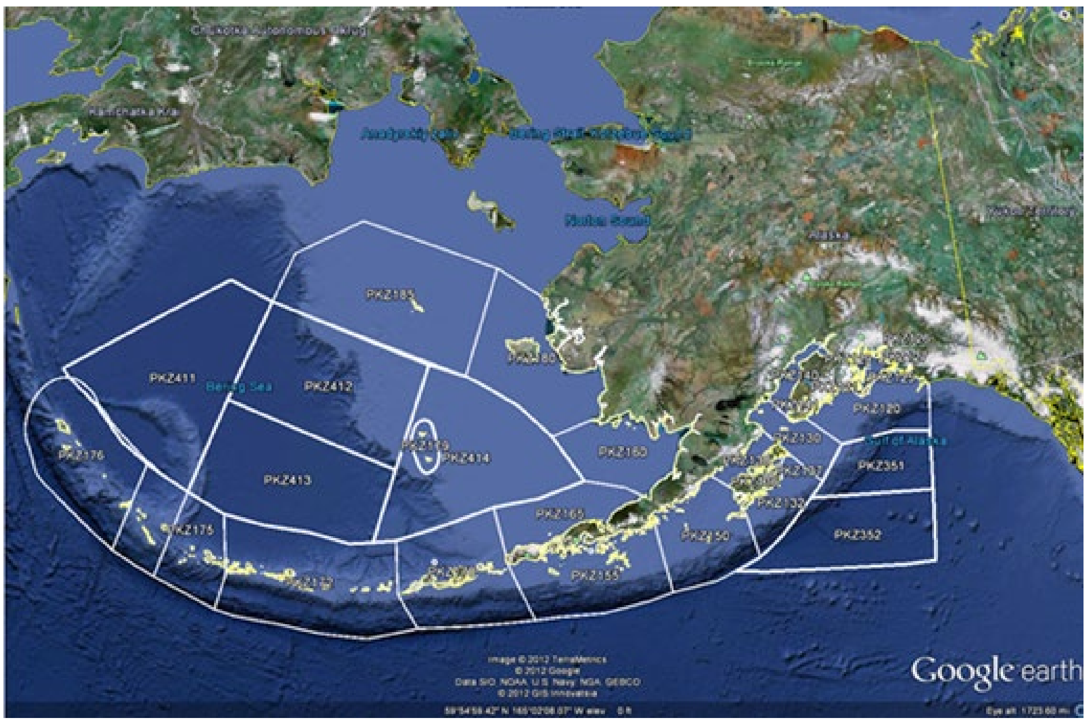
New Marine Weather Forecast Zones in Alaskan Waters Starting October 1, 2013

Dear Volunteer Weather Observers & Marine Operators in Alaskan Waters

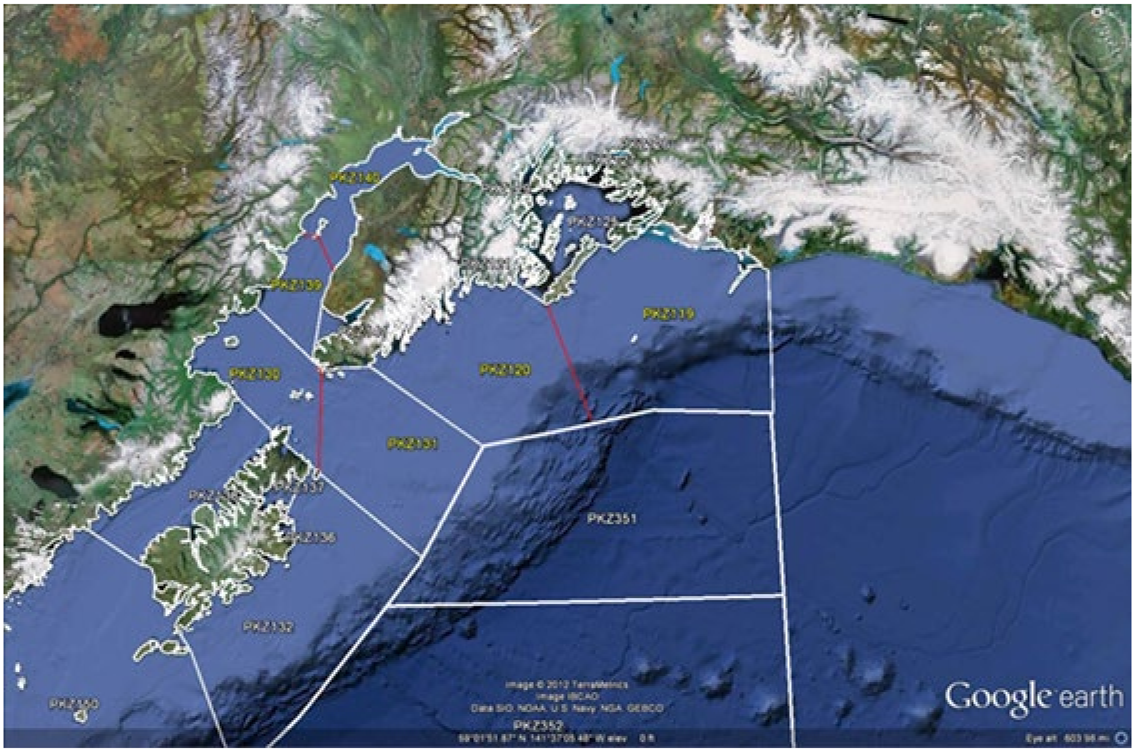
The National Weather Service Anchorage Forecast Office is making changes to their forecast zones for the marine forecast in the Bering Sea and Gulf of Alaska beginning October 1, 2013. The purpose of these changes is to improve the forecast by creating smaller forecast areas.

Here is a map showing the current marine zones:



The following map shows the new zone divisions in red, with the new zone numbers highlighted in yellow:

Here is a close up of the proposed zones in the eastern side of the area.



These maps can also be found at:
http://pafc.arh.noaa.gov/newmarinezones/

Shapefiles for use within GIS are located at:
http://www.nws.noaa.gov/geodata/catalog/wsom/html/marinezones.htm

Our official change notice is located here:
http://www.nws.noaa.gov/om/notification/scn13-36alaska_marine_zones.htm

Please take a look at the proposed zones so you are familiar with the upcoming changes. We invite anyone with comments or questions to contact:

James Nelson
Science and Operations Officer
National Weather Service
WFO Anchorage
6930 Sand Lake Rd
Anchorage, AK 99502
(907) 266-5120
pafc-marine.feedback@noaa.gov

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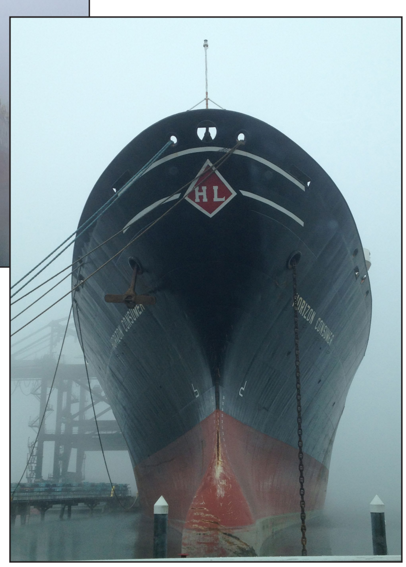
Matthew Thompson, the Port Meteorological Officer for the Seattle region sent some great photos for your viewing pleasure.

A great shot of a sunrise over Seattle with the YANGTZE XING HUA in the forefront.

This photo was taken from the Bremerton Ferry of Seattle showing a great skyline.

A great shot of a Bulk Carrier dealing with fog at the port of Longview Washington, in the Columbia River.



Impressive shots of the ship HORIZON CONSUMER taken at the dock in Tacoma Washington.

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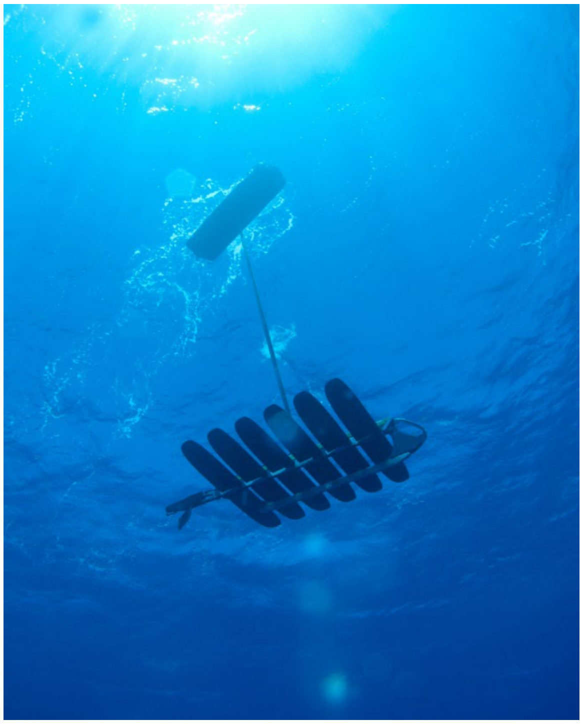
National Data Buoy Center Tsunami Wave Glider Retrieved by NOAA Ship Oregon II

Paula M. Rychtar
Email: paula.rychtar@noaa.gov

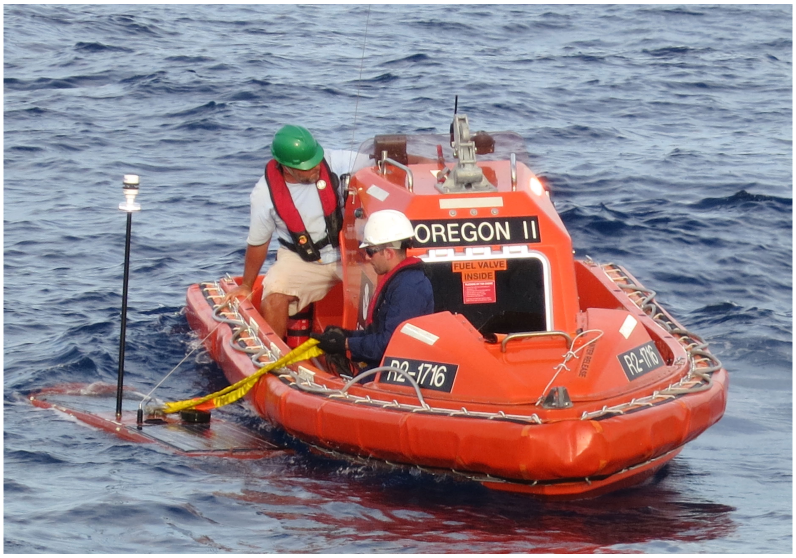
NOAA Ship OREGON II has conducted a successful at-sea recovery operation with a Wave Glider high-endurance unmanned surface vehicle manufactured by Liquid Robotics, Inc. and operated by the National Data Buoy Center (NDBC). During July, one of the NDBC's prototype tsunami monitoring wave gliders sustained problems with the rudder control and operation of the vehicle. The wave glider was operating near the Gulf of Mexico loop current and recovery of the glider was urgent. It happened that the NOAA SHIP OREGON II was conducting a summer groundfish survey in close proximity of the drifting wave glider. Master Dave Nelson, his crew of the OREGON II, and the cooperation of the National Marine Fisheries Field Party Chief (FPC), Kim Johnson, pulled together and with quick response, led to the successful recovery of the wave glider. The return of the wave glider gave NDBC the ability to conduct forensics on the vehicle and continue with their efforts on improving wave glider operations. The cooperation and coordination between the NOAA Marine Fisheries FPC and fellow biologists, OMAO Ship Master and crew, and NDBC engineer Lex LeBlanc demonstrates a can do attitude on all levels. In an effort to recover the wave glider, a small boat was deployed to better guide the glider to the awaiting crane. As it turns out, the weather that particular day was perfect for recovery with little to no wind waves. If the recovery was delayed, the outcome would not have fared well as the next day (due to a frontal system approaching) seas were rough and recovery most likely would not have been possible. The float portion of the glider weighs about 60 pounds and the glider portion weighs about 200 pounds. The glider holds two antennas atop and the lower unit is attached by a high strength 21 foot tether (umbilical).

Photo provided by Lex LeBlanc NDBC, Wave Glider

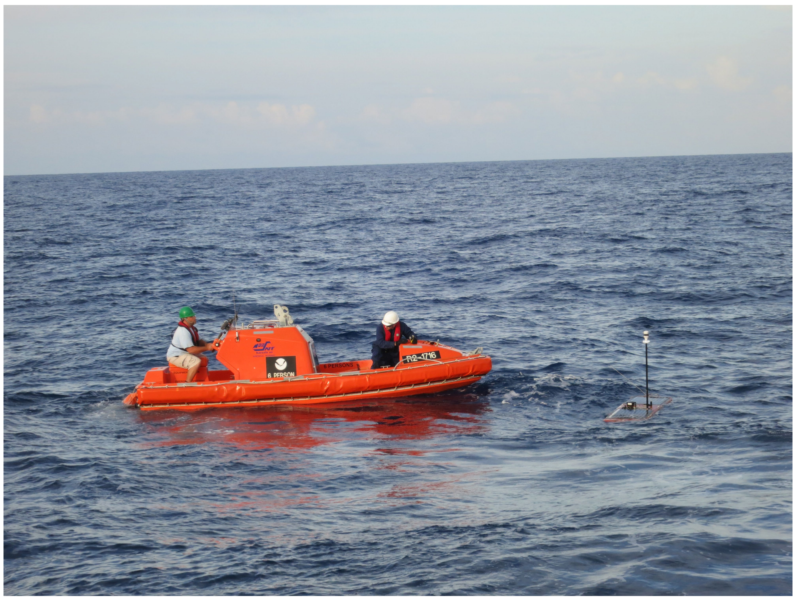


Glider as seen from below.
Photo from LRI website.

The Director of the NDBC, Helmut Portmann, is appreciative of the effort that took place to safeguard and retrieve this prototype wave glider. The effort saved valuable NOAA resources by avoiding the hiring of a contract vessel. In addition, because the wave glider was drifting towards the loop current, without quick response from the OREGON II, there was the possibility that the wave glider would have left the Gulf of Mexico making recovery much more difficult. Mr. Portmann wanted to officially thank Master Dave Nelson, his crew and the FPC in person for such a successful mission and to present them with a plaque

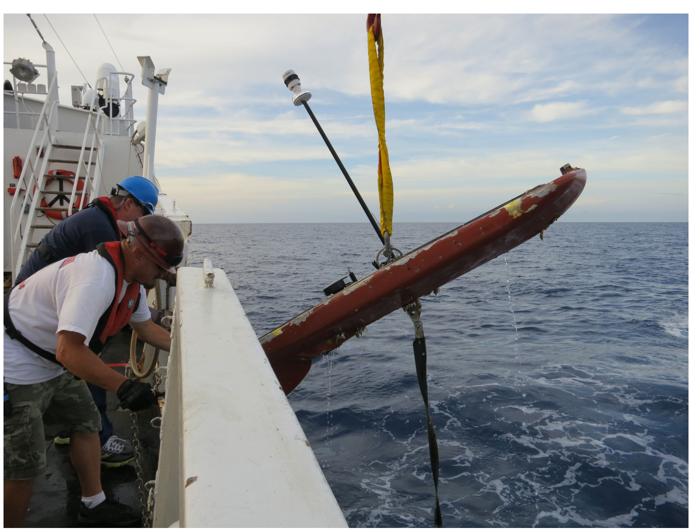


LTJG Brian Adornato, Navigation Officer, and Fisherman James Rhue retrieving the glider back to the ship



LTJG Brian Adornato, Navigation Officer, and Fisherman James Rhue in the Rigid-hulled inflatable boat (RHIB)

Foreground, Skilled Fisherman Chuck Godwin with the ships crane being hooked up to the glider



LCDR Eric Johnson, XO and Skilled Fisherman Chuck Godwin bringing the wave glider aboard

LCDR Eric Johnson, XO and Skilled Fisherman Chuck Godwin securing the glider on deck and letter showing his appreciation. After a brief tour of the NOAA SHIP OREGON II, Mr. Portmann had the opportunity to talk with many of the officers who were a part of the mission and the exciting details of that day. The FPC who was on the ship during the retrieval, Kim Johnson, was not able to attend, but her unit leader Butch Pellegrin attended and accepted in her absence.

Pictured: Director Helmut Portmann and Master Dave Nelson on the bridge of the OREGON II.
Photo courtesy by: Denice Drass

From left to right: Butch Pellegrin, NMFS Pascagoula,Team Leader Summer Ground Fish , Director of NDBC, Helmut Portmann, Master Dave Nelson NOAA SHIP OREGON II

Not pictured, Kim Johnson, Marine Biologist NMFS Pascagoula Laboratory, MS

Photo courtesy: Denice Drass

Lex LeBlanc offloading wave glider from the NOAA SHIP OREGON II

Photo courtesy: Paula Rychtar

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WANTED: Freezing Spray And Icing Observations

Freezing spray is an important safety issue in many coastal Canadian and United States waters. Ice accretion on the superstructure and decks of a vessel can quickly compromise its stability and make the ship vulnerable to capsizing. The National Weather Service (NWS) and Environment Canada's (EC) meteorological offices issue freezing spray advisories and heavy freezing spray warnings to alert mariners to conditions where ice accretion may occur.

NOAA and EC have traditionally used different freezing spray prediction models to make their forecasts, but in an effort to improve freezing spray forecasts, EC and NOAA have produced a suite of freezing spray guidance products that combine the different methods of EC and NOAA freezing spray calculations. This winter, marine forecasters from both Canada and the United States will be putting these new tools to the test; they will evaluate the models and provide feedback about how they think the models performed.

This project cannot be a success without your help! One of the key components to this study is observations. To thoroughly evaluate the different computer models that predict freezing spray, the team needs to know what conditions actually developed during icing events. Every temperature, relative humidity, wind speed, wind direction, ice accretion rate, and wave height observation submitted during this study will provide critical insight into model performance, strengths, and weaknesses. Each observation is a step towards enhancing the ability of each agency to protect life and property at sea.

Photo: NOAA SHIP OSCAR DYSON Courtesy of LT Christine L. Schultz,
NOAA Commissioned Corps
Technical Operations Coordination Meteorologist
National Weather Service - Ocean Prediction Center
National Centers for Environmental Prediction

Please visit the following website to view the guidance being evaluated in this project:
http://pafc.arh.noaa.gov/arctic/fzspy.php

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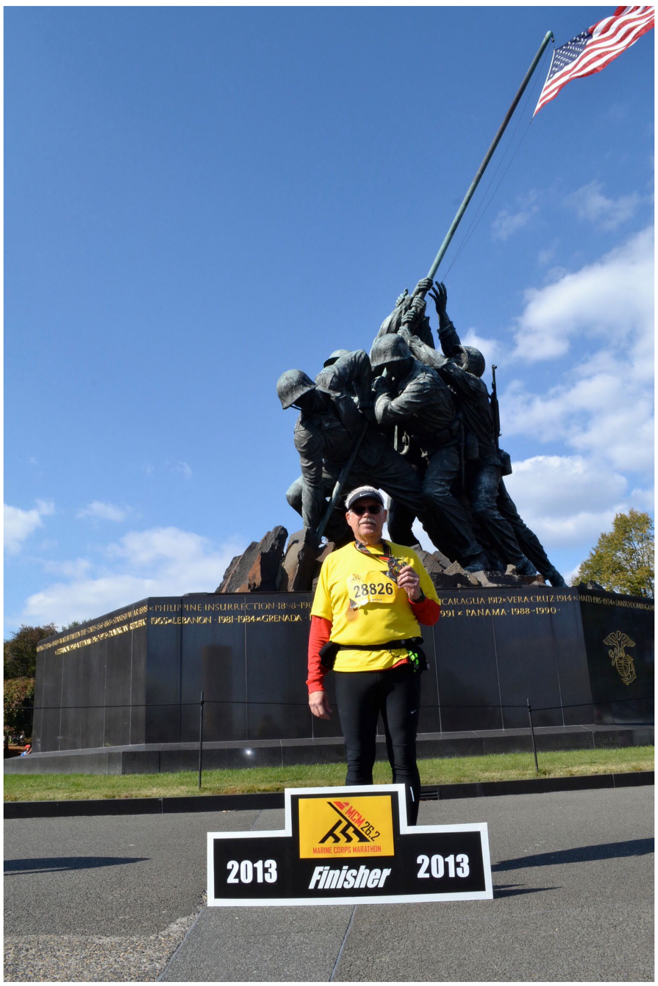
U.S. New York City PMO, Jim Luciani, completes the Marine Corps Marathon in Washington D.C.!!!

I think it is important to showcase not only VOS program accomplishments but human interest stories and huge accomplishments or milestones of the people who make VOS what it is. I would like to share with you one such milestone. Our PMO from New York City, Jim Luciani, completed a grueling Marine Corps Marathon held in Washington D.C. this past October 27th. His time was 5:07:57, which I think is amazing. Jim said around mile 19 things got a bit tough, but he did not quit…he plowed through and kept on going!

Bravo Zulu Jim!!!



Photos courtesy of Jim Luciani

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SHIPWRECK: Henry B. Smith

By Skip Gillham

Photo: HENRY B. SMITH – Doug Mackie Collection

After being missing for almost one hundred years, wreck hunters, searching for the hull of the sunken HENRY B. SMITH, achieved success on May 24, 2013. The remains of the ship were discovered on the bottom of Lake Superior, in very deep water, off Marquette, Michigan.

This freighter was one of the victims of the "Great Storm of November 1913" that swept in from the west and turned the upper Great Lakes into a death-trap for an estimated 251 sailors. While most of the losses occurred on Lake Huron, there was devastation and destruction elsewhere as well.

The HENRY B. SMITH was a product of the American Shipbuilding Co. of Lorain, Ohio. It was completed in June 1906 and registered under W.A. Hawgood & Co. The title of the 545 foot long by 55 foot wide bulk carrier was later noted under different arms of the Hawgood fleet and it was listed as owned by their Acme Transit Co. when the vessel disappeared.

Primarily an ore carrier, the steam powered HENRY B. SMITH usually loaded at one of the numerous Lake Superior ore docks of that day and sailed down the lakes for discharge at one of the steel mills or at a port that had rail connections to an inland steelmaker. A large carrier for the era still dominated by schooners and wooden hulled freighters, the HENRY B. SMITH was, by all accounts, a successful ship until the fateful storm of a century ago.

HENRY B. SMITH arrived at Marquette on November 7, 1913, but loading was delayed by frozen ore. Unseasonably mild weather helped remedy that situation and the ship got the cargo aboard and headed into Lake Superior and the voyage down the lakes to Cleveland on November 9.

Without the good weather forecasting of today, the ship did not get far as it was soon overtaken by the plunging barometer, wind whipped waves and falling temperatures. The mild and pleasant afternoon soon became a nightmare evening for the mariners caught in the grip of the storm.

It is believed that the HENRY B. SMITH departed port with some of the hatches still uncovered. This was not unusual for the day and it allowed the deckhands time at sea to finish the task by putting the wooden slats in place and battening down the heavy tarpaulins while the ship headed down the lakes. This worked fine under most circumstances but this would not be a normal circumstance.

Encountering rough weather, there was some thought that the Captain turned his ship to port seeking shelter off the Keweenaw Point but it was too late for shelter and neither ship nor any members of the crew were ever seen again.

A bottle with a note claiming that the HENRY B. SMITH broke in two at #5 hatch, 12 miles east of Marquette was found but the authenticity of this was questioned at the time. However, images of the rediscovered hull in 2013 note that the ship had cracked, likely on the surface, and that some of the cargo of ore was scattered along the bottom of the lake.

All 24 sailors perished and only two bodies were ever found. Debris was scattered along the south shore of Lake Superior from the famous Pictured Rocks to Grand Marais, Michigan, and the loss was pegged at close to $350,000.

The finding of the HENRY B. SMITH closes another chapter in the history of the “Great Storm” but there are other ships at yet undiscovered locations from the wind, waves and blinding snow of that terrible event of November 1913.

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Mean Circulation Highlights and Climate Anomalies

May through August 2013

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

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

May-June 2013

May 500-hPa heights were above-average from eastern Siberia eastward across the far northern Pacific and Canada to the high latitudes of the North Atlantic. Above-average heights were also noted over western Russia. Below-average heights were observed throughout the polar region, Europe, and central Russia (Figure 1). The sea-level pressure (SLP) pattern mostly mirrors the 500-hPa pattern (Figure 2).

June 500-hPa heights were above-average across Alaska and western Canada, the southwestern contiguous U.S., the central North Atlantic, and northwestern Russia. Below-average heights were observed over the polar region and southern Greenland (Figure 3). The SLP pattern weakly reflected the key features mentioned in the 500 hPa height field (Figure 4). As is typically the case during the warmer months, the stronger 500 hPa height and SLP features were observed at higher latitudes, consistent with the seasonal pole ward migration of the jet stream.

In Alaska, the May and June temperature patterns contrasted sharply. In May, unusually cold temperatures prevailed over the central Interior, with some areas as much as 4-5 C below-average for the month (Reference 1). The cold weather delayed the annual breakup of ice in the Tanana River in Nenana until May

Figure 1

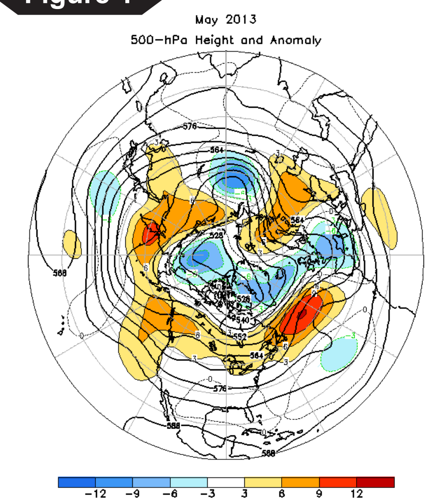


Figure 2

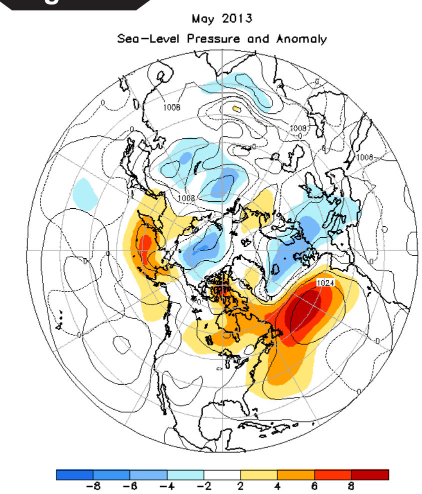


Figure 3

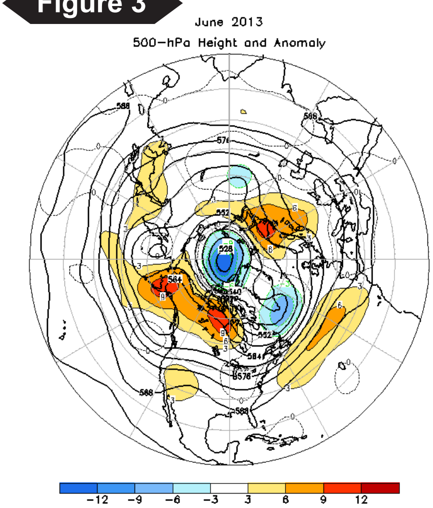
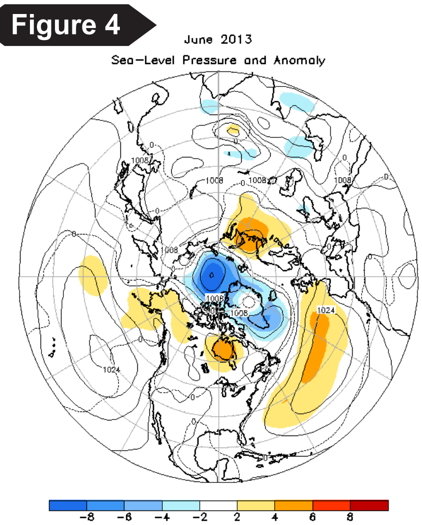


Figure 4



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

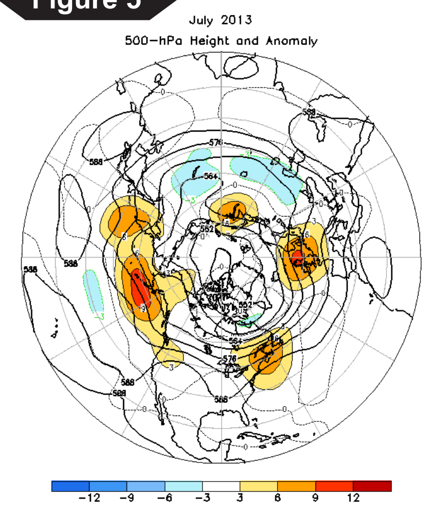
Sea-Level Pressure and Anomaly: Figures 2,4,6,8
Northern Hemisphere mean and anomalous sea level pressure (CDAS/Reanalysis). Mean values are denoted by solid contours drawn at an interval of 4 hPa. Anomaly contour interval is indicated by shading. Anomalies are calculated as departures from the 1981-2010 base period monthly means.

20th, beating the previous record by several hours. On average, ice in the Tanana River breaks up around May 4th (Reference 2). June, on the other hand, featured unusual warmth over Alaska. Temperatures in the central Interior and in south-central Alaska were as much as 4-5 C above-average for the month.

The Tropics

Sea surface temperatures (SST) remained near-average across most of the equatorial Pacific during the May-June period, and below-average over the far eastern Pacific. The latest monthly Nino 3.4 indices were -0.3 C (May) and -0.2 C (June), well within ENSO-neutral territory. The depth of the 20 C isotherm (oceanic thermocline) remained near-average in the east central equatorial Pacific. Equatorial low level easterly trade winds remained near to above-average over the western equatorial Pacific, and tropical convection continued to be enhanced over Indonesia and suppressed over the central equatorial Pacific.

Figure 5



July-August 2013

The 500 hPa circulation pattern during July 2013 featured below-average heights across much of Russia, and above-average heights across the high latitudes of the North Pacific, Eastern Canada, and Western Europe (Figure 5). In North America, the mean 500 hPa circulation featured a strong ridge centered over the Rocky Mountains and a deep trough over the midwestern contiguous U.S. This pattern reflected a westward shift of the mean summertime ridge axis and a deepening of the Hudson Bay trough. Over the northern and eastern flanks of the North Pacific, the circulation pattern was associated with a weakening of the mean trough over the Gulf of Alaska, and an overall pole ward shift of the mean westerly winds and storm track. The sea level pressure and anomaly map (Figure 6) mirrors the 500 hPa pattern.

Figure 6

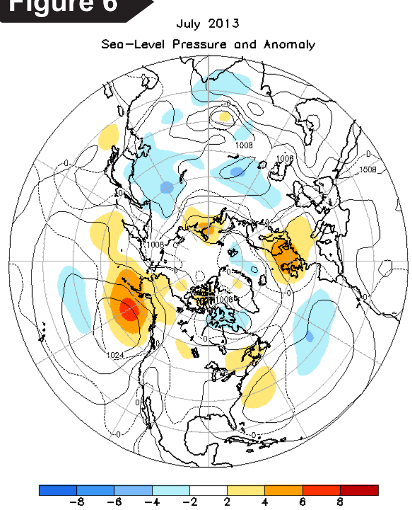


Figure 7

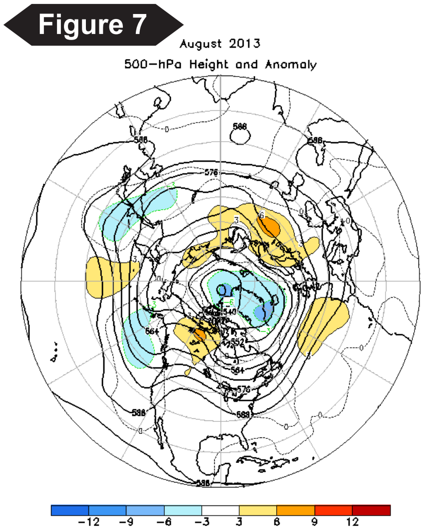
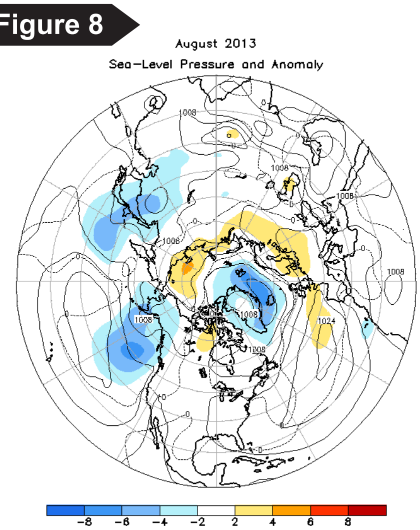


Figure 8



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

The month of August was characterized by above-average heights over Northwestern Canada, the East-central North Atlantic, and the region encompassing northern Europe and adjacent Northwestern Russia. Below-average heights were noted over the Gulf of Alaska, Greenland and the vicinity of the North Pole, and Mongolia (Figure 7). The SLP and anomaly field (Figure 8) largely mirrored the middle tropospheric circulation pattern.

The Tropics

ENSO-neutral conditions continued during July and August 2013. Sea surface temperatures (SST) remained near-average across the central and east-central equatorial Pacific, and below-average in the eastern equatorial Pacific. The latest monthly Nino 3.4 indices were -0.3 C for both July and August. The depth of the 20 C isotherm (oceanic thermocline) remained near-average in the central and east-central equatorial Pacific. Equatorial low level easterly trade winds remained near-average, and tropical convection remained enhanced over Indonesia and suppressed over the central equatorial Pacific.

The 2013 Atlantic hurricane season was unusually quiet during the months of June, July and August. Though six tropical storms had developed before the end of August, none reached hurricane intensity, which is very unusual. The dearth of hurricane activity in the Atlantic basin stands in sharp contrast with an active east Pacific hurricane season, with 11 tropical cyclones reported through the end of August, 5 of which reached hurricane intensity (Reference 3). Granted, the east Pacific hurricane season officially begins on May 15th, two weeks prior to the official onset of Atlantic hurricane season. Of particular interest is Tropical Storm Ivo, which weakened into a persistent remnant low pressure off the coast of Baja California. Moisture from the storm streamed northward across the Southwestern United States, triggering flash flooding in places such as western and central Arizona, southern California, southern Nevada and southern Utah.

References

1. http://www.esrl.noaa.gov/ Temperature Composite Anomalies (Earth System Research Laboratory, Boulder, CO)

2. Email communication with Rick Thoman (Climate Science and Services Manager, Fairbanks, AK)

3. http://www.nhc.noaa.gov/tafb_latest/tws_pac_latest.gif (National Hurricane Center, Miami, FL)

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

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Tropical Atlantic and Tropical East Pacific Areas

May through August 2013

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

Table 1. Non-tropical cyclone warnings issued for the subtropical and tropical Atlantic Ocean, including the Gulf of Mexico and Caribbean Sea between 1 May and 31 August 2013.

Onset	Region	Peak Wind Speed	Gale Duration	Weather Forcing
00 UTC 3 May	Gulf of Mexico	35 kts	18 hr	Cold Front
00 UTC 3 May	SW N Atlantic	45 kts	48 hr	Low Pressure
18 UTC 10 Jul	Caribbean Sea	35 kts	12 hr	Pressure Gradient
00 UTC 28 Jul	SW N Atlantic	35 kts	36 hr	Tropical Wave

Atlantic Ocean including the Caribbean Sea and the Gulf of Mexico

There were four non-tropical cyclone gale events that occurred between 1 May and 31 August 2013 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) Tropical Analysis and Forecast Branch (TAFB). Overall activity was quiet relative to the average activity of the last 10 years for the May through August period.

Gulf of Mexico Gale Warning

An unusually strong spring cold front moved over the warm Gulf of Mexico followed by cold air advection as strong high pressure built south over across the western half of the Gulf. The cold front reached from southwest Louisiana to Tampico Mexico by 00 UTC 3 May, and from just east of southeastern Louisiana to inland the northwest Yucatan peninsula and far southeast Gulf of Mexico by 18 UTC 3 May ***(Figures 1 and 2)***. Gale warnings were issued at 00 UTC

May for areas behind the front as the cold air advection over the warm sea surface temperatures led to boundary layer instability resulting in the gale force winds. The strong high pressure weakened throughout the day of May 3rd. The weakening of the high pressure allowed the tight pressure gradient behind the front to slacken. This diminished the winds to below gale threshold shortly after 18 UTC on May 3rd.

May Gale Event in the Southwest N Atlantic

The gale event with the longest duration occurred from the 3-4th May 2013 when a tight pressure gradient set up between low pressure in the southeast Gulf of Mexico, and strong high pressure that built southward along the east coast of the United States. This induced gale force winds across a portion of TAFB's southwest North Atlantic forecast zone, roughly from 28N to 31N and west of 77W. Gale warnings were first issued

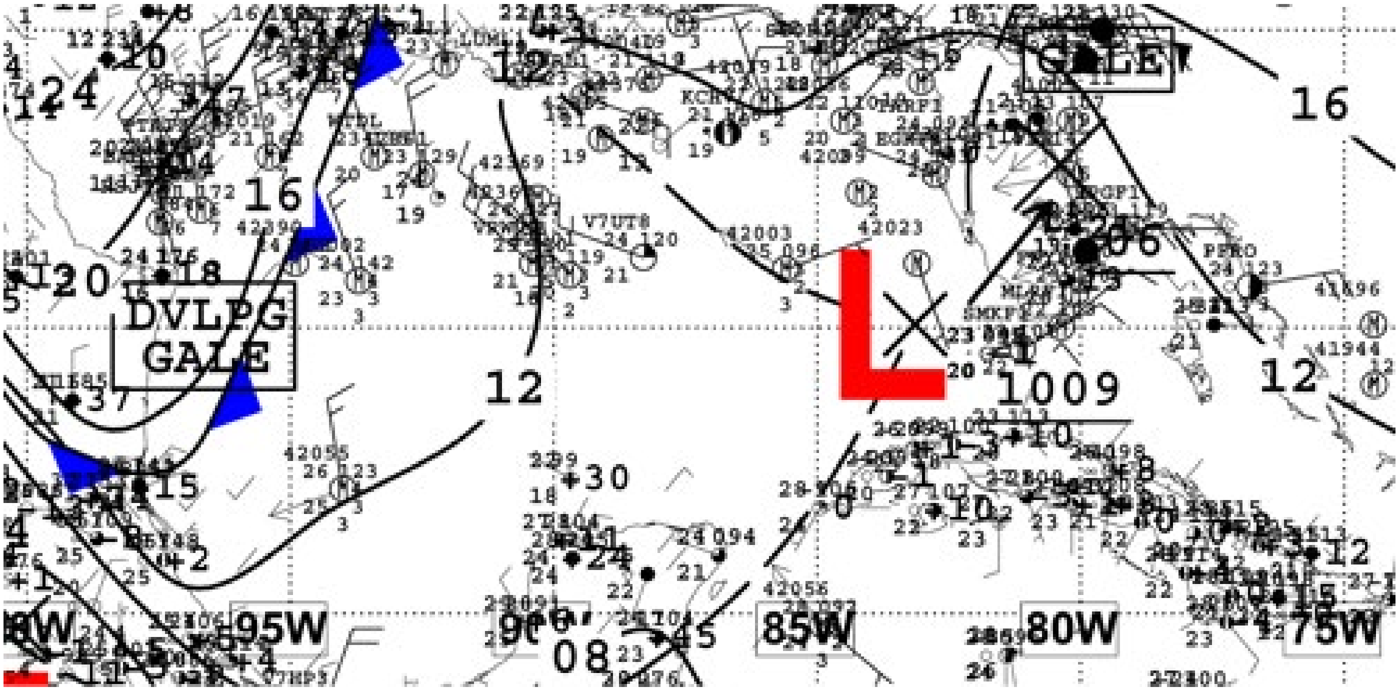

Figure 1. National Weather Service Unified Surface Analysis (USA) valid 0000 UTC 3 May 2013 showing cold front across the western Gulf.

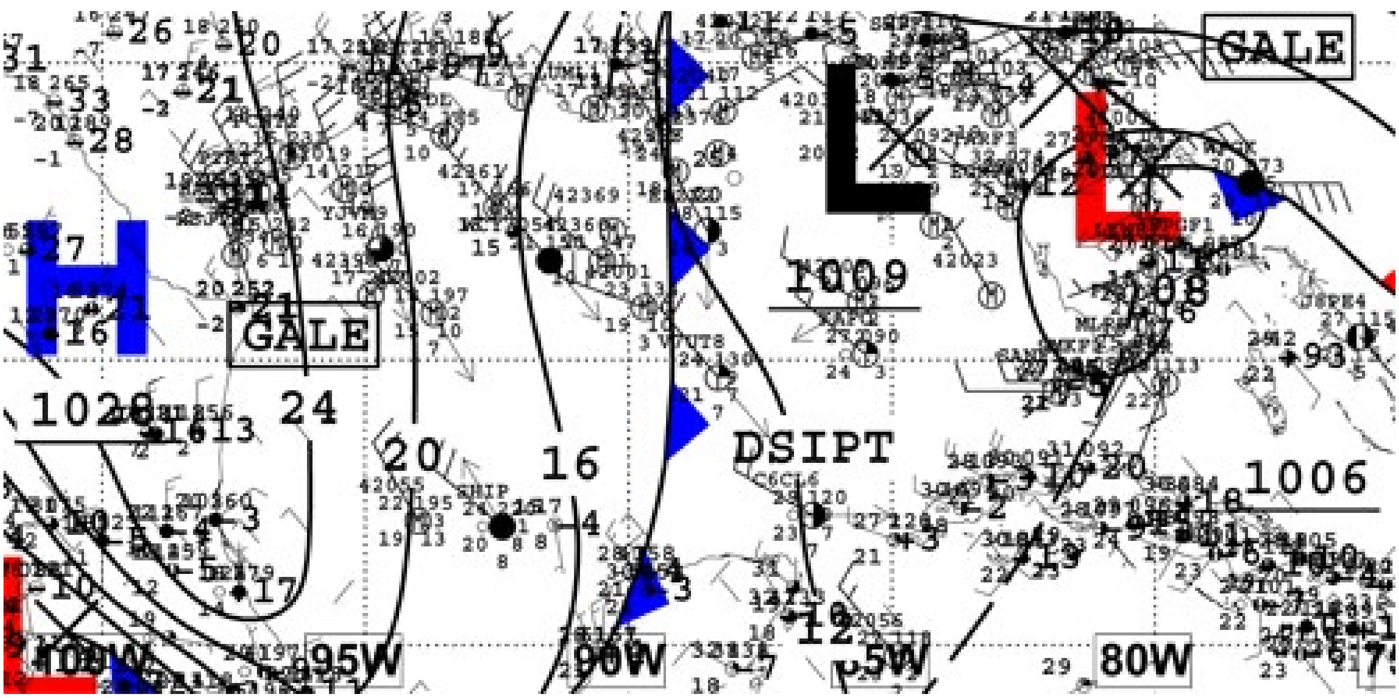

Figure 2. National Weather Service USA map from 1800 UTC 3 May 2013 revealing Gulf and Atlantic gale conditions.

over a portion of the southwest North Atlantic waters at 00 UTC May 3rd when the low pressure over the southeast Gulf of Mexico continued northeastward towards the Florida Peninsula, and the gradient to its northeast began to tighten considerably (***Figures 1 and 2***). As a result, the **Saint Augustine Beach Pier** (SAUF1) Coastal Marine Automated Network (CMAN) site reported winds in the 25-30 kts range with gusts

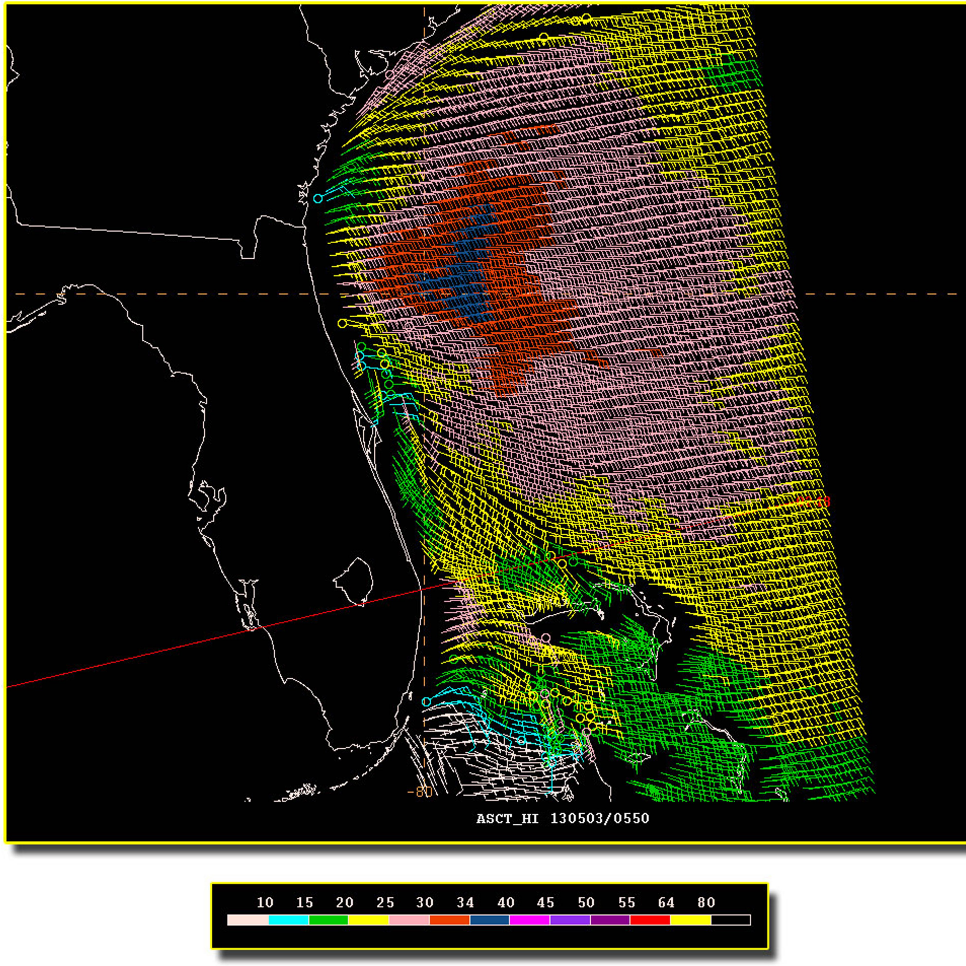

Figure 3. Southwestern North Atlantic ASCAT wind retrieval valid at 0550 UTC 3 May 2013**.** Note the solid area of gale force winds along the far northwest boundary of TAFB's forecast domain.

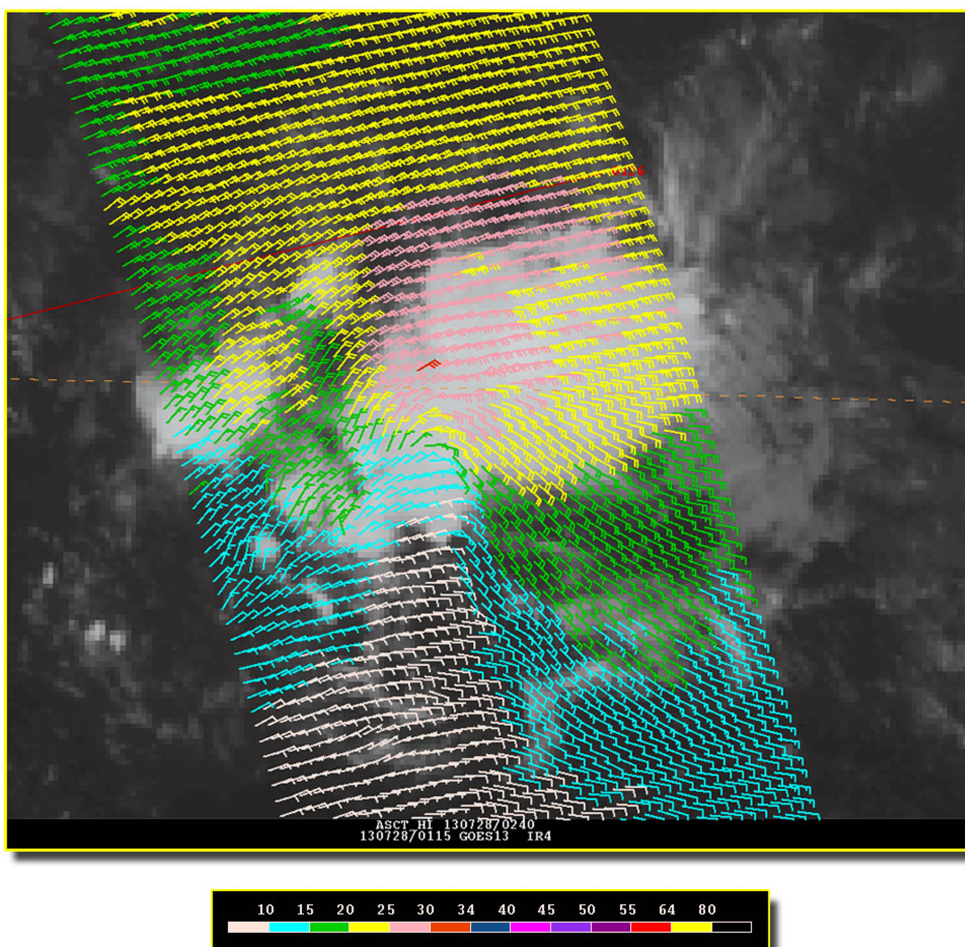

Figure 4. 25 km ASCAT scatterometer pass valid 024 0 UTC 28 July 2013 showing minimal gale force winds inferred from the ASCAT low bias .

to 35 kts through the afternoon of May 4th. In addition, NOAA buoy 41012 near 30N80.5W or about 40 NM northeast of Saint Augustine reported northeast to east winds in the range of 30 to 35 kts with combined seas to 16 ft during this time period. A MetOP-A Advanced Scatterometer (ASCAT) pass from 0550 UTC 3 May captured the gale force winds over a portion of the southwest North Atlantic as it clearly noted east winds of 30-35 kts north of 28N between 77W and 81W ***(Figure 3)***. The pass noted winds of 40 kts north of about 29N between 79W and 80.5W. The ship **Horizon Navigator** (WPGK) reported estimated east winds of 40 kts near 28N78W at 1800 UTC that same day while buoy 41009 near 28N80W reported northeast winds of 35 kts. The tight pressure gradient began to slacken on May 4th as the low pressure over the southeast Gulf of Mexico tracked northeastward across central and northeast Florida forcing the Atlantic frontal boundary positioned to its east in a northward direction closer to the Atlantic waters off the northeast Florida coast. This synoptic set up helped break down the tight pressure gradient responsible for the gale force winds allowing them to diminish to below gale force at 00 UTC May 5th.

Post Dorian Gale Event

The remnants of Tropical Storm Dorian, analyzed as a tropical wave near 56W south of 23N on 28 July 2013, interacted with a high pressure ridge along 29N/30N. This resulted in a tight pressure gradient that initiated an area of gale force winds of 30-35 kts that commenced around 00 UTC Jul 28th across the wave axis. ***Figure 4*** shows an ASCAT pass at 0240 UTC 28 July 2013 displaying these winds roughly over the area from 22N to 23N between 55W and 57W. The winds diminished to below gale force once the tropical wave began to weaken as it moved westward to near 67W by 12 UTC July 29th.

Eastern North Pacific Ocean

Two significant warning events not associated with tropical cyclones, and one gale warning which was associated with a circulation which eventually became a tropical cyclone, were documented primarily by scatterometer data in the May through August 2013 time period. **Table 1a** provides details on these brief gale wind events.

Table 1a. Non-tropical cyclone warnings issued for the subtropical and tropical eastern North Pacific between 1 May and 31 August 2013.

Onset	Region	Peak Wind Speed	Gale Duration	Weather Forcing
1800 UTC 03 May	Gulf of Tehuantepec	40 kt	21 hr	Pressure Gradient
0600 UTC 14 May	Gulf of Tehuantepec	35 kt	6 hr	Pressure Gradient
1800 UTC 27 Aug	Tropical East Pacific	35 kt	30 hr	Pre-Tropical Storm Juliette

Late season Gulf of Tehuantepec wind events are typically initiated by strong northerly winds behind a cold front across the western Gulf of Mexico. This strong flow advects cold air southward, and funneling effects are most pronounced across the Isthmus of Tehuantepec. This was the case for both gale warnings issued for the Gulf of Tehuantepec in May 2013. The more significant of these two events commenced around 1800 UTC May 3rd. High pressure behind a strong 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 Gulf of Tehuantepec (***Figure 5***). High pressure behind the front shifted quickly eastward into the southeast Gulf of Mexico, which weakened the pressure gradient, and gale force winds ended around 1500 UTC on May 4th.

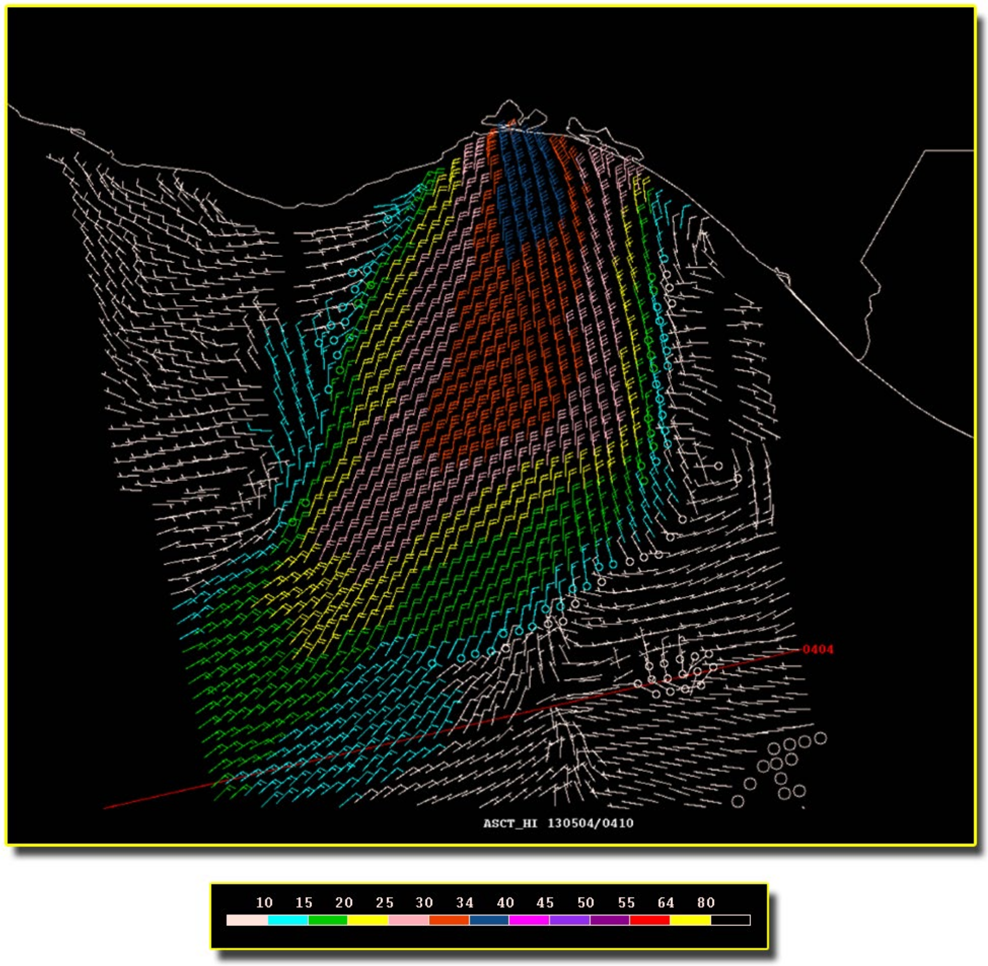

Figure 5. This METOP-A Advanced Scatterometer (ASCAT) pass at 0405 UTC 4 May 2013 captured a gale wind event in the Gulf of Tehuantepec near peak intensity. This image is an excellent example of what a high wind episode in the Gulf of Tehuantepec typically looks like. Highest winds are confined to a narrow band of north to northeast winds within 60 to 90 nm of the Isthmus of Tehuantepec. Wind speeds (and sea heights) will tend to diminish exponentially away from the core of the low level jet and fan outward away from the coast, as depicted here. Ships encountering high wind events in the Gulf of Tehuantepec are able to seek refuge in the regions of light and winds typically found on either side of the wind plume.

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Marine Weather Review – North Atlantic Area

March to August 2013

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Introduction

The late winter to early spring period of March to mid-April 2013 featured a blocked pattern in which cyclones moving off the U.S. east coast or originating over the south central Atlantic waters moved erratically or stalled, impeded from moving northeast. Seven cyclones developed hurricane force winds through the third week of April but others came close. One of these developed a lowest central pressure of 948 hPa in the north central waters late in March, the deepest of the period in both the North Atlantic and North Pacific. The pattern became more progressive from May to August as cyclones followed a more northern track, but May and June remained active with several systems developing storm force winds, including an unseasonably strong cyclone in late June. July was the least active month, but activity started to pick up in late August with the approach of fall.

Tropical activity affecting in OPC's marine area north of 31N consisted of two named cyclones which formed south of OPC's marine area and moved into OPC's far southwestern waters and either dissipated or became post tropical.

Tropical Activity

Tropical Storm Andrea: The first named tropical cyclone of 2013 originated in the Gulf of Mexico as a tropical storm, crossed northern Florida late on June 6, and maintained an intensity of 40 kts sustained winds with gusts to 50 kts while moving over coastal Georgia and the Carolinas on the 7th. The Sea-Land Navigator (WPGK) near 35N 73W reported south winds of 44 kts and 4.0 m seas (13 feet) at 1700 UTC on the 7th. One hour later the CSAV Laraquete (A8TI2) near 33.5N 76.3W reported south winds of 41 kts, and seas of 7.0 m (23 feet) at 1500 UTC on the 7th. Andrea then moved along the mid Atlantic coast as an extratropical gale late on the 7th, crossed the Gulf of Maine the next day and then passed east of Newfoundland on the 9th. As extratropical Andrea passed near Newfoundland the Statengracht (PHAQ) near 39N 54W encountered southwest winds of 45 kts at 1800 UTC on the 9th. Winds dropped below gale force as post-tropical Andrea approached Great Britain, where it dissipated June 12.

Tropical Depression Dorian: The second named tropical cyclone of 2013 originated as a tropical storm over the tropical Atlantic in July, degenerated into a remnant low on July 27th and then regenerated off the east coast of Florida as a tropical depression on the afternoon of August 2nd. Dorian entered OPC's far southwestern waters near 32N 79W on the afternoon of the 3rd with maximum sustained winds of 25 kts with gusts to 35 kts, before being declared post-tropical six hours later. The remains of Dorian crossed Newfoundland as a gale late on the 5th and moved over the northern Atlantic waters with central pressures as low as 987 hPa east of Greenland on the 7th. The cyclone then slowly weakened and moved inland over southern Norway on the 12th.

Other Significant Events of the Period

North Atlantic Storm, March 5-8: The first two significant events of the period developed almost simultaneously, with the first occurring as an area of low pressure formed over the northern waters by March 5th and drifted southwest and then southeast over the next two days while spawning secondary slow moving cyclones between Greenland and Iceland (Figures 1 and 2). An associated frontal system briefly developed hurricane force winds as it approached Iceland 0600 UTC on the 6th while another low formed on the front and moved southwest. A more significant low formed near 63N 30W 0000 UTC on the 7th and drifted toward Greenland while developing hurricane force winds on the west side, lasting until the 8th. The ASCAT (METOP-B) image in Figure 3 reveals winds of 50 to 70 kts in the northwest semicircle of the cyclone in the east Greenland waters (Figure 2). This is in an area typically with sparse ship reports. The cyclone drifted toward the southern tip of Greenland on the 8th with its winds dropping to gale force, while the primary low center, after developing a lowest central pressure of 964 hPa as a storm force low (Figure 2), drifted east and weakened to a gale approaching France on the 9th. Some ship reports taken in this event are listed in **Table 1**, mostly from the central North Atlantic.

Southwestern North Atlantic Storm, March 6-9: The second of a pair of early March events originated as a secondary low formed on a front over the mid Atlantic states of the U.S. (Figure 1) and moved offshore while developing storm force winds on the afternoon of March 6th. The cyclone moved slowly east northeast over the next two days while slowly intensifying, developing a lowest central pressure of 985 hPa near 39N 62W on the morning of the 8th. Blocked by strong high pressure to the north, the cyclone then drifted southeast and slowly weakened with its top winds lowering to gale force by the 10th. A broad area of gale to storm force easterly winds occurred between the high pressure and the cyclone and associated front, with some of these reports listed in **Table 1**. The cyclone subsequently passed south of 31N by the 13th with its winds diminishing to below gale force.

OBSERVATION	POSITION	DATE/TIME (UTC)	WIND	SEA(m/f)
MSC Monterey (D5BL4)	47N 36W	05/1500	N 45	6.5/21
CL Belgium (VRVQ9)	46N 45W 49N 44W	06/0300 07/0300	N 50 NW 55	7.6/25
Maersk Wyoming (WKPF)	45N 29W	08/0000	NW 43	9.5/31
St. Louis Express (WDD3825)	39N 55W 40N 54W 40N 53W 41N 49W	08/0200 08/0700 08/0900 08/2200	E 45 E 45 E 50 E 35	11.6/38 12.2/40 12.2/40 12.8/42
Hanjin Madrid (DHQS)	43N 58W	08/1800	E 50	10.7/35
Sea-Land Meteor (WDD3826)	42N 65W	09/0600	NE 50	5.0/16
Buoy 44024	42.3N 65.9W	08/2100 08/2200	NE 45 G54 NE 40 G49	 10.0/33
Buoy 44009	38.5N 74.7W	07/0100 06/2300	N 45 G54 Maximum	7.0/23 7.9/26
Buoy 44066	39.6N 72.6W	07/0600 07/0800	N40 G52 Maximum	8.8/29 9.5/31
Buoy 44150	42.3N 64.0W	09/0200		10.0/33

Table 1. Selected ship and buoy observations taken during the North Atlantic storm of March 5-8 and the southwestern North Atlantic storm of March 6-9, 2013.

Southwestern North Atlantic Storm, March 21-22: This cyclone originated near the north Florida coast late on March 20th and developed explosively in the twenty four hour period ending at 0600 UTC on the 22nd, when its central pressure fell 43 hPa (Figure 4). This is an impressive rate of intensification for that low latitude, more than twice what is needed for a "bomb" (Sanders, Frederick and Gyakum, 1980). The cyclone is shown at maximum intensity in the second part of Figure 4 when it briefly developed hurricane force winds before moving inland over the Atlantic provinces of Canada and weakening. The **Atlantic Compass** (SKUN) reported northeast winds of 65 kts near 45N 61W at 0600 UTC on the 22nd. The ship

BATEU01 (47N 57W) encountered southeast winds of 55 kts two hours later. Buoy 44139 (44.2N 57.1W) reported east winds of 43 kts with gusts to 54 kts and 5.0 m seas (16 feet) at 0300 UTC on the 22nd. The cyclone weakened inland with its winds diminishing to gale force the next day, and then dissipated over New Brunswick late on March 23rd.

North Atlantic Storm, March 25-31: This major cyclone originated as a low pressure wave (1000 hPa) over the southeastern U.S. on the morning of the 24th and gradually intensified while tracking offshore, taking almost four days to reach its lowest central pressure of 948 hPa near 51N 39W at 0600 UTC on the 28th. Figure 5 depicts a period of most rapid development, with OPC analyzing this system as a hurricane force low at 0600 UTC on the 27th. An ASCAT (METOP-B) pass from 1205 UTC on the 27th, six hours later, revealed a swath of west winds to 55 kts on the south side of the center with only partial coverage. The **Maersk Driscoll** (A8IY3) near 51N 30W reported southeast winds of 50 kts and 5.8 m seas (19 feet) at 1500 UTC on the 27th. The **APL Shanghai** (A8SN5) near 52N 23W encountered southeast winds of 50 kts and 9.0 m seas (30 feet) three hours later, and then at 0000 UTC on the 28th , 9.8 m seas (32 feet) near 52N 26W. The cyclone subsequently stalled near 51N 41W and began to weaken on the 28th and 29th before drifting southeast with its winds lowering to gale force on the 31st. The cyclone became absorbed by another system passing to the southeast on April 2nd.

North Atlantic Storm, Greenland area, April 3-6: The weaker of two hurricane force lows that formed in early April originated as a new low near 40N 57W late on April 2 and tracked north northeast over the next two days before turning northwest when approaching Greenland. It developed a lowest central pressure of 987 hPa near 59N 39W and hurricane force winds at 1800 UTC on the 5th. The first part of Figure 6 shows the cyclone six hours later before it weakened in the Davis Strait the next day. The OceanSat 2 (OSCAT) image in Figure 7 reveals 60 kts west to northwest winds near the southern tip of Greenland with many of the strongest winds detected in the later pass or 1614 UTC on the 5th.

North Atlantic Storm, April 5-8: A frontal wave of low pressure moved northeast out of the Gulf of Mexico early on April 4th, developed storm force winds when passing near the island of Newfoundland early on the 6th and hurricane force winds the next day. Figure 6 shows the final thirty six hours of development. The central pressure fell 31 hPa in the twenty four hour period ending at 0000 UTC April 7th and the lowest central pressure of 964 hPa occurred six hours later. **Hibernia Platform** (VEP717, 46.7N 48.7W) reported southwest winds of 66 kts at its anemometer height of 139 m at 1800 UTC on the 6th, while **Terra Nova FPSO** (VCXF, 46.4N 48.4W) encountered south winds of 50 kts at a height of 53 m. **Hibernia** reported seas as high as 8.2 m (27 feet) at 1500 UTC on the 7th. The **Hanjin Phoenix** (A8CN9) near 44N 51W reported south winds of 45 kts and 8.5 m seas (28 feet) at 1800 UTC on the 6th. The strongest winds as detected in ASCAT imagery were as high as 50 to 55 kts on the morning of the 7th both on the south and north sides of the cyclone, similar to Figure 9 for the storm that followed, and passed just north of the Grand Banks platforms. The cyclone subsequently tracked east and began a weakening trend late on the 7th and passed east of the North Sea late on the 12th (Figure 8).

North Atlantic Storm, April 12-14: The next developing storm originated as a low pressure wave south of Nova Scotia near 40N and rapidly intensified over the central waters (Figure 8), with the central pressure falling 42 hPa in the twenty four hour period ending at 0600 UTC on the 13th. It developed a lowest central pressure of 950 hPa six hours later, making it the second most intense of the period. At 2000 UTC on the 12th the **Maersk Ohio** (KABP) near 44N 47W reported west winds of 45 kts and 9.5 m seas (31 feet), followed by the **Integrity** (WDC6925) ten hours later with a report of northwest winds of 50 kts and 6.5 m seas (21 feet) near 50N 31W. The two ASCAT (METOP-B) passes in Figure 9 show swaths of 50 kts winds both north and south of the cyclone center. The system then passed near the British Isles on the 14th with its top winds lowering to gale force, and then well north of Scotland late on the 15th.

North Atlantic Storm, Greenland area, April 17-20: A developing low originating inland over eastern Canada early on the 16th moved across the Labrador Sea and into the east Greenland waters on the 19th as depicted in Figure 10, and was the last analyzed hurricane force system of the winter. The strongest winds of this cyclone appear in the form of a westerly jet off the southern tip of Greenland as depicted in Figure 11, with winds detected by satellite up to 60 kts, while the cyclone center was to the north in the east Greenland waters. The system turned eastward away from Greenland on the 20th with winds diminishing to gale force, and then dissipated east of Iceland the next day.

Northeastern Atlantic Storm, May 1-2: Low pressure originating south of Nova Scotia on April 26th moved northeast across the Atlantic, developing storm force winds as it passed through the Norwegian Sea on the 1st and 2nd and a lowest central pressure of 994 hPa near 66N 5E. The **Aleksandr Suvorov** (UCAD) near 62N 4E encountered south winds of 50 kts at 1200 UTC May 1st. At 0900 UTC on the 2nd the platform **LF3F** (64.3N 7.9E) reported southwest winds of 40 kts and 7.5 m seas (25 feet).

North Atlantic Storms, Greenland area, May 1-7: A developing storm moved from northeastern Canada north through the Davis Strait late on May 1st and on the 2nd. Although the cyclone developed a lowest central pressure of only 1002 hPa, the **Mary Artica** (BATEU00) at 0900 UTC on the 2nd reported south winds of 58 kts near the Greenland coast at 67N 54W. This in turn spawned a new cyclone between Greenland and Iceland which developed a central pressure of 982 hPa and, briefly, storm force winds the next day. This cyclone then moved east of Iceland late on the 3rd as a gale but two new centers formed between Greenland and Iceland on the 4th with storm force winds. A western center at 1200 UTC on the 4th with a 981 hPa central pressure developed 50 kts north winds off the east Greenland coast as detected in ASCAT imagery. As the complex system moved east on the 5th an ASCAT (METOP-B) pass at 1200 UTC on the 5th detected northeast winds of 50 kts to the northwest of Iceland, before winds weakened to gale force late on the 5th. Another storm force low moved north through the Davis Strait on May 6th and early on the 7th with a central pressure as low as 988 hPa late on the 6th.

North Atlantic Storm, May 11-12: This cyclone moved east across the far northwestern waters on the 9th as a gale, and into the east Greenland waters on the 10th where it stalled and developed storm force winds late on the 11th. These took the form of a westerly jet off the southern tip of Greenland as detected in ASCAT imagery near 0000 UTC on the 12th (similar to Figure 11 but with winds to 50 kts). The ship **BATEU05 reported** northwest winds of 40 kts near 60N 49W at 1800 UTC on the 11th. The cyclone developed a lowest central pressure of 978 hPa as it re formed between Scotland and Iceland late on the 12th then stalled, before becoming absorbed by a second low coming from the south on the 15th.

North Atlantic Storm, Greenland area, May 17-19: The development of this cyclone from a low pressure wave south of Greenland is depicted in Figure 12. The second part of Figure 12 shows the cyclone with its lowest central pressure. The **G.O. Sars** (LMEL) near 60N 40W reported a southwest wind of 62 kts at 1700 UTC on the 18th. ASCAT (METOP-B) imagery available near this time showed satellite measured winds of 50 kts in this area. The cyclone then moved slowly northeast between Greenland and Iceland late on the 19th and the 20th.

North Atlantic Storms, Greenland area, North Sea, May 22-23: Low pressure originating near 40N 47W early on the 20th moved north and developed storm force winds on the afternoon of the 22nd as the center passed near 58N 47W. Although the central pressure was a modest 1000 hPa, OceanSat (OSCAT) imagery from 1522 UTC on the 22nd revealed a northeast wind maximum of 50 kts near the southern tip of Greenland. The low stalled in this area and then dissipated late on the 23rd. Well to the east, blocking high pressure to the north forced an unusual track of a low pressure system moving westward out of the Baltic Sea into the North Sea late on the 22nd and early on the 23rd, developing storm force winds with a 992 hPa central pressure. Buoy 62140 (57.3N 1.3E) reported north winds of 48 kts at 1200 UTC on the 23rd, while buoy 62153 (57.3N 2.0E) reported north winds of 39 kts and 7.0 m seas (23 feet). The ship **ZQSD5** (58N 1E) encountered 9.0 m seas (30 feet) one hour later. The cyclone moved southwest in the North Sea on the 23rd and weakened, and dissipated over northern France the next day.

Northeastern Atlantic Storm, May 25-27: An unseasonably strong low developed in the northeastern waters late in May, originating near the Labrador coast on the 24th. It developed a lowest central pressure of 972 hPa as depicted in Figure 13, after a pressure fall of 30 hPa in twenty four hours. The **Excalibur** (ONCE) near 55N 16W reported west winds of 40 kts and 5.5 m seas (18 feet) at 1800 UTC on the 26th. The ASCAT (METOP-B) imagery in Figure 14 reveals a large area of winds 30 to as high as 45 kts on the southwest and west sides of the cyclone with the center near the upper right edge of the image. The cyclone subsequently drifted southeast and dissipated near Ireland on the 28th.

North Atlantic Storm, June 1-3: An unusually intense low for early June developed over the north central waters, originating as a new low near the northern Labrador coast early on May 31st and moving east over the next three days. It developed a lowest central pressure of 976 hPa near 55N 41W at 1200 UTC June 2nd and storm force winds. An ASCAT (METOP-B) pass about two hours later revealed widespread satellite detected winds of 30 kts to as high as 45 kts around the west semicircle of the cyclone, similar to Figure 14 for the late May event. The ship **BATEU04** (59N 43W) encountered north winds of 40 kts at 1900 UTC on the 2nd. The **Trinity Glory** (3FMV6) near 47N 35W reported northwest winds of 40 kts and 7.3 m seas (24 feet) at 0600 UTC on the 3rd. The system began to weaken on the 3rd and turned north into the east Greenland waters, where it dissipated late on the 5th.

North Atlantic Storm, June 20-21: A storm packing unusually strong winds for late June developed from a low pressure wave south of Nova Scotia over a thirty six hour period as depicted in Figure 15. The cyclone is shown at maximum intensity in the second part of Figure 15. The ASCAT image in Figure 16 reveals satellite detected winds of up to 55 kts on the south side. Due to the low bias of the imagery based on 10 m height and averaging, top winds in this cyclone briefly approached hurricane force. The **Norwegian Dawn** (C6FT7) near 36N 67W reported southwest winds of 45 kts at 2000 UTC on the 19th. **Hibernia** (VEP717, 46.7N 48.7W) reported southwest winds of 57 kts at 0600 UTC on the 20th. Later, the ship **BATFR52** (49N 4W) encountered southwest winds of 45 kts at 1400 UTC on the 22nd. The cyclone subsequently moved east northeast and weakened, passing over Scotland late on the 22nd and then inland over southern Norway two days later.

North Atlantic Storm, Greenland area, June 25-26: The next significant cyclone followed a more northern track, moving from the southern Labrador coast on the afternoon of the 24th to east of Greenland late on the 25th and early on the 26th, where it developed storm force winds and a lowest central pressure of 979 hPa. The **Arni Fridriksson** (TFNA) reported west winds of 45 kts near 59N 40W at 2100 UTC on the 25th. An ASCAT (METOP-B) pass from 2232 UTC on the 25th detected a small area of north winds of 50 kts northwest of the center. The cyclone then passed between Iceland and Greenland late on the 26th with its winds diminishing to gale force.

North Atlantic Storm, August 19-20: This late summer development affected mainly the northwestern waters and Greenland area, originating over northeastern Canada late on the 17th and moving over the Labrador Sea on the morning of the 19th where it developed storm force winds. The cyclone developed a lowest central pressure of 989 hPa near 58N 44W at 0600 UTC on the 20th, passed near the southern tip of Greenland shortly thereafter and then weakened to a sub gale force low while passing between Greenland and Iceland late on the 21st. The Mary Artica (BATEU00) near 59.5N 42W encountered north winds of 50 kts at 1500 UTC on the 20th.

North Atlantic Storm, August 22-23: A low pressure wave moved off the mid Atlantic coast of the U.S. on the 18th , developed gale force winds while passing south of the island of Newfoundland early on the 20th and then briefly storm force conditions with a lowest central pressure of 978 hPa while passing near 59N 21W 0000 UTC August 23rd. The Atlantic Compass (SKUN) near 58N 24W reported northwest winds of 50 kts at that time. The cyclone then weakened to below gale force while passing northeast of Iceland early on the 24th.

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National Weather Service VOS Program New Recruits:

July 1 through November 30, 2013

SHIP NAME	CALL SIGN
Advantage	WPPO
Algoma Provider	VCFW
Algoma Quebecois	CYGR
Algorail	VYNG
APL Antwerp	3FRT9
APL Hong Kong	A8AM6
Ari Cruz	WDG9588
BBC Tasmania	V2CZ2
Clementine Maersk	OUQK2
Davidson	5NLQ
Eships Liwa	VREF5
Ever Divine	9V7956
Great Happy	VRVF7
John J. Boland	WZE4539
Kea	D5DG4
Maersk Atlanta	WNTL
Maersk Columbus	WMCU
Maersk Danang	A8PS5
Maersk Denver	WMDQ
Maersk Hartford	WMHA
Maersk Memphis	WMMK
Maersk Virginia	VRMD3

SHIP NAME	CALL SIGN
OOCL Vancouver	3EBG2
Pago	A8TE5
Partici	A8UF9
Praia	A8TT4
Saga Discovery	VRBR8
Saigon Express	VRBT7
Sea Lynx	9MIL5
Sovereign Maersk	OYGA2
Star Lindesnes	LAQJ7
Tug Defiance	WDG2047
Tugela	9HA2292
USCGC Alder	NGML
USCGC Biscayne Bay	NRUS
USCGC Bristol Bay	NRLY
USCGC Healy (AWS)	NWS0003
USCGC Mobile Bay	NRUR
USCGC Morro Bay	NRWY
West Vela	3FNX5
Yacht Express	PJVV
Zim Texas	V7VE3

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NOAA WEATHER RADIO NETWORK

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

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

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

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

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