

NCEP Quarterly Newsletter - September 2013

 Print

EMC HWRF Implementation

A significantly enhanced version of the NCEP Operational Hurricane Weather Research and Forecast (HWRF) Model was implemented on July 25, 2013, concurrent with the NCEP Production Suite transition to the new Weather and Climate Operational Supercomputing System (WCOSS). Implementation of the 2013 version of the operational HWRF model includes improvements in the areas of data assimilation, high-resolution nesting algorithms, and model physics. The HWRF Data Assimilation System (HDAS) was upgraded to include a regional one-way hybrid global Ensemble Kalman Filter (EnKF) and regional 3-Dimensional Variational (3DVAR) data assimilation scheme, which incorporates flow-dependent global ensemble forecast error statistics in the variation data assimilation scheme. Compared with the static error covariances used in traditional 3DVAR scheme, the error covariances estimated from the short range ensemble forecasts better represent the 'error of the day'. Apart from conventional data, for the first time, HWRF will be assimilating in real-time the high-density inner-core Tail Doppler Radar (TDR) data collected from NOAA P3 reconnaissance aircraft. The nesting techniques employed in the HWRF model have been upgraded to include a sophisticated storm tracking algorithm based on nine different atmospheric variables providing more accurate storm center location compared to the mass centroid method used in the past. The retrospective tests had confirmed that the upgraded storm tracking algorithm rarely lost a storm, giving the full benefit of using high resolution around a tropical storm. The nest-parent interpolations have also been revised for more accurate computation of up-scale and down-scale feedback, apart from providing better vertical interpolation and mass adjustments. Finally, the planetary boundary layer (PBL) scheme was upgraded to improve PBL structure both in the hurricane region and its environment.

The HWRF modeling system had a major upgrade in 2012, where for the first time an operational hurricane model at NCEP was run at a cloud-resolving 3 km horizontal resolution, laying the foundation for significantly improved hurricane forecast skill. In this year's (2013) upgrades, the hurricane team at EMC took advantage of the better scaling of HWRF model on the new WCOSS Linux architecture and explored the full potential of the high resolution hurricane dynamics and physics. As a result, in addition to the great improvement of forecast skills noted in the 2012 HWRF (10-15% for intensity and 15-20% for tracks), the 2013 HWRF model was found to exceed the track forecast skill by more than 15% and, most importantly, exceeded the intensity forecast skills by about 10-15% compared to the 2012 HWRF model. Evaluation of retrospective forecasts for three hurricane seasons (2010-2012) indicated that the 2013 HWRF model exhibits better intensity forecast skill than NHC official forecasts for the Atlantic basin tropical cyclones (Figure 1). The HWRF model intensity errors are much smaller than the statistical model errors at all forecast periods. This remarkable intensity prediction skill from a deterministic dynamical model compared to official or statistical models is unprecedented. In addition to the improvements in intensity forecasts, the track forecasts (Figure 2) also showed significant improvements from the 2013 HWRF compared to the 2012 HWRF, and are comparable to those of the best performing NCEP's Global Forecast System (GFS).

Operationally, the HWRF model provides forecast guidance to the hurricane forecasters at the National Hurricane Center (NHC) and Central Pacific Hurricane Center (CPHC) for all tropical cyclones in the North Atlantic, North Eastern Pacific and North Central Pacific basins. In addition, with support from NOAA's Hurricane Forecast Improvement Project (HFIP), starting with the 2012 typhoon season, the hurricane team at NCEP's Environmental Modeling Center (EMC) has been providing experimental real-time guidance to the forecasters at US Navy's Joint Typhoon Warning Center (JTWC) for all tropical cyclones of the North Western Pacific basin. JTWC has decided to include the 2013 version HWRF model in their official consensus model, which is unprecedented for non-operational models in that basin. Other international weather agencies from different countries such as China, Taiwan, India, Vietnam and Oman have expressed interest in using the HWRF model for their operational tropical cyclone forecast needs. HWRF is operational at the India Meteorological Department (IMD) for tropical cyclone forecasts over the North Indian Ocean basin, making NOAA's HWRF model a unique and specialized tropical cyclone forecast model for all Northern Hemispheric ocean basins.

Future developments of the HWRF model are planned, including implementing more sophisticated physics packages applicable for high-resolution assimilation of satellite data in all sky conditions, and better utilization of flight level data from reconnaissance aircraft. Efforts will also continue to develop and upgrade the HWRF ensemble prediction system. Expanding the ocean model to other basins and coupling the HWRF model to land, wave, surge and hydrology models are other developmental paths EMC has chosen leading to the next generation comprehensive hurricane forecast modeling system.

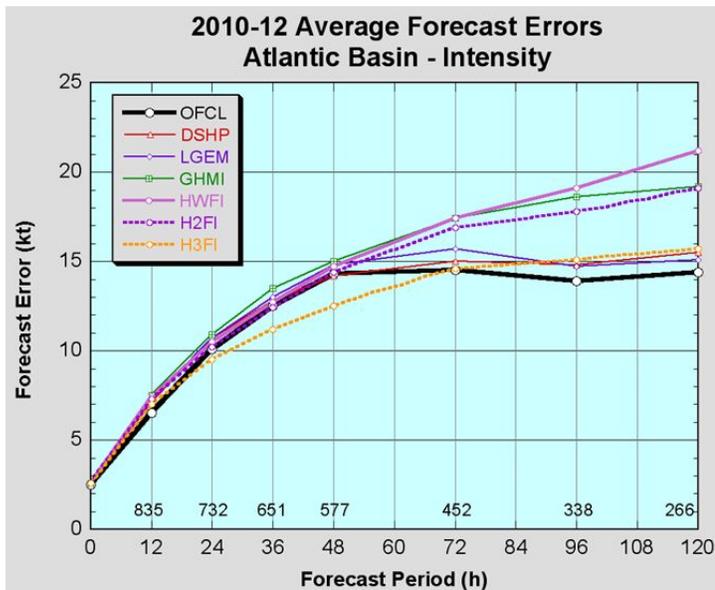


Fig.1 Intensity forecast errors in knots (y axis) versus forecast time in hour (x axis) for all tropical cyclones of Atlantic basin from 2010 to 2012 simulated by various models. The orange dotted line is for the 2013 HWRF, the purple dotted line represents the 2012 HWRF, green solid line is for GFDL, and thick solid black line denotes NHC official forecast errors. Also several statistical models, errors (DSHP in solid red and LGEM in solid purple) are shown in the picture. (Courtesy: James Franklin, NHC).

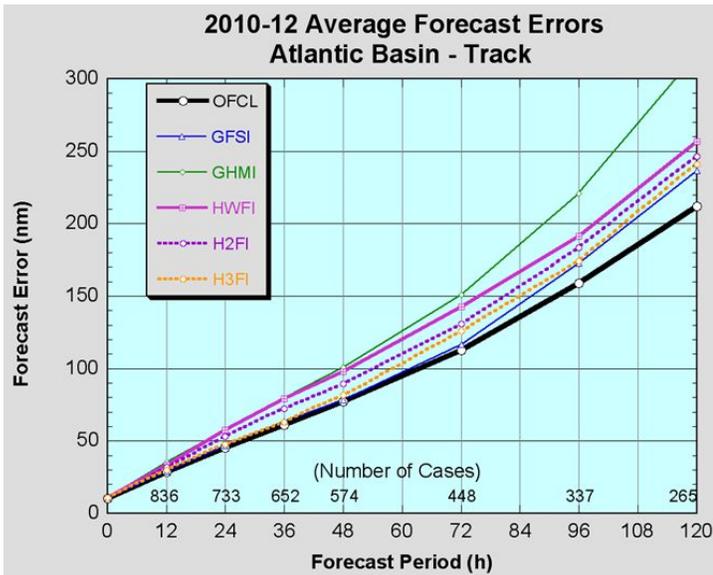


Figure 2: Same as Figure 1 except for track forecast errors in nautical miles. 2013 HWRP track errors (dotted orange) are comparable to the best performing NCEP GFS model shown in solid blue. (Courtesy: James Franklin, NHC).

EMC GFS Modeling Summer School

This past summer the [NCEP Environmental Modeling Center \(EMC\)](#) hosted the first-ever modeling summer school on the [NOAA operational Global Forecast System \(GFS\)](#) within the [NOAA Environmental Modeling System \(NEMS\)](#) framework. The four day summer school was held July 29 - August 1, 2013 at [NCEP/EMC](#) headquarters in the new [NOAA Center for Climate and Weather Prediction \(NCWCP\)](#) in College Park, Maryland.

The aim of the [NEMS/GFS Modeling Summer School](#) was to train users in the "art" of medium-range global numerical weather modeling: what is normally not documented in papers nor taught in classes. The courses took students through all steps involved in configuring, running and analyzing results from the [GFS](#) running on parallel supercomputers. The summer school also provided lectures by the scientists who developed the [GFS](#) and [NEMS](#) framework. Topics covered included the [GFS](#) numerics, dynamics, grid structure, physics, and post processing. Participants were exposed to the [NEMS](#) framework developed to optimize operational implementation of model systems and promote interoperability between components of the earth system required by advanced coupled model systems. The summer school students attended the technical lectures in the mornings and completed hands-on exercises running the [NEMS/GFS](#) in the afternoons on a [NOAA R&D supercomputer](#).

The four-day event proved not only beneficial to the diverse group of students who attended but to the [EMC](#) staff who participated as well, as many lectures stimulated one-on-one discussions between the students and subject matter experts. In the end this successful first run was an important step forward in developing opportunities for [EMC](#) to effectively interact with the academic community on global model development.



Image 1: Students listen to a morning lecture. (Credit: Nicole McKee, IMSG/EMC).

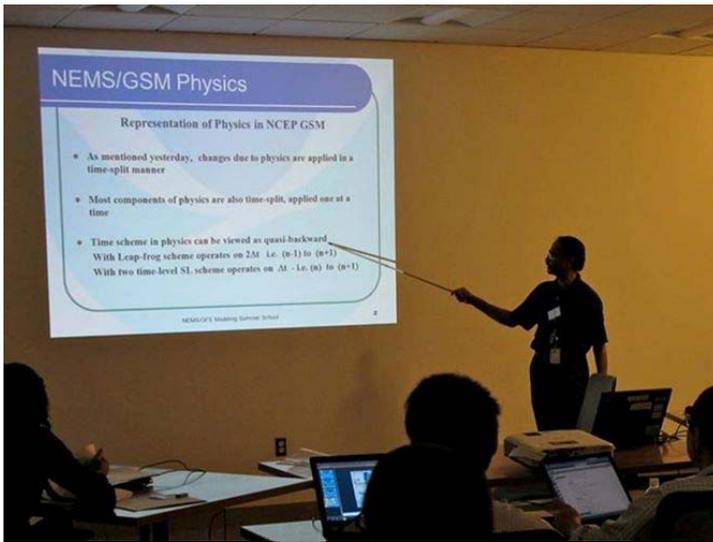


Image 2: Dr. Shrinivas Moorthi gives the students an introduction to the physics inside the NEMS/GFS. (Credit: Nicole McKee, IMSG/EMC).



Image 3: Students, lecturers, and summer school staff pose on the floating staircase in NCWCP's atrium. (Credit: Nicole McKee, IMSG/EMC).

Service Center Activities

AWC Aviation Weather Testbed Summer Experiment

The Aviation Weather Center's (AWC) Aviation Weather Testbed (AWT) hosted its third Summer Experiment from 12 August-23 August 2013. The collaborative experiment consisted of AWC operational forecasters and support staff along with external participation from academia, government, and private entities. The 2013 AWT Summer Experiment had over 50 external participants from 25 different institutions. The objective was to demonstrate new capabilities to AWC operational forecasters as well as to inform the external participants on how products are created and disseminated from AWC. The experiment was devised to mimic the operational environment at AWC with a few enhancements to the end products that may make the final product more usable for AWC clients. Five main experimental desks were created for the experiment, including: Convective SIGMET, Collaborative Convective Forecast Product (CCFP), Global Convection, Situational Awareness, and National Aviation Meteorologist (NAM). Two additional workstations were provided to demonstrate the Meteorological Development Laboratory's (MDL) AutoNowCaster (ANC) boundary input tool and the NOAA/Earth System Research Laboratory's (ESRL) Integrated Support for Impacted air-Traffic Environments (INSITE) tool. Along with the daily operational aspects of the experiment, 14 seminars were given during the two week period on a variety of topics ranging from convective initiation forecasting, to recent GOES-R developments, to how to best communicate forecast uncertainty.

The five desks formed the basis for the experiment as they demonstrated new experimental forecast grids and, in some cases, new experimental end products. The experimental Convective SIGMET desk had the new objective of trying to produce a 2-hour snapshot forecast instead of its current 2 to 6-hour time-ranged outlook product. This change required a change in forecaster mentality as well as interface changes to support the creation of such an end product. The experimental CCFP desk allowed for the addition of text tags to indicate

additional information on the mode or phase of convective activity.

The CCFP was also required to create a meteorological text discussion of impacts highlighted by the graphical product. The NAM desk has been issuing Aviation Weather Statements (AWS) from the Air Traffic Control System Command Center (ATCSCC) for the last two convective seasons for the New York Metro area. For this experiment it was expanded to handle all major air traffic impact regions of the CONUS. For one particularly impactful weather day for the National Airspace System (NAS), the AWSs were issued operationally from the Summer Experiment due to an increased workload for the NAM at the ATCSCC.

The Situational Awareness desk focused on short-range forecasting from simulated GOES-R fields that could aid both the NAM and Convective SIGMET desk. The Global Convection Desk was asked to forecast convection across the globe from 20° S to the North Pole using a suite of new probabilistic forecast tools. Feedback from AWC forecasters and stakeholders were key to the success of this experiment. The feedback gained, along with verification, will allow the AWC to begin transitioning experimental products to the operational floor for further and more thorough evaluations as well as preparing some desks for the transition to new products that will keep the AWC viable as we move forward in the NextGen era.



Figure 1. Aviation Weather Testbed Experiment participants collaborate at workstations.



Figure 2. Aviation Weather Testbed Experiment participants share experimental data sets.



Figure 3. Aviation Weather Testbed Experiment participants at work.

AWC Staff Participate in AirVenture

NCEP's Aviation Weather Center provided support to the NOAA information booth at the 2013 Experimental Aircraft Association's "AirVenture". During the week of July 29th-August 4th 2013, staff from the Aviation Weather Center, NWS Headquarters, NWS Weather Forecast Offices of Green Bay, Milwaukee/Sullivan, and La Crosse teamed up for another successful EAA AirVenture event. The NOAA booth was joined by representatives from Vaisala who provided some weather observing equipment for educational benefit. The National Weather Service team is part of the International Federal Partnership (IFP). The IFP consists of several U.S. federal agencies involved in aviation, as well as government agencies from other countries. IFP members provided public information and outreach booths inside the Federal Pavilion located just off the main runway at the EAA AirVenture event.

This year's AirVenture once again drew an estimated 500,000 people and 10,000 planes. 80,000 to 100,000 people are believed to have passed through the Federal Pavilion. EAA AirVenture is one of the largest outreach events for the NWS. NWS staff not only answered questions about the NWS mission and aviation weather services, but also handed out safety materials, and AWC participants demonstrated a new experimental website that was a huge success. The new website will replace the current www.aviationweather.gov website during the next year. You can check out the new website too, at new.aviationweather.gov. The feedback from thousands of pilots was overwhelmingly positive, including hopes for the new website to be operational as soon as possible.

NWS staff also provided daily educational presentations at the Federal Pavilion and live radio interviews at the EAA radio station. Attendance at presentations given by AWC staff made pilots eligible for credit towards their annual FAA training. EAA AirVenture was a week full of events, and the joint NWS effort helped make it a huge success.



Figure 1. NWS staff in front of the NOAA booth in the Federal Pavilion.



Figure 2. Photo of a Mikoyan-Gurevich (MiG) aircraft that was displayed outside the Federal Pavilion during the airshow.

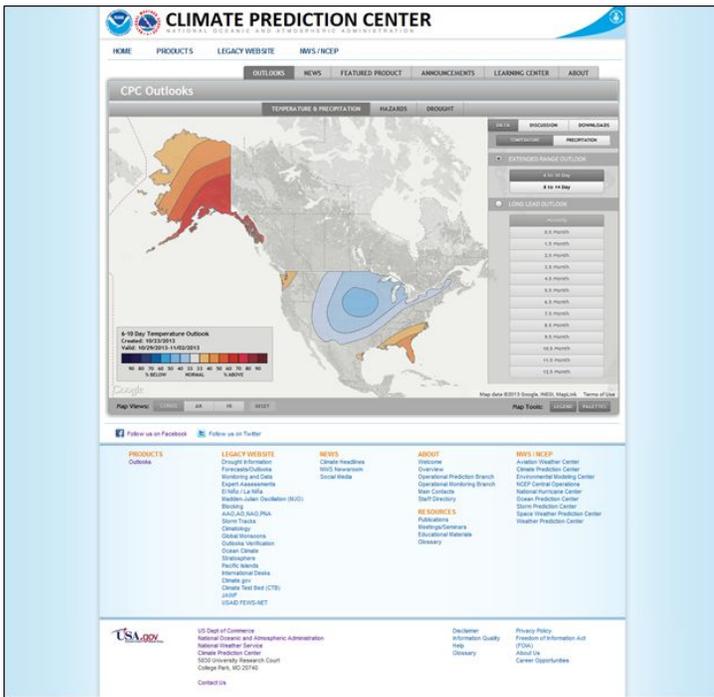
CPC New Website

The **Climate Prediction Center (CPC)** unveiled its new web page design on September 30, 2013. The new design incorporates the web page template used by the National Weather Service (**NWS**) and features a Rich Internet Application widget that is user-friendly and provides a clean and uncluttered navigation experience for the user, through the use of modern web-related tools and technology. The interface includes some of the **CPC**'s most popular outlooks products, as well as a number of informational sections.

The Outlooks section makes use of newer technologies, such as Geographical Information System (GIS) generated output, in the form of KML overlays that are displayed in Google Maps™. This coupled with interactive controls enable the user to better control the information being displayed. The result is a single map interface for the display, and is populated by the various outlook products (KMLs), which are selected by the user. The initial set of outlook products include: Temperature and Precipitation, Hazards and Drought.

The informational sections include: a "News Story" page that will highlight current climate-related news, and a "Featured Products" page that will showcase a particular **CPC** product. Both of these sections will routinely make use of video content to present the information through in-depth interviews of **CPC** staff and illustrative animations. Another section that will make use of video is the "Learning Center"-- a media "jukebox" that will stream video content that provides information on how to interpret and use **CPC** products. Rounding out the current informational sections are an "Announcements" page that will provide a current list of **CPC**-related activities; and an "About" section where users can learn more about **CPC**'s mission, as well as, find a **CPC** staff member by using an interactive staff directory.

The newly designed **CPC** web page represents the first overhaul to the web page design since mid-2001. The redesign of the **CPC** website will be an ongoing process with new pages added as they are completed. The initial set of the newly designed web pages is available for review at <http://current/www.cpcpara.ncep.noaa.gov/>. The **CPC** web team is currently improving upon the newly designed web pages based on user feedback. It should be noted that the existing **CPC** website and all products will continue to be available during the entire **CPC** website redesign process.



CPC's redesigned web page.

NHC Outreach about Storm Surge

When it comes to hurricanes, most people think of wind, but it is the water that claims the most lives and does the most damage. This was very evident to residents in the path of 2012's Hurricane Sandy. NOAA's National Hurricane Center is working closely with its media partners to get the public to understand the water danger. NHC will roll out an experimental inundation graphic in 2014, and an experimental storm surge watch and warning in 2015.



CNN meteorologist Chad Meyers interviews NHC storm surge team leader Jamie Rhone regarding the storm surge hazard and the new storm surge products to be introduced in 2014 and 2015.

NHC FLASH Collaboration Highlights Flooding Dangers

NOAA's National Hurricane Center teamed with the Federal Alliance for Safe Homes (FLASH) in an all-out effort to get the word out about the dangers of water from a hurricane and the importance of having flood insurance. FLASH CEO Leslie Chapman-Henderson joined NHC Director Dr. Rick Knabb on August 14th at the NHC facility, speaking via satellite to almost two dozen separate local media outlets from Texas to Rhode Island and several national outlets during a three hour span.



FLASH CEO President Leslie Chapman Henderson and NHC Director Dr. Rick Knabb get ready for another live interview to discuss the flooding dangers from hurricanes and ways to know your risk.

NHC Tweet Chat Hosted

Just ahead of the peak of the 2013 hurricane season, the **NHC** took to Twitter for a live Tweet Chat. On August 13th, **NHC** Director Dr. Rick Knabb and **NHC** senior hurricane specialist Daniel Brown served as the experts, answering questions ranging from the reasons behind the lack of storms so far this season to the latest in track and intensity forecasting.

More than 40 questions were answered in just an hour. Another one is planned for the end of the hurricane season.



NHC Director Dr. Rick Knabb and NHC senior hurricane specialist Daniel Brown answer questions in a live Tweet Chat.

OPC Experimental Web Lightning Strike Density

The **Ocean Prediction Center (OPC)** has introduced a new experimental web product called Lightning Strike Density. Graphical images of the gridded product with GOES satellite visible and IR satellite imagery are available on the Atlantic and Pacific pages of the **OPC** web page at: <http://current/www.opc.ncep.noaa.gov/lightning/> and these images update 24 hours per day.

Thunderstorm activity at sea can have significant impacts to the safety of mariners and impact operations. Presently, only satellite imagery gives mariners at sea an indication of thunderstorm activity beyond the land based **NWS WSR-88D** weather radar coverage. Satellite imagery provides the large scale view over the oceans, but does not provide definitive information concerning whether a particular cloud system is producing lightning.

The purpose of this lightning strike density product is to enhance awareness of developing and transitory thunderstorm activity by giving users the ability to determine whether a cloud system is producing lightning, if that activity is increasing or decreasing, and to emulate the future **GOES-R** satellite Global Lightning Mapper (GLM) data. Since the graphics are provided in an animated format, the general direction and speed the lightning activity is moving can also be inferred.

The Experimental Lightning Strike Density product produced by **OPC** is available in gridded form (GRIB2) and also through complementary web images. The product contains the number of lightning strikes per square meter per second. Users should remember that a lightning flash may be comprised of several or many cloud-to-ground strikes.

GRIB2 data will be available on the **OPC** FTP server, accessible via FTP and HTTP protocols:

ftp://current/ftp.opc.ncep.noaa.gov/grids/experimental/lightning_density/

http://current/ftp.opc.ncep.noaa.gov/grids/experimental/lightning_density/

Both static and animated images show the density of cloud to ground lightning strikes over a 30 minute time period. The lightning strikes are superimposed over infrared or visible satellite imagery and the user can select which imagery they prefer to see.

Figure 1 depicts lightning activity almost 250 nautical miles off the mid-Atlantic and Southeast US coastlines on October 23, 2013. The yellow lines in the image depict the Offshore Marine Zones that are used to define the forecast areas in the Atlantic Ocean for **OPC**. The storm with the highest lightning strike density in this image is located near 34 degrees N latitude and 71 degrees W longitude, indicated by the yellow coloring. The coloring is based on the number of strikes per unit area over a specified time period, which in this case is between 10 and 15 strikes per square meter per second.

OPC plans to add this product to their mobile website (www.opc.ncep.noaa.gov/mobile.php), as well.

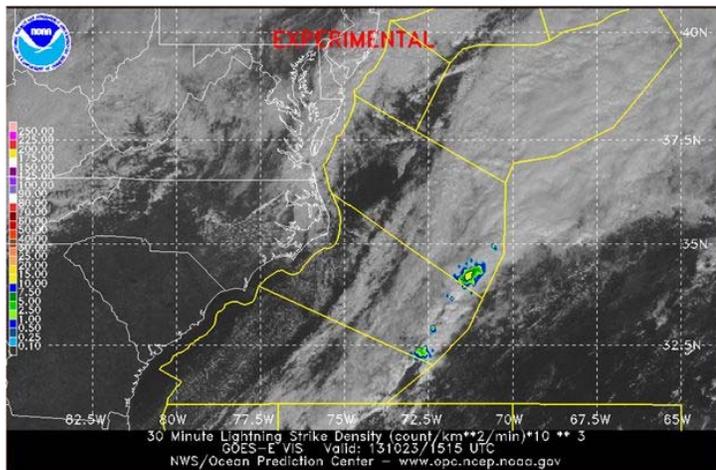


Figure 1. Lightning activity almost 250 nautical miles off the mid-Atlantic and Southeast US coastlines on October 23, 2013, depicted as the density of cloud to ground lightning strikes (the number of lightning strikes per square meter per second) over a 30 minute time period.

OPC SSCA Gam

The [Ocean Prediction Center](#) participated in the Seven Seas Cruising Association (SSCA) Gam in late September. A Gam is defined as a gathering of sailors and sailing vessels. The event was held at the YMCA Camp Letts on the banks of the Rhode River, just south of Annapolis, MD. About 400 cruising sailors took part with 70 boats anchored off the camp site.

OPC had the opportunity to make a presentation to several hundred sailors who are sophisticated consumers of weather forecast information. The presentation is available at http://current/www.opc.ncep.noaa.gov/sevenseas_2013.php. The sailors are frequent users of National Weather Service marine warnings, products, and services for Coastal, Offshore and High Seas areas. SSCA is an excellent organization for NWS to engage routinely and continue a dialog about the continued OPC migration of services into digital production.

The sailors currently rely heavily on gridded model information as well as graphical analyses and forecasts. For grids, the [Global Forecast System \(GFS\)](#) model is widely used by the group. Starting on May 1, 2013 the OPC started to produce forecaster generated grids which can be used by the mariners. These grids are not based on a single deterministic model run, but represent forecaster interpretation based on using multiple numerical models as well as forecaster expertise. These data are accessible through a graphical website that displays the [National Digital Forecast Database \(NDFD\)](#). On the web the link is <http://current/preview.weather.gov/graphical/>

The SSCA was very interested in using the forecaster generated grids as a source of forecast data. They contributed ideas on how to integrate the gridded data with existing graphical products. They had questions about National Weather Service computer servers for the grids as well as questions about how to access only the specific area of interest out of the larger gridded datasets. They also had ideas for expanding the grids in the future to include forecast confidence.

Many of the SSCA group are seasoned sailors with years of marine experience. At least one of the members circumnavigated the globe at high latitudes, which is a particular weather challenge. They expressed appreciation for the work that OPC does and a desire to continue the dialog about future marine forecast products and services.



Gam participants anchored off Camp Letts on the Rhode River in Annapolis.

SPC Fire Weather and Thunderstorm Outlook Enhancements

The Storm Prediction Center (SPC) began creation of three-category fire weather outlooks to aid communication of risk to our fire weather partners. Specifically, the old "see text" annotation is replaced by an explicit "elevated" risk area. This enhancement aids forecast specificity and addresses a major issue for Geographic Information Systems (GIS) users. The SPC's operational production of these new fire weather forecasts began on September 24, 2013. The change improves communication for both general fire weather conditions, as well as for dry thunderstorm risk areas associated with an increased risk of new fire starts.

Fire weather forecasters analyze meteorological parameters such as humidity, wind speed and direction, cloud cover, mixing heights, and soil moisture to determine whether conditions are favorable for fire growth and smoke dispersion. The SPC issues national [Fire Weather Outlooks](#) out to eight days for the contiguous United States.

Below is an example of the new Fire Weather Graphic, in this case for a Day 1 Outlook.



SPC Staff act as mentors for participants in the First Lego League.s (FLL) kick-off event for its Annual Robotics Competition at the National Weather Center (NWC) in Norman, Oklahoma. Photo Courtesy of Daphne Thompson, Meteorologist, Education Outreach Coordinator for NOAA Weather Partners.

SWPC ISES Web Site

The collaboration capabilities of space weather forecasters around the globe were enhanced in August with the release of the new web site of the [International Space Environment Service \(ISES\)](#). This web site includes a new online collaboration tool that will enable forecasters in multiple countries to compare numerical model output of solar disturbances to improve forecasts of geomagnetic storms.



International Space Environment Service web site was released in August, 2013 (www.spaceweather.org).

The [International Space Environment Service \(ISES\)](#) has been the primary organization engaged in the international coordination of space weather services since 1962. It currently is comprised of 15 Regional Warning Centers (RWCs) around the globe and four Associate Warning Centers, one in France and three in China. The European Space Agency serves as a Collaborative Expert Center for data and product exchange in Europe. The [NOAA Space Weather Prediction Center](#) serves as the World Warning Agency and acts as a hub for the exchange of forecasts.

The mission of [ISES](#) is to encourage and facilitate near-real-time international monitoring and prediction of the space environment to reduce the impact of space weather on activities of human interest. The RWCs provide a broad range of services, including forecasts, alerts and warnings of solar, magnetospheric, and ionospheric conditions; extensive space environment data; customer-focused event analyses; and long-range predictions of the solar cycle. While each RWC concentrates on its own region, [ISES](#) provides a forum to share data, to exchange and compare forecasts, to discuss customer needs, and to identify the highest priorities for improving space weather services.

The primary focus of the new collaboration capabilities is enabling ensemble forecasts of solar disturbances using Enlil, a state-of-the-art numerical prediction model. The Enlil model was developed in the U.S. and was recently distributed to our international partners in the UK, South Korea, and Australia. Forecasters will now be able to share their model runs and compare forecasts based on a spectrum of solar disturbance conditions. This will lead to an improved quantification of the sensitivity of the forecasts to various input parameters, and it will allow consensus forecasts to be considered.

In addition to the collaboration tools, the new [ISES](#) web site is an important step toward improving outreach to worldwide users of space weather information and to enhancing communication among all [ISES](#) Members. This site provides a forum for sharing news of recent developments and for the coordination of services.

The Korean Space Weather Center is responsible for developing and maintaining the [ISES](#) website. The Korean Space Weather Center's generous support and their dedication to continuing improvements are highly appreciated.

SWPC Geomagnetic Disturbance Workshop

It has long been recognized that a geomagnetic storm could cause considerable damage to the electric power grid, particularly in North America. Research in recent years suggests the impact could be very significant. In response, numerous government agencies have joined industry in a variety of efforts to assess the vulnerability of the power grid and define possible mitigation strategies.

These issues were addressed at the Geomagnetic Disturbance (GMD) Workshop in August 2013 at the [U.S. Department of Energy Idaho National Laboratory \(INL\)](#) in Idaho Falls, Idaho. Bill Murtagh of [NOAA's Space Weather Prediction Center \(SWPC\)](#) was a keynote speaker at this workshop which included electricity system experts from industry, government, and academia.

Bill introduced exciting new initiatives at [SWPC](#), which, in partnership with the [U.S. Geological Survey \(USGS\)](#) and [NASA](#), is developing regional specification products of geomagnetic disturbances and the associated electric field. Such products will help grid operators understand what they might expect at their location during geomagnetic storms. Other important elements of discussion focused on strengths and weakness of current prediction capabilities at [SWPC](#).

Another area of discussion focused on the variety of modeling activities that are underway to help grid operators assess power system vulnerability and predict the potential impacts on our Nation's power grid. [INL](#) has provided vital support for the modeling efforts by conducting testing of large power transformers which can be used to validate these models in an effort to better understand the effects of induced current from a geomagnetic storm.

The [INL](#), working with the [Defense Threat Reduction Agency](#), conducted the first full-scale testing which replicated what the utility users would experience on the electric grid from a geomagnetic storm. Their efforts validated many of the existing concerns and identified new vulnerabilities that were previously unknown or largely dismissed. Failure mechanisms in some of the most critical power grid components were presented at the meeting and mitigation strategies discussed. The mitigation strategies presented were largely twofold: introduce engineering hardware solutions (blocking devices), and/or implement appropriate operational responses to [SWPC](#) geomagnetic storm alerts and warnings.

It was recognized that high levels of power line harmonics that may be created by a severe geomagnetic storm might actually penetrate power-line filters and disrupt computer power supplies and uninterruptible power supplies. Such impacts were previously not well understood and it was recognized that impacts on the electronic equipment could be a significant concern.

Important details of the recent ruling by the [Federal Energy Regulatory Commission \(FERC\)](#) were also discussed. In May 2013, [FERC](#) made a ruling that requires the development of reliability standards to address geomagnetic storms. The standards will require owners and operators of the Bulk-Power System to develop and implement operational procedures to mitigate GMD effects. It also requires owners and to conduct initial and on-going assessments of the potential impact of benchmark GMD events on the Bulk-Power System.

The workshop provided an excellent forum to introduce important new findings, update progress in key initiatives, and identify new opportunities to mitigate potentially debilitating impacts of geomagnetic storms on the Nation's power grid.



The nation relies on power transmission systems that are vulnerable to geomagnetic storms.

WPC 2013 Flash Flood and Intense Rainfall Experiment

Flash flooding is a hazard that lies at the interface of meteorology and hydrology. The [Weather Prediction Center \(WPC\)](#) produces a suite of flash flood forecast guidance by considering both quantitative precipitation forecasts (QPFs) and the hydrologic response. In particular, the new [WPC Met Watch Desk](#) focuses on flash flood threats in the 1 - 6 hour timeframe. While the [WPC](#) is historically a QPF-focused center, it is recognized that a keen understanding of the hydrologic response to QPF is critical to providing skillful flash flood forecast guidance.

In collaboration with the [National Severe Storms Laboratory \(NSSL\)](#) and [Earth System Research Laboratory \(ESRL\)](#), the Hydrometeorological Testbed at the [Weather Prediction Center \(HMT-WPC\)](#) located at the [NOAA Center for Weather and Climate Prediction](#) in College Park, MD hosted the first annual Flash Flood and Intense Rainfall Experiment (FFaIR) from 8-26 July, 2013. The experiment brought together 26 meteorologists, hydrologists, researchers, and model developers, including eight remote participants from WFOs and RFCs, to explore the challenges associated with short-term QPF and flash flood forecasting (QPF) during the warm season. Each day, participants collaborated to produce an array of flash flood forecasts for the high-impact area of the day.

One goal of the experiment was to evaluate the utility of high resolution convection-allowing models and ensembles for short-term QPF and flash flood forecasts. Participants leveraged these ensemble datasets, including tools such as the ensemble probability of QPF greater than RFC Flash Flood Guidance (probability of QPF>FFG), as guidance to make probabilistic flash flood forecasts. Although both the meteorological and hydrologic guidance have limitations, it was found that tools that combine both sources information have potential to provide skillful flash flood forecasts.

Another goal of the experiment, and a difficult one to achieve, was to verify the flash flood forecasts. A recurring challenge throughout the experiment was determining when and where flash flooding had occurred since there is no single observational dataset that accurately depicts all flash flood events. Each morning during the experiment, participants assimilated an array of data to determine areas that were affected by flash flooding during the preceding day. These data included local storm reports (LSRs), WFO-issued flash flood warnings, return periods from a distributed hydrologic model ([NSSL-FLASH](#)), and areas where radar QPE exceeded FFG, among other datasets.

The FFaIR Experiment provided a unique opportunity to bring the meteorological and hydrologic communities together to explore the challenges of both short-term QPF and flash flood forecasting. The experiment provided valuable input to guide the development of new forecast tools to support [WPC's](#) flash flood guidance suite, including the new Met Watch Desk, and raised awareness about the limitations of the currently available forecast guidance. A complete summary of the inaugural FFaIR experiment has been published on the [HMT-WPC website](#) (<http://current/www.wpc.ncep.noaa.gov/hmt/experimentsummaries.shtml>).



Participants examine experimental guidance during the experiment.

WPC Spanish Version of National Forecast Chart Now Includes Day 2 and Day 3

On September 24, 2013 Spanish-language versions of the popular [Weather Prediction Center \(WPC\)](#) chart depicting significant weather across the continental U.S. were extended to include the Day 2 and Day 3 forecast range. The Spanish version of the Day 1 chart was first made available in 2011. The chart depicts the threat of significant weather expected for the day. The original (English version) day 1 chart is consistently [WPC's](#) most popular web product averaging over 350,000 hits per day. This day 1 chart is displayed on the [NWS](#) web page and the web pages of most local forecast offices.

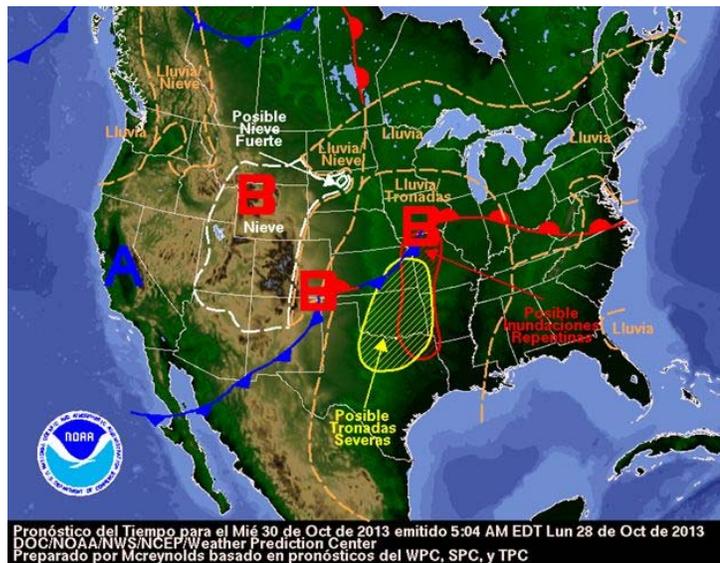
The [WPC National Forecast Charts](#) provide an overview of expected weather for up to the next three days, with emphasis on certain hazardous and significant weather. They summarize forecasts from several [NCEP Service Centers](#) including the Storm Prediction Center (for severe thunderstorm and tornado outlooks), the [National Hurricane Center](#) (for tropical storm and hurricane forecasts), and the [Weather Prediction Center](#) (for information concerning heavy rainfall, flooding, winter weather, and general weather). With overlaid frontal forecasts, these displays serve as a good overview of the expected weather for the next three days.

The charts are intended for use by anyone who needs a non-technical display of the expected weather including the general public, the media, and the emergency management community. They show the large-scale weather features and associated significant weather. These charts are especially useful to travelers or others needing a big picture forecast. They are not intended to provide detailed local forecasts for any particular area. See <http://current/weather.gov/> for access to detailed local [NWS](#) forecasts and warnings.

The original day 1 version was produced by WPC beginning in 2001. Previously a version of the chart had been prepared five days a week by staff at NWS Headquarters. The WPC version was extended to seven days a week. On June 6, 2011, the WPC added a day 2 version. The day 3 version of the chart was implemented on September 12, 2011. Both new charts were added to the WPC product suite at the request of the Department of Homeland Security.

The Spanish versions of the charts are produced with no forecaster interaction. A set of English phrases has been defined for use on the English version of the chart. There is a table to convert these phrases into their Spanish equivalents and a script automatically creates the Spanish version from the English version. This ensures a consistent product suite with no need for any knowledge of Spanish by the forecasters.

Both the English and Spanish versions of the charts can be found at http://current/www.wpc.ncep.noaa.gov/national_forecast/natfcst.php?day=1.



<http://www.ncep.noaa.gov/newsletter/>