NCEP Quarterly Newsletter - June 2011

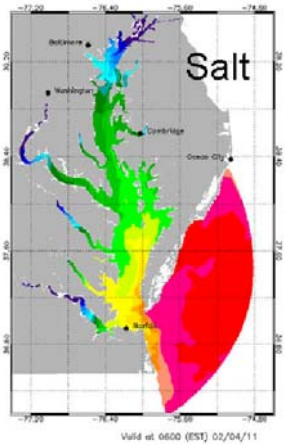
Print

Operational Implementation of 3 Bay Models

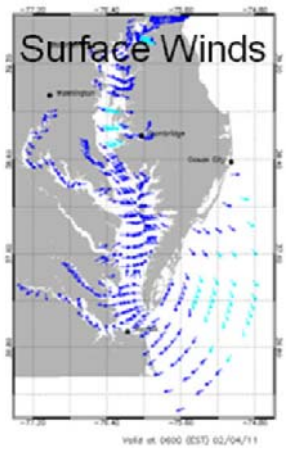
March 29, 2011 was an historic day for NOAA as numerical prediction models for the Chesapeake, Delaware, and Tampa Bays were implemented on NCEP's operational Central Computing System by the National Ocean Service (NOS) and NCEP's Central Operations (NCO), producing 48 forecasts of 3-D salinity, temperature, currents, and 2-d water levels and surface winds. This represents a major effort on behalf of NOS model developers and NCEP (NCO and the Environmental Modeling Center (EMC)) to fulfill the goals established through the NOAA agreement to the Science Advisory Board recommendation in 2005 that the NCEP central computer be used as a "backbone" for NOS computer forecast models and related ocean and coastal services. By taking this step, NOS made several important enhancements to these models including

- going from 2D to 3D which yielded marked improvements in water level forecasts;
- increasing resolutions with a range from 50m to 5 km (expandable/flexible grids);
- more reliable and quicker access to weather model fields (e.g. model winds);
- ability to feed off the initial and boundary conditions from the NCEP Atlantic HYCOM model;
- ability to distribute the output via the web and also through NOMADS, the National Operational Model Archive and Distribution System.

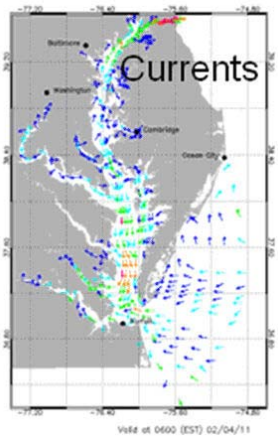
Furthermore, the models now run nearly 4 times faster than originally planned (due in part to the excellent partnership which developed between the NOS modelers and NCO) and will be part of the overall model suite running with 99.98% on time delivery. Last but not least, given the success of these models, it is now possible for NOS and other NOAA components to pursue ecological forecast systems in these Bays.



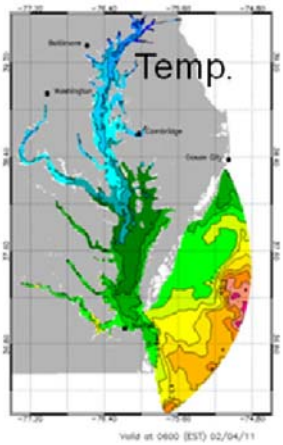
Salt forecast field for the Chesapeake Bay.



Surface Winds forecast field for the Chesapeake Bay.



Currents forecast field for the Chesapeake Bay.



Temperature forecast field for the Chesapeake Bay.

International collaboration between NCEP and the India Meteorological Department

Three EMC scientists visited the Indian Institute of Tropical Meteorology (IITM) in Pune, India from April 8 - 15 to deliver software and conduct training on how to operate NCEP's Global Forecast System. From April 11 - April 15, 2011, about 60 attendees from IITM, The Indian Meteorological Department, India's National Centre for Medium Range Weather Forecasting (NCMRWF), the Indian National Center for Ocean Information Services and other organizations, including academic institutions in India gathered for a five day workshop consisting of lectures on the use of the Global Forecast System and the Climate Forecast System in the morning and hands-on training in running the models in the afternoon. The workshop was part of a Memorandum of Understanding (MOU) between NOAA and India's Ministry of Environmental Science (MoES) designed to develop and transfer extended range and seasonal forecast systems that will permit more accurate and timely predictions of Indian Monsoons for enhancing food security and other agricultural uses. These activities, and the agreement, were highlighted during President Obama's trip to India in November 2010.

The workshop was a great success. By the end of the week, all the models were installed and running at IITM and participants had the opportunity to run each model. The model codes will be transferred to other organizations in the MoES through IITM. The forecast systems will be used (and evaluated) for this year's monsoon season. Future activities include regular coordination calls and India's participation in the upcoming meeting in August to plan the next version of the CFS.

Workshop facilities at Indian Institute of Tropical Meteorology

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Work Begins Anew at NOAA Center for Weather and Climate Prediction

As of March, 2011, work has resumed at the NOAA Center for Weather and Climate Prediction (NCWCP) located at the University of Maryland's M-Square Research and Technology Park. The 268,762 square-foot office and research complex is scheduled to become the new home for five of the nine centers that make up the NWS National Centers for Environmental Prediction, two sections of NOAA's National Environmental Satellite and Data Information Service (NESDIS), as well as the Air Resources Laboratory (ARL). Approximately 800 people will work in the facility.

Skanska USA's building business unit was awarded the contract to complete the building after a two year hold on construction activity when the development firm contracted to build the center filed for bankruptcy.

The building will contain offices and operational areas, a data center, a library, conference rooms, a 500 seat auditorium, a hot deli and a four-story atrium. The project also includes a stand-alone parking garage that can hold up to 685 vehicles. The new center will also include several sustainable features, including a green roof, which will be partially covered with vegetation. The roof will also include white Polyvinyl Fluoride roof areas designed to minimize the heat island effect on the environment. The site and building is constructed to comply with Interagency Security Committee building criteria. This includes blast resistant glass, progressive collapse structure, and anti-ram fencing and bollards.

Building construction is scheduled to reach substantial completion in March of 2012. Move-in is scheduled to start by July 2012 and complete by September 2012.

Entrance to NOAA Center for Weather and Climate Prediction

Climate Forecast System Version 2 (CFSv2) Upgrade

The CFSv2, which became operational March 30, 2011, is the NOAA operational dynamic, fully coupled model used to develop NWS forecasts ten months out in the future. Considerable advancements over version 1.0 (CFSv1) have been made in the physics, resolution, coupling, data assimilation, ocean and land models. See the comparison table below. Combined with reanalysis and reforecast data sets, this new version will remarkably improve week three and four and seasonal forecasts.

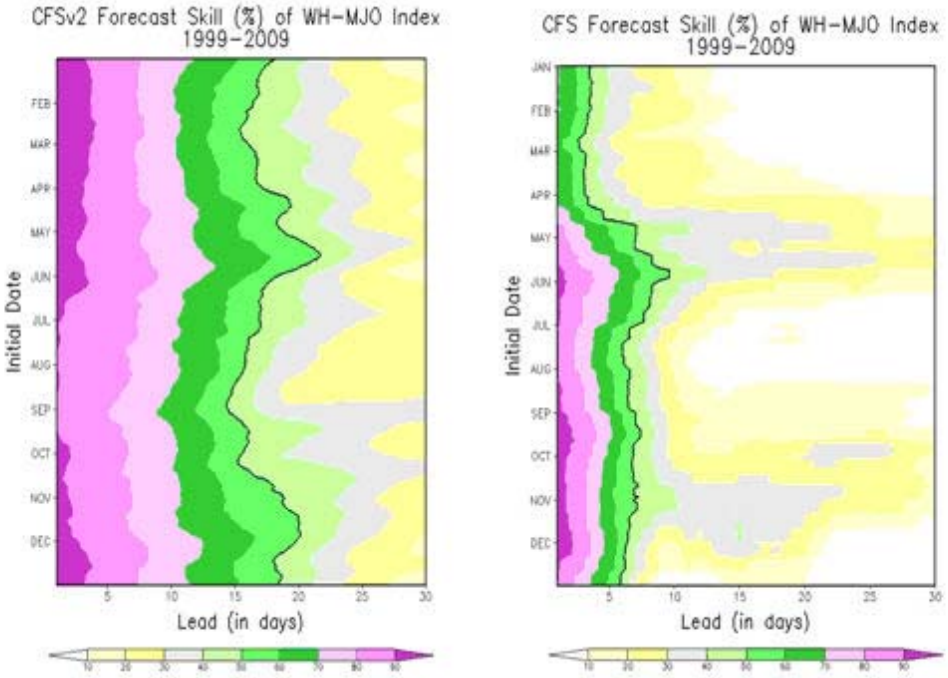
Configuration Comparison between Climate Forecast System v1 and v2

Attribute	CFSv1 Configuration	CFSv2 Configuration
Analysis Resolution	200 km	38 km
Atmosphere model	1995: 200 km/28 levels Humidity based clouds	100 km/64 levels Variable CO2 AER SW & LW radiation Prognostic clouds & liquid water Retuned mountain blocking Convective gravity wave drag
Ocean model	MOM-3: 60N-65S 1/3 x 1 deg. Assim depth 750 m	MOM-4 fully global 1/4 x 1/2 deg. Assim depth 4737 m
Land surface model (LSM) and assimilation	2-level LSM No separate land data assim	4 level Noah model GLDAS driven by obs precip
Sea ice	Climatology	Daily analysis and Prognostic sea ice
Coupling	Daily	30 minutes
Data assimilation	Retrieved soundings, 1995 analysis, uncoupled background	Radiances assimilated, 2008 GSI, coupled background
Reforecasts	15/month seasonal output	25/month (seasonal) 124/month (week 3-6)

Two encouraging results of CFSv2 are presented here. Both pertain to verification of hindcasts made with the new CFSv2 model from the Climate Forecast System Reanalysis (CFSR) initial conditions.

1. Subseasonal Madden-Julian Oscillation (MJO) Prediction

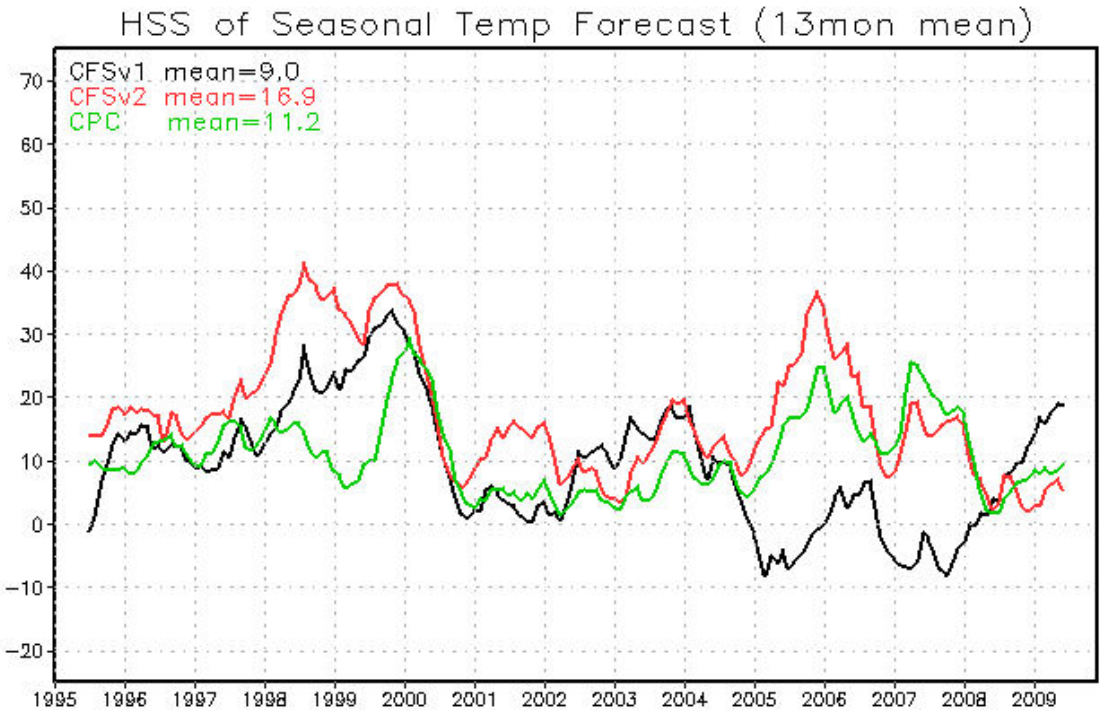
   Now that CFSv2 is run without delay in real time, the shorter range forecasts have practical applications. The figure below shows the skill as measured by bivariate anomaly correlation (BAC)x100 of CFS in predicting the MJO for period 1999-2009, as expressed by the Wheeler and Hendon (WH) index (two empirical orthogonal functions (EOFs) of combined zonal wind and Outgoing Longwave Radiation (OLR)). On the left is CFSv2 and on the right is CFSv1. The black lines indicate the 0.5 of BAC. The 0.5 anomaly correlation value has been adopted by the international MJO community as the threshold for a forecast having skill (AC>0.5) or not (AC<0.5). Both models were corrected for their own bias. (Courtesy: Qin Zhang, CPC)



The black line denoting 0.5 clearly shows that the skill of predicting the MJO has been extended from the 5-10 day range to the 15-20 day range with the CFSv2.

2. Seasonal Temperature Prediction

Seasonal temperature predictions by CFSv2 for the first three month period of a forecast were verified over the US and a 13-month running mean of the Heidke Skill Score (HSS) is plotted in the figure below as the red line for 1995-2009. For comparison CFSv1(black line) and CPC's official forecast(green line) are shown as well (Courtesy: Peitao Peng, CPC)



It is clear that CFSv2 is a substantial improvement over CFSv1 (16.9 vs 9.0 overall). This is attributed to the increase of CO_2 that is incorporated in CFSv2 (not in CFSv1), which allowed CFSv2 to perform bettter on the upward temperature trend.

Global Hawk UAV Demonstrates Capability for Collecting Atmospheric Data

The NASA Global Hawk Unmanned Aerial Vehicle (UAV), outfitted with a NCAR developed automated launching dropsonde system, successfully completed three mission flights in the Pacific in February and March of 2011. . These historic flights fully explored the range of capabilities this Unmanned Aerial System provides, demonstrating its utility in sampling Atmospheric Rivers, conducting Winter Storms Reconnaissance, and atmospheric sampling in the Arctic. Scientists from NCEP's Environmental Modeling Center are currently working with these recently collected data sets to mine their impact within the Global Forecast System. In total, 177 dropsondes were released during flights on Feb 11, Mar 4 and 10. The flight duration was 14 hours, 24 hours and 25 hours respectively. The success of these missions were largely a result of closely coordinated activities between NASA , NOAA and NCAR.

NASA's Global Hawk takes off from NASA's Dryden Flight Research Center in California's Mojave Desert

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Project to Increase Model Implementation Pace

NCEP Central Operations (NCO) and the Environmental Modeling Center (EMC) are working together on an Environment Equivalence project which will streamline the process for implementing model changes. As model software and hardware has become increasingly sophisticated, the current implementation process has become labor intensive, difficult to manage with potential for introducing errors. The development environment on NCEP's supercomputers differs from the production environment in ways that make it difficult for developers to emulate operations in their testing. Developers must attempt to replicate production scripts even though they do not have the ability to run their jobs similarly to operations. The process developers use to notify and instruct NCO on how to implement changes has become unwieldy for large upgrades.

The Environment Equivalence project goal is to mitigate these difficulties and speed up the model implementation process. EMC developers use the Subversion version control system for saving changes to their modeling systems. This project will extend the use of Subversion to deliver changes for implementation.

With this capability, NCO and EMC staff will start working together on model upgrades much earlier than is currently done so that EMC testing will include jobs for which NCO has typically had sole responsibility, and NCO will assist EMC in developing scripts that are production-ready. Scripts will be written so that they may be used either in development or production with minimal or no changes. By working together earlier in the implementation process, duplication of effort will be reduced and evaluations of model upgrades will be able to start earlier.

The current production environment on the supercomputer has codes from more than 40 models combined into a small number of locations. Developers and implementers have to know exactly what to look for when searching for the software for only one model. The production environment on the supercomputer will be modified to separate model software into model-specific locations, so development, implementation and troubleshooting will be easier.

EMC and NCO are doing initial testing on the new process using an upcoming model upgrade as the pilot. This will allow EMC and NCO to address technical issues which may arise and to determine the final environment configuration. A second upgrade will be used to test the final environment configuration. NCO and EMC expect to have this final test completed by the end of September, 2011. After the project's closeout, all future model upgrades will be implemented using the new process.

Early estimates show a time savings of at least one month, and in some cases, several months, in testing and implementing a typical model upgrade.

5th NCEP Ensemble User Workshop

Despite the tropical look of the venue, on May 10-12, the Environmental Modeling Center and the Developmental Testbed Center (DTC) jointly hosted the 5th NCEP/NWS Ensemble Users Workshop in Laurel, MD. About 90 people attended the 3-day workshop. This workshop brought together experts in the generation and use of NCEP ensembles and users from North America, Europe and Asia to review progress since the last workshop (in May 2008) on the generation and use of operational products and to discuss plans for future efforts and collaborations. The workshop theme was supporting NWS in its transition from single value to probabilistic forecasting, and how to convey forecast uncertainty in a user relevant form. Collaborative efforts on the national (NUOPC, DTC) and international (NAEFS, GIFS/TIGGE) scale were also addressed.

The workshop spent most of last day forming four working groups to discuss ensemble and uncertainty forecast related issues. Eight areas have been identified from the working group discussion. They are

1. ensemble configurations;
2. ensemble forecasting;
3. statistical post processing;
4. reforecast/hindcast generation;
5. probabilistic product generation;
6. forecaster role and training;
7. ensemble data depository/access and
8. database interrogation.

The summary and recommendations from this workshop will be a valuable reference for future NWS roadmaps.

5th NCEP Ensemble User Workshop Attendees

Network Upgrade Readies NCEP and DoD for Satellite and Other Data

NCEP Central Operations (NCO) is currently deploying a network upgrade for NOAA and the Committee for Operational Processing Centers (COPC). COPC coordinates data assimilation, analysis, and environmental prediction efforts through NOAA and the Department of Defense (DoD). COPC is comprised of senior leadership from NCEP, National Environmental Satellite, Data, and Information Service (NESDIS), Air Force Weather Agency (AFWA), Naval Oceanographic Office (NAVO), and Fleet Numerical Meteorology and Oceanography Center (FNMOC).

This upgrade provides a faster and more reliable network between NCEP, DoD, NESDIS and the NWS Telecommunication Operations Center (TOC). The upgraded network will be able to expand to support additional satellite data associated with the new NESDIS polar and geostationary satellites, new model product exchanges from the National Unified Operational Prediction Capability, and DoD access to NCEP.s operational data sources including NOMADS (NOAA Operational Model Archive and Distribution System).

Service Center Activities

The Daily Weather Map Becomes Fully Automated

The Hydrometeorological Prediction Center's (HPC) Daily Weather Map is the oldest continuously distributed publication of the NWS, having been published continuously since 1871. A hundred years ago, most field offices published a version of the weather map for local subscribers, but the *Daily Weather Map* is the last survivor.

While the basic content of the *Daily Weather Map* has remained relatively unchanged for 140 years, the publication has mirrored many of the science and technology changes that have taken place in the NWS. For example, in the 1940s fronts and upper air charts first appeared. The changing means of distribution of the charts, from mailed paper copies to electronic distribution reflects the changing technology. In the early years, with limited mass media and efficient postal services, it was primarily a way of disseminating weather information and forecasts to anyone interested in the weather. Over the years, it became less a source of current weather information and more of a convenient archive of weather data. As a result, in the 1960s, publication was changed from daily to weekly. In 2001, an electronic version appeared, available free on the HPC webpage to complement the paper copy available by subscription.

Until recently, the *Daily Weather Map*, while based on the operational surface chart, was prepared separately. During the first half of 2011, HPC streamlined its production. As of June 20, 2011, the production is completely automated. The appearance

and content remains the same, but there is no longer a need for any manual intervention. The surface analysis retains the limited selection of plotted stations for clarity, but the analysis of fronts and isobars, which is now obtained directly from the operational map, is more detailed. Shading of precipitation areas and isotherms for 0 and 32 degrees have been automated and improved, using gridded fields as the source for more detail. The ancillary charts, including the 500 millibar, maximum/minimum temperature, and observed precipitation, are generated automatically.

More changes will be coming soon. While the number of subscribers to the print edition has dwindled to double digits, the number of downloads from the HPC website has soared, reaching an average of 4800 per day for May 2011. The next step in the evolution of the *Daily Weather Map* will likely occur in 2012 when it becomes solely an electronic product.

If any publication can be said to represent the NWS and its predecessor agencies over a 100 year plus history, it is the *Daily Weather Map*.

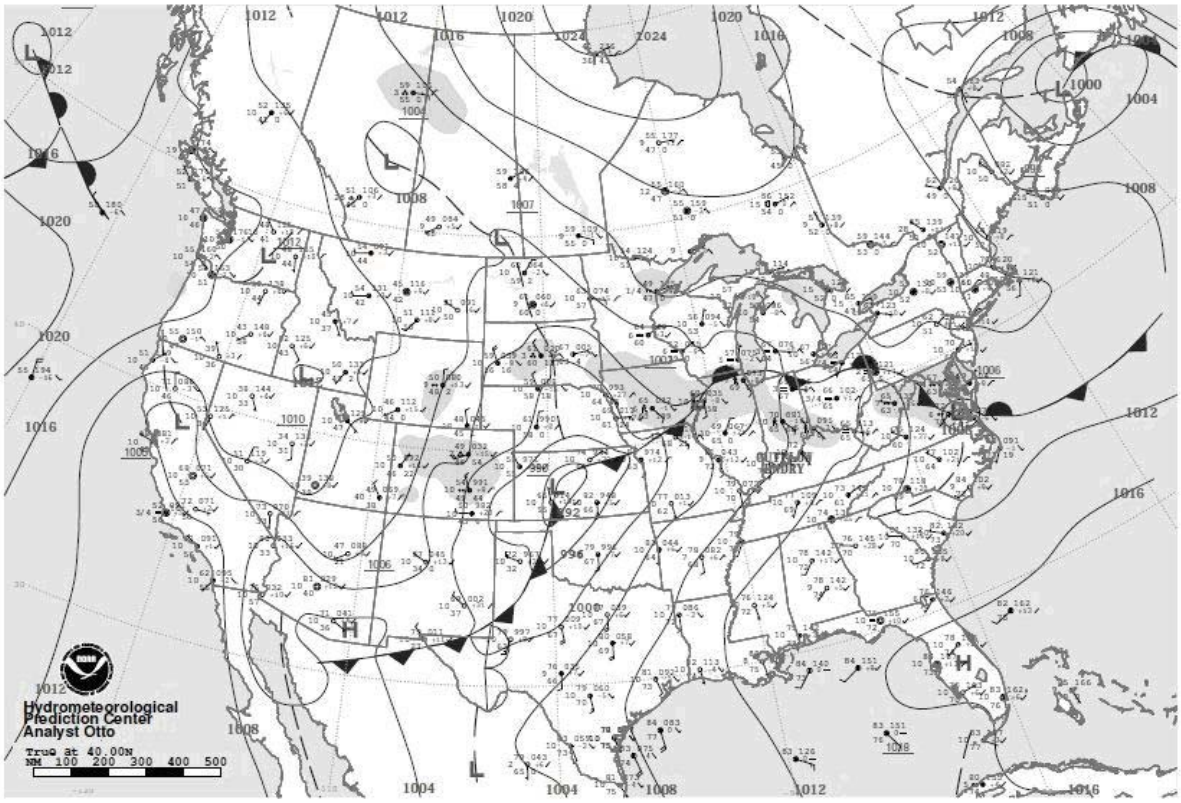

Image of the Daily Weather Map.

President Obama and UK Prime Minister Cameron Embrace UK Met and NOAA Space Weather Partnership

During a State Visit to the United Kingdom (UK) on May 25, President Obama and UK Prime Minister Cameron agreed to increase collaboration within the areas of higher education, science, and innovation in the coming months. The President and Prime Minister also embraced the growing partnership between the UK Meteorological Office and NOAA to create the world.s first combined numerical weather and space weather forecast model. This model will not only forecast the usual terrestrial weather with greater accuracy, but it will also indicate where, when, and the length of time that solar flare-induced disturbances will persist in our upper atmosphere which can impact GPS capabilities. Reliable advanced warning of the degradation and loss of GPS-enabled positioning, navigation, and timing capabilities is critical for safe and efficient air traffic management, deep sea drilling operations, and maritime commerce. It can also save construction, agriculture, and transportation industries from serious financial losses and setbacks.

Space scientists and meteorologists are beginning to embark on this initiative by increasing the altitude coverage of the

National Weather Service and UK Meteorological Service global weather forecast models to encompass those rarefied atmospheric layers above the stratosphere---the mesosphere, the thermosphere and the ionosphere---where space weather impacts on these technologies are found. The ultimate goal is to have both NOAA and UK Met running Whole Atmosphere Models for space weather predictions thereby providing a small ensemble for improved forecasts. The UK and the U.S. undertake jointly to uphold this commitment to safeguard our economies and societies against the growing risks posed by severe solar storms.

President Barack Obama and UK Prime Minister David Cameron participate in a joint news conference at Lancaster House in London, Wednesday, May 25, 2011.

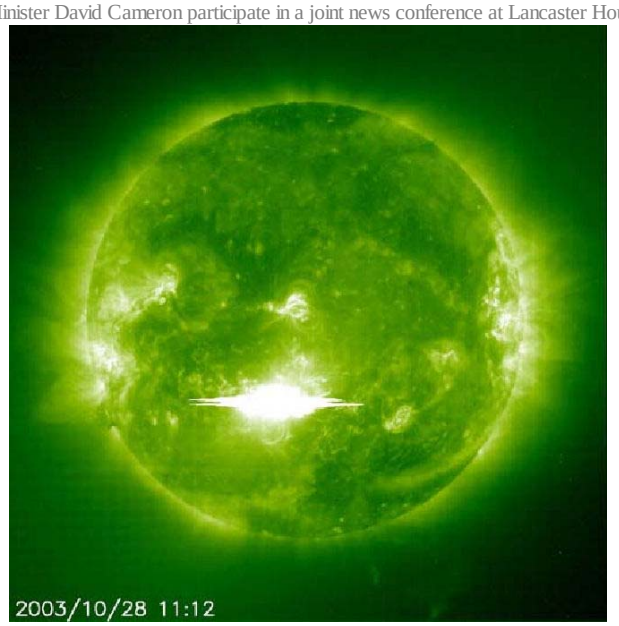

Image of a flare from SOHO satellite in 2003.

UK Prime Minister David Cameron holds bilateral talks with U.S. President Barack Obama and his delegation on May 25, 2011.

Associated links:

http://www.whitehouse.gov/the-press-office/2011/05/25/strengthened-collaboration-between-united-states-and-united-kingdom
http://www.whitehouse.gov/the-press-office/2011/05/25/joint-fact-sheet-us-uk-higher-education-science-and-innovation-collabora

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Annual Space Weather Workshop held in Boulder, Colorado

From April 26-29, NOAA's Space Weather Prediction Center (SWPC), partnering with the NSF and NASA, hosted the 12th annual Space Weather Workshop (SWW) in Boulder, CO. SWW brings researchers, forecasters and end users from around the world together to advance the discipline of space weather. Through presentations, discussions, poster sessions and side meetings, these networking opportunities provide SWPC with a setting to directly interact with constituents. Over 330 registered guests from 16 different countries participated in the conference which consisted of 13 sessions with topics that pertained to areas such as the Impacts of Space Weather, Space Weather Modeling, and Interagency and International Partnerships.

Highlights from the week included:

- Presentations by Former NOAA Administrator Vice Admiral Conrad Lautenbacher, NOAA's NWS DAA Laura Furgione, a Panel Discussion Expert Group on .Growing the Space Weather Enterprise., as well as a special evening session with Guest Speaker Dr. Pal Brekke of the Norwegian Space Centre.
- Key representatives from US and Canadian power grid companies joined SWPC staff to redefine NOAA's suite of space weather products and services in support of electric utility companies. SWPC wants to expand its services to include local and regional specification of geomagnetic storms, and introduce more appropriate indices to better capture intensity and duration of geomagnetic disturbances (GMD).
- Representatives from the NASA Community Coordinated Modeling Center (CCMC) and Geospace Modelers met to discuss the metrics against which the geospace models will be compared and the selection process that will be utilized to select the model to be transitioned into operations.
- The UKMet office and SWPC researchers discussed plans to collaborate and coordinate on the development of Whole Atmosphere Modeling (WAM) capabilities. The ultimate goal is to have both NOAA and UKMet running Whole Atmosphere Models for space weather predictions thereby providing a small ensemble for improved forecasts.
- Several representatives from the commercial space weather industry gave presentations during SWW providing an

opportunity to demonstrate NOAA's commitment to growing the space weather commercial enterprise and supporting the growing customer base requiring tailored products.
- Important representatives were brought in to explain their concerns, vulnerabilities, and needs from the space weather community with respect to GPS systems. This important customer-operator-researcher interaction produced critical insight to the concerns of the aviation community and the space weather community.s ability to respond to these needs.

Growing the Space Weather Enterprise Panel Discussion

NCEP Contributes to NOAA Support for Japan Tsunami Impacts

Immediately after the Japan earthquake on March 11, 2011 and the radiological emergency, the White House (Office of Science and Technology Policy, National Security Staff) and various US government agencies (Federal Aviation Administration, Department of Energy) and international agencies (World Meteorological Organization(WMO), International Atomic Energy Agency) were requesting weather information to help them deal with the disaster. NCEP Centers responded immediately to the requests for information and began developing new capabilities to provide that support. Some products became available within hours. Since March 11, 100% of all requests for dispersion model guidance has been provided on time.

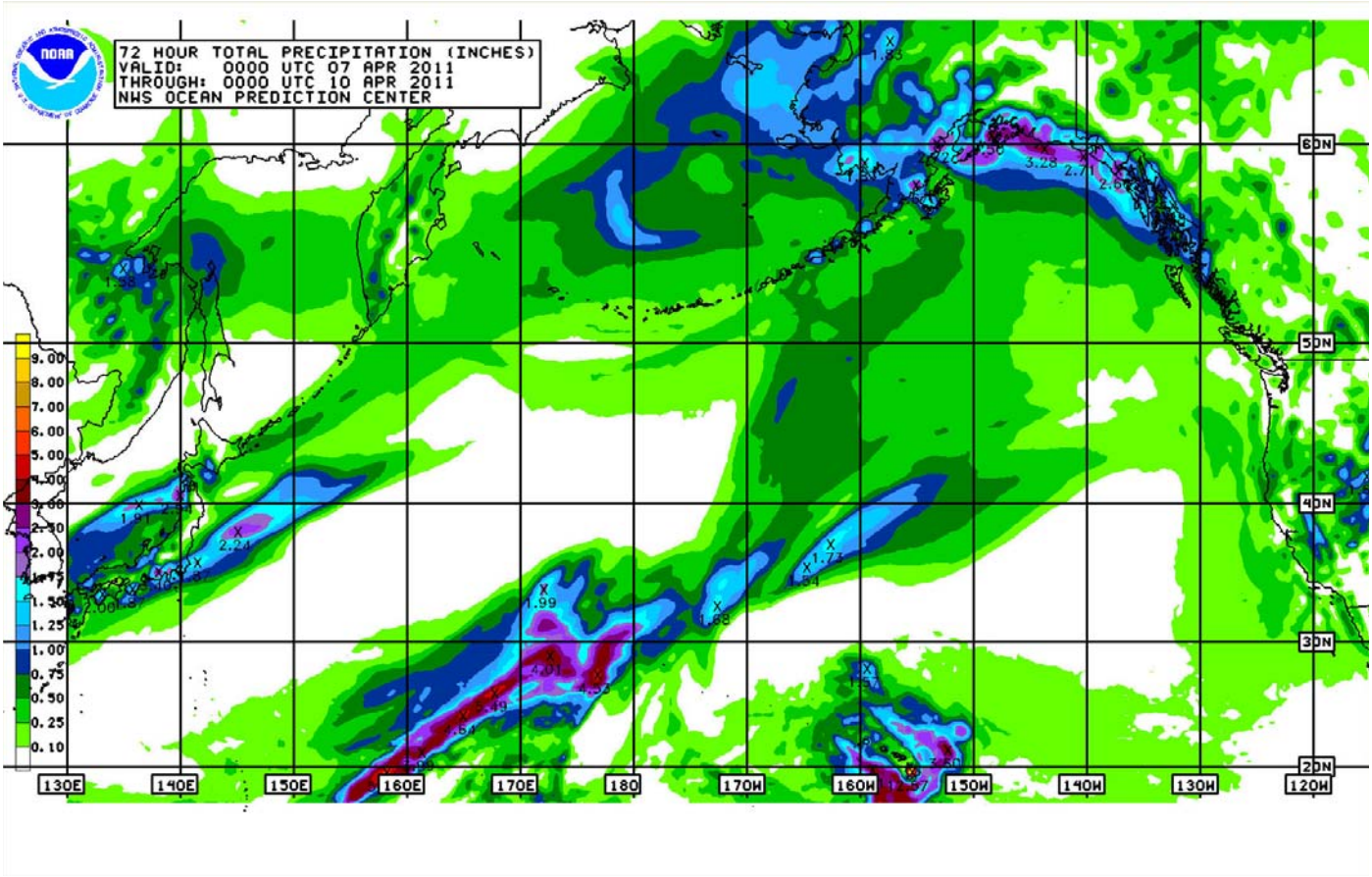
NCEP's Central Operations established new processes to provide radiological dispersion model guidance 24/7. The Environmental Modeling Center (EMC) implemented experimental modeling capability to track particles at the ocean suface, and estimate dispersion and retention times of radionuclides by ocean currents. The Hydrometeorological Prediction Center provided low and upper level wind and precipitation forecasts up to 4 times daily. The Aviation Weather Center coordinated and developed procedures for the placement of a radiological symbol on the SIGWX chart, which has never before occurred. The Climate Prediciton Center developed a suite of climate products and week two forecasts, routinely posted to a web page.

On March 16, after consultation with the U.S. maritime navigation safety authorities and international partners (WMO, International Maritime Organization, International Hydrographic Organization), NCEP's Ocean Prediction Center (OPC) placed the government of Japan navigation advisory regarding areas near the Fukushima nuclear power plant, on three OPC high seas radio fax charts that are transmitted to ships in the Western Pacific. On March 19, OPC replaced the government of Japan navigational advisory with the U.S. government navigation advisory. The OPC radio fax charts could reach ships coming east in the Western Pacific, west of dateline which is Japan's area of responsibility for maritime safety, thus, the U.S.

Government advisory could not reach through the standard Global Maritime Distress Safety System.

Sample of the label placed on the OPC charts.

On March 20, OPC began producing a briefing package of three charts; the surface analysis, 24 and 48-hour surface forecasts for the Pacific Ocean. Later, OPC increased the briefing package to twice daily. At the request from National Security Staff to NOAA, OPC began to produce daily 0-72 hour cumulative QPF for the Pacific Ocean including Japan. A 0-120 hour cumulative QPF was added on March 31. In response to a request from Navy to support the Defense Threats Reduction Agency radiological plume and dispersion modeling for ocean areas near Japan, OPC began to disseminate real time, high resolution (1km), Navy regional and coastal ocean model data.



Sample of the 0-72 hour Quantitative Precipitation Forecast.

Aviation Weather Center Supports FAA's Next Generation Air Transportation System

The Next Generation Air Transportation System (NextGen) will revolutionize the way air traffic is managed across the National Air Space System (NAS) over the next 15 to 20 years. The current system based on fixed jet routes, arrival points, and manual use of radar to separate aircraft, has reached the limit of how many airplanes can safely and efficiently be delivered to the core United States airports. With air traffic and passenger demand expected to continue to increase, improvements to the system must occur. NextGen will create a "network-enabled system". In this system, aircraft will utilize increasingly automated Global Positioning Satellite systems to know not only where the aircraft is, but where it is in relation to other aircraft or constraints in the atmosphere. In this system, free-flight trajectories will allow planes to travel the most efficient route, or to dynamically re-route around constrained airspace quickly, safely, and efficiently.

The single most troublesome constraint in the NAS is weather. As the FAA modernizes through NextGen, the weather information that goes into this network-enabled system must evolve as well. NOAA's Aviation Weather Center (AWC), one of nine National Centers for Environmental Prediction (NCEP), is on the leading edge of these weather changes. Currently the AWC produces over 200,000 routinely issued products annually, in addition to supporting the single largest aviation weather website and database. While this may seem like enough information to support NextGen, it doesn't even come close. Many of these products are text, graphical, or digital; and are in numerous different formats, and resolutions, with inconsistent refresh times. NextGen demands consistent, high-resolution data in four dimensions, with update rates on the order of minutes! A four dimensional weather cube, with access available by all users of aviation weather information will provide this data in a consistent format.

The Aviation Weather Center has been working closely with several partners to prepare for the NextGen weather needs. The joint FAA-NWS Traffic Flow Management Weather Requirements Working Group (TRWG) has been working to not just define some of these weather needs, but also to develop the roadmap between the weather information available today to the new weather data of tomorrow. NextGen will be implemented over the next 15 to 20 years. Specific milestones have been identified, such as Initial Operating Conditions (IOC), which will be the starting point in 2013. By 2016, the Middle Operating Condition (MOC) milestones will be met. Final Operating Conditions (FOC) won't be realized until around 2025.

The TRWG is working hard to develop the crucial roadmap to MOC. AWC, supporting the NWS and working with the FAA has helped this joint group to identify the high resolution weather requirements for MOC. There really are no real "requirements" for the current state; it has just evolved with the weather industry over the past 40 or 50 years. Therefore, the TRWG is creating baseline requirements for what we do now. The TRWG is also identifying what changes need to be made quickly to meet the IOC needs. AWC is integrally involved in the development of near term performance indicators. These performance measures will identify how well, and to what extent, the National Weather Service Aviation Weather programs are meeting the initial needs of NextGen. Once that performance is understood and tracked, we can work with the FAA, and aviation weather users to identify and prioritize what needs to be done to begin advancing toward the MOC weather needs.

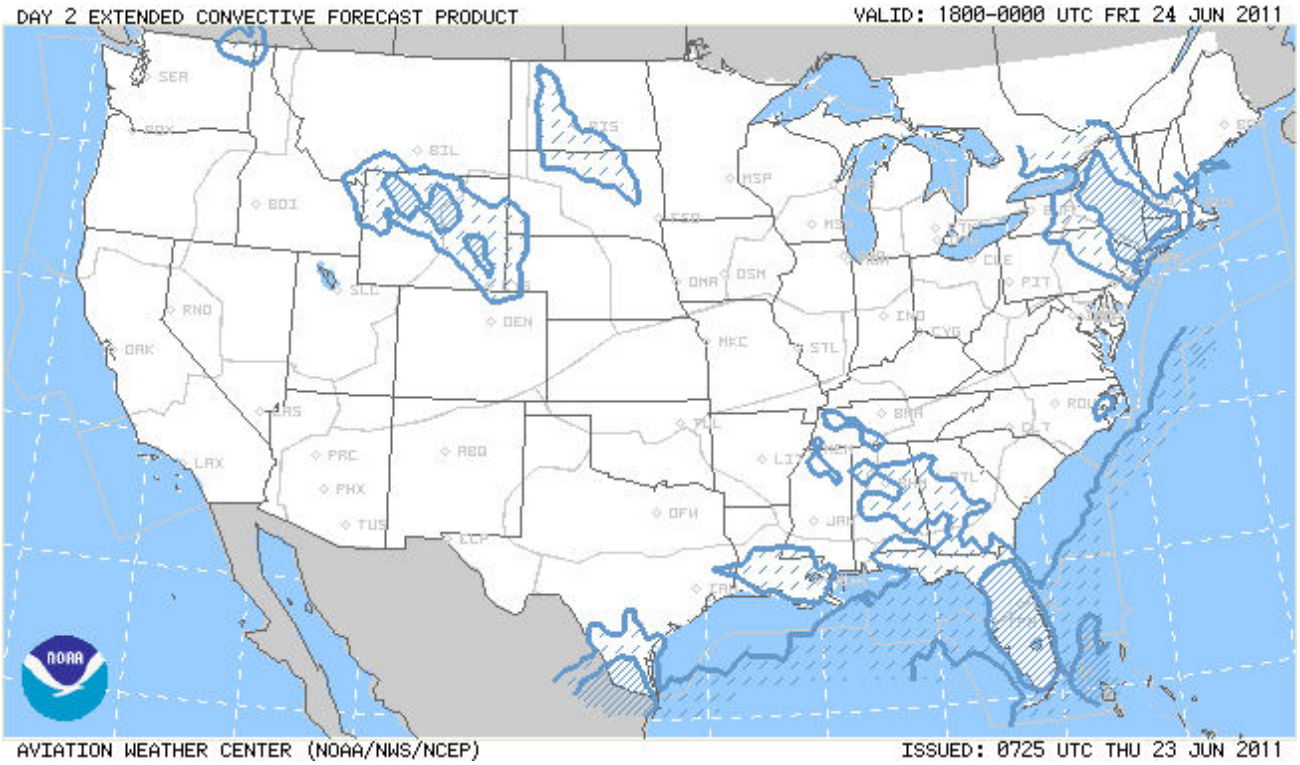
The Aviation Weather Center is working with many groups and on many fronts to support our FAA partners in making NextGen work. As the threshold of the NextGen Initial Operating Condition is very near, everything we now do will affect IOC. In essence we are already starting to operate in the NextGen world. The AWC is working with the FAA's Aviation Weather Research Group to focus and prioritize research efforts to improve weather observations and forecasts.

The AWC has been working with international partners, like the U.K. Met Office to harmonize Global Aviation Forecasts produced by the two centers. This has resulted in a globally consistent "Single Authoritative Source" of Icing, Turbulence, and Thunderstorm forecasts for aviation. The AWC has been working closely with the International Civil Aviation Organization to start looking at international standards, and evolving them to meet not just NextGen needs, but the changing global aviation needs.

This summer the Aviation Weather Center will be hosting a summer experiment in the new Aviation Weather Testbed to test, evaluate, and refine new and emerging weather forecast data for eventual inclusion into operational aviation weather prediction, in support of FAA NextGen goals. Various community partners are providing data sets to test specific hypotheses, which include basic scientific questions of model use and comparison (deterministic vs. ensemble, storm-scale vs. mesoscale guidance), the design of new data visualization strategies and tools (plumes along jet routes), and the exploration of new methods for communicating potential aviation impact to stakeholders and partners.

The Aviation Weather Center has been increasingly involved with the FAA-Airline partnership called Collaborative Decision Making (CDM). CDM is an approach by both airlines and the FAA to work through operational challenges together. There are a number of sub-teams in CDM who work on very specific traffic management challenges. Weather is so troublesome that it has its own sub-team, called the Weather Evaluation Team (WET). Through collaboration with the WET, the Aviation Weather Center has been able to respond quickly and effectively to traffic flow management's weather needs. One example is the Extended Convective Forecast Product (ECFP). ECFP is a graphic which presents complex probabilistic forecast thunderstorm predictions, and displays them in a way that is intuitive and translatable by the user. This has provided a useful tool for traffic managers to use to extend the planning process for the NAS to respond to weather. This is truly a NextGen tool, that will help improve efficiency well into the NextGen era.

When considering the execution and implementation of NextGen, we are "in the NextGen world" even though it's not yet 2013. The tools we are creating, the relationships we are building, the practices we are setting up today will be there for NextGen IOC. And we have the plans and partnerships to continue building toward the future.



Example of Extended Convective Forecast Product

Climate Prediction Center Issues 2011 Atlantic Hurricane Season Outlook

The Climate Prediction Center (CPC) issued its 2011 Atlantic hurricane season outlook on May 19th, calling for a high likelihood (65% chance) of an above normal season. This outlook is produced in collaboration with scientists from NCEP's National Hurricane Center (NHC) and the Atlantic Oceanographic and Meteorological Laboratory's Hurricane Research Division (HRD). The 2011 Atlantic hurricane seasonal outlook was presented by NOAA administrator Dr. Jane Lubchenco at a national press conference in Suitland, MD. The press conference also featured FEMA administrator Craig Fugate, who discussed the importance of hurricane preparedness, and of having a preparedness plan in place before the hurricane season begins.

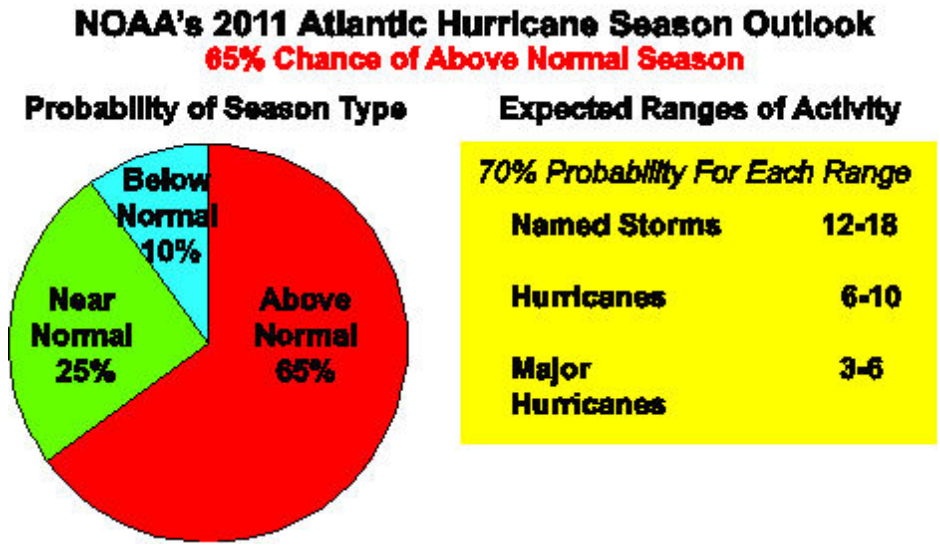
The outlook is based on predictions of large-scale climate factors known to influence seasonal hurricane activity, and on promising new climate models like the Climate Forecast System (CFS) that directly predict seasonal hurricane activity. The 2011 outlook reflects an expected set of conditions that are conducive to an above-normal Atlantic hurricane season. These conditions reflect three climate factors:

1. The tropical multi-decadal signal, which has contributed to the high-activity era in the Atlantic basin that began in

1995, while also suppressing hurricane activity in the central and eastern Pacific basins,
2. A continuation of above-average sea surface temperatures in the tropical Atlantic Ocean and Caribbean Sea,
3. ENSO-neutral conditions most likely (no El Niño or La Niña), with lingering La Niña impacts into the summer.

More information can be found here: http://www.cpc.ncep.noaa.gov/products/outlooks/hurricane.shtml

The 2010 Atlantic hurricane season was one of the busiest seasons on record, with 19 named storms, 12 hurricanes, and 5 major hurricanes. These totals were all within the ranges predicted in NOAA's seasonal outlooks issued on May 27 and on August 5, 2010. This season's update will be issued in early August.



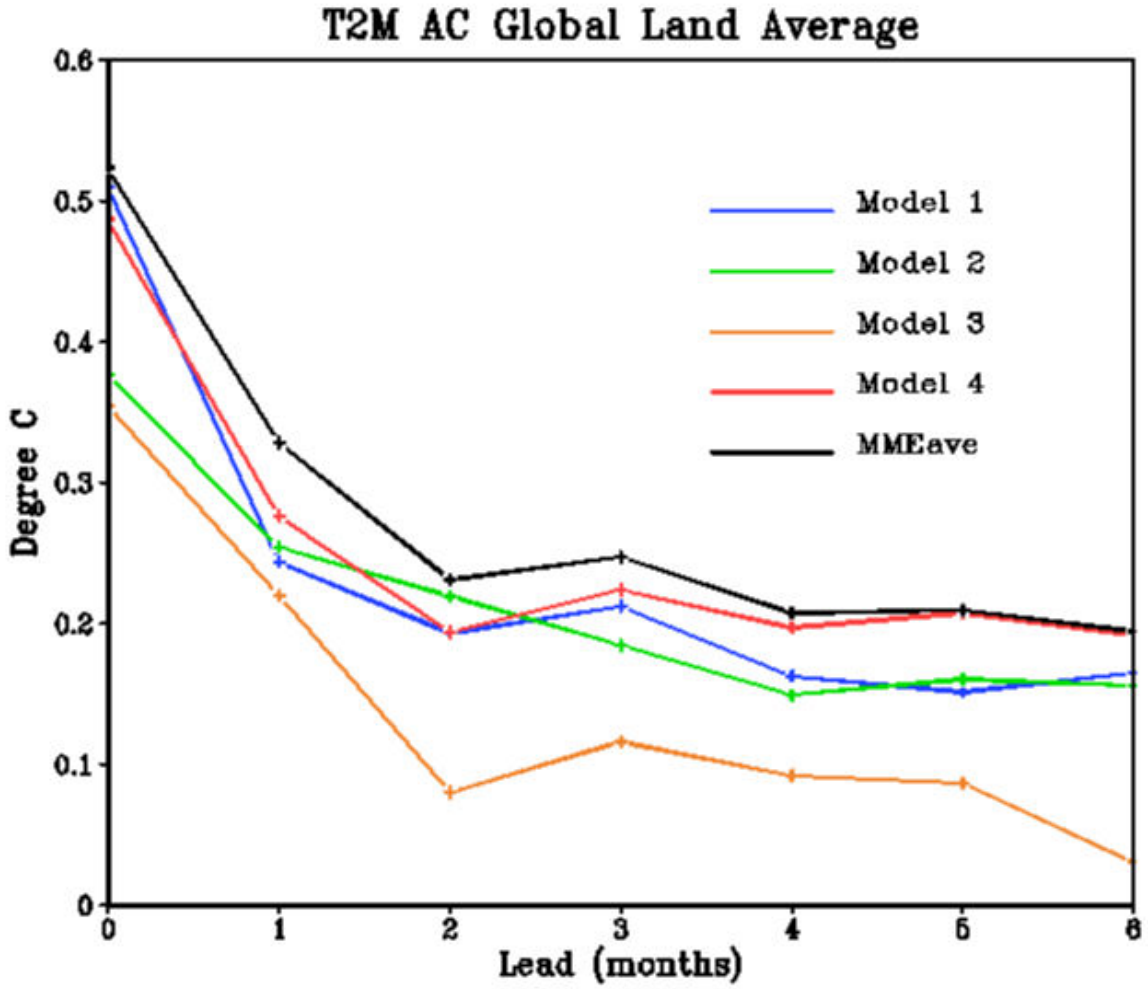
NOAA's 2011 Atlantic hurricane season outlook. This probabilistic outlook reflects the expected activity for the entire Atlantic basin, which includes the North Atlantic Ocean, Caribbean Sea, and Gulf of Mexico. The outlook is not a seasonal landfall forecast, and it does not predict levels of activity for any particular region.

International Multi-Model Ensembles

MME or Multi-Model Ensembles, in an informal way, are as old as numerical weather prediction. To use solutions from different centers, even if only in a subjective way, has seemed natural to weather forecasters, as in: the more opinions the better. However, organizing an MME more formally has turned out to be far more difficult since it requires agreements and dependable protocols, including "on time, all the time". In addition, seasonal predictions require the availability of model hindcasts, because systematic errors are very large in the long range.

Last year a memorandum of understanding was signed that admitted NCEP as an adjunct member to EUROSIP, a European venture which is focused on seasonal predictions using ocean-atmosphere-land models. EUROSIP is a joint effort made up of the European Center for Medium Range Forecasting (ECMWF), the UK Met Office, Meteo France and (now) NCEP via its Climate Forecast System (CFS) model. This activity is referred to IMME within NCEP, for International MME, differentiated from NMME, the National MME which may emerge with U. S. partners like GFDL, NCAR and NASA.

NCEP has acquired the 1981-present hindcasts for the three European models and combined them with our own recently upgraded CFSv2. A measure of skill for the prediction of global monthly mean temperature (land only) is shown in Figure 1. Skill, as per the anomaly correlation, is given for models 1-4, and for the average of the 4 models, which scores the highest, demonstrating the benefits of MME. The four models are not listed by name because the agreement with EUROSIP requires that the hindcasts are .not public., and cannot be redistributed by NCEP. The real time forecasts are also not public, mainly because of commercial issues in Europe. Therefore the real time EUROSIP forecast will only be available (late 2011) from NCEP as images of the Multi-Model average.



A measure of skill for the prediction of global monthly mean temperature (land only).

Figure 1. The anomaly correlation of monthly mean temperature predictions over global land, 1 is perfect, 0 is useless. Colors are used for the individual models, while the black line is for the ensemble mean (generally the best). The higher skill for lead 0 includes high skill weather prediction for the first few days of the upcoming month. The skill at longer lead, a more legitimate target, starts at about 0.3 and slowly decreases to 0.2 at a lead of six months

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HPC Collaborates with WFOs and RFCs to Provide Mississippi River Flood Support

The Hydrometeorological Prediction Center (HPC) is striving to serve the nation by working proactively with our partners and customers during high-impact weather events. A recent example is the collaboration from early April into June between HPC and Weather Forecast Offices (WFOs) and River Forecast Centers (RFCs) to provide Decision Support Services (DSS) to the emergency management community during the record-breaking floods along the Mississippi River.

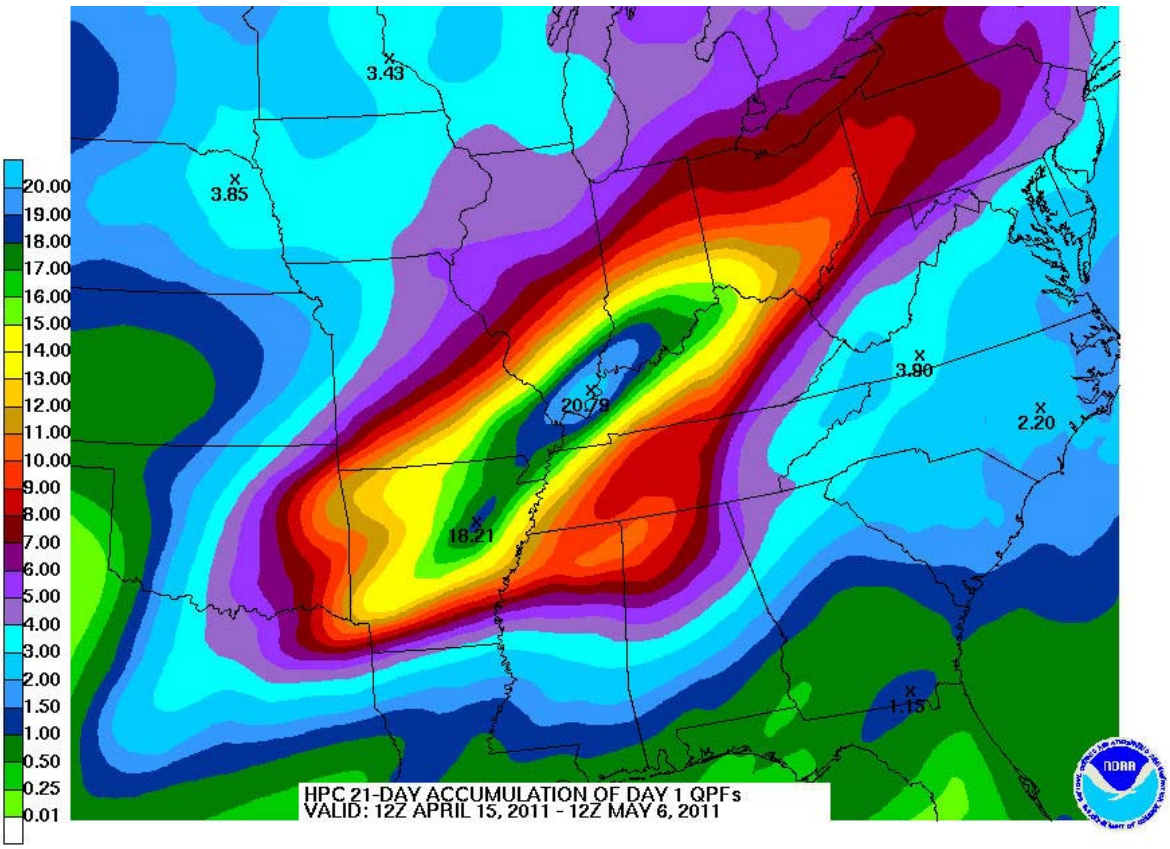
A good example of HPC support was the forecasts for an extended heavy rain event during the second half of April into early May. During this period, a series of storms brought heavy rainfall, up to 20 inches, to parts of the middle Mississippi and Ohio Valley during a time when the Mississippi was already near or at flood stage.

HPC provided early notification of the coming series of storms, which extended over a three-week period, in discussions issued on April 14, 19, and 21. These accurate forecasts gave more than 3 days lead time to each heavy rainfall episode. This was followed by extensive collaboration between HPC, RFCs, FEMA, and the U.S. Army Corps of Engineers -- as many as 3 collaboration calls per day -- resulting in a very good consensus on the quantitative precipitation forecasts (QPFs). Frequent and ongoing internal communication led to strong forecast performances by the National Weather Service (NWS).

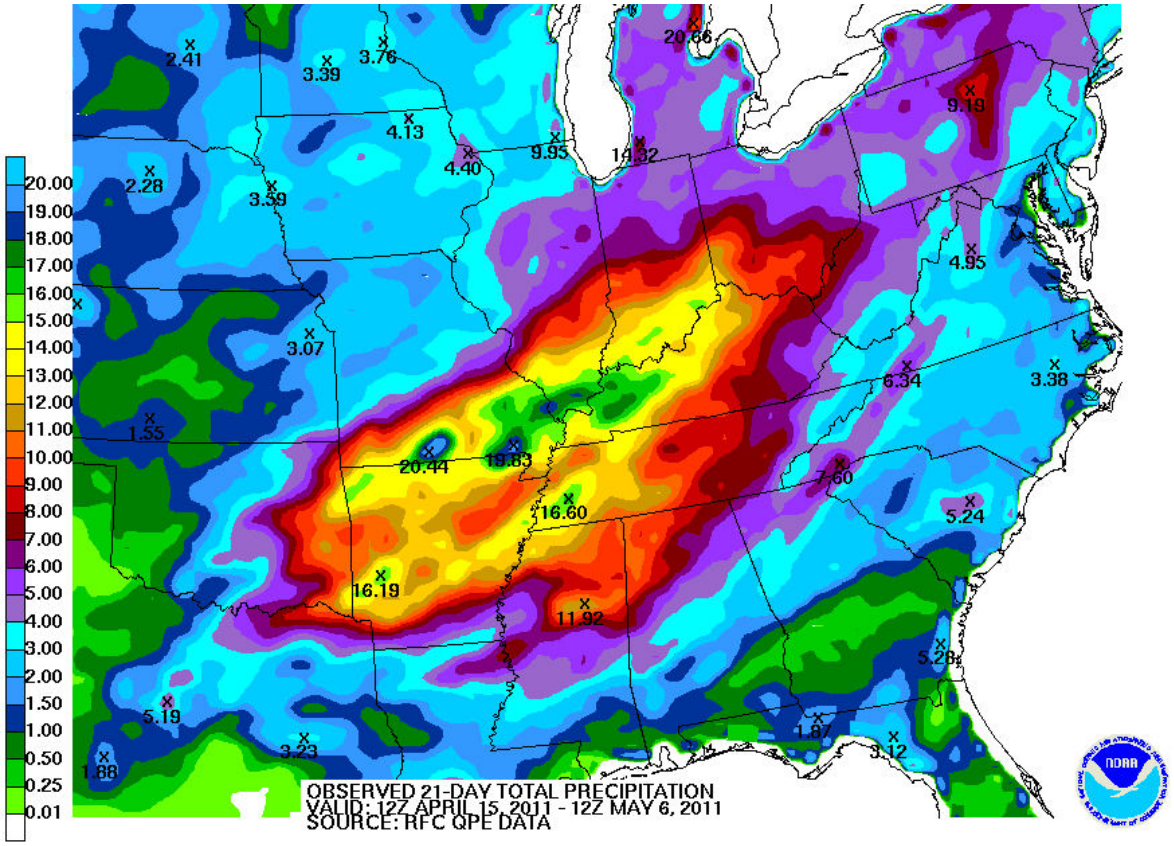
HPC forecasts verified very well. HPC aggregated Day 1 forecasts showed maximum total precipitation of 20.8 inches while

the observed maxima total precipitation was 20.4 inches. The HPC axis of maximum precipitation along lower Ohio River across southeastern Missouri and into Arkansas matched the observed core of maximum precipitation very well. Verification over the Ohio and middle Mississippi Valleys showed an accuracy (as measured by the threat score) of 0.46 for the Day 1 one-inch threshold.

Comments from partners and customers have been positive. For example, an NWS regional hydrologist, referring to the entire event, stated "QPF has been crucial in DSS during this monumental event. HPC's support, including the RFCs' use of probabilistic QPF, has been key."



HPC aggregated Day 1 QPF



HPC aggregated quantitative precipitation estimate.

Storm Prediction Center (SPC) Performance during Record-Breaking Tornado Season

The United States is still in the midst of a record breaking 2011 tornado season. This has already been the deadliest year for tornadoes (currently 537) in NOAA records (1950-present) and the 6th most deadly since 1875 (combined NOAA and academic research record). Through May, the SPC has issued over 500 Tornado and Severe Thunderstorm Watches with a Probability of Detection rate of 90% for tornado reports, and an average tornado lead time of over 3 hours.

The 16 April Carolina Tornado Outbreak was first highlighted as a significant severe weather event 3 days in advance. The risk level was increased each forecast update, with a declaration of High Risk the morning of 16 April. This is only the second High Risk forecast for the Carolinas since the 1984 Tornado Outbreak. .Particularly Dangerous Situation. (PDS) Tornado Watch 150 was issued at 12:30 pm EDT with over two hours of lead time prior to the onset of significant tornado activity.

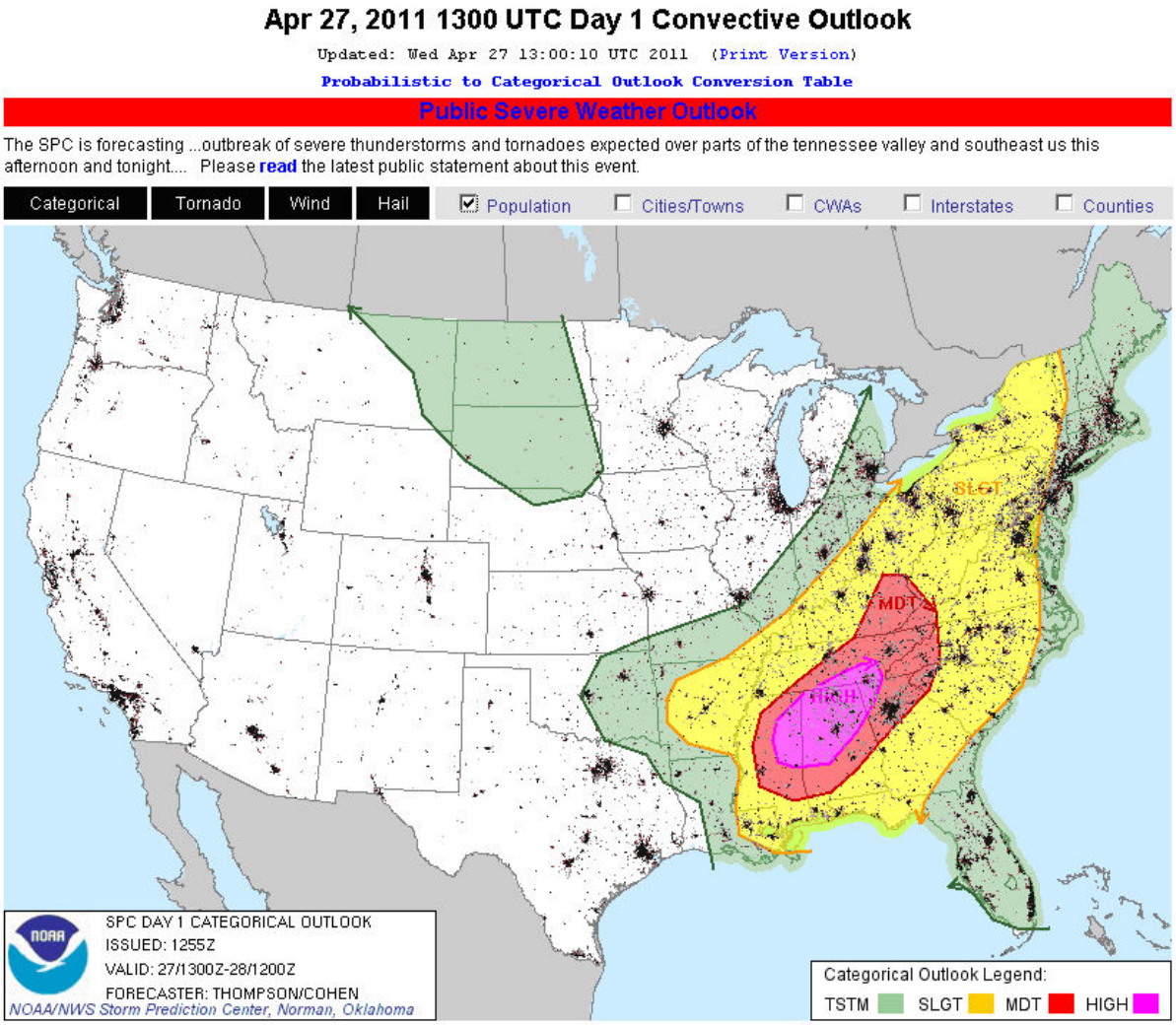
With 317 direct tornado fatalities, the 27 April Southeast Tornado Outbreak was worst single day outbreak in NOAA records (1950 -), and the 4th worst in the combined NOAA-research record. This is the highest toll since the 21 March 1932 .Dixie Outbreak.. The area was highlighted 5 days in advance, with a High Risk forecast issued for the outbreak area at midnight prior to the event. Particularly Dangerous Situation Tornado Watches were issued for the hardest hit areas with over 3 hours lead time for tornadoes in these watches. The SPC issued a record 40 mesoscale discussions during the single day outbreak as part of SPC.s continuous severe weather dialog with the weather enterprise.

With a current estimate of 151 direct tornado fatalities, the 22 May Joplin, Missouri Tornado is the deadliest in NOAA records and the largest death toll from a single tornado since the 1947 Woodward OK event in the combined NOAA-research record. The area was first highlighted for a significant severe weather event 3 days in advance. The risk level was increased each forecast update, with a Moderate Risk of severe weather issued the morning of 22 May. A tornado watch, with strong tornado probabilities was issued for Joplin at 1:30 pm, approximately 4 hours prior to the tragic tornado.

This is also one of the worst fire season.s on record with over 4.5 million acres burned nationwide, which is more than double the ten-year average with the season still in progress. The SPC has issued over 100 Day 1 Critical and Extremely Critical

forecast areas with a Probability of Detection for these extreme fire weather conditions of 89%.

Without strong partnerships, we cannot accomplish our mission to save lives or support the rapid recovery of society when disasters do occur. The SPC established a strong partnership with national FEMA for event driven severe and fire weather briefings. During 2011, the SPC has led 43 national FEMA coordination calls for forecast major severe and fire weather events. Briefings prior to the historic 27 April tornado outbreak began on Eastern Sunday, with two separate briefings the day of the Outbreak that included participation from over 60 national and state emergency management leaders. Each briefing includes graphical depictions of the forecast threat areas and magnitude that detail the characteristics of the forecast weather event with GIS information overlays.



NOAA-NWS Storm Prediction Center severe weather outlook issued the morning of 27 April 2011 with High Risk for the primary tornado outbreak area. An underlay of population density highlights the major population centers within the high risk area, including Tuscaloosa, Birmingham, Huntsville, AL and Chattanooga, TN.

Tornado Watch 325 which included Joplin, MO issued at 1:30 pm on 22 May 2011

Eruption of Icelandic Volcano Grimsvotn

On Saturday May 21, 2011, just over a year following the unprecedented aviation impact ($1.7B to the airlines industry alone) caused by the eruption of Eyjafjallajokull, another much larger and more intense Icelandic volcano, Grimsvotn, erupted ejecting fine particle ash to a height of 20 km (12 miles). This was its strongest eruption since 1873 with the last eruption occurring in 2004. However, this eruption did not have nearly the aviation impact as last year.s Eyjafjallajokull eruption.

Several differences can be attributed to the reduced impact. Ash from the Grimsvotn eruption, while still very fine, was 50-60% larger and fell out more quickly. Additionally, wind trajectories moved the ash plume further to the north and west keeping ash out of the highest concentration airspace. But most importantly, many new European airspace management procedures were put into place to better manage the airspace during volcanic ash events following the closure of much of the European airspace last year. Coincidently, the Volcex 11/01 Exercise, a two day drill including over 70 airlines and aviation operators and managers, was conducted in mid-April and examined a notional Grimsvotn eruption. Five weeks later, new approaches to safety modeled after how the United States manages airspace were put into practice for real.

This eruption was also an excellent opportunity for the National Centers for Environmental Prediction (NCEP) and the Washington Volcanic Ash Advisory Center (W-VAAC) to internally exercise upgrades to the HYSPLIT dispersion modeling system for volcanic ash. These upgrades, which were coordinated through the NOAA Volcanic Ash Working Group, were inspired by issues raised following the eruption last spring of the Eyjafjallajokull volcano. One of the main new features is a simple method to adjust the modeled downwind ash cloud position to better agree with satellite analyses; then the updated forecast is made from that adjusted ash cloud position. Other new capabilities include an option to enable or disable wet deposition, more readily handle time varying eruption heights, and more efficiently simulate long-lived eruptions.

This upgrade resulted from model development by NOAA.s Air Resources Laboratory, with valuable feedback from the NCEP Senior Duty Meteorologists during the training, testing, and evaluation period. The Senior Duty meteorologist runs HYSPLIT operationally for volcanic ash eruptions upon request from NOAA's Volcanic Ash Advisory Centers. Since the Eyjafjallajokull eruption, there has been much interaction between NOAA and NOAA's private industry partners, and among NOAA and the international volcanic ash sciences and services communities, particularly the London and Montreal Volcanic Ash Advisory Centers. Through NOAA's increased volcanic ash modeling capabilities and interactions with partners and international counterparts, NOAA is now better able to respond to volcanic ash eruptions in NOAA's Volcanic Ash Advisory Centers. areas of responsibility and to cases when ash from other parts of the world approaches or may approach the U.S. areas of responsibility.

An Operational VAAC Coordination Meeting will take place at the Canadian Meteorological Center in Montreal on July 8, 2011 where the Anchorage, London, Montreal, Washington, and Toulouse VAACs will participate in develop standard operating procedures (SOPs) for VAAC collaboration of volcanic events which span multiple VAACs. Also the U.S. is working closely with other International Civil Aviation Organization (ICAO) member states on Collaborative Decision Making (CDM) Concept of Operations procedures.

An image released by NASA shows smoke billowing from the Grimsvotn, Iceland's most active volcano.

Smoke billowing from the Grimsvotn. Photograph: AFP/Getty Images

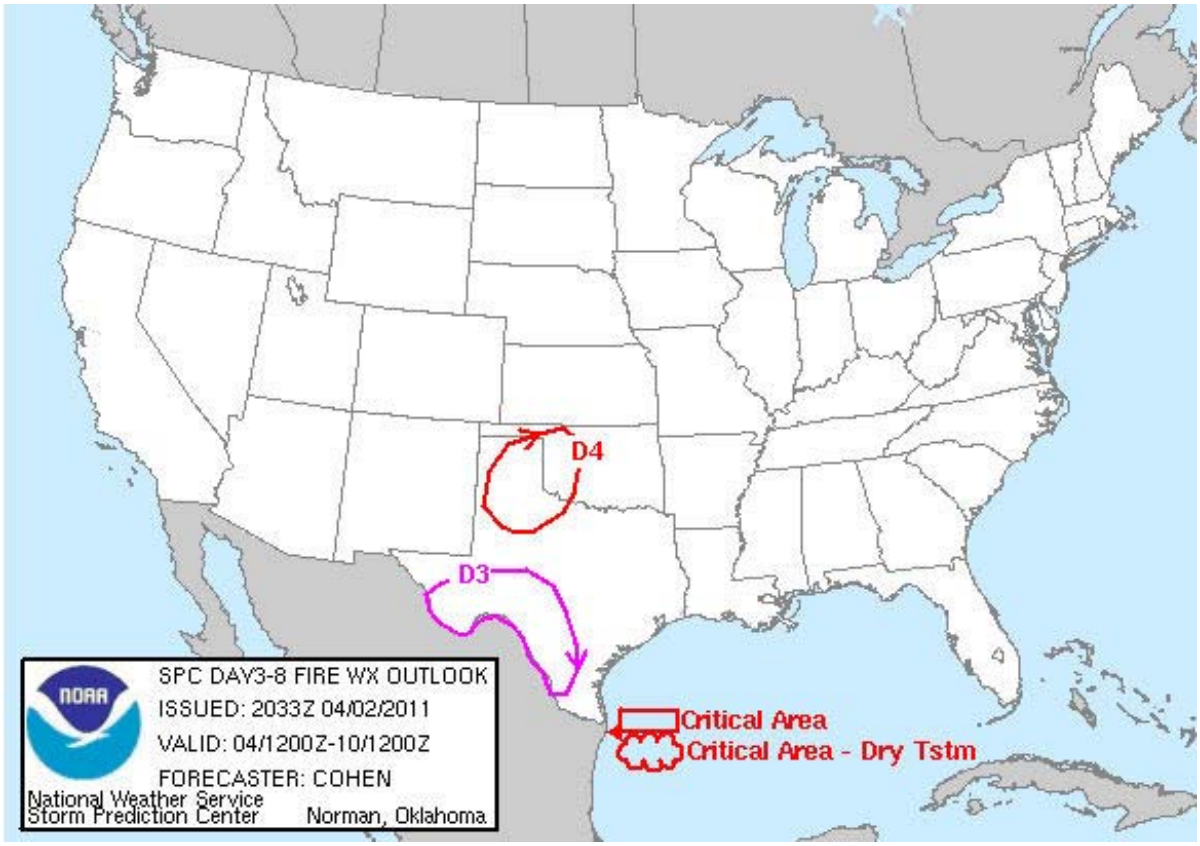
Experimental 3-8 Day Probabilistic Fire Weather Forecasts

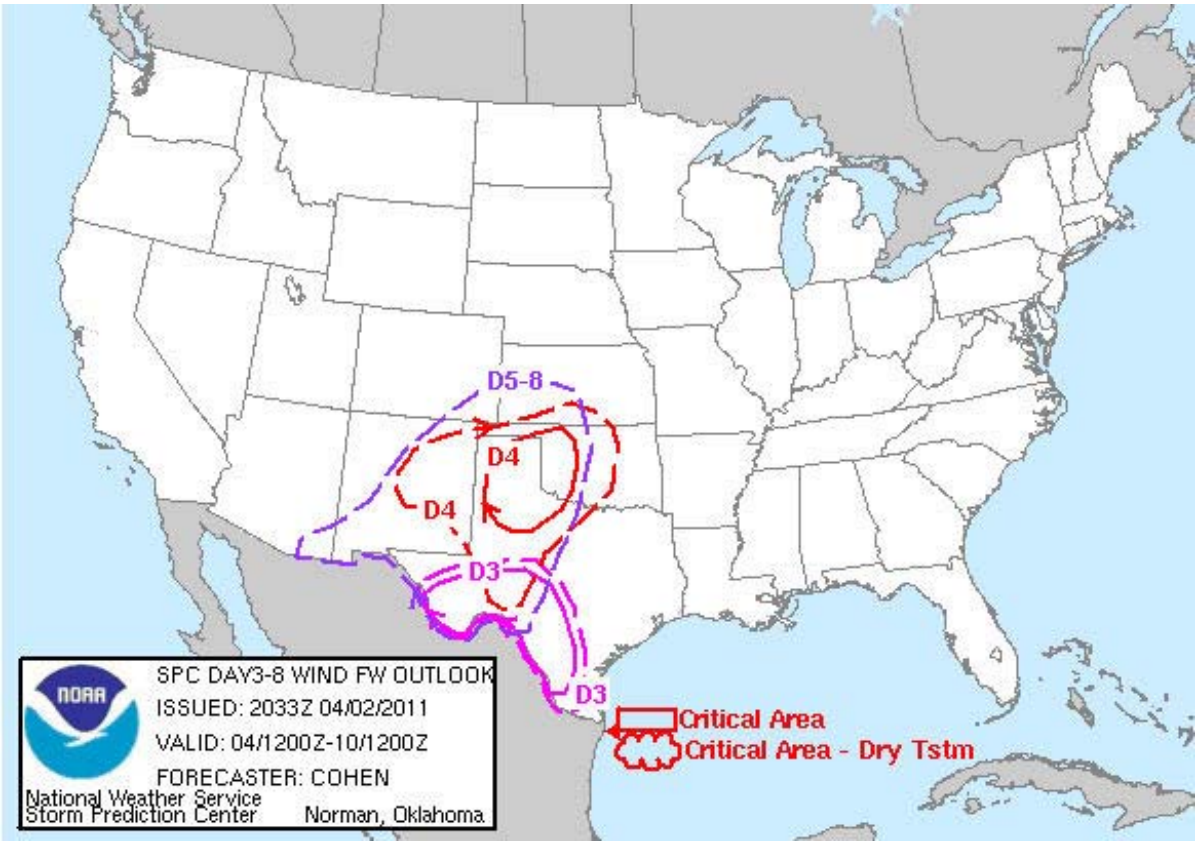
In April 2011, the Storm Prediction Center (SPC) began issuing probabilistic forecasts of critical fire weather conditions for Days 3-8 on an experimental basis.

These daily forecasts depict the probability of critical fire weather conditions across the continental U.S. during the Day 3-8 period via two experimental graphics available on the SPC fire weather web page. The graphics indicate the probability of

dry thunderstorms and the probability of strong winds combining with low relative humidity and warm temperatures occurring where dried fuels exist.

The experimental probabilistic forecasts provide information that supplements the operational Day 3-8 Fire Weather Outlook. The experimental graphics highlight, through lower probabilities, where the potential for critical fire weather exists, but predictability is too low to yet warrant a critical area designation on the operational graphic. This provides additional lead time in the graphical depiction of potential critical fire weather events.





Example of the operational Day 3-8 Fire Weather Outlook (left) and the experimental graphic (right) depicting a 40% (dashed) and 70% (solid) probability of strong winds combined with low relative humidity and warm temperatures on the indicated day.

New Hurricane Safety Videos and Podcasts

Well before the June 1st start of another hurricane season, NOAA's National Hurricane Center was preparing a new series of public service videos and audio podcasts to emphasize the importance of being prepared.

The seven high-definition videos and audio podcasts, each with a daily hurricane-related topic, made their debut just ahead of National Hurricane Preparedness Week (May 22-28).

Recorded in both English and Spanish, the safety messages feature the expertise of National Hurricane Center Director Bill Read, hurricane specialists Dan Brown and Robbie Berg, National Weather Service meteorologists Gladys Rubio, Robert Molleda and Dan Gregoria, and FEMA Administrator Craig Fugate.

The topics include: The Hurricane Season; Storm Surge; Wind; Inland Flooding; The Team Effort; Get a Plan; and What to Do Before/During/After a Storm.

The videos and podcasts are available for viewing and downloading at www.hurricanes.gov/prepare.

NHC WCM and senior hurricane specialist Daniel Brown prepares to record one of the PSAs regarding hurricane preparation.

National Hurricane Center Enters the World of Social Media

After establishing a presence on Facebook early this year, NOAA's National Hurricane Center joined the conversation on Twitter on June 1st with the start of the Atlantic hurricane season.

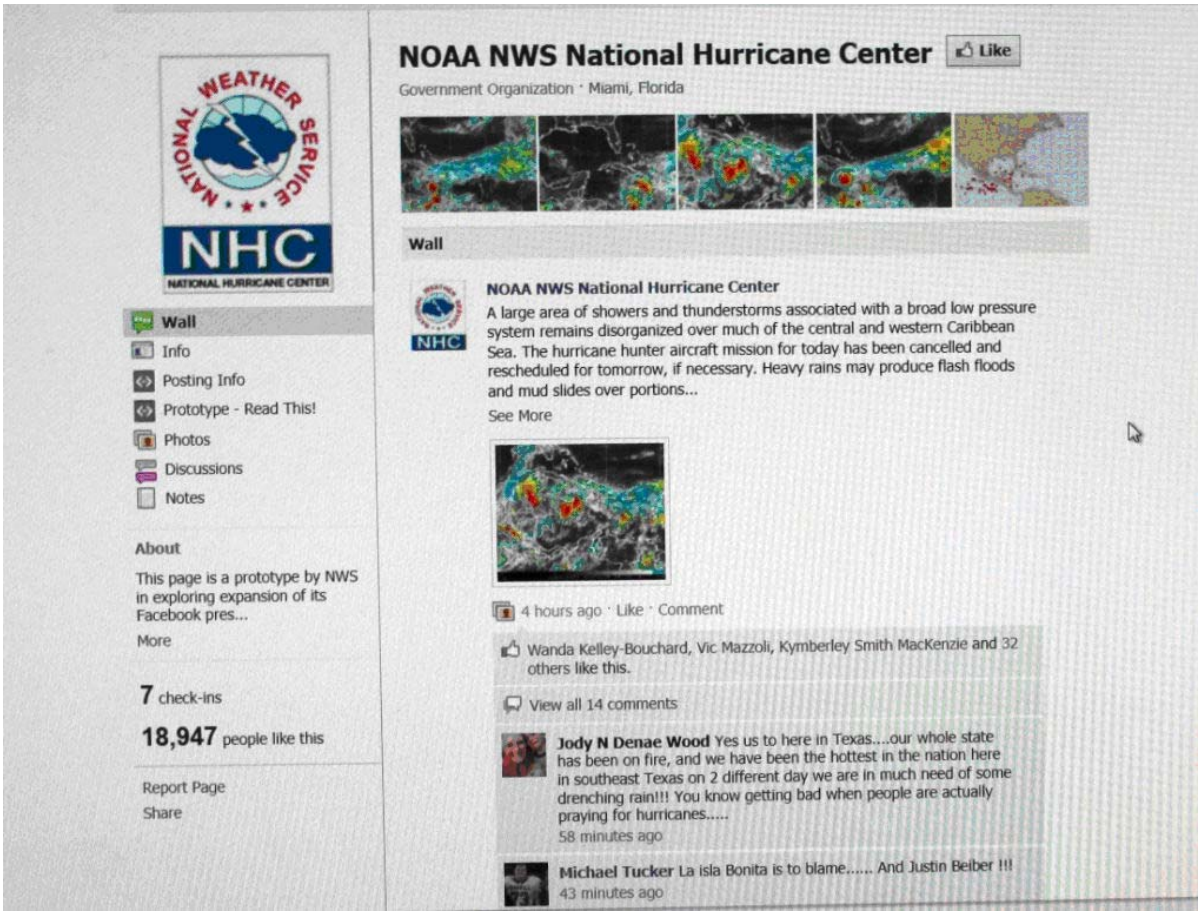
Its use of social media provides another avenue for NHC to build situational awareness, alerting a sector of the public that may not be tuned into television, radio or the Internet.

During the hurricane off-season months, NHC's Facebook page was used to showcase its many outreach programs, including the Caribbean and U.S. East Coast hurricane awareness tours, the FEMA and WMO workshops, and various national conferences. During the hurricane season, a daily tropical outlook is posted, providing a plain-English of what NHC is monitoring that day in the tropics. Each post always drives the user back to the NHC website for more information, as the Facebook page is not meant to be a forum to provide forecasts.

NHC has two Twitter accounts, one for the Atlantic basin, and the other for the eastern North Pacific basin.

A tweet will be sent whenever NHC issues a public advisory regarding a tropical cyclone (TCP); a tropical cyclone update (TCU); a position estimate (TCE); or a tropical weather outlook (TWO). Each tweet will contain a link to access the corresponding product on the NHC website. NHC can also tweet a special message at any time.

Other NCEP Centers have created a presence on Facebook. Look for the Facebook pages of the Aviation Weather Center, the Storm Prediction Center, the Ocean Prediction Center, the Hydrometeorological Prediction Center and the Space Weather Prediction Center.

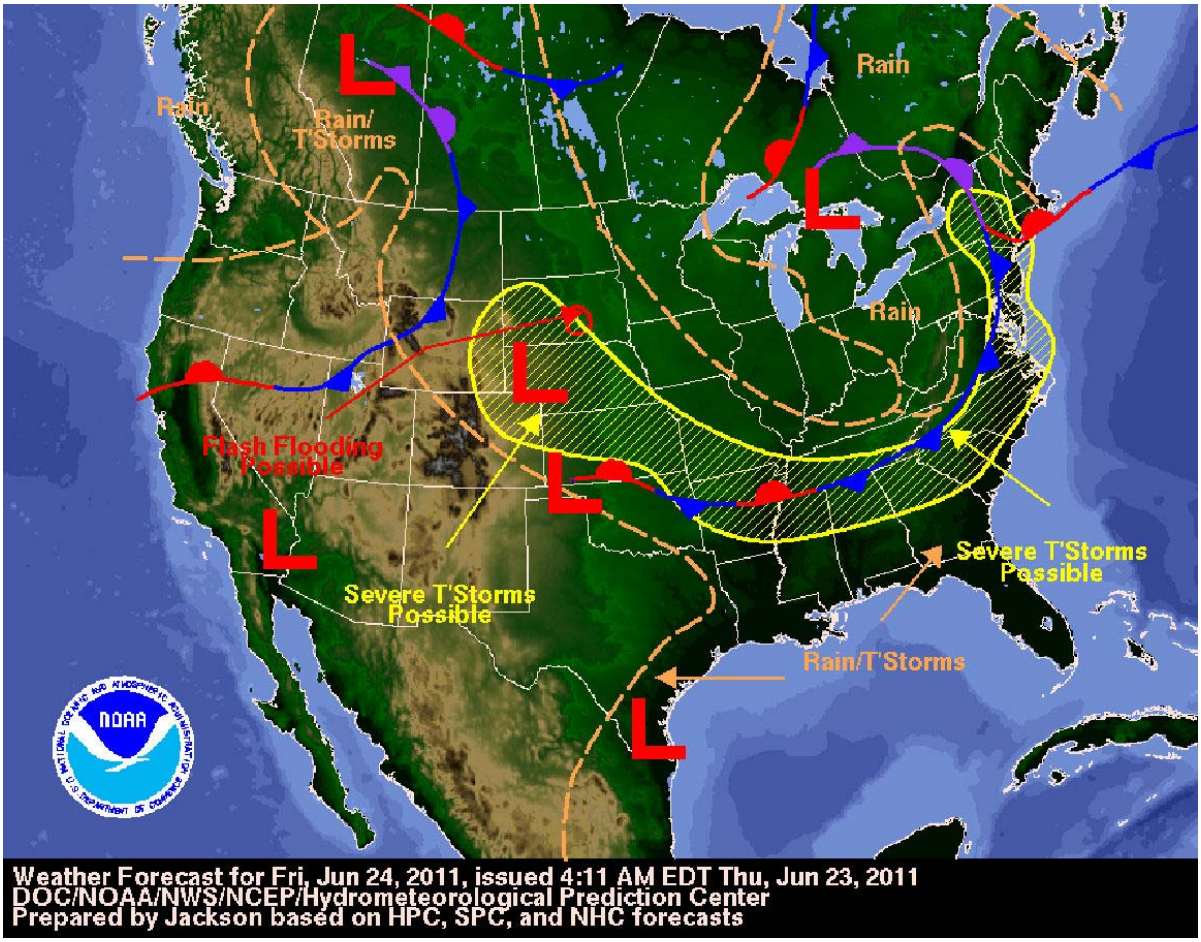


The NHC Facebook page had nearly 20,000 followers just days into the 2011 hurricane season.

Day 2 Version of National Forecast Chart

On Monday, June 6, the Hydrometeorological Prediction Center (HPC) implemented the day 2 version of the National Forecast Chart, also known as the *Gudes Chart* in honor of the former Deputy Under Secretary who was a big proponent of the day 1 chart. As you recall, this chart was requested by Department of Homeland Security (DHS) management and has been advocated by Al Mongeon, National Weather Service liaison to DHS. The new chart is available at http://www.hpc.ncep.noaa.gov/national_forecast/natfcst.php?day=2 along with the day 1 chart. The response from Al was very favorable -- "OUTSTANDING!!!! ... Wonderful and thanks for the efforts."

The new product was the result of much effort by many people. Forecast Operations Branch Chief Bob Kelly headed the overall project. Extensive programming was accomplished by Alan Robson and Mark Klein of the Development and Training Branch, who developed the scripts, used by the staff to facilitate production of the new product and created the new web interface. This was especially challenging because of the on-going AWIPS II development activities. Forecaster Tony Fracasso served and continues to serve as the focal point for establishing the operational procedures and for training the staff in preparing the new product. Negotiations were conducted with the National Weather Service Employees Organization (NWSEO), as implementing the new product involved a significant change in the working conditions for our meteorological technicians (met techs). Because the deadline for producing the new chart is 5 a.m., the daily operational met tech shift was changed from a day shift to a night shift. The schedule for implementing the day 3 chart is the end of September 2011.



Day Two National Forecast Chart for Friday, June 24, 2011, issued Thursday morning, June 23, 2011.

Taiwan Aeronautical Meteorologist visit Aviation Weather Center

As part of an effort to improve international aviation forecasting, NCEP's Aviation Weather Center (AWC) occasionally hosts training sessions for meteorologists from other countries. During the week of May 16, 2011, AWC played host to two meteorologists from Taiwan's Aeronautical Meteorological Center.

The Taiwanese meteorologists spent five days shadowing AWC meteorologists. During this time, they were introduced to methodology for producing warnings and forecasts for aviation parameters such as such as low ceilings and visibility, turbulence, convection, icing, volcanoes, jet streams and tropopause heights. Nearly an entire day of their visit was spent observing the production of the Collaborative Convective Forecast Program (CCFP), which produces thunderstorm forecasts via collaboration between meteorologists from the National Weather Service, Canada and the aviation industry. In addition to the CCFP chat, the AWC regularly hosts international chats to collect input on the global Significant Weather Charts. While Taiwan regularly participates in these chat sessions, viewing the entire production process from AWC's end should improve their input after they return home.

Ideas exchanged during visits to the AWC by meteorologists from other countries result in improved collaboration, better forecasts, and ultimately safer and more efficient global aviation travel. "The training is very helpful and inspiring. The most valuable experience to me is the discussion with Dr. Steven Silberberg (of AWC). With all the progress of numeric models, Civil Aeronautical Administration forecasters are often confused about how reliable these models are, and what should we do if the output of the models looks weird. Dr. Silberberg showed us the guidance fields and error fields of models, and answered our questions. The way AWC forecasters use their tools and the way AWC products are presented are very impressive, too. I think we are going to apply these concepts in our operation as soon as possible", said Bois Chen, one of the two Taiwanese forecasters.

Taiwanese meteorologists Tim Chang(left) and Bois Chang discuss the forecast with AWC meteorologist Scott Tansey (seated).