

# Confluence

## NWS Hydrology Program News

### NOAA Builds National Water Center

New 65,000 square foot NOAA facility under construction at the University of Alabama to serve as “nerve center” for national water resources research and operations...

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## Welcome to our first edition!



**W**elcome to Confluence, the new bi-monthly newsletter of the NWS Hydrology Program! These are exciting and challenging times, as we enter a new era of collaboration to address society’s water resources challenges, with new tools and capabilities in hand and more on the way. We’re starting to leverage the new Community Hydrologic Prediction System, advancing Integrated Water Resources Science and Services (IWRSS), transforming the Hydrology Laboratory to support a broader water resources mission, implementing new forecasting capabilities, and creating the world’s first National Water Center (NWC). With so many complex activities going on, we’ve launched Confluence to keep everyone up-to-date, and to help ensure the tributaries come together and merge into a single stream.

Our Program’s history has always been about delivering critical water information to our stakeholders to protect lives and property. But more is needed. Flood damages are worsening (see Annual Damage Costs, below), and the consequences of too little or poor quality water are just as important to our communities as too much water. Building a Weather-Ready Nation is about enhanced community resilience in the face of increasing vulnerability to extreme weather and water events. We must all stay informed and pull together in order to produce the new data and tools required to deliver

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Annual Flood Damage Costs:	1981 - 1990	\$4.7 Billion
	1991 - 2000	\$7.9 Billion
	2001 - 2010	\$10.2 Billion

## Project Spotlight

# Hydrologic Ensemble Prediction Service

*"Life's uncertain – eat dessert first!"* This familiar line reminds us that there is uncertainty in everything we do, and hydrologic forecasting is no exception. In early 2011 the Office of Hydrologic Development (OHD) started a three-year project to bring to our users a consistent and rigorous measure of the uncertainty associated with our hydrologic forecasts. The Hydrologic Ensemble Forecast Service (HEFS) will provide operational short-term probabilistic river forecasts, a major new capability added to our River Forecast Centers' baseline river forecasting system, the Community Hydrologic Prediction System (CHPS).

The roots of this new capability are traced to years of scientific research and experimentation performed by OHD scientists. Their work produced sophisticated prototypes of various functional components, which were evaluated in 2010 by a formal assessment team (the "A-Team"). Composed mostly of field personnel, the A-Team recommended a core set of components needed for construction of the first version of HEFS. These include three processors to remove bias from ensembles of meteorological input parameters, create ensemble river forecast outputs, and remove error from the forecast output ensembles, a graphics display tool, and verification tools.

The development of HEFS from prototypes to operations includes three software development releases that started in spring 2012 and will continue to fall 2013. The development releases are being tested by five RFCs who follow specific test procedures and provide user experience feedback to OHD.

The project has been accelerated by an agreement with the New York City Department of Environmental Protection, which needs the uncertainty information from these new forecast services to more efficiently manage the supply of drinking water for the residents of New York City.

## What will be new and different with HEFS?

Decision assistance for a variety of users will be improved by forecast probabilities of occurrence of different river flows from droughts to floods.

HEFS will improve management of the Nation's water resources for flood control, water supply, commerce, recreation, and the environment.

HEFS adds river flow forecast probabilities in the short term (days to weeks) to those already available from the RFCs in the medium to long term (months to seasons).

## HEFS Status Update

The HEFS project made its first development release of software to the five test RFCs on May 1, 2012. Those RFCs are Middle Atlantic, Northeast, California Nevada, Arkansas-Red Basin and Colorado Basin. These RFCs have completed their formal test procedures and are in an extended test phase using the HEFS components on a daily basis side-by-side to their normal forecast operations. During this time they are compiling user feedback and providing it to OHD for the two upcoming development releases in September 2012 and spring 2013. The development phase of the project is targeted to be complete by end of 2013 with roll out to all 13 RFCs in 2014.

*Mark Fresch, HEFS Project Manager*



# NOAA Starts Construction of National Water Center

*February groundbreaking marks the beginning of a new era in water resources science and services for NOAA*

## 305 Hackberry Lane.

That's the address of NOAA's new National Water Center, now under construction on the University of Alabama campus at Tuscaloosa! The February 21 groundbreaking ceremony, attended by Senator Richard Shelby, the President and vice-President of the University, and senior leadership from NOAA and the USGS, marked the beginning of an exciting new era for the NWS Hydrology Program. The NWC will be a 65,000 square foot environmentally friendly (LEED gold!) facility with a capacity of 200 people. A catalyst to enhance federal collaboration and leverage resources via the IWRSS consortium, the NWC will help achieve the goals of the White House's National Action Plan "Priorities for Managing Freshwater Resources". This first-in-the-world facility will enable NOAA and its federal water partners to introduce new data capabilities, models, and decision-support tools and produce the comprehensive information needed to support next-generation adaptive water planning, preparedness, and response activities. The NWC will serve as a cornerstone for Integrated Water Resources Science and Services and provide a central hub to integrate and advance regional field operations and services.

The building has been designed from the ground-up with unique features to support a new, highly collaborative and comprehensive water program to address the needs of our stakeholders and

help build more resilient communities. At the core of the NWC is the Operations Center, a collaborative "nerve center" for day-to-day national situational awareness that will house staff from multiple agencies and support a Common Operating Picture for water resources. State-of-the-art multi-media communications technology will bring the Operations Center to the field as well as to our stakeholders. Together with adjacent situation rooms, this facility will enable full hydrologic Impact-based Decision Support Services (IDSS) at a national level. The Geo-Intelligence Laboratory will support geospatial data and information needs across the enterprise and improve our Geographic Information System (GIS) capabilities. The Collaborative Science and Software Engineering Studio will strengthen our research and development activities in conjunction with the NWC Proving Grounds, a technology facility dedicated to testing and integrating new systems and capabilities before delivery to the field. The new Information Technology Laboratory will unify our IT resources and lead us into enterprise high-performance computing. The NWC Distance Learning facility will provide a unique state-of-the-art training and education resource with the same communications technologies as the Operations Center, bringing the classroom to the student and enabling us to provide expertise to anyone, anywhere. These features are key ingredients, enabling us to provide the new information needed by decision makers and to strengthen collaborative relationships, both within the NWS and NOAA and with our federal partners and stakeholders.

This new infrastructure sets the stage for an exciting future as we begin staffing and operating the NWC and building new and stronger relationships. Reflecting the broad scope of water resources, each part of the NWC

will require a broad range of scientific and technical expertise. The Operations





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Impact-Based Decision Support Services as exemplified by NOAA's Next Generation Strategic Plan and NWS's Strategic Roadmap for a Weather-Ready Nation.

During the past decade, we have reached out to our stakeholders and listened to how we can improve our services to address the growing water resources challenges. They need much more information to deal with problems like increased demand, limited supply, threats to water quality and security, changing climate, and increased uncertainty. And they need this information to be coherent and integrated. This challenge spans the capabilities of multiple Federal agencies, and all agencies are facing a prolonged period of constrained resources. To tackle this challenge, we launched IWRSS with the U.S. Geological Survey and the Army Corps of Engineers. Through IWRSS, NOAA and partner water agencies will leverage our assets to implement a broad and integrated system to provide reliable information for adaptive planning, preparedness, and response activities.

The National Water Center is a centerpiece of the IWRSS strategy. This new facility will become the U.S. "nerve center" for coordinated water resources forecast operations, research and collaboration across Federal agencies. The critical water intelligence information produced by the Center will enable today's River Forecast Centers to serve as regional Water Resources Forecast Centers within their respective geographic areas.

The NWC will be ready for occupancy in mid-2013. We are developing a phased approach to NWC staffing and operations that will start in 2013 and build up capacity over the next five years or so. This approach recognizes the challenging budget climate, and ensures that we can maintain and enhance the unity within the water missions, projects and activities of NOAA and our partners. We are working with our Leadership and the NWS Employees Organization to complete the planning to enable the NWC to achieve "Initial Operating Capacity" by mid-2014.

The environmental science community recognizes water forecasting as one of science's "grand challenges", and

*National Water Center, from p. 3*

Center will be staffed with experts on different aspects of hydrology and water resources, with regional liaisons that will specialize in different geographic areas and introduce a social science dimension, and with modeling and simulation experts. The R&D and IT facilities will be staffed with science and technical experts, software engineers and systems engineers, and IT specialists who will work closely with the Operations Center and with field offices. The Distance Learning facility will include staff specializing in education and communications, and will draw from all of the NWC staff to support various learning programs. Staffing of the NWC is expected to be phased over multiple years, starting soon after construction completion that is scheduled for June 2013. The NWC will include staff from multiple water agencies, starting with the U.S.G.S.

National centers play an important role in the NWS mission, and for the first time hydrology and water resources will have a major national center as part of its repertoire, complementing its field offices. The NWC will be a partner with River Forecast Centers (RFCs) to expand their forecast capabilities and facilitate their transition into Water Resources Forecast Centers (WRFCs). In addition to maintaining existing, mission critical river forecast services, WRFCs' focus will expand to facilitate IWRSS partnerships at the regional level, provide an broader suite of water resource forecasts and information, ensure data and forecast consistency, provide regional-level water resources services, and strengthen regional coalitions. Information produced at the NWC and WRFCs will enable Weather Forecast Offices (WFOs) to serve as water resources extension agents at the community level. WFOs will execute water resources IDSS as a part of their neighborhood level decision support services. Additionally, WFOs will provide an expanded suite of water resource forecasts and information, ensure data and forecast consistency, and strengthen local partnerships. Achieving these goals will ultimately strengthen our nation's water resources observation, forecast and warning capabilities to support a spectrum of water-related high-value decisions.

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## Hydrologic Services Innovator Retires

After 41 years, David G. Brandon has bid us farewell. Unquestionably a pillar of the NWS hydrologic community, Dave has long been recognized for his extensive operational skills, technical knowledge, developmental leadership, and customer service. “If a theme could be attached to Dave’s work, it would be high quality and innovative service,” stated Gary Carter,

Director of the Office of Hydrologic Development and NOAA’s Hydrology Program Manager. “Dave is true pioneer in hydrologic services and he will be missed.” Dave was the recipient of the 2007 Max A. Kohler Award, presented annually to honor individuals for sustained superior performance and distinguished accomplishments in support of the NWS Hydrology Program.

While Dave hasn’t been quite as visible to the NWS hydrologic community in his most recent role serving as the Deputy Regional Director of the NWS Western Region, prior to that assignment he was all-hydro: Chief of the NWS Western Region Hydrologic and Climate Services Division, Hydrologist in Charge of the Colorado Basin River Forecast Center, Western Region Hydrologic Services Division Deputy Chief, Research Hydrologist with the Office of Hydrology, and a Service Hydrologist at Topeka. Not bad for a guy who started out as a met intern.

In all of his positions, public service and the provision of quality products and information have always been an important focus. Water resources management has been another important service theme in Dave’s career. He supported and developed operational, day-to-day coordination with the U.S. Bureau of Reclamation, developed and supported programs with the Natural Resource Conservation Service, and frequently collaborated with the Western Governors Association.

Dave’s passion for hydrologic science and services, his will to make a difference, and commitment to the NWS and interagency collaboration, made an indelible and profoundly positive impact on the NWS Hydrology Program.



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together we're at the forefront of this – it's up to all of us to succeed. As we move forward with our partners to address this most important challenge, we will see fundamental changes to our organization and our culture. We hope the information shared via Confluence will help you to understand and support the efforts to build a Weather-Ready Nation.

## CHPS Bits

### *News and Updates on the Community Hydrologic Prediction System*

- Collaboration with Australia: Christine Brunner of OHD and Harold Opitz of the Northwest RFC traveled to Australia for a week in June to assist Australia's Bureau of Meteorology to scope and plan the national implementation of Australia's next generation flood and short-term flow forecasting system, which is akin to NWS's CHPS.
- HEC Reservoir Simulation Model Coming: The U.S. Army Corps of Engineers Hydrologic Engineering Center (HEC) has released the final official Version 3.1 of the joint reservoir simulation model, HEC-ResSim. OHD will incorporate this version into CHPS for its next major release, CHPS 2.1.1, this summer.
- Graphics Generator Coming: Following field-testing with the HEFS project, OHD plans to incorporate the Graphics Generator user interface extension into the CHPS software baseline for the winter 2012/2013 release of CHPS 2.2.1. The Graphics Generator will facilitate definition and creation of probabilistic river forecast products by RFC forecasters.

## Hydro People in the News

- Congratulations to Julie Meyer, Senior Hydrologist at the Missouri Basin River Forecast Center, for being selected as the recipient of the prestigious 2011 Max A. Kohler Award for her outstanding contributions in support of RFC database and verification activities. This award is presented annually to honor individuals for sustained superior performance and distinguished accomplishments in support of the NWS Hydrology Program.
- Trent Schade recently re-joined the NWS as the Hydrologist in Charge of the Ohio River Forecast Center After working at the Ohio RFC in the late 90s, Trent spent several years with the US Army Corps of Engineers, Great Lakes and Ohio River Division.
- Andy Wood was recently selected to be the Development and Operations Hydrologist (DOH) at the Northwest River Forecast Center. Andy spent the previous two years as the DOH at the Colorado Basin River Forecast Center. Before joining the NWS, Andy worked as a research hydrologist in Seattle, WA.
- The OHD software engineering branch welcomed Alan Harmon as a new Project Area Leader in May. Alan has worked for NOAA's National Marine Fisheries Service, Westinghouse (in support of NOAA/NASA satellite systems), the other federal agencies. Alan is an experienced program and project manager. We welcome him back into the NOAA family!
- On June 15, OHD said goodbye to Hydraulics Group Leader Seann Reed as he prepared to move on to the DOH position at the Middle Atlantic River Forecast Center. We look forward to future collaboration with Seann on hydraulics, ocean-estuary modeling, distributed hydrologic modeling, HEFS and summit-to-sea modeling projects as he takes up his new role.



## Field Spotlight: CNRFC

The California Nevada River Forecast Center is collaborating with both the private sector (Precision Water Resource Engineering) and federal (Federal Watermaster and the Bureau of Reclamation) partners to provide hydrologic decision support capabilities for the Truckee River Basin. The RFC's real-time, hourly forecasts—out to 120 hours—are used as input to their partners' flood operations model to construct hypothetical hourly release schedules from all basin reservoirs. In addition, longer-range ensemble streamflow forecasts provided by the RFC are being used to assist water supply management decisions in the Truckee-Carson basin. The partner's model simulates daily operations of the river, according to current basin policy, for each trace. Output from each run is analyzed statistically, providing estimates of risk and uncertainty in the operational forecast.

## Field Spotlight: AFWS

### *NWS Establishing New Methods to Collect Automated Flood Warning System Information*

For over thirty years, the NWS Automated Flood Warning System (AFWS) has collected and processed raw Automated Local Evaluation in Real Time (ALERT) messages. Critical for NWS hydrologic forecast and warning operations, these messages are currently collected from over 1700 rainfall and stream sensors in 12 states. To continue the AFWS, it has become necessary to depart from the current model of processing and supporting the collection of raw ALERT messages 24x7x365 and move to a new, more sustainable and extensible approach. To ensure these ALERT data continue to be available for forecast and warning operations and decision support, the NWS is engaging our valued data partners by requesting they provide this information in a Standard Hydrologic Exchange Format (SHEF). Specifically, the NWS is requesting SHEF encoded ALERT messages be sent to a central NWS server. From there, the messages will be

encoded within OHD's Hydrometeorological Automated Data System (HADS) and disseminated over the Satellite Broadcast Network for use by the NWS field offices in the watch, warning, and advisory mission. Additionally, this effort will enable better integration of ALERT rain and stream gage data into the Advanced Hydrologic Prediction Service (AHPS) web portal. For more information about the new methods to collect AFWS data, please contact the AFWS National Program Coordinator John Bradley.

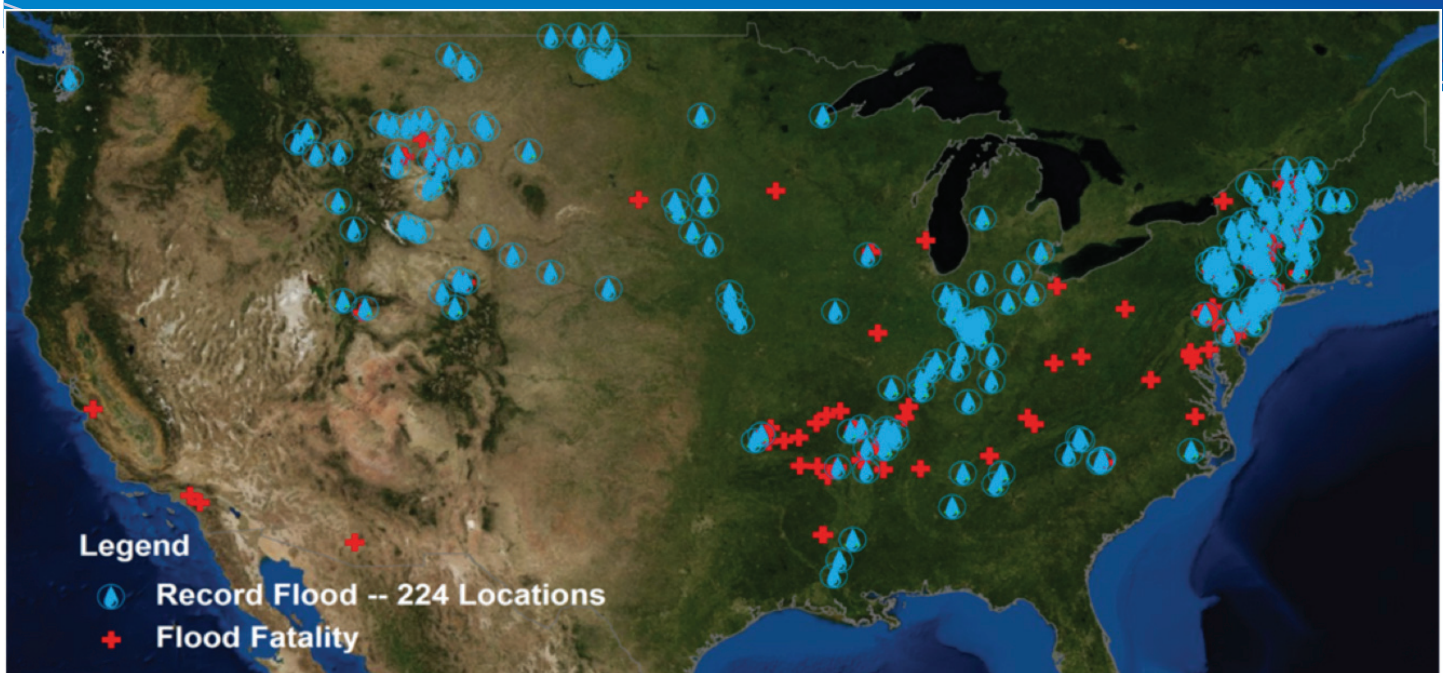
## Program Update

### *Water Year 2011 National Flood Loss Summary*

It's official - last year's floods were record-breaking, according to the National Flood Loss Summary, compiled annually by the Hydrologic Services Division of the Office of Climate, Water and Weather Services. Based on data from Weather Forecast Office StormData reports, flood loss statistics for Water Year 2011 (October 1, 2010-September 30, 2011) were dominated by record-breaking, prolonged floods. Record flooding was experienced at 224 river locations and there were 108 flood-related deaths (see map, p. 7). Direct flood damages during Water Year 2011 totaled \$8.41 billion.

Record rainfall fell across a broad expanse from Oklahoma to Ohio from April 15 to May 6, amplifying the snowmelt-induced flood wave heading southward from the Upper Mississippi River Basin. Flash floods associated with these storms caused 24 deaths across Oklahoma, Missouri, Arkansas, Louisiana and Tennessee in April and May. Lasting well over a month, floods on the Ohio River and the Lower Mississippi River broke decades-long records, exceeding the floods of 1937 and 1927 respectively. Although well forecasted, these floods caused a total of \$3.4 billion in direct damages, nearly half of the annual total.

Hurricane Irene and the remnants of Tropical Storm Lee, occurring just over a week apart in late August and



*Locations of record flooding and flood-related deaths during Water Year 2011*

*National Flood Loss Summary, from p. 7*

early September, impacted densely populated portions of the Mid-Atlantic and Northeastern U. S. These two tropical systems combined to produce 37 freshwater flood fatalities and at least \$3.9 billion in direct freshwater flood damages from Virginia to Vermont.

Unfortunately, there were 108 flood-related deaths in WY2011. Sixty-one of these (57%) were vehicle related incidents, highlighting the importance of the NWS Turn Around, Don't Drown campaign.

For the complete flood loss report please see <http://www.nws.noaa.gov/hic/summaries/WY2011.pdf>.

## Program Update

### *NWS Flood Inundation Mapping Goes Google*

Beginning in February 2012, the NWS has enhanced the Advanced Hydrologic Prediction Service (AHPS) Flood Inundation Mapping (FIM) Services with Google Maps. The purpose of this enhancement was to provide a better overall user experience by using a widely employed web mapping service application with high-resolution aerial satellite images. This enhancement provides the NWS more flexibility to visually communicate flood risk information and associated flood impacts for NWS flood forecasts and river flood warnings across geographic areas. NWS is working to move all existing AHPS FIM Libraries onto Google Maps. All FIM libraries currently under development will use the Google Map enhancement.

For more details, please refer to the FIM user guide ([http://water.weather.gov/ahps/inundation\\_mapping\\_user\\_guide.pdf](http://water.weather.gov/ahps/inundation_mapping_user_guide.pdf)), the video (<http://www.youtube.com/watch?v=flyTdd7f2JI&feature=email%22>), and the web site (<http://water.weather.gov/ahps/inundation.php>) to track the latest developments and review these new capabilities.