Confluence

NWS Hydrology Program News

Issue #5
September 2013

Headwaters

CAPT Barry Choy

Welcome to this issue of Confluence! I've had the privilege of being the Acting Director of the Office of Hydrologic Development for the past 8 months. They have been exciting times. I'd like to take this opportunity to provide a message to the folks of the NWS Hydrology Program – the national and regional headquarters groups, the Hydrology Laboratory, the River Forecast Centers, and the Weather Forecast Offices who support the NWS hydrology mission.

We're about to take ownership of the first ever National Water Center, a hallmark event for the hydrology program and the country as we move forward, in collaboration with our federal partners under the auspices of Integrated Water Resources Science and Services (IWRSS), to address our water resource needs and plan for a water secure future. This will be a world-class facility for collaborative development, infusing new ideas, research, and methods of operating more efficiently and effectively to provide our customers the very best forecast guidance, information, and decision support services. This shift to focus on water resources represents a national interest in clean, plentiful water supplies and realizing that, without action based on sound science, our water supplies are in jeopardy. Our public demands a better scientific understanding of water quantity and quality, and is betting on the NWS' and your ability to improve predictability of floods, low water conditions, water quality, and water for

In this issue…

Headwaters continued…

ecological health, among other things. It's going to be a lengthy and complex process to fully achieve the vision for a NWC and a modernized hydrologic program and as the future leaders in hydrology you have the opportunity to shape that vision in the coming years and participate in addressing one of our nation's most pressing needs.

We have all had front row seats in viewing the struggles during these challenging budgetary times and while this slows progress it hasn't stopped us or reduced our resolve. We continue to move forward with the very initial staffing recommendations for the NWC and have the support of the leadership within the NWS to "make things happen" despite the current budget uncertainties. The clouds will clear and the sun will shine again soon for the NWS and those of you who weather these challenging and uncertain times will have significant opportunity to emerge as the new leaders for the organization. You may not realize it yet, but you're living the very beginning of a transformation for hydrologic services within the NWS and I have no doubt that in a few years from right now you'll look back on this period and realize you had a hand in something great. Save this edition of Confluence and please find me in the coming years and tell me about your journey. Like any forecaster tracks skill, please let me know how this one verifies.

I've enjoyed serving as the Office of Hydrologic Development Director for the last several months, learned an awful lot, and know you'll have an even stronger leadership team to follow, a team who will move the ball forward. Thank you. - Barry

Max A. Kohler Award 2012

Harold Opitz, Hydrologist-In-Charge at the Northwest River Forecast Center, has made significant contributions to hydrologic research, facilitating cooperative efforts with other agencies, improving/investing in hydrologic projects, and advancing hydrologic services. This award is presented annually to honor individuals for sustained superior performance and distinguished accomplishments in support of the National Weather Service Hydrology Program.

Gregg B Rishel Award 2013

Katelyn Costanza, Senior Hydrologist at NWS Lower Mississippi River Forecast Center (LMRFC), has done extensive work with stakeholders in the LMRFC area and has played an integral role in the advancement of the RFC's hydrologic program. This award recognizes an individual for hydrologic science and/or service contributions which support the fulfillment of the hydrologic services mission of the National Weather Service.

The 2013 Flash Flood and Intense Rainfall Experiment (FFaIR)

By Wallace Hogsett, Faye Barthold and Tom Workoff

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) 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 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), areas where radar

The 2013 Flash Flood and Intense Rainfall Experiment (FFaIR) continued…

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. This Fall, a complete summary of the inaugural FFaIR experiment will be published on the HMT-WPC website (http://www.wpc.ncep.noaa.gov/hmt/).

Information Technology Corner

James Rawls

IT Service Management – The Core Services?

In our last issue I discussed ITSM in a high level, management driven perspective. One certainty of ITSM is enabling people, a set of processes, and managing them, will not happen without senior management influence and the governance they provide. So let's start with the people, processes, and management of these resources. ITSM is business driven, and will vary based on supporting the needs of the business goals and the customer. So let's look at the pieces.

People are the human resources required to enable the business goals. That staff is a critical piece of the puzzle. Staffing will encompass technical, management, and even administrative skills. While we primarily view ITSM as purely technical in delivery, the program/project managers and budget staff play important roles to ensure the other two pieces are in place and available to the technical staff. The other two involve the processes of direct technology, and the management and oversight of the workflow. The technology piece involves hardware, software and network availability which are used by the technical staff. So in reality the people and technology pieces are the direct delivers of those processes, and the management piece provides monitoring, and the goal of process improvement.

The success factor in ITSM depends on all three of the above, and how well each is done. Measuring success isn't just a senior management responsibility, but directly depends of how the customer views it all. An old saying "the customer is always right" is the driver on how ITSM is delivered, managed, and improved. So we hire the appropriate staff, provide them with the necessary technology, and then allow management to monitor and improve. Next issue let's break down the people, processes and the supporting technology, and management.

USACE Spotlight
Institute for Water Resources

Bob Pietrowsky, USACE IWR

Bob serves as the Director of USACE's Institute for Water Resources and the International Center for Integrated Water Resources Management, under the auspicious of UNESCO.

From its beginnings, the U.S. Army Corps of Engineers (USACE or Corps) Institute for Water Resources (IWR) has occupied a unique position within the Corps Civil Works program. As a separate field operating activity (FOA) reporting to the Corps Headquarters, the Institute is not directly part of USACE's project execution organizational hierarchy or laboratory structure. Yet its challenging mission as a water resources "think tank" has been and remains integral to shaping the strategic direction of the Civil Works program.

IWR owes its creation to the sweeping changes in water development policies in the decades leading up to passage of the National Environmental Policy Act in early 1970. As the public demand for water projects increased in post-WWII America, so did the "thirst" for USACE Civil Works projects likewise expand to meet this need. And, as the Federal outlays on water projects increased, controversies over large public works and the priorities for government spending continued to elevate the visibility of issues surrounding the Federal role in providing water resources services.

Although the conditions that stimulated the creation of IWR have changed over the last 45 years, the water resources issues of today have evolved to reflect new challenges stimulated by factors such as the rapid pace of technology and scientific advancements, evolving public values, an aging water infrastructure and seriously constrained budgets. In response, Corps decision-makers have increasingly looked to the Institute for advice on a host of perplexing policy and technical issues. As such, the need for a diverse set of professional, independent water experts to pursue innovative approaches to solve problems in a collegial, nonpartisan setting remains as compelling today as any time in the Institute's history.

Today, IWR serves as the USACE's knowledge center for integrated water resources management (IWRM), and is recognized as a national center of expertise in water resources planning methods, risk analysis, hydrologic engineering, conflict resolution and public participation, international water resources, global climate change science, and the collection, management and the dissemination of Civil Works program information and navigation related infrastructure performance information, including the Nation's waterborne commerce data.

USACE Spotlight continued…

IWR has offices at five locations, each of which is a USACE designated center of expertise. IWR's main office located in Alexandria, VA includes the Institute's executive office and the critical mass of its planning methodologies, socio-economic and strategic planning expertise, while also housing three of its centers – the Navigation and Civil Works Decision Support Center (NDC), the International Center for Integrated Water Resources Management (ICIWaRM), and the Conflict Resolution and Citizen Participation. The Institute's Hydrologic Engineering Center (HEC), specializing in the development of the HEC suite of hydrologic, hydraulic and reservoir system and related models, is located in Davis, CA, while the Waterborne Commerce Statistics Center, is located in New Orleans, LA. The Risk Management Center (RMC), specializing in the engineering aspects of dam and levee safety, has offices in Golden, CO and Pittsburgh, PA.

In addition to leading USACE's technical participation in national and international water forums, the Institute's water resources mission involves the production of white papers and policy-oriented national reports; a wide range of training and education events and instruments; the production of technical guidance, handbooks and manuals for USACE practitioners; the promulgation of new planning and decision-support methodologies; the development of improved hydrologic engineering methods and software tools; the advancement of risk analysis as applied to public works infrastructure; and the management of national waterborne commerce statistics and other Civil Works information systems. National interface with other agencies, NGO's, and academia, along with the infusion of new knowledge and technology across USACE also remain key focal areas of the Institute. Through ICIWaRM, which is affiliated with UNESCO's International National Hydrological Program (IHP), IWR supports U.S. capacity development efforts overseas as a means to improve water security around the globe.

One illustration of IWR's technical role in supporting USACE is its involvement in the Corps collaboration with the National Weather Service (NWS) and USGS on the tri-agency partnership on Integrated Water Resources Science and Systems (IWRSS). IWRSS represents a truly contemporary interagency collaboration aimed at synchronizing and leveraging each agency's mission contributions in science, water resources services and the use of analytical tools in order to support jointly developed and integrated water resources management advancements that are useful to other Federal agencies, States and others responsible for water management.

Two manifestations of this partnership are ongoing efforts on (1) developing a common operating platform for providing national flood inundation mapping services, and (2) ensuring that each agency's information can be seamlessly shared through improved system interoperability and data synchronization. Interagency work groups on each of these efforts were established last year, and these groups have just produced "Requirements" documents which articulate a path forward for better integrating our respective agency's flood mapping and related water services in the future. I'm delighted that the Institute, through its Hydrologic Engineering Center, led by HEC Director Chris

USACE Spotlight continued…

Dunn, is playing a key technical role in the charter efforts.

In addition, a third charter is currently being formulated on the long term collaborative development of a new national hydrological model based on an earth-systems context that integrates the next generation of hydrologic and atmospheric modeling capabilities within the U.S.
As IWR Director it is not only a privilege to work with and lead so many gifted water resources colleagues within the Institute and across USACE, but it's also been very fulfilling to team with our IWRSS partners working through: Don Cline and Tom Graziano at NWS and Jerad Bales and Robert Mason at USGS, who along with James Dalton, Jerry Webb and Chandra Pathak from the USACE Headquarters, have proved to be a very effective senior scientist/engineering team.

IWRSS is providing us all with a much greater appreciation of the advantages of an interagency engagement paradigm based on a true "whole-of-government" approach. The team is already seeing a glimpse of IWRSS's promise as we observe first-hand the progress being made towards improved data sharing and model integration – enhancements that will serve to conserve resources, deliver more accurate, consistent, and timely forecasts, and, from USACE's perspective, ultimately provide us with more informed water management decision-making capabilities during critical real-time operations of the network of Corps reservoirs and other water control structures across the U.S It is this desired outcome – providing enhanced life safety information, services and operations for the American people – that is motivating both the IWRSS team and the three participating agencies to strongly commit to this collaboration.

For further information about the Institute for Water resources, please check out our website at http://www.iwr.usace.army.mil/, while additional information about IWRSS can be found at: http://www.nws.noaa.gov/oh/docs/IWRSS_1p_summary.pdf.

Retirement Announcement

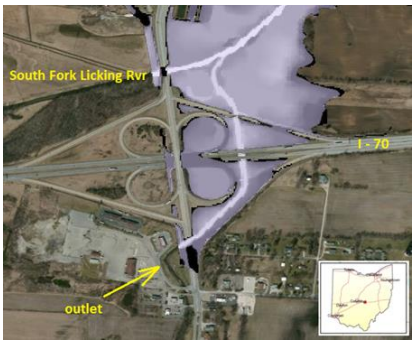
On May 2, **Greg Lamberty** retired after 21 years of service with NWS. Greg joined NWS in 1992 as a Met Intern working at Marseilles, IL; Evansville, IN; and Paducah, KY before becoming a Service Hydrologist in 1997 at the new WFO in Northern Indiana (IWX) where he was involved in two significant hydrologic events. The January 2005 ice jam/flood event earned him the group DOC Silver Medal. Greg moved on in 2007 becoming the Senior Service Hydrologist in Columbia, SC where he quickly transitioned from floods to extreme drought services.

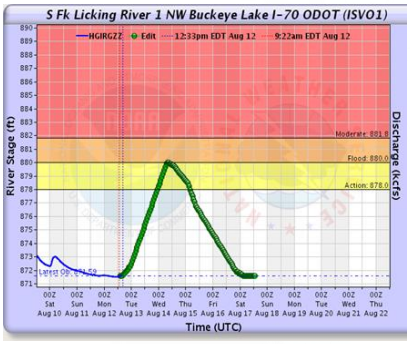
Forecasting Services for the Ohio Department of Transportation

OHRFC

WFO Wilmington (ILN), the Ohio River Forecast Center (OHRFC), and United States Geological Service Ohio Water Science Center (USGS) teamed up to provide a unique, innovative forecasting solution for the Ohio Department of Transportation (ODOT). A low spot on Interstate 70 near Newark, Ohio has an elevated risk for flooding from the South Fork Licking River. With adequate warning, ODOT could deploy crews to monitor the interstate and shut down traffic if conditions became too hazardous. ODOT sought help from USGS to identify potential solutions to the flooding, and USGS brought the problem to ILN and OHRFC to utilize hydrologic forecasting services.

The location is too complicated for a simple hydrologic model. At I-70, South Fork Licking River includes flow from a large headwater area as well as flow from Buckeye Lake. Further complicating the hydraulics, Buckeye Lake has two different outlets with different controls on each. Depending on lake levels, these outlets behave differently - one is a simple weir structure that only becomes active at higher lake levels the other is a control structure that is meant to be operated according to a lake management plan.





OHRFC determined a suitable strategy for modeling this location was a hydraulic model, and chose the U.S. Army Corps of Engineers (USACE) HEC-RAS model. USGS established a field program to collect cross-section data and flow information around the site and constructed a HEC-RAS model of the area. OHRFC combined this with detailed overbank elevation data to improve and expand the HEC-RAS model, adjusted the calibration and configured it to work in the Community Hydrologic Prediction System (CHPS). Next, OHRFC and ILN established an innovative modeling and communication process to notify ODOT of potential flooding at this location. OHRFC runs the model two times per day or more frequently as necessary and notifies ODOT and ILN when a forecast shows flooding approaching the roadway elevation. A graphical hydrograph is sent when action stage is approached.

This is a great example of several public agencies responding to a demand for hydrologic services to protect lives and property. With this development ODOT can rely on OHRFC to notify them about a potentially dangerous condition.

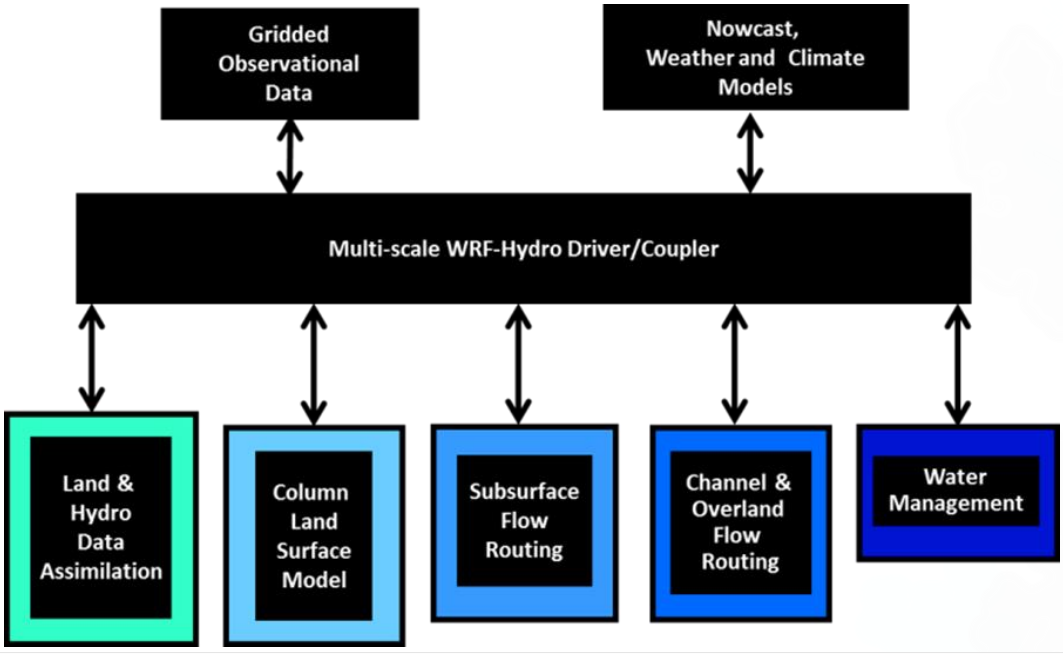
Wavefronts: New Developments in Hydrology

Tim Schneider

In the last issue of Confluence (Issue #4, March, 2013), we were introduced to a model called ParFlow, which explicitly coupled surface and subsurface processes. In this article we would like to introduce you to something of a quite different nature: a framework designed to couple together multi-scale process models (or data) of the atmosphere and terrestrial hydrology. WRF-Hydro is a hydrologic extension of the successful, community-based Weather Research and Forecasting (WRF) model, which is used in thousands of research and operational centers around the globe.

The development of WRF-Hydro is led by Dr. David Gochis, along with a team of NCAR and University scientists and engineers. However, the effort has adopted a 'community-based' development processes with an open and participatory working group environment. This means that the code, the documentation, and the applied knowledge user base, is much greater and more robust.

So what is WRF-Hydro? It is an extensible, multi-scale coupling architecture to link weather and climate models with hydrological component models. Flexibility is at its core. Technically, a collection of "flux and state coupling software" which manages the flow of time and the grids is at WRF-Hydro's core. But the hydrometeorological inputs could be gridded observational data, or fully (two-way) or singly coupled models ranging from very high resolution nowcast systems to long-range regional climate models. And on the terrestrial hydrology side, the system has "hooks" for varied models of the column land surface; subsurface flow routing; channel and overland flow routing; water management; and land surface and hydrological data assimilation.



Wavefronts: New Developments in Hydrology continued…

As our water resource management challenges grow in complexity and compound, it seems certain we will need to ask more of one of our most fundamental tools - models. So it is natural to expect our tools to grow in complexity (physics and chemistry) and scale (time and space). So in the future we expect that we will be running our models on some "big iron." Which takes us to another interesting and important aspect of the WRF-Hydro architecture: it has been designed and tested to run in a variety of high performance computing environments.

The first official version of the WRF-Hydro system, Version 1, was released in April 2013. It includes an initial suite of basic hydrological model components, which can be run in coupled or uncoupled mode right out of the box. But this is a dynamic community effort, so look for more features and capabilities in future releases. To date, the WRF-Hydro system has already been applied for a wide range of research and operational prediction problems both in the U.S. and abroad. Past projects include flash flood prediction, regional hydroclimate impacts assessment, seasonal forecasting of water resources and land-atmosphere coupling studies.

You can learn more about this work and download the documentation and the code at: http://www.ral.ucar.edu/projects/wrf_hydro/

IWRSS Stakeholder Engagement Forums

Mary Mullusky

Integrated Water Resources Science and Services (IWRSS), is a new business model for interagency collaboration consisting of a consortium of federal agencies with complementary missions in water science, observation, management and prediction. IWRSS' overarching objective is to enable and demonstrate a broad, integrative national water resources information system to serve as a reliable and authoritative means for adaptive water-related planning, preparedness and response activities. The leaders of NOAA, the U.S. Army Corps of Engineers (USACE), and the U.S. Geological Survey (USGS) formalized the partnership in May 2011 by signing a Memorandum of Understanding for the Collaborative Science, Services and Tools to Support Integrated and Adaptive Water Resources Management. Since then the agencies began working to align programs and set up management mechanisms to support IWRSS implementation.

IWRSS partner agencies understand that enhanced partnerships are necessary to efficiently deliver expanded and more integrated water resources services. As such, to enhance stakeholder interactions, socialize objectives, and inform the design and development of IWRSS, NOAA in coordination with the USGS and the USACE, conducted four 1-day in-basin stakeholder engagement forums to validate existing and identify new gaps in water resource services. The forums were conducted in coordination with four

IWRSS Stakeholder Engagement Forums continued…

major stakeholders: 1) the Delaware River Basin Commission (December 13, 2012), 2) the Interstate Commission on the Potomac River Basin (February 6, 2013), 3) the Susquehanna River Basin Commission (February 28, 2013), and the 4) Hudson River Foundation (June 27, 2012). At each in-basin forum, a group of approximately 30 stakeholders from national, regional, state and local organizations representing diverse interests, discussed water resource issues affecting the respective river basin. Attendees learned about hydrologic services envisioned to be provided by IWRSS, identified key gaps IWRSS might fill to inform water resources decision making, articulated socioeconomic benefits of addressing these gaps, and discussed possible demonstration projects for IWRSS to meet those gaps.

In advance of the 1-day forums, participants were polled to determine the highest priority water resources issues for the basin. Common priorities across all four basins included water availability and use, water extremes (flooding and drought), water quality and climate change impacts. The groups were charged to identify key decisions, questions, and gaps that IWRSS could address. The most commonly identified gaps involved: (1) models, analysis and reliable forecasts; followed by (2) data and monitoring; (3) communication and decision support needs; and (4) sediment transport and sedimentation information needs. Stakeholders also identified and discussed possible demonstration projects to build capacity for tri-agency integrated water resources management and explored the socio-economic benefits of such projects. The results of the stakeholder engagement forums and a follow on survey will be used to inform and guide the design and development of IWRSS and develop a business case to garner the resources necessary to deliver new/improved IWRSS services.

CHPS Bits : New Release

Jon Roe

The summer semi-annual release of CHPS, CHPS-4.0.1, is expected to be available to the RFCs in late October. CHPS-4.0.1 will include:

1. Delft-FEWS 2013.01

2. OHD-CORE-CHPS

-Second release of the Graphics Generator, including updates to software and documentation to address issues found at the RFCs with the first release

- Initial baseline release of the CHPS Calibration Service, a joint effort between Deltares and OHD that combines existing Delft-FEWS features and custom OHD developed functionality. For example, a part of the Calibration Service includes a CHPS version of the statistical package previously delivered with NWSRFS (i.e., STAT-QME). Where possible, the various STAT-QME calculations and reports were implemented using existing Delft-FEWS features; where not possible, features were implemented using custom OHD software

- Documentation for OHD delivered CHPS features is now being consolidated on the web at http://www.nws.noaa.gov/oh/hrl/general/indexdoc.htm which is still under construction

3. HEC Models in CHPS

- Performance improvements were made to the CHPS HEC-RAS adapter, prompted by NCRFC's request to use HEC-RAS during multi-year historical runs

- No changes for HEC-ResSim

CHPS Bits : New Training

Jon Roe

In August the NWSTC announced that the CHPS "RFC User" module is now available. It provides instructions on creating daily and supplemental forecast products and takes about 3.5 hours to complete in the LMS. The full set of CHPS modules is now available at: http://www.nwstc.noaa.gov/CHPS/

CHPS Modules

-- Introduction to CHPS
-- Basic Configuration
-- Display Configuration
-- Simulation Configuration
-- Advanced Configuration
-- System Manager
-- RFC User
-- WFO User (scheduled for September)

National Water Center Update

Sam Contorno

Construction of the approximately 65,000 square ft. National Water Center (NWC) facility in Tuscaloosa, Alabama, is progressing toward completion. The design-build contractor for the project, Triune-Beck, has largely completed brick installation, and window installation is nearing completion. Cast stone columns have been constructed on the south face of the building. The focus of construction is now centered on the interior of the facility. Work on domestic water lines electrical wiring, and plumbing is well underway. Data cable is being pulled on all floors. Interior wall framing is complete except for a few exceptions. The rotunda dome has been painted, and its copper roof installed. Sheetrock installation has begun on all floors.

The NOAA Project Team (Office of the Chief Administrative Officer/Project Planning and Management Division in Kansas City and the Office of Hydrological Development) conducted an extensive site review the week of August 19. The tentative completion date of the NWC facility is October 2013, with occupation expected in early 2014.

Have an idea for an article for the next issue of Confluence? Please contact Katie Garrett at katie.collins.garrett@noaa.gov. All articles for the next edition will be due on **Wednesday, November 20th**. Confluence is now published quarterly.