

# Office of Hydrologic Development Hydrologic Software Engineering Branch Quarterly Activity Newsletter January 2010

*Software for NWS Hydrology!*

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## 1. HIGHLIGHTS OF October, November, December 2009

AWIPS baseline software development efforts were minimal for this quarter. For OB9.2, we supported the testing of significant changes to the MPE/Daily QC which were made available to River Forecast Centers (RFCs) through an AWIPS Test Authorization Note (ATAN) and will be part of the OB9.2 baseline. The changes include enabling ingest from NSSL's experimental system, the National Mosaic and Multi-sensor Quantitative Precipitation Estimation (NMQ), and adding functionality to provide gridded forcings to the Community Hydrologic Prediction System (CHPS).

Almost all of our AWIPS activities continue to be providing considerable support to the AWIPS II (a.k.a. AWIPS migration) evaluation. Besides being part of various coordination tasks, we have been installing the latest contractor (Task Order 11) software releases and evaluate each release as it is available. We also provided significant input to NWS efforts to address gaps in the testing material for AWIPS II.

For Next Generation Radar (NEXRAD), the Office of Science and Technology (OST) and the Radar Operations Center (ROC) announced a six month slip to the beginning of formal testing of dual polarization enhancement to NEXRAD from October 2009 to April 2010. Beta Testing is now scheduled to begin in Fall 2010, and the beginning of full deployment is now scheduled for early 2011. However, the completion of deployment is still scheduled for the end of 2012. HSEB continues integration testing the dual polarization (or dual pol) Quantitative Precipitation Estimation (QPE) algorithm and products operational software

The CHPS Acceleration Team (CAT) RFCs received User Training in October; two of the four RFCs have now moved into the "parallel operations" phase of the project. December saw another week of Software Acceptance Testing (SAT) in Silver Spring, this time with one of the CAT-II representatives in attendance.

## 2. NEXRAD SOFTWARE DEVELOPMENT

NEXRAD release Build 11.2 deployment is nearly complete. Build 11.2 provides security updates and fixes an issue with the Radar Data Acquisition (RDA).

## **2.1 Dual Polarization**

The formal testing for the NEXRAD dual pol upgrade starts with a System Test which has been re-scheduled to begin April 2010. Meanwhile, HSEB continues testing the software for the dual pol QPE algorithm and products which they delivered to the ROC. In addition, HSEB is helping ROC and OST assess the quality of the data output by the test-bed radar that has been upgraded with dual pol by the contractor, Level III communications. We are also preparing to do quantitative evaluation of the dual pol QPE algorithm which will start after the quality of the dual pol base data is acceptable.

For the dual pol enhancement, the Radar Product Generator (RPG) software, including new algorithms and products, were implemented by the ROC, OST, and OHD. The Radar Data Acquisition (RDA) software and hardware changes for the dual polarization enhancement are being done by a contractor, Level III Communications.

## **3. AWIPS RELEASE OB9**

The OB9.2 release will contain fixes for several bugs and the MPE/Daily QC changes for NMQ and CHPS. The previously planned maintenance release OB9.3 has been eliminated.

### **3.1 WHFS Improvements**

Information on the WHFS, data ingest, and precipitation processing (e.g., MPE) applications are accessible on the NWS Office of Climate, Water and Weather Services Hydrologic Services Division (OCWWS/HSD) support web page at: <https://ocwws.weather.gov/intranet/whfs/>.

No significant work has been done on WHFS in the last quarter.

### **3.2 Precipitation Processing Improvements**

The significant changes made to MPE/DailyQC will be included in AWIPS Release OB9.2 which starts general deployment on Jan. 4, 2010. The MPE/Daily QC changes are described below in more detail. The changes related to CHPS are described in the CHPS Forcings section.

For 1-hr MPE precip processing, new options were added to read, process, and display NMQ-based grids. NMQ is an experimental system developed and maintained by NSSL; for more information see <http://nmq.ou.edu/>. The new options include the ability to read and display the raw radar-only NMQ grid and to use the raw grid to generate a local-bias corrected grid. The local-bias corrected grid can be used to generate a multi-sensor grid using the same algorithm used to generate the other multi-sensor grids within MPE. For Satellite-Radar-Gage (SRG) fields, a check was added so that if a top-of-the-hour satellite product is missing, MPE will look for a 15 minute after-the-hour product.

For 6-hr and 24-hr MPE/Daily QC precip processing, new options to generate netCDF format files and GRIB1 format files were added. The netCDF format files can be read by GFE. Also, the ability for the forecaster to edit a time distributed 6hr precip value was added.

### **3.3 Field Tests**

The following evaluations at certain offices are ongoing:

- Multiple RFCs continue to use a post-OB9 version of MPE which supports the NSSL NMQ radar-based QPE product and derived products.
- Selected RFCs continue to evaluate the Daily QC features in the post-OB9 version of MPE.
- CAT RFCs are using a post-OB9 version of MPE to provide gridded forcings for CHPS. (This version is the same as what will be deployed in OB9.2.)

## **4. DEVELOPMENT SUPPORT ACTIVITIES**

### **4.1 New RFC Software Architecture: CHPS**

After the December SAT, OHD CHPS Release 2.1.1 was disseminated to the CAT RFCs as part of the overall CHPS release, which included the FEWS December build.

Visit the CHPS web site at <http://www.nws.noaa.gov/ohd/hrl/chps/index.html>. The “News & Activities” section contains reports from these HSEB quarterly newsletters. The CHPS page can also be accessed from the main OHD page (<http://www.nws.noaa.gov/ohd/>).

#### **4.1.1 CHPS Implementation**

##### **CHPS Acceleration Team (CAT)**

Deltares led two days of CHPS User Training at each of the CAT RFCs in early October. At ABRFC, CNRFC, and NWRFC the first day was comprised of presentations and exercises to teach forecasters how to use some basic CHPS Interactive Forecast Display (IFD) capabilities. The second day provided an opportunity for forecasters to exercise their new skills during a pre-defined major flood event. CHPS User Training at NERFC was handled slightly differently; in this case, Deltares provided “Day 1” of the schedule to half of the staff, followed the next day by a repeat of the same material for the remaining staff. A “Day 2” training class was subsequently provided to NERFC in early December. Dave Cokely from the NWS Training Center (NWSTC) attended the training sessions at ABRFC.

During the SAT at OHD on December 7-11, forecasters from NWRFC and NERFC conducted further testing of the IFD. The latest version provided significant enhancements to the previous release which was distributed in September, and which formed the basis for CAT RFC forecaster training. Work on the IFD continues, with limited changes (primarily bug fixes, and some remaining missing functionality) expected in a late January release. Joe Ostrowski from

MARFC (a CAT-II RFC) also participated in this SAT.

In November and December ABRFC and NERFC moved into the “parallel operations” phase of the project. This involves using CHPS for the first time in a more realistic environment; i.e., running through selected basins/forecast groups in a practice mode. No operational forecast products are generated during this phase.

### **CHPS Acceleration Team-II (CAT-II)**

The CAT-II RFCs are currently focused on implementing gridded model forcings. In some cases this involves learning how to use the Gridded Forecast Editor (GFE) provided by AWIPS; in other cases it involves learning to use HSEB’s MPE/DailyQC application. Refer to the section below on CHPS Forcings for more information.

Meanwhile, to satisfy a request from Deltares for current station point data and mean areal data from the CAT-II distributed a CHPS version of the ofsde program to those RFCs. The CHPS version of ofsde produces slightly enhanced station data. This enhanced station data, along with basin average data (mean areals) from the NWSRFS fs5files, will be shipped to Deltares via NOHRSC to provide test data for the CAT-II initial basin configurations.

### **CHPS Software Development**

HSEB developers finished migration and testing of the legacy models required for BOC II. The models were formally tested in December. With the conclusion of the December SAT, the initial model development for BOC is complete. Any future development for BOC models will be in response to bug fixes or enhancements. Below is the final list of OHD’s BOC models

1. Baseflow
2. Channel Loss
3. Consumptive Use
4. Continuous API
5. Glacier Routing
6. RES-J
7. Lag and K Routing
8. Layered Coefficient Routing
9. Muskingum Routing
10. Rain-Snow Elevation
11. SAC-SMA
12. RES-SNGL
13. SNOW17
14. SSAR Channel Routing
15. SSARR Reservoir Regulation
16. Tatum Coefficient Routing
17. Unit Hydrograph

In addition, the BOC implementation of various baseline ensemble programs was also completed and tested, including ENS\_PRE, ENS\_POST, and ESPADP Input Generator.

HSEB folks continue to support the CAT RFC migration efforts in conjunction with HSD and Deltares. We investigate each operational support problem which might be related to a problem with the legacy models. When a software problem is identified and corrected the fixed software is packaged and released through the HSD and Deltares

HSEB developers started working on non-model related BOC features. These will be tested and delivered as part of future CHPS builds (e.g. March or June CHPS Release). They include

1. A utility to automatically convert NWSRFS mods to FEWS xml files through IFP. Currently only the SSARREG, WECHNG and SETQMEAN have been identified as needed for BOC
2. Generating headwater flash flood guidance (FFH) in CHPS. This consists of porting the existing NWSRFS FFH algorithm to CHPS, including generation of the FFH text product
3. Porting the parts of the Site Specific Hydrologic Predictor (SSHP) that were responsible for extracting data from the NWSRFS data base to extract data from the FEWS database

### **CHPS Forcings**

Progress towards generating gridded forcings for use in CHPS continued. The list-server has seen increasing use as a medium for discussion between RFCs of the setup and use of MPE/DailyQC.

OHD completed upgrades to MPE/DailyQC to generate grids in netCDF and GRIB1 formats. The netCDF format grid can be ingested by GFE for further processing. The GRIB1 format file can be sent directly to CHPS. The NC2GRIB application can be used to transform netCDF format files (output from GFE or MPE/DailyQC) into GRIB1 format. This application offers a second pathway for generating grids to be ingested by CHPS. OHD worked with NWRFC and Deltares personnel to successfully test ingest of GRIB1 format grids into CHPS. The NC2GRIB application is not part of the AWIPS baseline and is available from HSEB (contact Paul Tilles or Joe Gofus for the application).

HSEB developers completed changes to MPE/DailyQC aimed at AWIPS Release OB9.2 and provided support for OB9.2 testing. In addition, developers are working on a few further enhancements which have been identified as being necessary for smooth operations in CHPS. These enhancements will be completed and tested under an ATAN at the CAT RFCs after OB9.2 has been deployed.

A webinar was held on December 15 to provide an overview of MPE/DailyQC with a focus on those RFCs which are not yet using the application. Additional sessions may be held in 2010 to further discuss details and potential enhancements to improve its utility to provide forcings in the CHPS environment.

### **4.1.2 HEC-RAS for CHPS**

Deltares conducted further tests of the HEC-RAS during the December SAT, using a more comprehensive configuration developed by Deltares for the Lower Columbia River (NWRFC). A system problem prevented completion of all tests during SAT, but remaining functionality was successfully demonstrated to OHD by the end of December.

#### **4.1.3 HEC-ResSim for CHPS**

OHD learned in December that changes to the FEWS-ResSim adapter required to handle an updated version of ResSim were not implemented in time for the December SAT. Deltares will make the necessary changes for the January maintenance release.

#### **4.1.4 Experimental Ensemble Forecast System (XEFS) and Hydrologic Ensemble Forecast Service (HEFS)**

The XEFS includes experimental non-baseline versions of new ensemble-related software interfaced to CHPS and FEWS through model adapters. Any new baseline ensemble-related software will become part of the HEFS which is intended to be the operational name to follow XEFS.

XEFS components are a new Ensemble Pre-processor (EPP), Ensemble Post-processor (EnsPost), Ensemble Verification System (EVS), and Hydrologic Model Output Statistics (HMOS). Each of these components will be available to RFCs with CHPS for field testing following beta testing. In addition, each of these components will undergo a second phase where the prototype is re-factored into baseline CHPS software. During the past quarter, we completed integration and testing of EPP3, EnsPost, and HMOS and their model adapters with CHPS and started beta testing. The EVS (which completed integration and testing earlier) was made available for distribution.

The Graphics Generator is the first piece of the HEFS. The Graphics Generator is a Graphical User Interface (GUI) where users can change the look of graphics or displays and an engine to create special graphics not available through the standard CHPS GUI, the IFD. The Graphics Generator will be implemented in phases. For Phase 1 of the Graphics Generator, we will implement the same functionality as the existing Ensemble Streamflow Prediction Analysis and Display Program (ESPADP). During the past quarter, we completed most of the coding of the Graphics Generator and provided preliminary versions to RFC members of the steering team. In the coming months, we will complete the Phase 1 coding, complete internal testing and create a User's Manual. For Phase 2 of the Graphics Generator, the functionality will be extended to deterministic and spatial displays. For Phase 3, our current plan is to make the Graphics Generator functionality available to external users.

To help make XEFS easier to use and move toward operations, OHD will be setting up a web page to provide the XEFS software (models and adapters) and documentation (installation and configuration notes and users guides).

## **4.2 AWIPS II**

During this period, HSEB personnel continued to support the testing of the interim releases of AWIPS II software provided by Raytheon. As a part of this effort, HSEB wrote additional test procedures to eliminate gaps in testing coverage of hydro applications as critical or important to test.

In December 2009, Raytheon said it was behind schedule in delivering software which would provide all of the current AWIPS functionality. All functionality is now scheduled for delivery by the end of January, although a large number of Test Trouble Reports (TTRs) have been written and are still outstanding against the software. At this point there has been no change to the official schedule which calls for all critical problems to be fixed and delivered to the Government in mid-March 2010, then 6 months (March – September 2010) of system OT&E, then 4 months (September 2010 – January 2011) of field OT&E, then general deployment starting in January 2011.

## **5. HYDROMETEOROLOGICAL AUTOMATED DATA SYSTEM (HADS)**

Visit our web page at: <http://www.nws.noaa.gov/ohd/hads/>.

### **5.1 HADS Systems and Software**

Based on requests from the field, software has been enhanced to improve the delivery of hourly precipitation data (SHEF code PP) for those Data Collection Platform (DCP) sites that do not provide specific hourly rain fall amounts nor are their reporting times in sync with top of the hour data. The enhancement provides for the computation of hourly PP from sub-hourly PP and deriving these values for time stamps to the top of the hour. Similar work is underway to compute top-of-the-hour PP from sub-hourly PC sensors and this improvement is expected to be in place by the end of January.

*The following information is repeated from the October Newsletter:*

Historically most adjustments to the observed water level data values were depicted in the field entitled “Base Elevation”, but with the significant growth in the use of gage correction values it became apparent that our services needed to be improved in order to add clarity to the use of gage adjustment values. Therefore Base Elevation values and Gage Correction values have been separated. The change was put in place to clearly identify each. The Base Elevation field is used solely to present values, generally permanent in nature, that adjust the observed value due to a defined Sea Level elevation or a defined Datum. The Gage Correction field is now used to depict a gage correction value, expected to be temporary, and likely to be altered as conditions warrant.

Another enhancement to HADS web services was enacted in order to present, in near real-time, the USGS and Corp of Engineers data locations that are subject to draw-down adjustments. The web page at <http://amazon.nws.noaa.gov/cgi-bin/hads/listGageCorrectionsWeb.pl> presents the

data points at which known draw-down adjustments are in place. Sites are added to, or removed from this database table as details are received from the gage operator.

## **5.2 HADS Data Network**

There are now 14,110 data locations defined for HADS processing, an increase of 138 reporting locations since October 1<sup>st</sup>, 2009. The number of data values delivered to NWS operations is averaging 2.61 million each day, which is actually a little less than the volume of data from 3 months ago. The network oddity is that as sites were added to HADS during the past several months, a large number of existing sites stopped transmitting as winter weather took hold. During the first half of January, on average, each day 825 sites did not transmit any data. The seasonal network trends of the data network can be viewed at:  
<http://amazon.nws.noaa.gov/hads/charts/NetAnalysis.html>

The Historical Climate Network Modernization program has activated a number of sites in the Southwest region of the U.S. They are providing timely temperature and incremental precipitation data (SHEF code PP). These data are recorded at five-minute intervals and are transmitted less than five minutes after the most recent observation is recorded. It is expected that more of these sites will become active during the next several months. As the HADS program becomes aware of these new DCPs, and as NWSLI assignments are created for them, they will be added to HADS processing and their observations will be delivered as SHEF encoded data records.