

**Office of Hydrologic Development
Hydrologic Software Engineering Branch
Quarterly Activity Newsletter
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Software for NWS Hydrology!

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1. HIGHLIGHTS OF JANUARY, FEBRUARY, AND MARCH 2008

AWIPS software development efforts during this period were dedicated to supporting formal testing of OB8.3 and to development work for OB9. OB8.3 is scheduled to start full deployment by the beginning of June 2008. OB9 software is due in May 2008 for integration and formal testing and is scheduled to start full deployment in early 2009. Other key activities this period included support for field test and evaluations, and continued guidance to the AWIPS prime contractor (Raytheon) regarding the software development, maintenance, build, and release practices.

For NEXRAD, HSEB continued implementing the dual polarization Quantitative Precipitation Estimation (QPE) algorithm and associated products. This software and the dual polarization initial operating capability are targeted for operational deployment in NEXRAD RPG Build 12. Deployment of the initial dual polarization operating capability and Build 12 is scheduled to start in early 2010.

The Community Hydrologic Prediction System (CHPS) project has now moved into the planning phase for development of a basic operational system at the 4 “pilot” sites (i.e., ABRFC, CNRFC, NCRFC, and NWRFC), and subsequently at the remaining 9 RFCs. More details below.

HSEB also has devoted more resources for AWIPS-II in support of the Office of Science and Technology (OST) - details below.

2. NEXRAD SOFTWARE DEVELOPMENT

NEXRAD Build 10 is scheduled to begin deployment in May 2008. For Build 10, earlier this year, OHD made a small change to display the source ID of the mean field bias to a few of the PPS products (STP, OHP, and THP). As part of AWIPS OB8.2, WFOs have the option to send to their associated RPG(s) either their locally-computed mean field bias or an RFC-computed mean field bias. The source ID is the ID of the AWIPS site which computed the bias.

2.1 Terminal Doppler Weather Radar (TDWR) PPS

Starting in April 2008, OST will deploy the remaining 45 Supplemental Product Generators (SPGs) to WFOs near TDWRs, with a scheduled completion date of September 2008. An SPG is a modified RPG which ingests Terminal Doppler Weather Radar (TDWR) data to produce NEXRAD-like products. Coinciding with this deployment will be SPG Build 3. In SPG Build 3, HSEB adapted the NEXRAD PPS to the SPG so that it produces TDWR-based precipitation products with the same names and formats as NEXRAD precipitation products. As a result, the full suite of PPS products, such as the STP, DHR, and DPA, will become available from TDWRs in the coming months. TDWR-based precipitation products are displayable on AWIPS D2D with Release OB8.2.

2.2 Dual Polarization

HSEB continues to implement the dual polarization QPE algorithm and products into the Radar Product Generator (RPG). In May 2008, OHD will deliver a non-operational version of their dual polarization software for testing with Build 11. However, the operational dual polarization capability is scheduled for NEXRAD Build 12, and deployment begins in early 2010 and lasts for several months.

3. AWIPS RELEASE OB8.3

During the quarter, HSEB supported formal testing of AWIPS Release OB8.3. This build will include a new version of the PostgreSQL data server for all the OHD applications. Our major projects for this build are summarized below.

3.1 NWSRFS

For more detailed information about the OB8.3 projects below, the development documents are available at http://www.nws.noaa.gov/oh/hrl/hseb/software_dev_doc.html.

3.1.1 Re-implementation of ICP

HSEB accepted the software produced by RTi to re-implement the Interactive Calibration Program (ICP) in an object-oriented framework. While there is little new functionality in this application, re-implementing it in a modern language should make it easier to maintain and enhance in the future. Users should also notice that some functions which did not work correctly in the old ICP have been corrected.

3.1.2 NWSRFS Reservoir Tool Enhancements

HSEB also accepted the software produced by RTi to incorporate two enhancements to tools available in NWSRFS for modeling reservoirs. The first will allow the LOOKUP3 operation to have access to multi-value time series for use in regulation modeling. The second enhancement is to allow the Res-J MAXSTAGE method to use regular NWSRFS rating curves rather than separate Res-J specific curves and to enhance the MAXSTAGE method to support specifying a maximum discharge for cases where operations are based on discharge rather than stage.

3.1.3 Distributed Hydrologic Modeling (DHM)

Several enhancements to DHM have been made for OB8.3. The user will be able to specify MODs to the SAC-SMA states as a percentage of storage zone capacity in addition to as a multiplier of the current value. DHM will now use hourly observed precipitation data rather than disaggregated QPF data whenever it is available. DHM was modified to accept as input, rainfall and snowmelt grids created by the prototype Hydrology Laboratory Research Distributed Hydrologic Model (HL-RDHM), which incorporates the SNOW-17 model, in addition to the current QPE grids.

3.2 Multi-Sensor Precipitation Processing

Major work has been completed on integrating the gage-focused DailyQC methods within the Multi-sensor Precipitation Estimator (MPE) application suite. HSEB requests that the Western Region RFCs currently using DailyQC provide feedback on this OB8.3 functionality, especially if any issues prevent operational use of the integrated MPE/DailyQC.

Besides the DailyQC changes, other changes include the addition of a “disaggregation” operation now incorporated within MPE to use hourly gridded estimates to time-distribute 6-hour estimates into 1-hour estimates. OB8.3 also includes a fix to the operation which mosaics RFC QPE products at the WFO.

3.3 High-resolution Precipitation Estimator (HPE)

HPE will be a separate application from MPE, and will produce precipitation grids about 1 km by 1 km and as often as every 5 minutes. This change in conjunction with OB8.3 changes to FFMP will allow frequent high resolution mosaics (from multiple radars) to be used within FFMP. This quarter we completed a field test at the WFO in Houston, TX.

3.4 RFC Archive Database Synchronization

This project involves new software to perform two tasks. First, a set of automated tools are available to synchronize select meta-data in the RFC Archive (RAX) database with the Integrated Hydrologic Forecast System (IHFS) database. Data from the IHFS database can be copied to the RAX database. Because there is no feature to copy from the RAX database to the IHFS database, it is important to ensure the IHFS database contains the latest data. Second, a new application called “RAXBase” is provided to manage select data sets in the RAX database. RAXBase is similar to HydroBase in concept, although it has a different look and feel. The software has been actively evaluated by MBRFC, CNRFC, and APRFC.

3.5 WHFS

Information on the WHFS, data ingest, and precipitation processing (e.g., MPE) applications are accessible on the OCWWS/HSD support web page at: <https://ocwws.weather.gov/intranet/whfs/>
The OB8.3 release notes will soon be accessible via this page.

OB8.3 includes a collection of minor changes to HydroBase and assorted utility programs such as the ObsFcstMonitor application, which automatically compares observed and forecast values to check for consistency. RiverPro provides a new, much more user-friendly window for viewing the river stage/discharge data in a time-series form, and then allowing the user to make edits to the Valid Time Event Coding (VTEC) fields.

The RiverMonitor application was expanded significantly to automatically monitor precipitation data, in addition to its existing ability to monitor river data. A new table displayed by the “PrecipMonitor” mode lists precipitation data station locations (i.e., not basins) on each row of the table. The table columns present accumulation values for different durations along with the Flash Flood Guidance (FFG) value for the area containing the location. Difference and ratio comparisons between precipitation and FFG values are also provided. This information provides a hands-free, automatically updating, location-based complement to the basin-based mode used in FFMP. Offices are encouraged to try out this improved monitoring feature; early feedback has been positive. A few enhancements were also made to the river monitoring mode to allow information to be filtered better, including VTEC product time filters and forecast data time filters.

3.6 OB8.3 System Changes

AWIPS is upgrading a number of infrastructure packages for OB8.3. The list of packages upgraded is:

- PostgreSQL to version 8.2.6
- Grib2 decoder – degrib, version 1.85
- Python, version 2.5
- scientific python, version 2.6
- numeric python, version 24.2
- LDM, version 6.6.4
- Swig, version 1.3.31

4. AWIPS RELEASE OB9

During this past quarter, HSEB started software development for OB9 projects. Our major OB9 projects and work are summarized below.

4.1 High-resolution Precipitation Nowcaster (HPN)

HPN provides mosaicked radar-based high-resolution forecasts of precipitation rate at 15 minute increments up to an hour and of 1-hour precipitation accumulation. HPN uses HPE mosaic grids as input. HPN forecast rates can be used as input to FFMP, and the forecast accumulations can be used in the Site-Specific Hydrologic Predictor model. Also, both the forecast rates and accumulations can be viewed in D2D.

4.2 Variational Data Assimilation (VAR) for SSHP

VAR capability has been added to the Site-Specific Hydrologic Predictor (SSHP) model to update information about soil moisture conditions, thereby improving accuracy of the resulting stream forecasts. The stream routing that was also planned for OB9 has been deferred indefinitely due to unanimous regional concerns.

4.3 WHFS Improvements

The RiverPro application will be modified to incorporate Common Alert Protocol (CAP) codes around the call-to-action section, in coordination with CAP changes planned for all watch, warning, advisory products. Also, the ability to perform basic arithmetic operations on numeric template variables will be added, and the existing latitude and longitude template variables will be useful for more locations as the feature will be expanded beyond just river locations.

The rate-of-change (ROC) quality control operation will be modified in a small but important way by designating data that fails the check as being “bad”, rather than just “questionable”. Bad data is ignored for use in data intensive applications such as precipitation derivations. Also, a minor change in the format of the regular “alert_alarm” data reports will be made.

4.4 Precipitation Processing Improvements

Noteworthy changes include the complete revamping of the MPE gage table, allowing improved user interaction and supporting more precipitation fields. The satellite-radar-gage products will also have a numerical adjustment algorithm incorporated to smooth the transition between areas of different sourced precipitation estimates. The build_hourly application which currently assembles hourly precipitation reports from sub-hourly incremental reports will be enhanced to build six-reports from designated hourly stations. Lastly, some minor changes to the point precipitation derivation algorithms will provide improved derivations of irregularly reporting data, such as from ALERT networks. These changes will affect values displayed in HydroView point data displays (ad-hoc and time step modes), HydroView point precipitation utility window, RiverPro precipitation extractions, and the precipitation monitoring component of PrecipMon.

5. DEVELOPMENT SUPPORT ACTIVITIES

5.1 New RFC Software Architecture: CHPS

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/>).

As of January 1, 2008 WL | Delft Hydraulics became part of Deltares, an independent Dutch institute. Visit <http://www.wldelft.nl/gen/intro/english/index.html> for more information. OHD now uses the new name, Deltares, instead of ‘Delft’ or ‘Delft Hydraulics’.

5.1.1 CHPS Pilot

The CHPS Acceleration Team (CAT) delivered a report to Gary Carter, Director OHD, on January 9, 2008 recommending that the NOAA Hydrology Program proceed with FEWS as the infrastructure component for CHPS. Gary subsequently accepted and approved the recommendation and named Chris Dietz in OHD to lead the CHPS implementation project.

HSEB successfully led the CHPS Pilot Enhancements project through HOSIP Gate 4 on February 20, 2008. The CHPS Pilot project has now achieved its goal; therefore no further enhancements will be developed. Instead, OHD will focus its efforts on the operational implementation of CHPS.

5.1.2 CHPS Operational Implementation

TERMINOLOGY: Many people have expressed confusion over the terms CHPS, FEWS, CHPS/FEWS, etc. Here is some clarification:

FEWS (Flood Early Warning System) is the infrastructure software owned and maintained by Deltares. Several agencies in Europe have developed forecasting systems based on FEWS. The term Delft-FEWS is sometimes used, especially by Deltares themselves, but the CAT prefers to use FEWS, because the context is always clear. FEWS on its own (without specific configurations) does nothing; one analogy is that FEWS is like an electricity grid.

CHPS (Community Hydrologic Prediction System) is an NWS operational river forecasting system encompassing FEWS for its infrastructure and containing additional capabilities needed for RFC operations. Such additional capabilities include, for example, the SNOW-17 model. The extensibility of the FEWS infrastructure design will allow the NWS to access other modeling capabilities in the future. To continue with the electricity grid analogy, CHPS would encompass all appliances plugged into the grid as well as the grid itself.

The CAT would like to avoid using the terms “CHPS/FEWS”, “CHPS-FEWS”, and “CHPS FEWS” because they are confusing. You will notice that the term “CHPS FEWS Pilot” above has been revised to “CHPS Pilot”.

After the December workshop at NCRFC OHD worked closely with Deltares to define a broad migration strategy to introduce the first operational version of CHPS at all RFCs. HSEB presented early details of the strategy at the HIC conference in Silver Spring in January 2008.

The CHPS project leader and the CAT members have begun to flesh out an implementation plan based on the broad migration strategy. Weekly conference calls have been instituted to address the large number of activities that will occur under the plan. Karel Heynert from Deltares visited OHD in Silver Spring on February 21, 2008, to discuss and refine the proposed migration schedule.

Meanwhile, Apex re-focused their effort (the contract task was originally to conduct the Pilot Evaluation) to hold a series of fact-finding interviews with each of the CAT RFCs. The goal was to discover several key pieces of information:

- What the RFC end-to-end forecast process involves
- What RFCs see as weaknesses with the current system
- RFC’s short-term needs
- RFC’s vision for the future

The result was a report entitled “FEWS Pilot Results” (to be published on the CHPS web page later this month). Information contained in the report will be used by Deltares and OHD as the basis for a comprehensive gap analysis for CHPS implementation at the CAT sites.

HSEB members have now begun work on the migration of NWSRFS operations into CHPS. The development team grew from one Project Area Leader (PAL) plus two developers to two PALs and 10 developers in a very short period of time. Many developers have NWSRFS experience, although one or two come from other OHD projects. The CHPS software development team is now led by the second CHPS PAL, Joe Gofus. Developers have begun work on 7 NWSRFS model operations: CONS_USE, LAG/K, RES-SNGL, SARROUTE, SSARRESV, TATUM, and UNIT-HG. Some will be re-coded; some will be pulled from the NWSRFS infrastructure in the original FORTRAN and adapted for use in CHPS.

OHD has been working with NWS OS&T to investigate accessing Deltares through the AWIPS contract with Raytheon. The advantage of this approach would be to facilitate development of the AWIPS II-CHPS interface by leveraging professional software engineers who are familiar with AWIPS II technology. Discussions will continue into April.

5.1.3 ResSim

CNRFC continued to run the ResSim over the winter. Meanwhile HEC continued to work on the changes needed for a compatible warm start capability. CNRFC’s upgrade to AWIPS OB8.2 caused a few glitches, but these have now been resolved. Phase 2 (support for ensemble

functionality) is just beginning as CNRFC has conducted various requirements gathering sessions with California customers.

5.1.4 HEC-RAS

Deltares and OHD traveled to LMRFC in February to discuss functional requirements for the HEC-RAS capability in CHPS. OHRFC also attended. The Deltares-OHD team then traveled on to Davis, CA to meet with USACE HEC and its contractor Resource Management Associates (RMA); RMA is the contractor that built the Corps Water Management System (CWMS) in collaboration with HEC. The goal of the meeting in Davis was to discuss potential solutions.

Deltares, HEC, and LMRFC came to an agreement concerning the overall technical solution, which allowed Deltares to draw up a proposal for review on March 25.

Phase 1 (design) of the project is now complete. Phase 2 (implementation of the proposed solution) is expected to begin once contract tasks are in place for Deltares and HEC.

5.1.5 Experimental Ensemble Forecast System (XEFS)

Following Gary Carter's approval of the CAT's recommendation to proceed with FEWS as the software infrastructure for CHPS, planning activities to include an ensemble forecasting capability began in earnest. FEWS already contains the basic computational elements to generate a climatology-based ensemble; this feature was added to the CHPS pilot system in December 2007 and demonstrated at NCRFC. However, until the basic CHPS components are in place, work on the XEFS sub-system of CHPS must take a back seat for a while.

Meanwhile HSEB made good progress on porting HSMB HEP's existing prototype software to the FEWS environment. Output from the classical climatology-based Ensemble Pre-Processor (EPP) and the Ensemble Post-Processor can now be successfully displayed via the FEWS time series viewer. HSEB hopes to provide HEP with a more complete version by early May as a first step towards transitioning the HSMB from its previous development environment to a more CHPS-compatible framework.

5.1.6 HydroXC

The HydroXC effort did not receive any FY08 funding; all work has now been placed on indefinite hold. Apex will continue to host the website at <http://www.hydroxc.org/> until June 20, 2008 at which point the site will either be returned to NWS hosting or retired.

5.2 AWIPS II

Raytheon is migrating the national AWIPS baseline software suite into a new, modern services-oriented architecture (SOA). This migration is part of the overall AWIPS evolution process described at: <http://www.nws.noaa.gov/ost/SEC/AE/index.htm>. The Continuous Technology Refresh (CTR) Product Improvement Plan (PIP) describes the agreed upon Raytheon plan. This document is an excellent, albeit sometimes tedious, source of information on the "big picture"

for AWIPS evolution. Other links accessible from this web page provide technical and other helpful information.

Most of the legacy RFC software is not planned for migration in the primary AWIPS-II migration. CHPS will be implemented into AWIPS as part of the AWIPS-II Extended phase. However, the WHFS, Precipitation Processing, and Data Ingest software are planned for migration during the (4) AWIPS-II migration tasks, labeled as Task Orders 8, 9, 10, and 11. Roughly speaking, the four task orders are for D2D, GFE, "Hydro", and "SCAN, MDL software", in that order.

The TO8 software was delivered in February 2008. Members of a team of local application development representatives are currently installing the software, as are development organizations such as OHD. The Systems Engineering Center (SEC) within the NWS HQ Office of Science and Technology (OS&T) is managing the testing and evaluation of this and all AWIPS-II task orders.

In late April, OHD staff will join a diverse group of NWS and Raytheon staff in Portland, OR (at NWRFC) for a Technical Interchange Meeting (TIM) involving both the RFC and WFO operations. Task Order 10 will be delivered for government evaluation in January 2009.

Technical aspects of the AWIPS-II software are discussed in the "awips2dev" list server to which NWS staff can subscribe similar to the "awipsinfo" forum. OHD has developed a training plan which involves general instruction in Java and SOA technologies coupled with hands-on prototype activities. As work for OB9 is concluded, a significant amount of OHD resources will be directed towards AWIPS-II activities, which include the CHPS related work.

5.3 General Testing

Informal evaluations at certain offices are ongoing or are being readied:

- Fort Worth (FWD) WFO and WGRFC are testing the Site-Specific VAR components with other WFOs planned for the future.
- Oxnard (LOX) and San Diego (SGX) WFOs are testing changes to the station precipitation accumulations algorithm used for ALERT stations.
- NWRFC will be evaluating the OB8.3 MPE/DailyQC operations in the OB8.3 beta phase.
- ABRFC provides feedback on intermittent work for the MPE application as HSEB still continues to improve the speed of MPE re-run analyses.
- WGRFC is ingesting NSSL-provided Q2 QPE grids into the MPE environment for informal side-by-side comparison.

5.4 AWIPS System Changes

The AWIPS Software Engineering Group (SWEG) is still considering upgrades to infrastructure packages for the OB9 releases. No changes to the third party software are currently planned for

the main OB9 release. However, it is likely that an upgrade to the RedHat Enterprise Linux operating system will occur as a maintenance release OB9.2.

6. HYDROMETEOROLOGICAL AUTOMATED DATA SYSTEM (HADS)

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

6.1 HADS Systems & Software

HADS systems continued their stable performance. There was only one operationally significant software modification enacted during the past several months and it was very limited in scope. The modification involved specific time stamping of random data for a subset of data platforms in California.

The NWS Back-up Telecommunications Gateway (BTG) has been shut-down for the past couple of months, initially due to problems involving the commercial power supply to the facility. At this time it is unknown when the BTG will become a viable back-up data processing facility for the HADS program.

The U.S. Geologic Survey has constructed a GOES DCS down-link facility at the EROS Data Center in Sioux Falls, SD. This facility, expected to become operational during the next several months, will become available to DCP operators and can serve as a back-up to Wallops Island, VA for the acquisition of DCP data. The HADS program will be granted access to the Sioux Falls facility and HADS will develop methods to enact network connections to the USGS in order to create another level of back-up data acquisition.

During January, a couple of enhancements were put in place regarding HADS web pages. Graphic maps, displaying the location of defined data points are now available when viewing a site's metadata. Additionally, maps are now linked to those locations that are listed on the New DCPs page. The maps are served via the U.S. Census Bureau's Tiger Map service.

6.2 HADS Data Network

As of April 1, 2008 there were 13,055 data points defined in the network providing approximately 2.3 million data values each day. Network expansion was minimal during the winter months, but there were a significant number of sites transitioned from a four-hour reporting cycle to a one-hour reporting cycle. There are nearly 8,300 defined sites reporting every hour and now only 3,900 up linking data at the four-hour interval. This represents a transition of approximately 300 sites during the past 3 months.