

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

Chief, HSEB, Jon Roe

Project Area Leaders: Larry Cedrone, Chris Dietz, Mark Fresch, Mark Glaudemans, Joe Gofus

## **1 HIGHLIGHTS FOR April, May, and June 2007**

Most software development efforts during this period were dedicated to supporting the alpha and beta testing stages of AWIPS Release OB8.1, and development work for OB8.2 tasks. Other key activities 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 associated with OB8.1 and OB8.2.

Most sites have upgraded to AWIPS OB7.2. OHD provided software updates and associated support for the Daylight Savings Time (DST) emergency release (OB7.2.0.2) and OB7.2 maintenance release (7.2.1). During this quarter significant support continued for Raytheon's testing of AWIPS OB8.1. The final System Verification Review (SVR) for OB8.1 was held on June 28, 2007, with national deployment beginning July 30, 2007.

For NEXRAD, HSEB is implementing a dual polarization Quantitative Precipitation Estimation (QPE) algorithm and associated products. This algorithm is targeted for deployment in NEXRAD RPG Build 11, along with the dual polarization initial operating capability. Deployment of the initial dual polarization operating capability and Build 11 is planned to begin in 2009. To ease the transition to dual polarization, the current NEXRAD precipitation algorithm and products (known as the Precipitation Preprocessing Subsystem (PPS)) will continue to be available until dual polarization deployment is completed and the NEXRAD agencies decide to remove the current algorithms and products.

In the Community Hydrologic Prediction System (CHPS) area, several noteworthy events occurred during this past quarter:

- The CHPS FEWS Pilot evaluation effort has been postponed until extra functionality can be added to the Pilot system
- HSEB began implementation of the Experimental Ensemble Forecast System (XEFS) using the CHPS architecture
- HSEB initiated a project to incorporate the USACE HEC River Analysis System (HEC-RAS) into CHPS

HSEB also has devoted more resources in support of OS&T for AWIPS II, details below.

## **2 NEXRAD SOFTWARE DEVELOPMENT**

The next NEXRAD RPG build, Build 9, will deploy at the end of June. For that build, HSEB re-hosted the PPS to a LINUX operating system and fixed some minor bugs.

For Build 10, OHD made a small change to add the source ID of the mean field bias to a few of the PPS products. As part of OB8.2, WFOs will have the option to send to their associated RPG(s) either their locally-computed mean field bias or an RFC-computed mean field bias. Build 10 is scheduled to begin deployment in mid-2008.

### **2.1 Terminal Doppler Weather Radar (TDWR) PPS**

Recently the full deployment commenced for the approximately 35 remaining Supplemental Products Generators (SPGs) at WFOs located near TDWRs. An SPG is a modified RPG which ingests TDWR data to produce NEXRAD-like products. 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 such as the Storm Total Precipitation. SPG Build 3 will be deployed near the end of 2007. TDWR-based precipitation products will be displayable on AWIPS D2D with Release OB8.2.

### **2.2 Dual Polarization**

HSEB continues to implement the dual polarization QPE algorithm into the RPG. This past quarter, HSEB continued coding the algorithm and drafted product requirements for the dual polarization precipitation products. Dual polarization product requirements are being largely based on input from operational users and trainers. The dual pol QPE algorithm is planned for Build 11, and Build 11 software is due near the end of 2007. Build 11 and the hardware for the dual pol upgrade to NEXRAD are currently planned to start deployment in 2009. The large gap between delivery and deployment is to allow extensive testing of the new dual polarization hardware and software.

## **3. AWIPS RELEASE OB8.1**

The OB8.1 software is scheduled to be delivered to field offices beginning in late July 2007.

### **3.1 NWSRFS**

HSEB continued work on some enhancements which will be included in OB8.1:

#### **3.1.1 SRA Tools Enhancements**

Release OB8.1 will include four significant capability enhancements to the Res-J operation: a hindcasting capability, a “LOOKUP3” capability, diversion from a node, and a variable lag in the LAGK method in Res-J. These enhancements were described in detail in the April 2007 newsletter, so please refer to that document for more information.

### **3.1.2 Distributed Hydrologic Modeling (DHM)**

HSEB requests that RFCs other than the DHM Pilot sites wait until OB8.2 before using AWIPS DHM in operations. See Section 5.1.3 below for more information.

## **3.2 WHFS, Data Ingest, Precipitation Processing**

Within the WHFS software, a new set of database tables are being added to allow definition of forecast services provided for each river forecast point. This information will be used for management of the services provided by the NWS hydrology program and will be incorporated into the broader verification measures effort managed by OCWWS/HSD. A new interactive application (Forecast Services Manager) provides the tools needed to enter and manage the information in the database. The information is expected to be entered by RFCs, although these features are being provided to all offices.

OB8.1 also includes some minor improvements to the HydroGen image generation functions, along with assorted minor changes to WHFS applications.

No changes to the data ingest and precipitation processing operations are provided with OB8.1. A few minor software bugs and enhancements are being provided. These will be described in the OB8.1 release notes. Work is continuing on integration of QPE tools into MPE, and evaluations of MPE software is expected to continue through the OB8.1 period.

## **4. AWIPS RELEASE OB8.2**

AWIPS Release OB8.2 has been the main focus of software development efforts in the past three months. Two major milestones in the development process were met in June, with the completion of the forecaster Pre-Integration Testing (PIT) and the AWIPS Integration Readiness Reviews. We'd like to thank Mark Fenbers of the OHRFC for spending the week of June 11 in Silver Spring testing all of the OHD enhancements for OB8.2 and making suggestions for improvements which we are incorporating into the release. Here are some details about the OB8.2 enhancements:

### **4.1 NWSRFS**

#### **4.1.1 Enhancements to Deterministic Verification**

When AWIPS OB8.2 is installed, the RFCs will gain new software capabilities that will enable them to compute additional verification statistics and analyze the statistics in a more robust manner. Furthermore, users will be able to verify input to the hydrologic models, including precipitation and temperature, while also verifying output from those models. Personnel at ABRFC, NCRFC, OHRFC, and WGRFC spent six weeks testing prototypes of the application to assist Hank Herr improve the application enhancements. We really appreciate the testing and feedback these offices provided and think future users will benefit from their suggestions.

#### **4.1.2 NWSRFS MAT Enhancement**

As mentioned in the last edition, this enhancement to the DIURNAL technique allows the selection of temperature max/min conversion coefficients calculated specifically for APRFC, CNRFC, and CBRFC. After several months of testing at these offices under ATAN 876, this feature will be included in the OB8.2 release.

#### **4.1.3 Distributed Hydrologic Modeling (DHM)**

Following a review in November 2006, the DHM Pilot sites determined that the AWIPS OB7.2 and OB8.1 versions of the DHM software were not ready for operational use. HSEB therefore requests that RFCs other than the DHM Pilot sites wait until OB8.2 before using AWIPS DHM in operations.

At that time, OHD and the Pilot RFCs developed a strategy involving HSMB's prototype (HL-RDHM), the AWIPS version of DHM, and a local application developed by ABRFC (XDMS) as a solution for applying distributed modeling techniques in RFC operations. Part of this strategy involved significant enhancements to the DHM for AWIPS OB8.2.

A workshop led by HSMB, held June 5-7, provided the necessary background information and training for forecasters to begin using DHM once OB8.2 deploys. HSMB has made available all files (presentations, lectures, etc.) from the workshop at the following location:

[http://www.weather.gov/ohd\\_files/project-hydrology/index.php?view=../data/hydrology/dhmworkshop/wsfiles](http://www.weather.gov/ohd_files/project-hydrology/index.php?view=../data/hydrology/dhmworkshop/wsfiles)

## **4.2 Precipitation Processing**

### **4.2.1 RFC Bias Transfer to WFO RPG**

HSEB is on track with our OB8.2 project RFC Bias Transfer to WFO RPG. This project will enable WFOs to automatically receive a mean-field bias generated at an RFC. The quality control of rain gage data results in better bias information, and RFCs have staff that specializes in this task. The WFO will be able to a) select which RFC they receive the bias from, b) use the RFC generated bias in local MPE operations, and c) select whether to send the RFC generated or locally generated bias to their associated RPG.

## **4.2.2 Satellite-Rain-Gage Products**

Three new QPE products using satellite data will be incorporated into MPE operations for OB8.2. A raw satellite and locally unbiased satellite product already exist, but no products exist that quantitatively integrate radar and gage data with the satellite data. The three new products to be generated are: satellite-radar, satellite-gage, satellite-radar-gage (SRG). The automatic generation of these fields is expected to replace the manual cut-and-paste now required to combine the satellite field with the radar-gage multi-sensor field in areas with poor radar and gage coverage. This project includes both the generation (through MPE\_fieldgen) and display (through MPE\_Editor) of the new fields.

## **5. AWIPS RELEASE OB8.3**

Although the software for Release OB8.3 will not be formally handed off to AWIPS until December, HSEB has already been working throughout this quarter on several of these enhancements, which are described below.

### **5.1 NWSRFS**

#### **5.1.1 Re-implementation of ICP**

HSEB continued to oversee work by RTi to re-implement the Interactive Calibration Program in an object-oriented framework which will facilitate future maintenance and enhancements of the application. Forecasters at NWRFC, NERFC, and WGRFC who tested the interim prototypes have provided a number of comments (and put up with some slow application performance), but we hope that the final prototype which was provided to the testers in late June will address the issues which had been raised.

#### **5.1.2 NWSRFS Reservoir Tool Enhancements**

HSEB is working with RTi to incorporate two enhancements to tools available in NWSRFS for modeling reservoirs. The first will be to allow the LOOKUP3 operation to have access to multi-value time series for use in regulation modeling and to allow a lookup based on the day of year so that operating rules can be specified in lookup tables. 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. In the last three months, the project received HOSIP Gate 3 approval and completed the AWIPS Requirements Review. In the near future, the software design and test plans will also be reviewed by AWIPS SREC representatives.

#### **5.1.3 Distributed Hydrologic Modeling (DHM)**

HSEB is currently working to identify enhancements to DHM which can be included in the OB8.3 release.

## **5.2 Precipitation Processing**

Work will continue on the integrated QPE operations (i.e., DailyQC) through the OB8.3 period. HSEB will coordinate its activities with selected RFCs and ask for continued and possibly expanded evaluation of early versions of the resulting QPE software.

### **5.2.1 Enhanced MPE**

HSEB continues implementation of an Enhanced MPE (EMPE) with better spatial and temporal resolution to support flash flood warning operations. EMPE will be a separate application from MPE, and will produce precipitation grids as small as 1 km by 1 km and as often as every 5 minutes. This change in conjunction with planned changes to FFMP will allow frequent high resolution mosaics (from multiple radars) to be used within FFMP. This quarter, HSEB started a field test of EMPE at the WFO in Salt Lake City, UT.

## **5.3 RFC Archive Database Synchronization**

A new project is being worked on for delivery in OB8.3 to support the synchronization of the RFC Archive (RAX) database with the Integrated Hydrologic Forecast System (IHFS) database used for operations. This project is now in HOSIP Stage 3. It will include non-interactive “batch” tools to perform the synchronization. If resources become available, the interactive “ArcBase”, similar to HydroBase, will be available for OB83. If not, then this will be implemented in a future release.

## **6. DEVELOPMENT SUPPORT ACTIVITIES**

### **6.1 NEW RFC SOFTWARE ARCHITECTURE: CHPS**

A new CHPS web site is now available 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/>).

#### **6.1.1 HydroXC**

Apex Digital Services completed development of a proof of concept tool that converts between SHEF .B format and HydroXC-compliant XML. Apex led a workshop for Consortium members in June to demonstrate the tool, using actual SHEF .B data. The goal is for Consortium members other than OHD to further this work, or begin using HydroXC-compliant XML on real (i.e., not proof of concept) projects.

The new HydroXC web site has now been launched: <http://www.hydroxc.org>. The former OHD-hosted HydroXC web page (<http://www.nws.noaa.gov/ohd/hydroxc/>) is still available; however it will automatically forward you to the new site after 10 seconds.

### **6.1.2 CHPS FEWS Pilot**

Installation of the CHPS FEWS Pilot system at NWRFC and NCRFC occurred this quarter; Delft demonstrated the system in Portland, OR during the week of April 15. Those in attendance included: OHD, the Bonneville Power Administration, RTi, Apex Digital Systems, Delft, RSIS, and the CHPS Acceleration Team (CAT) members.

Beyond the success of the demonstration, CAT members recognized immediately that additional functionality is required for the Pilot system to be viable. In response to this, HSEB initiated a contract task with Delft through RTi to implement the following:

- Installation of the Pilot at ABRFC
- Develop a MODs-like capability (the “what-if scenarios” are inadequate for operations)
- Configure all Pilot sites as client-servers, not standalone as now
- Provide additional segment definitions for the Santiam River for NWRFC
- Provide more in-depth training to all Pilot sites

HSEB expects Delft to begin work on these additional tasks in July or August.

Meanwhile, Apex distributed an early version of the Pilot evaluation criteria document to the CAT; however in the absence of the additional functionality described above, the CAT members suggested that the evaluation effort be postponed until all functionality is complete.

### **6.1.3 CHPS-AWIPS II**

HSEB completed negotiations with Raytheon to define the interface between AWIPS II and CHPS. After delivery of Raytheon’s new AWIPS Development Environment (ADE), Raytheon has agreed to begin an analysis of the CHPS FEWS Pilot system to determine how FEWS will best fit within the AWIPS II architecture; also to identify any additional tasks that might be required to make CHPS operate successfully within AWIPS II. In their dual role as Raytheon AWIPS sub-contractor and OHD CHPS architect, Apex Digital Systems will participate in this analysis. OHD expects the task to begin in July or August.

### **6.1.4 ResSim**

The purpose of this project is to integrate use of the USACE HEC’s Reservoir Simulation (ResSim) model into CNRFC operations. The project is a joint effort between the HEC, who is enhancing the ResSim and converting it to Linux, and the NWS who will provide a software interface between ResSim and the NWSRFS. The NWS has specifically designed this interface to be compatible with CHPS; therefore the solution will incorporate the Delft-FEWS as a significant component.

Members of HSEB (Jon Roe, Chris Dietz), Apex, and Delft attended a progress meeting on April 19 in Sacramento, CA for the Yuba-Feather Forecast-Coordinated Operations (F-CO) Management Team. Joan Klipsch, HEC, provided a status report of ResSim development activities; Manuel Mattke (Apex) provided a progress update on NWS activities.

During the past quarter Apex and Delft continued to make good progress. Installation of the NWS solution at CNRFC will occur the week of July 9, with acceptance expected in September.

Following Gary Carter's request for a briefing package suitable for presentation to a wide range of audiences (hydrologists, program managers, upper level management, partners, etc.), Apex developed a package showcasing ResSim as an example of the new business model to be realized through CHPS. Apex completed this briefing by the end of June.

### **6.1.5 HEC-RAS**

After a series of discussions with HSMB and HEC, HSEB began the necessary paperwork to begin the task of incorporating the USACE HEC River Analysis System (HEC-RAS) into CHPS. HSEB anticipates two phases, the first of which will be the solution design; this piece will be contracted out to Apex. The second phase, implementation of the design, will require HEC and possibly others to develop additional software. The solution is expected to leverage much of the CHPS-based software developed on the ResSim project.

### **6.1.6 Experimental Ensemble Forecast System (XEFS)**

In May the XEFS Design and Gap Analysis Team, led by DJ Seo (HSMB) and Rob Hartman (CNRFC) presented to the Director of OHD, Gary Carter, a report entitled "The Experimental Ensemble Forecast System (XEFS) Design and Gap Analysis: Report of the XEFS Design and Gap Analysis Team", dated May 11, 2007. The report is available on the web at: [http://www.weather.gov/oh/rfcdev/docs/XEFS\\_design\\_gap\\_analysis\\_report\\_final.pdf](http://www.weather.gov/oh/rfcdev/docs/XEFS_design_gap_analysis_report_final.pdf)

This report provides a summary of current prototype Ensembles functionality developed by HSMB, and an identification of functionality that will be required to introduce an initial (experimental) short-to-long term Ensembles capability into RFC operations. Incremental enhancements to the XEFS will ultimately result in a fully operational Hydrologic Ensemble Forecast System (HEFS).

Gary Carter accepted the findings in the report and subsequently tasked HSEB with formulating an execution plan. Chris Dietz (HSEB) has been assigned as the XEFS Execution Manager, supported by an Oversight Committee whose members include DJ Seo, Chris Dietz, Rob Hartman, and Mary Mullusky (OCWWS).

HSEB has now formed a 4-person software engineering team (the final member will arrive on July 9) and has begun an in-depth analysis of the prototype software. The software architect, Sudha Rangan, has begun the process of formulating a design consistent with CHPS. A draft implementation plan is expected by the end of August 2007.

## **6.2 AWIPS II**

As part of their overall NWS contract, Raytheon activities include a series of tasks contained with the umbrella project of "Software Continuous Technology Refresh" (SW CTR). An



updated SW CTR Product Improvement Plan (PIP), available upon request, describes the plan that Raytheon is executing with oversight from the NWS to perform a migration of the AWIPS baseline software. The NWS oversight is being administered by the NWS HQ Office of Science and Technology.

This migration is considered essential for the development of new science capabilities and incorporation of new data types into the NOAA/NWS environment. The ultimate migrated system is being referred to as AWIPS II, with the migration to this new system being referred to as “AWIPS Evolution”. The evolution includes hardware, software, and communications changes.

There are eleven formally identified task orders to date. Task Order 6 was recently delivered and involves the first baseline version of the AWIPS Development Environment (ADE), its associated software infrastructure, and a Software Development Kit (SDK). Test and evaluation activities of this delivery are ongoing. Task Order 7 was delivered in late June and involves a documented plan for the migration of all base-lined AWIPS software to the AWIPS-II infrastructure. The actual migration is planned for Task Orders 8, 9, 10, and 11.

The ADE SDK is centered on a dramatically changed application environment built upon a comprehensive Services Oriented Architecture (SOA) design. The predominant software language for this new system is Java. In addition to the training, HSEB is involved in planning activities for AWIPS II, including membership on the AWIPS Evolution Leadership Committee (Mark Glaudemans) and the ADE Independent Validation and Verification (IV&V) team (Xuning Tan).

AWIPS II represents a major change to the AWIPS system, and will eventually affect essentially all aspects of the AWIPS system. The deployment schedule is very aggressive, with migration of applications scheduled to begin in summer of 2007 and continue for 2 years. Subsequent deployment of this new system is scheduled to phase in after the OB9 release, with deployments beginning in summer 2009.

OHD/HSEB continues to assess the strategic focus for AWIPS II with respect to hydrologic applications. Two key focus areas are:

- Integrated display of hydrometeorological data with the meteorological display (i.e., implementing HydroView functionality in the planned D2D successor: CAVE (Common AWIPS Visualization Environment))
- Integration of RFC modeling operations into a common SOA framework which includes an extensible architecture to support “plug-in” capabilities

Many other critical Hydrology software components are also being evaluated for their role in AWIPS II. This entire multi-year process is expected to require a major amount of resources in the coming months and years. Offices and regions are encouraged to become aware and participate in AWIPS II activities.

### **6.3 AWIPS BETA TESTING**

The NWSI 10-1703 (VTEC; Valid Time Event Coding) and NWSI 10-922 (WFO Hydrologic Products) features of RiverPro have been tested at field sites beginning in June 2006. The Operational Test & Evaluation (OT&E) formally ended in December 2006. On June 19, 2007 the experimental mode of VTEC has been enabled at all WFOs and on July 17, 2007, all WFOs will begin enabling the operational mode of VTEC.

### **6.4 AWIPS SYSTEM CHANGES**

No upgrades to the AWIPS operating system, except for routine security patches are officially planned through OB8.3. Recently, Raytheon has commented that a kernel upgrade will occur coincident with OB8.2, but this decision is not final.

Regardless, plans have been announced to add or upgrade several infrastructure packages in those releases.

#### **6.4.1 OB8.2**

This release will include a Java callable graphing package, ChartDirector 4.1.

#### **6.4.2 OB8.3**

AWIPS plans to upgrade a number of infrastructure packages for OB8.3. For the Hydro applications community the most significant one is a long-awaited upgrade of PostgreSQL to version 8.2.4. Other package upgrades include:

- Grib2 decoder – degrib, version 1.85
- Python, version 2.5
- scientific python, version 2.6
- numeric python, version 24.2
- pysvn, version 1.5.1
- subversion, version 1.4.3
- LDM, version 6.6.4
- Swig, version 1.3.31

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

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

## 7.1 HADS SYSTEMS & SOFTWARE

The deployment and activation of systems at the NWS Backup Telecommunications Gateway center (the “BTG”) represents the most active HADS event of the quarter. Four systems have been placed into operations and pseudo real-time processing is occurring in this new environment. At this time, raw data acquisition is dependant upon moving the raw data records received at the NWSTG in Silver Spring to the back-up facility. We expect to have a true real-time data feed at the backup facility near the end of August - but this is dependent upon actions to be performed by the NWS OCIO and NWS Gateway personnel.

Another on-going activity of HADS at the BTG is the implementation of a publicly accessible web interface. Once this is completed, all facets of HADS services will be available, a fully independent facility will exist and the OHD-HADS responsibilities of the NWS COOP will be complete.

HADS software and its data decoders have been stable during the past several months.

## 7.2 HADS DATA NETWORK

The data network continues to expand. The number of data points in the network is now 12,690 and approximately 2.24 million data values are processed each day.

The owners/operators of the GOES DCS platform are increasing their effort to migrate their older platforms to the High Data Rate (HDR) systems and changing their transmission schedules from 2, 3 or 4 hours cycles to the 1 hour cycle. This activity represents the major portion of the work involved in maintaining the HADS data network as a number of DCPs are replaced each day. The USGS has led this effort and has deployed thousands of HDR platforms. The COE is now increasing their effort to move to hourly transmitters while other DCP operators are also moving to HDR systems.

As of July 1<sup>st</sup>, the transmission frequency of DCPs processed in HADS:

- 7,175 transmit on a 1 hour cycle
- 69 transmit on a 2 hour cycle
- 775 transmit on a 3 hour cycle
- 4,658 transmit on a 4 hour cycle
- 13 transmit on a 6 hour cycle (These 6 hour sites are NWS platforms!)

All new GOES DCS deployments are hourly transmitting sites as the GOES DCS program continues on its path toward 100% HDR compliance by the year 2013.