

**Office of Hydrologic Development  
Hydrologic Software Engineering Branch  
Quarterly Activity Newsletter  
April 1, 2007**

*Software for NWS Hydrology!*

Chief, HSEB, Jon Roe

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

**1 HIGHLIGHTS FOR JANUARY, FEBRUARY, AND MARCH 2007**

Most software development efforts during this period were dedicated to supporting the late 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.

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 is scheduled for June 29, 2007, with national deployment beginning July 9, 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.

Tasks for the Community Hydrologic Prediction System (CHPS) made good progress as some major milestones were met and new activities initiated. All work remains on track and on schedule.

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

**SPECIAL NOTE REGARDING HYDROLOGIC SOFTWARE  
MAINTENANCE (REMINDER):**

On October 2, 2006 the AWIPS prime contractor, Raytheon, assumed Adaptive and Corrective Maintenance (ACM) responsibility for all of OHD's baseline AWIPS software. HSEB continues to work with Raytheon on knowledge transfer. This may result in a reduced quality of service in some instances, for which we request your patience.

## **2 NEXRAD SOFTWARE DEVELOPMENT**

The next NEXRAD RPG build, Build 9, has begun deployment for Beta Testing. 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**

The TDWR-based PPS on the Supplemental Products Generator (SPG), a modified RPG will become available with SPG Build 3 scheduled to begin deployment near the end of 2007. According to OST/SEC, current plans are to make the TDWR-based precipitation products (such as Storm Total Precipitation) displayable with AWIPS OB8.2, and full deployment of SPGs has begun.

### **2.2 Dual Polarization**

HSEB continues to implement the dual polarization Quantitative Precipitation Estimation (QPE) algorithm. This past quarter, HSEB began coding the algorithm and began the requirements definition 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 OB7.2**

AWIPS OB7.2 has nearly completed full national deployment.

### **3.1 NWSRFS**

During the past three months we provided support for problems discovered late in the Beta testing period as well as with the OB7.2 installations. We also provided revised executables

which efficiently handle the new Daylight Saving Time definition in emergency release OB7.2.0.2.

### **3.1.1 VERIFICATION**

With significant help from OHD personnel, Raytheon was able to complete the testing of the enhanced verification software which is now being tested at OB7.2 beta sites.

### **3.1.3 DISTRIBUTED HYDROLOGIC MODELING (DHM)**

A workshop sponsored by OHD will be held in the first week of June 2007 at ABRFC. The workshop will provide all RFCs with the necessary training in the operational implementation of DHM. For further details contact [Jeff.Zimmerman@noaa.gov](mailto:Jeff.Zimmerman@noaa.gov).

## **3.2 WHFS AND DATA INGEST**

The OB7.2 OHD Common Release Notes are available on the HSD web page, and list many key additions to the OB7.2 software functionality. Changes include:

- a) The implementation of the “Mapper” station data display function into WHFS, currently operating as a Western Region local application. It provides a robust method for displaying hydrometeorological data, similar in many ways to the existing WHFS TimeSeries and HydroView station data display control functions. Its benefits are in its more direct methods for displaying desired data sets (i.e., less mouse clicking), its “time-stepping” (quasi-animation) features, and its display speed.
- b) The data monitoring tool RiverMon provides a tool to monitor information related to river forecast points, including the VTEC event status. This application runs continuously with an automated refresh of color coded tabular information to identify alert/alarm conditions. Related to this is an automated application known as the “observed-forecast monitor” for monitoring differences between river forecasts and observations. This monitoring tool fits within the existing WHFS Alert/Alarm functionality.
- c) Some minor enhancements include a new editor interface in HydroBase for the HydroGen support information, a new feature to adjust the icon sizes in HydroView, and new features in the TimeSeries tabular mode for copying forecast time series data and for globally setting quality code attributes.
- d) Major enhancements were made to the RiverPro functionality to support NWS Directive 10-1703 (VTEC) and 10-922 (WFO Hydro Products). These changes also incorporated numerous changes based on lessons learned in the recently concluded Hydro-VTEC OTE (Operational Test and Evaluation). The changes include full support for operating RiverPro in a practice mode and the new end-to-end ability to generate corrected products.

### **3.3 PRECIPITATION PROCESSING**

A major change to MPE operations in OB7.2 is the incorporation of the Daily QC functions used in the Western Region into MPE operations. The goal is to provide a nationally-supported, baselined application usable by all offices to perform QPE operations. For OB7.2, the existing Daily QC functionality is integrated into MPE. This involved new temperature and freezing level data quality control features, additional precipitation gage quality control options, and assorted interactive features. The MPE Daily QC in OB7.2 still operates in its 6- and 24-hour domain.

HSEB is also working to coordinate the delivery of RFC-generated QPE products to the SBN for subsequent receipt and use at WFOs. Changes were made to make these RFC QPE products displayable in D-2D at WFOs, to complement the locally generated QPE products which can be displayed in D-2D as of OB6. HSEB is currently working with NWS communications staff to ensure that the ZET98 QPEBIN products are properly routed on the SBN. Currently, these products are not being routed onto the SBN.

Lastly, a new utility application (“build\_hourly”) was provided to assemble hourly precipitation reports from sub-hourly data, so that the resulting data can be used in MPE operations.

## **4. AWIPS RELEASE OB8.1**

OHD continued activities involved with the transfer of all OHD AWIPS baseline source code into Raytheon’s configuration management system, Serena ChangeMan Dimensions. The transfer is now complete, but many technical problems in managing, building, and releasing the software by Raytheon have required significant intervention on the part of HSEB.

Along with the KAP, this activity has significantly limited OHD’s contribution to AWIPS OB8.1 new functionality because of the continued considerable level of effort required of OHD.

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

### **4.1 NWSRFS**

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

#### **4.1.1 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. Riverside Technology, Inc. (RTi) has completed the software changes which implement these enhancements and HSEB personnel will complete the handoff procedures to get the enhancements into the AWIPS release. Below are further descriptions of each enhancement:

The RES-J operation will be updated to operate properly in ESP hindcasting mode. As RES-J prepares the carryover for returning to NWSRFS, additional logic will test the existence of a user-requested carryover save on the last simulation time step. The results of this test will define accurately the amount of carryover written at the end of simulation. This amount of carryover is included as an index in the carryover itself. The index embedded in the hindcast carryover file will be correct. Using the index, RES-J will successfully read saved hindcast carryover enabling it to simulate through successive periods necessary in hindcasting.

The RES-J operation will be extended to include a new method, LOOKUP3 method, defining a value as a function of two other values. The method will be applicable to RES-J reservoir and node components.

A node is assumed to have zero storage; therefore, the maximum diversion cannot exceed total nodal inflow minus some minimum discharge. A new node component parameter, MINDISCHARGE, will be added. This optional parameter will allow the user to define the minimum outflow discharge at a node similarly to how the MINRELEASE parameter currently defines minimum outflow release at a reservoir component. If not specified by the user, MINDISCHARGE will default to 0.

The RES-J operation's LAGK method will be enhanced to allow use of variable lags. The algorithms existent in the LAG/K operation to address variable lag for instantaneous input flow will be added to the RES-J operation's LAGK method. The mean discharge algorithms in the LAG/K operation will not be included as RES-J only uses instantaneous values.

## **4.2 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 OB81. A few minor software bugs and enhancements are being provided. These will be described in the OB81 release notes. Work is continuing on integration of QPE tools into MPE, and evaluations of MPE software is expected to continue through the OB81 period.

## **5. AWIPS RELEASE OB8.2**

### **5.1 NWSRFS**

#### **5.1.1 Enhancements to Deterministic Verification**

On March 13, most RFCs and region staffs participated in the Design and User Interface Review and Demonstration. HSEB has initiated an ATAN to allow some RFCs to test the software in April and early May, prior to its formal handoff to AWIPS. Upon delivery of the software for AWIPS OB8.2, 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.

#### **5.1.2 NWSRFS MAT Enhancement**

HSEB worked with Dave Kitzmiller of HSMB to enhance the DIURNAL technique to allow the selection of temperature max/min conversion coefficients calculated specifically for APRFC, CNRFC, and CBRFC. This capability addresses a deficiency described in DR 18651. The capability was made available in late March for testing at the affected sites under ATAN 876. If the testing confirms the value of the enhancement, it will be included the OB8.2 release.

### **5.2 Precipitation Processing**

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

HSEB is on track with their 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 whom specialize 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.

#### **5.2.2 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.

## **6. AWIPS RELEASE OB8.3**

### **6.1 NWSRFS**

#### **6.1.1 Re-implementation of ICP**

HSEB is continuing 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. The target release for the modernized application which will provide the same functionality as the current baseline was slipped to the AWIPS OB8.2 release to allow more time to resolve performance issues which were identified in the preliminary releases. To date, RTi has supplied three interim releases of increasing functionality which have been reviewed by HSEB and some selected field personnel.

#### **6.1.2 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.

### **6.2 Precipitation Processing**

Work will continue on the integrated QPE operations (i.e. MPE, P3, 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.

#### **6.2.1 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.

## **7. DEVELOPMENT SUPPORT ACTIVITIES**

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

A new CHPS web site is under development. Its launch is expected during April or May.

### **7.1.1 HydroXC**

Under the leadership of Dr. Michael Piasecki from Drexel University the Hydrology XML Consortium (HydroXC) is now developing sample schema objects. Dr. Piasecki has proposed that the Hydro-XML schema employ the existing spatial referencing features and the defined HydroFeatures of the Geographic Markup Language (GML). Based on these early concepts, Apex Digital Services has begun development of a parser that will convert between SHEF .B format and HydroXC-compliant XML. Apex led a workshop for Consortium members at the end of March to present these ideas.

The new HydroXC web site will be launched on or about April 1: <http://www.hydroxc.org>

### **7.1.2 CHPS FEWS Pilot**

In February HSEB delivered the Java-based implementation of Victor Koren's Sacramento Soil Moisture Accounting (Heat Transfer) model, along with the adapter, to Delft for inclusion in the FEWS Pilot system. This is the first demonstration of a successful science-to-operations migration made possible by the new CHPS environment.

During March, Delft visited NCRFC and NWRFC and began setting up the FEWS Pilot system in preparation for the demonstration which is due to take place the week of April 16 at NWRFC. Several representatives from OHD will attend the demo.

Once the FEWS Pilot system installation (and demonstration) is complete, a 6-month evaluation period will begin. HSEB has engaged Apex Digital Systems to conduct this independent evaluation.

### **7.1.3 CHPS-AWIPS II**

During March HSEB and Raytheon continued a series of discussions that will result in a definition of the interface between AWIPS II and CHPS. After delivery of Raytheon's new AWIPS Development Environment (ADE) in July, Raytheon has agreed to begin an analysis of the 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 is expected to participate in this analysis.

### **7.1.4 ResSim**

The Yuba-Feather Forecast Coordinated Operations (FCO) Management Team has scheduled a progress meeting on April 19 in Sacramento, CA. Manuel Mattke (Apex) will provide a progress update on OHD activities; Jon Roe and Chris Dietz will also attend.

In March HSEB initiated another task with Apex to develop a briefing package suitable for Gary Carter to present to a wide range of audiences, such as: the NWS Corporate Board, the AMS and AGU Conferences, Interagency Committees such as AWCI and SWAQ, HICs and MICs,



Congressional Staffers, USGS Meetings, and USACE Meetings. A key point in the briefing package is illustration of the “new way of doing business” being demonstrated concretely with the ResSim project.

## **7.2 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). A 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, new concept of operations, 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 seven formally identified task orders to date. Task Order 5 was recently completed and includes the delivery of the ADE (AWIPS Development Environment) Software Developers Kit (SDK) Version 0.2, with updated training on it provided to the primary NWS development organizations. Task Order 7 involves the planning for the migration of all NWS applications to the new AWIPS II infrastructure. In early March, HSEB staff participated in a two-day Technical Interchange Meeting (TIM) with Raytheon staff to help plan Task Order 7 activities.

The ADE SDK is centered on a dramatically changed application environment envisioned for AWIPS II. This new environment will be 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 and the ADE Independent Validation and Verification (IV&V) team.

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 sometime in the OB9 or OB10 release, tentatively planned for late 2009.

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

- Integrated display of hydrometeorologic data with the meteorologic 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.

### **7.3 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, but the OT&E sites continue to use ATAN (i.e., test) versions of RiverPro to evaluate the software. The latest ATAN version is identical to the version being provided in AWIPS OB7.2.

MPE related evaluations are also ongoing. The ABRFC formally evaluated an updated MPE application with most P3 functionality and is working with OHD to resolve the remaining issues. Development work continues on the MPE application integrated with Daily QC features, with testing and evaluation continuing at selected Western Region RFCs. HSEB appreciates this crucial evaluation work performed by the RFCs.

### **7.4 AWIPS SYSTEM CHANGES**

No changes to the AWIPS COTS software including the operating system have been announced for OB7.2 or OB8.1.

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

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

### **8.1 HADS SYSTEMS & SOFTWARE**

The most newsworthy item from HADS this quarter involves the deployment of new systems to the NWS Backup Telecommunications Gateway center (the “BTG”). The placement of these systems fulfilled the requirement of the Office of Hydrologic Development to provide for a continuing HADS services in the event of a catastrophic failure at the primary NWS Telecommunications Gateway center in Silver Spring, MD. The hardware was deployed and network connectivity was activated during the third week of February. The transfer of raw data from the primary HADS environment in Silver Spring to the BTG was briefly tested. We have

to await the NWS implementation of a live data feed to the BTG before we can fully test the system's throughput.

Within the Silver Spring HADS environment we are nearing the end of upgrading each unit's operating system to RHEL WS 4.0.

HADS software and its data decoders have remained stable during the past several months. We've implemented slight modifications to improve the efficiency of a specific decoder but this action was transparent to the end result of providing data products to our customers.

## **8.2 HADS DATA NETWORK**

The data network continues its dynamic nature. The number of data points in the network is now 12,542 – an increase of 42 data locations since January 1<sup>st</sup>. The total number of operational sensors has reached 44,800, as we process a little more than 2.1 million data values per day.

There is one significant change occurring for a subset of HADS customers, those offices ingesting data from NOAA's National Estuarine Research Reserve System (NERRS) platforms. The NERRS program has recently installed and activated their own satellite downlink system in order to directly acquire their data. Therefore, they no longer rely on HADS to be their data acquisition provider. With this change, HADS processing is being altered by converting the raw metric data from NERRS platforms to English units which is more common in HADS data products. Previously, the metric NERRS data were encoded with the "/DUS/" SHEF descriptor. As each of these platforms is transitioned to the English measurement units, the "/DUS/" descriptor will be eliminated from its SHEF encoded message.