

Office of Hydrologic Development Hydrologic Software Engineering Branch Quarterly Activity Newsletter July 2009

Software for NWS Hydrology!

Chief, HSEB, Jon Roe

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

1. HIGHLIGHTS OF April, May, and June 2009

First off we'd like to acknowledge the departure of Mark Glaudemans from HSEB on May 9. Mark accepted a new position as Branch Chief of the OCWWS/HSD support branch previously occupied by Jeff Zimmerman. HSEB hates to see Mark go but are glad that he continues to serve the NWS Hydrology Program from HSD. We thank him for his considerable contributions in OHD since the early 1990s and wish him well. HSEB plans to fill Mark's vacancy during the summer.

AWIPS baseline software development efforts were minimal for this quarter. Operational Build 9.0 (OB9.0) deployment was completed. Although there are serious problems with OB9.0 RFC software, OHD is in a support advisory role as the problems involve compiler changes managed by the contractor. OB9.1 involves an operating system upgrade and the OHD role has been minimal because OB9.1 does not contain any functional changes. For OB9.2, we continued to make 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 made part of the OB9.2 baseline. The changes include enabling the ingest from the 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 support of AWIPS has been in providing considerable support to the AWIPS II (a.k.a. AWIPS migration) evaluation activities. Besides being part of various coordination tasks, we have worked to install the latest Task Order 11 software and begun evaluating it. We also provided significant input to NWS efforts to collect, evaluate, and develop AWIPS software testing documents.

For Next Generation Radar (NEXRAD), HSEB is integration testing the dual polarization (or dual pol) Quantitative Precipitation Estimation (QPE) algorithm and associated products operational software. This software and the dual polarization initial operating capability are targeted for operational deployment in NEXRAD Radar Product Generator (RPG) Build 12. Deployment of the initial dual pol operating capability and Build 12 is scheduled to start in 2010.

CHPS continued on schedule for the 3rd quarter of FY09. May and June saw “Buddy” visits from CAT RFCs to their CAT-II partners. In mid-June a new suite of CHPS interactive forecaster displays was delivered to OHD and the CAT for evaluation and testing; also the second CHPS Implementation Workshop was hosted by NWRFC at the end of June. HSEB has started integrating the eXperimental Ensemble Forecast System (XEFS) prototype components to work within CHPS and FEWS. The third quarterly Software Acceptance test was successfully conducted in June and migration and testing of the legacy models for BOC II continued. Also to support CHPS, MPE/DailyQC was upgraded to add the functionality to generate netCDF grids for precip, temperature and freezing level in a format which can be read by GFE and the functionality to generate GRIB1 files.

2. NEXRAD SOFTWARE DEVELOPMENT

NEXRAD release Build 11 deployment is nearly complete. One major enhancement in Build 11 is the addition of the Clutter Mitigation Decision (CMD) which reduces clutter in reflectivity and, hence, precipitation products, although HSEB did not help implement that software. Build 11.1 which fixes an issue with the CMD has started Beta Test and is due to start full deployment by the end of July.

2.1 Dual Polarization

HSEB is testing the software for the dual pol QPE algorithm and products which they delivered to the Radar Operations Center (ROC) early in 2009. This software and other dual pol algorithms and products implemented by ROC and OST and the operational dual pol hardware capability will be part of NEXRAD Build 12.

For the dual pol enhancement, the Radar Product Generator (RPG) software, including new algorithms and products, are being implemented by the ROC, OS&T, 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.

This past quarter, the ROC and Level III Communications started integrating and testing Build 12 with help from OST and OHD. In August, the ROC test bed WSR-88D should be upgraded with dual pol, and OHD, OST, and ROC will start real-time testing of the dual pol software. Following an extended Beta Test period, deployment of Build 12 and the dual pol enhancement begins in late 2010 and lasts into 2012. The long integration and testing period is due to the complexity and magnitude of the dual pol enhancement. The long deployment period is because a major hardware change is part of the enhancement.

3. AWIPS RELEASE OB9

HSEB delivered software for OB9.0 projects in May 2008 and deployment began in late January 2009. Unfortunately, a number of problems were found with the OB9.0 software, especially

with the RFC-only software which is no longer maintained by HSEB. Raytheon is working to resolve these problems with an OB9.0.2 maintenance release. There are a few special releases scheduled after OB9.0 but before AWIPS II. Release OB9.1 updates the Linux operating system. The OB9.2 release will contain fixes for several bugs and the MPE/Daily QC changes for NMQ and CHPS.

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

We made critical changes to MPE/Daily QC related to NMQ and CHPS and provided these changes to RFCs via an ATAN. With OB9.2, those changes will be included in the AWIPS baseline. The MPE/Daily QC changes are described below in more detail. The changes related to CHPS are described in the CHPS section.

For 1hr 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 6hr and 24hr 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 value was added.

3.3 AWIPS System Changes

The AWIPS Software Engineering Group (SwEG) approved an upgrade to the FORTRAN compiler from Portland Group very late in the OB9.0 development process. Upon deployment of OB9.0 software, major problems relating to this change have manifested themselves at RFCs, and at WFOs in the case of the SiteSpecific application. The AWIPS contractor is working to prepare an emergency release (OB9.0.2 for July) to address these issues.

An upgrade to the RedHat Enterprise Linux operating system from RHEL 4 to RHEL 5 is planned as a maintenance release, OB9.1. The latest AWIPS schedule shows general release dates of 7/21/09 for OB9.0.2, 8/31/09 for OB9.1, 11/9/09 for OB9.2, and 1/8/10 for OB9.3.

3.4 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 configuring CHPS for operational testing expected to start this fall.
- CAT RFCs are using a post-OB9 version of MPE to provide gridded forcings for CHPS.

4. DEVELOPMENT SUPPORT ACTIVITIES

4.1 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/>).

4.1.1 CHPS Implementation

CHPS Acceleration Team (CAT)

The 4 CAT RFCs continue to make good progress with their NWSRFS segment migrations. Support from Deltares and OHD has been very good as the CATs uncover problems within the migration scripts and OHD models. The CATs report that they expect to be ready for parallel operations on schedule in October 2009.

Deltares completed another round of site support visits for each of the CAT RFCs; additional training and familiarization was provided. This will also bolster CAT RFC staff’s knowledge of CHPS in preparation for their support role when CAT-II RFCs begin migration activities.

During the Software Acceptance Testing (SAT) at OHD on June 15-17, five CAT RFC representatives conducted the first formal tests of the new Interactive Forecast Displays (IFD). Due to the importance of the forecaster interface, we requested extra representation from the CAT RFCs: NWRFC, NERFC, ABRFC, and NWSEO all participated this time. Additionally, the representatives were able to conduct some further joint design improvements with Deltares, expected in the next version of the IFD demonstration software.

CHPS Acceleration Team-II (CAT-II)

OHD gave monthly CHPS project status updates to the CAT-II and the Regions on April 9, May 14, and June 9. These briefings are intended to gradually increase exposure of the CAT-II RFCs

to the CHPS project, and to answer their questions.

The main event for this quarter was a series of “Buddy” visits. These visits involved a CAT-led team of people visiting every CAT-II RFC to kick-off their CHPS implementation process. The entire CHPS familiarization process for the CAT-IIs began in January 2009 in the form of webinars and conference calls, which provided some elementary CHPS information and some CHPS project status briefings.

Under the CHPS “Buddy” system each CAT-II RFC has been paired with one of the CAT RFCs for coaching purposes. During May and June a team comprised of one representative from OHD, one Deltares employee, and one or more forecasters from the appropriate CAT RFC visited each CAT-II RFC. As of the end of June 2009 only two visits (APRFC and NCRFC) remain. The visits identify some pre-CHPS activities that the CAT-II offices can start before they receive formal Configuration & Migration training next February.

CHPS Workshops

The CHPS Implementation Workshop #2 for CAT RFCs was held in Portland, OR (at NWRFC) during the week of June 22, 2009. The CAT discussions focused on migration progress reports, completeness of system functionality, and a review of planned support as the CATs move into a parallel operations phase in October.

CHPS Prototype Hardware

Purchase of the second set of prototype hardware for the CAT RFCs and the first set of hardware for the CAT-II RFCs was initiated in June. Delivery is expected to be in early October 2009.

CHPS Software Development

HSEB developers have been finishing migration and testing of the legacy models required for BOC II. These models are planned to be formally tested in September. HSEB developers have also been working with Deltares developers to improve the performance of CHPS model runs, especially for ensembles. Initial results of these efforts have been encouraging.

HSEB folks have also been supporting 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.

During this quarter, HSEB hosted CHPS formal testing sessions in April and June. These tests demonstrated that the CHPS BOC I models produced equivalent results as the NWSRFS counterparts. At the conclusion of the June tests, CHPS OHD release 1.1.1 was disseminated to the CAT RFCs for their use in migrating to CHPS.

Deltares held several IFD joint design meetings with some of the CAT forecasters. The focus of the design is to maximize forecaster efficiency (minimize mouse and button clicks) when

navigating the user interface, while providing access to all functionality. Some AWIPS-like use of screen “real estate” has been included in the design. In mid-June Deltares delivered to the CAT representatives a demonstration version of the CHPS IFD for evaluation and testing.

CHPS Forcings

Progress towards generating gridded forcings for use in CHPS continued. A listserver was set up to allow for the exchange of emails between members. The minutes from the CHPS Forcings Teleconferences are posted to the listserver.

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 was completed which is 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 the ingest of GRIB1 format grids in CHPS.

HSEB expects to wrap up changes to MPE/DailyQC by the end of July to get them into the AWIPS OB9.2 baseline.

4.1.2 HEC-RAS for CHPS

Software Development on Linux version of RAS: Deltares and HEC met at the Resource Management Associates (RMA) facility in California during the final week of June to address outstanding technical issues with interoperability between FEWS and the Linux version of RAS. RMA is the U.S. Army Corps of Engineers Hydrologic Engineering Center’s (HEC) contractor for this task. During this visit Deltares was also able to provide the necessary information for RMA to accept software maintenance responsibility for the Java-based FEWS adapter for RAS.

Development of a science-based technique to convert FLDWAV/DWOPER configurations to HEC-RAS in CHPS: The HSMB Hydraulics Group Leader, Seann Reed, is preparing to support CAT RFC migrations from NWSRFS FLDWAV/DWOPER to the new CHPS-based HEC-RAS.

HEC-RAS Training for RFCs:

- A basic (steady flow) course for any RFC wanting to learn basic HEC-RAS concepts was conducted the week of April 13 by the HEC.
- Hands-on training in advanced topics (unsteady flow) was provided by OHD HSMB directly to the CAT RFCs in Taunton, MA (at NERFC) during the week of April 27. OHD arranged for the lecture portions of the class to be shared with other RFCs via a webinar.

4.1.3 Experimental Ensemble Forecast System (XEFS) and Hydrologic Ensemble Forecast Service (HEFS)

The XEFS project definition has been subtly changed to include only experimental non-baseline versions of new ensemble-related software, such as the new Ensemble Preprocessor 3 (EPP3). Any new baseline ensemble-related software will be part of the HEFS which is intended to be the operational name to follow XEFS.

XEFS components will be available by fall 2009 as prototypes interfaced to CHPS and FEWS through model adapters. These components are a new Ensemble Preprocessor (EPP), Ensemble Postprocessor (EnsPost), Ensemble Verification System, and Hydrologic Model Output Statistics (HMOS). Each of these components will be available to RFCs with CHPS for field testing. In addition, each of these components will undergo a second phase where the prototype is re-factored into baseline CHPS software.

The Graphics Generator (formerly known as the Ensemble Product Generator (EPG)) will go straight into the CHPS baseline and will be the first HEFS component. The Graphics Generator will be a GUI where users can change the look of graphics or displays and an engine to create the graphics. The Graphics Generator will be implemented in phases with approximately 6 months between phases. For phase 1 of the Graphics Generator, by fall, we will implement the same functionality as the existing Ensemble Streamflow Prediction Analysis and Display Program (ESPADP). During the past quarter, we completed the phase 1 requirements and design and started coding the Graphics Generator. For phase 2 of the Graphics Generator, the functionality will be extended to deterministic displays. During the quarter, the phase 2 requirements were completed.

For the EPP3 XEFS prototype component, we began work to interface the software with CHPS and FEWS by developing two module adapters and started integration testing of the combined EPP3 prototype and model adapters within CHPS and FEWS.

4.2 AWIPS II

In March and early April HSEB folks spent a lot of effort completing the hydrology related portions of the Master Deliverables Matrix which identified all the functionality expected in AWIPS II. We also mapped test cases and procedures to this functionality.

Interactions between Raytheon/Omaha developers and OHD personnel included Technical Interchange Meetings (TIMs) attended by Mark Glaudemans in April and Paul Tilles in May. In June, OHD sent a tarball containing the latest MPE code to Raytheon/Omaha. This code contained the changes related to the Q2 fields and other changes made for DailyQC 6hr and 24 hr processing. This was an attempt to get the latest MPE/DailyQC changes into AWIPS II for RFCs if it was not possible to get them into OB9.2. It appears now that OB9.2 is the preferred route.

In February, Raytheon announced the functionality for Task Order 11 (TO11) would be delivered to the NWS in a series of six monthly slices beginning in April. Each of the first three slices was delivered early in the appropriate month (April 8, May 6, and June 3) and was installed for testing by HSEB. Much of the hydrology related functions had been deferred to TO 11, but Slice 3 was described to contain the first significant hydrology functions: all HydroView

and XDAT functionality. After overcoming some installation difficulties, HSEB testers subjected the software to a thorough review. So far, HSEB has written 14 Test Trouble Reports (TTRs) against this slice to identify missing or defective functionality in Slice 3.

Very late in June, we learned Raytheon planned to combine Slices 4 and 5 and deliver that later and a new Slice 3.1 (for DRs) would be delivered in early July. We plan to continue our testing with this new software after it has been received and installed.

The Systems Engineering Center (SEC) within the NWS OS&T is managing the testing and evaluation of this and all AWIPS II task orders. OHD is providing considerable support for the TO11 test and evaluation. Regardless, WFOs and RFCs are encouraged to obtain, install, and evaluate TO11 software.

5. HYDROMETEOROLOGICAL AUTOMATED DATA SYSTEM (HADS)

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

5.1 HADS Systems and Software

The HADS software that generates SHEF products was minimally adjusted during the past three months in order to enhance the processing of gage correction values. These are the values received from the USGS districts and implemented in HADS to ensure that HADS stream gauging values match those posted by the USGS on their National Water Information System (NWIS) web pages.

Details on how this process occurs:

- Daily, at 11:45Z, all correction files that have been uploaded to the USGS server during the previous 24 hours are retrieved.
- Software reads these tables and extracts the various corrections values and then determines the 'current' correction value.
- An automated process now alters the sites definition by inserting, deleting or altering the gage correction value. All 'large' correction values (five feet or greater) are flagged for manual confirmation, as are values for drawdown sites.
- The next set of data distributed by HADS from the affected site(s) will contain the adjusted stage value.

Drawdown sites are special situations where the gage correction value vary, based upon the observed stage. For this situation HADS has a database table that is manually maintained and threshold values of gage corrections are altered as the details are received from the USGS.

There are times in which the HADS stage data for a site will be temporarily out-of-sync with the USGS posting for that same site. There are cases in which a corrected observational appears on

NWIS before the station's details become available via a correction file. And there are times when the content of the correction file is not fully up to date.

5.2 HADS Data Network

There are currently 13,868 data locations defined for HADS processing, an increase of 114 data points since April. The number of data values delivered to NWS operations is now averaging 2.6 million each day.

Two important meteorological sub-networks within HADS are NCDC's Climate Reference Network (CRN) and the Historical Climate Network – Modernized ((HCN-M). During the past several months NCDC has altered the programming and added sensors to a number the CRN locations. These updated CRN sites now provide soil moisture and soil temperature data and timelier five minute readings of air temperature and incremental precipitation values. Over the next several months it is expected that all CRN sites will be altered to provide these types of information.

The fourteen prototype HCN-M sites in Alabama have been reprogrammed in order to provide much more timely temperature and incremental precipitation data. These data are recorded at five minute intervals and are now transmitted less than five minutes after the most recent observation is recorded. In the past, most of these data were 40 to 50 minutes old when first released for dissemination.

Routine monitoring of the CRN network is performed since these sites change without prior notification to HADS personnel.

There are unofficial indications that several HCN-M sites may be deployed in Colorado, New Mexico, Arizona, or Utah later in the year. As HADS learns of their deployment, pertinent information will be provided to the appropriate field offices.