Office of Hydrologic Development
Hydrologic Software Engineering Branch
Quarterly Activity Newsletter
April 1, 2009

Software for NWS Hydrology!

Chief, HSEB, Jon Roe
Project Area Leaders: Larry Cedrone, Chris Dietz, Mark Fresch, Mark Glaudemans, Joe Gofus

1. HIGHLIGHTS OF January, February, and March 2009

AWIPS baseline software development efforts were minimal for this quarter. Operational Build 9.0 (OB9.0) deployment is nearly complete. 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. We have done a minor amount of work for OB9.2.

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 10 software and begun evaluating it. Also we are providing significant input to NWS efforts to collect, evaluate, and develop AWIPS software testing documents.

For Next Generation Radar (NEXRAD), HSEB delivered the dual polarization (or dual pol) Quantitative Precipitation Estimation (QPE) algorithm and associated products operational software for integration and testing. 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.

The Community Hydrologic Prediction System (CHPS) continued on schedule for the 2nd quarter of FY09. Highlights include: OHD hosted a visitor from Deltares, Netherlands to discuss project planning for the eXperimental Ensemble Forecast System (XEFS); CHPS Preparation Workshop #3 held in Silver Spring, MD; beginning of migration activities for the CHPS Acceleration Team (CAT) RFCs following a week of migration training in Kansas City; “CHPS Day” at the national HIC meeting in Silver Spring, MD; and a CHPS Implementation Workshop #1, held in Sacramento, CA. Considerable activities have also taken place in support of the Forcings team goals.

2. NEXRAD SOFTWARE DEVELOPMENT

The next major NEXRAD release, Build 11, began Beta Testing in late March and full deployment is scheduled to begin in May 2009. One major enhancement in Build 11 is the addition of the Clutter Mitigation Decision which reduces clutter in reflectivity and, hence, precipitation products, although HSEB did not help implement that software.

2.1 Dual Polarization

As scheduled at the end of February, HSEB delivered the software for the dual pol QPE algorithm and products to the Radar Operations Center (ROC). 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 private contractor, Level III Communications.

Next the ROC and Level III Communications will integrate and test Build 12 with help from OST and OHD. Afterward, 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. Our major OB9.0 projects are summarized in the below sections. There are a few special releases scheduled after OB9.0 but before AWIPS II. Release OB9.1 updates the Linux operating system, while OB9.2 and OB9.3 are limited-scale maintenance releases.

3.1 High-resolution Precipitation Nowcaster (HPN)

HPN is a major enhancement to the High-resolution Precipitation Estimator (HPE). HPN provides mosaicked radar-based high-resolution forecasts of precipitation every 5 minutes. The HPN forecast accumulation can be used as input to FFMP and to the Site-Specific Hydrologic Predictor (SSHP) model and the forecast rates and accumulations can be viewed in D2D. For information on how to configure FFMP to use HPE/HPN grids, see http://www.nws.noaa.gov/mdl/ffmp/FFMPAsourceFile.pdf

3.2 Variational Data Assimilation (VAR) for SSHP

VAR capability has been added to the SSHP headwater model to dynamically adjust model state information such as soil moisture conditions, thereby improving accuracy of the resulting stream forecasts.

3.3 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/.

The RiverPro application was modified to incorporate Common Alert Protocol (CAP) codes around the call-to-action section in all watch, warning, advisory products. The ability to perform basic arithmetic operations on numeric template variables was added, and the existing latitude and longitude template variables are now usable for non-river locations.

The rate-of-change quality control operation ("roc checker") was modified in a small but important way by allowing designation of data that fails the check as being "bad", rather than just "questionable". Bad data are ignored for use in data intensive applications such as precipitation derivations. Also, a change in the format options for the hydrologic IHFS "alert_alarm" data reports was made.

3.4 Precipitation Processing Improvements

Noteworthy changes include the revamping of the MPE gage table, allowing improved user interaction and supporting more precipitation fields. The satellite-radar-gage products now have a smoothing algorithm for boundaries between areas using different precipitation data sources. Lastly, some minor but important changes to the point precipitation derivation algorithms will provide improved derivations of irregularly reporting data, such as from the NWS 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.

3.5 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 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. However, due to problems with the compiler and the new Linux kernel, OB9.1 has been suspended by Raytheon. This may impact general OB9.x schedules.

3.6 Field Tests

Evaluations at certain offices are ongoing or are being readied:

- Multiple RFCs are using a post-OB9 version of MPE which supports the NSSL NMQ radar-based QPE product and derived products.
- Selected RFCs are configuring and evaluating the DailyQC features in the OB9 version of MPE.
- Springfield, MO (SGF) WFO and Cleveland, OH WFO are field testing HPN.

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 CAT continued their weekly conference calls (captured as minutes, and available at http://www.nws.noaa.gov/oh/hrl/chps/meeting_minutes.html).

The non-CAT RFCs (often referred to as "follow-on" RFCs) have now been dubbed "CAT-II" (pronounced 'cat too') for simplicity.

CHPS Acceleration Team-II (CAT-II)

OHD gave monthly CHPS project status updates to the CAT-II and the Regions on January 8, February 12, and March 12. These briefings are intended to gradually increase exposure of the CAT-II RFCs to the CHPS project, and to answer questions. The briefings are supplemented by other exchanges, including a "CHPS Day" at the national HIC meeting (see CHPS Workshops below) and a weekly CAT-II conference call, which was initiated on March 10. The weekly conference calls have initially focused on deriving a Baseline Operational Capability (BOC) for the CAT-II RFCs, using the CAT BOC document as a starting point.

CHPS Workshops

The CHPS Preparation Workshop #3 was held in Silver Spring during the week of January 26, 2009. The CAT discussed a range of topics which were focused mainly on activities that will impact them later in the Spring or Summer of 2009, such as:

- the new Interactive Forecast Display (IFD)
- a decision to accelerate the first version of an XEFS product generator as the solution for a CHPS-based version of the ESPADP
- an early look at potential approaches for an Archive Database
- discussions on Calibration and Verification
- discussion of grid forcings for CHPS

- adoption (and expansion) of WaterML as an XML standard
- generation of deterministic products
- introduction of a CAT "buddy" system:
    - NERFC – MARFC, OHRFC
    - ABRFC – WGRFC, LMRFC, SERFC
    - NWRFC – MBRFC, APRFC
    - CNRFC – CBRFC, NCRFC
- CATs to conduct on-site "buddy" visits Summer 2009 instead of holding a national conference

With the NWSRFS-to-CHPS migration now underway, the CHPS Implementation Workshop #1 was held in Sacramento, CA (at CNRFC) during the week of March 30, 2009. This workshop focused on similar activities as the Preparation Workshop #3, but provided more depth and greater detail for the Archive Database, Calibration, and Verification approaches.

"CHPS Day" was held on February 26th during the national HIC meeting in Silver Spring, MD. This was intended as an information-sharing seminar between the CAT RFCs and the CAT-IIs. A wide range of CHPS-related topics was addressed; the CAT RFCs described their experiences and impressions.

Migration from NWSRFS to CHPS (CAT RFCs)

Deltares delivered migration training for the CAT RFCs during the week of February 9 at the NWS Training Center (NWSTC) in Kansas City, MO. This was followed by a week of Deltares on-site support at each CAT RFC to ensure that everything was in place for migration to begin. The CAT RFCs have now begun converting their NWSRFS segments and forecast groups to CHPS and are making good progress. OCWWS HSD has set up a new NOAA email address and a new infolist for the CAT RFCs to facilitate problem resolution during migration.

CHPS Hardware

OCWWS HSD completed the CAT CHPS software installations on the CHPS prototype hardware at CNRFC during January.

Purchase of hardware for the CAT-II RFCs is awaiting input from the Archive Database team, which has proposed a prototype activity to demonstrate some Integrated Water Resources Science and Services (IWRSS) principles; the proposal would impact hardware configuration at just one of the CAT RFCs.

CHPS Software Development

The first official release of the migrated legacy models (CHPS 1.0.0) was used to support the migration training in early February and then installed at the CAT RFCs the following week. This software is being used as the CAT RFCs migrate their operational segments to CHPS. As problems are uncovered, the development is investigating and supplying fixes.

This quarter HSEB developers completed the implementation of the CarryOver Transfer function for the legacy models in the BOC. This software will be part of the CHPS formal testing in April and should be released as 1.1.0. A few minor changes to provide enhancements and address issues uncovered by continued testing or problems discovered by the CAT RFCs will also be included.

Developers have begun addressing the migration of legacy models which are used by the CAT-II RFCs. Those six models, along with a new SAC-SMA model implementing improved heat transfer and soil moisture algorithms, will be completed in time for the initial CAT-II CHPS installations in the Fall of 2009.

CHPS Forcings

Both the RFCs and OHD have made considerable progress to prepare for the changes to the methods and form by which forcings data are delivered and processed by FEWS. The minutes of the near-weekly CHPS Forcings team conference calls document the discussions and activities of the team and are accessible via the CHPS web site.

The CAT RFCs have made major progress in developing methods for generating the gridded forcings data using a combination of GFE methods, MPE/DQC, and local applications. Descriptions of the methods being adopted are also available on the CHPS Forcing team web site. For the BOC-1 period, the grid format used will be GRIB1. OHD has completed prototype methods for transforming GFE output into GRIB1 and we are now working on getting the GRIB1 data imported into FEWS. OHD has also made modifications to MPE/DQC as requested by the RFCs to allow operational use of the DQC mode of MPE. The team is continuing discussions and preparing for the FEWS import of the generated grids and the subsequent side-by-side evaluations which will follow.

A temperature processing application has been developed by OHD which uses hourly reports and maps the data to a grid using distance-PRISM-weighting. Before incorporating a lapse rate adjustment, OHD has suspended work on this application in lieu of RFC evaluations of the RTMA temperature products. Also, OHD is considering incorporating a quadrant-based distance-weighting MAP algorithm into MPE/DQC which would emulate the MAP pre-processor methods.

The CAT-II RFCs have also begun to make plans for forcings data in the CHPS era. These nine RFCs have presented an initial description of the methods they plan to use. OHD is considering these comments in their planning for both CAT-I and CAT-II RFC operations.

4.1.2 HEC-RAS

Software Development on Linux version of RAS: A technical problem has arisen concerning some Linux software developed by Resource Management Associates (RMA), the US Army Corps of Engineers Hydrologic Engineering Center's (HEC) contractor for this task. Deltares and RMA have identified a technical solution and are awaiting guidance from OHD and HEC; until this item is resolved Deltares cannot demonstrate a complete solution for HEC-RAS in

CHPS. OHD and HEC will meet on April 1 in Sacramento, CA to discuss a resolution for the situation.

Software Development on the FEWS adapter for RAS: After the April 1 meeting between OHD and HEC, Deltares can move forward with RAS adapter training for HEC and/or their contractor RMA.

Development of a science-based technique to convert FldWav/Dwoper configurations to HEC-RAS in CHPS: This task is assigned to OHD HSMB. The HSMB Hydraulics Group Leader, Seann Reed, attended the February CHPS migration training in anticipation of the need to support CAT RFC migrations to a CHPS-based HEC-RAS.

HEC-RAS Training for RFCs:

- A basic (steady flow) course for all interested RFCs will now be conducted by HEC during the week of April 13 in Davis, CA (formerly scheduled for March). The course will be provided through NSTEP.
- Hands-on training in advanced topics (unsteady flow) will now be provided by OHD HSMB directly to the CAT RFCs in Taunton, MA (at NERFC) during the week of April 27 (formerly scheduled for March). In response to a request by the CAT-II RFCs that they be permitted to participate in the same training, OHD arranged for the lecture portions of the class to be shared via the Web.

4.1.3 Experimental Ensemble Forecast System (XEFS)

Within the past quarter, the XEFS project made some important progress. At the beginning of 2009, Mark Fresch took over as XEFS project area leader, started leading weekly XEFS planning meetings among key partners, including Rob Hartman (CNRFC), Mary Mullusky (OCWWS/HSD), representatives from Deltares, and members of OHD's HSMB and HSEB. In addition, in late January and mid-March, we had a series of planning meetings with Deltares. We have set a goal by early Fall 2009 to have the main XEFS components integrated into CHPS.

One new component is the Ensemble Product Generator (EPG) which will be part of the CHPS baseline. By Fall 2009, EPG will provide at least the same functionality as the existing Ensemble Streamflow Prediction Analysis and Display Program (ESPADP) functionality, but the EPG will be built on a FEWS framework. Initial EPG requirements and design are under review. A second phase of EPG development is planned to provide expanded ensemble and deterministic product generation and display control functionality.

Other XEFS components will be available by Fall 2009 as prototypes interfaced to FEWS. 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.

4.2 AWIPS II

Raytheon delivered Task Order 10 (TO10) to the NWS in February 2009. It contains a number of hydrology related software functions. Task Order 11 is scheduled for delivery later this year in preparation for a planned Operational Test and Evaluation (OT&E) beginning in December 2009. This is the last of the four software migration task orders and is expected to include all the NWS baseline operational software, including the OHD software.

TO10 includes the migrated SHEF decoder, TimeSeries display, HydroBase, and portions of HydroView and the Multi-Sensor Precipitation Estimator (MPE) applications. Other applications such as the metar2shef decoder, DPA decoder, HydroGen, and SiteSpecific are being left unchanged and will be configured to operate in the new architecture. Many hydrology software components were scheduled for TO11 or have been deferred to TO11 since they were not completed in TO10. As such, TO11 is an important milestone for hydrology and AWIPS migration efforts.

The Systems Engineering Center (SEC) within the NWS OS&T is managing the testing and evaluation of this and all AWIPS II task orders. Because TO10 is an interim release and TO11 is expected to represent the full migrated system, most of the testing focus is being concentrated on TO11. OHD is providing considerable support in preparation for the TO11 test and evaluation period. Regardless, WFOs and RFCs are encouraged to obtain, install, and evaluate TO10 software.

5. HYDROMETEOROLOGICAL AUTOMATED DATA SYSTEM (HADS)

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

5.1 HADS Systems & Software

HADS data processing software was minimally adjusted in January in order to further automate the process of implementing gage corrections values, based upon details received from the USGS. USGS correction files are very diverse, and HADS processing may require additional enhancements if differing content of the USGS files is encountered.

Relating to this activity, ancillary processes are in place that provide HADS network technicians a browser based interface to modify the gage correction values for those situations where the supplied correction file is out of date. The browser interface also allows for altering the range of stage values impacted by a “drawdown” effect. Human intervention occurs when the automated process discovers a change in the existing range of drawdown values and alerts technicians to review and then manually implement the new range values.

This service is directly related to changes in the USGS web based National Water Information System (NWIS). The USGS has completed the modernization of its system and all district

offices are now providing gage correction tables to a single national server, HADS processes routinely retrieve these tables for processing.

Some 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 entering, deleting or altering the gauge correction value. All 'large' correction values 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.

There will still be 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 there is access to the 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 13,754 data locations defined for HADS processing, an increase of 329 data points since January 1st. The number of data values delivered to NWS operations is now averaging 2.5 million each day.

One of the sub-networks within HADS is NCDC's Climate Reference Network (CRN). It is expected that a significant change will be occurring during the upcoming months (spring, summer and fall) that will enhance the usefulness of CRN data to NWS operations. A prototype data platform is being tested in order to improve the timeliness of temperature and precipitation observations from CRN platforms. In their current configuration, the most current data transmitted is the top-of-the-hour observation; in the re-programmed environment, the current data will be from the 5 minute time interval just prior to GOES transmission.

An example --- a CRN platform transmits its data at 12:28 GMT. Today, its most recent observation is from 12:00 GMT….the data are at a minimum of 28 minutes old when transmitted. Via the new programming, the transmission at 12:28GMT will contain data from 12:25 GMT and 5 minute intervals back to 11:30 GMT. In this example, the re-programmed platform makes data available to HADS processing when it is only 3 minutes old, vs. 28 minutes old via the current data platform program. It is expected that CRN sites will be altered when routine maintenance is performed on the data platforms during 2009.