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

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1. HIGHLIGHTS OF October, November, and December 2008

AWIPS software development efforts involved formal testing support of Operational Build 9 (OB9), ongoing since initial delivery of the software in May 2008. Full deployment starts in late January 2009. Other activities included support for field test and evaluations and continued guidance to the AWIPS prime contractor. HSEB also supported evolving AWIPS-II activities, in coordination with other offices in NWS HQ.

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

The Community Hydrologic Prediction System (CHPS) project closed out 2008 with a week of software testing in Silver Spring, MD, attended by OHD, Deltares, and 3 RFC representatives. See section 4.1 below for more details.

2. NEXRAD SOFTWARE DEVELOPMENT

The next major NEXRAD release, Build 11, is scheduled to begin deployment in spring 2009.

2.1 Dual Polarization

HSEB continues to implement the dual polarization QPE algorithm and products into the RPG. OHD delivered a non-operational version of their dual polarization software for testing with Build 11. However, the operational dual polarization capability will be part of NEXRAD Build 12. OHD is scheduled to deliver their dual polarization software to the Radar Operations Center (ROC) at the end of February 2009 for integration and formal Build 12 testing. After the delivery, there is a long formal testing period due to the complexity of the dual polarization enhancements, and parts of the enhancement are being done by different groups. The Radar Product Generator (RPG) software, including new algorithms and products, are being

implemented by the ROC, OST, and OHD, while the Radar Data Acquisition (RDA) software and hardware changes for the dual polarization enhancement are being done by a private contractor, Level III Communications. Deployment of the Build 12 and the dual polarization enhancement begins in late 2010 and lasts into 2012. The long deployment period is because a major hardware change is part of the enhancement.

3. AWIPS RELEASE OB9

HSEB delivered software for OB9 projects in May 2008 with deployment to begin in late January 2009. Our major OB9 projects are summarized in the below sections. There are a few special releases scheduled after OB9 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 forecasts are of rates at 15 minute intervals up to an hour and of 1-hour precipitation accumulation. HPN uses HPE mosaic grids as input. The HPN forecast accumulation can be used as input to FFMP and to the Site-Specific Hydrologic Predictor (SSHP) model. Also, both 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.

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). Of particular note was an agreement to provide monthly status briefings to the follow-on RFCs (HICs, DOHs, SCHs) and their respective regions as the first step towards kicking off CHPS implementation for the non-CAT (often referred to as "follow-on") RFCs. The first briefing will be given by Jon Roe on January 8. Also, a new CHPS team was formed to manage the integration of external model forcings data into CHPS. The CHPS Forcings team is discussed below.

CHPS Workshops

CHPS Preparation Workshop #3 will be held in Silver Spring during the week of January 26, 2009.

Migration from NWSRFS to CHPS (CAT RFCs)

The start of migration for the CAT RFCs has been delayed by one month to February 2009. The main reason for the delay stems from a desire on the part of Deltares to ensure the quality of the conversion scripts, which depend heavily on an understanding of the nature of NWSRFS operations and basin connectivity. These concerns were validated during software testing at

OHD in December, where the end-to-end testing did indeed reveal a few issues.

Deltares will provide migration training for the CAT RFCs during the week of February 9 at the NWS Training Center (NWSTC) in Kansas City, MO. This will be followed by a week of Deltares on-site support at each CAT RFC to ensure that everything is in place for migration to begin, and that there are no remaining unforeseen problems.

CHPS Hardware

CHPS "prototype" hardware was delivered to the CAT RFCs in October 2008. Deltares and OCWWS HSD traveled to NERFC to conduct the installation and to develop installation instructions for the remaining CAT RFCs. The hardware consists of 3 servers:

Master Controller (MC)
Forecasting Shell Server (FSS)
Database Server

These 3 servers together comprise an "Online Standby" system; another 3-server hardware suite to be added in 2009 will form the "Online Duty" system. The Operator Client software will run on existing AWIPS LX workstations. Together these form the prototype operational hardware for CHPS. Plans to evolve from the CHPS prototype hardware to AWIPS baseline hardware have still to be worked out between OHD and OS&T.

In November Randy Rieman (OCWWS HSD) traveled to NERFC to install the hardware and finalize installation instructions in the form of an AWIPS-like "mod note". The instructions were then used by the other CAT RFCs to install their hardware locally.

In early December Randy Rieman and Xiaobiao Fan (also OCWWS HSD) traveled with Frederik van den Broek (Deltares) to NERFC to learn how to install the FEWS server software on the new prototype hardware. Having successfully mastered the necessary skills, Randy went on to install the FEWS software at NWRFC later in the month. Installations for ABRFC and CNRFC are scheduled for January.

CHPS Software Development

This quarter HSEB developers completed the initial migration of all the NWSRFS models selected to be part of the CHPS Baseline Operational Capability (BOC). Formal testing of the migrated models in the CHPS environment was begun the week of December 15 in Silver Spring with participation from Deltares folks, Harold Opitz and Joe Intermill (NWRFC), and Ron Horwood (NERFC). The one major capability which remains to be implemented for most models is the CarryOver Transfer function which the developers are currently implementing. Minor changes are also being made to provide enhancements and address any issues uncovered by either internal or formal testing. The migrated models will be ready for the start of the RFC migration process.

The testing in December was the first formal testing of CHPS with the migrated legacy models

integrated with the FEWS system. Analysis of the results of individual model tests is not yet complete but the testing revealed a few problems with the configuration files which have already been addressed; no problems with the migrated model software itself was uncovered. The testing of more typical complete segment forecasts revealed some issues with both the test design and the system and more testing will be undertaken.

In early December HSEB also delivered data transfer scripts for testing at ABRFC and CNRFC. These scripts fulfill two tasks: making data extracted from the IHFS database by the OFSDE program available to the FEWS ingest process and transferring input data to a Deltares server to support testing and transition. Policy issues were raised with the latter function which delayed the use of the scripts.

CHPS Forcings

During the Summer of 2008, the CAT made a strategic decision that all forcing data required by the river modeling operations within CHPS would be: a) provided by methods external to CHPS and b) would be provided in gridded form. This decisions means that the existing MAP (Mean Areal Precipitation) and MAT (Mean Areal Temperature) pre-processors will not exist within the new CHPS framework. To accommodate the planning and development necessary for the transition to the new operational approach, a new CHPS Forcings team was established and conducted their first set of conference calls in November 2008. This team is led by Mark Glaudemans in OHD/HSEB and is composed of two members from each of the four CAT RFCs. It also includes members from OHD/HSMB and OCWWS/HSD.

The elements being considered by the team are precipitation, temperature, freezing level, and potential evapotranspiration, in both the observed and forecast domain. The team is considering the methods to generate these grids, and the physical form of the grids, along with the interface to and usage by the CHPS infrastructure. Discussion to this point has identified use of GFE, MPE/DailyQC, and local applications to generate these grids. The grid form definition includes the grid spatial resolution, grid projection, and grid format. The grid formats to be used for CHPS ingest are not yet decided, but will likely be in GRIB format Another consideration is the temporal resolution of the grids but that is dictated more by the model operations. The immediate team focus is on ensuring proper grid forcings are available for BOC-1, but attention is also being given to BOC-2 and beyond.

4.1.2 HEC-RAS

Software Development on Linux version of RAS: The US Army Corps of Engineers (USACE) Hydrologic Engineering Center (HEC) delivered a Linux version of the modeling software to Deltares in early December. Testing by Deltares at NERFC is expected to occur in late January.

Software Development on the FEWS adapter for RAS: With the delivery of a Linux-based RAS, Deltares can now complete their software development activities. Once software development and testing are complete, Deltares will provide HEC (and/or their contractor) with training on the RAS adapter.

The above two tasks are scheduled to be completed by the end of March 2009.

Development of a science-based technique to convert FldWav/Dwoper configurations to HEC-RAS: This task is assigned to OHD HSMB, and is scheduled for completion in January 2009. The primary focus this quarter has been on assisting the CAT RFCs, which require operational implementation of RAS sooner than other RFCs, and before the end of FY09.

HEC-RAS Training for RFCs: After numerous discussions between OHD, HEC, and the CAT RFCs, the following agreement was reached in December:

- A basic (steady flow) course will be given by HEC during the week of March 9; the course will be provided through NSTEP;
- Hands-on training in advanced topics (unsteady flow) will be provided by OHD HSMB directly to the CAT RFCs as needed (date yet to be determined).

4.1.3 Experimental Ensemble Forecast System (XEFS)

As of November, Mark Fresch has become the PAL for all XEFS activities.

On November 21, Albrecht Weerts (Deltares) initiated a series of bi-weekly conference calls to better define how the various XEFS components will fit within the FEWS infrastructure and within CHPS. Participants include Rob Hartman (CNRFC), Mary Mullusky, DJ Seo, Hank Herr, Mark Fresch, Chris Dietz, and Julie Demargne. The group is developing a document entitled "Linking XEFS components with CHPS-FEWS: Functional Requirements". Albrecht will also visit OHD during the first week in January to discuss some major XEFS topics, and to define the steps necessary to get an early XEFS out to one or more CAT RFCs.

4.2 AWIPS II

Raytheon continues to migrate the national AWIPS baseline software suite into a new, modern services-oriented architecture (SOA) as part of overall AWIPS evolution process. The AWIPS software migration is being performed under four task orders: Task Orders (TO) 8, 9, 10, and 11.

The TO9 software was delivered in September 2008 and included run-ahead basic SHEF decoder capabilities and time series display features. The Systems Engineering Center (SEC) within the NWS OS&T is managing the testing and evaluation of this and all AWIPS II task orders. Recent formal testing of these run-ahead TO9 capabilities indicated that the initial deliverables for hydrologic functional are deficient. HSEB has installed the TO9 software and is evaluating it in detail in an ad-hoc fashion. Developer training and basic prototyping with Rich Client Platform (RCP) application are also ongoing.

In TO10, a major portion of the hydrologic functions will be migrated into the new architecture and delivered for evaluation in February 2009. HSEB performed a formal review of the proposed contractor test plan for TO10. Other reviews and contractor support functions have also been performed by OHD in support of TO10.

4.3 General Testing

Evaluations at certain offices are ongoing or are being readied:

- Fort Worth (FWD) WFO and West Gulf RFC (WGRFC) continue to test the SSHP VAR components until OB9 is delivered.
- Oxnard (LOX) and San Diego (SGX) WFOs continue to testing changes to the station precipitation accumulations algorithm used for ALERT stations until OB9 is delivered.
- 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.

4.4 AWIPS System Changes

The AWIPS Software Engineering Group (SwEG) approved an upgrade to the FORTRAN compiler from Portland Group very late in the OB9 development process. An upgrade to the RedHat Enterprise Linux operating system from RHEL 4 to RHEL 5 is planned as a maintenance release, OB9.1.

5. HYDROMETEOROLOGICAL AUTOMATED DATA SYSTEM (HADS)

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

5.1 HADS Systems & Software

The software enhancements of implementing gage corrections values, based upon details received from the USGS continues to move forward. There are several phases to evaluating and implementing these corrections, most of which will be fully automated in the near future. We are now at the point in which a manual review occurs before any automated adjustments are allowed, but we are beyond the point where manual adjustments are routinely performed.

This service is directly related to changes in the USGS web based National Water Information System (NWIS). Now that the USGS has completed the modernization of its system and that all district offices are now providing gage correction tables to a single national server, HADS is routinely retrieving these tables for processing. Unfortunately there are no hard standards for the content of these correction tables and we must evaluate and adjust processing as new/different content is encountered.

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.
- The result of the process is manually reviewed – new 'large' correction values are manually confirmed.
- Additional software then updates each affected site's HADS definition and upon the next set of data from the DCP, the new adjusted stage value is distributed.

In addition to these gage correction values there is another type of data adjustment identified by the USGS as 'draw down corrections'. These data value adjustments are quite different; they are variable and are dependant upon the location of the water level measuring device and the effects of nearby structures that negatively impact the observational values. The process to adjust values at these data locations with known draw down correction factors is now fully automated within the data decoders.

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 gage correction 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.

Another improvement that occurred during the past several months involves our ability to provide a cross reference of GOES IDs to USGS station numbers for those DCP locations owned to the U.S. Army Corp of Engineers (USACE) but operated/maintained by the USGS. Basically any USACE DCP that appears on NWIS, is now cross-referenced in HADS at: http://www.weather.gov/ohd/hads/USGS/

5.2 HADS Data Network

On January 1st there were 13,425 data locations defined for HADS processing, an increase of 414 data points for the year 2008. The total number of sensors defined in the system is now 48,400 and there is delivery of 2.4 million data values per day to NWS operations.

The most important change in the network continues to be the reporting interval of data platforms and the timeliness of data. Seventy-two percent of the network provides new data each hour and the majority of hydrologic platforms provide stage and rainfall data at sub-hourly intervals. There are now only 3,000 defined data sites still on the old 4-hour reporting cycle and most of these will convert to hourly reporting over the next couple of years.