Office of Hydrologic Development
Hydrologic Software Engineering Branch
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Software for NWS Hydrology!

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1 HIGHLIGHTS FOR July, August, and September 2007

Most software development efforts during this period were dedicated to supporting the integration and alpha testing stages of AWIPS Release OB8.2, and development work for OB8.3 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 OB8.2 and OB8.3.

Most sites have upgraded to AWIPS OB8.1 during this period. During this quarter significant support continued for Raytheon's testing of AWIPS OB8.2; the Software Integration Testing (SWIT), System Integration Testing (SIT) and Alpha Testing have all been completed.

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

In the news this quarter is the Community Hydrologic Prediction System (CHPS) area with the following achievements:

- First installation of the USACE HEC Reservoir Simulation (ResSim) model at the CNRFC was completed in mid-July
- Riverside Technology, Inc (RTi) led the CHPS FEWS Pilot Enhancements project kick-off meeting in August
- OHD delivered to Delft our SNOW-17 for use in the FEWS Pilot (extracted from NWSRFS)
- At the end of September HSEB completed the preliminary software design for the Experimental Ensemble Forecast System (XEFS) for transition to CHPS

- HSEB and the USACE HEC completed all necessary paperwork to fund and execute a new project which will link the HEC River Analysis System (HEC-RAS) into CHPS
- Raytheon began work to define the AWIPS II interfaces with CHPS

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

2 NEXRAD SOFTWARE DEVELOPMENT

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 (STP, OHP, and THP). As part of AWIPS OB8.2, WFOs will have the option to send to their associated RPG(s) either their locally-computed mean field bias or an RFC-computed mean field bias. Build 10 is scheduled to begin deployment in mid-2008.

2.1 Terminal Doppler Weather Radar (TDWR) PPS

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

2.2 Dual Polarization

HSEB continues to implement the dual polarization QPE algorithm into the RPG. This past quarter, HSEB continued coding the algorithm and drafted product requirements for the dual polarization precipitation products. In addition, this past quarter, HSEB started supporting GSD's implementation of dual polarization products displays into AWIPS, which will be available in AWIPS OB8.3 upon deployment of NEXRAD dual polarization. The dual polarization QPE algorithm is planned for Build 11, and Build 11 software is due in spring 2008. Build 11 and the hardware for the upgrade to NEXRAD are currently planned to start deployment in 2009. The large gap between delivery and deployment is to allow extensive testing of the new dual polarization hardware and software.

3. AWIPS RELEASE OB8.1

The OB8.1 software began regular deployment to field offices on July 31, 2007. Please refer to previous newsletters and release notes for further information on AWIPS 8.1.

3.1 AWIPS MAINTENANCE RELEASE OB8.1.1

OB811 full deployment starts October 2, 2007. This release includes some modest fixes to RiverMonitor which corrected cases with displaying flood stage or action stage departures, and to RiverPro which corrected cases where it would fail to generate very large products.

This release also includes a significant addition to the HydroGen function run at WFOs. The current approach for extracting river data and generating bulk products for transmission to web farms via the LDAD is being phased out, sometime after the deployment of OB811. A new XML format presentation of data is provided, including only data posted since the last time the data extraction operation was performed. This will result in considerably less data being packaged in each transmission. Also the data will be sent as an official NWS product, using the "HML" product category to identify the product. This product will be sent via the WAN to the SBN, bypassing the need for the LDAD communications path to the web farm. The local HML product definition will need to be added to the local afos2awips.txt file, as per the OB811 installation instructions. These changes are part of the overall NWS web consolidation efforts.

4. AWIPS RELEASE OB8.2

HSEB formally handed off the software for AWIPS Release OB8.2 to the AWIPS testing organization on June 29, after successfully completing the Integration Handoff Review on June 20. After that point, HSEB developers have been supporting the AWIPS testing process and addressing a few problems which have been discovered in the testing.

4.1 NWSRFS

AWIPS Release OB8.2 will include enhancements to three NWSRFS areas: Deterministic Verification (IVP), Distributed Hydrologic Modeling, and DIURNAL technique for Mean Areal Temperature calculations at some RFCs. For more details of the enhancements, please refer to earlier newsletters.

4.2 Precipitation Processing

4.2.1 RFC Bias Transfer to WFO RPG

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

4.2.2 Satellite-Radar-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.

4.2.3 RFC QPE Products

OB7.2 provided the ability in the MPE software suite for RFCs to transmit their best estimate hourly QPE grids for external distribution, and for the WFOs to receive these products and display them in D2D and WHFS applications (HydroView, MPEeditor). This ability complemented the ability provided in OB6 for displaying the locally generated MPE best estimate grid in D2D.

Unfortunately, approval issues prevented the grids from being available on the SBN data stream, even though they are being sent via the NCF to NCEP for use in verification activities. Starting in August, the QPE grids, which are identified using the ZETA98 (WMO identifier) have been accepted in a test environment for evaluations. We in HSEB feel that we are on the verge of getting the final approval for accepting these products for full and routine transmission on the SBN.

There is interest in these best estimate products in many operations outside of the RFC, regardless of whether MPE or local applications generated the grid. These grids represent the best hourly QPE the NWS has available, and can be of great benefit for many activities, including real-time analysis, QPF verification, etc.

The above mentioned testing revealed a bug in the GRIBdecoder for these QPE products. This bug is fixed for OB82. This fix, coupled with the data transmission capabilities mentioned above, should allow RFCs to send their products for use by WFOs. Offices do need to perform some minor configuration changes to enable this feature; please contact HSD for this information upon delivery of OB82.

5. AWIPS RELEASE OB8.3

In this period, the HSEB developers have been focused on developing software for the AWIPS OB8.3 enhancements, which are described below. They are currently completing the development and internal testing in anticipation of the Pre-Integration Testing (PIT) which is scheduled for December.

5.1 NWSRFS

For more detailed information about the OB8.3 projects, below, the development documents are available at http://www.nws.noaa.gov/oh/hrl/hseb/software_dev_doc.html.

5.1.1 Re-implementation of ICP

HSEB continued to oversee work by RTi to re-implement the Interactive Calibration Program in an object-oriented framework. RTi is finishing the last software changes to address the issues found through the long prototyping and test period. HSEB again wants to thank the folks at NWRFC, NERFC, WGRFC, LMRFC, and OHD/HSMB who tested the interim prototypes. While there is little new functionality in this application, re-implementing it in a modern language should make it easier to maintain and enhance in the future. Users should also notice that some functions which did not work correctly in the old ICP have been corrected.

5.1.2 NWSRFS Reservoir Tool Enhancements

HSEB is working with RTi to incorporate two enhancements to tools available in NWSRFS for modeling reservoirs. The first will be to allow the LOOKUP3 operation to have access to multi-value time series for use in regulation modeling and to allow a lookup based on the day of year so that operating rules can be specified in lookup tables. The second enhancement is to allow the Res-J MAXSTAGE method to use regular NWSRFS rating curves rather than separate Res-J specific curves and to enhance the MAXSTAGE method to support specifying a maximum discharge for cases where operations are based on discharge rather than stage. In the last three months, the software design and test plans were reviewed by AWIPS SREC representatives.

5.1.3 Distributed Hydrologic Modeling (DHM)

During the period, HSEB worked with field representatives to identify the enhancements to be included in the OB8.3 release. The most pressing need identified for expanding the use of DHM in operations was the availability of the SNOW-17 functionality. Unfortunately, the HSEB resources available were not sufficient to implement this functionality within DHM in OB8.3. In order to address the operational need within the HSEB resources available, DHM will be modified to accept as input rainfall and snowmelt grids created by the prototype Hydrology Lab Research Distributed Hydrologic Model (HL-RDHM), which does incorporate SNOW-17, in addition to the current QPE grids. The two other DHM enhancements for OB8.3 will allow the user to specify MODs to the SAC-SMA states as a percentage of storage zone capacity in addition to as a multiplier of the current value, and use hourly observed precipitation data rather than disaggregated QPF data whenever it is available.

5.2 Precipitation Processing

Work will continue on the integrated QPE operations (i.e., DailyQC) through the OB8.3 period. HSEB is coordinating its activities with RFC and regional representatives. A national conference call was held in late August where the requirements and activities for OB8.3 were provided. HSEB uses a spreadsheet to track the requirements and their implementation; this spreadsheet can be provided upon request.

Currently, there is no scheduled work for OHD on QPE tasks after OB8.3, although there have been considerable informal requests made for changes. We are working with OCWWS/HSD to schedule some tasks, but it would be helpful for active support from parties interested in seeing these QPE tasks scheduled.

5.2.1 Enhanced MPE

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

5.3 RFC Archive Database Synchronization

This task is the synchronization of the RFC Archive (RAX) database meta data with the Integrated Hydrologic Forecast System (IHFS) database meta data. It will include non-interactive "batch" tools to perform the synchronization and an interactive "ArcBase" application, similar to HydroBase.

6. DEVELOPMENT SUPPORT ACTIVITIES

6.1 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/).

6.1.1 HydroXC

A visit in September by the Australian Water Information Delegation to establish closer ties for information exchange revealed their interest in our work on Hydrology XML. Apex Digital Services and Dr. Michael Piasecki from Drexel University met with them about the XML schema and the Consortium. There may be opportunities for collaboration in the future.

6.1.2 CHPS FEWS Pilot

On August 15 RTi led a kick-off meeting for the CHPS FEWS Pilot Enhancements project. To recap, these enhancements include:

- Installation of the Pilot at ABRFC (3rd Pilot site, joining NWRFC and NCRFC)
- Develop a MODs-like capability for the SAC-SMA

- Configure all Pilot sites as client-servers, not standalone as now
- Provide additional segment definitions for the Santiam River for NWRFC
- Provide more in-depth training to all Pilot sites
- Provide access to SNOW-17 (replaces Delft's SNOWMELT in the existing Pilot)

A workshop to demonstrate these new features is scheduled for December, at NCRFC.

During a discussion in early September, the CAT agreed that the term 'Initial Operating Capability (IOC)' will refer to the suite of functionality at the CHPS FEWS Pilot sites that will enable those sites to abandon use of NWSRFS as their primary forecasting tool.

Delft recently proposed a user interface design for the MODs-like feature, and held a meeting to review and discuss with the CHPS Acceleration Team (CAT) members in late September.

HSEB, through its RSIS contract, completed testing of the SNOW-17 model and adapter for use within the CHPS FEWS Pilot system, and delivered the code to Delft. HSEB also developed and delivered segment definitions for all basins of the Pilot sites.

In response to a request at the July meeting of HICs in Silver Spring, MD HSEB invited all RFCs to participate in its "chps_fews_pilot" list server forum. The list quickly reached its membership limit and has since been increased to accommodate.

6.1.3 CHPS-AWIPS II

With the contract task successfully initiated, Raytheon began their analysis of CHPS (in the form of Delft-FEWS) to develop a design approach for the CHPS-AWIPS II interface. Delft visited Raytheon in Omaha, Nebraska at the end of September to provide a walk-through of the FEWS system, and to develop technical details of a proposed approach. HSEB expects to receive a draft analysis and design approach document at the end of October 2007, with a follow-up discussion meeting occurring some time in November.

6.1.4 ResSim

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

During the week of July 9, Delft led an installation at CNRFC bringing all collaborative components together in one place for the first time. This included the Delft-FEWS configured for CNRFC, an early Linux version of the ResSim from HEC, and a modified version of NWSRFS from Apex. The installation revealed some missing functionality needed for NWSRFS, which HSEB provided at short notice, and which was delivered to CNRFC during August.

Full end-to-end testing continued throughout August and early September. Delft sent a hydrologist to CNRFC during the week of September 17 to troubleshoot an outstanding issue on-site. The cause of the problem turned out to be configuration and environment, not software.

For these and other reasons related to CNRFC's anticipated workload, acceptance testing at CNRFC has been delayed until mid-November. A fully functional version of ResSim will be installed at that time, along with an enhanced version of NWSRFS. During the ensuing months CNRFC will run ResSim in parallel with their normal operations.

6.1.5 HEC-RAS

The goal of this project is to provide RFCs with access to the USACE HEC River Analysis System (HEC-RAS) via CHPS (not NWSRFS). HSEB anticipates two phases, the first of which (Phase 1) will be the solution design; this piece has now been contracted out to Delft. The solution is expected to leverage much of the CHPS-based software developed on the ResSim project, without the connection to NWSRFS.

Also this quarter NOAA and the USACE finalized an updated Memorandum of Agreement (MOA) between the two agencies, thereby providing a vehicle to fund HEC's contributions to Phase 1 of this project. Funding is also now secured.

With agreements, contracts, and funding in place, all that remains is for HEC to complete other unrelated commitments and release their staff to begin Phase 1.

The second phase, implementation of the design, will require HEC and other HSEB contractors (to be determined) to implement the proposed software design into CHPS.

6.1.6 Experimental Ensemble Forecast System (XEFS)

HSEB spent most of this quarter conducting an in-depth analysis of existing prototype software that is related to experimental hydrologic ensembles. That analysis, along with an examination of requirements captured in the XEFS Design and Gap Analysis Report (available at http://www.weather.gov/oh/rfcdev/docs/XEFS_design_gap_analysis_report_final.pdf), forms the basis of a high level software design for the XEFS. With the design in place, the XEFS Execution Manager is in the process of putting together a preliminary implementation plan, and specifying cross-functional team composition. An XEFS implementation kick-off meeting is expected in October.

The XEFS Execution Manager announced a one-month slip in the schedule, due to some AWIPS OB9 work which has impacted key XEFS resources.

6.2 AWIPS II

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

updated SW CTR Product Improvement Plan (PIP) 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 led by the NWS HQ Office of Science and Technology (OST).

The migrated system is being referred to as AWIPS II, with the migration to this new system being referred to as "AWIPS Evolution". The evolution includes hardware, software, and communications changes.

There are eleven formally identified task orders. Task Order 6 was delivered and primarily consists of Version 1.0 of the AWIPS Development Environment (ADE), its associated software infrastructure, and a Software Development Kit (SDK). Task Order 7 was delivered in late June and involves a documented plan for the migration of all base-lined AWIPS software to the AWIPS-II infrastructure. The actual migration is planned for Task Orders 8, 9, 10, and 11. Each task order is scheduled to last 6 months. The bulk of the OHD software is scheduled for Task Order 10, which begins in July 2008 and ends January 2009.

The ADE SDK is centered on a dramatically changed application environment built upon a comprehensive Java-based Services Oriented Architecture (SOA) design. 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 aggressive, with migration of applications scheduled to begin in summer of 2007 and continue for 2 years. Subsequent deployment of this new system is scheduled to phase in after the OB9 release, with deployments beginning in summer 2009.

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

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

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

6.3 GENERAL TESTING

Informal evaluations for NSSL-provided Q2 QPE grids ingested into the MPE environment is ongoing at WGRFC. Informal evaluation of MPE is also continuing at ABRFC; this testing is focused on improving the speed of MPE re-run analyses performed interactively.

6.4 AWIPS SYSTEM CHANGES

No upgrades to the AWIPS operating system, except for routine security patches are officially planned through OB8.3. Recently, Raytheon has commented that a kernel upgrade may occur coincident with OB8.2, but this decision in not final. Regardless, plans have been announced to add or upgrade several infrastructure packages in those releases.

6.4.1 OB8.2

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

6.4.2 OB8.3

AWIPS will upgrade a number of infrastructure packages for OB8.3, but this list has changed slightly from that provided in the previous newsletter. The current list of packages upgraded is:

- PostgreSQL to version 8.2.5
- Grib2 decoder – degrib, version 1.85
- Python, version 2.5
- scientific python, version 2.6
- numeric python, version 24.2
- LDM, version 6.6.4
- Swig, version 1.3.31

7. HYDROMETEOROLOGICAL AUTOMATED DATA SYSTEM (HADS)

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

7.1 HADS SYSTEMS & SOFTWARE

The deployment of systems to the NWS Backup Telecommunications Gateway center (the "BTG") has been completed, but we are still waiting for a fully supported real-time data feed to be implemented by NWS OCIO and NWS Gateway personnel. In the meantime, along with a file transfer function from the Domestic Satellite reception in Silver Spring we have enacted a network connection from HADS at the BTG to the Wallops Island DCS facility. This activity provides a secondary /backup data feed to the BTG systems in case of acquisition failures at the primary site in Silver Spring. We are still lacking an operational path to deliver products from the HADS BTG, but we are capable of transferring SHEF products to the RFCs and to the OHD

web environment if it should ever become necessary. The solution to implementing a real-time communication link to the BTG remains as an unsettled issue due to OCIO budget restraints.

Meanwhile HADS data processing functions continue in their normal manner. One software deficiency involving the computation of hourly incremental precipitation (PP) from a small subset of data platforms was recently discovered and quickly corrected.

During the past two months a couple of newsworthy events have occurred within the DCS community.

First, at the NESDIS facility in Wallops Island, VA., a new data processing system has been brought on-line to provide backup to the circa 1979 DAPS processor. This new backup system was called into operations several times during July and effectively eliminated down-time and data loss when failures occurred on the original DAPS computer.

The second event, an activity that will eventually enhance availability of GOES DCS data, involves the USGS efforts to field a GOES DCS facility at the EROS data center in Sioux Falls, SD. The GS is on track to begin deployment of a DCS downlink and a network based data relay system during the first-quarter of 2008. Establishing this center will provide an operational backup to Wallops Island and eliminate the 'single point of failure' attribute of the GOES DCS.

7.2 HADS DATA NETWORK

The data network continues to expand. The number of data points in the network is now 12,858 and approximately 2.3 million data values are processed each day.

The owners/operators of the GOES DCS platform continue their efforts to migrate their older platforms to the High Data Rate (HDR) systems and change their transmission frequencies to a 1-hour cycle. This activity represents the major portion of the work involved in maintaining the HADS data network as a number of DCPs are replaced each day. The USGS continues to lead this effort as 6,350 USGS platforms processed via HADS with 3,500 of these now uplinking on the 1-hour cycle. The USACE is increasing their effort to move to hourly transmitters as are all other platform operators within the GOES DCS. Of the 12,858 sites processed by HADS, 7,600 now provide new data every hour.