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

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1   HIGHLIGHTS FOR APRIL, MAY, AND JUNE 2006

Besides support activities for operational sites, all of which are now at OB6 or later, recent efforts were focused on support of the OB7.1 software delivery, completion and delivery of OB7.2 software, and more planning for OB8.x releases. The OB7.1 release focuses on the upgrade to the Redhat operating system, the gcc compiler, and a partial de-commissioning of the AWIPS data servers, while OB7.2 involves significant additions and enhancements to the applications.

As reported in a page available via: https://www.ops1.nws.noaa.gov/Secure/awips_softwre.htm the OB6 installations are complete and OB6.1 installation has begun. The alpha testing for OB7.1 is nearly complete, with beta testing beginning sometime in July, and deployment scheduled for September 2006.

OB7.2 installations are scheduled to begin December 2006. OB7.2 development includes the following major OHD tasks: implementation Build 1 of the Distributed Hydrologic Modeling capability, conversion of the RFC Archive database from Informix to PostgreSQL, upgrades to the Multi-Sensor Precipitation Estimator (MPE) suite of applications, and an enhancement of the HydroView station data display capabilities.

Efforts are underway to implement Terminal Doppler Weather Radar (TDWR)-based precipitation products (with target SPG Build 3 in 2007). When completed, NEXRAD-like precipitation products will be generated from TDWRs with Supplemental Product Generators (SPGs). SPGs have been deployed for a limited number of WFOs with TDWRs, but plans are to deploy SPGs to all 45 WFOs with TDWRs. Support of NEXRAD Dual Polarization (target RPG Build 11, deployment expected 2009) continued. This quarter HSEB started the requirements definition for the dual polarization Quantitative Precipitation Estimation algorithm, and next quarter our branch will begin to implement the algorithm.

2   NEXRAD SOFTWARE DEVELOPMENT

The next NEXRAD RPG build, Build 9, is scheduled for deployment in mid-2007. For that build HSEB re-hosted the Precipitation Processing System (PPS) to a LINUX operating system and fixed some minor bugs. Level III radar precipitation product specifications for the RPG are available on OHD's website: http://hsp.nws.noaa.gov/oh/hrl/wsr88d_prods/index.htm.

2.1 TDWR PPS

The team has been adapting the RPG-based PPS to process TDWR data on the SPG. During the quarter, the coding was nearly completed; next quarter testing should be completed. Current plans are to make TDWR-based NEXRAD-like precipitation products (such as Storm Total Precipitation) displayable with AWIPS OB8. This project is managed within HOSIP and is funded from the NEXRAD Product Improvement (NPI) budget. The requirement for TDWR-based products was ranked as being very high last summer by regional representatives to the OS&T-led Radar Capability Enhancement Priorities working group. This HOSIP managed project is awaiting Gate 3. OS&T is managing the overall TDWR effort as OSIP project 05-066.

2.2 Dual Polarization

The HSEB NEXRAD project team continued to support the Dual Polarization project. Deployment of dual polarization is planned to start in Build 11 in 2009. The Dual Polarization project is tracked via the NWS OSIP as project 05-023 (https://osip.nws.noaa.gov/osip/index.php). The project is now in Stage 3 with an expected Gate 3 in June or July. This project is the NEXRAD team's highest priority, but, it still has a way to go before being ready for deployment.

This quarter HSEB, OST/SEC, and OOS/ROC began the requirements definition of the dual polarization software algorithms, including holding biweekly walkthroughs of NSSL's prototype algorithms. The walkthroughs are nearly complete, and next quarter we plan to begin implementing the baseline version of the algorithms into the NEXRAD RPG.

The Dual Polarization Software Design Working Group formed and led by HSEB continues to meet monthly. The primary goal of the group is to share knowledge among all collaborators (OHD, OOS/ROC, NSSL, OS&T, and the FAA) and define schedules that will assure smooth transition of NSSL's algorithms into the operational baseline.

In coordination with the ROC, NSSL has begun a Product Development project, whose objective is to make recommendations on the operational polarimetric product suite and formats to implement and use, based on input from operational users and trainers. The project is expected to run through Fall 2006.

3. AWIPS RELEASE OB6

Refer to the OCWWS/HSD web pages for release notes and other relevant documentation:
    -- For RFS Support: http://www.nws.noaa.gov/os/water/RFC_support/index.shtml.

-- For OHD Common Support: http://www.nws.noaa.gov/om/whfs/

The primary purpose of the OB6 build was to port our applications to the PostgreSQL database and to the new RHEL 3 operating system. The Red Hat Enterprise Linux Workstation Basic Version 3 Update 4 (RHEL3u4) is the operating system for AWIPS Release OB6 for all systems except the RAX, which stays at Red Hat 7.2.

3.1 NWSRFS

In mid-June, the RFC Support team notified us that a critical problem with the OFSDE application had been identified at NCRFC. The problem caused older forecast data rather than the latest forecast data to be provided to OFS as input. We were able to provide a potential fix to the RFC Support team for testing within 24 hours. We will continue to provide support to the RFC Support team as additional RFCs install the OB6 software.

3.2 WHFS/IHFS DATABASE

Besides the PostgreSQL conversion, a few features are new to OB6 and include the ability to view locally-generated MPE hourly grids in D2D; to include flow-based impacts in RiverPro; to assign proper durations to AWOS METAR precipitation data that have unique sensor reset times; to better control duplicate data SHEFdecoder posting; and to display Contingency data in TimeSeries. The HydroGen (Hydrograph Generator) function, which replaces the RivDat local application, was provided for the first time as part of the national AWIPS baseline in OB6.

An Operational Test and Evaluation (OT&E) of the RiverPro VTEC features began in June, 2006, using RiverPro software provide via AWIPS ATAN 825. The plan is to continue the OT&E until October 2006, at which time all offices would use VTEC in RiverPro generated forecast point specific warning products. This phased rollout had the unfortunate consequence for sites not using VTEC, since a new method to determine which forecast points to include and which product category to generate was adopted for OB6. Without VTEC, these recommendations are not meaningful, as the new method cannot determine when an FLS product should be recommended, so it recommends an FLW if flooding is occurring or forecast, and an RVS otherwise. Problems and issues identified during the OT&E are being addressed via the OT&E team tracking and regular discussion.

OB6 also includes additional RiverPro changes to ensure compatibility with the workstation test mode operations to be introduced in OB6. With this feature, an AWIPS workstation is designated to be in Operational, Test, or Practice mode, and the formatter applications respond accordingly.

Lastly, the WHFS "oper" user cron which, prior to OB6, was implemented on the DS systems, will be re-distributed so that data ingest operations are scheduled on the DX system and data processing operations on the PX. The OB6 Modification Note (Installation Procedure) and System Managers Manual discuss this further.

3.3 PRECIPITATION PROCESSING

A major change in OB6 involved adding the ability to display locally generated MPE output in D2D. In order to view the local MPE grids in D2D, a minor localization step was recently identified as being omitted from the OB6 installation process. This step was added to the OB7.1 installation post-install notes, and can be provided upon request by the OHD Common (i.e., WHFS) support team.

To support this change, the GRIB product generation code was moved in OB6. Its directory location is controlled via updated national application token values. RFCs should review a new script which supports transmission of the GRIB products, in order to add locally selected destinations such as the NPVU NCEP destination.

4. AWIPS MAINTENANCE RELEASE OB6.1

The RFC-only software did not include any fixes in the OB6.1 Maintenance Release. There were three fixes for the OHD Common software that were provided in OB6.1. These include a fix to the Generate Areal Flash Flood Guidance application which displays RFC FFG data in Hydroview; a fix to the Metar2shef data ingest application so that it properly handles reports with certain remarks in the wind field; and a fix to RiverPro which involved a change to handle coded VTEC times for discharge based forecast point locations.

5. AWIPS RELEASE OB7.1

Release OB7.1 is undergoing alpha testing at selected sites. System Acceptance Testing, which includes beta installations, is scheduled to begin sometime in July.

5.1   NWSRFS

Due to the limited time available after the OB7.1 schedule was announced, no functionality changes or bug fixes were made for the OB7.1 release. NWSRFS in OB7.1 will simply provide the same functionality as in OB6 in the OB7.1 operating system environment. Note that OB7.1 does include all of the fixes issued as interim releases to the OB6 release. The NWSRFS developers have spent June providing support to the AWIPS/Raytheon testers conducting System Integration Testing.

5.2   OHD COMMON SOFTWARE

In addition to adjusting the software to function in the operating system environment, some modest enhancements and fixes were introduced in the OB7.1 common software. The noteworthy enhancements include:

- The ability to store and manage low water (i.e., drought) impact statements in the HydroBase application.

- The ability to perform alert/alarm against lower limit thresholds, to complement the existing upper limit exceedance thresholds.
- The improved ability to specify and manage the display of flow-based flood impact statements in RiverPro, beyond the existing traditional stage-based impacts.
- The separation of HydroView /MPE into separate applications – one for HydroView and another for MPE (more MPE discussion is given in the precipitation processing section below).
- Assorted minor bug fixes including the restored ability to properly restart the SHEF decoder from the HydroBase application.

5.3   PRECIPITATION PROCESSING

In OB7.1, a collection of changes are introduced as part of the general mission to provide an integrated set of QPE tools within the Multi-Sensor Precipitation Estimator (MPE) application. Although the Western Region's Daily QC (DQC) functionality will not be introduced until OB7.2, some enhancements from the Tulsa RFC P3 QPE application are introduced in OB7.1.

The changes include the introduction of three new grid types: a) Triangulated Local Bias Corrected Multi-Sensor Mosaic; b) Radar Average mosaic; and c) Radar Maximum Mosaic. A token is used to control which grids are actually generated at a given office. A separate token is used to control which of the radar mosaics is used for the subsequent grids that use a radar mosaic as an input. Either the existing climatologically-based mosaic is used or one of the new average or maximum grids is used. The existing MPE polygon editing tools were extended in OB7.1 to allow the user to apply, save, or delete polygon-based edits. Lastly, the MPE application, which is now separate from the HydroView application, has a split-screen feature to allow side-by-side comparison of grids.

6. AWIPS RELEASE OB7.2

Software for release OB7.2 was delivered to the AWIPS contractor on June 6, 2006. Pre-Integration Testing (PIT) began June 12, and ends July 7. The PIT provides a platform for operating the AWIPS applications developed by different organization where, for the first time in a given release development cycle, the applications work together in an integrated environment. A major component of the PIT was a visit by seven field forecasters to Silver Spring, MD, where their operational experience provided a more realistic quality to the testing. Special thanks go to the hydrologic testers ; Steve DiRienzo from Albany, NY WFO, and Joe Ostrowski from State College, PA RFC. This release is scheduled to begin national deployment in December 2006.

6.1 NWSRFS

During June we completed the development phase for AWIPS OB7.2. Aside from general bug fixes, items targeted for OB7.2 include:

6.1.1 VERIFICATION

New functionality will include new graphical displays. The calculation of confidence intervals has been postponed to a later release to allow additional research on the calculations.

6.1.2 CONVERSION OF RFC ARCHIVE DATABASE TO RHEL/POSTGRESQL

The RAX will be converted to RHEL 4 in OB7.2 and the database engine will be converted to PostgreSQL version 7.4.8.

OHD's software (raw shefdecoder, processed shefdecoder, and Verification) has been modified to work with PostgreSQL. The RAXUM-maintained software was converted and tested by various members of the RAXUM team (lead: Julie Meyer, MBRFC).

With Julie Meyer's help, OHD wrote scripts to convert the relational database, which will run at all RFCs. They involve steps to export and save data stored in the Informix database, create a new PostgreSQL database and schema, convert the Informix data to PostgreSQL format, and upload the re-formatted data into the new PostgreSQL database.

Since the RAX upgrade also involves an operating system upgrade (RedHat 7.2 to RHEL4), installation of PostgreSQL, and a disk re-partition, HSEB staff have worked closely with Raytheon engineers to ensure that the upgrade and database conversion go as smoothly as possible. HSEB's scripts also save and restore the "flat-file" archive, which must be preserved across the operating system upgrade and disk repartition.

This functionality is about to undergo testing on the NHD-A, and then on one of the AWIPS contractor's test beds.

6.1.3 DISTRIBUTED HYDROLOGIC MODELING (DHM)

New distributed hydrologic modeling techniques will be introduced into RFC operations. DHM is being tracked via OSIP as project 04-007 "Operational Implementation of Distributed Hydrologic Modeling". Visit the OSIP website for more information (https://osip.nws.noaa.gov/osip/index.php).

We delivered the first release of DHM to the AWIPS contractor in early June. Several Services Oriented Architecture (SOA)-like concepts have been built into the software, making this an early CHPS project.

This first release will permit display (but no editing) of distributed modeling grids via D-2D. Over the next few months HSEB will be working closely with the field to define the next set of requirements for OB8, which is expected to include GFE accommodation of DHM grids, plus some improvements to the early D-2D functionality provided in OB7.2. This activity will be led by the AHPS "Short- to Long-Term Forecasts" Theme Team.

6.1.4 HISTORICAL DATA BROWSER (HDB)

We delivered the HDB software to the AWIPS contractor in early June. This application was formerly administered and maintained outside of the AWIPS baseline, but becomes part of the national baseline as of AWIPS OB7.2.

The source code for the application has undergone a major re-write, as the original HDB was based on old software that does not work in the Linux environment. The software has also been upgraded to access a PostgreSQL database instead of Informix. All functionality remains the same.

6.2 WHFS/IHFS DATABASE

Changes for OB7.2 include the implementation of the "Mapper" station data display function into WHFS, which currently operates as a local application used primarily in the Western Region. It provides a robust method for displaying hydrometeorological data, in many ways similar to the existing WHFS TimeSeries and HydroView station data display control functions. Its benefits are in its more direct methods for displaying desired data sets (i.e., less mouse clicking), its time-stepping features, and its speed of display. A new simplified TimeSeries feature is included with this new data display feature. This feature, dubbed "TimeSeriesLite", is a much scaled-down version of the current WHFS Time Series feature.

A new data monitoring tool was provided which monitors information related to river forecast points, including the VTEC event status. This application is intended to run continuously, with an automated refresh of color coded tabular information to identify alert/alarm conditions. Related to this is an automated application for monitoring differences between river forecast and observations to better identify unreliable forecasts such as when QPF forecasts are inaccurate. This monitoring tool fits within the existing WHFS Alert/Alarm functionality.

Some minor enhancements were also provided, including a new editor interface in HydroBase for the HydroGen support information, a new feature to adjust the icon sizes in HydroView, and new features in the TimeSeries tabular mode for copying forecast time series data and for globally setting quality code attributes.

6.3 PRECIPITATION PROCESSING

Please refer to the January 1, 2006 newsletter supplement for a detailed discussion of the HSEB QPE tasks which are ongoing. Some of this information related to OB7.2 is also mentioned below.

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

domain, solely. In early August, HSEB staff will be visiting CBRFC to demonstrate and discuss the changes.

For OB8, there are some minor existing Daily QC features that still need to be addressed. There is one noteworthy new feature for OB8 and that is the temporal integration of the 6- and 24-hour Daily QC gage data with the 1-hour MPE reports. In many ways, this is similar to the existing disagg and post-analysis functions

HSEB is also working to coordinate the delivery of RFC-generated QPE products to the SBN for subsequent receipt and use at WFOs. Changes were made to make these RFC QPE products displayable in D-2D at WFOs, to complement the locally generated QPE products which can be displayed in D-2D as of OB6.

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

7. AWIPS RELEASE OB8

As of October 2006, the AWIPS prime contractor, Raytheon, is obligated to assume Adaptive and Corrective Maintenance (ACM) responsibility for all of OHD's baseline AWIPS software. This activity begins with the Knowledge Acquisition Process (KAP), slated to start in late July 2006. Related to this is the Source Code Transfer (SCT) task, which will involve transfer of all the OHD AWIPS baseline source code into the PVCS Dimensions configuration management tool operated by Raytheon. These activities will significantly limit OHD's contribution to AWIPS OB8.1 new functionality because considerable labor is required of OHD for these projects.

Last month Donna Page took over SREC voting membership duties from Jon Roe, although the HSEB will continue to play an active support role. The Software Recommendation and Evaluation Committee (SREC) is responsible for the specific release tasking prioritization and scheduling for the primary projects in a given AWIPS release.

For OB8.2 and OB8.3 HSEB has been working closely with OS&T SEC to define our task assignments. For further information refer to the SREC's web site at: http://sec.noaa3.awips.noaa.gov/srec/. Click on the 'Operational Build Information' link.

8. DEVELOPMENT SUPPORT ACTIVITIES

8.1 NEW SOFTWARE ARCHITECTURE

Phase 2 of the contract task to refine and extend The Hydrology XML Consortium (HydroXC) is complete. Two workshops were held, one in February and one in March. The first workshop presented a real world example of using HydroXC-compliant XML to serve flood inundation data from the FLDWAV model to any application that might map those data. The second workshop consisted of presentations by NWRFC and NCRFC on their uses of XML and their

needs as we move toward a third phase of this project. The third phase of work has been defined and will concentrate on crafting tools to manipulate HydroXC-compliant files, tools to convert into and out of HydroXC, and creation of commonly agreed upon object templates. The goal of Phase 3 will be to provide tools that can be used by Consortium members in their operational software as desired. A slightly revised Version 2 of the HydroXC-compliant XML schema definition has been published as a result of the work performed in Phase 2.

On the CHPS front, two new exciting initiatives were begun in June:

- **<u>CHPS Realization Plan Definition</u>**: The purpose of this task is to bring together several thought leaders within OHD and at the River Forecast Centers (RFCs) to define this specific vision and to create sufficiently detailed plans to bring CHPS into daily reality. In June OHD awarded the task to Apex Digital Systems, Inc. Apex will begin the task in July by initiating a "discovery engagement" with all stakeholders.

- **<u>Evaluate FEWS for CHPS</u>**: WL | Delft's DELFT-FEWS software package, developed originally for the U.K. Environment Agency, is based on Service Oriented Architecture (SOA) concepts, and uses technology almost identical to that used for the CHPS Proof Of Concept (POC). OHD believes that the DELFT-FEWS ready-made suite of SOA and modeling capabilities could accelerate CHPS implementation by several years, yielding significant savings for the Government, and providing RFCs with much-needed improvements far sooner than originally envisioned. The purpose of this task is to conduct a pilot study of DELFT-FEWS for NWSRFS.

Manuel Mattke, President & CEO of Apex Digital Systems, Inc., will attend the July 2006 HIC meeting in Kansas City, MO to brief the new CHPS implementation approach with Jon Roe.

A third CHPS-related external project to provide RFCs access to the USACE Reservoir Simulation (ResSim) model from NWSRFS also made good progress this period. In June OHD awarded a contract to Apex Digital Systems, Inc. to lead this effort. Apex plans to make use of WL | Delft's FEWS infrastructure as part of its solution. Over the next several months Apex will be working closely with Rob Hartman, HIC at CNRFC, the USACE's Hydrologic Engineering Center (HEC), and consultants from WL | Delft.

8.2 AWIPS BETA TESTING

The VTEC (Valid Time Event Coding) and NWSI 10-922 features of RiverPro are being tested at field sites beginning in June 2006. This includes evaluation of the OB6-fitted version of the monitoring application RiverMon.

MPE related evaluations are also ongoing or starting soon. The ABRFC is evaluating an updated MPE application with P3 functionality. Because this version requires the OB6 PostgreSQL database server, it is limited to a non-baseline AWIPS system at ABRFC. Upon formal delivery of OB6, the capability to evaluate the integrated application under full operational scenarios will be available. Testing the MPE application with Daily QC features will be conducted at CBRFC beginning in August 2006.

8.3 AWIPS SYSTEM CHANGES

For OB7.1, the AWIPS Software Engineering Group (SwEG) has adopted numerous changes to the AWIPS COTS software. These include changing to the RHEL4u2 operating system version, the gcc 3.4.3 compiler, and the PostgreSQL 7.4.8 database server.

Recent prioritization activities by the AWIPS SREC resulted in a number of recommendations related to AWIPS system configurations. In addition to plans for updating the Redhat Operating System and the COTS application packages, the SREC accepted two high-priority items related to the database. One involves improvements to the performance of the PostgreSQL database in terms of the speed of input and output transactions, and the other provides a redundant feature for the storage of the PostgreSQL database.

9. HYDROMETEOROLOGICAL AUTOMATED DATA SYSTEM (HADS)

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

9.1 HADS SOFTWARE

HADS software modules that drive data acquisition, data translation and routine product distribution have not undergone any changes. However, a significant new utility has been added to the HADS program in which we now have the ability to reprocess raw data as old as 45 days, and redistribute its SHEF messages without negatively impacting the routine real-time performance of the system.

The functional benefits of this utility are:
1. Processing and distributing data for a newly defined site, effectively providing a site's observations from before it was added to HADS.
2. Process data for a site whose GOES assignment was changed which resulted in a period of non-availability.
3. Reprocessing data for a period of time in which a site's message format changed (sensors swapped) and the HADS decoding was not yet in alignment.

This utility is undergoing refinement and it requires manual activation. Typically, we will activate this utility only upon request from a HADS customer.

9.2 HADS DATA NETWORK

The number of defined sites in the HADS network is approaching 12,200 reporting locations (12,179) and we are nearing 2.0 million data values processed per day.

The GOES DCS network continues to expand as new co-operators make use of this efficient communications system. Our newest partner, NOAA's National Estuarine Research Reserve System (NERRS) is now expanding its network of real-time reporting locations to include the

Gulf coast area and the Atlantic seaboard. NERRS data platforms provide an array of meteorological observations as well as a suite of Water Quality measurements.

9.3 HADS Web Portal

Due to ongoing events within NOAA's Environmental Realtime Observational Network (NERON), and its associated developing policies, HADS will no longer provide public access to any observational data originating from NERON sites (Modernized CO-OP / ISOS sites) nor from any of NCDC's Climate Reference Network (CRN) sites. We will continue to provide each site's meta-data details, as they apply to HADS, and the HADS delivery of operational SHEF encoded information from these networks.