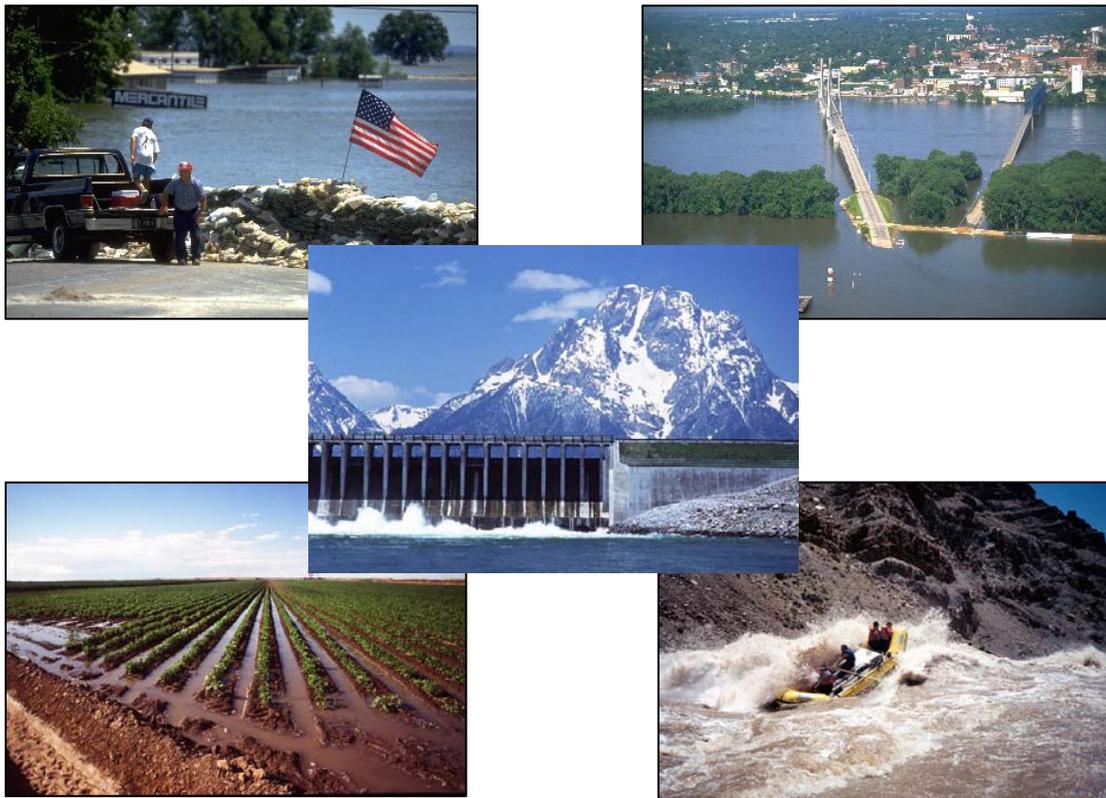




Advanced Hydrologic Prediction Service Quarterly Report 1st Quarter FY 2011



February 01, 2011

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Notes:

- * Project folded into another AHPS project
- + Project on hold; will not be reported on until/unless funding received
- ** Project completed or phased out; will no longer be reported on after this quarter
- *+ Project soon completed; will shortly no longer be reported on

Innovation/Collaborative Research

On-going Competitive and Collaborative Research (Grants and CREST)

Theme: Innovation

Management Lead: Pedro J. Restrepo

Objective: Coordinate the evaluation and management of the collaborative grants program

Milestones

| Task | Due Date | Status |
|----------------------------|----------|--------|
| - None presently defined - | | |
| | | |

1st Quarter FY10

- Projects are on-going. The two river regulation projects will be finishing on Q3. The PIs will give a presentation to the HICs before the HIC meeting.

2nd Quarter FY10

- Forwarded the continuing funding request to the two on-going collaborative projects, and to the NOAA-CREST projects as well

3rd Quarter FY10

- All projects are funded now. Received the draft final report from HRC, and are expecting the one from Aptima any day now.

4th Quarter FY10

- Reviewed and accepted all progress report. Final reports from HRC and Aptima. Progress report from UC-Irvine, U. Arizona and Boise State.

1st Quarter FY11

- Received and reviewed progress reports from UCLA, UC Irvine, U. Arizona, and Arizona State University. Returned all reports with comments. Held a project meeting via teleconference with Boise State University. Their progress report is due shortly.

Problems Encountered/Issues

1st Quarter FY10 – None

2nd Quarter FY10 – None

3rd Quarter FY10 – None

4th Quarter FY10 – None

1st Quarter FY11 – None

OHD – NCEP Coordination

[**Note:** Reporting on project “**THORPEX-HYDRO**” is merged into this project as of FY11 Q1]

Core Goal: Provide, then improve, gridded water resource data production capability and quantify uncertainty of our forecast information

Management Lead: Pedro Restrepo

- Objective:** Coordinate OHD and NCEP hydrologic modeling efforts, including the following objectives
- 1) Accelerate development of reliable and skillful hydrometeorological (precipitation, temperature, and potential evaporation) ensemble forecast products for hydrology and water resources applications (THORPEX-HYDRO project)
 - 2) Fast-track infusion of new and improved hydrometeorological ensemble and probabilistic guidance products into the RFC operations through the EXperimental Ensemble Forecast System (XEFS) to support the Hydrologic Ensemble Forecast Service (HEFS) (THORPEX-HYDRO project)
 - 3) Evaluate the NCEP-OHD National High-Resolution modeling using the 30-year SNOW17/SAC-HT model outputs at the HRAP scale and investigate uncertainties in high resolution water resource products using different land surface models or model physics to support drought and flood monitoring (OHD-NCEP joint project).

Milestones:

FY11 Milestones for Merged Project:

| Task | Due Date | Status |
|--|----------|---------------------------|
| Implement downscaled NAEFS forecasts for Alaska domain, including additional new near-surface variables for CONUS (2m min/max & dewpoint temp, 10m wind speed and direction). (?) | FY11 Q1 | Completed (12/07/2010) |
| Include FNMOC ensemble into NAEFS (NUOPC IOC) | FY11 Q3 | Ongoing |
| Produce verification metrics for RFC-based spatial areas (e.g., RFC areas, main carryover groups, and main forecast groups) for GEFS and NAEFS | FY11 Q3 | Ongoing |
| Evaluate climatology-calibrated precipitation analysis (combined RFC-CPC) datasets over CONUS | FY11 Q3 | Ongoing |
| Implement pseudo-precipitation for ensemble forecasts to convert precipitation into a continuous variable and improve bias correction | FY11 Q3 | Ongoing |
| Test climatological downscaling of NAEFS precipitation forecasts over CONUS. | FY11 Q3 | Ongoing |
| Implement bias correction for NAEFS precipitation forecasts over CONUS. Complete downscaling of precipitation from model grid to NDFD grid using CCPA precipitation over CONUS. | FY11 Q4 | Ongoing |
| Increase resolution for global and regional ensembles. Implement hindcast system that uses the latest version of the data assimilation and numerical modeling system, allowing high-quality bias correction of precipitation and river flow. | FY11 Q4 | |
| Introduce ESRL/NCEP reforecast and hindcast for ensemble control for GEFS using the latest version of the data assimilation and numerical modeling system for improved bias correction of precipitation and river flow. | FY12 | |
| Implement the Bayesian Ensemble Processor for 6-hourly precipitation for NAEFS and SREF to reduce systematic errors | FY12 | |
| Include ECMWF ensembles into NAEFS | FY12 | |

| | | |
|---|---------|---------|
| Collaborate with NCEP EMC and CPC to make use of forecasts and reforecasts from new Climate Forecast System version 2 (CFSv2) in the Atmospheric Ensemble Pre-Processor for XEFS/HEFS | FY12 Q1 | Ongoing |
| Collaborate with NCEP EMC and ESRL to make use of new GEFS forecasts and reforecasts in the Atmospheric Ensemble Pre-Processor for XEFS/HEFS | FY12 | Ongoing |
| Collaborate with NCEP EMC on production and hydrologic evaluation of water resource products at HRAP scale over CONUS | FY11 | Ongoing |
| | | |

Accomplishments/Actions

THORPEX-HYDRO project:

1st Quarter FY10

2nd Quarter FY10

3rd Quarter FY10

- The climatology-calibrated precipitation analysis (CCPA) has been implemented. NCEP produces CCPA products 4 times per day (every 6 hours) around CONUS with various spatial resolutions based on HRAP and NDGD resolutions: 0.125, 0.5 and 1.0 (lat/lon) degree. NCEP has produced CCPA products for these resolutions for at least 8 years.
- Discussed the current activities at NCEP and OHD and future planned activities on 05/25.
- Started to work with NCEP on providing the RFC specific areas for NCEP ensemble verification. This activity has been delayed due to differences in data format between OHD and NCEP and due to the departure of DJ Seo from OHD.

4th Quarter FY10

- Provided NCEP with 3 grids of RFC-specific areas for their calibration and verification purposes.
- Held a NCEP-OHD meeting to discuss recent progress made at NCEP EMC on recent implementation, post-processing, and CCPA datasets.

OHD-NCEP Coordination project:

1st Quarter FY10

- Work in progress.

2nd Quarter FY10

- OHD and NCEP held their regular coordination meetings. Results of the research by Jiarui Dong are now being used by the USGS as well

3rd Quarter FY10

- OHD and NCEP are in the process of preparing the Core project report. No changes on the status of Jiarui Dong's work.

4th Quarter FY10

- Work in progress. New proposals were submitted to OAR to fund the continuation of the Core project, which will include Jiarui's work during FY11 due to the new budget allocation.

Merged project:

1st Quarter FY11

- OHD and NCEP EMC discussed current activities for the THORPEX-HYDRO project on 12/02/2010, including the assessment of CCPA precipitation datasets and SREF ensembles on selected RFC basins.

- OHD and NCEP EMC discussed the high-resolution modeling and hydrologic assessment of SNOW17/SAC-HT model outputs at the HRAP scale on 12/06/2010.

Problems Encountered/Issues

THORPEX-HYDRO project:

1st Quarter FY10

- None

2nd Quarter FY10

- None

3rd Quarter FY10

- The work done at OHD has been delayed due to the departure of DJ Seo from OHD.

4th Quarter FY10

- The OHD activities have been delayed due to the departure of the old HEP group leader, DJ Seo, and appointment of the new group leader, Julie Demargne, which resulted in a shift in responsibilities, and a reduction in time available to work on the deliverables of this project. The collaborative activities between OHD and NCEP EMC will continue in FY11.

OHD-NCEP Coordination project:

1st Quarter FY10 – None

2nd Quarter FY10 - None

3rd Quarter FY10 – None

4th Quarter FY10 – If no funding is forthcoming from OAR to fund Jiarui's work, this task will have to be terminated

Merged project:

1st Quarter FY11 – The funding situation is still unclear. Pedro Restrepo contacted Jin Huang to inquire about the status of the grant proposals. She mentioned that no decision would be made before OAR knew how much funding they would receive.

Quantify Uncertainty (Ensembles)

Hydrologic Data Assimilation

Core Goal: Quantify uncertainty of our forecast information

Management Lead: Julie Demargne (Project Lead: Haksu Lee; previously Yuqiong Liu)

Note: for FY11, this project constitutes a merger of AHPS projects that were reported on individually in FY10 and earlier years, as follows:

- Hydrologic Routing DA
- Snow & Streamflow DA
- DA for RDHM

Please refer to AHPS Quarterly Report for FY2010 Quarter 4 for prior-year details on those projects.

Objective: Develop hydrologic data assimilation (DA) capabilities that can be implemented in the Community Hydrologic Prediction System (CHPS) to support the Hydrologic Ensemble Forecast Service (HEFS).

The DA capabilities are designed to generate optimal initial states for the hydrologic models to produce improved snowmelt and hydrologic forecast outputs. Once implemented in operations, the DA techniques can provide objective guidance for the manual modifications (run-time MODs) done by the forecasters and automate these modifications by using the latest available observations and quantifying various sources of uncertainty to reduce forecast bias and improve forecast skill.

The DA techniques need to be objectively evaluated on selected test basins for both deterministic forecasting and ensemble forecasting to determine the cost-benefit effectiveness for their implementation in CHPS. This evaluation should include the comparison with the techniques used in the current operations to demonstrate the value of these DA techniques. Also the DA techniques need to be compared with statistical post-processing techniques developed for HEFS to establish their individual and combined impacts on reducing and quantifying the uncertainty in the initial conditions and the hydrologic model uncertainty.

The integration of DA techniques in CHPS is based on the open source data assimilation software (OpenDA) developed by Deltares with its partners, with collaborative R&D efforts by Deltares and OHD under the CRADA project. OpenDA provides a generic interfacing protocol for describing the interactions between models, observations, and data assimilation algorithms. Therefore it facilitates the integration and testing of multiple DA techniques using techniques already implemented in OpenDA, thus accelerating the advances of DA capabilities for operational hydrologic forecasting.

This project includes the following tasks:

- 1) Improve the integration of the CHPS-compatible hydrologic routing DA prototype via OpenDA, and evaluate its performance within CHPS for both deterministic and ensemble forecasting by running it as part of the EXperimental Ensemble Forecast System (XEFS) on selected test basins under different conditions. The prototype employs the one-dimensional variational data assimilation technique (or 1DVAR), which assimilates real-time streamflow observations at the upstream and downstream locations over the predefined assimilation (time) window to adjust the three-parameters of the Muskingum routing technique to bring the downstream streamflow simulation (which is a combination of routed upstream flows and local runoff) into better agreement with the downstream streamflow observations. The 1DVAR technique needs to be compared with the operational Lag/K to demonstrate its added value in river flow forecasting. The evaluation of 1DVAR as a part of the XEFS includes the comparison with XEFS statistical post-processing (e.g., EnsPost) to reduce biases in the streamflow ensemble forecasts. This will be coordinated with the project "XEFS Evaluation and Improvement".
- 2) Develop a prototype data assimilator that assimilates streamflow, precipitation, and potential evapotranspiration data into the lumped Sacramento Soil Moisture Accounting (SAC-SMA) and Unit Hydrograph (UH) models to improve streamflow forecasting. The existing prototype data assimilator for the SAC-SMA and UH models employs the two-dimensional variational data assimilation

technique (or 2DVAR), which aims to improve streamflow forecasts by reducing the uncertainty in the initial soil moisture conditions of the SAC-SMA. The existing prototype needs to be expanded to include ensemble data assimilation techniques, such as the Maximum Likelihood Ensemble Filter (MLEF), the Ensemble Kalman Filter (EnKF), and the Ensemble Kalman Smoother (EnKS). This also needs to be expanded to additionally assimilate snow observations into the coupled SNOW17/SAC-SMA system to improve streamflow predictions in snow-dominated basins. The DA capabilities need to be integrated in CHPS via OpenDA and evaluated at test basins for different situations. The snow-streamflow assimilation technique needs to be compared with the regression-based snow updating method that is currently used in the RFC operations, to demonstrate its value.

- 3) Plan the enhancements of the prototype data assimilator for the gridded SAC-SMA to support future operational distributed modeling. The current prototype employs the four-dimensional variational data assimilation technique (or 4DVAR) that assimilates streamflow observations at the basin outlet as well as interior locations, gridded precipitation, potential evapotranspiration, and, if available, in-situ soil moisture observations into the distributed SAC-SMA and kinematic-wave routing models of RDHM to improve streamflow forecasting at the outlet as well as interior locations in a basin. The current prototype needs to be expanded to incorporate ensemble data assimilation techniques (e.g., EnKF, EnKS, MLEF) to more efficiently support ensemble forecasting. This work will leverage the development, OpenDA integration, testing, and enhancements of the DA capabilities for lumped modeling in the two sub-projects described above.

Milestones

| Task | Due Date | Status |
|---|----------|---------|
| Prepare a scientific manuscript on the multi-basin evaluation of DA for RDHM | FY11 Q3 | Ongoing |
| Perform a comparative evaluation of three-parameter Muskingum with operational Lag/K | FY11 Q4 | Ongoing |
| Run the prototype 1DVAR in hindcasting mode in the CHPS environment | FY11 Q4 | Ongoing |
| Evaluate the performance of direct insertion method and EnKF technique in the context of streamflow forecasting via assimilating snow water equivalent data into the SNOW17 | FY11 Q4 | Ongoing |
| Evaluate the performance of 2D-MLEF based on multi-basin simulations | FY11 Q4 | Ongoing |
| Develop and test an on-line timing error estimation procedure for the research prototype DA for RDHM | FY12 | |
| Design and develop a prototype data assimilation code for snow and streamflow DA | FY12 | |
| Generate results from both the regression-based snow updating methods and direct insertion for comparison with those from the snow/streamflow DA prototype | FY12 | |
| Design 2DVAR interface with OpenDA and enhance the 2DVAR code for OpenDA compliance | FY13 | |

Accomplishments/Actions

1st Quarter FY11

- 1DVAR-OpenDA was successfully tested within CHPS, based on the CHPS configuration obtained from ABRFC.
- The new adjoint code of 4DVAR with ability to adjust routing parameters was generated and tested in an attempt to improve the DA performance in the presence of timing errors
- An ensemble Kalman filter (EnKF) code for the distributed SAC was developed. Inter-comparison of the EnKF and 4DVAR performance was carried out for Eldon, OK. The results were presented in the 2010 AGU Fall meeting held in San Francisco, CA.
- An initial performance evaluation of 2D-MLEF (ensemble extension of 2DVAR) was carried

out, based on multi-basin simulations with hydrologic and hydrometeorologic dataset from TX basins in the WGRFC service area. The results were presented in the 2010 AGU Fall meeting held in San Francisco, CA.

- A multiple linear regression (MLR) technique was developed to derive areal snow water equivalent (SWE) data from point SNOTEL measurements. A Principle Component Analysis (PCA) analogous to the regression algorithm of the RFC operational snow updating system was developed. MLR- and PCA-derived SWEs were evaluated against SNOW17-simulated SWE for Stehekin river basin in the NWRFC service area. The direct insertion method was applied to assimilate both MLR- and PCA-derived SWEs into the coupled SNOW17/SAC-SMA model to produce streamflow predictions. The results were presented in the 2010 AGU Fall meeting held in San Francisco, CA.
- The 4DVAR manuscript on simultaneous assimilation of soil moisture and streamflow was revised based on reviewers' comments from *Advances in Water Resources*. The revised manuscript will be submitted to the journal after co-author review.

Problems Encountered/Issues

1st Quarter FY11

- Schedules for DA activities have been adjusted due to Yuqiong Liu's departure in Jan 2011. The new schedule is focused on DA activities for lumped models in support of RFC operations and the development of Hydrologic Ensemble Forecast Service as described in the project "HEFS Phase 1 Implementation".

Snow and Streamflow Data Assimilation

Note: This project has been incorporated under “**Hydrologic Data Assimilation**” as of FY11 Q1

Data Assimilation for RDHM

Note: This project has been incorporated under “**Hydrologic Data Assimilation**” as of FY11 Q1

eXperimental Ensemble Forecast System (XEFS)

[**Note:** The work previously reported under the above title is now being phased into the official, HEFS project work. See the following reports for ongoing work on the operational/software (HEFS) and experimental/science (XEFS) sides of the NWS Ensemble Forecast System:

- HEFS Phase I Implementation
- XEFS Evaluation and Improvement
- Hydrologic Data Assimilation
- Improve Ensemble Forecast Verification and Post-Processing

After this quarter, reporting under this title will be discontinued; see below for history of work FY2008-2010.]

Core Goal: Quantify uncertainty of our forecast information

Management Lead: Geoff Bonnin

Objective: Implement an experimental short-to-long term hydrologic ensemble capability for use by all RFCs and which meets the recommendations provided by the "Design and Gap Analysis" report published May 11, 2007.

Milestones:

| Task | FY08 Due Date | Status |
|--|-------------------------------|--|
| XEFS Phase 1 Implementation: Pass OSIP Gate 1 | FY09 Q2 (formerly FY08 Q2) | See new HEFS template |
| XEFS Phase 1 Implementation: Pass OSIP Gate 2 | FY09 Q3 (formerly FY08 Q3) | See new HEFS template |
| XEFS Phase 1 Implementation: Pass HOSIP Gates 1, 2 and 3 | FY09 Q3 (formerly FY08 Q4) | See new HEFS template |
| XEFS Phase 1 Implementation: Reconcile differences between prototype and operational Ensemble Post Processor (pass HOSIP Gate 3) | FY09, Q2 | HOSIP P-2005-005 "Ensemble Post Processor Evaluation" in Stage 3 |
| XEFS Phase 1 Science Algorithm Development: Pass HOSIP Gate 3 | FY09, Q4 | HOSIP P-2006-010 "Hydrologic Ensemble Preprocessor 3" in Stage 1 |
| XEFS Science Infusion | TBD | HOSIP project P-2005-022 "VAR Verification, Validation & Enhancement" in Stage 3 |
| Integrate prototype Ensemble Preprocessor 3 (EPP3) into CHPS | FY09, Q4 | Completed FY10, Q1 |
| Integrate prototype Ensemble Post Processor (EnsPost) into CHPS | FY09, Q4 | Completed FY10, Q1 |
| Integrate prototype HMOS into CHPS | FY09, Q4 | Completed FY10, Q1 |

Accomplishments/Actions:

1st Quarter FY08

- Budget discussions continued during this quarter.
- On October 19 HSEB submitted a "High Level Analysis and Design" document to the XEFS Implementation Team for review.
- In December HSEB held a meeting to address feedback received on the XEFS document. However the discussion prompted a re-think of the implementation strategy, which will now be based on Delft-FEWS in light of the CAT recommendation for CHPS.

- The HEP group continued its science discovery activities (these are reported under separate projects).

2nd Quarter FY08

- On January 17 the NOAA Hydrology Program Manager announced his approval of the Community Hydrologic Prediction System (CHPS) Acceleration Team (CAT) recommendation to proceed with implementation of the ready-made Deltares software package “Flood Early Warning System” (FEWS) as the infrastructure solution for CHPS. The draft XEFS software design, based on service-oriented concepts, must be adapted to accommodate FEWS as the infrastructure.
- Hence the XEFS implementation project is now heavily dependent on the CHPS implementation project; Deltares expects to play an important role in this effort later in the CHPS project cycle.
- Meanwhile HSEB began converting HSMB HEP’s existing prototype software to the FEWS Pilot environment. The goal is to provide the HEP group with a CHPS environment for familiarization purposes and to facilitate the future ensemble science-to-operations path.
- The XEFS Execution Manager, Chris Dietz, delivered a draft version of the XEFS Implementation Plan to the XEFS Oversight Group for review and discussion; a final version of the plan is expected in Q3. This plan will provide input for the OSIP Gate 1 project plan.
- HOSIP project P-2007-019 has been delayed (refer to problems/issues below).

3rd Quarter FY08

- Preparation activities continued; some interactions with Deltares took place regarding FEWS capabilities
- Completed and delivered FEWS-based prototypes (EPP2, HMOS, etc.) to HSMB. Training provided. Intention is that HSMB will now continue XEFS prototyping activities in a CHPS environment instead of its alternative software structure.
- Completed part of most NWSRFS long-term ensemble components to CHPS. ESPADP will be more complicated; work will begin next quarter.
- The annual Hydrologic Ensemble Prediction Experiment (HEPEX) conference was held in Delft, Netherlands in June. Deltares continues to collaborate with the NWS on hydrologic ensembles.
- Activities related to ensembles capabilities in CHPS are not scheduled to begin until CY 2009.

4th Quarter FY08

- HSEB modified the NWSRFS climate-based ensembles application (ESPADP) to work with CHPS. This is a BOC requirement until XEFS is implemented.
- Hank Herr of HSEB formed a team and conducted an Ensembles Product Generator (EPG) project kick-off meeting on August 29. The goal is to define requirements for the EPG. Hank has begun the task of gathering all known ideas regarding desired ensemble products for users.
- OHD hosted a visit from Albrecht Weerts (Deltares ensembles focal point) during the week of September 8. Albrecht gave presentations and demonstrations of Delft-FEWS; he also reviewed preliminary plans for CHPS-based ensembles. Albrecht documented details for the CHPS Preparation Workshop #2 at NERFC in September (see status report for Core Goal #13 - CHPS).

1st Quarter FY09

- Deltares initiated routine (bi-weekly) conference calls with OHD to define how the requirements for XEFS map onto the FEWS-based CHPS architecture.

2nd Quarter FY09

- New HSEB Project Area Leader started in January: Mark Fresch
- OHD initiated weekly conference calls with XEFS Planning Team which includes members from Deltares, HSD, CNRFC, NWRFC, HSMB, and HSEB.
- Held planning and design discussions with Deltares. Deltares began implementing framework for EPG.
- EPG: completed draft high-level requirements and started Phase 1 design.
- XEFS EPP3 prototype was partially delivered, and integration into FEWS began.

3rd Quarter FY09

- A new and separate AHPS status sheet was created for implementing the Hydrologic Ensemble Forecasting System (HEFS), i.e. implementing new ensemble functionality into the operational baseline.
- The EPP3 prototype code has been nearly completed and model adapters have been written to enable EPP3 to run within CHPS. EPP3 and the model adapters are undergoing integration testing.

4th Quarter FY09

- EPP3 beta testing at CNRFC was delayed a few weeks in order to rebuild EPP3 with the latest FEWS release. EPP3 and the model adapter are being retesting, and the installation instructions are being written.
- Updated HMOS prototype code was completed by HSMB, and the model adapter was updated to enable HMOS to run within CHPS. HMOS and the model adapters are undergoing integration testing.
- Updated EnsPost prototype code was completed by HSMB – no changes to the model adapter are needed. EnsPost and the model adapters are undergoing integration testing.
- The XEFS support web-page was drafted. Next quarter, the Ensemble Verification System will be the first XEFS component provided on that web-page.

1st Quarter FY10

- EPP3, HMOS, and EnsPost and their model adapters passed integration by HSEB.
- The Ensemble Verification System (EVS) was made available for distribution on the HSMB web-page.

2nd Quarter FY10

- We set up beta testing at CNRFC, and continue to provide minor updates to the XEFS components.

3rd Quarter FY10

- We have started CHPS configuration reviews of the different XEFS components, which will make XEFS installation and configuration easier. In addition, we started reviewing and improving the installation procedures and user's manuals and continued to work on the XEFS support web-page.
- HSMB continued testing the XEFS components on test basins at CNRFC and ABRFC as described in the other ensemble projects.

4th Quarter FY10

- OHD updated the model adapters based on the configuration reviews. The next XEFS delivery with these changes is scheduled for November 2010.
- HSMB continued testing the XEFS components on test basins at AB-, CN-, and NW-RFCs as described in the other ensemble projects.

Problems Encountered/Issues:

1st Quarter FY08 - None

2nd Quarter FY08

- Due to the requirement to implement a CHPS-based XEFS, HSEB in-house resources are necessarily focused on development of an operational CHPS before attention can be paid to an operational XEFS. Consequently, HSEB has only 1 software engineer (Hank Herr) assigned to the XEFS project. Deltares resources will not become available to assist the NWS with hydrologic ensemble forecasting until Q4 FY09. This delays the date of providing an experimental hydrologic forecast capability to all RFCs (as part of CHPS) until mid-2011 when CHPS is deployed. Milestones listed above have been adjusted accordingly.

3rd Quarter FY08 - None

4th Quarter FY08 - None

1st Quarter FY09 - None

2nd Quarter FY09

- Some AHPS due dates will need to be adjusted to reflect realistic schedules.

3rd Quarter FY09 – None

4th Quarter FY09

- XEFS prototype code was completed later than scheduled.
- Some XEFS components will need to be rebuilt with each new CHPS and FEWS delivery. Due to the risk and resources associated with beginning of CHPS BOC operations, OHD will likely need to provide more support to RFCs participating in XEFS field tests.

1st Quarter FY10

- The CHPS integrated versions of EPP3, HMOS, and EnsPost await beta-testing by CNRFC.

2nd Quarter FY10

- Beta-testing feedback has been limited.

3rd Quarter FY10 – None

4th Quarter FY10 – None

XEFS Operational Support

Note: This project has been incorporated under “**XEFS Evaluation and Improvement**” as of FY11 Q1

XEFS Implementation

Note: This project has been incorporated under “**XEFS Evaluation and Improvement**” as of FY11 Q1

XEFS Evaluation and Improvement

Core Goal: Quantify uncertainty of our forecast information

Management Lead: Julie Demargne

Note: for FY11, this project constitutes a merger of AHPS projects that were reported on individually in FY10 and earlier years, as follows:

- XEFS Evaluation and Improvement
- XEFS Implementation
- XEFS Operational Support
- Evaluate Climate Forecasts
- Improve Hydrologic Hindcasting

Objective: Improve the components of the eXperimental Ensemble Forecast System (XEFS) to quantify and reduce the atmospheric and hydrologic uncertainties for short- to long-range hydrologic forecasting to support the operational implementation of the Hydrologic Ensemble Forecast Service (HEFS).

The current XEFS includes the following components: 1) an atmospheric ensemble pre-processor prototype to produce reliable and skillful short- to long-term precipitation and temperature ensembles at the basin scale using the RFC operational single-valued forecasts and ensemble forecasts from NCEP's Global Forecast System (GFS) and Climate Forecast System (CFS); 2) the hydrologic processor that propagates the atmospheric uncertainties to the hydrologic outputs via running a suite of hydrologic, hydraulic, and routing models; 3) data assimilator prototypes to produce improved estimates of model initial conditions by assimilating various types of observations of precipitation, evapotranspiration, soil moisture, and streamflow via variational techniques; 4) hydrologic ensemble post-processor prototypes (e.g., EnsPost, Hydrologic Model Output Statistics, and Multi-scale CDF Matching) to produce reliable and skillful hydrologic ensemble forecasts that reflect the hydrologic uncertainty; and 5) the Ensemble Verification System (EVS) to perform comprehensive diagnostic verification of atmospheric and hydrologic ensemble forecasts.

The development and improvement of XEFS requires the evaluation of the individual XEFS prototypes and the end-to-end XEFS through multi-year hindcasting and verification on multiple RFC test basins with different characteristics. Such verification helps identify the factors responsible for model error and skill in different situations and demonstrate how the different XEFS uncertainty components could improve the quality of short- to long-term hydrologic ensemble forecasts. It helps establish the biases present in the forcing and flow forecasts at various temporal and spatial scales, including unconditional and conditional biases from key controls or conditioning variables (e.g., seasonality, precipitation/flow magnitude, forecast time, lead time, basin location and size). Also the XEFS testing includes different RFC pilot projects for the RFCs to test the XEFS prototypes in an operational forecast environment and assess the enhancements necessary to produce hydrologic ensemble products meaningful for diverse applications. To accelerate the implementation of XEFS at the RFCs, the XEFS prototypes have been interfaced with the NWS Community Hydrologic Prediction System (CHPS) through developing CHPS model adapters for the individual prototypes. The improvement of XEFS is also based on the outcome of the Hydrologic Ensemble Prediction Experiment project (<http://www.hepex.org>), which includes international collaborative ensemble research and community test bed projects to advance probabilistic hydrologic forecast techniques and identify the best ways for the user community to utilize ensemble forecasts.

This project will leverage: 1) the development and improvement of hydrologic data assimilation techniques developed in the project "Hydrologic Data Assimilation"; 2) the improvement of the ensemble verification and post-processing techniques from the project "Ensemble verification and post-processing improvements". This project will be coordinated with the project "HEFS Phase 1

Implementation” to support the development of the first operational HEFS at the RFCs.

This project includes the following tasks:

- 1) Evaluate the current atmospheric Ensemble Pre-Processor (EPP) prototype based on multi-year hindcasting using HPC/RFC operational single-valued forecasts and GFS ensemble means for a larger set of RFC test basins (i.e., with various regimes) and for multiple temporal scales (i.e., time steps and forecast horizon, from 6-hr to seasonal). This includes the evaluation of the Schaake shuffle technique for extreme events and the performance of the multi-scale component using different user-defined multi-scale (“canonical”) events. This will establish the baseline performance of EPP-produced precipitation and temperature ensembles.
- 2) Improve the EPP prototype to make use of newly available climate forecasts for the long range (Climate Forecast System version 2 – CFSv2) and weather forecasts for the medium range (Global Ensemble Forecast System) once reforecasts datasets are available for the EPP calibration. This includes the documentation of the upgraded EPP prototype.
- 3) Evaluate the EPP-produced ensembles of precipitation and temperature using the new CFSv2 reforecasts (obtained from NCEP EMC, CPC, and NCDC) and GEFS reforecasts (obtained from ESRL) on selected test basins. This also includes evaluating the quality of the CFSv2 reforecasts and the CPC consolidation forecast products (if forecasts made available by NCEP CPC) to maximize their utility in EPP.
- 4) Evaluate the current hydrologic Ensemble Post-Processor (EnsPost) prototype and the current Hydrologic Model Output Statistics (HMOS) prototype for the short range using a larger set of RFC test basins. These 2 post-processing techniques will be included in the HEPEX post-processing testbed project to be inter-compared with other post-processing techniques.
- 5) Help organize the HEPEX post-processing workshop planned for June 2011 at UNESCO-IHT and coordinate the testbed project (including providing testbed datasets). Present initial results from EnsPost and HMOS at the workshop. Plan for enhancing the post-processing capability of HEFS based on the HEPEX testbed results of the inter-comparison of different post-processing techniques.
- 6) Evaluate the Multi-Scale CDF Matching (MSCM) prototype on these test basins. Develop a unified post-processor prototype that comprises both EnsPost and MSCM and expands the utility of post-processing from the short range to the long range.
- 7) Evaluate the end-to-end XEFS prototype using the current EPP prototype, the hydrologic processor, and the current EnsPost and HMOS prototypes via multi-year hindcasting and ensemble verification using a larger set of RFC test basins. The evaluation will include multiple temporal scales and various forecast scenarios (e.g., different forecast sources for EPP). It will also include the evaluation of the sampling uncertainties in the verification metrics using the experimental EVS-R prototype for confidence intervals. The verification results will be documented in scientific manuscripts for publication in international journals.
- 8) Document the end-to-end XEFS hindcasting in CHPS and support ensemble hindcasting at the RFCs to perform verification using large samples of forecasts.
- 9) Evaluate the end-to-end enhanced XEFS prototype using the latest pre-processing and post-processing prototypes (to be coordinated with the project “Ensemble verification and post-processing improvements”) and the data assimilation prototypes (to be coordinated with the project “Hydrologic Data Assimilation) via multi-year hindcasting and ensemble verification. This includes the analysis of the combined impacts of data assimilation and hydrologic post-processing to reduce and quantify the hydrologic uncertainties.
- 10) Support the integration of XEFS prototypes into CHPS and the development of the operational HEFS; this includes supporting the development of calibration processors and MODs for real-time operations.
- 11) Support the calibration, implementation, and testing of the XEFS prototypes in pilot RFC projects at selected RFCs (AB-, CB-, CN-, NW-, MA-, and NE-RFCs) to expand the XEFS evaluation to an operational environment and improve the RFC experimental ensemble forecasting capabilities.

Milestones

| Task | Due Date | Status |
|---|----------|----------|
| Evaluate EPP prototype using RFC and GFS forecasts to establish its baseline performance | FY11 Q3 | Ongoing |
| Finalize the EPP paper for publication in Journal of Hydrology | FY11 Q1 | Complete |
| Upgrade EPP prototype to make use of new CFSv2 hindcasts and forecasts and document upgraded prototype | FY12 Q1 | Ongoing |
| Evaluate upgraded EPP prototype using CFS and CFSv2 hindcasts to establish its baseline performance at long range | FY12 Q4 | |
| Upgrade EPP prototype to make use of new GEFS hindcasts and forecasts and document upgraded prototype | FY12 Q4 | |
| Evaluate upgraded EPP prototype using new GEFS hindcasts to establish its baseline performance at medium range | FY12 Q4 | |
| Evaluate EnsPost and HMOS prototypes on test basins to establish their baseline performance | FY11 Q3 | Ongoing |
| Prepare a draft manuscript on the HMOS technique and verification of ensemble outputs | FY11 Q2 | Ongoing |
| Evaluate MSCM prototype on test basins and develop unified MSCM-EnsPost prototype to expand post-processing to long-range | FY12 Q1 | |
| Evaluate the end-to-end XEFS prototype using EPP and EnsPost to establish its baseline performance | FY11 Q3 | Ongoing |
| Prepare a draft manuscript on the quality of XEFS ensembles | FY11 Q4 | |
| Document XEFS hindcasting in CHPS | FY11 Q4 | |
| Evaluate the end-to-end XEFS prototype using upgraded EPP, new/enhanced hydrologic post-processors, and data assimilation prototypes to establish XEFS baseline performance | FY12 | |
| Support integration of XEFS prototypes into CHPS and development of operational Phase 1 HEFS | FY12 | Ongoing |
| Support RFC pilot projects | FY12 | Ongoing |
| Support HEPEX project, including post-processing workshop and testbed project | FY12 | Ongoing |

Accomplishments/Actions

1st Quarter FY11

- Released the new ensemble generation and calibration prototype programs for EPP, EnsPost, and HMOS components on 11/15/2010; this included user's manuals for EPP, EnsPost, and HMOS, as well as a report on XEFS performance on selected test basins and for selected forecast scenarios. All documents were made available on the XEFS web page (www.weather.gov/oh/XEFS/).
- Expanded EPP calibration to additional RFC test basins using HPC/RFC operational forecasts and GFS ensemble means. Carried out hindcasting experiments for 4 ABRFC test basins, 5 CNRFC test basins, and 4 NWRFC test basins. Verification results for the GFS-based ensembles were produced for the 24-hr scale up to 14 lead days into the future. The verification results using GFS ensemble means were presented at the 2010 AGU Fall meeting in San Francisco.
- Submitted the final revisions of the EPP manuscript to the Journal of Hydrology for publication.
- Discussed with NCEP EMC and CPC the transition to the new CFSv2 system. Obtained reforecast datasets from NCEP to start working on the monthly CFSv2 datasets available for 10 months into the future. Developed plan to upgrade the EPP prototype to make use of CFSv2 reforecast and forecast datasets.

- Finalized HMOS calibration using the new stratification approach for 6 ABRFC test basins and 5 CNRFC test basins. Provided the RFCs with the calibration parameters to support their XEFS testing.
- Carried out verification of the HMOS hindcasts using EVS for 6 ABRFC test basins and 2 CNRFC test basins. The verification results for the ABRFC test basins are included in the HMOS manuscript, for which a draft is expected by FY11-Q2.
- Expanded EnsPost calibration to 3 ABRFC test basins, 7 CNRFC test basins, and 2 NWRFC test basins. Provided the RFCs with the calibration parameters to support their XEFS testing.
- Carried out hindcasting experiments with EPP, Hydrologic Processor, EnsPost for 5 CNRFC test basins using RFC and GFS forecasts. The verification results of short-term streamflow ensembles from EPP-Hydro-EnsPost and from HMOS for one CNRFC test basin were presented at the 2010 AGU Fall meeting in San Francisco.

Problems Encountered/Issues

1st Quarter FY11

- Schedules for the XEFS activities have been adjusted due to Yuqiong Liu's departure in Jan 2011. All activities will continue to be coordinated with the project "HEFS Phase 1 Implementation" to support the development of the first operational HEFS at the RFCs.

HEFS Phase I Implementation

Core Goal: Quantify uncertainty of our forecast information

Management Lead: Jon Roe, Mark Fresch

Objective: Implement Phase 1 Hydrological Ensemble Forecast Service (HEFS) into the operational baseline. The operational ensemble functionality will be based on prototypes developed and tested in the eXperimental Ensemble Forecast System. The capabilities included in this first operational HEFS will be decided based on high-level requirements and concept of operations created by a team of scientists, software engineers, and RFC forecasters.

Milestones

| Task | Due Date | Status |
|---|-----------|--|
| HEFS Graphics Generator: Pass HOSIP Gate 2 | FY10, Q2 | Milestones and HOSIP project management will be rolled up into new HEFS planning |
| HEFS Graphics Generator: Pass OSIP combined Gate 1/2 | FY10, Q2 | Milestones and HOSIP project management will be rolled up into new HEFS planning |
| Complete the Phase 1 Graphics Generator Implementation | FY10, Q1 | Completed March 2010 |
| Complete the Phase 2 Graphics Generator Implementation | FY10, Q4 | Postponed until a FEWS graphics API is implemented |
| Complete the HEFS high-level requirements and concept of operations | FY 11 Q2? | On going |
| Complete software development project plan for EPP3 and EnsPost | FY11Q3 | On going |
| | | |
| | | |

Accomplishments/Actions

3rd Quarter FY09

- A new HOSIP project P-2009-007 "Implementation of Hydrologic Ensemble Forecast Service (HEFS) passed HOSIP Gate 1 was created to replace HOSIP project 2007-019, Experimental Ensemble Forecasting System (XEFS). The new HEFS project is the implementation of new ensemble related functionality into the CHPS baseline. Whereas XEFS encompasses several experimental ensemble sub-projects. The new HEFS project is an umbrella projects, and as a result, it will not continue through HOSIP. However, the XEFS components ready for implementation into the CHPS operational baseline will be sub-projects of the HEFS umbrella project which will go through HOSIP and OSIP. The Graphics Generator is the first of these sub-projects and also passed HOSIP Gate 1 during the quarter.

4th Quarter FY09

- The Graphics Generator Phase 1 code is nearly complete. An early limited functionality version was provided to the steering team for feedback. The completed Phase 1 code will be released in coming weeks to get feedback from RFCs. In addition, the Graphics Generator Phase 2 requirements were drafted.

1st Quarter FY10

- Additional preliminary versions of the Graphics Generator Phase 1 were made available to RFCs for feedback. Additional Phase 1 functionality was added, and the Graphics Generator was rebuilt using the latest CHPS and IFD releases. Installation instructions were written. More

thorough in-house testing has been done and several minor bugs were fixed. As a result of these activities and on-going testing, the final Phase 1 delivery has been delayed until the end of February.

2nd Quarter FY10

- The Graphics Generator Phase 1 was made available to CAT RFCs at the end of March to provide basic ESPADP functionality. During the next few months, we plan to incorporate minor functionality improvements, bug fixes and improved user documentation based on feedback from RFCs. We will continue to provide monthly updates to incorporate those changes and keep up with FEWS and CHPS releases.

3rd Quarter FY10

- Over the past few months, we've continued to make changes to the Graphics Generator based on feedback from the RFCs, although our release frequency of the Graphics Generator has gone down from once per month to once per quarter. We also tested the Graphics Generator within an operational setting. We started making changes to make the Graphics Generator easier to use, including improving the User's Manual. For the next few months, we'll create plot templates which very closely match ESPADP products and can be automatically applied to all segments. Over the next few months, we will work with Forecast Decision Training Branch to develop Graphics Generator training. In addition, we're working with AHPS Web-Team to compare Graphics Generator and ESPADP output.

4th Quarter FY10

- During the last quarter, OHD has tested and improved the Graphics Generator functionality as an operational replacement to ESPADP with some additional displays for probabilistic information. Recently, we've gotten good feedback from CNRFC and NWRFC and from the NWS Regions through the AHPS web-team. The next delivery of the Graphics Generator (and XEFS) is scheduled for November 2010. Following this delivery, there will be a one-month period to develop must-have changes with a follow-up delivery with those changes in January 2011.
- At the beginning of October, OHD kicked-off the Hydrologic Ensemble Forecast Service (HEFS) project. This project is OHD's first effort to improve the way we plan, develop, and deliver new functionality to the field. It involves the creation of end-to-end packages where everything needed for successful implementation in the field office has been integrated in the package, including scientifically sound, well engineered software, information for dissemination, training, and support.
- The HEFS project has become one of OHD's top priorities and has a firm end date just 3 years away. By late 2013, the project is to be completely operational at NE and MA RFCs and providing data to NYC. A beta version will be provided to NE and MA RFCs by early fall 2013. OHD management, led by Don Cline (HL Lab Chief), is currently having weekly meetings to complete more detailed planning.

1st Quarter FY11

- OHD provided an updated Graphics Generator which included some added functionality requested by RFCs and bug fixes. In addition, OHD and the Forecast Decision Training Branch developed video training for the Graphics Generator and held a ½ day workshop for users at CAT RFCs. Next quarter, OHD will solicit a 'must-have' list of changes from RFCs on using the Graphics Generator as a replacement to ESPADP.
- An HEFS Assessment Team (A-Team) was formed to determine the high level requirements (such as major components) and concept of operations for the HEFS. The team met with the OHD scientists and software engineers to discuss the strengths and weaknesses of the existing prototypes for the different XEFS components and the planned enhancements. A report is expected in Q2-FY11.
- OHD started analyzing computer resources used by the end-to-end XEFS using the existing ensemble pre-processor prototype (EPP3), the existing hydrologic processor (i.e., the suite of hydrologic and routing models that generate hydrologic forecast outputs), the existing hydrologic post-processor prototype (EnsPost). The goal is to estimate computer resource needs for HEFS.

OHD also completed an analysis of FEWS components which could be used in HEFS; this was passed to Deltares for review.

Problems Encountered/Issues

3rd Quarter FY09

- None

4th Quarter FY09

- Extra Graphics Generator coding was needed to provide better usability with the CHPS Interactive Forecast Display (IFD).
- Due to the risk and resources associated with beginning of CHPS BOC operations, the milestone of making the Graphics Generator part of the CHPS baseline may need to be delayed.

1st Quarter FY10

- Due to the high priority nature of CHPS development and migration, little feedback was received from the field and some IFD functionality was not available to the Graphics Generator. As a result, more thorough testing was done, and some IFD functionality was reproduced and customized within the Graphics Generator. In addition, software development activities were underestimated.

2nd Quarter FY10

- The feedback from the CAT RFCs continues to be limited due to the high priority nature of CHPS development and migration.
- The CAT directed that before the Graphics Generator goes into Phase 2, FEWS should be enhanced with an Application Program Interface (API) for common graphics functionality and information which the Graphics Generator and other planned GUIs should use.

3rd Quarter FY10

- The feedback from the CAT RFCs continues to be limited due to the high priority nature of CHPS development and migration.

4th Quarter FY10

- None

1st Quarter FY11

- None

NCEP Collaboration (THORPEX)

Note: This project has been incorporated under “**OHD – NCEP Coordination**” as of FY11 Q1

Compare Post Processors

Note: This project has been incorporated under “**Improve Ensemble Forecast Verification**” as of FY11 Q1

Hydrologic Uncertainty in Extreme Events

Note: This project is on hold, awaiting resources. It will not be reported on after this quarter unless resources received

Evaluate Climate Forecasts

Note: This project has been incorporated under “**XEFS Evaluation and Improvement**” as of FY11 Q1

Gridded Water Resources

Distributed Model - SAC-SMA Parameters

[Note: This project was successfully completed through HOSIP Gate 3 in Nov 2010 and will not be reported on after this quarter]

Core Goal: Provide, then improve, gridded water resource data production capability

Management Lead: Mike Smith

Objective: The objective of FY08 work will be to conduct research on usage of SSURGO data and verify whether the use of the data can improve current SAC-SMA parameter estimation and further our distributed modeling. Download data for various projects. Procedures will be developed to store and process the massive data sets.

Milestones

| Task | Due Date | Status |
|--|----------|-----------------------------|
| Evaluate performance of SSURGO-based and STATSGO based parameters on soil moisture simulation over DMIP 2 basins where data available. | FY09 Q3 | Complete |
| Derive and test a priori parameters by using combination of STATSGO and Curve Number Grids | FY07 Q3 | Complete |
| Complete hydrograph analysis of STATSGO-SSURGO parameters and hydrologic simulations, journal paper and RFC recommendations. | FY09 Q3 | Journal paper in OHD review |
| Derive SSURGO parameters for remaining states of CONUS | FY09 Q3 | Complete |

Accomplishments/Actions

1st Quarter FY08

- Ziya Zhang ran simulations using new parameter sets on 16 basins, and started results analyses for a journal paper which is under preparation.

2nd Quarter FY08

- Ziya Zhang nearly done with analysis of simulations from SSURGO and STATSGO parameters. HOSIP Stage III plan conditionally approved March. Yu Zhang and Seann Reed helped APRFC derive SAC parameters for Hawaii. Yu provided the processing scripts to APRFC. The RFC gathered the SSURGO data and use land use / land cover data from a local university in the absence of the USGS LULC data. Processing nearly complete: now need to aggregate up to 4km scale. Assessed availability of STATSGO and SSURGO data for Puerto Rico and provided this update to SERFC.

3rd Quarter FY08

- Ziya Zhang has completed the comparison of a priori SAC parameters based on SSURGO and STATSGO soil data and analysis of simulations for 16 selected basins using derived parameters. Draft paper has been finished for group members to comment. Results were presented in Spring AGU (2008) meeting and DOH conference. Ziya Zhang started work with Yu Zhang to derive SSURGO based SAC parameters for the rest of CONUS.

4th Quarter FY08

- Ziya Zhang has downloaded available SSURGO data (as well as land cover data) for the rest of CONUS. Started deriving SSURGO-based a priori SAC parameters.

1st Quarter FY09

- Ziya Zhang derived SSURGO-based a priori SAC parameters for 23 states in the scales of HRAP, half HRAP and a quarter HRAP. The result grids only cover CONUS where data are

available so far. Newly derived grids need to be combined with those derived before for the rest of CONUS states.

2nd Quarter FY09

- Ziya Zhang derived SSURGO-based a priori SAC parameters for 23 states and combined with the results for 25 other states after correcting some problems. Applied climate adjustment factors from STATSGO parameters to newly derived SSURGO-based a priori SAC parameters covering CONUS. Filled the missing values from STATSGO-based a priori SAC parameters. A new mask grid is created to tell users whether the value for a specific grid cell is SSURGO-based or STATSGO-based or is water body (as missing values).
- Ziya began work on Puerto Rico SSURGO parameters.

3rd Quarter FY09

- Ziya Zhang has finished deriving SSURGO-based a priori SAC parameters for CONUS and delivered the grids to RFCs and other users to use.
- Ziya Zhang finished a draft paper on the comparison of SSURGO-based and STATSGO-based a priori SAC parameters and their effect on distributed modeling and soil moisture estimates.

4th Quarter FY09

- Ziya Zhang has downloaded raw SSURGO data for all states.
- Ziya Zhang finished revisions to the paper on the comparison of SSURGO-based and STATSGO-based a priori SAC parameters and their effect on distributed modeling and soil moisture estimates based on co-authors' comments.

1st Quarter FY10

- None for this period. Concentrated on DMIP2 related project. Wait for co-authors' comments on the draft paper.

2nd Quarter FY10

- None for this period. Concentrated on DMIP2 related project. Started to revise the paper based on comments from some of co-authors.

3rd Quarter FY10

- None for this period. Concentrated on DMIP2 related project and preparation for the HOSIP meeting. Revised the paper based on comments from some of co-authors.

4th Quarter FY10

- Finalized journal article comparing STATSGO and SSURGO based SAC-SMA parameters and submitted paper to OHD review process
- July 26: Conducted OHD seminar on results of comparing streamflow and soil moisture from the STATSGO and SSURGO derived parameters
- Submitted HOSIP documents in preparation for Gate 3 review.

1st Quarter FY11

- Successfully completed HOSIP Gate 3 (November,2010)

Problems Encountered/Issues

1st Quarter FY08 – None

2nd Quarter FY08 – None

3rd Quarter FY08 – None

4th Quarter FY08

- Disk space problem has been resolved and 150GB of disk space became available. Final

derived SAC parameters may not cover all counties for some states due to the SSURGO data unavailability. These holes can be filled later once the SSURGO data become available

1st Quarter FY09

- Ran out of disk space during the data process. Additional disk space of 100GB was requested. Some of procedures were run twice due to a header error in scripts.

2nd Quarter FY09

- Uncovered a geographic projection problem caused either by HRAP window not being big enough at the beginning (for the case of state Maine) or the initial USGS land cover (1992) as a template was not compatible with 2001 data set (for the case of state Florida). The problem associated with Florida caused extra work of re-processing previously processed data of 25 states.
- Given the climate adjusted parameters, need to recompute the frequency plots of parameters over CONUS for summary paper.
- Scripts and programs used to derive SSURGO parameters for CONUS didn't apply to Puerto Rico due to HRAP coordinates being limited.
- Discovered that OHD does not have the intermediate data on hand containing soil texture data. These data would be good to have for SAC-HT and future parameterization work.

3rd Quarter FY09

- Due to the introduction of a new algorithm to estimate one of the SAC parameters, it's necessary to download raw SSURGO data for all states. Disk space needs to be resolved before downloading and processing the SSURGO data.

4th Quarter FY09

- Summer student hired to download raw SSURGO data departed early; Ziya completed the downloading tasks.

1st Quarter FY10 – None

2nd Quarter FY10 – None

3rd Quarter FY10 – None

4th Quarter FY10 – None

1st Quarter FY11 – None

Distributed Model - Evaluate New Parameter Approaches

[Note: This project was successfully completed through HOSIP Gate 3 in Nov 2010 and will not be reported on after this quarter]

Core Goal: Provide, then improve, gridded water resource data production capability

Management Lead: Mike Smith

Objective: The objective will be to evaluate a parameter regionalization approach for SAC and Snow-17 using lumped calibrated parameters. Value of soil moisture data for evaluation and calibration of *a priori* parameters will be also analyzed.

Milestones

| Task | Due Date | Status |
|---|---------------|----------|
| <ul style="list-style-type: none"> • Derive relationships between lumped calibrated SNOW-17 parameters and watershed properties | Mar. 31, 2005 | Complete |
| <ul style="list-style-type: none"> • Generate SNOW-17 parameter grids over Susquehanna River basin | Apr. 30, 2005 | Complete |
| <ul style="list-style-type: none"> • Evaluate and calibrate derived SNOW-17 parameter grids using snow observations and streamflow | Dec. 30, 2005 | Complete |
| <ul style="list-style-type: none"> • Evaluate <i>a priori</i> SAC-SMA parameters over Oklahoma Mesonet using runoff and soil moisture data at different spatial scales | Sep. 30, 2005 | Complete |
| <ul style="list-style-type: none"> • Initial evaluation of possibility of using soil moisture data to calibrate <i>a priori</i> SAC-SMA parameters | Sep. 30, 2005 | Complete |
| <ul style="list-style-type: none"> • Develop a physically-based procedure to derive <i>a priori</i> values of the most critical SNOW-17 parameters over CONUS | Mar 30, 2006 | Complete |
| <ul style="list-style-type: none"> • Evaluate <i>a priori</i> STATSGO-based SAC parameters over selected regions (e.g., Oklahoma) by comparing to available measurement (e.g., soil moisture, runoff, evaporation) | May 31, 2006 | Complete |
| <ul style="list-style-type: none"> • Analyze effect of climatological PE on the water balance simulation results, and develop a calibration approach of the spatial adjustment of climatological PE grids. Modify HL-RDHM code to incorporate developed PE calibration approach. | FY08 Q4 | Complete |
| <ul style="list-style-type: none"> • Test PE adjustment approach on a large region, e.g., Oklahoma Mesonet using soil moisture data. | FY08 Q4 | Complete |
| <ul style="list-style-type: none"> • Perform calibration of SAC parameters, and analyze their relationships to <i>a priori</i> and climatologic indexes | FY08 Q4 | Complete |
| <ul style="list-style-type: none"> • Test SAC and SNOW-17 derived parameters over uncalibrated areas/basins | FY07 Q1 | Complete |
| <ul style="list-style-type: none"> • Evaluate soil moisture simulations over DMIP2 basins from lumped and distributed models. | FY07 Q3 | Complete |
| <ul style="list-style-type: none"> • Extend analysis and tests of a climate adjustment to <i>a priori</i> parameters (increase time period and basins) | FY09 Q1 | Complete |
| <ul style="list-style-type: none"> • Compare long-term climatologic variables (precipitation, evapotranspiration) to their averages over shorter test periods, and evaluate effect of their differences on the climate adjustment factors. | FY09 Q1 | Complete |
| <ul style="list-style-type: none"> • Test PE adjustment approach to large region i.e., uncalibrated areas/basins from lumped and distributed simulation results. | FY09 Q2 | Complete |

| | | |
|--|---------|--|
| <ul style="list-style-type: none"> Investigate other sources of Snow-17 <i>a priori</i> parameter ranges: use energy budget model results | FY08 Q4 | Complete |
| <ul style="list-style-type: none"> Derive and test first-cut <i>a priori</i> values of Snow-17 parameters SCF and UADJ | FY08 Q4 | Complete |
| <ul style="list-style-type: none"> Evaluate new ZPERC algorithm, provide recommendations to RFCs. Deliver new ZPERC grid. | FY09 Q4 | Complete |
| 1. Finish journal paper on derivation of Snow-17 parameters. Co-author and non-co-author review | FY10 Q1 | Complete |
| 2. Journal paper on derivation of Snow-17 parameters. OHD management review | FY10 Q3 | Submitted to Journal of Hydrometeorology |

Accomplishments/Actions

1st Quarter FY05

- Task 1: Similar analysis was performed for Cont-API model
- Task 4: Runoff and soil moisture data for the Oklahoma Mesonet region are collected.

2nd Quarter FY05

- Task 1. Basic relationships developed.
- Task 2, 3. Completed. Fekadu Moreda and Zhengtao Cui delivered distributed model and all parameter grids to MARFC. Fekadu presented paper on this work at the conference of the International Association of Hydrologic Science (IAHS) in Brazil in April.
- Task 4. Ziya Zhang has acquired and processed fine scale soils data for the Oklahoma areas. Victor completed this task and presented work at the conference of the International Association of Hydrologic Science (IAHS) in Brazil in April.

3rd Quarter FY05

- Victor and Fekadu tested the distributed model for a multiyear period over the OK. Mesonet domain to evaluate against soil moisture estimates from the NLDAS project run by NCEP.

4th Quarter FY05

- Victor extended the analysis of Oklahoma Mesonet simulation results. Developed climate adjustment factor to modify the existing a-priori parameters. A grid of these adjustment factors was developed for CONUS. Testing with OK Mesonet soil moisture justifies again the physics of the modified SAC-SMA model. Hypothesis is that the climate index can improve a-priori parameter identification and thus simplify the calibration of distributed and other models.

1st Quarter FY06

- Developed CONUS data set of *a priori* parameters for Snow-17 based on Eric Andersons initial suggestions.

2nd Quarter FY06

- Ongoing work on evaluation and calibration Sacramento parameters over Oklahoma region and 20 selected river basins. Distributed and lumped approaches are used in these tests. Tests of climate adjustments are ongoing.

3rd Quarter FY06

- Published two papers (IAHS Red Book) on evaluation of *a priori* SAC parameters over the Oklahoma Mesonet region.
- Extended analysis of *a priori* parameter performance over Oklahoma Mesonet basins for lumped-based simulations using runoff and soil moisture measurements.
- Soil moisture measurements were incorporated into the automatic calibration process as an additional performance measure. Preliminary results suggest that the use of soil moisture data can improve a parameter estimation procedure and reliability of model parameters. They are also helpful in manual calibration to be sure that 'good results are achieved for scientifically

sound reasons'.

4th Quarter FY06

- More soil moisture tests were performed at 2 New Mexico sites. These tests led to development of an approach that allowed rescaling of soil moisture states simulated using HRAP scale *a priori* parameters into point soil moisture states by using local soil properties (porosity and wilting point). It has potential for simulation/prediction of soil moisture at a local scale. However, wide range tests need to be performed.

1st Quarter FY07

- SAC-HT: Additional soil moisture tests conducted at the request of New Mexico State researchers (for the Economics Study of the NOAA Water Resources program). The developed approach to rescale soil moisture states simulated using HRAP-scale *a priori* parameters into point soil moisture states by using local soil properties was tested for 48 Oklahoma Mesonet soil measurement sites. These simulations show much higher accuracy at Mesonet sites comparing to just use of HRAP-scale *a priori* parameters without rescaling. This shows promise for end-users to get site-specific soil moisture information during coarse-scale (i.e., 4km grid) executions of the SAC-HT model. End-users can obtain local soil properties from field-collected soil samples or perhaps SSURGO data would be useable.
- Snow-17: Developed CONUS estimates of MF-MAX, MF-MIN using Eric Anderson's recommended ranges modified by topographic attributes such as aspect and forest cover. Delivered estimates to CBRFC. Began testing parameters for selected areas in the Juniata River basin (MARFC).

2nd Quarter FY07

- Developed CONUS Sacramento model parameters from STATSGO data and variable NRCS Curve Number (CN). Parameters developed at 1km and 4km scale. Developed parameters for Maryland to support Baltimore Flash Flood Project with DHM-TF. Began initial evaluation of the STATSGO parameters with/without variable CN.
- Obtained calibrated SNOW-17 parameters of several basins from ED Clark (CBRFC). Started comparing these parameters with *a priori* Snow-17 parameters.
- Updated HOSIP documents to reflect the current status of these tasks.
- Investigators at U. New Mexico report 'promising' results using Victor's soil moisture simulations for an agricultural economics study. Draft journal paper being prepared.

3rd Quarter FY07

- Victor Koren performed analyses and prepared presentation on the use of soil moisture observations for calibration for IUGG conference in Italy, July 2007.
- Reviewed draft report from U. New Mexico: "Exploratory Case Study on the Value of Improving Soil Moisture Forecast Information for Rangeland Management" which showed the value of soil moisture data from the SAC-HT model.

4th Quarter FY07

- Victor completed analysis of using soil moisture data to aid model calibration. Victor developed paper from July IUGG conference and submitted to Journal of Hydrology for publication. Results showed that more consistent SAC model parameters can be developed when using additional data for calibration (not just basin outlet streamflow)
- Received request to provide CONUS 1/8 degree scale SAC parameters for NCEP's North American Land Data Assimilation System (NLDAS) project. This will provide more independent testing and evaluation of the soils-based parameters at a national scale.
- Began testing of *a priori* Snow-17 parameters in western DMIP 2 basins.
- Completed analysis of distributed model soil moisture simulations for DMIP 2. Presented results at DMIP 2 workshop September 10-12, 2007.

1st Quarter FY08

- Evaluated *a priori* grids of MFMAX and MFMIN over DMIP2 basins.
- Processed CONUS-wide NARR wind data and generated monthly climatological grids. A preliminary HRAP grid of UADJ parameter was generated using these climatological grids.

2nd Quarter FY08

- Developed new approach to derive ZPERC SAC parameter from infiltration theory and first principles. Delivered SAC and SNOW-17 parameters for DMIP 2 western basins to NASA for testing in the NASA Land Information System. Monthly UADJ and SCF grids (October through June) have been created for CONUS. They are under evaluation. Used simplified energy-budget snow model equations to derive another set of MFMAX and MFMIN parameters for CONUS: evaluation underway.

3rd Quarter FY08

- Obtained DEM and forest grid to start investigation on a snow-17 parameterization for Alaska
- Completed MFMAX and MFMIN parameters for CONUS with simplified energy-budget snow model and Naoki Mizukami presented the methodology in National DOH conference. The parameter grids were also created at 1/2 HRAP for mountainous regions. Evaluation still underway.

4th Quarter FY08

- Completed the first phase of climate adjustment to a priori PE and SAC-HT parameters. Technical note on this analysis is close to finish. The next step will be application of the adjustment to regional/CONUS a priori grids and testing in lumped and distributed modes.
- Completed preliminary MFMAX and MFMIN grids for Alaska using simplified energy budget model. Next step, ratio of MFMIN to MFMAX needs to be evaluated to refine parameter values for Alaska and possibly for CONUS.

1st Quarter FY09

- Prepared a Technical note of the first phase of climate adjustment to a priori PE and SAC-HT parameters. Generated CONUS grids of adjusted UZTWM and LZTWM parameters. Started tests of the climate adjusted parameters.
- Victor presented his lumped model results with newly derived climate adjusted parameters in dry areas. Presentations made to RFCs and OHD.
- Modified the melt factor parameterization methodology (aforementioned as energy-budget based temperature index model) based on the results of observed snow data analysis. Recomputed MFMAX and MFMIN parameter grids for CONUS (1 hrap, 1/2 hrap, 1/4 hrap) and Alaska (1 hrap). Naoki Mizukami presented the methodology and evaluation in AGU conference. Computed monthly UADJ parameter grid for Alaska.

2nd Quarter FY09

- Revised energy-budget based temperature index model based on documents obtained from Russia. Recomputed MFMAX and MFMIN over CONUS and Alaska based on the revised model. Recomputed UADJ with winter month average wind for CONUS and Alaska. Extend the grid domain to Canadian portion of RFCs. Started evaluation (comparison with lumped parameter, sensitivity tests).

3rd Quarter FY09

- Analyzed sensitivity of streamflow simulation to parameters (MFMAX and MFMIN). Tested scaling effect on simulation, random error effect on simulation. Started writing a separate paper (from SNOW17 melt factor parameterization paper) regarding this analysis.

4th Quarter FY09

- Wrote a report on three major *a priori* parameterization work (MFMAX and MFMIN and UADJ) and delivered it to RFCs along with HRAP-scale parametric grids (CONUS and AK). The majority of the evaluation of *a priori* parameters is based on comparison with SNOTEL observed melt factors. Sensitivity tests (random error effect on simulation) are completed (focusing on MFMAX and MFMIN). More analysis will be performed with journal paper preparation if necessary.
- CONUS STATSGO -based parameters with new climate adjustment delivered to RFCs via FTP site. Also, these parameters are being tested in NCEP's 30yr reanalysis.
- Climate adjustment also applied to the CONUS SSURGO parameters and delivered to RFCs via

FTP site.

1st Quarter FY10

- Finished a journal paper draft on a priori melt factor parameterization method and put it in the OHD internal review process.
- Initial analyses on melt factor sensitivity of distributed hydrologic simulations (streamflow and basin average SWE) were performed using the east folk of Carson basin (one of DMIP2 western basins) and the results revealed ensembles of the simulations with perturbed melt factor grids (100 random error added MFMAX and MFMIN grids) is heavily biased compared to a priori simulation. Currently under investigation on this behavior.

2nd Quarter FY10

- Revised of the journal paper based on Mike's comments.
- For an evaluation of a priori MFMAX and MFMIN parameters, 1) compared basin average a priori parameters with lumped calibrated parameter for 388 CNRFC segments, 250 NERFC segments and 242 Alaska segment (generated a few plots - scatter-plots and CDF). 2) Examined a priori parameter range compared to Eric's recommended range (created a map showing the pixels out side Eric's range). Summarizing the results and will attempt to close this project during the next Quarter.

3rd Quarter FY10

- Submitted the journal paper on melt factor derivation to OHD review on 6/23/2010.
- Prepared for HOSIP Gate III meeting (originally scheduled on July 7th and postponed to August).
- Working on presentation for OHD seminar in July.

4th Quarter FY09

- July 26: Conducted OHD seminar on the derivation of CONUS Snow-17 melt factor parameters
- Prepared for HOSIP Gate 3 meeting in Q1 FY11
- Journal paper in final OHD review by Gary Carter
- Melt factors successfully used for DMIP 2 simulations in the North Fork American River. Streamflow simulations based on these *a priori* parameters compared very well to the other distributed model simulations.

1st Quarter FY11

- Successfully completed HOSIP Gate 3 meeting (November, 2010).
- Submitted paper on Snow-17 *a priori* parameter derivation to Journal of Hydrometeorology.

Problems Encountered/Issues

1st Quarter FY05 - None

2nd Quarter FY05 – None

3rd Quarter FY05 – None

4th Quarter FY05 - None

1st Quarter FY06 – None

2nd Quarter FY06 - None

3rd Quarter FY06 - None

4th Quarter FY06

- Planned work delayed to work on SnowMIP and New Mexico soil moisture simulations to support Water Resources Economics study. However, the use of soil moisture in the auto-calibration process and a technique of relating point-to-grid soil textures from the New Mexico

work will lead to better calibrated parameters to use in the analysis of a climatological adjustment.

1st Quarter FY07

- Delays again due to additional tests requested by the New Mexico Economics study.

2nd Quarter FY07 - None

3rd Quarter FY07

- Hydro group currently managing over 30 projects; OHD prioritization needed to reduce workload.

4th Quarter FY07

- PE adjustment of parameters delayed due to Cold Regions workshop, DMIP 2 gridded data derivation for FY07 OHD AOP item, results analysis, preparation of OHD Science Plan, and other projects.
- Fekadu Moreda leaving Hydrologic Modeling Group to join River Mechanics group. Fekadu worked on the *a priori* estimates of the Snow-17 parameters. Replacement won't start until November 13, 2007

1st Quarter FY08 – None

2nd Quarter FY08

- Testing of *a priori* Snow-17 parameters SCF and UADJ delayed due to group turnover and need to analyze DMIP 2 precipitation data sets for HMT testing.

3rd Quarter FY08 – None.

4th Quarter FY08 – None

1st Quarter FY09 – None

2nd Quarter FY09 – None

3rd Quarter FY09 – Issue with SCF parameterization - difficulty in relating physical basin characteristics and parameter values. Hold off this task. Slight delay due to new DMIP2 QPE analysis, Red River flooding investigation

4th Quarter FY09 – None

1st Quarter FY10 – None

2nd Quarter FY10 – SNOW-17 melt factor uncertainty analysis was postponed based on the discussion with Geoff, Mike and Naoki. Plan to prepare for new HOSIP project as a separate project and resume the analysis.

3rd Quarter FY10 – None

4th Quarter FY10 – None

1st Quarter FY11 – None

Auto Calibration for Distributed Model

Core Goal: Provide, then improve, gridded water resource data production capability

Management Lead: Mike Smith

Objective: The objectives of this work include developing tools and procedures for auto-calibrating the HL-RDHM to generate parameters for the AWIPS DHM delivered in OB7.2. Two phases are identified for this area of research. First, initial work will focus on auto-optimization of the scalar multipliers of all the gridded parameters (SAC, Snow-17, and routing) so that all parameters are adjusted uniformly. This was done manually in DMIP 1 with good success. A prerequisite for this work is the development of sound lumped hourly parameters. Second, future funding will support work to optimize individual gridded parameters for groups of grids.

Milestones

| Task | Due Date | Status |
|---|----------|---|
| 1. Investigated separate procedures for elevation zones for mountainous areas. | TBD | On hold |
| 2. Develop outline for overall strategy for distributed model calibration | TBD | On hold |
| 3. Develop approach for auto calibration of elevation zone parameters; parameter limits, and routing model parameters | TBD | Delayed to put HL-RDHM components into FEWS |

Accomplishments/Actions

1st Quarter FY10

- Various bugs fixed in the auto calibration routine: most notable was the improper handling of scalar multipliers.
- Hydro group developed and presented AHPS/WR proposal to investigate U. Arizona's parameterization (regularization) approach and to explore their MATLAB version of HL-RDHM containing multi-objective calibration routines.
- Mike evaluated the uncalibrated and calibrated results of DMIP 2 in the Oklahoma basins. Results indicate that the strategy used for HL-RDHM works well. Other results from DMIP 2 show that if a model does not perform well with initial parameters, then calibration alone cannot greatly improve its performance compared to other DMIP 2 models.

2nd Quarter FY10

- Hydro group met with JJ Gourley to discuss his results of using the global optimization approach Differential Evolution Adaptive Metropolis (DREAM) autocalibration approach with HL-RDHM on the Tar River basin. JJ also ran SLS and manual calibration. His results show that parameter limits are important. DREAM has promise but takes a very long time. Hydro group provided guidance on the proper order of parameters for SLS. JJ will follow the guidance as the Tar Basin is re-calibrated on a sub-basin basis. Hydro group also provided guidance on how to use the 'calb' versions of the SAC and routing models to reduce the autocalibration run times with DREAM.
- Portions of the FY-10 AHPS/WR proposed projects were approved for incorporation even though not specifically funded: parameter limits will be examined in the FEW/CHPS version of HL-RDHM and autocalibration. Also, an approach for manually adjusting the routing parameters (similar to the ICP Percolation Analysis) will be investigated in FEWS.

3rd Quarter FY10

- Analysis of DMIP 2 results shows that several of the uncalibrated HL-RDHM simulations have better statistics (correlation, bias) than simulations from other calibrated distributed models from DMIP 2 participants. This highlights the importance of *a priori* parameters in the implementation

of the distributed model.

4th Quarter FY10

- Basic HL-RDHM components migrated to CHPS/FEWS. A data flow path was developed to facilitate efficient multi-year calibration runs in the CHPS/FEWS framework.

1st Quarter FY11

- None this quarter

Problems Encountered/Issues

1st Quarter FY10

- Limited work as HL-RDHM components are being migrated to FEWS environment.

2nd Quarter FY10

- Limited work as HL-RDHM components are being migrated to FEWS environment.

3rd Quarter FY10

- The development of a strategy for distributed model calibration may need to be coordinated via the to-be-formed Distributed Modeling Investment Team.

4th Quarter FY10

- Limited work as HL-RDHM components are being migrated to FEWS environment.

1st Quarter FY11

- None this quarter

Distributed Modeling Spatial Display and Analysis Tool (DHM-SDAT)

Note: This project has been incorporated under “**Distributed Hydrologic Model with Threshold Frequencies (DHM-TF)**” as of FY11 Q1

Distributed Model Intercomparison Project (DMIP II)

[Note: Reporting on project “Calibration - Complete IDMA Study” is merged into this project as of FY11 Q1]

Core Goal: Provide, then improve, gridded water resource data production capability

Management Lead: Mike Smith

Objective: Develop then Refine Gridded Water Resources Products.

Milestones

| Task | Due Date | Status |
|---|----------|---|
| 1. Complete analysis of simulations from the Oklahoma experiments | FY-10 Q4 | Completed |
| 2. Submit Oklahoma basin papers for DMIP 2 Special Issue | FY10 Q3 | Submitted to OHD review August, 2010 |
| 3. Design OK forecast mode experiment (this experiment postponed) | FY09 Q1 | withdrawn |
| 4. DMIP 2 Western Basin Experiments: generate and analyze basic (w/o HMT data) distributed and lumped simulations | FY10 Q4 | Complete |
| 5. Finalize the 'basic' (non-HMT) gridded QPE and QTE data and make available to DMIP 2 participants. | FY10 Q2 | Complete |
| 6. Complete analyses of participants' western basin 'basic' simulations. | FY10 Q4 | Interim analysis of submitted simulations completed |
| 7. (Jointly with Hydrometeorology Group) Support ESRL and NSSL in the derivation and evaluation of the HMT products for DMIP 2. | FY10 Q4 | On track |
| 8. Deliver to DMIP 2 the HMT advanced data for 2005-2006 with new modeling instructions. | FY10 Q4 | Withdrawn as DMIP 2 is officially over |
| 9. OHD support for DMIP 2 participants | FY10 Q4 | Complete |
| 10. Submit overview and results papers for DMIP 2 Western Basin experiments | FY-11 Q4 | On track |
| 11. Develop and deliver recommendations on the use of biased and inconsistent precipitation data | FY10 Q4 | Delaved to FY11 Q2 |

Accomplishments/Actions

Calibration - Complete IDMA Study project:

1st Quarter FY10

- Completed QC of NCDC data for North Fork American River and began QC of data for East Fork Carson River. Encountered many cases of -999 values that should be -998.
- Mike Smith gave a presentation to the HMT leaders on the impact of not correcting the problems with the NCDC data. Daily precipitation values that can't be time-disaggregated by the new Calibration MAP preprocessor are put into one hour of the station time series and can create 'bull's-eyes' in the resultant MPE hourly grids and lead to anomalous hydrograph peaks.

2nd Quarter FY10

- Mike and Hydrogroup completed the data QC for the DMIP 2 Western Basins. Analyses show that the correct time distribution of daily station precipitation totals is very important when deriving gridded historical hourly QPE fields. Such non-distributed daily values cause anomalous hydrograph rises which calibration can't correct. NCDC station data erroneously

flagged as missing (-999) when the values are missing accumulations (-998) should also be corrected.

- Naoki Mizukami revised his paper on identifying and diagnosing non-stationarities in gridded precipitation forcings. This paper is the result of analyzing the flawed initial QPE data for DMIP 2.

3rd Quarter FY10

- Mike analyzed the HL-RDHM simulations in DMIP 2 that used biased QPE data from 1993-1996 in ABRFC. Results indicate that the HL-RDHM model calibrated using this data with known biases generates biased simulations compared to the model calibrated with the 1996-2002 ABRFC QPE data. This was one of the DMIP 2 Oklahoma basin experiments.
- Naoki completed all reviews of his western basin QPE paper and submitted to OHD for review. Favorable comments were received from Pedro. This paper deals with the impact of biased and non-stationary data in mountainous areas.

4th Quarter FY10

- Naoki completed all reviews of his western basin QPE paper and submitted to the Journal of Hydrometeorology.
- DMIP 2 Oklahoma results paper submitted to OHD management for review. The paper contains the results of the experiment to calibrated distributed models with inconsistent data.

1st Quarter FY11

- Naoki presented a poster at the AGU in San Francisco on the analysis of Western basin gridded QPE data consistency.

DMIP II project:

1st Quarter FY10

- Hydro group continued to make progress with a new method for deriving hourly gridded gauge-only QPE fields. Zhengtao Cui made several modifications to the Calibration MAP preprocessor: it outputs hourly times series at each station, it flags non-distributed daily values over 0.5" in depth. Zhengtao wrote a script to time-disaggregate the flagged values uniformly over a user-specified time interval of say 12 or 24 hours.
- Feng Ding created gauge-only gridded QPE fields for the North Fork American and the East Fork Carson basins.
- Mike Smith announced to the RFCs the availability of the modified MAP code and the use of MPE to create historical gridded hourly precipitation fields. NWRFC began using the approach and requested several updates which Zhengtao performed. They derived gridded 6-hour historical data sets for their entire RFC domain.
- Ziya Zhang performed QC of NCDC and Snotel data for the Carson basin. He downloaded and processed precipitation data for 68 stations in and around Carson River Basin used as input to MAP and MPE. Manually quality controlled procedures have been done and xmrq grids have been generated. Ran HL-RDHM and stat_q programs to check consistency of generated precipitation data.
- He began evaluating the QPE grids via cumulative plots and runs with HL-RDHM. Initial tests indicate the data and approach to deriving gridded QPE are sound
- Mike completed the data QC of the North Fork data (300 corrections in 20 years). The goal here is to provide guidance to the RFCs on how much data QC is needed when deriving hourly gridded QPE fields.
- Brian Cosgrove used Google Earth display software developed for the DHM-TF project to display gridded precip fields to analyze errors in the time distribution of NCDC and SNOTEL data. Mike announced that the RFCs could use this tool as well.

2nd Quarter FY10

- Hydro and Hydromet groups finalized the revised QPE for the DMIP 2 western basins. They followed CNRFC guidance and re-generated the QPE using the 1971-2000 high resolution PRISM climatology to generate the grids. Mike announced the restart of DMIP 2 western basin

experiments and the new data and documentation were placed on the DMIP 2 web pages. To date, the following institutions will participate in the western basin experiments: 1) Hydrologic Research Center with K. Georgakakos, 2) CEMAGREF, France with Vazken Andreassian, 3) NCEP/EMC with Jairui Dong, and 4) U. Washington with Jessica Lundquist. CEMAGREF and U. Washington are new participants.

- Hydro group analyzed the QPEs derived using the 1961-1990 and 1971-2000 PRISM data: the later period seems to result in different precipitation patterns. Results were sent to CNRFC.
- NWRFC tested the DMIP 2 gridded QPE approach (Calb MAP and MPE) for their CHPS forcings evaluation. They developed 50 year gridded 6hour and daily QPEs with the method.
- Hydro and Hydromet groups coordinated with HMT on the processing of the 2005-2006 'gap-filling' radar data.
- As a by-product of the derivation of using the Calibration MAP preprocessor and MPE, Mike looked at the Calibration MAT code to see if the station time series of 6-hour temperatures could be written out and used as input to a gridded interpolation algorithm.
- Mike processed remaining non-OHD papers for the Journal of Hydrology Special Issue on the Oklahoma Experiments. Only one non-OHD paper remains.
- Mike, with help from the Hydro group, resumed work on the DMIP 2 Oklahoma overview and results papers.

3rd Quarter FY10

- Mike, with help from the Hydro group, analyzed the results of the routing experiment and experiment for calibration with biased data. Mike finished a draft version of the DMIP 2 Oklahoma overview results paper and sent it to ABRFC and all participants for review June 23. Comments received from received from several participants. Mike revised the results paper for submission to OHD review by Aug 2.
- Hydro group provided support to CEMAGREF, U. Washington, and others for data processing for the western basin experiments.
- Victor Koren began recalibrating HL-RDHM for the East Fork of the Carson River basin using the revised QPE data.
- Ziya set up Eric Anderson's lumped models for the Carson Basin to generate final lumped simulations for analysis.
- Mike and Naoki made several runs of HL-RDHM to compare to lumped simulations.
- As Guest Editor, Mike completed all the non-OHD paper reviews for the DMIP 2 Special Issue of the Journal of Hydrology.
- The Hydromet group developed three QPE cases for two events from the 2005-2006 HMT West season: radar only (88D), gauge only, and radar-gauge mosaic. Naoki successfully generated HL-RDHM simulations with the three cases and compared to the HL-RDHM simulation with the QPE from the dense DMIP 2 data set. The preliminary results indicate that the radar-gauge mosaic QPE led to the best simulation of the flood event. This was a milestone for a HMT-West: to evaluate the QPE methodology for two events before processing the entire 2005-2006 data period.
- Mike presented a paper at the ASCE EWRI conference in Rhode Island on the derivation of historical gridded QPE fields for mountainous areas. Presentation was later given to RFCs via GoToMeeting.
- Mike and Zhengtao Cui worked on modifying the MAT calibration preprocessor to write out station 6-hour temperature time series for input to a grid interpolation program for historical gridded QTE generation.

4th Quarter FY10

- Mike and Zhengtao worked on modifying the MAT calibration preprocessor to write out station 6-hour temperature time series for input to a grid interpolation program for historical gridded QTE generation.
- Mike conducted OHD seminar on derivation of historical gridded QPE July 26
- Hydrology Group received and analyzed simulations from six institutions (U. Bologna Italy, CEMAGREF France, U. Valencia Spain, U. Ca. Irvine, U. Washington, and OHD). The Hydrologic Research Center and NCEP/EMC are finalizing their simulations. NCEP/EMC is generating gridded runoff volumes to be routed using HL-RDHM.

- Hydrology group performed an interim analysis of the results and submitted the report to OHD management and later to CNRFC.
- Mike, Julie Demargne, Naoki Mizukami, and Andy Wood (DOH, CBRFC) finalized plans for a session on Advances in Hydrologic Forecasting at the Fall Meeting of the AGU in December, 2010.
- Hydrology Group submitted the overview and results papers for the Oklahoma Experiments to OHD management for review.
- DMIP 2 officially ended as a project on September 30, 2010.

1st Quarter FY11

- Mike presented an overview of the Western Basin results at the HMT-West meeting October 6 and 7.
- Mike presented the Western Basin DMIP 2 results in a poster at the Fall AGU in San Francisco. The poster was sent to all DMIP 2 Western Basin participants for comments.
- Mike received comments from Geoff Bonnin on the DMIP 2 Oklahoma results paper. The overview paper for the Oklahoma experiments was approved by OHD.
- Mike Julie Demargne, Naoki Mizukami, and Andy Wood (DOH, CBRFC) chaired a session at the AGU meeting on Advances in Operational River Forecasting. Rob Hartman gave an invited oral presentation on hydrologic forecasting in mountainous areas.
- Analyses continued of the OHD distributed model simulation improvements compared to the lumped model in the North Fork American. The analyses for three events show that the OHD distributed model improvement is from the generation of more runoff due to better modeling of the rain/snow line. The Hydrology Group began the analysis of the HMT 'precipitation type on the surface' grids for 2005-2006.
- The DMIP 2 methodology for generating hourly 4km gridded QPE data sets was considered for inclusion into the AOR project.

Problems Encountered/Issues

Calibration - Complete IDMA Study project:

1st Quarter FY10

- Group leader review of Naoki's paper delayed.

2nd Quarter FY10

- None

3rd Quarter FY10

- None

4th Quarter FY10

- None

1st Quarter FY11

- Delays by the Journal of Hydrometeorology in the review of the Western basin QPE analysis paper (4 months).

DMIP II project:

1st Quarter FY10

- Longer than expected time required to QC the NCDC data for both the American and Carson basins.

2nd Quarter FY10

- None

3rd Quarter FY10

- Delays in delivery of HMT West QPE data
- Delays requested by DMIP 2 participants to submit simulations. Deadline was Aug 15. Late submission of simulations will allow for only a preliminary analysis of results by Q4. Full analysis of results will occur in FY11.

4th Quarter FY10

- Delays in delivery of HMT West QPE data
- Delays by HRC and NCEP/EMC in submitting simulations for the western basin experiments.

1st Quarter FY11

- Delays in the OHD review of the DMIP 2 Oklahoma experiment results paper (5 months).
- Delays in the delivery to OHD of the HMT-West advanced QPE from the 'gap-filling' radars.

Support Distributed Model Implementation

Core Goal: Provide, then improve, gridded water resource data production capability

Management Lead: Mike Smith

Objective: Provide training and support to RFCs as necessary to support implementation for river, flash flood, and new product forecasting.

Milestones

| Task | Due Date | Status |
|---|----------|--------|
| 1. Provide training and support to RFCs as necessary to support implementation for river, flash flood, and new product forecasting. | Ongoing | |

Accomplishments/Actions

1st Quarter FY10

- Zhengtao made multiple bug fixes to HL-RDHM per field and OHD researcher requests. These were put on the AWIPS LAD for availability to the RFCs. He and Victor fixed a bug in the auto-calibration routine in which the scalar multipliers were not stored correctly.
- Zhengtao was nominated by one of the RFCs for his 'tireless' efforts to support their distributed model implementation.
- Zhengtao assisted OHRFC with getting HL-RDHM to run the Snow-17 model in their area.
- Zhengtao assisted CBRFC with a routing problem.
- Zhengtao located the source of slowness when running HL-RDHM over CONUS at NOHRSC. He fixed the bug and now a 6-hour run of HL-RDHM over CONUS at an hourly time step takes under 5 minutes when before it was 88 minutes.

2nd Quarter FY10

- Incorporated surface water freezing option into HL-RDHM and provided to NCRFC for a potential use for the Red River flood prediction scenarios
- Brian provided RFCs with updated scripts to process the USGS flow measurements for deriving *a priori* routing parameter estimates.
- Victor and Zhengtao provided assistance to John Halquist on CONUS executions of the SAC-HT.

3rd Quarter FY10

- Victor and Zhengtao resolved problems with RFC wide runs of HL-RDHM at NCRFC. Scott Stockhaus is implementing GFFG and needed to run HL-RDHM over a long period to get states correct. Scott reported that the issue were resolved
- Hydro group provided guidance to John Halquist for CONUS runs of HL-RDHM.
- Zhengtao and Mike worked on MAT preprocessor to write out 6-hour temperatures per request of NWRFC.

4th Quarter FY10

- Zhengtao and Mike finalized the modified MAT code and sent it to NWRFC for testing. They provided several bug fixes and guidance to NWRFC.
- Zhengtao developed and delivered the configuration files for two basins in ABRFC for the CHPS/FEWS version of the basic HL-RDHM components. Zhengtao worked with Eric Jones to select the basins and derive the configuration files.

1st Quarter FY11

- The Hydrologic Modeling Group provided support to CBRFC to move to 1km grid modeling for better modeling with Snow-17 in steep terrain.

- Zhengtao Cui provided support to ABRFC in the CHPS handling of static gridded parameters.

Problems Encountered/Issues

1st Quarter FY10

- None

2nd Quarter FY10

- None

3rd Quarter FY10

- NCRFC reported problems running HL-RDHM for a two year period. The problems were resolved

4th Quarter FY10

- None

1st Quarter FY11

- None

Migration of HL-RDHM Components to CHPS

Core Goal: Provide, then improve, gridded water resource data production capability

Management Lead: Mike Smith

Objective: This proposal covers work to implement the basic HL-RDHM components into the CHPS/FEWS architecture. Work began in FY-09 but funding did not begin until FY-10

Milestones:

| Major Task | Due Date | Status |
|---|----------|----------------------------|
| 1. Performance testing, prepare for and conduct Gate 4 | FY11 Q1 | Complete except for Gate 4 |
| 2. Implement SAC-HTET into CHPS HL-RDHM | FY11 Q4 | On track |
| 3. RFC testing of CHPS HL-RDHM | FY11 Q3 | On track |
| 4. Submit a journal article describing the change in the evapotranspiration processes of SAC-HT | FY11 Q4 | On track |

Accomplishments/Actions

1st Quarter FY10

- Developed JNI codes
- Added HL-RDHM basic components

2nd Quarter FY10

- Design review with Geoff Bonnin, Jon Roe, Peter Gijsbers, Zhengtao Cui, Lee Cajina, and Mike Smith. The group approved the use of a separate data flow path for multi-year calibration runs.
- Developed general adaptor to convert NetCDF files to XMRG' files.

3rd Quarter FY10

- Design workflow schemes and configuration files for various distributed model simulation scenarios

4th Quarter FY10

- Successfully completed Gate 3 meeting September 22, 2010
- Zhengtao Cui developed FEWS configuration files for two basins in ABRFC to help Eric Jones implement and test the FEWS version. Delivered the configuration files and provided updates and assistance to Eric Jones.
- Zhengtao began performance testing of the real-time data flow option involving converting xmrgr input grids to the native FEWS gridded format.
- CBRFC offered to test the FEWS version starting in the November 2010 time frame.

1st Quarter FY11

- Zhengtao Cui and Victor Koren began work to implement SAC-HTET into CHPS as a component for gridded distributed modeling.
- Zhengtao provided ESRL with CHPS version of HL-RDHM to work on HMT-West follow-on project using WARF QPF.
- Victor and Mike began writing journal papers on the SAC-HT and the SAC-HTET. These will be written as companion journal articles.

Problems Encountered/Issues

1st Quarter FY 10

- None

2nd Quarter FY10

- None

3rd quarter FY10

- Discovered the need to modify HL-RDHM codes so that error messages were passed to FEWS. Zhengtao performed the necessary coding to facilitate this.

4th Quarter FY10

- None

1st Quarter FY11

- Testing at ABRFC of CHPS HL-RDHM components delayed until the RFC gets to a good point in its CHPS operational transition. This will delay the HOSIP Gate 4 meeting.

Hydrologic Verification

Improve Hydrologic Hindcasting

Note: This project has been incorporated under “**XEFS Evaluation and Improvement**” as of FY11 Q1

Improve Hydrologic Forecast Verification Strategies

Note: This project has been incorporated under “**Ensemble Forecast Verification and Post-Processing Improvement**” as of FY11 Q1.

Ensemble Forecast Verification and Post-Processing Improvements

Core Goal: Verify our forecast and uncertainty information

Management Lead: Julie Demargne (Project Lead:James Brown)

Note: for FY11, this project constitutes a merger of AHPS projects that were reported on individually in FY10 and earlier years, as follows:

- Improve Ensemble Forecast Verification
- Improve Verification Strategies
- Compare Post-Processors

Please refer to AHPS Quarterly Report for FY2010 Quarter 4 for prior-year details on those projects. Activities described below are coordinated with the activities of the project “XEFS Evaluation and Improvement”.

- Objective:**
- 1) Conduct a systematic evaluation of hydrometeorological ensemble forecasts from different forecasting models and across several climate regions to help improve the atmospheric Ensemble Pre-Processor (EPP) component of the Experimental Ensemble Forecast System (XEFS). Including:
 - ⇒ to undertake verification of the SREF and GEFS precipitation forecasts in order to evaluate and improve the Eastern Region Meteorological Model Ensemble Forecast System (MMEFS).
 - ⇒ to evaluate the sampling uncertainties of the verification metrics using the experimental prototype for confidence intervals.
 - ⇒ to document the results in a scientific manuscript for publication in international journals.
 - 2) Based upon comprehensive verification of the temperature and precipitation forcing ensembles from the XEFS (see project “XEFS Evaluation and Improvement”), identify, improve, and evaluate appropriate techniques for bias correcting these forcing ensemble forecasts. Including:
 - ⇒ to evaluate the indicator co-kriging (ICK) statistical post-processor for a large sample (30 years) of precipitation ensemble hindcasts from the GEFS.
 - ⇒ to extend the ICK post-processor to allow for space-time ensemble generation.
 - ⇒ improve the objective function in the ICK post-processor to reduce the type-II conditional biases; investigate the Conditional Bias Penalized Kriging technique of D-J Seo as a possible means to reduce the conditional biases.
 - ⇒ to compare the ICK technique with other statistical post-processors (including EPP) for bias correcting precipitation ensemble forecasts in selected study basins across different climate regions.
 - ⇒ to document the results in scientific manuscripts for publication in international journals.
 - 3) Based upon comprehensive verification of the XEFS streamflow ensemble forecasts (see project “XEFS Evaluation and Improvement”), including dynamical ensembles generated by the ESP-type approach and statistical ensembles generated by Hydrologic Model Output Statistics (HMOS), identify, improve, and evaluate appropriate techniques for bias correcting these streamflow ensemble forecasts. Including:
 - ⇒ to evaluate the indicator co-kriging (ICK) statistical post-processor for streamflow ensemble hindcasts from selected basins with river regulations.
 - ⇒ to compare the ICK technique with other statistical post-processors (including EnsPost and HMOS) for bias correcting streamflow ensemble forecasts in selected study basins across different climate regions.

- ⇒ to extend the HMOS technique with single-valued predictors from multiple hydrologic models and to evaluate the multi-model HMOS for test basins in the MARFC using forecasts from the SAC and Continuous API models.
 - ⇒ to help coordinate the HEPEX post-processing testbed activities (in collaboration with John Schaake and others) on comparing statistical post-processors for single-valued and ensemble streamflow forecasts, including a planned workshop at UNESCO-IHT in June 2011.
 - ⇒ to document the results in scientific manuscripts for publication in international journals.
- 4) Develop and evaluate methods for quantifying the sampling uncertainties of various ensemble verification metrics (e.g. through confidence intervals), focusing on the metrics available in the EVS. Including:
- ⇒ to develop an improved prototype for computing confidence intervals for the EVS verification metrics.
 - ⇒ to develop improved prototype displays for the sampling uncertainties surrounding the EVS metrics.
- 5) Develop additional, simple, diagnostic verification measures for the EVS, including measures for rare events, and examine integrated measures of forecast quality that combine information from several metrics. Including:
- ⇒ to extend the research version of the EVS (EVS-R) in which a few candidate measures are included for evaluation at the RFCs.
 - ⇒ to collaborate with the Verification Testbed of the Hydrological Ensemble Prediction EXperiment (HEPEX) and the National Centers for Environmental Prediction (NCEP), under the auspices of THORPEX-HYDRO.
- 6) Evaluate and extend methods for diagnosing the phase (timing) and amplitude errors in flow forecasts, initially focusing on single-valued flow forecasts, then extending the technique to ensemble forecasts. Including:
- ⇒ to extend the XWT tool for diagnosing timing errors in hydrologic ensemble forecasts.
 - ⇒ to document the potential uses and pitfalls of timing-error decomposition in an operational context.
- 7) Identify and evaluate criteria for selecting historic analogs to real-time ensemble forecasts in collaboration with the NWS Hydrologic Forecast Verification team. Including:
- ⇒ solicitation of feedback from operational forecasters at the RFCs about the forecasting situations under which historic analogs would be most useful, and the parameters on which specific queries should be built.
 - ⇒ a software prototype for evaluating analog queries against a file database.
 - ⇒ a brief report documenting the results from the example queries, problems identified, anticipated value and future work.
- 8) Develop prototype displays of real-time verification information (which include historic analogs and summary verification maps) to be implemented in the NWS's Community Hydrologic Prediction System CHPS Verification Service (CHPS-VS) in collaboration with the NWS Hydrologic Forecast Verification team. Including:
- ⇒ solicitation of feedback from operational forecasters at the RFCs about the summary verification statistics and products that would be the most useful and for which forecasting situations.
 - ⇒ improved prototype map displays for selected verification measures and additional map displays for new verification measures.
 - ⇒ prototype displays for historic analog events, together with a report on the software enhancements necessary to implement these within CHPS (specifically, the Graphics Generator component).

⇒ guidance for the RFCs on how to extract summary verification information for various verification scenarios.

9) Extend the EVS with known and ongoing feature requirements and bug-fixes. Including:

- ⇒ the inclusion of additional metrics and integrated measures of forecast quality.
- ⇒ enhancements in the Graphical User Interface (GUI) and software operation, such as the ability to predefine metrics to be displayed in the GUI.
- ⇒ enhancements to the documentation that accompanies the EVS, including the developer documentation and user's manual.
- ⇒ delivery of a new version of the EVS (3.0) to the public.

10) Extended testing of the EVS within the CHPS environment. Including:

- ⇒ testing the prototype EVS-CHPS Model Adapter for the EVS within a workflow context.
- ⇒ making any necessary bug fixes or enhancements to the EVS-CHPS Model Adapter.
- ⇒ delivery of a new version of the EVS-CHPS Model Adapter to the RFCs.

11) Maintain and extend external collaborations with COMET (verification training modules), academia, Deltares, NCEP, NWS Performance Branch, and HEPEX participants to advance verification science and software. Including:

- ⇒ to help identify core verification measures to inter-compare the different post-processing techniques in the HEPEX post-processing testbed.

Milestones for FY11

| Task | Due Date | Status |
|--|----------|---------|
| Implement into EVS-R an improved prototype for computing confidence intervals for the EVS verification metrics (based on the stationary block bootstrap) and release for internal testing. | FY11 Q2 | Ongoing |
| Produce a draft paper on the verification of the SREF precipitation ensemble forecasts. | FY11 Q3 | Ongoing |
| Implement additional diagnostic measures in the EVS-R for experimental testing at the RFCs, including metrics for the verification of rare events. | FY11 Q4 | Ongoing |
| Investigate how to extend the Cross Wavelet Transform (XWT) prototype for timing error decomposition of ensemble forecasts. | FY11 Q4 | Ongoing |
| Maintain and extend external collaborations to advance verification science and software. | Ongoing | Ongoing |
| Enhance the GUI/software operation of the EVS | FY11 Q4 | Ongoing |
| Enhance the documentation of the EVS | FY11 Q4 | Ongoing |
| Release an enhanced version of the EVS (4.0) and associated documentation | FY11 Q4 | Ongoing |
| Conduct extended testing of the EVS Model Adapter within a workflow context | FY11 Q3 | Ongoing |
| Release an enhanced version of the EVS to CHPS Model Adapter and associated documentation | FY11 Q4 | Ongoing |
| To conduct verification of the SREF ensemble forecasts for selected basins in MA, AB, CN and NW RFCs | FY11 Q3 | Ongoing |
| To produce a draft scientific manuscript for an international journal on the results from the SREF verification work. | FY11 Q3 | Ongoing |

| | | |
|--|---------|---------|
| Obtain and archive the GEFS ensemble forecasts of precipitation and temperature. | FY11 Q4 | Ongoing |
| Improve the objective function in the ICK post-processor to reduce conditional bias. | FY11 Q4 | Ongoing |
| Help coordinate HEPEX post-processing testbed project | Ongoing | Ongoing |

New AHPS reporting

The current AHPS project, “Ensemble Forecast Verification and Post-processing Improvements” was developed in Q1 FY11. This project merges three earlier AHPS projects, namely “Improve Ensemble Forecast Verification”, “Improve Verification Strategies”, and “Compare Post-Processors.” The new AHPS project includes some redefined objectives, deliverables and milestones. For clarity, the Milestones and Accomplishments/Actions associated with the two old projects are given separately (at the end of this document) and cover the reporting period Q1 FY10 to Q1 FY11, when the new project became active.

Accomplishments/Actions

1st Quarter FY11

- Developed a parallel track of the EVS for research enhancements, EVS-R, and added an associated project to SVN for storage of the source code.
- Implemented a first version of the stationary block bootstrap (SBB) for evaluating the sampling uncertainties of the verification metrics in the EVS. The SBB involved sampling, with replacement, blocks of verification pairs whose block length is proportional to the correlation length of the underlying variable being verified. In addition, the block lengths are randomized by assigning a random variable, L , corresponding to the block length, with geometric pdf and mean equal to the required block length. This avoids non-stationarity from assigning a constant block length.
- Implemented first versions of the GUI features for defining confidence intervals, including the ability to specify a number of samples, mean block length, and a list of confidence bounds that should be computed.
- Implemented first versions of the graphical and numerical outputs in the EVS with confidence intervals.
- Developed R scripts for plotting all of the EVS verification metrics with associated confidence intervals.
- Made several bug fixes to the EVS 3.0, including fixed to reading of the OHD CS binary files and OHD Datacard files. Uploaded the new code to the public website.
- Assisted HEP and the RFCs with their use of the EVS 3.0 and EVS-R, including Andrew P. of MARFC with his evaluation of the SREF forecasts for the MMEFS project.
- Conducted comprehensive verification of the SREF ensemble forecasts for 10-20 basins in each of 4 RFCs, namely MA, AB, CN and NW RFCs. This included running EVS-R project files with bootstrapped confidence intervals for a large number of verification thresholds.
- Started working on the manuscript reporting the verification results for the SREF ensemble forecasts. This manuscript will provide valuable input to the Eastern Region MMEFS project.
- Compared the NCEP QPE-derived MAP (“CCPA” dataset) to the RFC-derived MAP (gauge only) and MAPX (radar) by pooling observations across the 10-20 basins in each RFC. Found reasonable agreement between the CCPA and RFC datasets for MA, AB and CN RFCs, but a consistent (35%) apparent over-estimation by CCPA for NW RFC. Through discussion with NWRFC, this was deemed to be likely caused by manual modification of the RFC MAPS during hydrologic model calibration and, hence, not a bias in the CCPA dataset, but in the RCF MAPs.

Problems Encountered/Issues

1st Quarter FY11

- Major problems were encountered with OHD computing resources, which affected all aspects of the statistical post-processing and verification work, likely contributing to delays of several weeks. These comprise a combination of lack of reliability of the physical and virtual machines and inadequate Linux resources as a whole, including repeated crashes and system instability (leading to jobs being killed many times).
- In addition to problems with the Linux computer systems, several mistakes and delays in the ordering and assembly of the new GP-GPU computer system impacted the post-processing and verification work. The initial order for this machine was placed in Summer 2010 and the machine is still not ready for use by HEP.
- The activities done in collaboration with the NWS Hydrologic Forecast Verification team have been reduced due to limited resources available for FY11.

(Milestones and Accomplishments/Actions for the original AHPS projects)

- Improve Ensemble Forecast Verification -

Milestones for FY10

| Task | Due Date | Status |
|--|----------|-----------------|
| Identify the candidate post-processors for Phase I | FY10- Q1 | Complete |
| Develop a post-processor inter-comparison tool (PIT) to orchestrate the hindcasting and verification of each post-processor (including relative skill assessment) with dependent and independent validation modes. | Q1 | Complete |
| Implement Indicator Cokriging (ICK) within the PIT framework. | Q1 | Complete |
| Implement Bayesian Model Averaging (BMA) within the PIT framework. | Q2 | Complete |
| Implement logistic regression (LGR) within the PIT framework. | Q2 | Complete |
| Prepare the precipitation forecast and observed data sets for Phase I. | Q2 | Complete |
| Carry out the comparison experiments for post-processor Phase I. | Q3 | Delayed to FY11 |
| Analyze and summarize the results. | Q4 | Delayed to FY11 |
| Write a draft paper for an international journal on the results of the Phase I intercomparison. | Q4 | Delayed to FY11 |

Accomplishments/Actions

1st Quarter FY10

- Defined a new HOSIP project entitled “Improve Ensemble Forecast Verification” for FY10/FY11.
- Designed and sent a survey to solicit feedback from RFC forecasters on the real-time verification functionality. It includes questions about the forecasting situations and parameters important for analog selection and the summary verification statistics and products that would be the most meaningful for specific forecasting situations.
- Completed minor revisions to the EVS manuscript, which has now been accepted for publication in the international journal *Environmental Modeling and Software*.

- Completed minor revisions of the ensemble verification paper that has been accepted for publication in *Atmospheric Science Letters* for the special issue on the HEPEX June 09 workshop.
- Prepared the EVS Version 2.0 and associated documentation for public release (including completion of required security checks and disclaimer).
- Designed a website for public download of the EVS Version 2.0 and made the first public release of the EVS via that website (<http://www.nws.noaa.gov/oh/evs.html>).
- Started working on the manuscript for preliminary work on timing error analysis, focusing on testing the reliability of using XWT for timing error estimation and application to single-valued streamflow simulations in a number of test basins. Presented the methodology and initial results at the AGU Fall 09 conference in San Francisco, CA, in December 09.
- A Beta version of the prototype (evsCI_0.0) for computing confidence intervals for EVS metrics was completed and released to HEP for internal testing. It was used to generate graphics of confidence intervals for a couple of EVS metrics; these graphics are part of the second verification training module being developed by COMET (see the AHPS project entitled “Improve Hydrologic Forecast Verification Strategies”).

2nd Quarter FY10

- Summarized the RFC results of the survey on the real-time verification functionality and discussed it with the NWS Hydrologic Forecast Verification team. This will help guide the development of prototype real-time verification functionality.
- Completed a draft version of the manuscript on timing error analysis (Liu et al.) The timing error analysis uses the Cross Wavelet Transform (XWT) approach. The draft manuscript has been submitted for internal review and, subject to review, will then be submitted to the *Journal of Hydrology*.
- Assisted MARFC with evaluating the sampling uncertainties surrounding the EVS verification metrics (for their NWS Verification Team case study) using the prototype confidence interval tool, evsCI. Updated the prototype Matlab code as part of this.
- Updated the CHPS-EVS model adapter to improve the diagnostic information.
- Worked on enhancements to the EVS in preparation for the release of EVS 3.0 by Q4. These enhancements include computation of metrics as a continuous function of threshold amount; improvements in memory use and writing of paired files, improvements in the performance of the routine for temporally aggregating data across several forecast lead times; and many other enhancements.

3rd Quarter FY10

- Completed all predefined enhancements to the EVS in preparation for release of Version 3.0 in Q4 FY10. The enhancements are currently being evaluated. All enhancements over the previous version have been documented in the release notes for inclusion in the software release. However, the decision was made to implement existing functionality to sub-select verification pairs within the EVS. This will form the real-time verification prototype. Originally, several scripts were developed in R for this purpose, but it was decided that there were several benefits of moving this to the EVS, including having a common interface for sub-selecting historical forecasts and verifying them, as well as enhancing the functionality of the EVS.
- Started work on updating the documentation for the next release of the EVS.
- Submitted a draft version of the manuscript on timing error analysis (Liu et al.) to the *Journal of Hydrology* on 24th May.
- Assisted MARFC with evaluating the sampling uncertainties surrounding the EVS verification metrics (for their NWS Verification Team case study) using the prototype confidence interval tool, evsCI.
- Evaluated the CHPS-EVS model adapter within a CHPS workflow for NWRFC. The adapter worked properly. Some documentation needs to be prepared to accompany the adapter, which will then be placed on the XEFS website.
- As an illustration case study for the HEFS paper, worked on verifying the ensemble precipitation and streamflow forecasts produced from EPP and EnsPost, as compared to the climatology-

based ensembles. evsCI was used to compute the confidence intervals for the verification results.

4th Quarter FY10

- Completed evaluation, bug-fixing, and additional enhancements to the EVS Version 3.0 beta in light of testing by HEP.
- Revised and enhanced all documentation associated with the EVS, including the user's manual, developer's documentation, and release notes.
- Completed coding and testing of the additional functionality within the EVS for sub-selecting historical pairs of forecasts and observations, which constitutes the "software prototype for selecting historic analogs from hindcast datasets using predefined queries."
- Tested and ran EVS 3.0 to verify XEFS ensemble forecasts of precipitation, temperature, and streamflow that are produced by multiple XEFS components (EPP3 Ensemble Pre-Processor, Hydrologic Processor, EnsPost Hydrologic Post-Processor, and HMOS Ensemble Processor). The results are described in the preliminary evaluation report of XEFS, which will be finalized by October 2010. The evaluation of XEFS ensembles will continue in FY11.
- Prepared the final version of EVS 3.0 for release from the public website.
- Assisted MARFC with evaluating the sampling uncertainties surrounding the EVS verification metrics (for their NWS Verification Team case study) using the prototype confidence interval tool, evsCI.
- Assisted COMET with their preparation of a second module on forecast verification.
- Completed final testing of the EVS-CHPS model adapter.
- Prepared some documentation for the EVS-CHPS model adapter.
- Prepared the final version of the EVS-CHPS model adapter for release from the XEFS "One-Stop" website (i.e. with restricted download access).
- Tested the evsCI prototype with EVS 3.0 to evaluate necessary modifications to evsCI in order to be compatible with the new version of EVS.

Problems Encountered/Issues

1st Quarter FY10 - None

2nd Quarter FY10

- The Q2 milestones to test the CHPS-EVS model adapter and release a new version of the tested CHPS-EVS model adapter have been delayed due to problems in running the ensemble hindcaster within CHPS. The EVS-CHPS model adapter requires testing within a hindcast workflow, and this cannot be accomplished until the ensemble hindcaster is working within CHPS. Towards the end of Q2, progress had been made on this problem. We anticipate the successful completion of these deliverables by Q3. This does not (and will not) impact the RFC's experimental use of the EVS.

3rd Quarter FY10

- The delayed Q2 milestone to test the CHPS-EVS model adapter has now been completed, but the documentation needs to be prepared prior to its release. This will be completed by Q4.
- There are three Q4 milestones that culminate in the preparation of a draft manuscript on the quality of the XEFS ensembles, namely: 1) "Evaluate quality of XEFS ensembles"; 2) "Evaluate sampling uncertainties of verification metrics"; and 3) "Prepare a draft manuscript on the quality of XEFS ensembles". These milestones will not be met by Q4 due to delays in the testing and calibration of EPP3 for the experimental basins across several RFCs. These milestones have been added to the FY11 workplan.
- The Q3 deliverable on preparing a prototype for selecting historical analogue forecasts has been delayed to Q4 and will be incorporated in an enhanced interface within the EVS for sub-selecting historical forecasts and observations and writing them to a paired file.

4th Quarter FY10

- Several items have been delayed due to the departure of the old HEP group leader, DJ Seo,

and appointment of the new group leader, Julie Demargne, which resulted in a shift in responsibilities, and a reduction in time available to work on the deliverables of this project.

- The two remaining deliverables associated with the confidence interval prototype, evsCI, namely the production of an Algorithm Description Document (ADD) and the development of prototype displays for showing sampling uncertainty have been delayed to FY11. The HOSIP Project Plan for project “Improve Ensemble Forecast Verification” will be updated with a revised timeline to reflect this.
- The three remaining deliverables associated with the real-time verification work, namely the enhancement of real-time verification display prototypes for mapped statistics, the development of prototype displays for analog forecasts, and the report on future steps necessary, have all been delayed to FY11. Again, the HOSIP Project Plan will be updated with a revised timeline.

- Improve Verification Strategies -

Milestones for FY10

| Task | Due Date | Status |
|---|--------------|---------------------------------|
| Support existing verification software and prototypes | As necessary | Ongoing |
| Support RFC verification case studies | As necessary | Ongoing |
| Develop guidance report on verification scenarios | FY10 – Q4 | Delayed to FY11 |
| Enhance display prototype capabilities to produce verification standards | FY11 – Q2 | Delayed to FY11 |
| Propose improved verification standards in the second NWS Hydrologic Forecast Verification Team report with case studies | FY11 – Q4 | Delayed to FY12 |
| Solicit feedback on proposed standard verification products | FY10 – Q3 | Delayed to FY11 |
| Develop report on forecasters’ and users’ feedback on standard verification products and list products for dissemination | FY10 – Q4 | Delayed to FY11 |
| Support the development of verification training material | FY11 – Q4 | Ongoing |
| Test proposed standard verification strategies with HEPEX verification test-bed datasets and compare methodologies with test-bed participants | FY11 – Q2 | Delayed to FY11 Q4 |
| Provide NCEP with RFC specific areas to report verification statistics | FY10 – Q4 | Ongoing – will continue in FY11 |
| Support the National Verification Focal Point activities | As necessary | Ongoing |

Accomplishments/Actions

1st Quarter F10

- Finalized the second team charter for the NWS Hydrologic Forecast Verification Team and updated the team website (http://www.nws.noaa.gov/oh/rfcdev/projects/rfcHVT_chart.html).
- The NWS verification team met on 12/03/09 to discuss the survey on the real-time verification functionality and summary verification products. MBRFC and NCRFC presented their initial verification results of the CR QPF horizon case study.
- Presented the user analysis of verification products planned for FY10 to the Service Coordination Hydrologists (SCH) on 11/09/2009. The SCHs agreed on working with forecast users to provide feedback.
- Presented the hydrologic forecast verification strategies proposed in the verification team report for the CHPS-VS at the Eleventh Northeast Regional Operational Workshop in Albany, NY, in November.
- Developed the verification work plan for FY10-11 with the OHD/HSMB/HEP group, the OHD/HSEB, and the AHPS Verification Planning Team. The FY10 verification work plan was presented to the OHD management and the ARC/HIC committee in November and December 2009.
- Discussed the second COMET training module on hydrologic verification with Matt Kelsch, Tom Adams from OHRFC and Andrew Philpott from MARFC. Produced a first draft of the EVS case

study (including results of confidence intervals for a couple of EVS metrics with the evsCI_0.0 prototype) in coordination with Andrew Philpott. Discussed the initial IVP results with Tom Adams.

- Continued to support the verify-hydro list server to answer questions on verification software and science.
- Participated in the NPMC meetings to discuss progress on verification applications.

2nd Quarter FY10

- Finalized the verification work plan for FY10-11 with the OHD management. The work of the NWS verification team for FY10-11 and the selection of RFC verification case studies were discussed at the HIC meeting on 02/25/10.
- The NWS Hydrologic Forecast Verification Team met on 02/25/10 to discuss the results of the survey on the real-time verification functionality, which concerns the forecasting situations and parameters important for analog selection and the summary verification statistics and products that would be the most meaningful for specific forecasting situations. The survey results were also used to provide more detailed requirements on the new archiving capability to store and access all the necessary datasets for real-time verification.
- Developed a first draft for the survey on the standard verification products, including the examples from the September 09 team report, as well as extra plots for single-valued and ensemble verification. The survey will be sent to the Service Coordination Hydrologists (SCH) to work with a few key external users on determining the most meaningful verification products. The survey will also be filled out by the NWS verification team members.
- Discussed the second COMET training module on hydrologic verification with Matt Kelsch, Tom Adams from OHRFC, and Andrew Philpott from MARFC. Provided comments on the results and plots for the case studies with EVS and IVP.
- Continued to support the verify-hydro list server to answer questions on verification software and science.
- Participated in the NPMC meetings to discuss progress on verification applications, including the EVS software and the Network-Enabled Verification Service project for aviation services.

3rd Quarter FY10

- Started to develop the verification work plan for FY11.
- The NWS Hydrologic Forecast Verification Team met on 04/15/10 to discuss verification results for the operational single-valued flow forecasts for different flow and precipitation conditions; these findings were relative to the HMOS ensemble project.
- Continued to support COMET, MARFC and OHRFC to prepare the second COMET training module on hydrologic verification. Provided comments on the results and plots for the case studies with EVS and IVP.
- Continued to support the verify-hydro list server to answer questions on verification software and science.
- Participated in the NPMC meetings to discuss progress on verification applications.
- Worked with NCEP on providing the RFC-specific areas for NCEP verification computation.

4th Quarter FY10

- Prepared the verification work plan for FY11 for the discussion between the OHD management and the RFCs at the HIC meeting in August 2010.
- Continued to support COMET, MARFC and OHRFC to prepare the second COMET training module on hydrologic verification. Provided COMET with comments on the case studies with EVS and IVP. COMET will finalize the module in FY11-Q1.
- Continued to support the verify-hydro list server to answer questions on verification software and science.
- Participated in the NPMC meetings to discuss progress on verification applications.
- Provided NCEP with 3 gridded masks of the RFC-specific areas for NCEP calibration and verification purposes.

Problems Encountered/Issues

1st Quarter FY10 - None

2nd Quarter FY10

- The survey on the standard verification products is expected to be completed in FY10-Q3 and the report on the survey results will be developed in FY10-Q4. The schedule change is due to unexpected issues to run hindcasting experiments in CHPS for the AHPS project entitled “Improve Hydrologic Hindcasting”.

3rd Quarter FY10

- The survey on the standard verification products is expected to be completed in FY10-Q4 and the report on the survey results will be developed in FY11. The schedule change is due to loss of resources in the Hydrologic Ensemble Prediction group.

4th Quarter FY10

- Several items have been delayed due to the departure of the old HEP group leader, DJ Seo, and appointment of the new group leader, Julie Demargne, which resulted in a shift in responsibilities, and a reduction in time available to work on these tasks.
- The charter of the NWS Hydrologic Forecast Verification Team will be revised to reflect these changes.

- Compare Post-processors -

Milestones for FY10

| Task | Due Date | Status |
|--|----------|-----------------|
| Identify the candidate post-processors for Phase I | FY10-Q1 | Complete |
| Develop a post-processor inter-comparison tool (PIT) to orchestrate the hindcasting and verification of each post-processor (including relative skill assessment) with dependent and independent validation modes. | Q1 | Complete |
| Implement Indicator Cokriging (ICK) within the PIT framework. | Q1 | Complete |
| Implement Bayesian Model Averaging (BMA) within the PIT framework. | Q2 | Complete |
| Implement logistic regression (LGR) within the PIT framework. | Q2 | Complete |
| Prepare the precipitation forecast and observed data sets for Phase I. | Q2 | Complete |
| Carry out the comparison experiments for post-processor Phase I. | Q3 | Delayed to FY11 |
| Analyze and summarize the results. | Q4 | Delayed to FY11 |
| Write a draft paper for an international journal on the results of the Phase I intercomparison. | Q4 | Delayed to FY11 |

Accomplishments/Actions

1st Quarter FY10

- Identified the candidate post-processors for Phase I of the intercomparison experiment, namely Bayesian Model Averaging (BMA), logistic regression (LGR), and indicator co-kriging

(ICK). Each of these post-processors is known to be suitable for bias-correction of precipitation. The techniques were selected to cover a range of complexity in terms of the number of parameters that must be estimated. The BMA technique is based on a parametric model of the predicted distribution (e.g. a gamma distribution with point mass at zero). The LGR technique is also parametric, based on the “S-shaped” logistic distribution, but is applied on a threshold-by-threshold basis (i.e. prediction of the unbiased precipitation amount not exceeding a given threshold). The ICK technique is non-parametric and employs a threshold-by-threshold correction without a distributional assumption.

- Developed a post-processor intercomparison tool in Java to orchestrate the hindcasting and dependent/independent validation (via verification with EVS) for each post-processor. First, a post-processor must be implemented within the PIT framework. This is straightforward, since the PIT tool allows an executable to be called directly and can also interface with code in R and Matlab. One implementation of each post-processor (i.e. with one input/parameter set) is identified as a “scenario” in the PIT framework. The PIT tool takes an XML input file with each scenario identified and executes each scenario consecutively.
- Finished implementing a prototype version of BMA in the PIT framework using the R package “ensembleBMA”. This framework currently allows for modeling of precipitation from one forecasting model with a predicted distribution that is assumed to be gamma distributed with a point mass at zero.
- Started identifying suitable datasets for the intercomparison experiment. Evaluation of sensitivity to sample size will be evaluated with the frozen GFS precipitation hindcast dataset (20+ years). We also have access to the operational GEFS (5 years) and SREF datasets (2+ years).

2nd Quarter FY10

- Obtained and pre-processed a range of NWS model outputs and observations for use in Phase I of the post-processor intercomparison project. These include a four-year archive of operational precipitation and temperature forecasts for CONUS from NCEP’s Short Range Ensemble Forecasting (SREF) system, an eight-year archive of operational forecasts precipitation and temperature from the Global Ensemble Forecasting System (GEFS) and a thirty-year precipitation and temperature reforecast dataset from the frozen version of GEFS. The data have been pre-processed for the MARFC Juniata region for input to the post-processor inter-comparison tool and will be pre-processed for the other regions considered (in AB, CN- NW- RFCs) once the post-processing work begins for those regions. A new 10-year gridded observed dataset will shortly be available from NCEP and will provide the basis for bias-correction in all regions. Currently, observed MAP values are being used. The climate regions used in the Meteorological Development Laboratory HR-MOS scheme were obtained from Jess Charba of MDL and may be used for spatial pooling (to increase sample size), depending on the computer resources required to pool over such large regions.
- Performed extensive evaluation and verification of the SREF precipitation forecasts for the Juniata basins, conditional upon forecast lead-time, physics-model, event-size, ensemble member and location.
- Implemented indicator co-kriging and Bayesian Model Averaging for the SREF forecasts within a dependent-validation framework and verified the resulting bias-corrected forecasts.
- Implemented an initial version of logistic regression within the post-processor intercomparison tool. Initial results for the SREF precipitation forecasts under dependent validation appear very favorable and bear further scrutiny.

3rd Quarter FY10

- Evaluated the BMA post-processing technique for the MARFC study basins and made some enhancements after noting the poor performance compared to the other techniques (logistic regression and ICK). The performance enhancements involved simplifying the dependence of the mean of the bias-corrected distribution centered on the forecast member on the forecast amount. Originally this dependence was described with the linear model $\mu = b_0 + b_1x$ with forecast amount x and parameters b_0 and b_1 to be determined through least-squares regression. The new structure is $\mu = b_1x$, with parameter b_1 to be determined.
- Obtained vector files containing MAP basin outlines for each of four RFCs, namely MA-, AB-, CN, and NW-RFCs. Extracted the basin boundaries for 10-15 basins in each RFC and used

these polygons to compute the MAP from the SREF gridded data. This was implemented in a Java program that is part of the post-processor inter-comparison tool (PIT). The tool extracts the gridded information from the SREF forecasts, interpolates the grid to a finer grid (to avoid edge effects when aggregating over the basin polygons) and then averages over all points on the refined grid that fall within the polygon boundary for a given basin.

- Coordinate with Jun Du of NCEP and Joe O. of MARFC to augment OHD's archive of SREF forecasts. Joe O. has agreed to download the SREF gridded forecasts and archive them at MARFC. He will also provide the last six months of data, coordinating with Pen State. The NCEP archive is available on tape, which is accessible online, but each file archived stores the output from all modeled variables. The data proved too unwieldy to transfer at 75GB per file and with limited options to reduce this prior to transfer from the tape deck.
- Started identifying potential enhancements to the Indicator Cokriging (ICK) technique. These enhancements include modeling the covariance structure and maintaining temporal statistical dependencies for ensemble generation. The covariance structure was explored as a function of threshold separation distance. This may provide an avenue for modeling the covariances, but it is not yet clear, since a simple relationship between covariance and threshold separation distance is clouded by conditional biases in the forecast at different absolute threshold amounts.
- Developed a SON document for a new HOSIP project on the post-processor inter-comparison work and started writing the project plan.

4th Quarter FY10

- Completed downloading of all missing SREF forecasts. The partial dataset obtained from Brian Colle of SUNY was ~33GB. The augmented dataset, downloaded from the NCEP HPSS to include all 4 x daily model runs, is ~110GB in size.
- Completed processing of all precipitation data for the post-processor inter-comparison, including the GEFS and SREF datasets and the NCEP gridded QPE.
- Compared the NCEP QPE-derived MAP to the RFC-derived MAP (gauge only) and MAPX (radar) and found some significant differences for high-valued precipitation amounts. Some further work will be necessary to establish whether the NCEP QPE data will meet the needs of this project. This work will be coordinated with Haksu Lee and Yu Zhang who are investigating similar issues.
- Identified a new task to be completed in FY11, namely to conduct comprehensive verification of the GEFS and SREF datasets as the basis for providing more rapid input to the Eastern Region RFCs on how to blend ensembles from GEFS and SREF (as part of the Meteorological Model Ensemble Forecast System, MMEFS). This work will lead to a draft manuscript for publication in an international journal and associated guidance to the MMEFS project on the nature and degrees of bias in the GEFS and SREF precipitation forecasts. This task will feed into the comparison of post-processors by establishing the pre-existing biases in the GEFS and SREF forecasts; it will also be completed while waiting for new computer resources to conduct the post-processing work (a workstation with GP-GPU purchased in June 2010 and due for delivery in October 2010).
- Started initial verification of the GEFS and SREF forecasts using the Ensemble Verification System (EVS).

Problems Encountered/Issues

1st Quarter FY10

- None.

2nd Quarter FY10

- None.

3rd Quarter FY10

- Due to insufficient computing resources to implement the post-processing techniques within a cross-validation framework, three activities will be delayed, namely: 1) "Carry out the comparison experiments for post-processor Phase I"; 2) "Analyze and summarize the results";

and 3) "Write a draft paper for an international journal on the results of the Phase I intercomparison". However, actions have been taken to remedy this problem. A new workstation with a GP-GPU card has been purchased and will be used to conduct the cross-validation work. These activities are ongoing in FY10 Q4 and will be further delayed to FY11.

4th Quarter FY10

- A new computer was ordered in June 2010 and is still awaiting delivery (as of 6th October 2010). While this has delayed the post-processor inter-comparison, a new task and associated milestone will be added to the FY11 workplan on comprehensive verification of the GEFS and SREF ensembles. This task will provide a baseline for comparing the statistical post-processors for precipitation (by establishing existing biases in these forecasts) and should provide valuable guidance to the MMEFS project earlier than anticipated (i.e. before the post-processor inter-comparison has been conducted), offsetting the impacts of the delay in acquiring computing resources.

Inundation Mapping

Static Flood Inundation Maps Web-Page Development and Deployment

Core Goal: Improve Flood forecast Inundation Maps – Static Maps

Management Lead: Victor Hom

- Objectives:**
- 1) Develop AHPS web page interface,
 - 2) Deploy flood inundation maps in a nationally consistent, scientifically sound, and objective manner, and
 - 3) Implement program elements to assure quality deliverables and maintenance of viability.

Team Members:

- Frank Bell – Southern Region
- Jay Breidenbach – Western Region
- Laurie Hogan – Eastern Region
- Victor Hom – Office of Climate Water and Weather Services / HSD
- Kris Lander – Central Region
- Doug Marcy – National Ocean Service / Coastal Services Center
- Seann Reed – Office of Hydrologic Development / HSMB
- Wendy Pearson – Central Region

This AHPS Core Goals team have been in operations since Q4 of FY07.

I. FY11 Main Objectives and Task Areas

- Main FY11 Objectives:**
- (1) Update AHPS Flood Mapping Web Portal and Display
 - (2) Update the NOAA Flood Inundation Map Guidelines to document the recommended methods and standards to produce Flood Inundation Map Libraries affected by levees and bridges.
 - (3) Implement, via the AHPS web portal, additional flood inundation mapping libraries and provide assistance to the regions for development/implementation of other AHPS flood inundation mapping.

II. FY11 Milestones

| Task Area #1 - AHPS Flood Mapping Web Portal and Display | | |
|---|-----------------|---------------|
| Subtask 1-1 AHPS Web Portal for Bridges (Continuation) | Due Date | Status |
| Evaluate and Prioritize Changes to AHPS Portal for bridges and roadway infrastructure. | FY10Q1 | Completed |
| Work with Contractor on Project Scope | FY10Q2 | Completed |
| Contractor Delivers FY10 AHPS Web Changes | FY10Q3 | Completed |
| Evaluate and Prioritize Changes to AHPS Portal for extended mapping for bridges and roadway infrastructure at risk. | FY10Q4 | Completed |
| Work with Contractor on Project Scope | FY11Q1 | |
| Contractor Delivers FY10 AHPS Web Changes | FY11Q3 | |
| Subtask 1-2 AHPS Web Portal for Levees and Flood Risk Areas (Continuation) | Due Date | Status |
| Evaluate and Prioritize Changes to AHPS Portal for Levees/Risk Areas | FY10Q1 | Completed |
| Work with Contractor on Project Scope | FY10Q4 | Completed |

| | | |
|--|-----------------|-------------------------------|
| Contractor Delivers FY10 AHPS Web Changes | FY11Q2 | Revised from FY10Q2 to FY11Q2 |
| Evaluate and Prioritize Changes to AHPS Portal for extended mapping of E-19 impacts | FY10Q4 | Completed |
| Work with Contractor on Project Scope | FY11Q1 | Completed in FY10Q4 |
| Contractor Delivers FY11 AHPS Web Changes | FY11Q3 | - |
| Subtask 1-3 Provide more geospatial intelligence to NWS AHPS Products | Due Date | Status |
| Work with Contractor on Defining Requirements of Google Interface | FY11Q2 | - |
| Demonstrate existing AHPS Flood Mapping Capabilities on Google Interface and enhanced current interface to meet AHPS FIM Partner Needs | FY11Q3 | Awaiting FY11 Funds |
| Contractor provides beta version of Google interface for review | FY11Q4 | - |

| Task Area #2 Quality Assurance and Consistency of Regional Flood Maps | | |
|--|-----------------|-----------------------|
| Subtask 2-1 Quality Assurance and Phase 2 Quality Control Training Workshop | Due Date | Status |
| Overview of Flood Mapping Process | FY10Q1 | Completed |
| Flood Mapping: Hydraulics & Hydrology | FY10Q1 | Completed |
| Flood Mapping: GIS Analysis | FY10Q1 | Completed |
| Quality Assurance and Checking: Phase 2 | FY10Q1 | Completed |
| CSC will create training modules for Residence Workshop. | FY10Q2 | Completed |
| Conduct Webinars and QAQC Hands-on Workshop | FY10Q2 | Completed |
| Work with CSC on Logistics fro Webinar and Workshop | FY11Q3 | - |
| Conduct Flood Mapping Webinars | FY11Q4 | - |
| Conduct QAQC Hands-on Workshop | FY12Q1 | Subject to FY11 Funds |

| Task Area #3 - National Flood Inundation Mapping Guidelines and Program Standards | | |
|--|-----------------|----------------------------|
| Subtask 3-1 Federal Guidelines and Statement of Work Templates (FIM08-2P) | Due Date | Status |
| Review Federal Guidelines V.2 | FY11Q1 | Ongoing, Revised to FY11Q1 |
| Evaluate Changes to SOW V.2 | FY11Q2 | Ongoing, Revised to FY11Q2 |
| Meet with FEMA Stakeholders and NFIP Coordinators | FY10Q3 | Completed, Ongoing |
| Update Federal Guidelines and SOW Templates | FY10Q4 | Completed in FY10Q2 |
| Update Federal Guidelines to V.3 | FY11Q4 | On schedule |
| Update SOW to V.3 | FY11Q4 | - |
| Subtask 3-2 Partnered Program/Project Management Support Tool (FIM09-7P) | Due Date | Status |
| Define Scope and Deliverables | FY11Q1 | Onhold, Unfunded |

| | | |
|--|--------|------------------|
| Review QAQC Reports, Lessons Learned, Guidelines, SOW Templates, QAQC Training Modules | FY11Q2 | Onhold, unfunded |
| Complete AHPS Management System Tools | FY11Q4 | Onhold, unfunded |
| Complete QA Inundation/Depth Tools | FY12Q1 | Onhold, unfunded |
| Complete QA Metadata Tools | FY12Q2 | Onhold, unfunded |

| Task Area #4 - Regional Flood Mapping Development | | |
|--|-----------------|-----------------------------------|
| Subtask 4-1 Southern Region's Gulf Coast Libraries | Due Date | Status |
| Implement remaining Flood Inundation Map Libraries | FY11Q4 | Ontrack |
| Subtask 4-2 Eastern Region's Susquehanna River Flood Inundation Libraries (FIM08-4P) | Due Date | Status |
| Implement up to 3 Flood Inundation Map Libraries | FY10Q4 | On-hold |
| Subtask 4-3 Eastern Region's Delaware River Flood Inundation Libraries (FIM08-4P) | Due Date | Status |
| Implement remaining DRBC Flood Inundation Map Libraries | FY11Q4 | Ontrack |
| Subtask 4-4 Central Region's Indiana Inundation Libraries (FIM08-4P) | Due Date | Status |
| Implement up to 2 Flood Inundation Map Libraries | FY11Q4 | Awaiting State DOT Funds and USGS |
| Subtask 4-5 Western Region's Truckee River Flood Mapping | Due Date | Status |
| Implement 1 Demonstration Flood Inundation Map Library | FY11Q4 | Ontrack |
| Subtask 4-6 Central Region's Iowa Inundation Libraries (FIM10-1P) | Due Date | Status |
| Implement 1 Flood Inundation Map Libraries | FY11Q2 | Ontrack |
| Subtask 4-7 QAQC Technical Review and Oversight Support (FIM10-2P) | Due Date | Status |
| Provide assistance to the regions for development/implementation of AHPS flood inundation mapping. | FY11Q4 | Ontrack |
| Subtask 4-8 Demonstration AHPS Flood Map Libraries (FIM10-3P) | Due Date | Status |
| Implement 2 AHPS Flood Map Libraries one in Central and one in Western Region | FY11Q4 | Ontrack |

| Task Area #5 - Maintenance and Servicing Maps | | |
|---|-----------------|-------------------------------------|
| Subtask 5-1 Maintain AHPS Flood Maps (FIM09-10P) | Due Date | Status |
| Evaluate and Prioritize Map Updates | FY10Q3 | Completed in FY10Q4 with Additional |
| Work with WFO and RFC to update NC Libraries | FY11Q2 | - |
| Supply Revisions on Test Platform for NWS Evaluation | FY11Q3 | - |
| Implement Updates on Regional Servers | FY11Q3 | - |

III. FY11 Accomplishments/Actions

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| FY11 Q1 |
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Task Area #1 - AHPS Flood Mapping Web Portal and Display

AHPS Web Portal

- Orion demonstrated the enhanced AHPS Depth Grid Raster display which uses HTML version 5 standards and allows AHPS Water Depth Maps to be created directly from Ascii Depth Raster with software such as HECRAS/GeoRAS.

Task Area #3 - National Flood Inundation Mapping Guidelines and Program Standards

Federal Guidelines and Statement of Work Templates

- Dewberry completed review of NWS suggestions for revisions to Flood Mapping Guideline Revisions and also provided an assessment of areas for guideline enhancements.
- NOAA has accepted this assessment and is now coordinating with Dewberry on a schedule and the priority for these revisions.

Task Area #4 - Regional Flood Mapping Development

Gulf Coast Libraries

- Plans for additional implementations in FY11 includes:

| | | | |
|-----------------------|--|-------|-------|
| SEGT2 | Guadalupe River - Seguin, TX | (EWX) | |
| DUPT2 | Guadalupe River - Bloomington, TX | | (CRP) |
| VICT2 | Guadalupe River- Victoria, TX | (CRP) | |
| SHEA1 | Aldridge Creek at Sherwood Dr - Huntsville, AL | (HUN) | |
| TKSN7 | Tuckasegee River at Bryson City, NC | (GSP) | |

Southern Region's Rio Grande/Rio Bravo Projects

- In partnership with the International Boundary and Water Commission (IBWC), NOAA NWS agreed to develop up to 7 web-based flood inundation maps for FY2011, which will provide information on the spatial extent and depth of flood waters in the vicinity of NWS river forecast locations on the Rio Grande/Rio Bravo along the Texas/Mexico border.
- WGRFC is conducting and coordinating Phase 2 QAQC of the maps for the following locations:

| | | | |
|-----------------------|-----------------------------------|-------|-------|
| LDOT2 | Rio Grande @ Laredo/Nuevo Laredo | (CRP) | |
| EPPT2 | Rio Grande @ Eagle Pass | | (EWX) |
| DLRT2 | Rio Grande @ Del Rio/Ciudad Acuna | (EWX) | |
| RGDT2 | Rio Grande @ Rio Grande City | (BRO) | |
- In consultation with the engineering contractor, WGRFC has developed a series of PDF files for Phase 2 Review. This additional step is an alternative and enhancement from the normal phase 2 QAQC. It will make the communication easier with the partners and does not rely-on having ArcGIS. The PDFs represent mock ups of the inundation maps as they will appear on the AHPS pages.

Eastern Region's Delaware River Flood Inundation Libraries

- ERH is working with the partners and local stakeholders to deliver up to 4 DRBC libraries for FY11. Work is progressing for the following locations:

| | | |
|-----------------------|---------------------------------|-------|
| BVDN4 | Delaware River at Belvidere, NJ | (PHI) |
| ESTN4 | Delaware River at Easton, PA | (PHI) |
| MTGN4 | Delaware River at Matamoras, NJ | (BGM) |
| MTMP1 | Delaware River at Montague, PA | (BGM) |

Central Region's Iowa Inundation Libraries

- University of Iowa is working with NWS on AHPS Flood Maps for the Iowa River in the vicinity of Iowa City, IA ([IOWI4](#))
- The project is currently in Phase 3 QAQC review.
- NWS identified and suggested some revisions and enhancements to the mapped shapefiles and depth grids, which the partners are adjusting.

Western Region's Flood Inundation Libraries

- WR Staff members have been consulting with OCWWS HSD in performing site selection of a suitable demonstration AHPS Flood map library for Western Region: During this period, reviews of the Truckee River near Vista, NV ([VISN2](#)) were conducted. Meetings with the Washoe County

are being planned.

- WR Staff members have been coordinating with Federal, State, and local partners on the review of the Hydraulics Model for the Boise River near Eagle Island ([BIG1](#)) and the necessary deliverables to NWS for implementation onto AHPS. Based on the review of the models and the results, additional work, such as extra flood inundation maps, will need to be generated for other flow conditions.

NOAA-USGS Collaborations

- USGS hosted Flood inundation Mapping Workshop with several NWS offices in attendance. The workshop and the presentations are posted at: <http://in.water.usgs.gov/fim/> . The purpose was to discuss and review ongoing regional efforts amongst the various agencies towards Flood Mapping. Some of these efforts are discussed in: http://water.usgs.gov/osw/flood_inundation/
- The USGS Flood Inundation Mapping Steering Committee met with NWS to finalize agreement of a standard checklists for NOAA-USGS projects. This checklist will be available in FY11Q2. NWS also have been working with USGS on web display and map publication standards. The goal is to push these standards forward to IWRSS.
- The USGS is working with NWS to enhance Flood Inundation Mapping, especially in areas where static maps are not suitable, such as Peachtree Creek near Atlanta Georgia. The goal is to identify the challenges and raise these issues to the IWRSS charter team, National Flood Inundation Mapping Services for their consideration. It is anticipated that this new team will create the roadmap and blueprint for the development of real-time dynamic flood mapping.

IV. Problems Encountered/Remaining Issues

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|-------------|
| FY11 |
|-------------|

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|--------------------------------|
| <u>1st Quarter FY11</u> |
|--------------------------------|

General

- Moratorium on new web implementation and AHPS contractor priorities for the NIDS will result in delayed implementation of AHPS Flood Map Libraries. The earliest expected Library deployment onto AHPS will be in the spring of FY11 around Q2..

| |
|-----------------------------------|
| Remaining Issues from FY10 |
|-----------------------------------|

None at this time.

The ARC and Core Goal Team Lead need to ensure funds are available.

Inputs and Forcings

Prototyping NMQ for FFMP

Note: This project is on hold, awaiting resources. It will not be reported on after this quarter unless resources received

Core Goal: Improve the quality of physical inputs and forcings

Management Lead: Ken Howard and Jian Zhang, NSSL; Mary Mullusky and David Kitzmiller, NWS

Objective: To test a high resolution Cartesian based regional multisensor QPE and QPF as input into FFMP and to facilitate a NCEP implementation of NMQ system for the national creation of QPI products and prototype dissemination to individual RFCs and weather forecast offices. The following project builds upon the FY05 NMQ to FFMP demonstration project and a FAA sponsored project for the implementation of the NMQ 3-D reflectivity mosaic code set within NCEP operational environment. Through an NCEP implementation, the full NMQ product suite can be prototyped and enhanced for potential utilization within RFC operations as well as within WFOs in FFMP.

Milestones FY08

| Task | Due Date | Status |
|---|--------------------|-------------------------------------|
| Customization of NMQ Q2 product real time dissemination per RFC domain | December 1, 2008 | Completed |
| Infusion of Canadian and TDWR radar data as available into NMQ NCEP QPI grids | April 1, 2008 | Completed for NMQ system |
| National prototype 2.5 minute update cycle for NMQ and QPE products | July 1, 2008 | Completed in FY09Q4 |
| Initial development and testing of a multi sensor 'best of the science' QPE product | August 30, 2008 | Will be part of NCEP Implementation |
| Development strategies and testing protocols for Dual polarization data in Q2 | September 20, 2008 | Ongoing |

Milestones FY09

| Task | Due Date | Status |
|---|--------------------|--|
| Customization of NMQ Q2 product real time dissemination per RFC domain | Continuous | Completed |
| Evaluation and testing of VPR corrected QPE using case studies | May 1, 2009 | Completed |
| Complete hardware and software design/configuration for national NMQ implementation | July 1, 2009 | Completed |
| Assessment of Q2 performance in collaboration with RFC | August 30, 2009 | Ongoing with several initial reports completed |
| Implementation of new PERSIANN satellite rainfall estimation algorithm in NMQ/Q2 | September 20, 2009 | Removed |

Milestones FY10

| Task | Due Date | Status |
|---|---------------|-----------|
| Dissemination of NMQ Q2 products in 'real time' | Q2/Continuous | Completed |
| Assessment of Cool Season Q2 performance for RFC and selected FO operations | Q1/FY11 | Ongoing |
| Assessment of Warm Season Q2 performance for RFC and FO operations | Q1/FY11 | Ongoing |

| | | |
|---|-----------------|---|
| Compilation of RFC and FO feedback and recommendations | Final Report Q4 | Conducting quarterly conference calls. |
| Conducting testing of wdss-ii build within the NCEP Dell server environment | Q3 | Completed with report submitted to NCEP, OHD, and FAA |

Accomplishments/Actions

1st Quarter FY08

- Completed scripts and communication protocol for providing River Forecast Centers with real time Q2 products.
- Completed code and configuration changes to ingest real time high resolution 88D L2 for NMQ and Q2 products.

2nd Quarter FY08

- Providing, in real time, Q2 product suite to the following RFCs: ARBRFC, WGRFC, CBRFC, and ORFC.
- Continued interactions with RFC staff on Q2 product strengths and weakness. Feedback from RFCs continues to be favorable towards improved coverage, continuity, and quality of Q2 QPE products for potential use in operations.
- Revised several thresholds and system parameters for the tropical precipitation identification. System updates can viewed at http://docs.google.com/View?docid=dcf7xh8d_31gkwgqj54

3rd Quarter FY08

- Established new NMQ/Q2 server and website – nmq.ou.edu
- Documentation for establishing the NMQ systems as a stand-alone operational system has been provided to NCEP and OHD. The documentation included hardware specifications, software and system configuration.
- With the assistance of the Salt River Project and the PHX FO, Q2 products are being made available to 4 forecast offices for use in FFMPA. An evaluation protocol will be established to receive feedback from individual offices in Q4.
- Canadian radar 3D mosaics are being generated in real –time every 5-minutes at 1x1km resolution within the NMQ system. Product grids containing the Canadian radar data will be made available in Q4.

4th Quarter FY08

- Updated NMQ and Q2 QPE products grids to encompass 33 Canadian radars. The products are available in digital form and viewable on the NMQ website – nmq.ou.edu.
- Testing is currently underway for hardware and software configurations required for 2.5-minute update cycle for the NMQ products.
- A detailed assessment of Q2 performance during calendar year 2008 has been completed and made available to OHD in PowerPoint form.
- Q2 products were made available in real time to the Phoenix forecast office as an input into FFMPA beginning July 15 to current. Evaluation is ongoing.

1st Quarter FY09

- N/A

2nd Quarter FY09

- Q2 QPE products produced during the 2008 PUFFS project are being validated as input for FFMPA. 8 FF events are being analyzed and compared to Stage 2 MS in collaboration with the Phoenix forecast office.
- Testing and evaluation of a VPR-corrected QPE algorithm has been completed on 14 cases. A VPR corrected Q2 QPE product will be implemented in real time CONUS in FY09 Q3.
- Q2 QPE products are currently being disseminated in real-time to 7 RFCs in addition to NOHRSC in FY09 Q2.
- Activities and discussions continue with OHD and NCEP regarding documentation of NMQ/Q2

hardware and software specs, configuration, and costs for a NCEP implementation

3rd Quarter FY09

- A final set of technical specifications for the NMQ/Q2 hardware and software were provided to NCEP and OHD.
- The new VPR correction methodology was expanded and further refined using case data from the 2006 HMT field program. Based upon cool season HMT cases in the northern Sierra Nevada, it was clear that the VPR correction algorithm required enhancements to allow corrections for radar beams extending above the melting layer. The revised VPR is being further tested and a final code set for real time implementation is expected in fy10 Q1. A formal write up of the VPR correction algorithms to address the bright band has been completed and is in formal review.

4th Quarter FY09

- A new feedback forum was established at <http://q2-collaborations.ning.com/>. The forum is to facilitate feedback from NWS RFCs and FOs on issues related to improving QPE science through the use of Q2.
- Updated distribution of Q2 products to RFCs is shown in the following table.

| RFC | Primary Contact | Data Protocol | Q2 Radar-only HSR | Q2 Gauge-corrected | Q2 Radar-only HSR |
|-------|------------------|---------------|-------------------|--------------------|-------------------|
| ABRFC | Bill Lawrence | HTTP | Y | Y | N |
| CBRFC | Michelle Schmidt | HTTP | Y | Y | N |
| LMRFC | Glenn Carrin | LDM | Y | Y | N |
| MBRFC | John LaGue | LDM | Y | Y | N |
| NCRFC | Bob Wavrin | LDM | Y | Y | N |
| NERFC | Rob Shedd | HTTP | Y | N | Y |
| OHRFC | Jim Myers | LDM | Y | Y | N |
| SERFC | Judi Bradberry | HTTP | Y | Y | N |
| WGRFC | Greg Story | HTTP | Y | N | N |

- The NMQ verification system (<http://nmq.ou.edu>) was enhanced during the 3rd and 4th QRs to include new verification tools and displays.
- A 2.5 minute update cycle for NMQ and Q2 QPE products was completed. Q2 radar only HSR QPEs are available CONUS every 2.5 minutes.

1st Quarter FY10

- A Q2 feed was established for the MARFC
- Q2 performance Input from RFCs was obtained through conference calls held on 16 September and 4 November. Comments included issues related to MPE and SSHP in addition to more general meteorological issues. Minutes from the conference calls have been compiled and provided to OHD as well as the Q2 development team.
- NSSL has been working with ESRL and NCDC to formulate a robust gauge QC program based on manual efforts at RFCs. Efforts are ongoing to compare NSSL automatic gauge QC with manual RFC bad gauge lists.
- David Kitzmiller delivered an OSIP briefing on progress on December 1 - an extension for the OSIP Gate 3 review for the NMQ implementation project 06-039 has been granted to CY 2010.

2nd Quarter FY10

- Real time Q2 feeds continue to RFCs as outlind in 4th quarter FY09.
- Final coding and testing completed for VPR corrected Q2 QPE product suite. VPR corrected QPE product will be implemented in real time during Q3 with products available to RFCs beginning May 1.

- Q2 performance input from RFCs was obtained through conference call held on February 17th. Minutes from the conference call have been compiled and provided to OHD as well as the Q2 development team.
- Four NCEP hardware test trials completed, however, additional testing is underway to assess issues with running VMware for system management.
- After initial FY10 RFC conference call NSSL undertook a major effort to assess the degree in which light precipitation was being removed from Q2 products. After a nearly a daily review of Q2 performance during Q1 it was found the wdssii reflectivity quality control was removing valid reflectivity echo especially during cool season events. Refinements were made to the quality control logic and a reduction of light precipitation has been realized but assessments will continue.

3rd Quarter FY10

- Real time Q2 feeds continue to RFCs as outlined in 4th quarter FY09.
- During Q3 NSSL implemented within the real time Q2 MRMS system ten new products related to quantitative precipitation estimation. The products include:
 - Radar Quality Index
 - Tilt Based Vertical Profile Reflectivity
 - Seamless Hybrid Scan Reflectivity (SHSR)
 - Seamless Hybrid Scan Reflectivity with power adjustment
 - Seamless Hybrid Scan with Vertical Profile Reflectivity correction
 - Height (MSL) of the Seamless Hybrid Scan Reflectivity
 - Q2 QPE using the SHSR with power adjustment
 - Q2 QPE using the SHSR with Tilt based Vertical Profile Reflectivity correction
- The new products are being generated in real time CONUS at 1-km horizontal resolution with a 5-minute update rate.
- NSSL is currently assessing the performance and limitations of the new products. Initial evaluations show
 - SHSR was able to mitigating blockage artifacts, but also introduced BB contamination and thus needs refinements.
 - The VPR correction is successful in mitigating the BB-lead QPE overestimation. The VPR correction is limited by the assumption of horizontal uniformity.
 - The VPR correction reduced underestimation in areas where the radar sampled ice regions.
- Further evaluations and refinements are ongoing.
- The new QPE products are available to OHD, RFCs and FOs in AWIPS NetCDF format in real time. All new products are viewable within the QVS webpage (nmq.ou.edu)

4th Quarter FY10

- Real time Q2 feeds continue to RFCs.
- Established feed of CONUS Mountain Mapper QPE to ARBRFC for CONUS analysis.
- A new verification tool set was created for conducting long-term verification statistics for individual RFCs, CWAs, and custom regions per the FY10 milestones. The url for the new verification tools is <http://nmq.ou.edu/beta/q2-tools.html>.
- The appearance of wind farm contamination in QPEs has been increasing and a issue for RFCs and FOs. A comprehensive effort was undertaken at NSSL to indentify the wind farm locations impacting QPEs. After a 4-month effort all wind farms impacting radar visibility were identified with GIS shape files developed along with the Meta data for wind farm locations. The shape files and metadata have been provided to the Radar Operations Center for distribution to individual offices and RFCs.
- Comprehensive verification of all products in the NMQ system is ongoing within the HMRG group. Results from the verification efforts have and will continue to be sent to OHD in the form of PowerPoint's and performance statistics. Additionally OHD and other NOAA individuals can easily obtain performance statistics in real time for all Q2 products in addition to Stage 2,3, and 4.
- New gauge QC tools were implemented in the system for real time automated quality control for HADS and mesonet gauges.

- Q2 products were provided as part of the NextGen NWS demo.

1st Quarter FY11

- NSSL staff contributed substantial time to preparation for NWS/OAR senior managers' review of MRMS-NMQ project on December 10, which resulted in NMQ being identified as a line office transition project.
- There is presently no AHPS funding for this project. We continue to maintain the distribution feeds and address RFC questions.

Problems Encountered/Issues

1st Quarter FY08 - None

2nd Quarter FY08

- The NMQ verification system moved to University of Oklahoma computing infrastructure.

3rd Quarter FY08

- A major effort was expended during this period to address issues related to ingest and QC of super_res base level data. New QC applications for super_res are currently being evaluated.
- 14 -dual processors HP servers were procured and will be added to the NMQ level 2 processing server farm. The additional servers will facilitate an increased in temporal and spatial resolution of NMQ products starting in Q4.

4th Quarter FY08

- The super_res base level data was found to be extremely noise and required significant investigation in to mitigating the noise in base QC as well as impacts on VPRs. Initial changes were made in the QC code, which were not effective and introduced a low bias in Q2 QPEs with tropical events in June, July and August. Techniques are being reassessed, modified and tested to mitigate the impacts of super_res on QPE products.

1st Quarter FY09 - None

2nd Quarter FY09 - None

3rd Quarter FY09 - None

4th Quarter FY09

- The new PERSIANN satellite rainfall estimation algorithm source code was not released to NSSL for implementation into NMQ. Discussions are ongoing to facilitate the transfer and testing of the code. For now the task has been removed.

1st Quarter FY10 – None

2nd Quarter FY10 – None

3rd Quarter FY10 – None

4th Quarter FY10 – A position error was found in the radar polar to Cartesian gridding. The references files within the wsdii system were incorrect. New references files were created and implemented on the NMQ system on October 10th.

1st Quarter FY11

- There is presently no AHPS funding for this project. Some work continues on a limited basis.

Gauge-Radar Analyses in High-Resolution Precipitation Estimator (HPE)

Note: This project is on hiatus. It will not be reported on after this quarter unless activity re-commences

Satellite Based Analysis for Potential Evaporation

Note: This project has been incorporated under “**Gridded Hydromet Forcings for CHPS**” as of FY11 Q1

Short-range radar-based quantitative precipitation forecasts

Core Goal: Improve the quality of physical inputs and forcings

Management Lead: David Kitzmiller

Objective: To develop and deliver a statistically-based 0-6 hour probabilistic quantitative precipitation forecasting system using remote-sensor and numerical prediction model input. The system is based on a Model Output Statistics approach requiring several years' data. Most work for which funding is requested is to be done in first two years.

Milestones

| Task | Due Date | Status |
|--|------------|--------------------------------------|
| 1. Archive necessary radar, lightning, and RUC2 numerical model output | Continuous | Ongoing – started FY09 Q2 |
| 2. Develop 6-h extrapolation prediction algorithm and codes based on operational High-Resolution Precipitation Nowcaster (HPN) | FY09/Q4 | Done |
| 3. Construct dataset with collocated radar extrapolation forecasts, satellite precipitation extrapolation forecasts, RUC2 precipitation forecasts, and Stage4 verifying precipitation, for available CY2009 data | FY10/Q1 | Done |
| 4. Deliver interim report on data evaluation, including CONUS-wide statistics on RUC2 and radar forecast correlations with observed precipitation | FY10/Q2 | Done – EWRI conference preprint |
| 5. Prepare and submit OSIP documents for implementation process – Completed HOSIP Gate2 review as a research project, to be followed on by an implementation task | FY10/Q3 | HOSIP Gate2 review passed in FY10/Q2 |
| 6. Assemble statistical dataset and develop regionalized probability equations based on CY2009-2010 input data | FY10/Q4 | Completed |
| 7. Prepare and journal article on initial results from CY2009 data | FY11/Q1 | Likely slip to Q2 |

Accomplishments/Actions

2nd Quarter FY09

- Began collecting necessary input radar data from NMQ sources
- Began collecting necessary RUC2 forecasts (precipitation and other fields)

3rd Quarter FY09

- Continued data collection
- Began adapting operational HPN code to make extrapolation radar forecasts out to 6 hours

4th Quarter FY09

- Continued data collection
- Got radar extrapolation forecast code working
- Collected input from field sponsors to refine operational requirements (timing, product suite)
- Began work on preparing extrapolation forecasts of satellite rainfall rate based on operational Hydroestimator fields
- Abstract on the project submitted for presentation at EWRI congress in 2010

1st Quarter FY10

- Continued data collection
- Got verification statistics for RUC2 and radar extrapolation QPF in the 0-3, 3-6, and 0-6h

timeframes (warm season, 1800-0000 UTC) demonstrating the manner in which radar and physical-dynamical QPFs complement each other

- Began preparation of preprint article for EWRI Congress scheduled May 2010

2nd Quarter FY10

- Passed HOSIP gate2 review, for research project, March
- Revised milestones above per approved HOSIP research project research plan and FY10 AHPS submission
- Completed and submitted preprint article for EWRI Congress scheduled May 2010
- Presented seminars on initial results at Norman National Weather Center, ABRFC

3rd Quarter FY10

- Presented results, demonstrating probability and QPF amount fields, at EWRI congress May 2010
- Obtained verification statistics demonstrating approximate parity with skill of HPC 0-6h update forecasts, for 2009 data
- New results presented in preprint for European Radar Conference, submitted July 2010
- Continuing data collection, refinement of probability and amount equations, methodology for probability matching to insure a realistic distribution of forecasts

4th Quarter FY10

- Presented results for comment by HPC staff, including Forecast Branch chief and SOO. They confirmed that verification statistics appeared correct.
- Presented results, demonstrating probability and QPF amount fields, at European Radar Conference (September)
- Continued collecting-collocating data for 2010
- Expanded initial predictor dataset to include stability and humidity indices from RUC model

1st Quarter FY11

- Continued data collection for CY 2010
- Developed local-regional probability and QPF equations from warm (2009-2010 data) and cool (2009-2010) season input data. Developed codes for spatial interpolation of regression equation coefficients to obtain spatially-continuous equation output on the 4-km HRAP grid
- Developed scripts for real-time operation of the forecast system

Problems Encountered/Issues

2nd Quarter FY09

- Funding not committed until FY09 Q3

3rd Quarter FY09

- None

4th Quarter FY09

- None

1st Quarter FY10

- None

2nd Quarter FY10

- Have revised initial milestones (above) to reflect approved HOSIP research plan, latest FY10 AHPS funding plan

3rd Quarter FY10

- None

4th Quarter FY10

- None

1st Quarter FY11

- Delivery of final development report slipped to Q2

Evaluation of Radar Precipitation Estimates from NMQ and from WSR-88D DPA Products over Conterminous United States

Core Goal: Improve the quality of physical inputs and forcings

Management Lead: Project lead Wanru Wu

Objective: To assess strengths and weaknesses of NMQ radar-only and NEXRAD PPS precipitation estimates over the conterminous United States, in a variety of weather situations, and to determine effective limits of areal coverage of both products

Milestones

| Task | Due Date | Status |
|---|-----------------|---|
| Literature review | FY09Q4 | Complete |
| Data collection (NMQ radar-only, NCEP Stage2 radar-only, ASOS rain gauge reports) | Through FY10/Q3 | Complete |
| Analysis and evaluation (spatial characteristics of radar/gauge errors, regions of effective radar coverage, radar QPE errors in cold weather situations) | FY10/Q3 | Complete |
| Review of research results | FY10/Q4 | Complete; OFC seminar delivered in July |
| Prepare journal article | FY10/Q4 | Completed Jan 2011 |

Accomplishments/Actions

3rd Quarter FY09

- Began data archiving
- Began preparation of HOSIP project plan

4th Quarter FY09

- Project plan approved, passed HOSIP Gate2 review (project P-2009-006)
- Collected initial results of evaluation; presented results in AMS Radar Conference preprint and poster (early October 2009)

1st Quarter FY10

- Continued data collection in real time
- Got NSSL assistance to retrieve NMQ data covering some missing periods in early 2009
- Collected fresh statistics using recent NCEP StageII radar-only data without any gauge bias correction; there was only minor influence on StageII (DPA) verification statistics, generally positive
- Processed and applied rmosaic data to replace bias-corrected Stage2 data as original DPA products from January 1st - September 31, 2009 and reevaluated NMQ radar-only QPE during the period, with ASOS rain gauge 24-h precipitation as the verification.

2nd Quarter FY10

- Continued data collection in real time
- Derived evaluation statistics for 1-h, 6-h, 24-h point data (ASOS rain gauge verification)
- Began evaluation of statistics in cold-rain situations (surface temperature 34-40°F)
- Began evaluation of spatial correlation statistics of DPA-based and NMQ-based radar-only gridded fields, relative to StageIV multisensor and gauge-only precipitation

3rd Quarter FY10

- Completed statistical analyses
- Began preparation of tech report and OFC seminar material (seminar delivered in July)
- HOSIP Gate3 scheduled 1 September

4th Quarter FY10

- HOSIP Gate3 review presented on September 1
- Awaiting final approval of technical report from gatekeeper

1st Quarter FY11

- Worked report in journal article format; got initial internal reviews
- Awaiting final approval of technical report from gatekeeper

Problems Encountered/Issues**3rd Quarter FY09**

- Funding not committed until FY09 Q3

4th Quarter FY09

- Discovered error in NCEP Stagell processing that introduced gauge/radar bias correction into gridded radar QPE products; worked on alternative methods of getting around the problem (an alternative data source for mosaicked DPA data appeared in Oct 2009)

1st Quarter FY10

- None this quarter

2nd Quarter FY10

- None this quarter

3rd Quarter FY10

- None this quarter

4th Quarter FY10

- Awaiting gatekeeper's final review of technical report

1st Quarter FY11

- Awaiting final approval of technical report from gatekeeper

Gridded Hydrometeorological Forcings for Community Hydrologic Prediction System (CHPS) – FY10-FY11

Core Goal: Improve the quality of physical inputs and forcings

Management Lead: David Kitzmiller

Note: for FY11, reporting on the following project has been merged into this report:

- Satellite Based Analysis for Potential Evaporation

Objectives: To facilitate RFC studies on biases or statistical differences between current operational basin-average forcings (precipitation, temperature, potential evapotranspiration [PET], and freezing level) and new gridded versions such as are intended to be used in CHPS. In many instances the forcings now entering the river forecast system are calculated from a weighted sum of point measurements; operational practice is shifting to calculating all basin-average forcings from grids, and in some documented instances the grid calculation is biased relative to point-based values, or relative to the calibration dataset. We will consolidate and summarize results reported by RFCs into a final document;

To consolidate and summarize any results on the impact of the new gridded forcings on hydrologic simulations with NWSRFS;

Identify methodologies and any ongoing projects for deriving a gridded calibration dataset of precipitation, temperature, and PET for all RFCs, based on in-house reanalysis, Analysis of Record (AOR), or other means; produce a report on preferred options for generating long-term calibration datasets for these variables at 4-km, 1-hour resolution;

Assist and coordinate with RFCs in cataloging archives of point and gridded hydrometeorological data using in constructing calibration datasets.

Proposed Milestones:

| Task | Due Date | Status |
|---|------------------|---|
| 1. Archive forcings data from CAT sites (ABRFC, NERFC, CNRFC, NWRFC) | Continuous | Ongoing – started FY09 Q4 |
| 2. Initiate real-time archive development from all remaining RFCs) | Initiate FY10/Q2 | Ongoing at most sites – FY10 Q2 |
| 3. Document statistical differences between point-based and gridded forcings from MPE, Mountain Mapper/Daily QC, GFE, and report on findings. | FY10/Q3 | Results reported from all CAT RFCs |
| 4. Execute parallel streamflow simulations driven by point-based and grid-based basin average precipitation, temperature; report on magnitude of differences in simulations and differences in quality relative to gauge observations | FY10/Q3 | Results reported from ABRFC, CNRFC, NERFC |
| 5. Coordinate with RFC staff to locate historical point or gridded inputs (precipitation, temperature, cloud cover, winds, relative humidity) used to construct hydrologic calibration datasets – needed for either development of new datasets or verification of calibration datasets from an outside source such as AOR. | FY11/Q2 | Revised timeline based on start of full-time contract support |

| | | |
|---|----------------|--|
| <p>6. Report on potential and preferred methods of deriving gridded calibration datasets (other than precipitation and PET) of at least 50 year duration – possibly a re-analysis of historical data, or an external source such as the Analysis of Record (AOR) now under development, possibly other methods of reanalysis. Calibration datasets will be ~4-km mesh length, 1-h time series.</p> | <p>FY11/Q3</p> | <p>Revised timeline based on start of full-time contract support</p> |
| <p>7. Report on potential and preferred methods of deriving gridded precipitation calibration dataset, 50-year duration, including reanalysis with archive of RFC raingauge and radar data; available satellite products, and disaggregation of climatic datasets with daily-to-monthly total precipitation</p> | <p>FY11/Q3</p> | <p>Revised timeline based on start of full-time contract support</p> |
| <p>8. Report on potential and methods of deriving gridded potential evapotranspiration (PET) calibration dataset, focusing on geostationary satellite estimates of cloud cover and/or surface radiation balance, and reanalysis estimates of radiation balance, wind, temperature, and humidity.</p> | <p>FY11/Q4</p> | <p>Now includes tasks from original CHPS PET task from FY09</p> |
| <p>9. (Tentative as of FY11 Q1): report on potential impact of PET forcings in calibration, to assess any impact of use of real-time estimates vs. application of local climatic values on hydrologic simulations</p> | <p>FY12/Q1</p> | |
| <p>10. Evaluate methods of improving MPE/DQC disaggregation of multi-hour precip accumulations to 1-h, including spatial interpolation of 1-h radar QPE when necessary, use of reanalysis precipitation forecasts</p> | <p>FY12/Q1</p> | |
| <p>11. Re-analysis for precipitation from point (gauge) observations: develop offline capability for gridded record of precipitation for ≥ 10 years. Report on methods for further disaggregating to hourly time series.</p> | <p>FY12/Q2</p> | |
| <p>12. Re-analysis for precipitation from radar/remote sensor observations: Determine if CPC and/or NCDC efforts to produce long-term high-resolution gridded precipitation are moving forward. Depending on schedules, either prepare to utilize one of these sources or re-analyze existing StageIII/StageIV grids using external high-reliability sources such as PRISM monthly totals.</p> | <p>FY12/Q2</p> | |
| <p>13. Reanalysis for sky cover and remote-sensor PET: Determine availability/reliability of RTMA or research sky cover datasets; create PET grids from these data and temperature, wind and relative humidity information from NARR</p> | <p>FY12/Q4</p> | |

Accomplishments/Actions

1st Quarter FY10

- Project plan reviewed and refined based on RFC staff input
- Presentations to ARC and other NWS staff in December
- Data collection (gridded and basin average forcings, some other hydrometeorological inputs) was organized by RFC staff and hosted at NOHRSC
- OHD and field staff met at AMS conference to open dialog on science possibilities for long-term (50-year) reanalysis of precipitation and temperature, yielding hourly high-resolution grids for hydrologic model calibration

2nd Quarter FY10

- Final review of project plan during January HIC meetings, ARC meetings
- Reviewed results of comparison of gridded temperature forcings with legacy point-based forcings at ABRFC, during site visit in March (Kitzmilller)
- Results of gridded forcings comparisons at CNRFC, NWRFC, ABRFC, NERFC reviewed during DOH conference call, April (lead Don Laurine)
- Collected information on multiple NWS operations and projects creating real-time and retrospective precipitation grids; also reviewed availability and characteristics of datasets created by PRISM group and U. Washington (Hamlet and Letternmaier, *J. Hydrometeorology*, 2005)

3rd Quarter FY10

- Ongoing work to hire a contractor to assist with remainder of study
- Determined approximate schedule for upcoming meetings associated with defining requirements for the 2nd phase Analysis of Record (AOR), an effort headed by OST staff. Meetings to be lead by NCEP-EMC and WR staff
- Delivered an OFC seminar on CAT RFC forcings results, ongoing precipitation analysis activities in NWS, and possibilities for expanding data records (July 19)

4th Quarter FY10

- Limited work – contractor still not hired
- Prepared abstract for CLIVAR program conference on reanalysis and user needs for reanalyses, November 2010
- Joined CPC-led effort to gather user input on general needs for Analysis of Record data

1st Quarter FY11

- Presented a poster at CLIVAR program conference on reanalysis and user needs for reanalyses, Baltimore, in November 2010. Presentation entitled “Requirements for Long-term Retrospective Analyses of Hydrometeorological Data to Support Hydrologic Operations and Development” by Kitzmilller, Wu, Zhang, and Adams
- Obtained some valuable information about the availability, limitations, and potential uses of various reanalyses in our effort, particularly for higher latitudes and North America as a whole
- Gathered a basic outline plan for creating calibration datasets from quality-controlled point precip and temperature input, radar QPE and reflectivity input, and existing reanalysis datasets – presented the outline to HICs (January)
- Drafted HOSIP Statement of Need and project plan
- In early January, received some new direction involving real-time gridded data forcings needed at National Water Center, from OHD management
- Got commitment of initial contract support starting in January

Problems Encountered/Issues

1st Quarter FY10

- Final disposition of funding still at issue – but proceeding on the assumption the plan will see only minor changes

2nd Quarter FY10

- Working to hire new contractor to collect reports and carry out literature and operations searches to develop plan for long-term forcings calibration datasets

3rd Quarter FY10

- Contractor hire still pending as of the end of the quarter – expect some delays in milestones for items 6, 7, 8

4th Quarter FY10

- Limited work – contractor still not hired

1st Quarter FY11

- Work still limited by lack of a full-time contractor for support

ARSR/ASR radar QPE evaluation

Core Goal: Improve the quality of physical inputs and forcings

Management Lead: David Kitzmiller

Objective: To verify the reliability of single-polarization radar quantitative precipitation estimates (QPEs) derived from Air Route Surveillance Radar (ARSR-4) and Airport Surveillance (ASR-11) units. Staff in HSEB have updated a local radar Supplemental Product Generator (SPG) to generate precipitation fields from ASR data, in the format of regular Precipitation Processing System products. Data from radar sites at Erie PA and Makah WA are being ingested and tested.

Milestones

| Task | Due Date | Status |
|--|----------|---|
| 1. Collect ARSR- and ASR- based 1-h QPE product files for multiple precipitation events | FY10/Q4 | Started FY10 Q3 |
| 2. Validate FAA radar QPEs via comparison with RFC precipitation and available rain gauge reports; report on results at HOSIP gate meeting | FY09/Q4 | HOSIP or other review delayed, will try FY11-Q2 |

Accomplishments/Actions

2nd Quarter FY10

- Initial HSMB subjective assessment of products generated by HSEB during software development
- Began collection of data product files, from ASR-11 at Erie PA and ARSR-4 in Makah WA (April 2010). Aim to collect data for at least three months.

3rd Quarter FY10

- Continued collection of data products – initial analysis started
- Discovered that while the QPE products appear accurate in terms of placement and timing of precipitation, the Erie unit has a significant low bias

4th Quarter FY10

- Evaluated multiple hours of product data from each of the Makah WA, Watford ND, and Erie PA sites, in terms of correlation with StageIV gauge-radar gridded precipitation analyses and Stagell radar-only precipitation
- Erie data has best correlation with WSR-88D and gauge-radar data overall
- Makah WA output difficult to interpret because of lack of gauge or radar ground truth on the west side of the Olympic Peninsula, and over Pacific Ocean
- Results were forwarded to HSEB staff for comment (October)

1st Quarter FY11

- Received initial review of results from HSEB and OST staff. Based on comments, we must repeat some of the data analysis within a 60 nm range of the radar units at Makah and Watford. These will be reviewed again FY11 Q2. Also, there is very little ground truth for the Makah unit, which has an effective coverage area limited to the Pacific off the Olympic Peninsula of Washington

Problems Encountered/Issues

2nd Quarter FY10

- Funding not committed until FY10 Q2

3rd Quarter FY10

- Initial indications are that data quality is poor – investigation is continuing
- Limited number of sites means that few cases are being collected

4th Quarter FY10

- Requested HSEB review of results; some data artifacts might have gotten into the precipitation products.

1st Quarter FY11

- Must repeat some of the data analysis within a 60 nm range of the radar units at Makah and Watford. These will be reviewed again FY11 Q2

Flash Flood Services

Distributed Hydrologic Model with Threshold Frequencies (DHM-TF)

[Note: Reporting on project “Distributed Modeling Spatial Display and Analysis Tool” is merged into this project as of FY11 Q1]

Core Goal: Improve forecasts of fast response hydrologic events and improve relevant distributed hydrologic model spatial display and analysis tools (DHM-SDAT)

Management Lead: Michael Smith

Objective: Understand the nature of the model errors when running a distributed hydrologic model forced by WFO type data streams (e.g. 15 minute resolution observations and nowcasts). Do additional historical precipitation analysis to support the threshold frequency approach. Collaborate with the Baltimore/Washington, Binghamton, and Pittsburgh WFOs to evaluate real-time and retrospective DHM-TF simulations. Create and modify DHM output visualization tools guided by input from OHD and field offices.

Milestones

| Task | Due Date | Status |
|--|----------|---------|
| 1. Implement Snow17 within BGM WFO DHM-TF operations | FY10 Q2 | Ongoing |
| 2. Implement DHM-TF at Baltimore/Washington WFO | FY10 Q3 | Ongoing |
| 3. Create and/or modify data visualization tools as needed | FY11 Q4 | Ongoing |
| 4. Recommend high level requirements for operational development | FY11 Q4 | Ongoing |
| 5. Publish results | FY12 Q1 | Ongoing |

Accomplishments/Actions

DHM-SDAT project:

1st Quarter FY10

- Refined Google Earth conversion tool to enable use in visualizing DMIP2 related data

2nd Quarter FY10

- Further refined Google Earth conversion tool to enable use in visualizing DMIP2 related data
- Modified color schemes used to display Pittsburgh WFO return period data per user feedback

3rd Quarter FY10

- Modified color schemes and title wording used to display Pittsburgh WFO return period data per user feedback
- Provided support to Hydromet group in use of xmrgtokml conversion program

4th Quarter FY10

- Provided support to IT staff at BGM WFO in the installation and alteration of DHM-TF visualization tools
- Modified color schemes and title wording used to display Binghamton WFO return period data per user feedback

1st Quarter FY11

- Discussed use of Google Earth visualization tools with staff at Baltimore/Washington WFO

DHM-TF project:

1st Quarter FY10

- Further enhanced GRASS GIS and Google Earth programs and scripts needed to visualize

DHM-TF output at Pittsburgh WFO

- Gathered feedback from WFO concerning Google Earth and GRASS GIS plots, and altered image production as necessary
- Continued to monitor operation of model on Pittsburgh's server. Altered scripts as necessary to account for minor bug fixes and for server reconfiguration.
- Worked with Bob Davis at PBZ on analysis of 2007 Millvale flash flood event, determining that standard precipitation forcing under represents the precipitation that actually fell during the event. Bob has provided more realistic gridded AMBER precipitation which will soon be used in a comparison model run.
- Began selection process of next WFO location for installation of DHM-TF.
- With Seann Reed, began derivation and validation of CONUS-wide a priori routing parameters which will be used in DHM-TF operations (and by the broader RDHM modeling community as well)

2nd Quarter FY10

- With Pittsburgh, began investigation of May 2010 flash flood event—planned visit to PBZ WFO to discuss this event, broader DHM-TF issues, as well as to give a talk at PBZ flash flood workshop.
- Delivered DHM-TF lecture to WFO/RFC forecaster audience at COMET workshop in Boulder, CO.
- Continued to monitor operation of model on Pittsburgh's and OHD's servers. Altered scripts as necessary to account for minor bug fixes and for server reconfiguration.
- Worked with Eastern Region and BGM WFO personnel to plan DHM-TF prototype implementation at BGM WFO.
- Coordinated DHM-TF and DHM-FSR research with CBRFC, coming up with joint plan to implement FSR-style surface runoff post-processing into DHM-TF.
- With Seann Reed, continued derivation and validation of CONUS-wide a priori routing parameters which will be used in DHM-TF operations (and by the broader RDHM modeling community as well)

3rd Quarter FY10

- Visited PBZ WFO to talk with staff about current and future DHM-TF operations
- With Seann Reed, continued derivation and validation of CONUS-wide a priori routing parameters which will be used in DHM-TF operations (and by the broader RDHM modeling community as well)
- Delivered DHM-TF talk to WFO/RFC/Academic audience at Eastern Region flash flood conference
- Worked with staff at BGM WFO in a continuing effort to set up DHM-TF on BGM server. Work included derivation of routing parameters, bias correction of forcing data, and establishment of necessary HPN, HPE, and MPE data feeds. Process is nearing completion pending a change in BGM's MPE domain size.
- Continued to monitor operation of model on Pittsburgh's and OHD's servers. Altered scripts as necessary to account for minor bug fixes and for disk space limitations.

4th Quarter FY10

- Completed setup of DHM-TF at BGM WFO. System is now running (and producing visualizations) in a real-time automated mode.
- Began to analyze October 1st flood event in conjunction with BGM WFO staff
- Worked with Ed Clark to create a questionnaire which will be used by WFO/RFC staff to record their usage of DHM-TF and to provide feedback concerning the system.
- With input from Seann Reed, completed set of CONUS *a priori* routing parameters and produced initial parameter report per OHD AOP item.
- Responding to initial contact by LWX WFO, planned visit to LWX to discuss installation of DHM-TF at their location. Sent DHM-TF output to them during DC/Balt-area flood event.

1st Quarter FY11

- With Ed Clark, met with staff at LWX (Baltimore/Washington WFO) to plan DHM-TF deployment

at their WFO.

- Delivered DHM-TF presentation at NOAA/CREST institute in New York City
- Worked with NERFC and BGM WFO staff to enable transfer of MPE precipitation data from the RFC to the WFO. Efforts are still ongoing.
- Created DHM-TF presentation for use by Mike Schaffner at BGM WFO
- Worked with EMC to create 30 years dataset of 2m temperature for use in Snow17 simulations at BGM WFO. Processing work is ongoing, as is work on obtaining real-time 2m temperature data

Problems Encountered/Issues

DHM-SDAT project:

1st Quarter FY10

- None

2nd Quarter FY10

- None

3rd Quarter FY10

- None

4th Quarter FY10

- While GRASS was installed on the operational dx machine at the PBZ WFO, this proved not to be possible at the BGM WFO. The solution implemented by the BGM WFO IT staff was to install it on a separate machine, shuttling the data back and forth between the dx machine and the visualization machine.

1st Quarter FY11

- None

DHM-TF project:

1st Quarter FY10

- Initial approach for derivation of CONUS-wide routing parameters was unstable and has necessitated a comparison of several additional techniques.

2nd Quarter FY10

- Instability of OHD computer system has hampered the continuity of real-time Sterling-domain runs at OHD.
- System upgrade (OB) at Pittsburgh WFO led to a changed scripting environment and an interruption in prototype operations.

3rd Quarter FY10

- Instability of OHD computer system has hampered the continuity of real-time Sterling-domain runs at OHD as well as the ability to run baseline simulations to support prototype operations at PBZ and BGM.

4th Quarter FY10

- MPE product used as forcing for DHM-TF operations at BGM WFO was found not to cover the entire BGM CWA (NERFC precipitation data is missing). NERFC will coordinate with BGM WFO to fix the data supply issue. DHM-TF baseline run will be re-run once precipitation data is fixed.

1st Quarter FY11

- Problems continue to be experienced with the transfer of MPE data from NERFC to BGM. In addition, the production of real-time and retrospective 2m temperature data (needed for Snow17

simulations at BGM) has proven to be extremely time consuming and challenging.

Evaluate Gridded Flash Flood Guidance (GFFG) Approaches

Core Goal: Improve forecasts of fast response hydrologic events

Management Lead: Michael Smith (Project Lead: J.J. Gourley)

Objective: Quantitatively evaluate the ABRFC and OHD TF-GFFG approaches. Use observed streamflow data from small basins, grid inter-comparison techniques, and new verification data collected by NSSL. Evaluate NOAA-NESDIS percent impervious surface area (ISA) data for modeling applications in urban/suburban basins.

Milestones

| Task | Due Date | Status |
|---|----------|---|
| 6. Finalize and check TF-GFFG codes | FY10 Q3 | Complete for 1 hr GFFG |
| 7. Complete initial assessment of impervious surface area data for small basins | FY10 Q3 | This should be re-scoped as a separate project. |
| 8. Continue assessment of flash flood events and utility of SHAVE data | FY10 Q4 | Ongoing |
| 9. Assemble flash flood guidance values from 2006-present for all RFCs | FY11 Q2 | Complete |
| 10. Create CONUS-wide flash flood database using USGS streamflow observations | FY11 Q2 | Ongoing |
| 11. Produce DHM-TF values for RFCs with sufficient StageIV archive | FY11 Q3 | |
| 12. Establish benchmark skill of operational FFG and GFFG methods over CONUS | FY11 Q4 | |
| 13. Compare DHM-TF skill to operational FFG and GFFG skill | FY11 Q4 | |

Accomplishments/Actions

1st Quarter FY10

- Journal article describing data collection strategy and an analysis of flash flood observations from SHAVE and how they can contribute to NWS Storm Data for building flash flood climatologies and conducting rainfall-runoff process studies has been submitted to the Journal of Hydrology's special issue on flash flooding.
- Downloaded the polygons from the StormDat FF event database, provided by Ernie Wells. The csv data have been downloaded and converted into shapefile format for use in GIS.

2nd Quarter FY10

- Journal article describing data collection strategy and an analysis of flash flood observations from SHAVE and how they can contribute to NWS Storm Data for building flash flood climatologies and conducting rainfall-runoff process studies has undergone two revisions and is conditionally accepted to the Journal of Hydrology's special issue on flash flooding.
- We have included the polygons from the StormDat FF event database into our analysis of FFG and GFFG. A complete analysis of the results is pending.

3rd Quarter FY10

- Evaluated skill of FFG and ABRFC-GFFG methods using NSSL flash flood verification database.
- Submitted article to Weather and Forecasting describing ABRFC-GFFG and FFG results, emphasizing thresholds used to maximize skill.
- Created CONUS-wide flash flood database using NWS Storm Data reports.
- Collected dense flash flood observations for a number of cases throughout the summer,

including an OKC flash flooding event.

- Software has been developed to automatically classify SHAVE flooding reports as detailed in Gourley et al. (2010). The 2010 SHAVE reports will be added to the existing database of SHAVE observations from summers 2008-2009.

4th Quarter FY10

- Hosted Ernie Wells and Ed Clark from the Office of Climate, Water, and Weather Services at the National Weather Center in Norman, OK. We met over the course of 2 days to discuss last year's progress and ideas for future work. We invited Dr. Eve Grunfest and her students to participate in the meetings regarding the inclusion of social science in flash flooding research. We were joined by Scott Watson from the Kansas City Forecast Office who presented results from his MS thesis work on evaluating the MBRFC's high-resolution experimental FFG products.

1st Quarter FY11

- Completed quality control of 2010 SHAVE flash flood observations and made all data available from 2008-2010 in comma-delimited files and shapefile format here: http://ftp.nssl.noaa.gov/users/gourley/ffg/ff_conus_databases/shave/
- Requested and obtained 10-yr archive of StageIV hourly rainfall estimates over the CONUS
- Requested and obtained archive of operational, hourly FFG values from 9/2006 to 09/2010. These CONUS mosaics contain whichever version of FFG or GFFG was running operationally at each RFC.

Problems Encountered/Issues

1st Quarter FY10

- Previously, we were working with the FF event locations specified by county and were not aware the polygon-specific events were available for our dataset. We will need to conduct our analysis of FFG and GFFG skill for the NWS StormDat FF polygons.

2nd Quarter FY10

- We had initially conducted our analysis of GFFG and FFG by comparing the rainfall exceedance associated to the FFG and GFFG values precisely coincident with the StormDat polygon location. The results were rather unsatisfactory due to either uncertainties in the spatial assignments of the FF polygons, displacement of intense rainfall from the location where FF impacts were recorded, or both. Revisions were made to the analysis software to search for the most intense rainfall; i.e., that which was most likely associated with the recorded FF event, in pixels surrounding each polygon.

3rd Quarter FY10

- None

4th Quarter FY10

- One challenge that was identified in current CONUS-wide FFG and GFFG evaluation methodologies is the need for recent years' 15-min streamflow observations from the USGS. There is a website that enables users to request data site-by-site (<http://ida.water.usgs.gov/ida/>), but a much greater offline request for data will be required. Once details of the requested data are identified (i.e., station IDs, time period) Ed Clark has agreed to put us in touch with a contact at the USGS who can assist with the request.

1st Quarter FY11

- We will need to get some documentation about which versions of FFG or GFFG were running in real time for each RFC. This must be known because our CONUS FFG dataset is comprised of each RFC's FFG or GFFG values, all stitched together.
- Similarly, before attempting to derive DHM-TF values using StageIV data, we will need to get some information about the details of the rainfall algorithms that were running in real-time at

each RFC to yield the mosaicked rainfall fields.

Improve Guidance for DamBreak Forecasting

Core Goal: Improve forecasts of fast response hydrologic events

Management Lead: Seann Reed

Objective: Identify a nationally supportable, consensus set of dam break modeling procedures and document them in a NWS Dam Break Forecasting Guidance Document. Provide any prototype tools necessary to implement these procedures. Identify formal software engineering requirements to develop improved tools

Milestones*

* FY10 milestones in this project were substantially delayed. See “Problems Encountered” for explanation. Revised due dates are provided below. .

| Task | Due Date (original) | Status |
|--|---------------------|--|
| 1. Coordinate with Army Corps of Engineers to get updates on the NID database and identify how these updates are used at RFCs and WFOs. | FY09 Q4 | Information learned will be included in Guidance Document. |
| 2. Write guidance document for existing procedures (first draft) | FY11 Q2 (FY10 Q3) | On track with new due date. |
| 3. Deliver prototype GIS-based SMPDBK tool (GeoSMPDBK) | FY11 Q2 (FY10 Q3) | Tool will be sent out for beta testing in February |
| 4. Add ability to quickly map SMPDBK results to ArcGIS Toolkit | ? (FY10 Q4) | Replaced by higher priority Tasks 9 and 10 for FY10; could be done for FY11; waiting to see priority level and relationship to IWRSS before assigning a new due date |
| 5. Revisit Rules of Thumb and include findings in final report | FY11 Q2 (FY10 Q4) | On track with modified due date shown. |
| 6. Examine deficiencies in DamCrest data; recommend short-term workarounds and medium term functional requirements for software enhancements | FY11 Q3 (FY10 Q4) | On track with modified due date. |
| 7. Peer review of guidance and GeoSMPDBK. | FY11 Q3 (FY10 Q3) | On track with modified due date.. |
| 8. Revisions to guidance document and GeoSMPDBK | FY11 Q3 (FY10 Q4) | On track with modified due date. |
| 9. HOSIP Gate 3 | FY11 Q4 (FY10 Q4) | On track with modified due date. |
| 10. Conference presentation (ASDSO) | FY11 Q4 | New |

Accomplishments/Actions

1st Quarter FY10

- Presented project updates and plans to Hydraulics AHPS Theme, HICs and ARC. Adapted plans based on feedback.
- Analyzed results from FLDWAV, HEC-RAS, and SMPDBK simulations.
- Wrote a program that prepares input data for SMPDBK from RAS/HEC-GEO-RAS format cross-section file. This tool will be part of the GIS tool that will be used quickly prepare cross-sections data for SMPDBK

2nd Quarter FY10

- Prepared a paper for an ASCE-EWRI conference: “Towards Improved Guidance And Tools For NWS Dam Break Forecasting”.

- The paper for the ASCE-EWRI conference was not approved by Geoff and Pedro because they believed the content was useful to an NWS audience but not necessarily to the larger ASCE audience; however, we discussed revised content and still plan to put together a presentation for ASCE. Written information from the paper will contribute to Task 6.
- Fekadu, Seann, and Cecile prepared a draft Quick Reference document for SMPDBK runs to provide NCRFC short-term assistance in preparation for potential dam break scenarios this Spring. Fekadu provided informal training on this topic via GoToMeeting to NCRFC hydrologists (Andrea, Laura and Bill). This information will be used for Task 6.
- Seann investigated a concern Steve Predmore (MBRFC) raised about DamCrest during the HIC meeting. He identified the cause of the problem and met with Steve to explain and discuss solutions. Steve provided useful input that we can include in our “Best Practices” material we are preparing.
- We also gathered more information from David Welch on DamCrest and how DamCrest data can be updated (Task 5). Next quarter we will gather additional feedback on DamCrest from Service Hydrologists in Eastern Region and document our findings.
- Fekadu helped Ed Capone (NERFC) modify the Gilboa Dam HEC-RAS model to include a spillway.
- Fekadu and Seann worked on writing the Guidance Document for Task 6.
- Cecile has worked on Task 7 -- Develop and document tool to quickly derive cross-sections for SMPDBK and HEC-RAS applications. Seann reviewed software alternatives and concluded that our ArcGIS-based approach makes sense..
- We acquired disk storage space necessary to complete this project but it is still being configured by NWS IT staff.

3rd Quarter FY10

- Completed analysis of FLDWAV, HEC-RAS, and SMPDBK simulations for three dams.
- Prepared a presentation for an ASCE-EWRI conference: “Towards Improved Guidance and Tools For NWS Dam Break Forecasting”. Delivered an expanded presentation at an NWS Webinar.
- A document “Rapid Preparation of a SMPDBK Model Using HEC-GeoRAS to Cut Cross Sections” is 95% complete. The procedures include a new Spreadsheet program to make it easy to create a SMPDBK input deck. A very limited and early version of these procedures was provided to NCRFC in February.
- Collected questions on DamCrest (primarily from WFOs) and began compiling answers.
- 80% of final project document is complete.

4th Quarter FY10

- Collected data from the literature on historical failures to review and potentially improve Rules of Thumb.
- Identified a revised set of tasks required to complete the project. Critical among these are experiments to determine if very approximate default DamCrest assumptions have any value.
- Determined that “Rapid Preparation of a SMPDBK Model Using HEC-GeoRAS to Cut Cross Sections” is too complicated in the form from Q3 work. Began creating new scripts to simplify further.
- Cecile will return for 1 month in October. New time estimates for project completion are provided in the table above.

1st Quarter FY11

- Building on scripts developed by Fekadu and Seann, James developed a much improved tool to rapidly develop a SMPBK model within ArcGIS.
- With assistance from James, Seann used the tool to compare results from GIS derived cross-sections with DamCrest default cross section assumptions for historical dam failures. Initial analysis suggests the approach has benefits. The approach is much more viable than full HEC-RAS modeling in an emergency. This is critical information to provide guidance on data, appropriate assumptions and whether further development of the tool would improve RFC response in the event of a flood.

Problems Encountered/Issues

1st Quarter FY10

- Some schedule delay is due to extended sick leave for a team member.
- FY10 milestones have also been adjusted anticipating that team members will need to spend time on more urgent tasks for the “Transition to HEC-RAS: Model Development and Implementation” project early in the year. The total resource requirement is unchanged.

2nd Quarter FY10

- Task 5 is delayed and will be completed at the same time as Task 6.
- Some schedule delays are due to extended sick leave for a team member.
- It has taken more time than anticipated to acquire the necessary disk storage to complete Tasks 7 and 8.

3rd Quarter FY10

- Both contractors working on this project have left OHD causing delays as indicated in the Table.

4th Quarter FY10

- Both contractors working on this project have left OHD causing delays indicated above. We anticipate getting time from Cecile and a new RTi employee (James Halgren) to complete this project during FY11 Q1 and Q2.

1st Quarter FY11

- Original milestones are delayed primarily due to personnel changes and unanticipated complications (e.g. discovering there has been no quantitative assessment of DamCrest default cross-sections assumptions and there is very limited documentation on NWS Rules of Thumb). Also, other activities with more critical deadlines have taken precedence (e.g. support for HEC-RAS transitions).

FFMP Small Basin Support

Core Goal: Improve forecasts of fast response hydrologic events

Management Lead: Ami Arthur, NSSL

Objective: To provide training and assistance to all WFOs for customization of the FFMPA small-basin shapefile datasets, to coordinate and facilitate the sharing of customized files to prevent duplication of effort among WFOs, and to establish a repository for base and derived datasets and other information relevant to Gridded Flash Flood Guidance.

Milestones

| Task | Due Date | Status |
|---|----------------|--|
| 1. FFMPA Dataset Tier II/ III Customization Webinars | Jan 2010 | Completed |
| 2. Coordination of dataset sharing via the Basin Customization Repository | Ongoing | Ongoing |
| 3. Provide technical assistance and additional training as needed for dataset customization | Ongoing | Ongoing |
| 4. Develop a repository for base and derived datasets and other information relevant to Gridded Flash Flood Guidance (GFFG) | Sept. 30, 2010 | Completed (The GFFG repository is now online and populated with data. Additional data will be added to the site as it is received from and based on ongoing discussions with the RFCs.) |

Accomplishments/Actions

1st Quarter FY10

- Three of the webinars were given during this quarter, and the Basin Customization Repository was updated with relevant training materials and data for the topics covered.
- Due to scheduling conflicts, the fourth webinar that was originally set for 17 Dec 2009 was rescheduled for Thursday, 28 Jan 2010.
- We also continued to provide technical assistance to FFMPA dataset users.

2nd Quarter FY10

- The fourth webinar was given during this quarter, and the Basin Customization Repository was updated with relevant training materials and data for the topics covered.
- Technical assistance on basin customization was provided to several FFMPA dataset users.
- Based on discussions with several RFCs, a prototype repository was established for Gridded Flash Flood Guidance base and derived datasets and other files. A plan for organization of the larger datasets in a hydrologically meaningful way that will allow easy download for GFFG and other projects has been developed and is being tested.

3rd Quarter FY10

- We continued to work with the RFCs to finalize the type and format of datasets to be included in the GFFG repository. Progress was made on gathering and formatting the gridded datasets including the National Elevation Dataset, Land Use/Land Cover dataset, and STATSGO soils data. These gridded datasets are being organized into hydrologic units roughly corresponding

to the 4-digit USGS cataloging units. This will allow easy access for many hydrologic projects.

- We also continued to provide technical assistance to FFMPA dataset users.

4th Quarter FY10

- During this quarter, the Hydrologic and GFFG Data Repository was brought online. The following datasets and files are available for download from the repository:
 - National Elevation Dataset organized into hydrologic download units
 - National Land Cover Dataset organized into hydrologic download units
 - GFFG derived grids submitted by LMRFC (Curve Number, Threshold Runoff, Peak Flow, Critical Flow)--additional GFFG derived grids will be added as they are submitted by RFCs
 - GFFG scripts and documentation
- Several programs and GIS scripts were developed to extract soil parameters from the very complex high-resolution Soil Survey Geographic Database (SSURGO). The result of this work is a national Hydrologic Soil Group layer (the Hydrologic Soil Group is used in the derivation of GFFG). This layer was originally made available on the repository, but was taken offline after the most recent conference call with the RFCs when a request was made that this parameter be expressed in a slightly different way. This update is in progress.
- ArcGIS delineation instructions were written and contributed to the GFFG ThreshR procedure being developed at the ABRFC.
- Several FFMP basin/stream datasets were assembled and delivered for testing the version of FFMPA ported to AWIPS II.
- Continued to provide technical assistance to FFMPA dataset users.

1st Quarter FY11

- During this quarter, the SSURGO shapefiles with extracted Hydrologic Soil Group parameters were updated to include components and percentages as requested in Q4 FY10 by the RFCs. This update is near completion, and the shapefiles will soon be uploaded to the Hydrologic and GFFG Repository.
- Provided technical assistance to some of the first users of the Hydrologic and GFFG Repository.

Problems Encountered/Issues

1st Quarter FY10

- none

2nd Quarter FY10

- none

3rd Quarter FY10

- none

4th Quarter FY10

- none

1st Quarter FY11

- none

Routing (Hydraulics)

Transition to HEC-RAS: Model Development and Implementation

Core Goal: Improve the routing techniques used to connect forecast locations

Management Lead: Seann Reed

Objective: Support RFCs in the transition to HEC-RAS.

Milestones*

*Some delays in FY10 due to personnel changes.

| Task | Due Date (original due date) | Status |
|---|---------------------------------|--|
| Support FLDWAV/DWOPER conversions for non-CAT RFCs. | FY11 Q4 (FY10 Q4) | Ongoing. Most interaction has been with NCRFC and LMRFC. NCRFC now have several folks trained so our role will diminish but will not likely end until later this year. |
| Assist with HEC-RAS configuration in CHPS as needed and HEC-RAS troubleshooting during parallel operations. | FY11 Q4 (FY10 Q4) | Ongoing. Making good progress helping NCRFC and LMRFC. Our role will diminish but will not likely end until later this year. |
| Assist in the transitioning of Red River flood mapping service to CHPS. | FY11 Q3 (FY10 Q4) | Plan to work with NCRFC on new Red River HEC-RAS model after 2011 flood season. |
| Recommend how to segment HEC-RAS models operationally. | FY11 Q2 (FY10 Q4) | Plan to work on in March. |
| Help coordinate a NWS HEC-RAS Workshop on advanced topics. | FY11 Q2 (FY11 Q1) | LMRFC is now the lead with OHD assistance (scheduled for FY11 Q2) |
| HOSIP Gate 3 | FY11 Q4 | On track. |

Accomplishments/Actions

1st Quarter FY10

- Seann converted the NCRFC M19 model to HEC-RAS with assistance from Angelica and did initial calibration work. Some additional work is recommended to examine different ways to account for the effects of the lock and dam structures.
- Seann participated in HEC-RAS/CHPS software acceptance testing.
- Seann reported on HEC-RAS transition status to the CAT RFCs and received feedback/suggestions.
- Fekadu answered questions from NERFC.
- HSMB Hydraulics Group had a conference call with NCRFC. Seann and Fekadu scheduled travel to NCRFC during January 2010.
- Seann prepared the HOSIP Statement of Need. This project follows on from the completed project: Transition from FLDWAV to HEC-RAS; Forecast Implications and Transition Tools” (HOSIP Project P2007-21).
- Hydraulics Theme Team and ARC members provided suggestions on scope of work.

2nd Quarter FY10

- Seann and Fekadu visited NCRFC during January to provide hands-on training and discuss what needs to be done to transition their DWOPER and FLDWAV models to HEC-RAS.
- Seann presented the status of HEC-RAS transition to the CAT.

- Seann assisted Deltares in troubleshooting a HEC-RAS adapter problem identified by NERFC and responded to a HEC-RAS Adapter question from NWRFC.
- Fekadu attended the CHPS migration training, and began bi-weekly training sessions for the Hydraulics Group.
- Seann completed Gate 2 documents for the “Transition to HEC-RAS: Model Development and Implementation” and the Gate 2 meeting has been scheduled.
- Fekadu and Seann held several GoToMeetings to assist NCRFC in converting their MISILO (Mississippi-Illinois) DWOPER model to HEC-RAS.
- Fekadu visited SERFC and discussed their needs with respect to HEC-RAS model development and implementation.

3rd Quarter FY10

- OHD has finished work on the NWRFC M1022DW Mississippi model and made substantial progress on the ABVSTPFW and M10FW models. Fekadu was the lead on the ABVSTPFW and M10FW models and is now gone, so there will be a delay in completing that task.
- Seann and Fekadu helped with a few ‘chps_ops’ questions.
- Seann prepared a presentation discussion HEC-RAS Transition issues for the ASCE-EWRI conference and then presented similar information to an NWS audience during a June 28 Webinar.
- Fekadu visited SERFC to help assess their needs with respect to HEC-RAS model development.

4th Quarter FY10

- Seann created a new model for LMRFC’s “Upper Mississippi” domain which incorporates data from the OHRFC community model and provided the model to LMRFC.
- Tested HEC-RAS 4.1 CHPS Adapter on Linux. Learned enough CHPS to answer several RFC support questions. Revised Deltares document: “How to Add HEC-RAS Models to CHPS”.
- A new RTi contractor, Alfonso Mejia, began work on this project. He will complete the conversion of the ABVSTPFW and M10FW models during FY11 Q1.
- Planned and advanced HEC-RAS training class with LMRFC.

1st Quarter FY11

- Seann and Alfonso led several modeling coordination calls with NCRFC.
- Alfonso refined the HEC-RAS model for the upper Mississippi River, from Anoka, MN, to Lock and Dam 10 (including major tributaries). He computed statistics, refined the calibration, and checked cross-section data.
- Seann and Alfonso reviewed and discussed three other Mississippi River models with NCRFC.
- Alfonso learned CHPS and worked with Varlakshmi Rajaram (HSEB) to create an example configuration for a small portion of the Mississippi river. They created a supplemental instructional document that will assist RFCs with configurations.
- Alfonso completed the ice jam exercise from Pedro.
- Seann coordinated with LMRFC, West Consultants, Dennis Johnson, and Mark Glaudemans on HEC-RAS training plans. The agenda is finalized.
- Seann and Alfonso assisted NWRFC with some HEC-RAS modeling instability problems.
- James assisted LMRFC with a HEC-RAS modeling boundary condition problem.
- James began learning CHPS.

Problems Encountered/Issues

1st Quarter FY10

- None

2nd Quarter FY10

- None

3rd Quarter FY10

- Both contractors working on this project have left OHD. We have initiated the process of finding replacements. The resulting delays for certain tasks are reflected in Table 1.

4th Quarter FY10

- Both contractors working on this project left OHD in June. A new RTi contractor, Alfonso Mejia, began work on Sept. 20, 2010.

1st Quarter FY11

- Found a problem with the HEC-RAS Adapter. The adapter will not allow users to specify time series as internal boundary conditions. We have provided a description of the problem and example data to RMA and they are working on a fix.

River-Estuary-Ocean Modeling to Enhance Operational River Forecasting -- Chesapeake Bay Study Area

Core Goal: Improve the routing techniques used to connect forecast locations. Improve the quality of physical inputs and forcings (e.g. wind data into hydraulic models).

Management Lead: Seann Reed

Objective: Provide an accurate hydraulics model that extends from river mouths upstream to at least existing forecast points and beyond if necessary to achieve accuracy. Provide accurate river flow forecasts to NOS operational estuary models. Evaluate 2D/3D models or a combination of HEC-RAS and 2D/3D models to meet the goals. Evaluate and document appropriate boundary conditions, including water level and flux boundary conditions at the downstream boundary and wind forcings on the water surface.

Milestones

FY10 Milestones for "Incorporate Wind Information into HEC-RAS" project (merged in):

| Task | Due Date | Status |
|--|----------|--|
| 1. Compare models and document recommendations | FY10 Q2 | Delayed, see Problems Encountered |
| 2. Provide requirements to HEC | FY10 Q3 | On hold until funding to work with HEC is identified |
| 3. Publish Results documentation: presentation and paper | FY10 Q3 | Journal article will be submitted FY11 Q2 |

FY10 Milestones for River-Estuary-Ocean Modeling project (i.e. this project):

| Task | Due Date | Status |
|--|----------|--|
| 1. Calibrate HEC-RAS | FY10 Q2 | Complete |
| 2. Calibrate ADCIRC (task revised to focus on comparisons with CIPS ELCIRC and CBOFS2) | FY10 Q3 | N/A |
| 3. Compare HEC-RAS and ADCIRC scenarios (now CIPS ELCIRC and CBOFS instead of ADCIRC) | FY10 Q4 | Complete (see also extended work in next table Task 1) |
| 4. Coordinate with NOAA Storm Surge Team | Ongoing | Ongoing |

FY11 Milestones for Merged Project

| Task | Due Date (original) | Comments |
|---|---------------------|---|
| 1. Compare HEC-RAS, CBOFS2, SLOSH/ET-Surge, Sobek 1D with wind | FY11 Q1 | Several analyses are complete. Still working on wind analysis. |
| 2. Submit drafts of two journal articles | FY11 Q2 (FY11 Q1) | In progress |
| 3. Finalize journal articles | FY11 Q2 | On track |
| HOSIP Gate 3 | FY11 Q3 (FY11 Q2) | On Track |
| 4. Participate in broader CERIS planning efforts | Ongoing | |
| 5. Provide documentation to RFCs on how to access gridded extra-tropical surge data to use as HEC-RAS model boundary conditions | FY11 Q2 | On track. Not in original project plan but identified as a key activity that can show tangible benefits in the near term. |
| 6. Prepare and deliver lecture on "Downstream Boundary Conditions for Coastal Hydraulic Situations" at Advanced HEC-RAS course. | Feb. 14, 2011 | On track |
| 7. Define tasks for Kate Abshire | May 2011 | On track: Activities we are considering may also benefit IWRSS. |

Accomplishments/Actions

Incorporate Wind Information into HEC-RAS project:

1st Quarter FY10

- Data analysis for Sobek runs partially completed
- Continued support for MARFC learning the Potomac HEC-RAS model
- Prepared preliminary draft of HEC recommendations.

2nd Quarter FY10

- Mashriqui and Cecile calibrated the Potomac HEC-RAS model (serves both this project and REO project). Sobek model still needs calibration for high wind period.
- Mashriqui updated some cross sections in the HEC-RAS model based on MARFC's feedback and worked with Deltares to convert this new HEC-RAS model to SOBEK for wind modeling experiments. Roughness factors must be checked in Sobek for each section.

3rd Quarter FY10

- This project received no AHPS funding after FY10 Quarter 2. Work continues with FTE resources. For further updates, please see the HOSIP Projects web page: https://bestpractices.nws.noaa.gov/contents/hosip/Pages/HOSIP_Projects/index.php. Project ID is **P-2008-007**.

4th Quarter FY10

- Plans made to revisit SOBEK work and analysis of 1D winds in FY11 Q1.

River-Estuary-Ocean Modeling project:

1st Quarter FY10

- HOSIP Project Plan revised again and submitted.
- Conference paper prepared for FIHMC: Toward Modeling Of River-Estuary-Ocean Interactions To Enhance Operational River Forecasting In The NOAA National Weather Service

2nd Quarter FY10

- Mashriqui and Cecile calibrated the Potomac HEC-RAS (Task 4)
- Seann and Mashriqui prepared a proposal to the HPCC Incubator Program to acquire funds so that we can develop a more robust computational framework for model testing and add CIPS ELCIRC to our suite of models being tested. The final decision on this proposal is not in but it does not look promising.
- Mashriqui presented the Gate 2 presentation for "Modeling River-Estuary-Ocean Interactions". Geoff and Pedro wanted some follow up discussion on how to document the broader effort in addition to the specifics of the one-year Project Plan provided. Seann and Mashriqui met with Pedro to discuss this. Additional discussion is needed.
- Seann and Mashriqui attended several presentations at the DHS Science and Technology for Intelligent Resilience workshop in D.C. Specifically, "Hazards Resilience: A New Approach for Forecasting the Coastal Impacts of Hurricanes". There were 3 presentations from Jackson State University in Mississippi and one from NASA.
- Mashriqui attended the NOAA-CMOP exchange meeting. CMOP is the Center for Coastal Margin Observation and Prediction, an NSF Science and Technology Center in the Pacific Northwest. This meeting was organized by Don Laurine.
- Mashriqui met with NOS/CSDL ADCIRC modeler Jiantao Xu and made progress on ADCIRC model runs on the NCEP computer. Specifically, they discussed ADCIRC capabilities to incorporate freshwater inflows (Task 5).
- Mashriqui and Seann worked with Ken Pavelle on CERIS and NOAA Storm Surge Team planning activities.

3rd Quarter FY10

- This project received no AHPS funding after FY10 Quarter 2. Work continues with FTE resources. For further updates, please see the HOSIP Projects web page: https://bestpractices.nws.noaa.gov/contents/hosip/Pages/HOSIP_Projects/index.php, Project ID is **P-2008-009**.

4th Quarter FY10

- Mashriqui delivered a seminar on August 25 discussing hydraulic modeling of the Potomac River with particular emphasis on the relative importance of tides and freshwater inflows in the transition zone and comparisons among HEC-RAS, CIPS - ELCIRC, and CBOFS2 models.
- Mashriqui drafted two documents outlining how we have met two AOP items related to this project: "Identify downstream river stage boundary conditions to use for initial, real-time testing of new hydraulic modeling techniques for the Potomac River." and "Document the comparison of hydraulic and ocean model simulations for the southern extent of the Potomac River."
- Seann Reed and Mashriqui participated in several CERIS planning meetings with Ken Pavelle, NOS/CSDL, and NSSL. In coordination with Mashriqui, Seann drafted three new mini-Project Plans for FY11 CERIS.

Merged Project:

1st Quarter FY11

- Using Sobek, Mashriqui made progress towards understanding the benefits of a wind force in modeling surge on the Potomac River.
- Mashriqui received and analyzed more CBOFS data to better understand the implications of 1D vs. 2D modeling on the Potomac River.
- James and Mashriqui learn more about ETSurge by collaborating with MDL. James collected and developed some initial pieces of code to help manage the ETSurge data.
- Mashriqui and James prepared lecture slides on "Downstream Boundary Conditions for Coastal Hydraulic Situations" in the Advanced HEC-RAS course.
- Mashriqui continued to write papers describing the HEC-RAS modeling, HEC-RAS vs. 2d model comparisons, and boundary condition data implications.
- James, Seann, and Mashriqui defined specifications for a new server computer with Windows to facilitate research.

Problems Encountered/Issues

Incorporate Wind Information into HEC-RAS project:

1st Quarter FY10

- Data analysis for Sobek runs partially completed
- Continued support for MARFC learning the Potomac HEC-RAS model
- Prepared preliminary draft of HEC recommendations.

2nd Quarter FY10

- Mashriqui and Cecile calibrated the Potomac HEC-RAS model (serves both this project and REO project). Sobek model still needs calibration for high wind period.
- Mashriqui updated some cross sections in the HEC-RAS model based on MARFC's feedback and worked with Deltares to convert this new HEC-RAS model to SOBEK for wind modeling experiments. Roughness factors must be checked in Sobek for each section.

3rd Quarter FY10

- This project received no AHPS funding after FY10 Quarter 2. Work continues with FTE resources. For further updates, please see the HOSIP Projects web page: https://bestpractices.nws.noaa.gov/contents/hosip/Pages/HOSIP_Projects/index.php, Project ID is **P-2008-007**.

4th Quarter FY10

- Plans made to revisit SOBEK work and analysis of 1D winds in FY11 Q1.

River-Estuary-Ocean Modeling project:

1st Quarter FY10

- None

2nd Quarter FY10

- We are not expecting substantial FY10 AHPS/WR funds for this project. Some time from Cecile Aschwanden (contractor) is still available to wrap-up FY09 funded tasks.
- There will no longer be AHPS/WR funds supporting this work after FY10 Q2. All subsequent work will be funded through other resources.

3rd Quarter FY10

- See above

4th Quarter FY10

- No AHPS/WR funding.

Merged Project:

1st Quarter FY11

- Waiting for IT Summit to get approval for hardware to more efficiently examine 1D vs. 2D modeling questions and the impacts of wind forcings on 2D models.

Incorporate Wind Information into HEC-RAS

Note: This project has been incorporated under “**River-Estuary-Ocean Modeling to Enhance Operational River Forecasting -- Chesapeake Bay Study Area**” as of FY11 Q1

Hydrologic Models

Physically-Based Modifications to the Sacramento Model

[**Note:** The evapotranspiration component of this project will be incorporated into the project “**Migration of HL-RDHM Components to CHPS**” as of next quarter (i.e. FY11 Q2). The remaining components are complete]

Core Goal: Improve the forecasts by improving hydrologic models

Management Lead: Mike Smith

Objective: The objectives of this work are to investigate further modifications to the Sacramento model. These include: investigate/modify SAC model to run over cascading planar elements; better treatment of vegetation, perhaps from the NCEP LSM model; treatment of old water/new water in runoff process; treatment of re-infiltration of runoff, etc.

Milestones

| Task | Due Date | Status |
|---|----------|--|
| 1. Evaluate need for adding vegetation component to Sac Model. This could include: 1) Evaluate NOAA LSM treatment of vegetation in context of DMIP 2 in OK and Western basins. 2) Evaluate benefit of better PE estimates versus adding vegetation component (i.e. collaborate with Martha Anderson of Beltsville, ARS; get NCEP's PE estimates, evaluate NASA Marshal PE). | FY07 Q4 | Done via DMIP 2 and investigation of dry area SAC parameterization. |
| 2. Identify basins with clear evidence of channel re-infiltration. Coordinate with Dave Goodrich of ARS for this; set up RDHM runs for analysis 3. Modify RDHM to test approach if necessary. | FY07 Q4 | Delivered capability to specify channel losses in HL-RDHM routing algorithm to CBRFC |
| 4. Evaluate need for treatment of Mean residence times and old/new water as per seminar by Jeff McDonnell. | FY07 Q4 | Delayed |
| 5. Evaluate new NASA PE time series to assess value for hydrologic simulations. | FY08 Q3 | Complete |
| 6. Investigate linkage of sub-surface flows in gridded Sac model | FY09 Q4 | Complete |
| 7. Modify SAC-HT for better evapotranspiration treatment | FY10 Q4 | Complete |

Accomplishments/Actions

1st Quarter FY07

- Initiated new project for physically-based modifications to the Sacramento Model

2nd Quarter FY07

- Time estimates developed for potential modifications to SAC-SMA. Identified NCEP actual PE values as possible path. Evaluation of Blue River in Oklahoma for channel re-infiltration not conclusive. McDonnell commented during the seminar on 'old water' that this concept is probably most geared towards hillslope runoff processes.

3rd Quarter FY07

- Identified Blue River in Oklahoma as one that has channel losses from karst formations. Contacted Dr. Todd Halihan, a hydrogeologist from Oklahoma State University who is very familiar with the Blue River and springs and karst formations. Requested any data for this basin.

4th Quarter FY07

- Provided Guidance to NASA researchers on Joint OHD/NASA project for PE estimates. This work will test the combination of MODIS satellite-derived cloud mask information with ASOS ceilometer data to derive a replacement for the manual sky cover observations required for SYNTRAN. Initial interim results look promising.
- Obtained many papers etc from Dr. Todd Halihan on the hydrogeology of the Blue River basin.

- Sent one presentation to ABRFC for their use. Hopefully, these will provide useful data.
- Some DMIP 2 participants used the NARR data for evaporation; must evaluate these results

1st Quarter FY08

- Shane Sheldon began analysis to compare the impacts of several different PE sources on simulations in the Blue River.

2nd Quarter FY08

- Found USGS data for the spring in the Blue River (largest in Oklahoma). Sent data to ABRFC. Shane Sheldon tried various values of SAC 'side' parameter to improve simulations for this basin.
- Evaluation of daily PE time series is underway on two basins in Oklahoma: Blue River and Black Bear Creek. The Blue River is somewhat problematic so we switched to the Black Bear Creek. Analyzing 3 PE time series: derived from ASOS cloud height, MODIS cloud mask, and combination of ASOS and MODIS. Advantages compared to monthly climate PE approach not initially obvious, but the PE time series are certainly within a reasonable range.
- Dr. Soroosh Sorooshian of the U. California at Irvine will send a PhD student to work at OHD over the summer. One aspect of the work will be to develop sub-surface linkages of gridded Sac elements.

3rd Quarter FY08

- PhD student Behnaz Kahkbasz from UCI started June 9 at OHD for summer internship. She and Victor developed a physically-based strategy to use the soil moisture levels computed by SAC-HT and channel invert elevations to determine the proportion of interflow and baseflow that would be routed to the downstream grid cell's storages. The SAC fland1.f subroutine was modified for proof-of-concept testing. Hypothetical tests of the modifications showed reasonable results.

4th Quarter FY08

- Concept and initial results of using SAC-HT to model sub surface flow connections presented at DOH 2008 conference. Work continued at UC Irvine.
- Victor Koren developed outline for modifying the SAC-HT model to account for better treatment of vegetation, canopy, and evapotranspiration losses using experience from Noah land surface model. This will be submitted as an AHPS/WR FY09 proposal. This modification is primarily focused on work in dry climates.

1^{sr} Quarter FY09

- Behnaz Khakbasz modified the HL-RDHM to generate a grid cell water exchange for primary and supplemental baseflow based on a concept developed earlier. Started tests with the new structure.
- Victor presented results of his SAC *a priori* parameterization work in dry areas and the deficiency of the SAC model regarding evaporation. Presentation made to RFCs and OHD.
- Victor prepared plan for modifying SAC model for refined evapotranspiration approach. Mike presented plan to AHPS/Water Resources Innovation Theme Team.

2nd Quarter FY09

- SON approved for modifying SAC-HT for advanced evapotranspiration; HOSIP Stage III project plan begun. OHD (Victor Koren) provided guidance and SAC-HT code to U. Washington for their unified land surface model consisting of SAC-SMA and the Noah models.
- Daily PE 4km grids delivered to OHD for 2006 and 2007 for Oklahoma and Texas. Evaluation underway. Initial spatial analyses indicate that a better method is needed to interpolate ASOS observations of meteorological variables to a grid.
- Linkage of sub-surface elements: Victor Koren provided much guidance to UCI researcher Behnaz Khakbasz. She finished coding of a water exchange component into HL-RDHM. Generated needed parametric data to run the new RDHM version for the Eldon basin. She is planning sensitivity tests using Eldon data. Ms. Khakbasz generated many simulations and experiments noting the sensitivity of model performance to the relationship of channel invert to SAC lower zone storages.

3rd Quarter FY09

- HOSIP Stage III plan approved for this project.
- Modification SAC-HT project: Completed Task 3, formulated SAC-HT water exchange mechanism based on the Noah evapotranspiration parameterization, adjusted software, and performed water balance tests. The algorithm has two options: a) original SAC-HT water exchange mechanism, and b) mixing of Noah-type diffusive mechanism (for tension water) and SAC-HT mechanism (for free water).
- Linkage of sub-surface elements: Behnaz Khakbaz is performing sensitivity tests with the new HL-RDHM water exchange component to quantify effects of subsurface water exchange on greek cell runoff at different scales.

4th Quarter FY09

- Tested and implemented air temperature based approaches for estimation of solar radiation and water vapor pressure to be implemented into canopy resistance component.
- Finishing implementation of a canopy resistance component into SAC-HT software
- Linkage of sub-surface elements: Behnaz Khabaz at U. California Irvine is finishing evaluation of HL-RDHM modification that accounts for the subsurface water exchange between grid cells.

1st Quarter FY10

- Purchased, collected, and processed input fluxes data for four sites of the Oklahoma Mesonet.
- Downloaded and generated xmrq-type grids of air temperature over ABRFC from 30-year NCEP reanalysis database.
- Performed tests of a few options of canopy resistance formulation using Oklahoma Mesonet sites data
- Behnaz Khabaz at U. California Irvine is summarizing research results on the subsurface water exchange in her PhD Thesis.

2nd Quarter FY10

- Extended tests of modified SAC-HT with the vegetation effects over few Oklahoma Mesonet river basins. Improved formulation of root distribution.

3rd Quarter FY10

- Victor completed major testing, began writing final report for HOSIP gate meeting on the modification of the SAC-HT for enhanced evapotranspiration
- Behnaz Khakbaz submitted paper on her results to Water Resources Research

4th Quarter FY10

- Victor completed final project report for the modification of the SAC-HT for enhanced treatment of evapotranspiration (Hereafter called the SAC-HTET)
- Victor conducted Gate 3 project review and OHD seminars in September
- Victor's project report selected by OHD as a model report for future HOSIP projects
- Hydrology Group completed analysis of NASA-derived gridded PE time series and submitted report to OHD.

1st Quarter FY11

- Victor, Zhengtao, and Mike developed plans for implementing the SAC-HTET into CHPS as a component of the CHPS HL-RDHM.
- Reporting for the SAC-HTET will be transferred to the AHPS Project: Migrating the HL-RDHM Components to CHPS.

Problems Encountered/Issues

1st Quarter FY07 - None

2nd Quarter FY07

- Hydro group is currently managing 38 major tasks...need prioritization and final budget resolution before moving ahead with new projects.

3rd Quarter FY07

- Hydro group is currently managing 38 major tasks...need prioritization and final budget resolution before moving ahead with new projects.

4th Quarter FY07 - None

1st Quarter FY08 - None

2nd Quarter FY08 - None

3rd Quarter FY08 - None

4th Quarter FY08

- Some delays in receiving time series from NASA Marshall SFC of gridded PE derived from MODIS and ASOS cloud observations. These are expected FY09 Q1.

1st Quarter FY09

- Continued delays in receiving gridded PE data from Marshall SFC.

2nd Quarter FY09

- Continued delays in receiving gridded PE data from Marshall SFC.

3rd Quarter FY09

- None

4th Quarter FY09

- There is difficulty with obtaining meteorological data for the Oklahoma Mesonet to test the modified SAC-HT. No response yet from the Mesonet staff despite repeated requests.

1st Quarter FY10

- There was a general space problem on the Linux machines which delayed progress. Also, the /fs/hsm5 file system was damaged and needed to be fixed.

2nd Quarter FY10

- None

3rd Quarter FY10

- Victor determined that he needs extensive medical leave and will take sick leave for the majority of September, 2010.

4th Quarter FY10

- NASA Marshall could not deliver in time the final version of the PE grids using the correct B3 parameters.

1st Quarter FY11

- None

Calibration - Complete IDMA Study

Note: This project has been incorporated under “**Distributed Model Intercomparison Project (DMIP II)**”
as of FY11 Q1

Software Refresh

Community Hydrologic Prediction System (CHPS)

Core Goal: Enhance the usability and/or internal workings of existing software

Management Lead: Jon Roe

Project Manager: Chris Brunner

Objective: Provide an improved software infrastructure for operational use at RFCs, as a replacement for the existing NWSRFS, and which will meet the future forecasting needs of all RFCs.

FY11 Milestones:

| Task/Subtask FY11 Milestones | FY11 Due Date | Current Status |
|---|---------------------|---------------------|
| 1 CHPS Software Implementation | | |
| 1.1 Deltares: Confirm that ResSim capability works at CNRFC | FY11 Q1 | Delayed to FY11 Q2 |
| 1.2 Deltares: Implement Rating Curve Mod software in CHPS for NCRFC | FY11 Q3 | Not started |
| 1.3 Deltares & OHD contractors: Implement gridded FFG in CHPS using a distributed model approach for MARFC | FY11 Q4 | Started |
| 1.4 OHD contractors: Complete FFG/FFH capability for CAT-II RFCs and assist with migrations | FY11 Q4 | FY11 Q1: continuing |
| 1.5 Deltares & OHD contractors: Implement an initial CHPS-based Calibration capability for use by all RFCs | FY12 Q2 | Started |
| 1.6 Deltares: Design and implement an initial graphical API for prototyping via one or more NWS projects, such as Calibration or Graphics Generator. | FY11 Q4 | Started |
| 2 CHPS Operational Support & Maintenance | | |
| 2.1 Deltares: provide as-needed CHPS support to all RFCs during migration, parallel operations, and after going operational. This might involve bug fixes to the Deltares-developed software. | FY11 Q1, Q2, Q3, Q4 | FY11 Q1: complete |
| 2.2 OCWWS HSD HSB contractors: hire 2 new contractors; provide as-needed CHPS troubleshooting support/solutions to all RFCs during migration, parallel operations, and after going operational. | FY11 Q2, Q3, Q4 | Started |
| 2.3 OHD contractors: provide as-needed CHPS troubleshooting support/solutions to all RFCs during migration, parallel operations, and after going operational. This might involve bug fixes to OHD-developed software. | FY11 Q1, Q2, Q3, Q4 | FY11 Q1: complete |
| 2.4 RMA contractors: provide as-needed troubleshooting support/solutions for the CHPS software adapter for HEC-RAS. This might involve bug fixes to the HEC/RMA-developed software. | FY11 Q1, Q2, Q3, Q4 | FY11 Q1: complete |
| 3 CHPS Training | | |

| | | |
|---|---------------------|---|
| 3.1 Deltares & CAT RFCs: Provide User (Forecaster) Training for CAT-II RFCs | FY11 Q1, Q2 | FY11 Q1: complete |
| 3.2 Deltares & CAT RFCs: Provide Advanced Configuration Training for CAT-II RFCs | FY11 Q2 | Not Started |
| 3.3 Deltares: Provide supplemental System Manager refresher training for all RFCs, in the form of classes or a series of conference calls | FY11 Q2 | Not Started |
| 3.4 Deltares: Provide extra training (3 or more classes, to be defined) for OCWWS HSD, OHD, and others in NWS who require training but who are not able to take advantage of training provided to RFCs. | FY11 Q1, Q2, Q3, Q4 | FY11 Q1: None |
| 4 CHPS Workshops and Other Meetings | | |
| 4.1 Deltares: lead CHPS workshops for RFCs OHD, OCWWS HSD HSB, other: attend workshops led by Deltares | FY11 Q1, Q2, Q3, Q4 | FY11 Q1: complete FY11 Q2: cancelled |
| 4.2 OHD: participate in workshop(s) related to community development of a GUI-based API and a DB-based API | FY11 Q1, Q3 | FY11 Q1: complete |
| 4.3 CAT RFCs: provide on-site "buddy" support to CAT-II RFCs | FY11 Q1, Q2, Q3, Q4 | FY11 Q1: complete |
| 4.4 CAT RFCs: provide supplemental "buddy" support for CAT-II RFCs during the User (Forecaster) Training | FY11 Q1 & Q2 | FY11 Q1: complete |
| 4.5 CAT RFCs: provide supplemental "buddy" support for CAT-II RFCs during the Advanced Configuration Training | FY11 Q2 | Not Started |
| 4.6 OHD, OCWWS HSD HSB, other: attend training provided by Deltares to RFCs | FY11 Q1 & Q2 | FY11 Q1: complete |
| 4.7 CAT, CAT-II RFCs: meet with local partners to share information on CHPS | FY11 Q1, Q2, Q3, Q4 | FY11 Q1: none required |
| 5 CHPS Hardware | | |
| 5.1 OHD/OCWWS HSD HSB: Acquire extended warranties for the 1 st set of CHPS hardware originally purchased for the CAT RFCs | FY11 Q4 | Not Started |
| 6 CHPS community building | | |
| 6.1 OHD contractor: Design & implement a web-based portal to share information and expertise on CHPS for the purpose of building a knowledge base and fostering community collaboration. | FY11 Q4 | Not Started |
| 7 CHPS Software Enhancements | | |
| 7.1 Deltares: Implement small FEWS software enhancements as requested by the NWS | FY11 Q4 | Not Started |
| 7.2 OHD contractors: Implement small software enhancements to the OHD models/adapters as requested by the NWS | FY11 Q4 | Not Started |
| 7.3 RMA contractors, HEC: Implement small software enhancements to ResSim and HEC-RAS and/or associated adapters as requested by the NWS | FY11 Q4 | Not Started |
| 8 RFC Archive Prototype | | |

| | | |
|---|---------|--------------------|
| 8.1 NOHRSC contractor to support Archive DB programming | FY11 Q1 | Delayed to FY11 Q2 |
| 9 DB Tuning | | |
| 9.1 DB consultant: contractor to support tuning of CHPS central database and (possibly) OC database | FY11 Q4 | Not Started |
| 10 RFC Backup Prototype | | |
| 10.1 Define and purchase hardware for RFC Backup prototype. Provide recommendations for CHPS operational database improvements. | FY11 Q4 | Not Started |

Accomplishments/Actions:

1st Quarter FY11

- 1.1 CNRFC was too busy this Quarter to direct enough time on the ResSim configuration in CHPS. Activity is delayed until Q2.
- 1.3 Deltares hired a new employee, who will be trained next Quarter in the application of PCRaster to distributed modeling, with the goal of implementing MARFC's gridded FFG.
- 1.4 OHD contractors worked on FFG and FFH migrations for ABRFC, NERFC, LMRFC, MARFC, MBRFC, WGRFC
- 1.5 Calibration: Deltares provided assistance to OHD HSEB in configuring FEWS for calibration-related functionality.
- 2.1 Deltares provided 74 hours of CHPS support to the RFCs during Q1.
- 2.2 During Q1 OCWWS HSD HSB initiated the paperwork to solicit bids for 2 contracting positions.
- 2.3 OHD contractors provided approximately 1700 hours of CHPS support to the RFCs during Q1. Work focused on: October SAT testing, fixing various bugs, completing the FFG/FFH migration scripts and running those scripts at OHRFC, LMRFC, MBRFC, and WGRFC, finalizing and preparing CHPS-1.0.2, learning the MARFC gridded-FFG approach and investigating solution options, writing documentation, continuing to convert string time series to XML, and reviewing XEFS and EVS code for the HEFS project.
- 2.4 RMA contractors provided 3 hours of RAS-FEWS adapter support to the RFCs during Q1.
- 3.1 Deltares provided User Training to APRFC, CBRFC, NCRFC, SERFC, and LMRFC.
- 3.4 Extra training for OCWWS HSD, OHD, and others in NWS was identified, but no classes were planned in time for Q1. Classes will held in Q2.
- 4.1 Deltares led a workshop in Taunton, MA (at NERFC) during Q1. At that workshop the CAT agreed that no further CAT-only workshops would be needed. Hence the workshop in Q2 has been cancelled.
- 4.2 In Q1 Chris Brunner and Andy Rost traveled to Delft, NL to attend the annual FEWS User Days. At that workshop they participated in a series of meetings related to development of GUI and Database Application Programming Interfaces (APIs), which is viewed by OHD as key to the NWS's independence from Deltares for future software development, and which will provide low-level access to existing FEWS capabilities without having to re-write them. It is different from the FEWS PI-service, which is a higher-level XML-based interface.
- 4.3 In November NERFC provided on-site buddy visits for MARFC.
- 4.4 NWRFC, ABRFC, and CNRFC attended the training classes (3.1 above) to provide buddy support.
- 4.6 OCWWS HSD HSB attended User Training at APRFC in November. NWSTC attended User Training at SERFC in November.
- 8.1 NOHRSC expects to hire a contractor to work on Archive Database programming in Q2 instead of Q1.

Problems Encountered/Issues:

1st Quarter FY11

- The limited funding available has put some new Deltares tasks on hold until Q2 or later. This affects tasks 1.6 and 3.4.

Dissemination (Web Pages)

AHPS Web Page Activities

Core Goal: Generate and disseminate information to and for our users

Management Lead: Donna Page

Objective: Provide a standard look and feel for the presentation of AHPS hydrologic and forecast information on the World Wide Web by all NWS weather offices. Also, complete the implementation of a single national database that aggregates information on hydrologic observation and service locations used by WFOs and RFCs (National Rivers Location Data Base - NRLDB).

Milestones

| Task | Due Date | Status |
|--|----------|--|
| 1. Initial Phase VII definition | FY10Q4 | Complete |
| 2. Support AHPS web aspects of NIDS sustainment project | FY11Q2 | In progress |
| 3. Finalize Phase VII definition based on sustainment project progress | FY11 Q2 | Waiting for new sustainment project plan/schedule |
| 4. Phase VII development | FY11 Q3 | Not started – depends on definition task and funding |
| 4. Phase VII deployment | FY11 Q4 | On track |

Accomplishments/Actions

1st Quarter FY10

- Reprocessed inundation locations at the request of OCWWS HSD
- Worked on implementation of AHPS Phase VI checklist
- Worked on modifications to national precipitation interface and downloadable datasets

2nd Quarter FY10

- Phase VI web page implementation activities began in earnest this quarter.
- All Phase VI processes were installed and running on the CR and HQ webfarms
- Orion developed and provided training to the TOC and WHFS Support groups.
- Began parallel testing with field and regions looking at test site and providing feedback through support structure.
- Successfully tested the re-hosting AHPS web pages on Consolidated Internet Farm's (CIF) outside vendor's farm
- Successfully tested the failover from CR to HQ and from HQ to CR webfarms serving all AHPS content
- Made numerous modifications to address performance.
- Provided numerous briefings and email status reports.
- Deployment date scheduled for April 19.

3rd Quarter FY10

- Implemented AHPS Phase VI at two NWS Consolidated Internet Farm(s) in April
- Implemented webpage redirects at regional web-farms to transition users to the new water.weather.gov domain
- Implemented national AHPS monitoring webpage and RSS feeds for NWS TOC support activities
- Update AHPS observation and forecast RSS feeds to include GeoRSS (geographically tagged), which supports plotting of AHPS locations in third party mapping applications

4th Quarter FY10

- Implemented nine AHPS flood inundation locations
- Three additional beta AHPS flood inundation locations were worked on during this period
- Decommissioned pre-phase VI regional AHPS backend systems
- Worked with OCWWS HSD and Regions on AHPS Phase VI requirements and priority rankings

1st Quarter FY11

- Delivered five flood inundation locations for NWS review
- Attended Consolidated Internet Farms (CIF) meeting at CRH
 - Note: CIF was recently renamed the NWS Internet Dissemination System (NIDS)
- Worked to implement NIDS changes for AHPS systems and code
- Performed normal O&M activities during the period

Problems Encountered/Issues

1st Quarter FY10

- Waiting for several OCIO consolidated web-farm activities to be completed so that AHPS Phase VI can be tested/implemented

2nd Quarter FY10

- Reworked the national map and rss processes to address performance issues
- Moved all AHPS processes off the central filer to local processors to address filer issues.
- Rehosted the hydrogen data databases from the CIF cluster database to the AHPS CMS servers in CR and HQ to address issues with the stability of the CIF cluster database. Procurement of new server for SR in the works.
- Changed the HQ data feed from and LDM feed from SR to a direct gateway feed to address problems with dropped products

3rd Quarter FY10

- Resolved post AHPS Phase VI deployment issues at CIFs with NRLDB updates, hydrograph scaling, and ERH Intranet photo upload process

4th Quarter FY10

- Addressed AHPS support tickets submitted via NWS TOC. CIF operations performed as expected during this period with no major outages.

1st Quarter FY11

- Lack of NIDS documented plan for sustainment activities which affected AHPS workload
- NIDS Database and filer outages during the period

Western Water Supply Forecast Service Improvement

Core Goal: Dissemination

Management Lead: Kevin Werner, Jeff Zimmerman, Don Laurine

Objective: Improve western water supply forecast services by incorporating all NWS water supply forecasts, ensemble forecasts, forecast verification, and data access into web services.

FY10 Milestones

| Task | Due Date | Status |
|--|----------|--|
| 1a. Roll Out "Version 4" | Q2 | Complete |
| 1b. Maintain "Version 4" | Q4 | Ongoing |
| 2a. Develop social science methodologies to apply to WS/WRO services | Q3 | Complete |
| 2b. Test social science methods in CO and UT with user groups | Q4 | CO user group done UT user group postponed (Q3FY11) |
| 3. Hardware upgrades for NWRFC web farm | Q4 | Complete |
| 4. OSIP gate 2 passage | Q3 | Delayed – Expected FY11Q2 |

FY11 Milestones

| Task | Due Date | Status |
|---|----------|-----------|
| 1. Maintain (bug fix and minor enhancements) "Version 4" | Q4 | Ongoing |
| 2. Run user engagement workshops at: - AMS Meeting (Jan 11) - Utah Water Users Meeting (March 11) - Utah (June 11) - SE NIDIS pilot (TBD) - CA NIDIS pilot (TBD) | Q2-Q4 | Planned |
| 3. Hardware upgrades for NWRFC web farm | Q4 | As Needed |
| 4. OSIP gate 2 passage | Q3 | Planned |
| | | |
| | | |

Accomplishments/Actions

1st Quarter FY10

- Version 4 released (Jan 2010)
- Teleconferences held in October and November to update progress, collect requirements, and coordinate planning
- NOAA HPCC Incubator proposal drafted for hardware and back-end work
- Discussions held with NIDIS office on coordinating and funding future efforts
- OSIP gate 2 work ongoing with gate meeting expected FY10Q3
- Presented at 2009 Drought Monitor Forum in October, 2009

2nd Quarter FY10

- Task 1: Website development:
 - Version 4 released (Jan 2010)
 - Enhancement and bug tracking software (stormtrac) collecting new requirements and tracking work
- Task 2: User engagement:
 - Draft toolkit for user engagement developed in collaboration with NOAA RISAs (WWA and CLIMAS) includes decision gaming, usability surveys, and general discussion to identify decision making processes involving forecasts
 - Draft toolkit field tested at CBRFC (March 2010)
 - First application of toolkit planned for Grand Junction, CO (April 2010)
- Task 3: Hardware:
 - Specific new hardware for NWRFC webserver dependent on NOAA HPCC proposal funding. TBD
- Task 4: OSIP:
 - WRH/HCSO (Zimmerman) leading team to draft OSIP gate 2 materials. Materials nearing completion; expect gate 2 passage in Q3 or early Q4.
 - NWSH/HSD has agreed to lead gate 3 effort once gate 2 is passed
- Discussions on collaborations with NIDIS to integrate capabilities with drought portal and develop drought specific products are promising and ongoing.
- Presented project at CPASW meeting in San Diego (March 2010)

3rd Quarter FY10

- Task 1: Website development:
 - Minor bug fixes and modifications made.
- Task 2: User engagement:
 - First user engagement workshop held in Grand Junction, CO (April 2010)
 - CLIMAS/WWA/CBRFC are compiling an initial report. Organizing committee met in Boulder, CO to assess Grand Junction results and plan next workshop (June 2010)
 - Second workshop planned for Salt Lake City, UT (August 2010)
- Task 3: Hardware:
 - Hardware upgrade at NWRFC funded with remainder of AHPS project funds. The new system will have 2 quad processors, 24GB Ram and 1.5 TB of disk space. The design of this system addresses future scalability. Additional drives can be added more easily based on added requirements for storage.
- Task 4: OSIP:
 - WRH/HCSO (Zimmerman) leading team to draft OSIP gate 2 materials. Materials nearing completion; expect gate 2 passage in Q3 or early Q4.
 - NWSH/HSD has agreed to lead gate 3 effort once gate 2 is passed
- NIDIS funded integration work with NIDIS portal (~\$25k) and organizational workshop (~\$15k)
- Organizational workshop planned for August 4-5, 2010. Major goal is to identify drought related products, services, plots, and/or datasets based on RFC forecasts that could be included on webpage. Participants include representatives from all three NIDIS pilot areas, relevant RFCs, and WRH and NWSH.

4th Quarter FY10

- Task 1: Website development:
 - Minor bug fixes and modifications made.
- Task 2: User engagement:
 - CLIMAS developed initial report for August 2010 Grand Junction meeting
 - Utah user engagement workshop postponed pending new WWA hire
- Task 3: Hardware:
 - Hardware upgrade at NWRFC complete
- Task 4: OSIP:
 - WRH/HCSO (Zimmerman) leading team to draft OSIP gate 2 materials. Materials nearing completion; expect gate 2 passage FY11Q2.

- NWSH/HSD has agreed to lead gate 3 effort once gate 2 is passed
- Contract for integration with drought portal in place using NIDIS funding
- Organizational workshop held in August 2010 with key stakeholders from three NIDIS pilot areas and NWS staff. White paper developed documenting key recommendations from group. White paper also offers a consensus definition for water resources outlook addressing 3rd quarter issue. Will be submitted along with this report. Concise recommendations
 - Water demand forecast tools
 - Sophisticated low flow forecasts
 - Ensemble forecast services
 - Credible, high resolution precipitation analysis
 - Reservoir data
 - Partnership development and maintenance
 - Two way education to support decisions
 - Periodic independent review panels on all parts, as well as particular parts, of RFC efforts and products
- Key achievements to date:
 - Consolidation of NWS water supply forecast program
 - Verification tools for water supply forecasts enabled first systematic verification of forecasts
 - User engagement workshops have provided an iterative development process
 - Clearinghouse for reforecasts, archived forecasts, real time forecasts, and observed streamflow datasets
 - First step toward an objective national water resources outlook based on RFC ensemble forecasts

1st Quarter FY11

- Task 1: Website development:
 - All SERFC ESP points added
 - Minor bug fixes to multiple parts of webpage
- Task 2: User engagement:
 - New WWA hire for user engagement work selected and stationed at CBRFC
- Task 3: Hardware:
- Task 4: OSIP:
 - WRH/HCS (Zimmerman) leading team to draft OSIP gate 2 materials. Materials nearing completion; expect gate 2 passage FY11Q2.
 - NWSH/HSD has agreed to lead gate 3 effort once gate 2 is passed
- Contract for integration with drought portal in place using NIDIS funding
- Key achievements to date:
 - Consolidation of NWS water supply forecast program
 - Verification tools for water supply forecasts enabled first systematic verification of forecasts
 - User engagement workshops have provided an iterative development process
 - Clearinghouse for reforecasts, archived forecasts, real time forecasts, and observed streamflow datasets
 - First step toward an objective national water resources outlook based on RFC ensemble forecasts

Problems Encountered/Issues

1st Quarter FY10

- 1st quarter travel financed on “credit” since budget not available

2nd Quarter FY10

- ESP forecast inconsistencies between RFCs are a problem (e.g. forecast frequency, forecast duration, forecast type (regulated vs unregulated), etc).
- Web development capacity has been reduced with recent personnel changes; Have contacted Orion to scope out possible contract work via NOAA HPCC and NIDIS.

3rd Quarter FY10

- Web development / maintenance capabilities – Our lead developer, Andrew Murray, has left the NWS for a position in Boulder. Our lack of development and maintenance capabilities going forward will likely present a major obstacle to both new development as well as maintenance of existing capabilities. This lack of NWS capacity is especially acute given the recent evolution of the NIDIS collaboration with this project. Recommend identifying a combination of FTE and contract personnel to support project.
- ESP forecast inconsistencies between RFCs are a problem (e.g. forecast frequency, forecast duration, forecast type (regulated vs unregulated), etc). Preliminary discussions with OCWWS/HSD and informally among RFCs have raised awareness to the problem.
- “Water resources outlook” is not well defined. Some RFCs view this as a flood risk product while others view it as a water availability outlook. This needs to be better defined.

4th Quarter FY10

- Web development / maintenance capabilities – Our lead developer, Andrew Murray, has left the NWS for a position in Boulder. Our lack of development and maintenance capabilities going forward will present a major obstacle to both new development as well as maintenance of existing capabilities. This lack of NWS capacity is especially acute given the recent evolution of the NIDIS collaboration with this project. Recommend identifying a combination of FTE and contract personnel to support project.
- ESP forecast inconsistencies between RFCs are a problem (e.g. forecast frequency, forecast duration, forecast type (regulated vs unregulated), etc). Preliminary discussions with OCWWS/HSD and informally among RFCs have raised awareness to the problem.

1st Quarter FY11

- Web development / maintenance capabilities – Project is still without a lead web developer. Website capabilities are basically stable. However, without some capacity for further development, the capabilities on the webpage will lag those that have ongoing development and become increasingly less relevant. NIDIS is interested in funding some development this FY.
- ESP forecast inconsistencies between RFCs are a problem (e.g. forecast frequency, forecast duration, forecast type (regulated vs unregulated), etc). Preliminary discussions with OCWWS/HSD and informally among RFCs have raised awareness to the problem.

New Service Locations

AHPS Implementation APRFC

Management Lead: Ben Balk, APRFC

Objective: Implement probabilistic hydrologic forecasts for basins in the Alaska/Pacific Forecast Center's (APRFC) area of responsibility.

Milestones

| Task | Forecast Points Planned | Due Date | Actual to Date 1 st Qtr FY11 | Variance |
|--|-------------------------|---------------------|---|-----------|
| Identify 9 potential basins for new calibrations | | 1 st Qtr | Complete | |
| Calibrate 9 new basins for non-AHPS implementation | 9 | 4 th Qtr | 1 | 8 |
| Implement 9 new forecast points (non-AHPS) | 9 | 4 th Qtr | 1 | 8 |
| Identify 12 locations for AHPS implementation for FY11 | | 1 st Qtr | Complete | |
| Implement 12 new AHPS points | 12 | 4 th Qtr | 0 | 0 |
| Total | 12 | | 0 | 12 |

Accomplishments/Actions

1st Quarter FY11

- Identified 12 new AHPS points that will be implemented this fiscal year.
- Identified 9 new basins to calibrate. Completed one of the nine calibrations and have established as a non-AHPS forecast point. Ongoing work on the other eight basin calibrations.
- Plan to implement 12 new AHPS points during 2nd Quarter FY11.

Problems Encountered/Issues

1st Quarter FY11

- none

FY11 AHPS Implementation for - NCRFC

Team Lead: Mike DeWeese

Objective: Implement AHPS for locations in the North Central River Forecast Center’s area of responsibility. AHPS locations include those with probabilistic forecast products, Site Specific Hydrologic Prediction, statistical (Western) water supply, and/or inundation mapping points. For FY11, this would include only those additional points implemented per Weather Forecast Office request.

Milestones

| Implementation Area | Forecast Points Planned | Due Date | Actual to Date (1st Qtr FY11) | Variance |
|---------------------------------------|-------------------------|----------|-------------------------------|----------|
| | | | | |
| | | | | |
| | | | | |
| New, unplanned forecast points | | | | |
| Total | 0 | | | 0 |

Accomplishments/Actions

1st Quarter FY11 – none

Problems Encountered/Issues

1st Quarter FY11 – n/a

FY11 AHPS Implementation for - MBRFC

Team Lead: Tom Gurss, Gregg Schalk

Objective: Implement AHPS for locations in the MB River Forecast Center’s area of responsibility. AHPS locations include those with probabilistic forecast products, Site Specific Hydrologic Prediction, statistical (Western) water supply, and/or inundation mapping points. For FY11, this would include probabilistic forecast products for the Blue, South Platte, North Platte, Platte, Loup, and Republican River Basins.

Milestones

| Implementation Area | Forecast Points Planned | Due Date | Actual to Date (1st Qtr FY11) | Variance |
|--------------------------------|-------------------------|---------------------|-------------------------------|------------|
| South Platte River Basin | 2 | 2 nd Qtr | | -2 |
| North Platte River Basin | 7 | 2 nd Qtr | | -7 |
| Loup/Platte River Basin | 9 | 2 nd Qtr | | -9 |
| Republican River Basin | 15 | 4 th Qtr | | -15 |
| Blue River Basin | 7 | 2 nd Qtr | | -7 |
| New, unplanned forecast points | 0 | | 2 | +2 |
| | | | | |
| | | | | |
| Total | 40 | | 2 | -38 |

Accomplishments/Actions

1st Quarter FY11 – added two unplanned points: SPOI4 (Spencer, IA - Ocheyedan R) and YNNS2 (Yankton, SD - James R.)

Problems Encountered/Issues

1st Quarter FY11 - none

AHPS Implementation for MARFC

Management Lead: Peter Ahnert (HIC/MARFC), Joe Ostrowski (DOH), Patti Wnek (SCH)

Objective: Implement probabilistic hydrologic forecasts for basins in the Middle Atlantic River Forecast Center's (MARFC) area of responsibility. MARFC implemented basic AHPS for existing forecast points in the entire MARFC area of responsibility in FY 2006.

Milestones

| Implementation Area | Forecast Points Planned | Due Date | Actual to Date (1 st Qtr FY2011) | Variance |
|---------------------|-------------------------|----------|---|----------|
| None | | | | |
| Total | 0 | | 170 | |

Accomplishments/Actions

1st Quarter FY2011

New Forecast Service:

- No new forecast points
- Changes made to Flash Flood Guidance to account for new zone alignment in northern NJ
- Working with WFO LWX SSH to establish flood stages at 5 points in the Potomac Basin

Hydrologic Modeling:

- Began issuing daily local inflow forecasts at points in the James and Susquehanna River basins to the USACE Norfolk and Baltimore District offices for use in calibrating hydrologic models and assessing operational alternatives and effects of reservoir releases

CHPS:

- Buddy visit from NERFC to set-up ESP and gridded forcings
- New build installed
- Working with OHD to develop scripts to migrate FFG & FFH functions from NWSRFS to FEWS
- Staff IFD familiarization training in preparation for on-site CAT-II training
- Migration completed with exception of few segments remaining
- Refinement were made to the forcings, graphics, and workstation configurations

AWIPS 2:

- Assisted electronic staff to localize AWIPS 2 SCAT system as an RFC using a beta version of the AWIPS 2 Localization document. AWIPS 2 system now is localized as RHA and non-RFC-specific applications will be tested within the new environment.
- For RFC Testbed Platform (RFCTP) project, modified the code used to capture and distribute baseline RFC-specific application configuration files to handle files which cannot be placed into a compressed archive file due to operating system limitations. Code has been successfully tested at two RFC(s). This step closes down the development of code working directly with AWIPS 1 systems. The goal of the RFCTP project is to duplicate on AWIPS 2 the work successfully demonstrated using AWIPS 1 systems.
- Investigated the full AWIPS 2 environment (new AWIPS 2 software installed on a full AWIPS 1 platform) at NMTR. Worked with Raytheon contractor and NMTR managers to understand the changes in AWIPS 2 which will affect the RFCTP program code.
- Hosted visit by Raytheon contractor Sean Bowser for AWIPS 2 testing. Reviewed and tested current capabilities of RFC-oriented AWIPS 2 applications. Discrepancies were noted and submitted to the Raytheon development team, who are working toward solutions.

- Helped prepare RFC FIT testing agenda for FIT session to be conducted at NWS HQ. Reviewed RFC-oriented test cases to be run during the FIT
- FIT conducted on AWIPS 2 system manually configured in joint NWS/Raytheon effort
- RFC Test bed Platform (RFCTP) project is momentarily on hold, awaiting more stability on the AWIPS 2 file structure design and implementation. Expected return to RFCTP development in 1/2011. Note RFCTP completion is not a requirement for a successful FIT.
- Attended RFC FIT at NWS HQ to do a "day-in-the-life" scenario on AWIPS 2 using the NMTR system, which was implemented as an AWIPS 2 site and localized as RHA, including data flow and application configuration. However, SHEFDECODE, which was re-written for A2, was failing (it wasn't posting data properly to various obs and forecast tables). Many hours were spent trying to gather evidence of its behavior to pass along to the Raytheon developers. The problem was not resolved by week's end. Without data being posted in the correct tables, review of the baseline A2 applications seemed premature.
- There also were other distractions of trying to determine if they could run AWIPS 2 test cases and to verify supposed fixed discrepancy reports (i.e. problems). Both of these distractions pointed out to a need for a WFO Hydro-oriented FIT.
- They were able to discuss a path to achieving a more robust RFC test of A2, which would require some minor engineering changes of the A2 ADAM (AWIPS2 Data and Application Migration) platform. In discussions with all who had interest or authority in the project viewed the suggestion as worthwhile. Should it be implemented, the 4 OT&E RFCs (MARFC, NCRFC, ABRFC and NWSRFS) would be able to construct a full A2 environment on their ADAM platforms to provide the environment RFCs would need to test the A2 applications and to determine changes needed to local applications to be integrated into the A2 environment.

AHPS Outreach:

- Delaware River Basin Commission
 - Participation at Federal Summit in a technical meeting on impacts of gas energy production in the watershed
 - Attended Commissioner's briefing meeting
 - Participated in quarterly Flood Advisory Committee meeting
 - Provided Silver Jackets Initiative briefing to the Flood Advisory Committee
- Susquehanna River Basin Commission
 - Participated in Federal Agency call
 - Participated in drought coordination calls
- Silver Jackets Initiative
 - Participated in kick-off meeting of the Pennsylvania Silver Jackets
 - Provided Silver Jackets Initiative briefings to ER HPM(s) & WCM/SCH(s)
 - Participated in Virginia Silver Jackets meeting
 - Reviewed and commented on national document summarizing programs of each member agency
- Nurture Nature Foundation
 - Participated in kickoff meeting of the Nurture Nature Science on a Sphere grant project at the Baltimore Science Center
 - Briefed national SCH(s) on Nurture Nature outreach material availability
 - NOAA grant project "*Flood Education Campaign*" provided deliverables which include kids coloring & activity pages, poster, video, tabletop exhibit and "*Know Your Number*" magnets.
 - Facilitated a collaboration meeting with NN and CoCoRaHS representatives
 - Reviewed script for new NN outreach exhibit "*Understanding Flood Risk*"
- New outreach materials
 - Final printing completed on two MARFC Fact Sheets courtesy of SRBC
 - Obtained Ward's Stormwater Floodplain Simulation Model from ER HSD
 - "*What's Your Number?*" outreach activity received from Nurture Nature. Includes magnets and tabletop display that guide people to the AHPS website to find their closest river forecast point location and reference flood stage.
 - Trailer for new 9 minute film clip from Nurture Nature that will show people actively preparing for and surviving a flood through proper behavior

- “*Floods Happen. Lessen the Loss*” themed coloring activity for kids received from Nurture Nature. Introduces new character, “*High Water Mark*” and his dog “*Noah*”, as a way to model best practices for flood safety and preparedness.
- Presented two presentations (climate change impacts and flood inundation mapping) with WFO PHI at the NJ State Association of Floodplain Managers annual conference
- Hosted MARFC familiarization visit by WFO RNK forecaster as part of ERLDP (leadership development program)
- Participated in inaugural PA State Association of Floodplain Managers
- HIC invited speaker at the International Workshop on Early Warning for Flash Floods held in Prague, Czech Republic. Presentation titled “*U.S. National Weather Service Flash Flood Warning Program*”
- Provided input to COMET on need for social science training in hydrology
- Provided training and a tour to a University of Pittsburgh at Johnstown hydrology class
- Presentation with MD Department of the Environment on the use of NWS MPE data to support Healthy Beaches Program at the MD Water Monitoring Council annual meeting in Baltimore
- Customer Advisory Board: Meeting to review recent flooding and brainstorm session on most effective ways to communicate river forecast updates with the CAB and WFO(s).
- Regional team completed a new outreach display. The display is ready for use by field offices.
- Hosted visit by Canadian scientist interested in learning about RFC forecast operations

Flood Inundation Mapping:

- Member of the Susquehanna Flood Forecast and Warning System Technical Mapping Committee
- Participated in meeting in Harrisburg with ER HSD. Team will be advising SRBC on best methods to grow their inundation map suite and conduct associated outreach.
- Reviewed V2.0 of [SFFWS SIMV](#) at Flood Inundation Mapping Technical Committee meeting

Gages/Observations/Data:

- Met with ER HSD, DRBC and USGS to provide NWS priorities for rating curve extensions
- Assisted Texas State University Water Resources providing stream gage information that will be used to investigate a potential hydrologic signature in the Susquehanna basin due to hydraulic fracturing (Marcellus Shale/Natural Gas extraction).
- Provided gage inventory and gap analysis feedback to SRBC contractor for use in the update to the Susquehanna Flood Forecast and Warning System Improvement Plan. Provided preliminary evaluation of proposed enhancements.

Training:

- Visiting forecaster from WFO RNK made two presentations to RFC staff: 1) hydrologic issues in the RNK HSA, and 2) recent research completed on heavy rain from tropical systems
- Operational Readiness Exercise on GFE completed by staff
- Attended WFO CTP Winter Weather Workshop
- Hydrologist completed course on Distributed Hydrologic Models for Flow Forecasts
- Provided office tours to students from Shippensburg University
- Three talks to visiting hydrology class from the University of Pittsburgh-Johnstown on 1) how the NWS forecasts river stages, 2) MMEFS and 3) Flood Inundation Mapping
- Webinars attended:
 - “*Nowcasting of Precipitation*” and “*Transboundary Cooperation in Flood Forecasting and Warning Services*” by the Institute of Atmospheric Physics and Czech Hydro meteorological Institute.
 - “*Multi-partner Decision Support Lessons Learned: Experiences from the 2010 MN and Upper MS Valley’s Spring Flood*” by Diane Cooper at WFO BGM Winter Weather Workshop
 - IFLOWS, AFWS website webinar
 - WFO CTP Media Workshop

Ensemble River Forecasts (MMEFS):

- Added the NAEFS meteorological ensemble suite to the MMEFS system
- Mentoring students on two projects with the Penn State College of Information Sciences and Technology to enhance MMEFS web-delivery information
- Assisted OH, NE and SE RFC(s) to add NAEFS meteorological ensemble suite to MMEFS systems. Implemented at OHRFC, undergoing testing at SERFC, and awaiting additional assistance from MARFC at NERFC
- Worked with ER SSD and other RFCs in adding SREF data to the ER LDM-delivery stream. IP changes at NCEP created data retrieval problems which can be avoided using the LDM delivery approach (this method used for NAEFS delivery)
- Provide assistance to NERFC & SERFC for their roll-out of the GEFS and NAEFS and retirement of GEFSa. Testing is underway with results posted to MMEFS page.
- Participated in planning for MMEFS rollout in January
- Leading regional team to design an online training course to ensure all ER forecasters understand how to interpret and explain MMEFS information to others. Course outline finalized and drafts of parts 1 & 2 of the course are in the review phase. Team meeting weekly.
- Provided 2 MMEFS Refresher Training sessions for MARFC, WFOs and Customer Advisory Board

Problems Encountered/Issues

1st Quarter FY2011

None

AHPS Implementation for NERFC

Management Lead: David Vallee (HIC/NERFC), Robert Shedd (DOH), Ed Capone (SCH)

Objective: Implement probabilistic hydrologic forecasts for basins in the Northeast River Forecast Center's (NERFC) area of responsibility. Goal is to have AHPS implementation for long-term forecasts for the entire NERFC area of responsibility by the end of FY 2012.

Milestones:

| Implementation Area | Forecast Points Planned | Due Date | Actual to Date (1 st Qtr FY2011) | Variance |
|---------------------|-------------------------|----------|--|----------|
| Thames River | 4 | FY12Q3 | 0 | |
| Naugatuck River | 1 | FY12Q3 | 0 | |
| | | | | |
| Total | 5 | | 174 | |

Accomplishments/Actions:

1st Quarter FY2011

CHPS:

- Parallel operations throughout Q1 with daily generation of internal products
- FFG and FFH working using new procedures from OHD
- ESPADP working and generating baseline set of graphics using CHPS data
- RVF formatter re-done due to data access problems and RFC requirements not met by gxsets
- Importing daily tidal data from Stevens Institute of Technology for the Hudson River

MMEFS:

- System converted to using GEFS and NAEFS instead of GEFSA meteorological ensembles
- Member of regional team developing a training module for field forecasters

Outreach:

- Provided verification data to University of Connecticut for a CSTAR study
- Posting QPF and QPE data for use by NHDES
- Met with FEMA Region I contractor (CDM) regarding a data exchange; their LIDAR and HEC-RAS models on new studies and our calibrated unit hydrographs for their review in new hydrologic analyses for FEMA Flood Insurance Studies (Concord River Basin)
- Met with NH DES to discuss forecast services for the Souhegan and Nashua Rivers
- Met with Plymouth State to discuss observation & forecast services for the Pemigewasset River
- Participated in Silver Jacket Team activities in New England and New York

XEFS/HEFS:

- Began work on implementation of Graphics Generator; replaces ESPADP functionality

Problems Encountered/Issues

1st Quarter FY2011

- Experienced problems attempting to stabilize CHPS following Oct10 release; worked with OHD/Deltares to resolve instability
- Problems with piService extracting correct datasets for RVF generation; nearly solved

1st Quarter FY2011 AHPS Implementation for OHRFC

Management Lead: Craig Hunter (HIC/OHRFC), Tom Adams (DOH), Jim Noel (SCH)

Objective: Implement AHPS and probabilistic hydrologic forecasts for new basins in the Ohio River Forecast Center's (OHRFC) area of responsibility.

Milestones:

| Implementation Area | Forecast Points | Date | Actual to Date (1 st Qtr FY2011) | Variance |
|---------------------|-----------------|------|--|----------|
| None | 0 | | 0 | |
| | | | | |
| Total | 0 | | 278 | |

Accomplishments/Actions:

1st Quarter FY2011

Forecast Points:

- No new forecast points. RFC point total = 278
- Upgraded two points from flood only to daily
 - Monongahela River at Point Marion (PMRP1)
 - Monongahela River at Maxwell (MAXP1)
- Two new SSHP points. SSHP point total = 82.
 - Drakes Creek near Alvaton, KY (ALVK2) for WFO Louisville (LMK)
 - Mill Creek at Woodbine, TN (WBNT1) for WFO Nashville (OHX)

NWSRFS Modeling:

- Added Lock 13 in the Kentucky River System
- Updated basin boundaries and sent to NOHRSC
- Removed USACE forecasts from Old Hickory (OHIT1) and Cordell Hull (CORT1)

HEC-RAS Ohio River Community Project with USACE Great Lakes and Ohio River Division (LRD)

- HEC-RAS Ohio River is run in daily operations
- HEC-RAS forecasts are displayed with operational forecasts but not transmitted
- HEC-RAS training for operations is ongoing

HEC-RAS Cumberland River Project:

- Received HEC-RAS LRN model of DamBreak for the Cumberland River
- Received RTi model for lower Cumberland River from LRD
- Researching how to proceed on conversion of Cumberland River below Wolf Creek to HEC-RAS
- Identified gate rating and rating issues on the Lower Cumberland River. Raised this to the Service Assessment Team, USACE and USGS

CHPS-FEWS Transition:

- Refining displays
- User training for staff completed

Service Backup:

- No additional progress for onsite and offsite service backups made

Ensemble River Forecasts (MMEFS) / ESP:

- Member of ER team to develop online training module to ensure all forecasters understand how to interpret and explain MMEFS information. Weekly team meeting are being conducted. Developed “Background” and “Theory” sections.
- Assisted FEMA Region V with interpretation of MMEFS product suite
- Added GEFS 21 members to MMEFS; now running SREF, NAEFS & GEFS Meteorological Ensembles
- Support to USACE for Dam Safety was converted from GEFS to NAEFS
- Added Bolivar to MMEFS to support USACE Dam Safety projects

Gages/Observations/Data:

- Working with USACE LRD, LRN and LRH on data flow via LDM. Working to improve, add and delete data as needed.
- Worked with Ohio WFOs to ensure they were aware of potential bad gages with STORMS data from the State of Ohio
- Worked with WFO Pittsburgh to ensure OHRFC is using the latest and most complete rainfall network in Pittsburgh’s area
- Added OHHT1 HP redundant pool readings for Old Hickory Dam to improve Nashville forecasts
- Provided USACE LRD with NOAA/NWS/CPC winter outlook dates

Gridded Flash Flood Guidance:

- Flash Flood Guidance converted to AVTreshR for calculating threshold runoffs
- Provided training via recorded GoTo Webinar on recent FFG change

Climate/Flood Potential:

- Added new CRWESPTIR product for chances of minor, moderate, major and flood potential risk management decision support deviation from normal flood risk graphics to website <http://www.weather.gov/ohrfc/WRO.shtml>

Outreach:

- Site visits to new forecast service locations in Newark & Hebron, OH with USGS OH & WFO ILN
- Participated in the Mississippi Tri-Agency Water Control Meeting
- Participated in NOHRSC/Eastern Region coordination meeting
- Office visit to WFO Louisville
- Participated in Olmstead Dam project on the lower Ohio River providing long range outlooks
- Participated in Mississippi NWS-USACE Water Control Forecasters Training in New Orleans
- Participated in Virginia, Ohio, and Pennsylvania Silver Jacket meetings
- Office visit to WFO Pittsburgh which included tour of the Monongahela and parts of the Allegheny and upper Ohio River system
- On site visit USGS West Virginia Water Science Center
- Participated in USACE LRD/LRL low flow coordination call
- Participated in OSU Climate, Weather & Water outlook for Dept. of Crop and Soil Sciences
- Toured the Great Miami River System with the Miami Conservancy District & WFO Wilmington
- Presented at COMET COMAP Virtual Course on QPF Rapid Onset Floods
- Discussed potential flood inundation mapping opportunities in Nashville with the National Flood Inundation Mapping (FIM) Team & WFO Nashville
- Attended National Flood Inundation Mapping Initiative (FIMI)
- Attended USACE Nashville operations meeting with USACE LRD and District Offices (LRB, LRP, LRH, LRL, & LRN) and the Chicago and Detroit District Offices. Discussions on data flow, operations, use of data, etc. Presented on “Use of MMEFS” and “Coordination”.
- Office visit to WFO Nashville
- Attended State of Kentucky meeting on the Kentucky River project with WFO Louisville
- Staff visited Cincinnati Water and Sewer District
- Staff visited USACE Captain Anthony Meldhal Locks and Dam on the Ohio River
- Conducted coordination webinar with WFO Pittsburgh, USACE Pittsburgh, and USGS Pennsylvania on improving ratings along the Monongahela River
- Partnered with Ohio University on educational outreach to the high schools

Training:

- Provided NWS Chat training
- Annual Flood Workshop – Part 1 & 2 and Flood Table Top Exercise
- GIS Webinar
- Provided Flash Flood Guidance Webinar

Problems Encountered/Issues

1st Quarter FY2011

- Configuration of displays and setup mainly at a holding pattern waiting for patches and upgrades as most of the focus is now with CAT 1 offices
- Experiencing loss of data from NCEP for MMEFS; not able to log into NCEP computer to get NDFD data for operations and NCEP having issues receiving FOP
- Data issues between USACE and OHRFC; using backup for LDM via USACE Huntington until USACE LRD and OHRFC data issues are solved

AHPS Implementation for ABRFC

Management Lead: Billy Olsen, HIC

Objective: Implement probabilistic forecasts for basins in the Arkansas-Red Basin River Forecast Center's (ABRFC) area of responsibility.

Milestones: Initial implementation of probabilistic forecasts for ABRFC was completed in 2009. **No new areas are planned for 2011.**

| Implementation Area | Forecast Points Planned | Due Date | Actual to Date 4 th Qtr FY10 | Variance |
|---------------------|-------------------------|----------|--|----------|
| | | | | |
| | | | | |
| | | | | |
| Total | 0 | | 0 | 0 |

Accomplishments/Actions

1st Quarter FY11

- N/A – Implementation of probabilistic forecasts were completed in FY09. No new forecast services added.

2nd Quarter FY11

-

3rd Quarter FY11

-

4th Quarter FY11

-

Problems Encountered/Issues

1st Quarter FY11– None

2nd Quarter FY11 –

3rd Quarter FY11 –

4th Quarter FY11 –

AHPS Implementation for LMRFC

Management Lead: Dave Reed, HIC

Objective: Implement probabilistic hydrologic forecasts for basins in the Lower Mississippi River Forecast Center's (LMRFC) area of responsibility. For FY11 this includes the Ouachita, Lower Arkansas, and Red River basins.

Milestones:

| Implementation Area | Forecast Points Planned | Due Date | Actual to Date 1 st Qtr FY11 | Variance |
|--------------------------------|-------------------------|----------|--|----------|
| Ouachita River Basin, AR/LA | 5 | Q1 | 5 | 0 |
| Lower Arkansas River Basin, AR | 1 | Q1 | 1 | 0 |
| Ouachita River Basin, LA | 7 | Q2 | 0 | 0 |
| Ouachita River Basin, LA | 1 | Q3 | 0 | 0 |
| Red River Basin, TX | 5 | Q3 | 0 | 0 |
| Red River Basin, TX/LA | 6 | Q4 | 0 | 0 |
| Total | 25 | | 6 | 0 |

Accomplishments/Actions

1st Quarter FY11

- AHPS outreach activities this month.
 - October 4 – 7, Kai Roth presented at the NWA Annual Meeting in Tuscon, AZ.
 - October 4 – 8, Jeff Grascel and Dave Reed presented at the Tri-Agency and River Forecasters Meetings in St. Paul, MN.
 - October 5, David Welch and Amanda Roberts participated in Mississippi Silver Jackets conference call.
 - October 14, Jessica Smith, Ken Kleeschulte, and Gina Tillis-Nash participated in the FEB's close out meeting for the EAOC's August workshop in New Orleans.
 - October 16, Jeff Grascel, Jessica Smith, Ken Kleeschulte, and Gina Tillis-Nash participated in the US Fish and Wildlife Services' Annual Wild Things outreach event, with over 4,200 attendees.
 - October 18 – 19, David Welch attended the NASA/NWS/UCF Meeting in Manhattan, NY.
 - October 18, Dave Reed & Jeff Grascel along with WFO LIX's Ken Graham & Pat Brown met with Washington Parish Emergency Managers and Park Rangers at Bogue Chitto State Park.
 - October 24 – 26, David Welch presented at the National Flood Workshop
 - October 26, National Hurricane Center's Bill Read and Chris Landsea toured LMRFC operations and gave presentation.
 - October 27, Kai Roth showcased LMRFC products and services for Career day at Hancock North Central Elementary, MS.
 - November 2 – 3, David Welch, Jeff Grascel, Gina Tillis-Nash, and Angelo Dalessandro participated in the Tri-Agency River Forecasters meeting in New Orleans, LA.
 - November 3, Katelyn Costanza, Kai Roth, and Dave Reed met with representatives of Pat Harrison Waterways on upcoming HEC-RAS modeling project.
 - November 4, Jeff Grascel participated in the Fusion Team meeting in New Orleans, LA.
 - November 3 – 5, Dave Reed, Katelyn Costanza, and Kai Roth participated in the Mississippi Water Conference in Bay St. Louis, MS.
 - November 5, NCRFC's HIC Scott Dummer, toured LMRFC operations.
 - November 5, Jeff Grascel participated in the TVA Interagency meeting in Nashville, TN.

- November 9, Jeff Grascel, Jessica Smith, Ken Kleeschulte, and Gina Tillis-Nash participated in LSU's Ocean Commotion, sponsored by the NOAA Sea Grant, with over 2400 attendees.
 - November 15 – 19, Gina Tillis-Nash attended the NWSTC's Field Operations Management Training in Kansas City, MO.
 - November 18, David Welch, Katelyn Costanza, and Dave Reed toured NCDDC operations at Stennis Space Center, MS and facility to host the NWS Advanced HEC-RAS/GeoRAS training course.
 - November 19, a Chinese delegation toured LMRFC operations.
 - November 23, The LMRFC participated on a conference call with OHD, SERFC and the NOS to discuss the verification and lessons learned from the Deepwater Horizon Gulf Inflow forecasts to support oil trajectory modeling and future plans.
 - November 30, Dave Reed participated in the Annual NGI meeting in Mobile, AL.
 - December 7, Scott Lincoln participated in the Camo Jackets conference call regarding development of static inundation map libraries by the USGS, Jackson, MS.
 - December 7, Gina Tillis-Nash, David Welch, Dave Reed, and Jeff Grascel participated in the FY10 Calibration Status conference call with RTi.
 - December 8, Scott Lincoln continued with DLOC training
 - December 9, Dave Reed, David Welch, and Jeff Grascel, along with WFO LIX's Ken Graham and Pat Brown, attended the Baton Rouge Flood Awareness meeting hosted by the East Baton Rouge Parish Homeland Security and Emergency Preparedness.
 - December 9, Gina Tillis-Nash, Ken Kleeschulte, and Jessica Smith participated in the FEB's EAOC meeting, New Orleans, LA
 - December 14, Dave Reed and David Welch participated in NWS Advanced HEC RAS/GeoRAS training course coordination call.
 - December 15, Dave Reed and Jeff Grascel attended the Levee Demonstration meeting in Vicksburg, MS.
- Completed four in-house basin calibrations (ENGG1, LNDM6, AKFM7 and EMCM7).
 - LMRFC continued CHPS migration activities, including in house training for expanded team members.
 - LMRFC participated in numerous conference calls, including Gridded FFG workshop planning, LMS, CHPS, LOMRC, and Olmstead Construction Project.
 - Ashley Hayes transferred from LIX to become LMRFC's newest hydrologist.
 - CTPN7's flood stage lowered from 12 ft to 10 ft.
 - Began flood only forecasts for ENGG1.
 - Filled MAP data request for NGDC/Bureau of Mine Reclamation climatology study.
 - CAT II CHPS training session led by Erik de Rooij and Eric Jones for LMRFC staff
 - LMRFC CHPS 4/5/6 hardware installed, waiting on software mod-note.
 - Implemented ESP graphics generation for 8 sites, 6 new and 2 expanded service sites (PFAA4 for WFO LZK, ENGG1 for WFO FFC, RYEA4 for WFO LZK, and FELA4, RHLL1, LDBL1, MLUL1, and COLL1 for WFO SHV), completing Q1 AHPS implementation requirement
 - Completed historical MAPs time-series for the Upper Red, Lower Red, and Atchafalaya Basins.
 - LMRFC continues support of AHPS activities with in-house calibrations for remaining basins east of the Mississippi River and generation of MAP calibrations for upcoming FY calibrations.

Problems Encountered/Issues

1st Quarter FY11 –

- None

AHPS Implementation for SERFC

Management Lead: John Feldt, HIC

2. Objective: Implement probabilistic forecasts for basins in the Tombigbee and Central Florida River Forecast Center’s area of responsibility. For FY11, this would include ...

3. FY 2011 calibration funding (\$K):

4. AHPS Implementation

Milestones

| Implementation Area | Forecast Points Planned | Due Date | Actual to Date (4 th Qtr FY11) | Variance |
|---------------------|-------------------------|---------------------|---|----------|
| Tombigbee | 10 | 1 st Qtr | 0 | -10 |
| | 10 | 2 nd Qtr | 0 | |
| Central Florida | 8 | 3 rd Qtr | 0 | 0 |
| | 8 | 4 th Qtr | 0 | |
| Total | 36 | FY11 | 0 | -10 |

Accomplishments/Actions

1st Quarter FY11

- The first 10 points of this year’s ESP implementation are being worked on at this time. Should be caught up by the end of the second quarter.

2nd Quarter FY11

3rd Quarter FY11

4th Quarter FY11

Problems Encountered/Issues

1st Quarter FY11-

2nd Quarter FY11-

3rd Quarter FY11 -

4th Quarter FY11-

AHPS Implementation for WGRFC

Management Lead: Thomas Donaldson, WGRFC

Objective: Implementation of probabilistic hydrologic forecasts for the San Jacinto and Pecos basins in the West Gulf River Forecast Center's area of responsibility.

Milestones

| Implementation Area | Forecast Points Planned | Due Date | Actual to Date 1 st Qtr FY11 | Variance |
|---------------------|-------------------------|--------------|--|----------|
| San Jacinto | 15 | 31 Dec. 2010 | 15 | 0 |
| Trinity | 2 | 31 Dec. 2010 | 2 | 0 |
| Lavaca/Navidad | 1 | 31 Dec. 2010 | 1 | 0 |
| | | | | |
| | | | | |
| | | | | |
| Total | 18 | | 18 | 0 |

Accomplishments/Actions

1st Quarter FY11

- Continuing work towards operational implementation of Phase II calibrations. Two sites (Del Norte and Alamosa) will be officially available beginning in November as requested and coordinated with WFO Pueblo. There is significant in-house effort ongoing to reconcile/build OFS station definition, MAP, and MAT files used to define these within the model; Segment definitions being built from calibration decks are ongoing; Troubleshooting and resolving precipitation and temperature data flow issues to support model.
- Held monthly Pecos River project call with RTi for contract RTi T10-XXXX on 10/26. Discussed lingering station data real-time questions, status of model development, and other planned deliverables. Also discussed snow-17 training agenda for wgrfc.
- Reviewed basin and elevation zone delineations and unit hydrographs previously delivered.
- Completed OHD request to review/compile AHPS forecast locations and associated products available for the PECO and URIO.
- Completed FY11 AHPS implementation information for PECO requested by SRH.
- Coordination and planning for contracted RTi training scheduled for November 18th, 2010.
- Continued inquiries and discussions with NM State Engineer's office and Interstate Stream Commission to compile information about the Pecos Riverware model.
- Resolved snotel precipitation data flow problems that plagued operational modeling efforts last water supply season.
- Upgraded Buffalo Bayou modeling points to 3 hour model to match the rest of San Jacinto Forecast Group.
- Installed ESP generation for all points on the San Jacinto and Buffalo Bayou segments.
- Adjusted graphics generation program to create products for all site.
- Added Res-J operation to Lake Conroe and prepared Addics and Barker reservoirs for RES-J installation.
- Added 4 new forecast points requested by Houston WFO to San Jacinto River system.
- Completed and installed new SAC-SMA calibrations on all basins for San Jacinto River and Buffalo Bayou.
- Ran system for 1 year to check for irregularities in the long range forecasts.
- Finalized all routings, especially for new simulation/forecast points.
- Continuing work towards operational implementation of Upper Rio Grande Phase II calibrations. Two

sites (Del Norte and Alamosa) were scheduled to be available beginning in November as requested and coordinated with WFO Pueblo. There continues to be significant in-house effort to reconcile and resolve station precipitation and temperature data flow issues to support model and OFS problems with implementation. Segment definitions being built from calibration decks are ongoing with troubleshooting to resolve errors.

- Completed OFS station definition work; completed MAP and MAT files needed for OFS definitions, although unable to run do to OFS issues.
- Review other western RFC processes for handling precip/temp data flow issues; conference call with CBRFC to discuss and for guidance with dailyQC.
- Compile station list to support dailyQC application needed for data QA/QC to support operational forecasting.
- Setup calibration training decks to support inhouse snow-17 training; setup and tested IFP, ICP, snowupdating, and espadp applications needed for snow training exercises.
- Loveland/McKee completed pre-requisite training material (snow modules and required readings)
- Completed 1 day snow-17 training hosted at wgrfc on November 18th. Training led by RTi contractor Jay Day and covered general overview, calibration, esp, and operational review of 2009 water supply season.
- Held monthly Pecos River project call with RTi for contract RTi T10-XXXX on 11/30. Discussed of model data analysis; MAPs/MATs done, PET analysis discussion, Unregulated flows outstanding questions, and water balance ongoing. Also discussing other planned deliverables and provided feedback from recent snow-17 training at wgrfc.
- Continued inquiries and discussions with NM State Engineer's office and Interstate Stream Commission to compile information about the Pecos Riverware model.
- Installed and debugged RES-J operation for Addicks and Barker reservoirs.
- Determined the need for adding an additional modeling point on Buffalo Bayou (ADBT2) and created new segment definition for installation.
- Finalized all graphics for San Jacinto River forecast points.
- Implemented ESP for all sites on San Jacinto River.
- Set up calibration decks for Buffalo Bayou sites needing to be remodeled.
- Began development of new forecast point at Greens Bayou – Ley Rd.
- Continuing work towards operational implementation of Upper Rio Grande Phase II calibrations. Two sites (Del Norte and Alamosa) were scheduled to be available beginning in November as requested and coordinated with WFO Pueblo. There continues to be significant in-house effort to reconcile and resolve station precipitation and temperature data flow issues to support model and OFS problems with implementation. Segment definitions being built from calibration decks are ongoing with troubleshooting to resolve errors. Ten of sixteen segments are successfully defined in OFS with outstanding errors to resolve on the remaining six.
- Completed MAP, MAT, and FMAP definitions in OFS for Phase II implementation.
- Training student intern and 2 journey hydrologists about station data types, ingest, flow paths, and resource tools to build awareness and troubleshooting skills for project support.
- Updated all ratings for URIO in Colorado from CDWR to support anticipated successful Phase II implementation.
- Modified snow_updating tool to accommodate new forecast locations and snotel stations for Phase II snow update implementation. Compiled and reformatted historical NRCS snotel data needed for statistical computations.
- Reconciling WHFS and internal database tables with Pecos station analysis performed by RTi for data flow and meta data checks.
- Held monthly Pecos River project call with RTi for contract RTi T10-XXXX on 12/16. Discussed model data analysis; analyzed two set of PET estimates with initial water balance, discussed unregulated flows outstanding questions, and initial water balance results. Verified task 2 deliverables (ie. basin/elev zone delineations; MAP/MAT time-series). Now moving into task 3 with setting up initial calibration decks for assessment.
- Completed all work adding new modeling point at ADBT2.
- Completed calibration for Buffalo Bayou forecast points.
- Finalized all graphics for Buffalo Bayou forecast points.

- Implemented ESP for all sites on Buffalo Bayou system (3 new sites, 2 expanded sites).
- Continued calibration for new forecast point Greens Bayou – Ley Rd.

2nd Quarter FY11

3rd Quarter FY11

4th Quarter FY11

Problems Encountered/Issues

1st Quarter FY11 – Complications with OFS continue to slow progress toward phase II implementation of two sites (Del Norte and Alamosa) previously scheduled to be available in November as requested and coordinated with WFO Pueblo. Problems with OFS implementation are being resolved and successful operational implementation is anticipated by end of January. In addition, there continues to be significant in-house effort to reconcile and resolve station precipitation and temperature data flow issues to support model; requires addressing station data issues that have never been needed before at WGRFC (ie. internal scripts to compute daily temperature max/min values from hourly data; also timestamp precip/temp data at 12Z for COOP data that are timestamped outside the acceptable OFS ingest window.) Also remaining is troubleshooting 6 segment definitions for successful operation, testing model simulations, and modifying files to run/generate ESP output and graphics.

2nd Quarter FY11 –

3rd Quarter FY11 –

4th Quarter FY11 –

AHPS Implementation for CBRFC

Management Lead: Michelle Schmidt, HIC/CBRFC

Objective: Implement probabilistic hydrologic forecasts in the Colorado Basin River Forecast Center's (CBRFC) area of responsibility.

Milestones

| Implementation Area | Forecast Points Planned | Due Date | Actual to Date 1 st Qtr FY11 | Variance |
|---------------------|-------------------------|----------|--|----------|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Total | 0 | | 0 | 0 |

Accomplishments/Actions

1st Quarter FY11

- N/A

2nd Quarter FY11

- N/A

3rd Quarter FY11

- N/A

4th Quarter FY11

- N/A

Problems Encountered/Issues

1st Quarter FY11

- Implementation for regulated points is delayed until delivery of new software

2nd Quarter FY11

-

3rd Quarter FY11

-

4th Quarter FY11

-

AHPS Implementation CNRFC

Management Lead: Robert Hartman, HIC/CNRFC

Objective: Implement probabilistic hydrologic forecasts in the California-Nevada River Forecast Center's (CNRFC) area of responsibility.

Milestones

| Implementation Area | Forecast Points Planned | Due Date | Actual to Date 1 st Qtr FY11 | Variance |
|---------------------|-------------------------|----------|--|----------|
| | | | | |
| | | | | |
| | | | | |
| Total | 0 | | 0 | 0 |

Accomplishments/Actions

1st Quarter FY11

- N/A

2nd Quarter FY11

- N/A

3rd Quarter FY11

- N/A

4th Quarter FY11

- N/A

Problems Encountered/Issues

1st Quarter FY11

- Implementation for regulated points is delayed until delivery of new software

2nd Quarter FY11

-

3rd Quarter FY11

-

4th Quarter FY11

-

AHPS Implementation for NWRFC

Management Lead: Harold Opitz, HIC/NWRFC

Objective: Implement probabilistic forecasts for basins in the Northwest River Forecast Center's (NWRFC) area of responsibility.

Milestones

| Implementation Area | Forecast Points Planned | Due Date | Actual to Date 1 st Qtr FY11 | Variance |
|---------------------|-------------------------|----------|--|----------|
| | | | | |
| | | | | |
| | | | | |
| Total | 0 | | 0 | 0 |

Accomplishments/Actions

1st Quarter FY11

- N/A

2nd Quarter FY11

- N/A

3rd Quarter FY11

- N/A

4th Quarter FY11

- N/A

Problems Encountered/Issues

1st Quarter FY11

- Implementation for regulated points is delayed until delivery of new software.

2nd Quarter FY11

-

3rd Quarter FY11

-

4th Quarter FY11

-

Training

Hydrologic Science Training - COMET

Core Goal: Provide science and software training on hydrology program applications throughout the research to operations cycle

Management Lead: Mark Glaudemans

Objective: Develop training and education materials to facilitate the implementation of new science and technologies into hydrologic operations.

Milestones:

| <i>Task</i> | <i>Due Date</i> | <i>Status</i> |
|---|-----------------|---|
| Techniques in Hydrologic Forecast Verification Distance Learning Module [HY21] | Q4 FY 2010 | Delivered to LMS December, 2010 |
| Advanced Hydrologic Science Course [HY14]. Funded COMET \$60K from AHPS. Virtual component July 25, residence component Aug 15, 2011. | Q4 FY11 | Agenda and instructors being planned. |
| CHPS Training Material Development [HY36]. Funded NWSTC \$110k from AHPS. | FY11 | Work progressing on Basic Configuration module. |
| QPE/Flash Flood Operations Course. Funded COMET \$57k from AHPS. Residence course Mar 8-10, 2011 | Q2 FY11 | Course preparation on track. |
| Communicating and Understanding Hydrologic Ensemble Information – Distance Learning Module (FDTB) [HY20] | Q3 FY10 | Suspended indefinitely in Q3 FY10 in lieu of higher priority work for XEFS training development |
| QPF Verification II Distance Learning Module [HY29] | Q1 FY11 | Suspended due to lack of AHPS funding to complete work |
| NCEP-HPC Visits | FY11 | No visits completed |

Accomplishments/Actions:

1st Quarter FY11

- Techniques in Hydrologic Forecast Verification Distance Learning Module [HY21] delivered to LMS in December 2010.
- Planning for agenda and instructors continues for Advanced Hydro Science course. Coordinating with Matt Kelsch and Pedro Restrepo.
- CHPS training continues in multiple tracks. A CIMMS employee, Daniel Henz, was hired in October 2010. A Training Advisory Group (TAG) was formed with members from each of three CAT-I sites, Mark Glaudemans, and NWSTC staff. After discussions, the plan is to develop an online module on FEWS Basic Configuration, tailored to the NWS. This module is expected to be completed in May, 2011, with possible modifications after initial student review. A separate activity is the implementation of a CHPS configuration at the NWSTC. Hardware was purchased by the NWSTC and was installed in Jan 2011. Additional modules are planned, with topics TBD by the the TAG.
- For QPE/Flash Flood Operations course, registration is complete and course agenda is set, with instructors and cases studies identified. Some final preparations still remain but this course is on track for presentation.

Problems Encountered/Issues

1st Quarter FY11

- No AHPS funding provided yet, so NCEP-HPC visits with RFCs have not taken place.

Outreach

FY11 Hydrology Program Outreach Work Plan

Theme: Hydrologic Services Outreach

Management Lead: Tom Graziano, Dan Matusiewicz, Regional Hydrologic Services Program Representatives

Objectives: Accomplish outreach with national, regional, and local partners and customers with emphasis on locations where AHPS or water resource services are being or will soon be implemented. Develop clear and consistent outreach materials for use by national, regional, and local personnel.

Milestones

| Tasks | Org | Cost (\$1000) | Quarter Due Date | Status |
|--|-------|---------------|------------------|-------------|
| OCWWS/HSD | | | | |
| Re-Print Floods the Awesome | OCWWS | 7.0 | 1 | Moved to Q2 |
| IWRSS Outreach Materials | OCWWS | 6.0 | 1 | Moved to Q2 |
| Plan and conduct the 7th Annual National Flood Safety Awareness Week, March 2010 | OCWWS | 0 | 2 | |
| Coordinate with Wash/Balt WFO to get a TADD Road Sign posted in the Metro area during Flood Safety Awareness Week. Coordinate with COMMS Office to get NWS Director to participate. | OCWWS | 0 | 2 | |
| Annual FEMA National Flood Conference, (New Orleans, LA), May 1-4, 2011 | OCWWS | 6.6 | 3 | |
| Biennial National Hydrologic Warning Council (San Diego) May 9-12, 2011 | OCWWS | 21.2 | 3 | |
| Association of State Flood Plain Managers (ASFPM) Annual Conference, Louisville, KY; May 15 - 20, 2011 | OCWWS | 14.2 | 3 | |
| Redesign TADD tri-fold with yellow TADD warning sign | OCWWS | 7.0 | | |
| Begin revision of joint NWS, FEMA, and American Red Cross Floods the Awesome Power AHPS Safety Brochure | OCWWS | 0 | | |
| Submit TADD Articles: 1) Move Magazine; 2) Road Safety Foundation | OCWWS | 0 | | |
| Student support for outreach to refine AHPS service location database. | OCWWS | 6.0 | 4 | |
| Sub Total | | 68.0 | | |
| Eastern Region | | | | |
| South Carolina Water Resources Conference (SERFC); Columbia, SC | ER | 1.0 | 1 | Completed |
| Mississippi Basin Tri-Agency Meeting (OHRFC); Brainard, MN | ER | 1.0 | 1 | Completed |
| NWS-USACE Coordination Meeting (OHRFC); Huntington, WV | ER | 0.5 | 1 | Moved to Q3 |
| Ohio Basin Tri-Agency Meeting (OHRFC, WFO); Cincinnati, OH | ER | 1.0 | 1 | Moved to Q3 |
| Silver Jacket Meeting & WFO Station Visit (OHRFC); Indianapolis, IN | ER | 0.3 | 1 | Completed |
| Maumee River Basin Commission & WFO Station Visit (OHRFC); North Webster, IN | ER | 0.2 | 1 | Moved to Q2 |
| Present at North Carolina Water Resources Conference (SERFC); Raleigh, NC | ER | 1.2 | 2 | |
| Ohio Basin Water Resources Alliance (OHRFC); Nashville, TN | ER | 0.3 | 2 | |
| Coordination visit to WFO Wakefield and Dominion Power to review hydrologic services (SERFC); Columbia, SC and Wakefield, VA | ER | 1.0 | 3 | |
| National Flood Conference (NERFC); New Orleans, LA | ER | 1.3 | 3 | |
| Participate in WMO Sponsored-Saint John River Hydrology Committee Meeting. Share AHPS development and deployment activities in northern New England. (NERFC, HSD, WFOs); Location: TBD | ER | 2.0 | 3 | |
| National HIC Meeting (NERFC, OHRFC, MARFC, HSD); Anchorage, AK | ER | 3.7 | 3 | |
| North Atlantic Tri-Agency Meeting (NERFC, MARFC, WFOs); Portland, Maine | ER | 1.5 | 3 | |

| | | | | |
|--|----|-------------|----|-----------|
| Silver Jacket Meeting in ER (SERFC); Location: TBD | ER | 0.5 | 4 | |
| FEMA Regions III, IV, and V Coordination Meetings (OHRFC); Atlanta, Philadelphia and Chicago | ER | 1.5 | 4 | |
| Customer Advisory Board Meeting (NERFC); Location: TBD | ER | 0.5 | 4 | |
| Partner Meetings and WFO Station Visits (NERFC); Location: TBD | ER | 0.5 | 4 | |
| Sub Total | | 18.0 | | |
| Central Region | | | | |
| Tri Agency Meeting (NCRFC and MBRFC) Location: Brainerd, MN | CR | 1.3 | Q1 | Completed |
| Missouri Basin Forecaster Meeting (MBRFC and NCRFC) Location: KC or Nebraska City, NE | CR | 1.4 | Q1 | Completed |
| AHPS presentation to MN Association of Flood Plain Managers (NCRFC) Location: Fergus Falls, MN | CR | 0.5 | Q1 | Completed |
| AHPS presentation at Red River Land & Water International Summit (NCRFC) Location: Fargo, ND | CR | 0.4 | Q2 | |
| AHPS & Flood Safety Promotional Outreach Items | CR | 0.25 | Q2 | |
| NCRFC WFO Outreach MI/GLERL Outreach | CR | 2.0 | Q3 | |
| Mississippi Basin Forecaster Meeting (MBRFC) Location: TBD | CR | 1.25 | Q4 | |
| MBRFC WFO Outreach (FSD, OAX, and DMX) | CR | 1.0 | Q4 | |
| Coop Stream Gage Meeting (MBRFC) Location: Billings, MT | CR | 0.6 | Q4 | |
| Montana DES Workshop (MBRFC) Location: TBD | CR | 1.7 | Q4 | |
| Climate Forum (MBRFC) Location: TBD | CR | .3 | Q4 | |
| Participate in Red River Basin Commission Ex-Officio Meeting (NCRFC) Location: Grand Forks, ND | CR | 0.15 | Q4 | |
| 3 rd HIC meeting (MBRFC, NCRFC, and CRH) Location: TBD | CR | 4.0 | Q4 | |
| High Water Mark Signs | CR | 1.2 | Q4 | |
| Stormwater Floodplain Simulation System | CR | 1.95 | Q4 | |
| Sub Total | | 18.0 | | |
| Southern Region: (additional \$10K for 1-day Stakeholder meeting in Tulsa (Dec – ABRFC) and Tuscaloosa (Spring – SERFC)) | | | | |
| Oklahoma Governor's Water Conference. (ABRFC) Location: Oklahoma City, OK | SR | .3 | 1 | Completed |
| High Water Mark Sign Ceremony (ABRFC) Location: Amarillo, TX | SR | .3 | 1 | Completed |
| Red River Valley Authority Water Conference (ABRFC) | SR | .35 | 1 | Completed |
| Mississippi River Tri-Agency Meeting (LMRFC) Location: Brainerd, MN | SR | 1.5 | 1 | Completed |
| Mississippi Water Resource Conference (LMRFC) Location: Bay St. Louis, MS | SR | .6 | 1 | Completed |
| AHPS Outreach and Customer Requirements Meetings, (WGRFC) Location: Houston, TX San Jacinto River Authority, Harris County Flood Control District, and WFO HGX | SR | .75 | 1 | Completed |
| Texas DEM & FEMA Region VI Meeting, (ABRFC) Location: TX | SR | .4 | 2 | |
| NCDC Meeting (ABRFC) Location: NC | SR | .65 | 2 | |
| AHPS Outreach Meetings with Tennessee USGS and WFO OHX, (LMRFC) Location: Nashville, TN | SR | 1 | 3 | |
| AHPS Outreach Visit to WFO LCH, (LMRFC) | SR | .5 | 3 | |

| | | | | |
|---|----|--------------|---|--|
| Location: Lake Charles, LA | | | | |
| Louisiana Annual Emergency Managers Meeting, (LMRFC) Location: Lake Charles, LA | SR | .5 | 3 | |
| Florida Governor's Hurricane Conference, (SERFC) Location: FL | SR | 1.1 | 3 | |
| Interdepartmental Hurricane Conference, (SERFC) Location: TBD | SR | 1.2 | 3 | |
| Upper Rio Grande Customer Meeting, (WGRFC) Location: CO | SR | 2.5 | 3 | |
| International Boundary Water Commission Flood Workshops, (WGRFC) Location: South Texas | SR | .75 | 3 | |
| Silver Jacket Meeting, (SERFC) Location: TBD | SR | .6 | 4 | |
| High Water Mark Signs, (SRH-HSB) | SR | 1 | 4 | |
| HIC Meeting, (SRH-HSB) Location: TBD | SR | 4 | 4 | |
| Water Resource Stakeholder Meeting, (SRH-HSB) Location: Tulsa, OK | SR | 5 | 2 | |
| Water Resource Stakeholder Meeting, (SRH-HSB) Location: Tuscaloosa, AL | SR | 5 | 3 | |
| Sub Total | | 28.0 | | |
| Western Region | | | | |
| Support WR attendance at NHWC Meeting | WR | 4.0 | 3 | |
| LOX Global Monitoring Exhibit | WR | 3.0 | 4 | |
| PHX Outreach Materials | WR | 1.0 | 4 | |
| SEW Outreach Materials | WR | 3.0 | 4 | |
| Travel for HIC Meeting | WR | 4.0 | 4 | |
| TFX High Water Mark Signs and Outreach Materials | WR | 1.0 | 4 | |
| PQR TADD signs and outreach materials | WR | 2.0 | 4 | |
| Sub Total | | 18.0 | | |
| Alaska/Pacific Region – (additional \$5K for 1 – day Stakeholder meeting in Anchorage (Summer – APRFC) | | | | |
| IHCA and/or other outreach in Juneau | AK | 1.0 | 3 | |
| AWRA and/or other outreach in Fairbanks | AK | 1.0 | 3 | |
| Watershed Model | AK | 1.5 | 2 | |
| High Water Mark Signs and/or Outreach Materials | AK | .5 | 3 | |
| Outreach Visits to Explain Hydrologic Program to Partners and Customers | AK | 2.0 | 4 | |
| Sub Total | | 11.0 | | |
| Grand Total | | 161.0 | | |

Accomplishments/Actions

1st Quarter FY11

2nd Quarter FY11

3rd Quarter FY11

4th Quarter FY11

Problems Encountered/Issues

1st Quarter FY11 - None

2nd Quarter FY11

3rd Quarter FY11

4th Quarter FY11

Program Management

Program Management

Theme: Program Management

Management Lead: Donna Page

Objective: Provide national program management; coordinate and track AHPS budgets and project plans; manage AHPS contracts; and foster Agency, Departmental, and Legislative Interface.

Milestones

| Tasks/Subtask FY11 Milestones | Responsible | FY11 Quarter Completion Date |
|---|---|--|
| OHD Portfolio Definition | OHD | Q4 |
| AHPS Planning/ Execution/ Reporting <ul style="list-style-type: none"> • E-CPIC Updates • Monthly Status for NWS Monthly Report | OHD OHD/Regions | Quarterly Monthly |
| NOAA SEE Hydrology Program Support <ul style="list-style-type: none"> • Program Operating Plan • Quarterly Program Review | OHD OHD | 3 rd Quarterly |
| Agency/ Department/ Legislative Interfaces <ul style="list-style-type: none"> • Budget Fact Sheet • Prepare and submit Budget Request • Prepare Briefings and Support OMB/Congressional Meetings • Prepare Response to Pass Back • Prepare Response to Budget Hearing Questions • Program Assessment Rating Tool Progress | OHD OHD OHD OHD OHD OHD | 1 st 2 nd 3 rd 3 rd 4 th Quarterly |
| HOSIP Process Improvement and Document Development <ul style="list-style-type: none"> • Instructions • Guidance & Standards • Performance Statistics • Quality Control Reports • Validation & Recommendation Reports • HOSIP Documents • Gate Status, Branch Chief Status Reports | OHD OHD OHD OHD OHD OHD OHD | Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Weekly |

Accomplishments/Actions

1st Quarter FY11

- Meeting in Hanover, NH at Corps of Engineers Cold Regions Research and Engineering Lab (Oct. 26-28) to learn about how they use Technical Readiness Levels as a tool for improved management. OHD will be adapting its internal management processes to incorporate TRLs in the coming months. Also looked at how CRREL develops and measures their research portfolio.
- Began process of defining OHD portfolio.
- All milestones are on schedule – all scheduled reports completed
- As a reminder, for FY11, there are no project management funds for the AHPS, NOAA or Agency parts of this task. All AHPS project management is being handled by government FTE - Quarterly AHPS reports are being compiled by Dennis Miller. Other reporting handled by other government FTE (John Ingram, Ken Pavelle).

Problems Encountered/Issues

1st Quarter FY11 - None