

Northwest River Forecast Center



National Weather Service Implementation of Community Hydrologic Prediction System

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Portland, Oregon, USA

SCH Workshop
December 2008

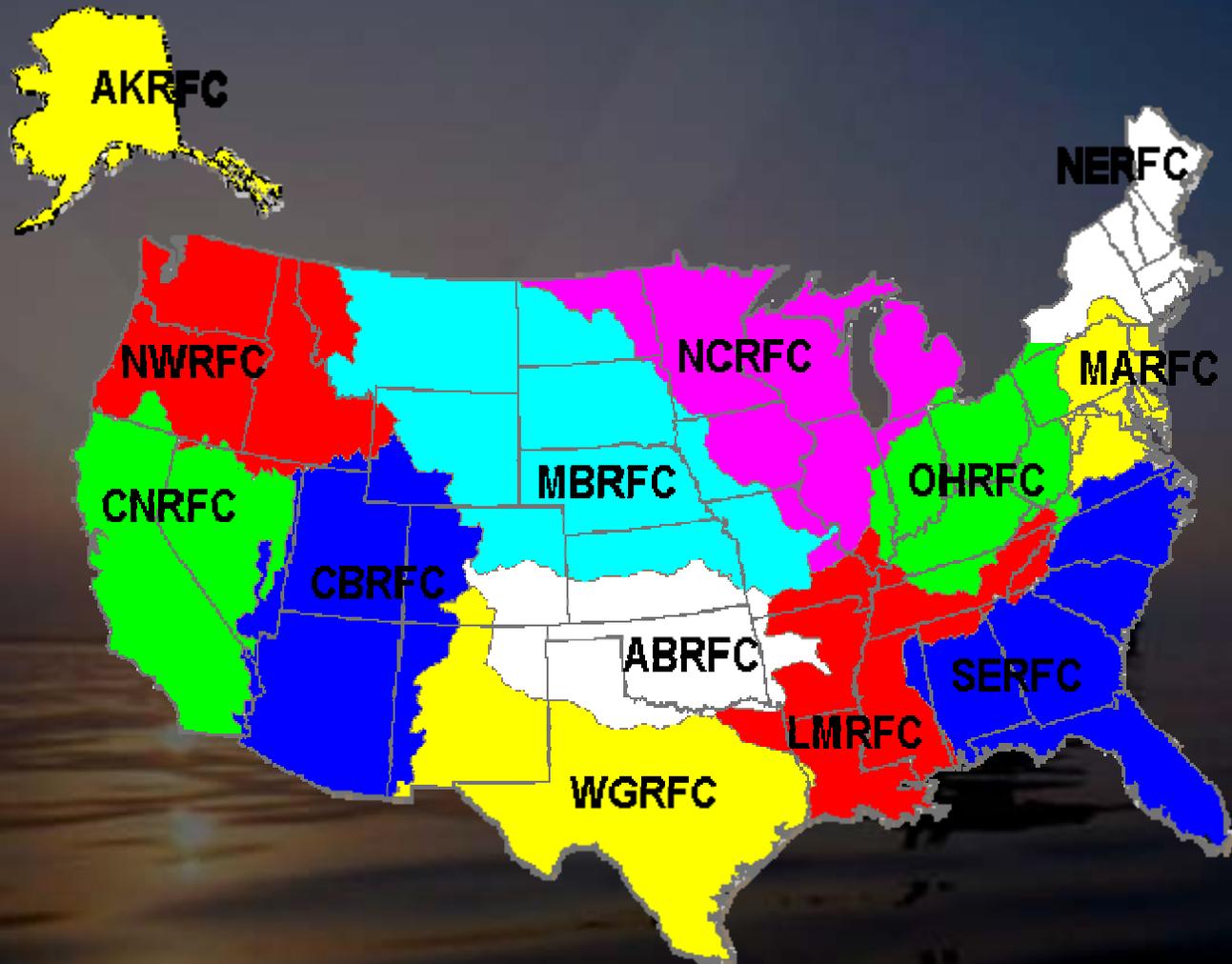


Outline

- Background and history
- Why are we doing this?
- How are we doing it?
- When will we do it?
- FEWS System Overview
- FEWS Mockups



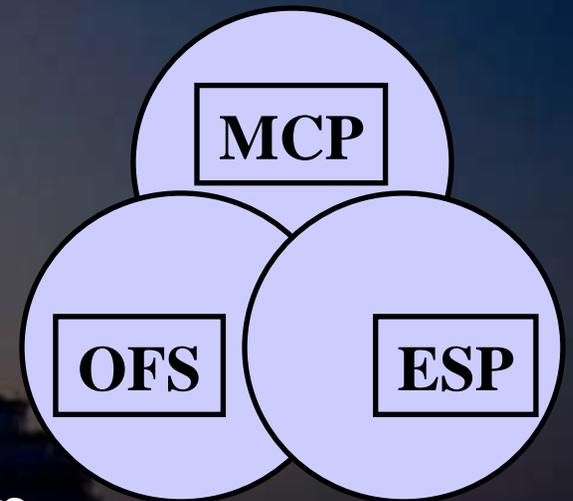
NWS River Forecast Center





National Weather Service River Forecast System

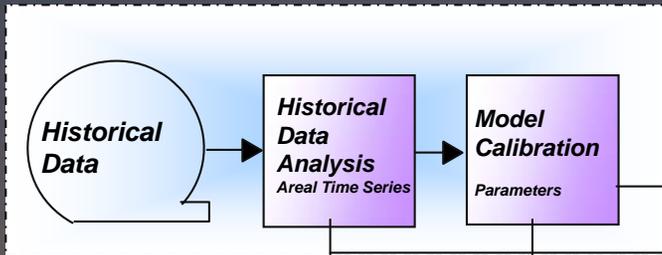
- NWSRFS serves as central modeling system
 - *Umbrella of models, flexible*
 - *Sound Science*
- Operates in 3 integrated modes.
 - *Calibration - parameter estimation*
 - *Operational - short term deterministic forecasts*
 - *Ensemble - longer term forecasts*
- New initiatives necessitate RFCs to increase capability & services



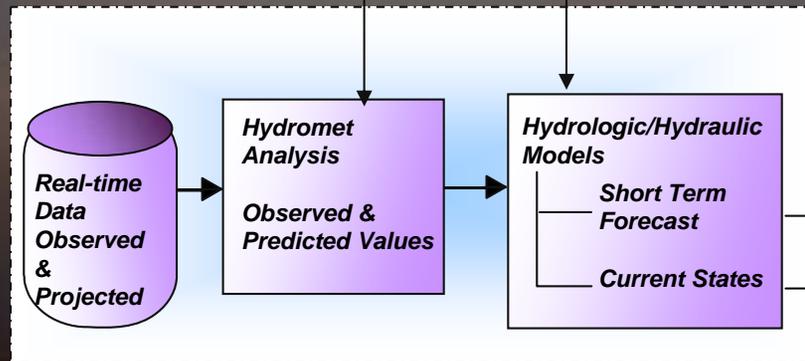
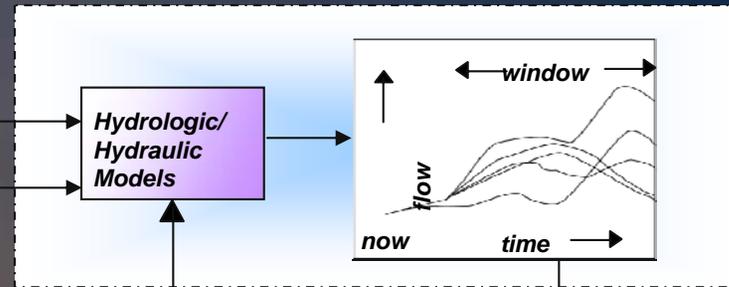


NWSRFS – An Integrated System

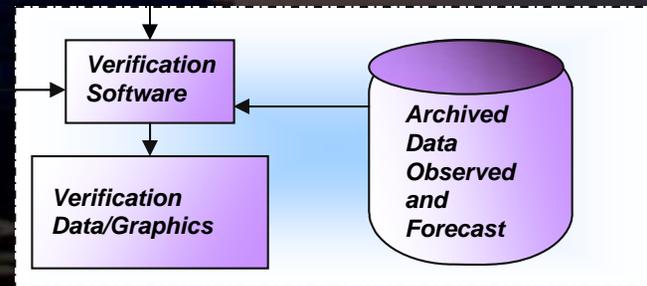
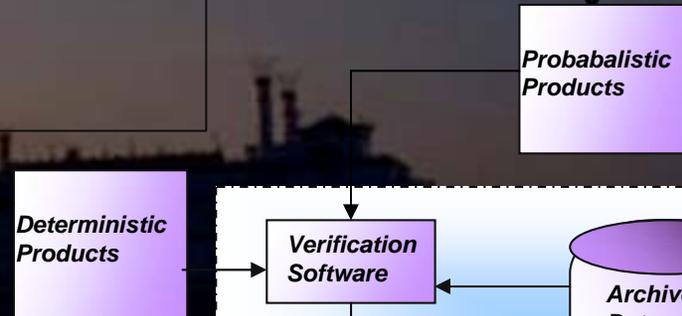
Calibration System



Ensemble Streamflow Prediction



Operational System

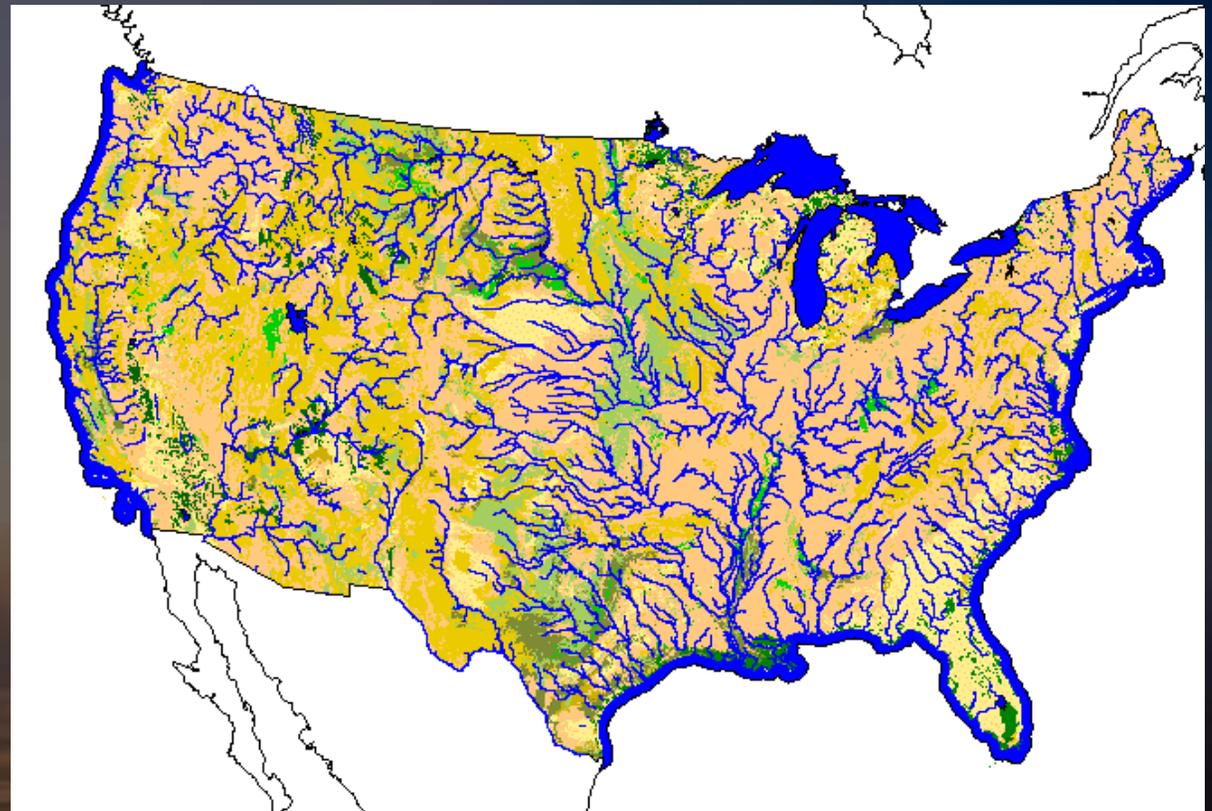


Verification System



Water Resources - an Integrated Perspective*

Rivers & Streams
Reservoirs & Lakes
The Great Lakes
Wetlands
Estuaries
Coasts
Soil Moisture
Snow Pack
Ground Water
Water Quality



**Any of the entire range of the Earth's natural waters that are of potential use to society*

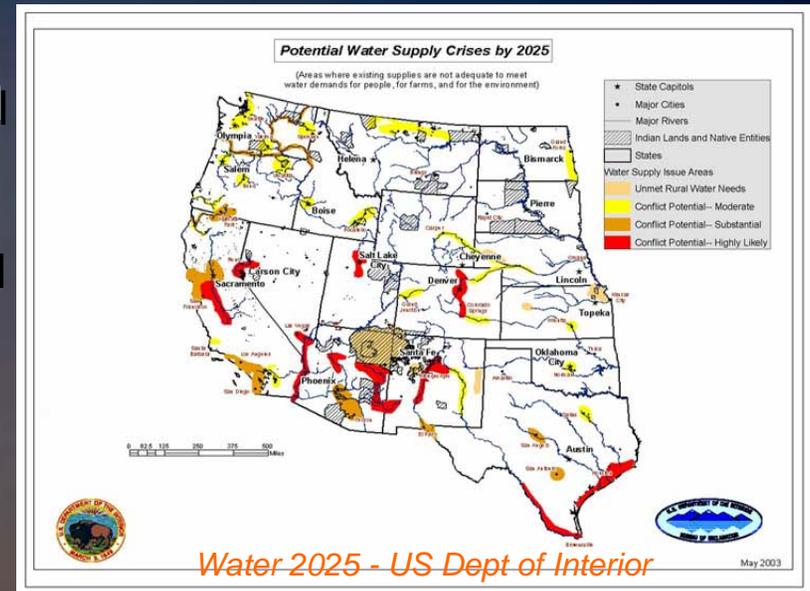


New NOAA Water Resources Initiatives

Objective: Nationally consistent, water and soil forecasts delivered via a national digital database

Outcome: Water resources forecasts delivered to Federal, academic, public and private sector partners for critical decisions related to:

- Sustainable irrigation
- More efficient power generation
- Sensible, year-long water conservation plans
- Rational allocation and distribution of water
- More cost-effective river commerce
- Protection of threatened and endangered species
- Balanced terrestrial/aquatic watershed management
- Enhanced aquatic habitats



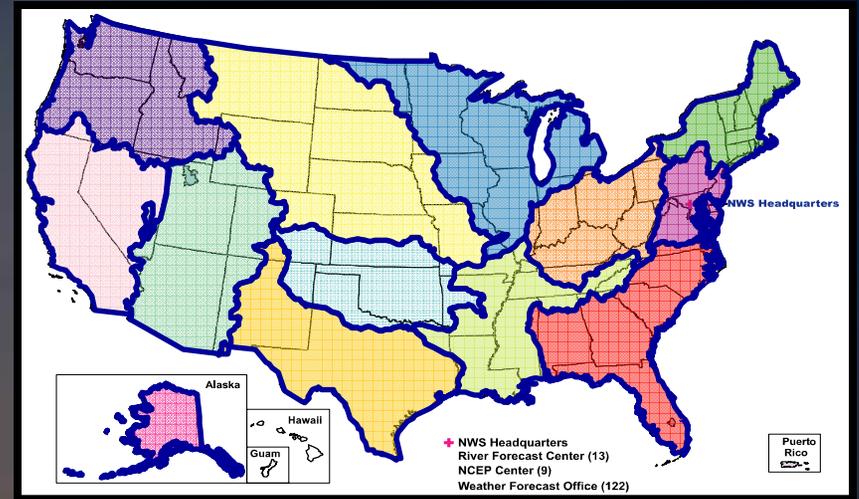
Builds on the Advanced Hydrologic Prediction Service

Creates a Community Hydrologic Prediction System for the rapid transfer of collaborative research into operations



Private and Public Partners and Collaboration

USDA Natural Resources Conservation Service
U.S. Army Corps of Engineers
U.S. Geological Survey
U.S. Bureau of Reclamation
Environmental Protection Agency
National Aeronautics and Space Administration
U.S. Fish and Wildlife Service
Federal Emergency Management Agency
Federal Energy Regulatory Commission
Tennessee Valley Authority
Bonneville Power Administration
Plus, universities, and state, regional,
and local cooperators

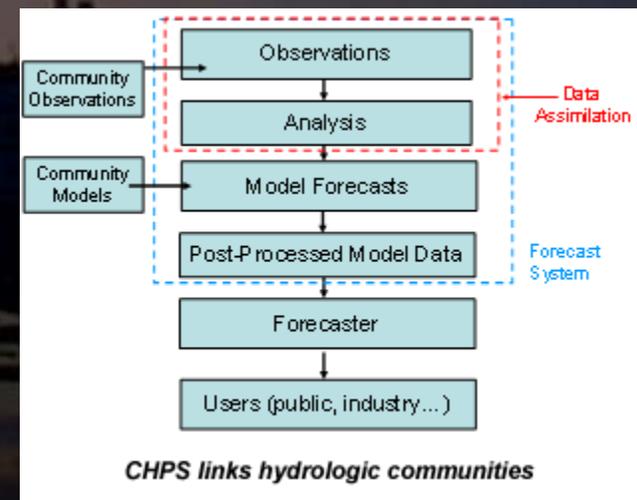
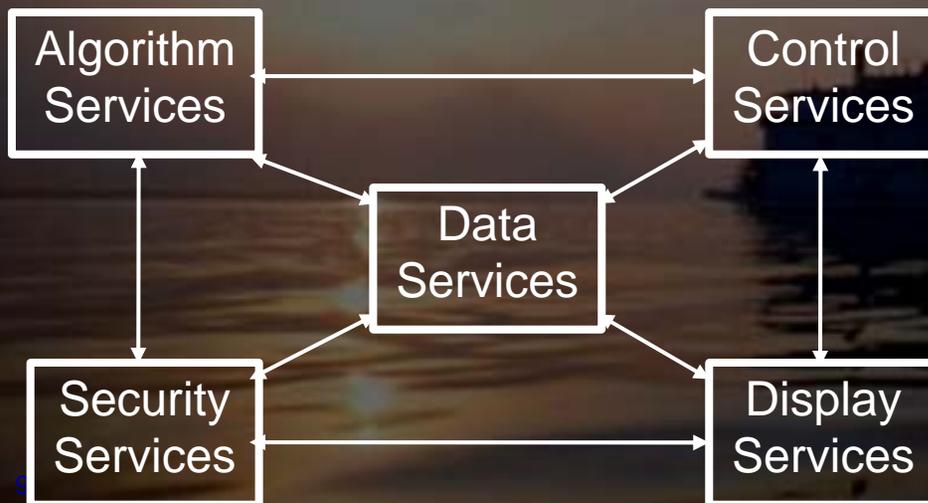




Community Hydrologic Prediction System CHPS

NOAA's National Weather Service (NWS) River Forecast Centers (RFCs) are key partners in the provision of water resource information.

The Community Hydrologic Prediction System (CHPS) will enable NOAA's water research, development enterprise and operational service delivery infrastructure to be integrated and leveraged with other federal water agency activities, academia, and the private sector.





Why CHPS?

1970s

1980s

1990s

2000s

2003

today

- NWSRFS was a great architecture originally developed for use on mainframe computers
 - *lacks modern modularity*
 - *difficult to add new models and techniques*
 - *inhibits collaboration and research to operations*
- CHPS will allow:
 - *greater ease in implementing new models*
 - *greater collaboration with agency partners, universities, international community*



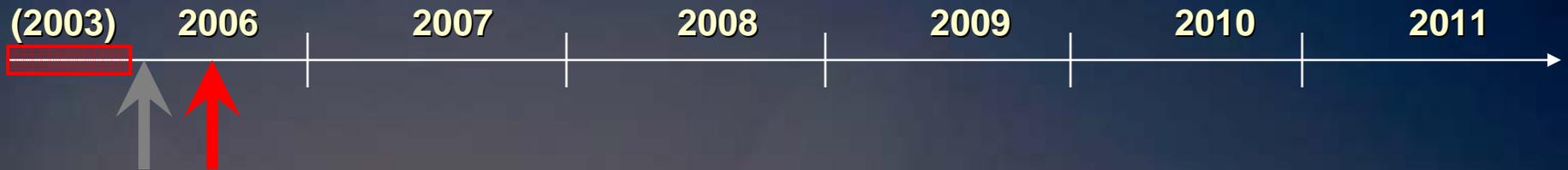
Development Time Line



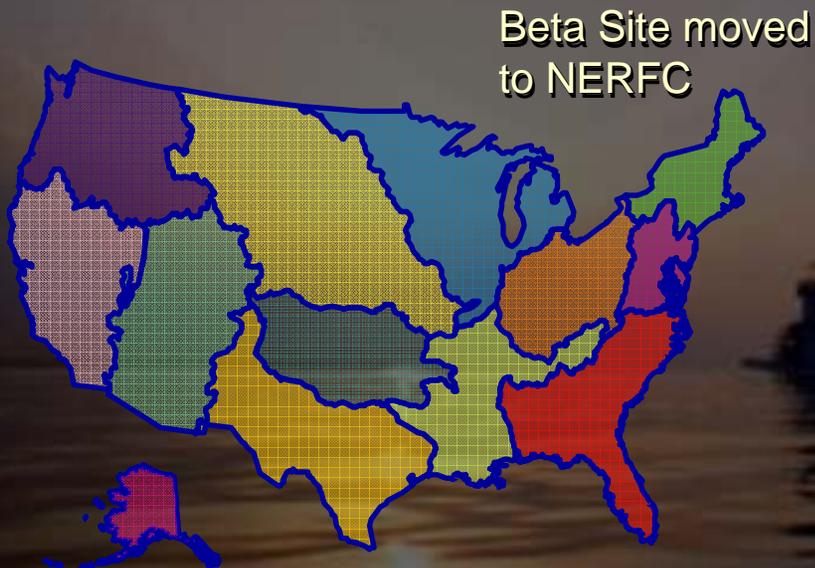
- OHD initiated exploration in 2003
 - *Infrastructure analysis*
 - *Several candidates considered including Delft-FEWS in Oct 2005*



CAT River Forecast Centers



Evaluation Delft-FEWS as a CHPS candidate



- *ABRFC, NCRFC, NWRFC volunteered to work w/ OHD.*
- *Team formed in July 2006*
- *CNRFC later drafted*
- *Known as CHPS Acceleration Team or "CAT" RFCs*
- *Criteria established through evaluation of NWSRFS strengths and weaknesses*



CHPS/FEWS



What is FEWS?

- *JAVA based system and repository for hydrologic and hydraulic modeling*
- *Client/server architecture*
- *Mature system developed by Delft Hydraulics|WL since the 1990s*
- *Deterministic and ensemble capabilities*
- *Employs Postgres database*
- *System synchronization*
 - *Backup and stand-by*



History of FEWS System at Deltares-Delft Hydraulics

- 1992
 - *The first system referred to as FEWS was that of FEWS Sudan. This became operational in 1992, and covered the Blue Nile and Atbara rivers, as well as the White Nile from just u/s Khartoum to Lake Nasser. This was a very early system – completely purpose built. Used Sacramento Rainfall-Runoff, HD routing (including Kalman filter), Reservoir models and a cold cloud duration technique for deriving rainfall. Rumour has it the system is still operational.*
- 1997/1998
 - *The next step was in 1997/1998. A new FEWS system, based on the concepts of FEWS Sudan, but now more flexible to open model integration, was developed. The data handling and database functionality was still poor. This system was developed for the Punjab in Pakistan (tribs to the Indus). The system has now been converted to the more modern FEWS 2.0 system (this is the current generation).*
- The same system used in Pakistan was configured and applied in the Czech republic for the Orlice river (current status unknown)

Jhelum

Status

Current Time **1998-03-04 13:11**

Update Until **1997-09-07 06:00**

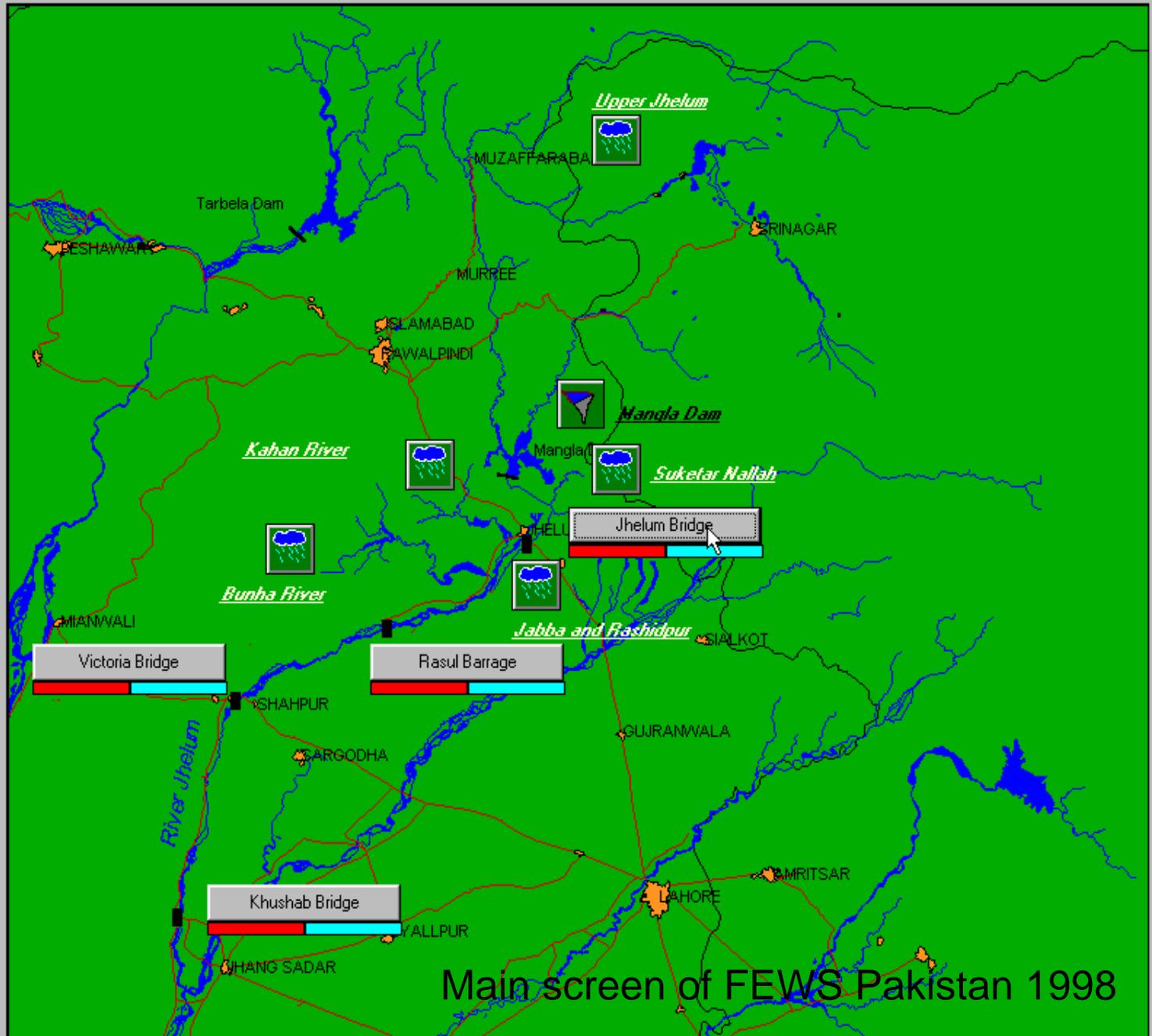
Forecast Until **1997-09-21 06:00**

Inflow Models Accepted

Update Accepted

Legend

-  Extremely High
-  Very High
-  High
-  Medium
-  Low
-  No Information
-  Sub Catchments
-  Reservoir
-  Zoom in to Sub System



Main screen of FEWS Pakistan 1998



History of FEWS System at Deltares-Delft Hydraulics

- 1999
 - *A European research project was initiated, called an European Flood Forecasting System (EFFS). In the context of both this project and the Swiss and Dutch authorities who initiated a project to modernise the flood forecasting capabilities. This was the birth of the Java style FEWS, known to us as FEWS 1.0. Very much a stand alone system – but embracing the open model integration approach.*
- This system was applied both on the European project – which focused on ensemble forecasting, as well as the operational system in Switzerland & the Netherlands

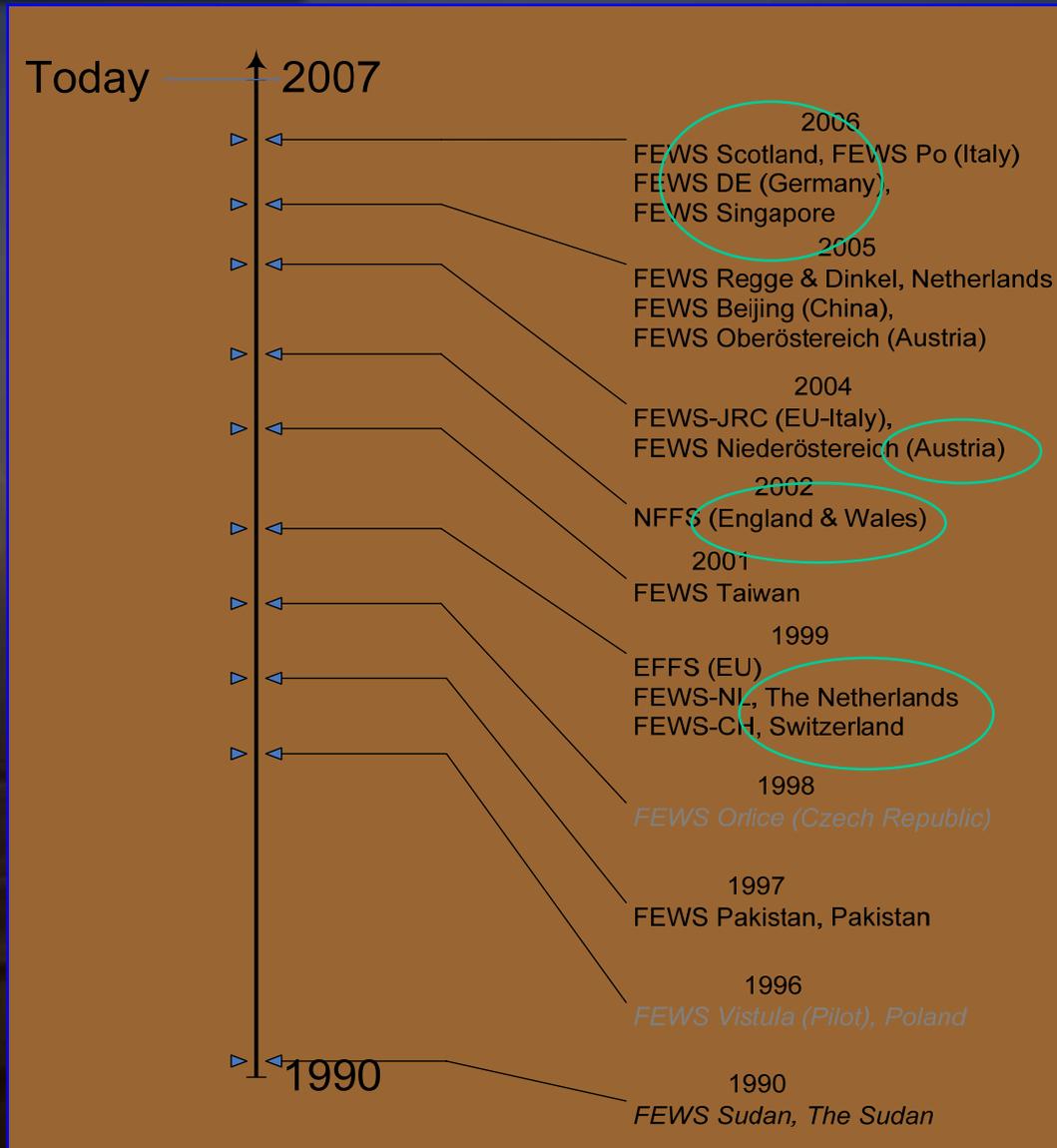


History of FEWS System at Deltares-Delft Hydraulics

- 2002
 - *In early 2002 the Environment Agency, UK put out a tender for the development of the National Flood Forecasting System. This was won by Delft Hydraulics/Tessella. Work started late 2002, and this was considered the birth of the current FEWS (FEWS 2.0 as we know it). It carries forward some of the earlier ideas, but the code was revamped, and the system was now set up as a client-server system, rather than stand alone.*
- Since its application in the UK, and subsequent migration of several of the earlier systems to the new standards, quite a lot has happened ...



Chronology of FEWS System at Deltares-Delft Hydraulics

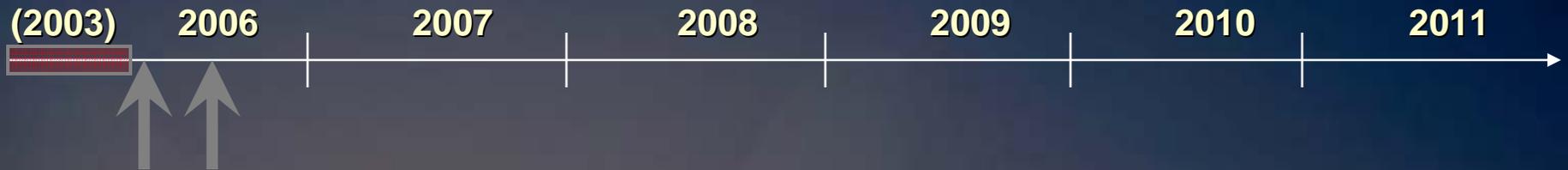


Operational Users at the
FEWS User Group
Workshop

Delft, The Netherlands



FEWS Users



Who Uses FEWS?

- *United Kingdom, Austria, Switzerland, Germany...*
- *The Delft FEWS User Group represents a consortium of international representatives who employ the modeling architecture known as FEWS.*
- *The User Group is a wide array of international delegates who employ FEWS to support their hydrologic and hydraulic forecast needs.*

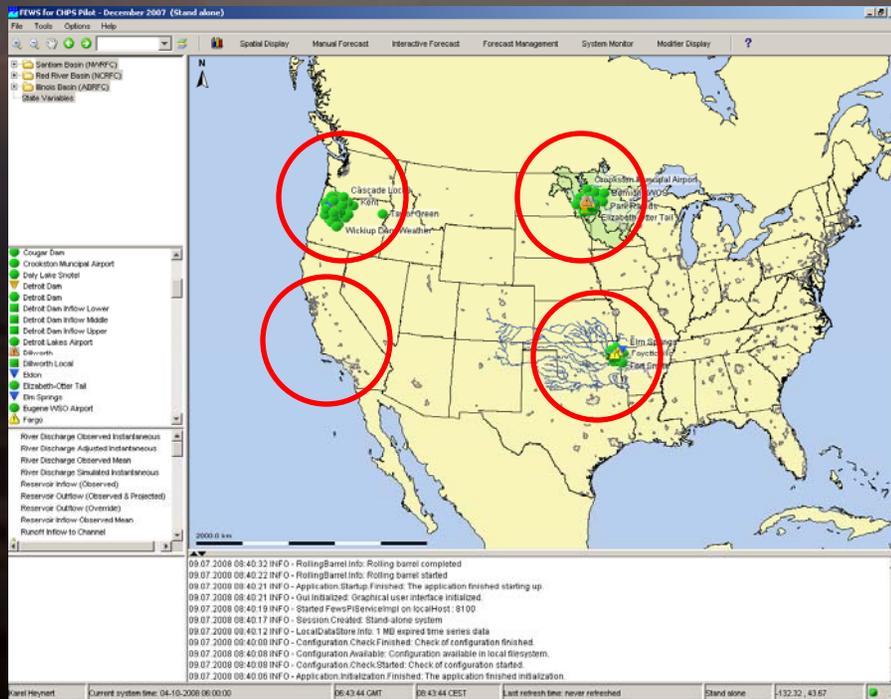


Delft-FEWS Prototype Evaluation



Oct 2006 – Basin Demonstrations

- *Facilitated by OHD, Apex, RTi, and WL-Delft Hydraulics*
- *NWRFC & NCRFC Implementation*
- *Strategy to include basic functionality (including SAC_SMA)*
- *Use surrogate FEWS models/functions/displays*
- *Other demonstrations added later*





Delft-FEWS Prototype Evaluation

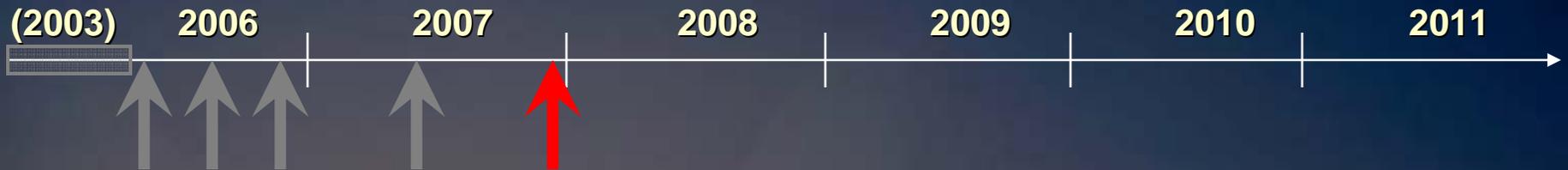


Results reviewed at April 2007 NWRFC workshop

- *“Very promising”, but more evaluation needed...*
- *MODS-like capability*
- *Client-Server application*
- *Integration of SNOW-17*
- *Displays with English Units*



FEWS Prototype Evaluation



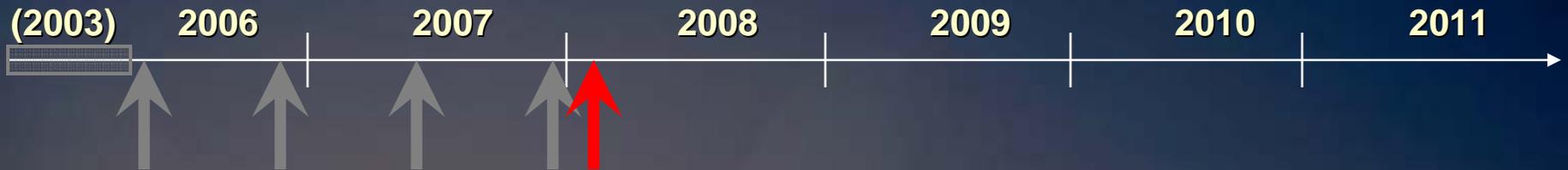
Dec 2007 workshop addresses review results

- *Solid progress on MODs capability*
 - *Client-Server demonstrated*
 - *SNOW-17 integration easier than expected*
 - *Display units mostly taken care of*
 - *ESP capabilities demonstrated and discussed*
 - *Followed by training on FEWS configuration*
- CNRFC implement/test COE ResSim Project

CAT RFCs recommend FEWS to replace NWSRFS



CAT Recommendation



Approved by Office Director – Gary Carter – Jan 17, 2008

- Proceed with implementation of Delft-FEWS as the CHPS software infrastructure.
- Target operational use at all RFCs within 3 years.
- Retain CAT with a revised implementation charter



CAT Recommendation



Resource Implications

- Re-direct OHD resources toward CHPS/FEWS
- Terminate “dead-end” NWSRFS enhancements
- Align/re-evaluate HSMB-oriented “Research to Operations” (RTO) projects



Implementation Strategy



Clear planning and execution by CAT RFCs

- *Weekly phone call with OHD, CAT RFCs, and Deltares*
- *Gap analysis for essential operations*
 - *Use of existing calibrated parameter sets is essential*
- *Build NWSRFS functionality within FEWS*
- *Preprocessing and post-processing utilities*
- *AWIPS II integration*
- *Staff training*
- *Technical support*
- *Many others...*



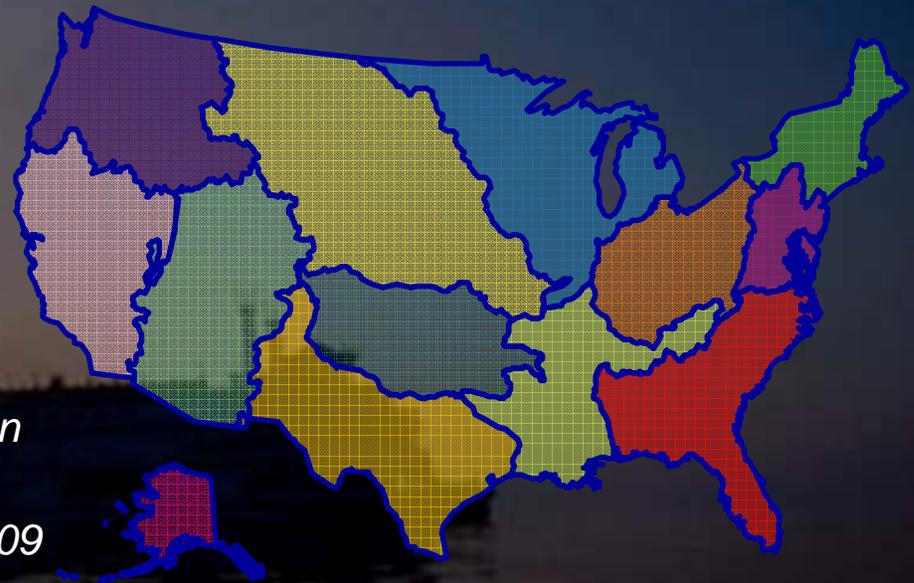
Implementation Strategy



- Two tiers of deployment

4 CAT RFCs

- *Initial hardware delivery Oct 2008*
- *Initial migration software and training in Jan 2009*
- *Operational hardware delivery summer 2009*



Parallel operations by October 2009



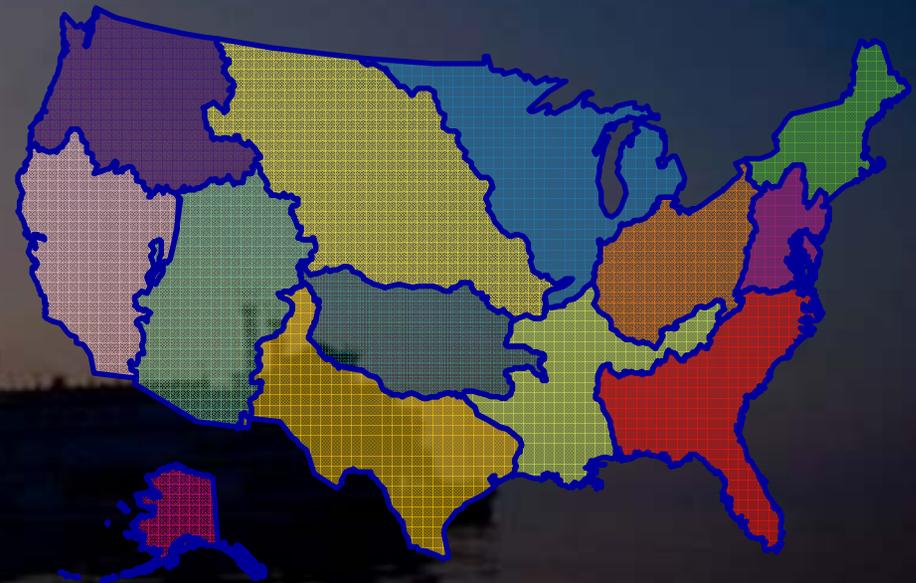
Implementation Strategy



- Two tiers of deployment

Remaining 9 RFCs

- Initial hardware delivery in October 2009
- Migration/Systems training – Fall 2009
- Migration begins January 2010
- Parallel operations by October 2010



RFCs not required to drop NWSRFS until “fully ready”



Why CHPS/FEWS?



- Enables NWS/RFCs to meet the original initiative for new services and collaboration
- New opportunities for potential services/modeling available in FEWS
- Capitalize and engage others on sciences and models



NWS and CHPS/FEWS



- And we are on schedule





- Implementation Strategy





Implementation Strategy

Today

CAT RFCs

Pilots/Demonstrations

BOC

Software Migration

- Models
- Operations

Initial Hardware Installed

Software Acceptance (Dec 15-17)

Migration

Parallel Ops

Operational

2006

2007

2008

2009

2010

2011

BOC-II

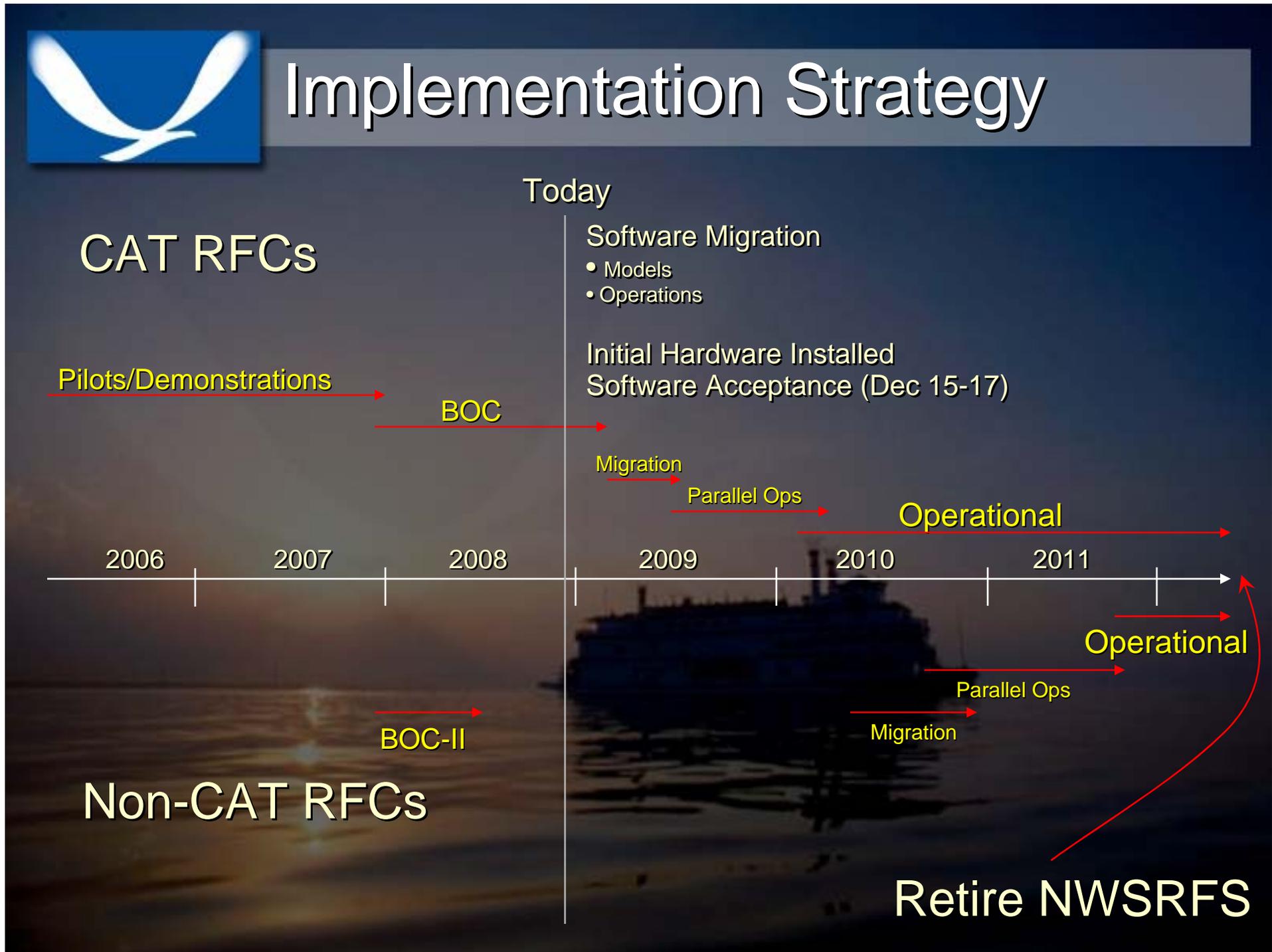
Non-CAT RFCs

Migration

Parallel Ops

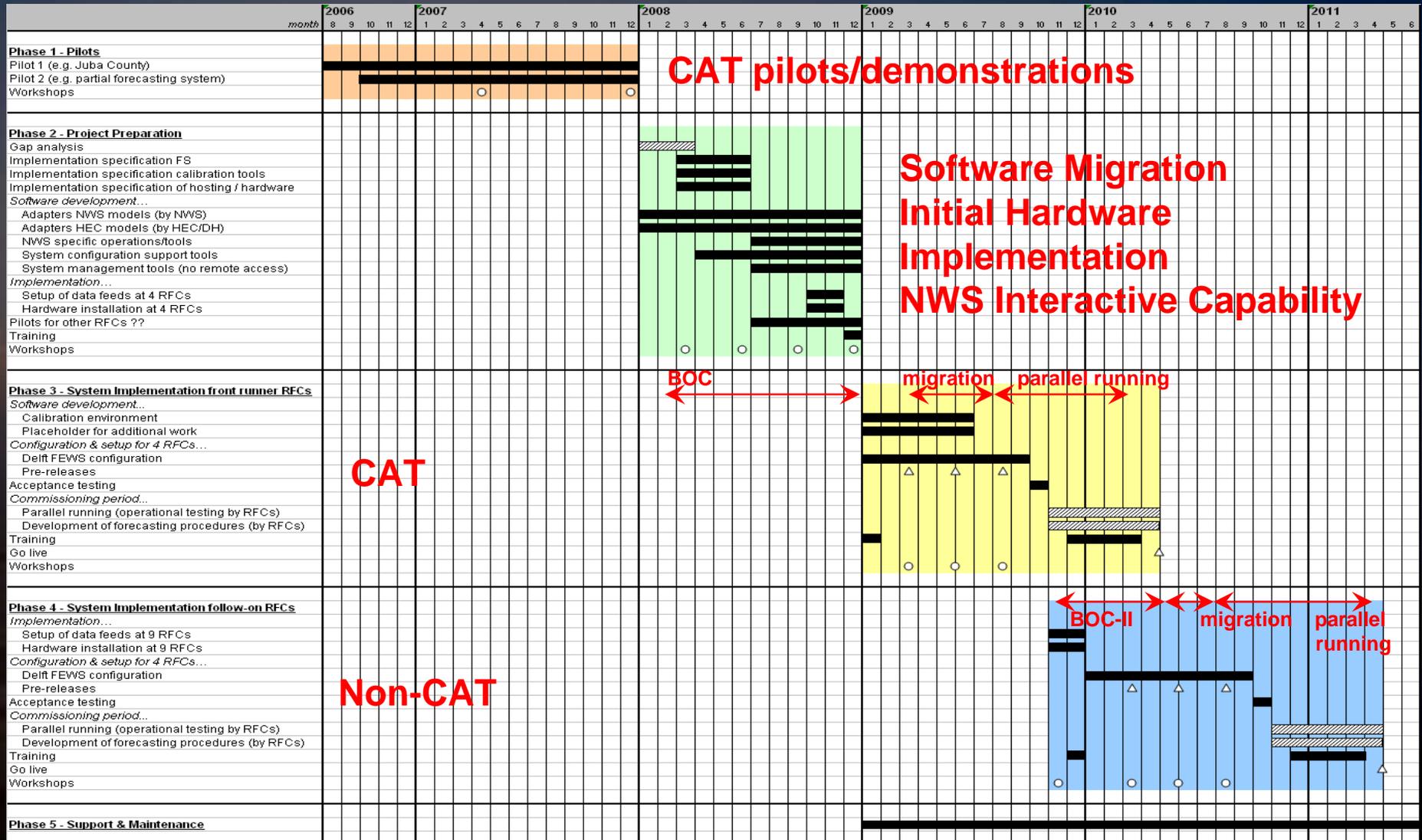
Operational

Retire NWSRFS





Project Timeline





Implementation Strategy

BOC - Basic Operating Capability defined

- Minimum set of software, hardware, and information infrastructure to operationally support the 4 CAT RFCs
 - *Models, Operations, Display utilities*
- Consistent with operational service delivery as of Jan 1, 2008
 - Snapshot of 4 CAT RFC determined functionality and operations that would be included in initial CHPS/FEWS system
- Mechanical Change only
 - *No re-calibration*
- Sophisticated data visualization and quality control functions
 - *ie, IFP & MODS*



Implementation Strategy

BOC-II Basic Operating Capability round 2

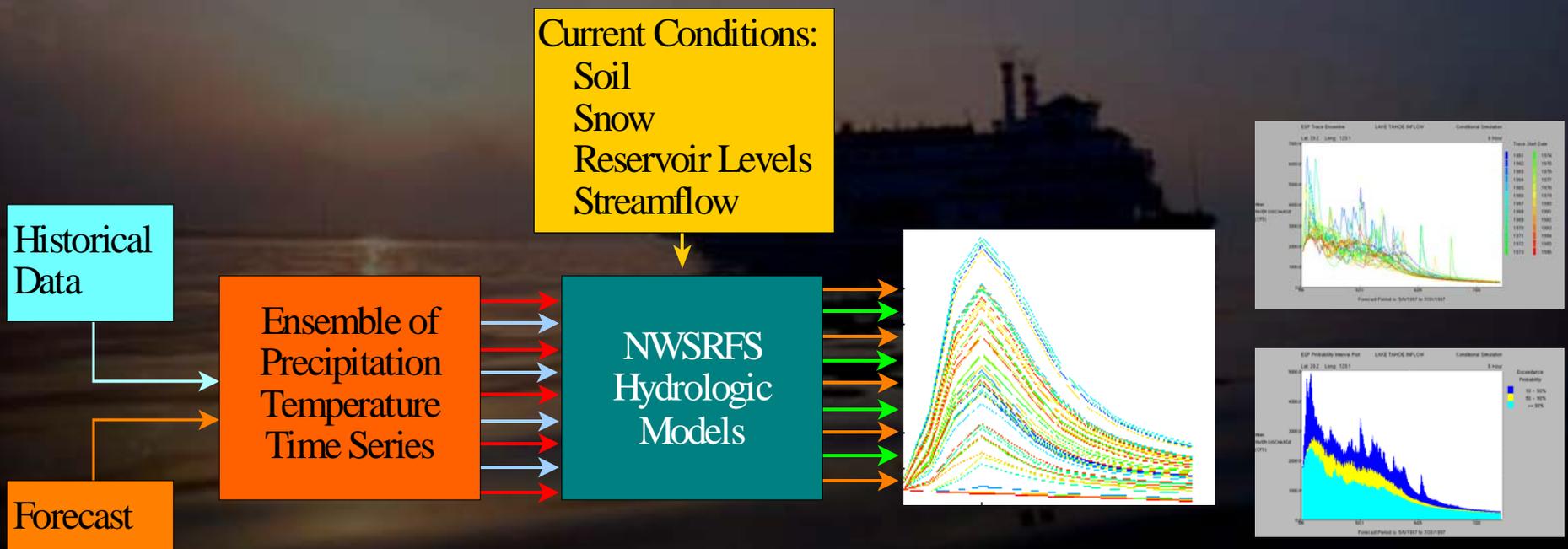
- BOC-II are the non-CAT RFCs
- Non-CAT RFC will inventory their capability and determine additional NWSRFS operations and models required for CHPS/FEWS operations
 - BOC-I (CAT RFCs) may not have captured all RFC capabilities
- Stress difference between NWSRFS and local-application capabilities



Implementation Strategy

Ensemble Streamflow Prediction Services – ESP

- FEWS will provide for existing level of ensemble operations, products, and services
 - *Port ESPADP to use FEWS architecture and data resources*





Implementation Strategy

Calibration System

- CAT RFCs determined that it is to remain independent of CHPS/FEWS
 - Absent in BOC but not forgotten
- Will need to work toward some common linkages
- ICP remain outside the CHPS/FEWS environment
 - *MAPS/MATS will remain accessible eg., ESP*



Implementation Strategy

Migration Tools

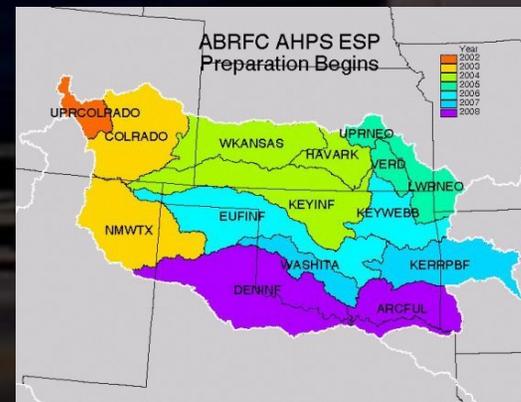
- Deltares will develop necessary tools to convert NWSRFS to CHPS/FEWS
- Transform NWSRFS configurations/definitions to FEWS
- Transfer parameters/model states to FEWS



Implementation Strategy

Hydrologic/Hydraulic Configuration

- Workflows will emulate Forecast Group and Segment structure of current NWSRFS implementations
- This will help simplify migration





Implementation Strategy

NWSRFS OFS Preprocessors

- CAT RFCs agreed to retire all OFS Pre-processors and employ routines within FEWS
- All input forcings will be in gridded form
- NWS team formed to address OFS PP retirement



Implementation Strategy

NWSRFS OFS Preprocessors

- Validate techniques in mean areal computations against current OFS PP data
 - *Adjust for biases*
- Maintain temporal considerations of 6 & 24 hour time series
- Include hourly gridded forcings to FEWS
 - *Precipitation and temperature*
 - *How to yet to be determined*
- Maintain flexibility to import locally-generated TS into FEWS
- Prepare necessary data formats
 - *Grib1, Netcdf, HDF5*



Implementation Strategy

NWSRFS Pre Processors

Observed and Forecast Forcings

- Observed and forecast forcings will remain external to FEWS
 - *Quality control is not initially intended to be part of FEWS*
 - *The exception – RRS data via interactive sessions*
- Goal is for all input forcings to be grid form
 - *FEWS will transform input to mean areal*
- FEWS will also support both point and time series data ingest
 - *Eg., post time series data to FEWS*
- (NWS) RRS Quality Control within FEWS will propagate to external systems and repositories

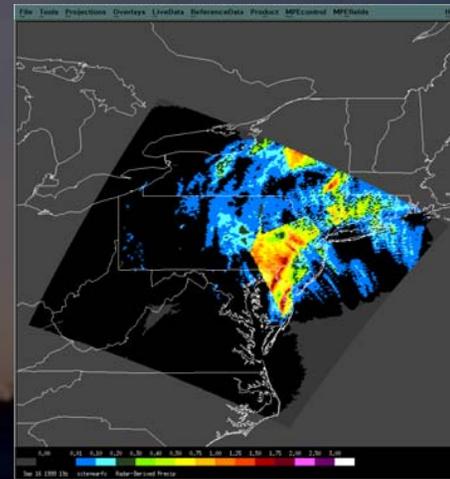


Implementation Strategy

NWSRFS Pre Processors

Observed Forcings

- MPE to include functionality to address observed forcings
 - *Precipitation, temperature, PET*
 - *MM daily qc functionality*
 - *6- and 1-hourly time steps*
- Output in points, grids
 - *GRIB1, XMRG, Netcdf, HDF5*
 - *Eliminate XMRG*
- User defined projections and resolutions
 - *Not at this time due to software limitations*
 - *Data Networks can define resolution*





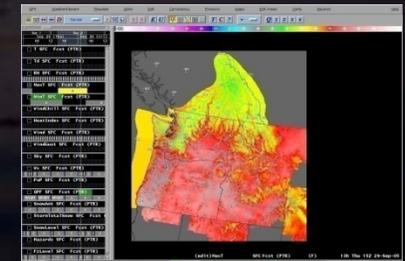
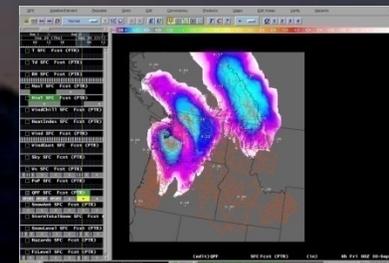
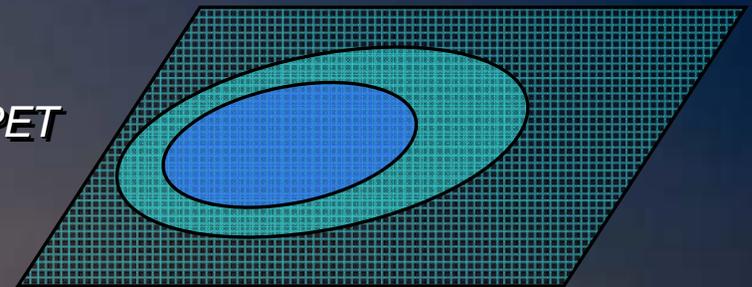
Implementation Strategy

NWSRFS Pre Processors

Forecast Forcings

- RFCs to employ NMAP, GFE, or MM
 - *Precipitation, temperature, freezing level, PET*
 - *6- and 1-hourly time steps*
- Output in points, grids, time series
 - *GRIB1, XMRG, Netcdf, HDF5*
 - *Eliminate XMRG*
- User defined projections and resolutions
 - *GFE - yes*
 - *NMAP - unknown*
 - *MM- no*

RFC-GFE 2.5 km





Implementation Strategy

NWSRFS Model/Operations

OFS Models and Operations

3-classes of Models or Operations changes relating to porting NWSRFS system

- Re-written into JAVA
- Adapters added to current NWSRFS functionality and ported to CHPS/FEWS
- Employing functions within CHPS/FEWS

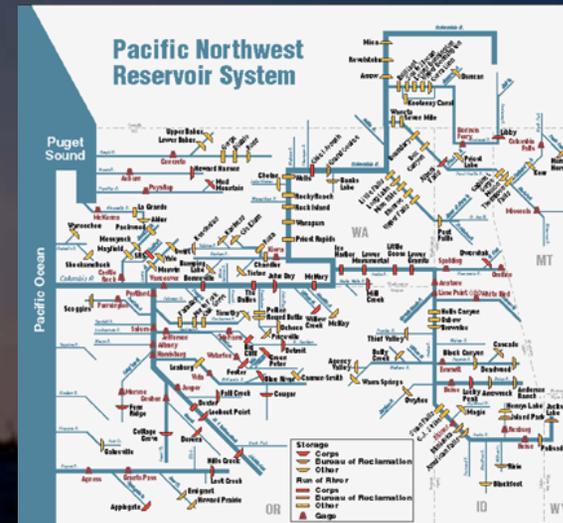


Implementation Strategy

NWSRFS Model/Operations

Apply adapters for other models and operations

- Reservoir Models
- Routing Models
- Consumptive Use
- Unit Hydrograph Operations



RES-J, RES-SNGL, BASEFLOW, SARROUTE, CONS_USE, LAG/K, LAY-COEF, TATUM, TIDEREV, MUSKROUT, RES-J, RSNWELEV, CHANLOSS, SSARRESV, STAGEREV, UNIT-HG, RES-SNGL

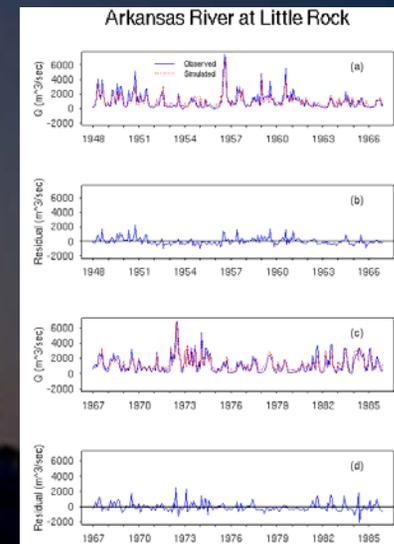


Implementation Strategy

NWSRFS Model/Operations

Replace with similar functions already embedded within CHPS/FEWS

- Time series or data manipulation



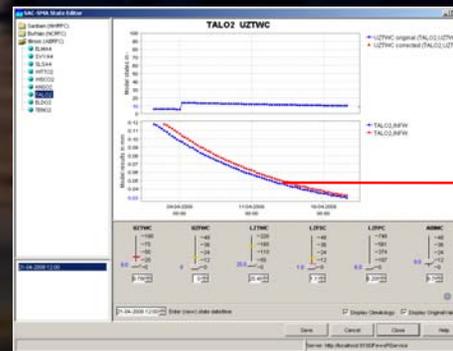
CLEAR-TS, CHANGE-T, ADD/SUB, SET-TS, MULT/DIV, NOMSNG, MERG-TS, MEAN-Q, WEIGHT-TS, LOOKUP3, LOOKUP, DELTA-TS, ADJUST-Q, ADJUST-H, ADJUST-T, PLOT-TS, PLOT-TUL



Implementation Strategy

Introduce and Develop “MODs” capability in FEWS

- *Deltares developing MODs interface and capability*
 - CHPS/FEWS Interactive Forecast GUI meeting (Aug 2008)
- *The ability to adjust the model in real time*
- *Emulate NWSRFS functionality with more sophistication and intuitiveness*
- *Modify states or data to models & time series*
 - Soil Moisture States
 - Snow States
 - simulated forecasts
 - Regulation



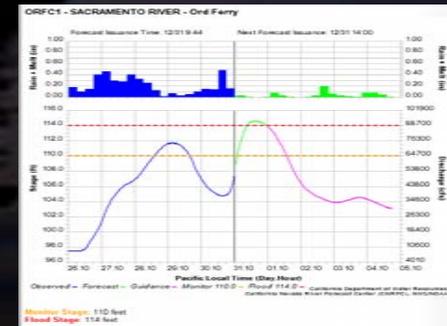
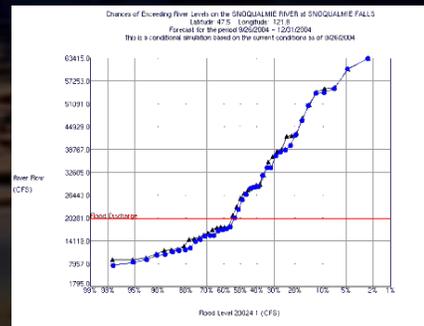


Implementation Strategy

Post Processing

- Port existing tools and local applications
- FEWS to export XML and SHEF messages
- Forecast Generation (and transmission) will be by forecast group or single segment
- Ability to visually (read-only) monitor forecast process by other users

— e.g. WFOs?





Implementation Strategy

System Support/Maintenance

- FEWS software builds delivered by Deltares
- Deltares integrates NWS operations into CHPS/FEWS
 - *Available to all other users (share concept)*
- OHD/OCWWS HSD will be first line support
 - *Maintenance NWS operations only*
 - *Other FEWS bugs reported/fixed by Deltares*
- 2nd line support direct from Deltares



Implementation Strategy

Training

- Key component to CHPS/FEWS transition and migration
- Combination of contractor/field training
- Deltares visiting CAT RFCs to provide both system and migration training.
- Hydrology training remains responsibility of RFC



Implementation Strategy

Training

- Post BOC (including BOC-II) remains a combination of Deltares, OCWWS, Documentation, and OJT
- Includes help from CAT RFCs
- Hydrologic forecast training remains within RFC



- Status





Implementation Strategy



Where are we today?

- *Models have been ported to Java*
 - Sac-SMA, SSARRESV, Snow-17
- *APIs developed for OFS operations and ported with no change in functionality*
 - 90% complete and lab tested
- *Hydraulic Models a work-in-progress*
 - HEC-RAS will replace DWOPER4, FLDWAV
 - Sobek, MIC-11, MIC-21 to be investigated (within FEWS)
 - Investigating NOS, Deltares coastal/surge models
 - *Wind, barometric pressure, etc*



Implementation Strategy



Where are we today?

- *Initial hardware received Oct. 2008*
 - Installed at CAT RFCs
 - Potential refresh in 2009?
- *Hardware will be integrated in baseline AWIPS and AWIPS II*
- *Real-time data feeds have been established for NWSRFS and FEWS*
- *Request for multi-system synchronization is being addressed*



Implementation Strategy



Where are we today?

- *Software acceptance on Dec 15-17 at OHD.*
- *Software system will include requested NWS changes*
 - Models and operations
 - Forecaster interactive GUI
 - MODs interface
 - New functions for backup and development
- *Deployment to RFC in December 2008/January 2009*



Implementation Strategy



Where are we today?

- *Decision to port observed and forecast input data forcings to FEWS in the form of gridded fields (precip, temp, PE, Freezing Levels, other?)*
- *OFS PP team formed and working with OHD*
 - *Areal computations based on gridded data will occur within the FEWS environment.*
- *Migration Tool training week of February 5, 2009*



- New Definitions
- System Configuration





CHPS/FEWS Primer

NWS

Basins

Forecast groups

Carryover

Contingency/What-ifs

Production system (AWIPS)

Backup (coop)

/oper files

/oper.test

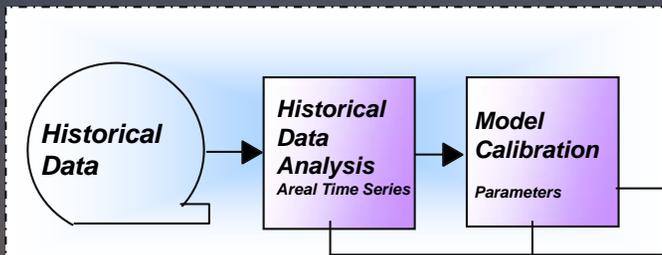
CHPS/FEWS



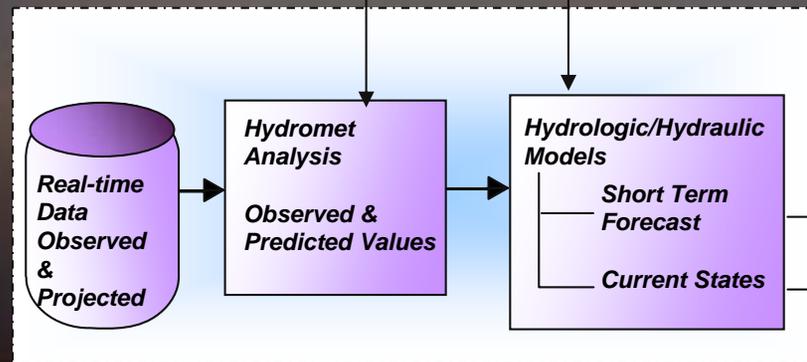
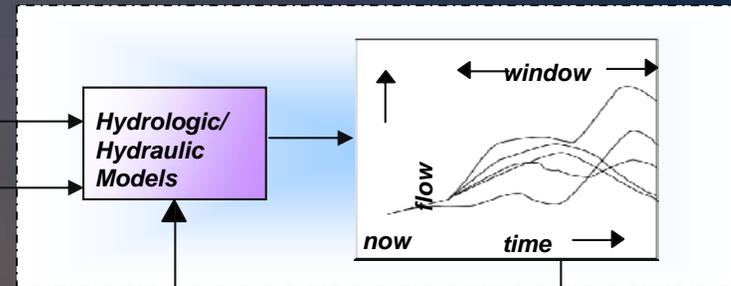


NWSRFS – An Integrated System

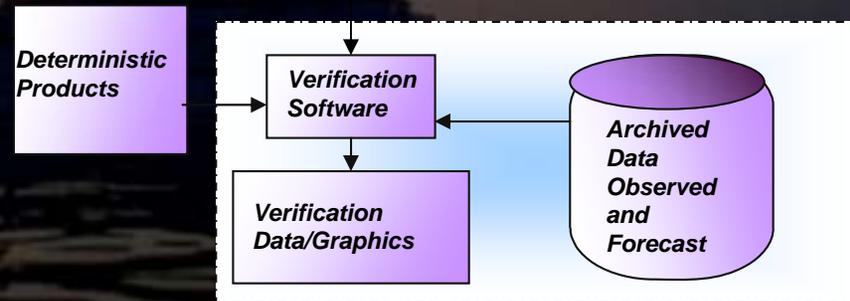
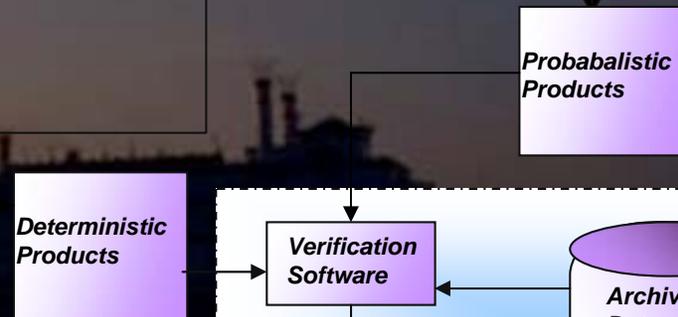
Calibration System



Ensemble Streamflow Prediction



Operational System



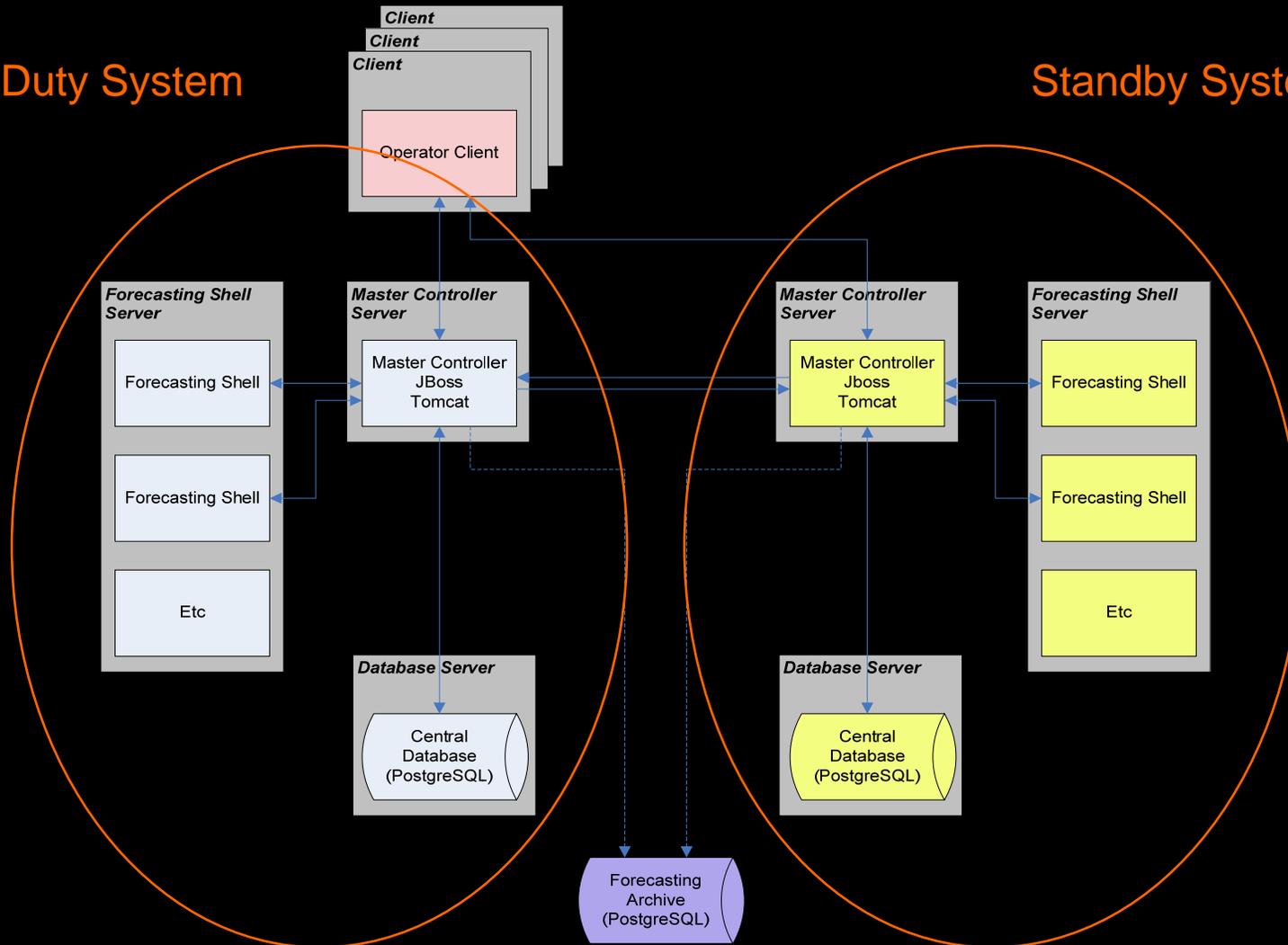
Verification System



FEWS Hardware Infrastructure

Duty System

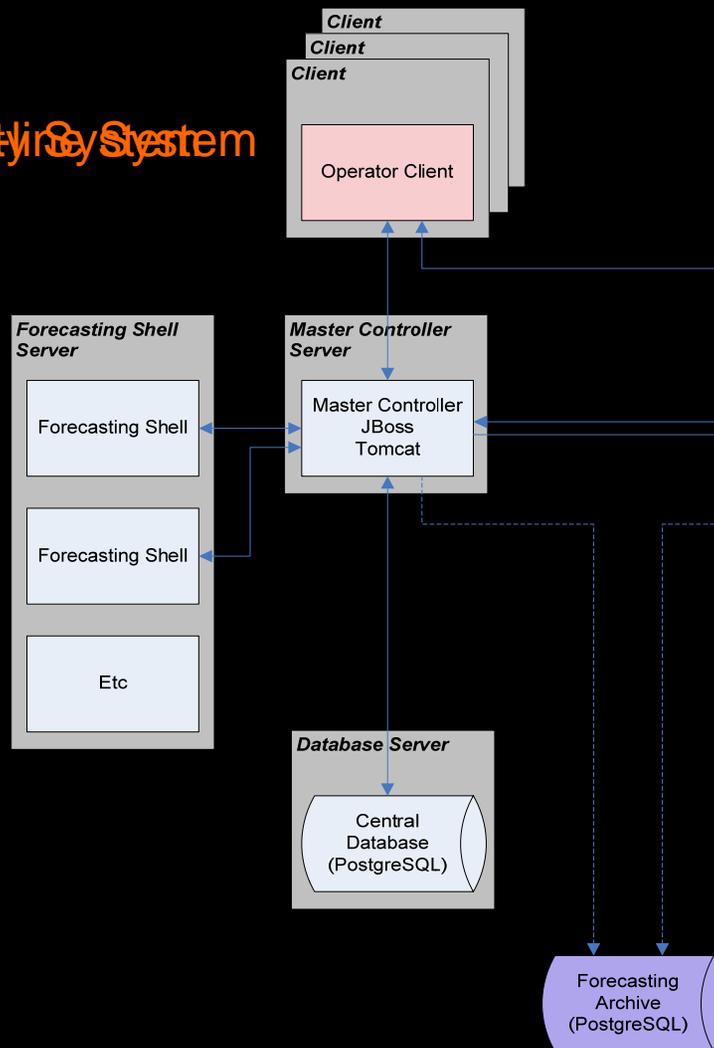
Standby System



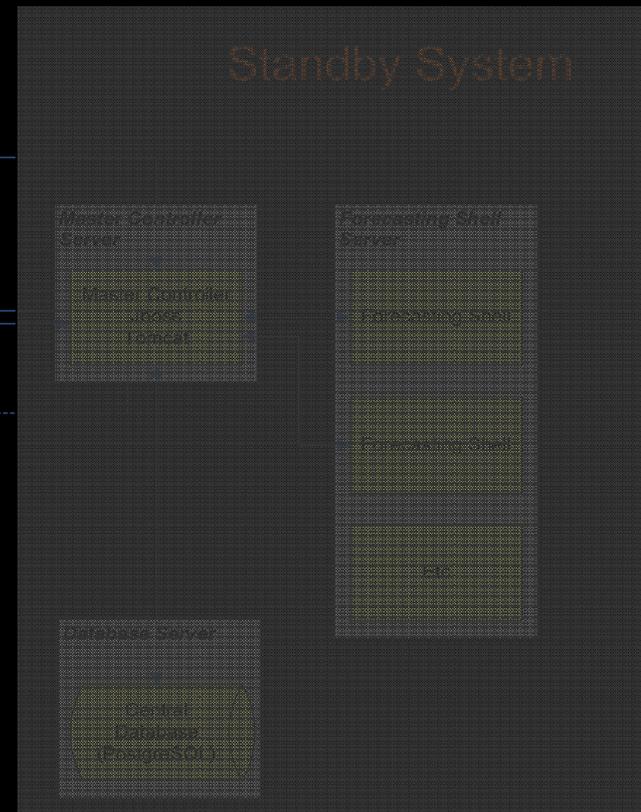


FEWS Hardware Infrastructure

Office System



Standby System

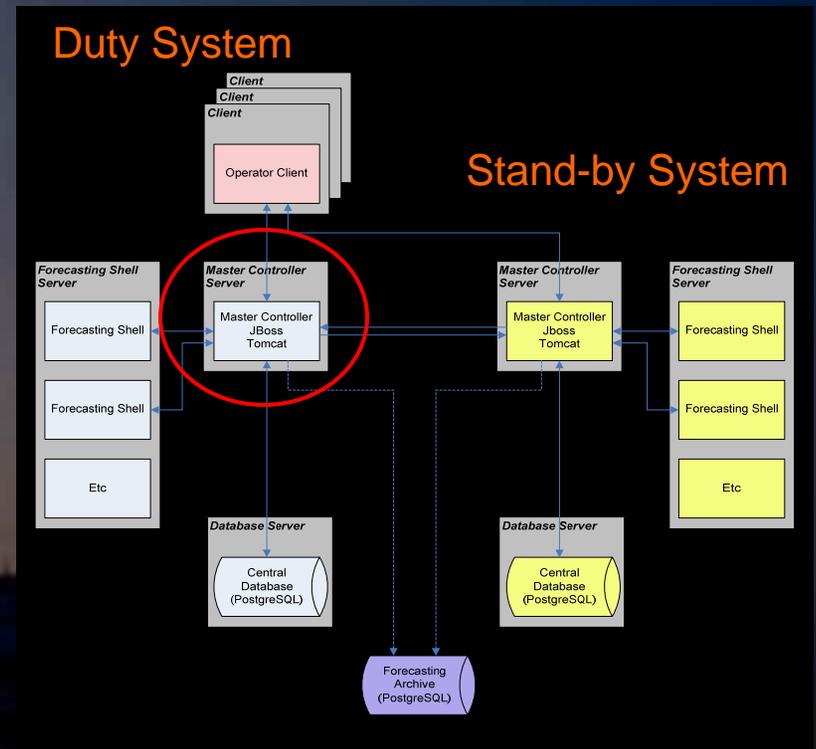




FEWS Hardware Infrastructure

Master Controller

- Hosts an agent process
- Traffic cop for (JMS) traffic between Central Database, Forecasting Shells, and Operator Clients
- Host to JBoss application service (JMS queues)
- Host to Tomcat Servlet Engine
 - Drives http admin interfaces and archive server

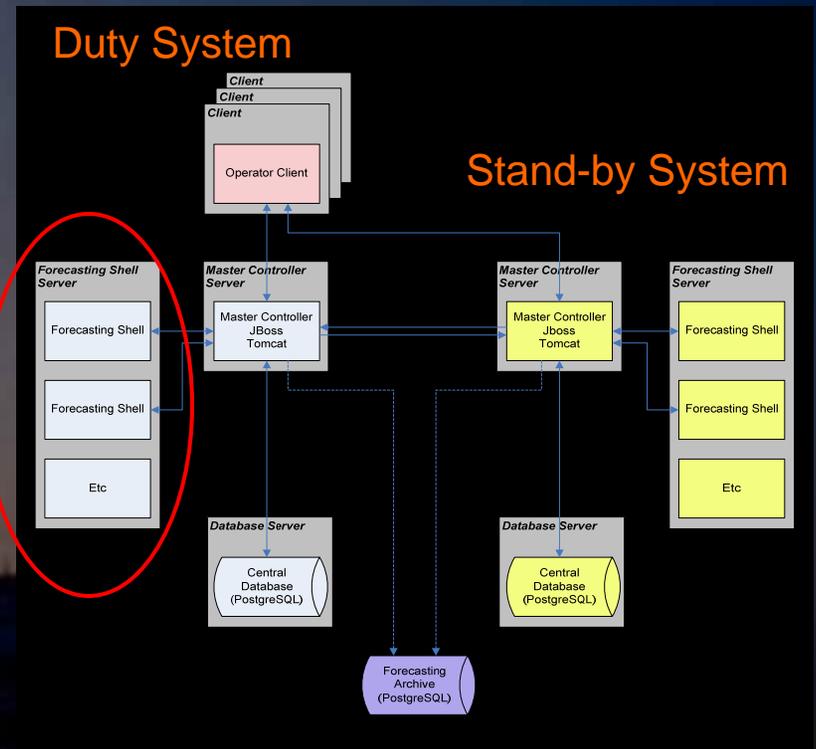




FEWS Hardware Infrastructure

Forecasting Shell

- *Processing server for run execution*
 - *Workflows (forecast group)*
- *Accepts requests from the Master Controller*
- *Houses execution run*
- *Results available to Master Controller for posting to Central Database*
- *Can have multiple Forecast Shells*

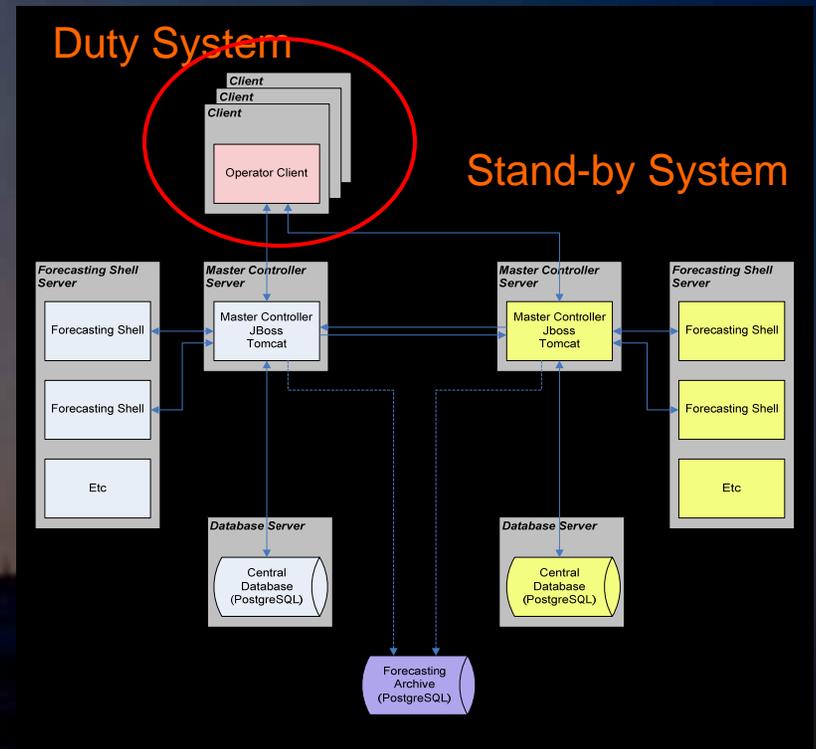




FEWS Hardware Infrastructure

Operator Client

- *Typically the User Workstation*
- *Interactive data and forecast system*
- *View input data to forecasts*
- *Intermediate & final forecast results*
- *Request execution runs dispatched to Master controller*

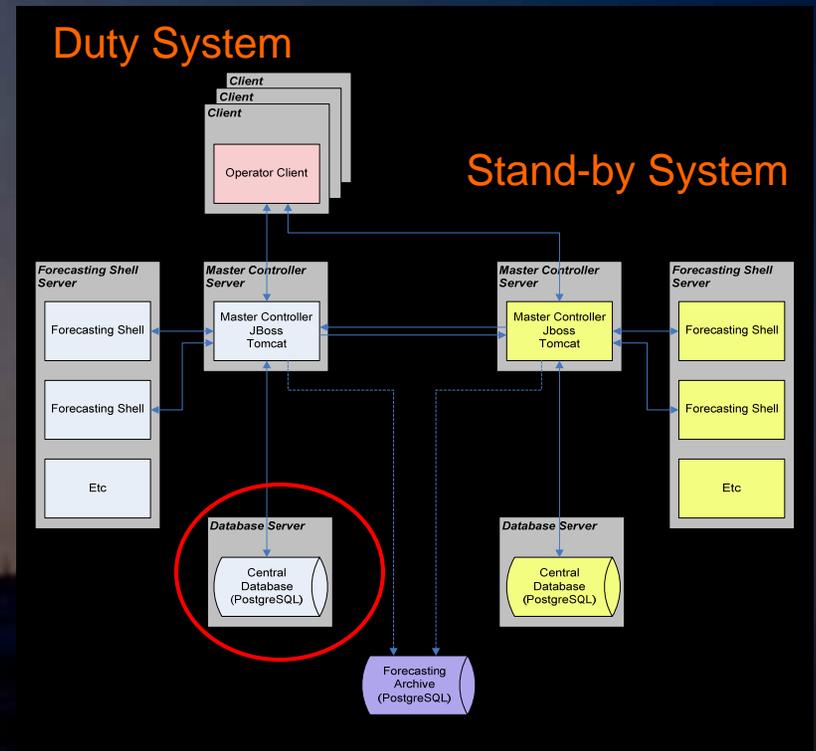




FEWS Hardware Infrastructure

Central Database

- *Repository for all input*
- *Mean areal, point, grid*
- *Processed and pre-processed data*
- *Observed and forecast time series*
- *All MODs*
- *States, parameters*
- *Configuration*



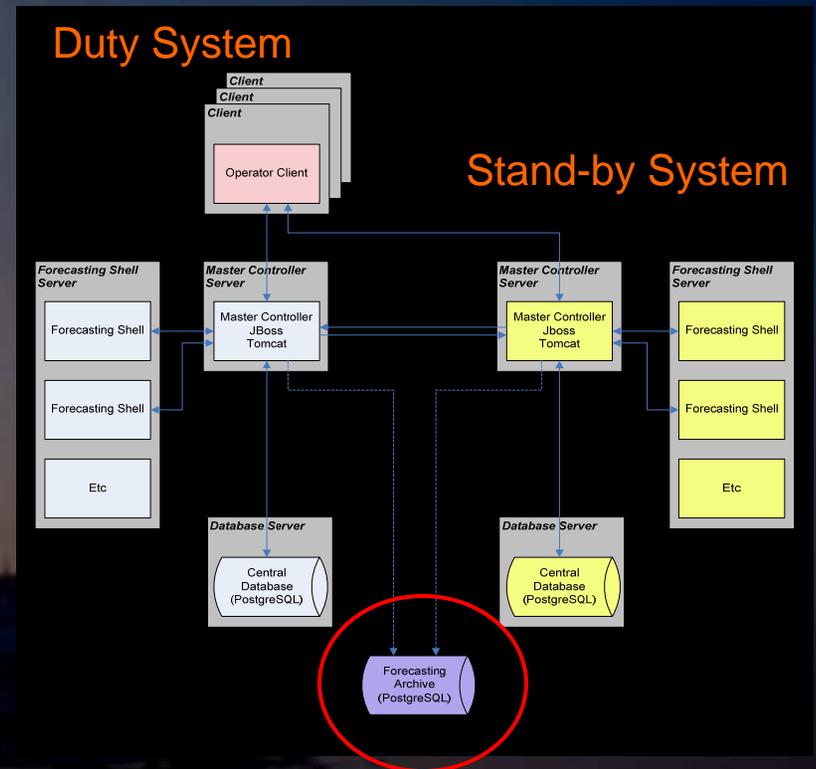


FEWS Hardware Infrastructure

Forecast Archive Database

- *Permanent Repository for all input used to generate forecast*
- *States, MODs*
- *Mean areal, point, and grid*
- *Configuration*
- *Independent of Central Database*
- *Employ as hind-caster*

- *Configurable by User*
- *NWS will extended capability*



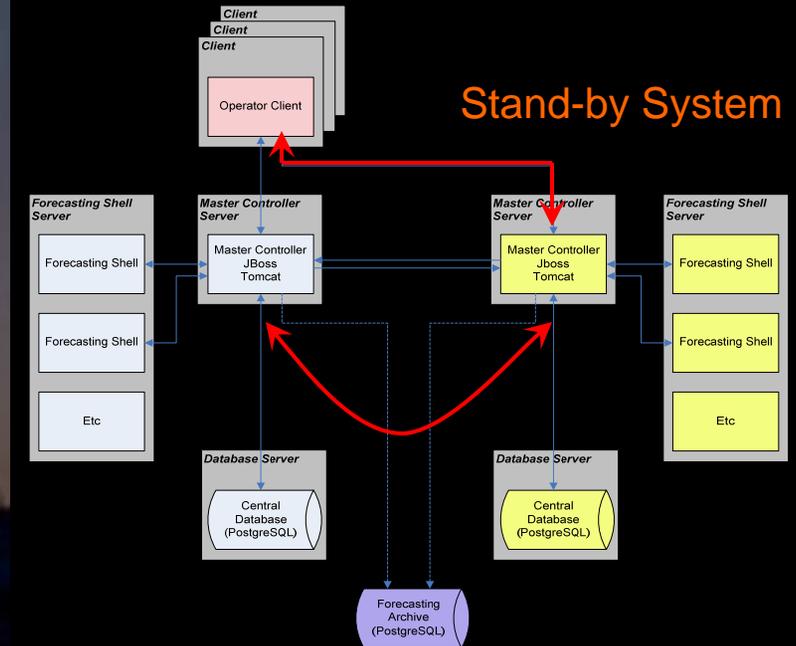


FEWS Hardware Infrastructure

Stand-by System

- *On-line and Stand-by are identical*
- *Independent data feeds*
- *Data is synchronized between system via the Master Controller*
 - *eg., Forecast runs*
- *Operator client can attached to either*

Duty System



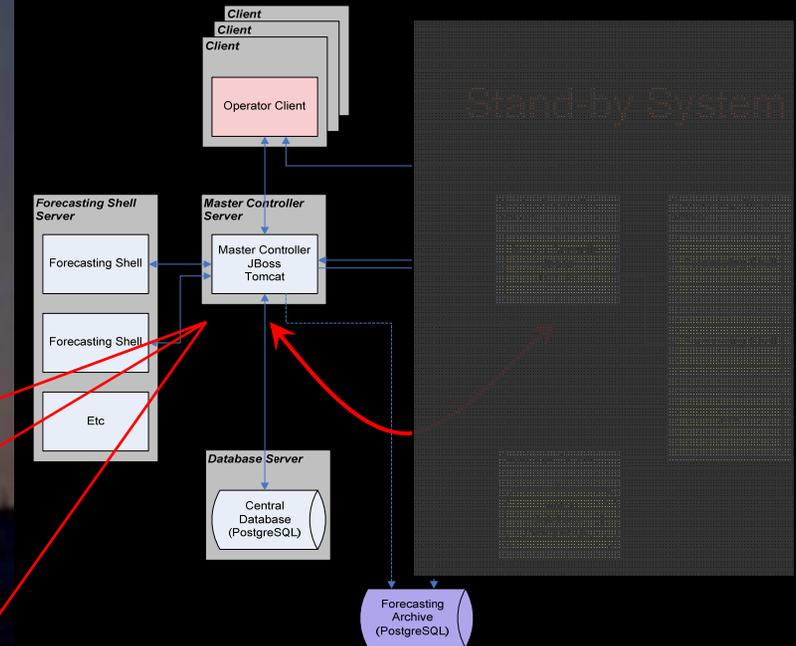


FEWS Synchronization

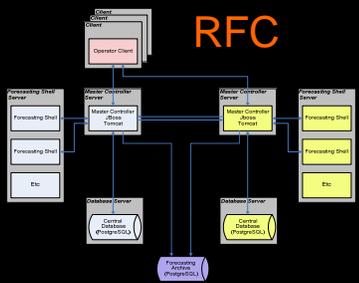
Synchronization

- All data is synchronized between system via the Master Controller
- Deltares standard to 1 system
- NWS requested multi-point capability

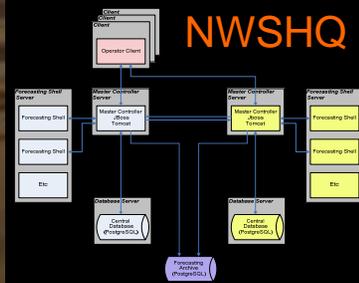
Duty System



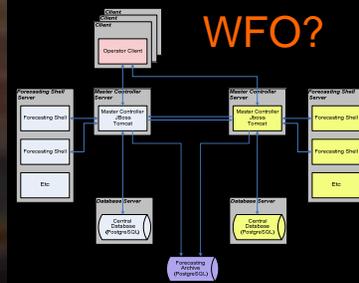
RFC



NWSHQ



WFO?





- Mockups





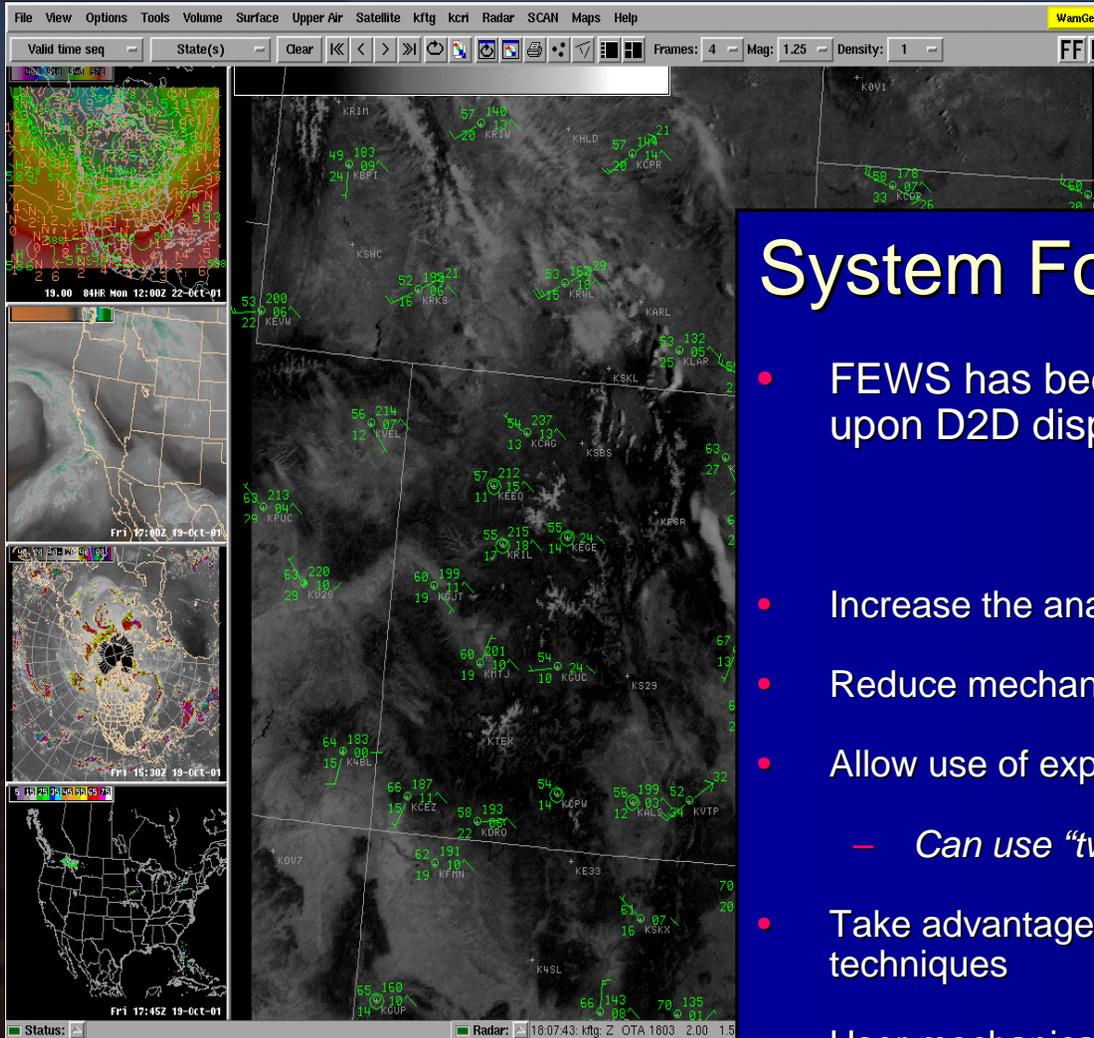
Display Concepts

Forecaster Interactivity Concept

- FEWS engineered to employ and expand upon D2D display and functional concepts
- Increase the analysis time of forecaster
- Reduce mechanics (clicking) to information panels
- Allow use of expanded screen real estate per user needs
 - *Can use “twin-view” screen expansion*
- Take advantage of tabs, docking, earlobes, tear-offs techniques
- User mechanical state memorized and used on re-entry



Display Concepts



System Forecaster Interactivity

- FEWS has been engineered to employ and expand upon D2D display and functional concepts
- Increase the analysis time of forecaster
- Reduce mechanics (clicking) to information panels
- Allow use of expanded screen real estate per user needs
 - Can use “twin-view” screen expansion
- Take advantage of tabs, docking, earlobes, tear-offs techniques
- User mechanical state memorized and used on re-entry



Display Concepts

FEWS for CHPS Pilot - December 2007 (Stand alone)

File Tools Options Help

Forecast group: Coastal
Carry over group: NW_WEST
Carry over time: Jul 29, 2008 12

Navigation: Home Graph Navigation

Spatial Data

- Observed Precip and Temp Snotel
- Mean Areal Temperature (MAT)
- Mean Areal Precipitation (MAP)
- Observed Precip and Temp Red River
- Mean Areal Temperature (MAT)
- Mean Areal Precipitation (MAP)
- Gridded Precipitation (MAPK)
- Multisensor Precipitation Image (MAPG)
- Observed Precip and Temp Illinois River
- Gridded Precipitation (MAPK)
- Multisensor Precipitation Image (MAPG)
- Quantitative Precipitation Forecast (FMAP)
- Evapotranspiration Potential Grid (MAPE)

Log messages - Forecast notes

Log messages tab:
Contains all logging messages produced by runs or system. May be good idea to split type of messaging into different tabs

Forecast notes tab:
Contains hand-over information from forecasters. This information can be edited in the tab.



Display Concepts

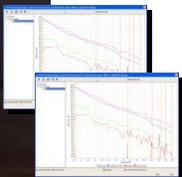
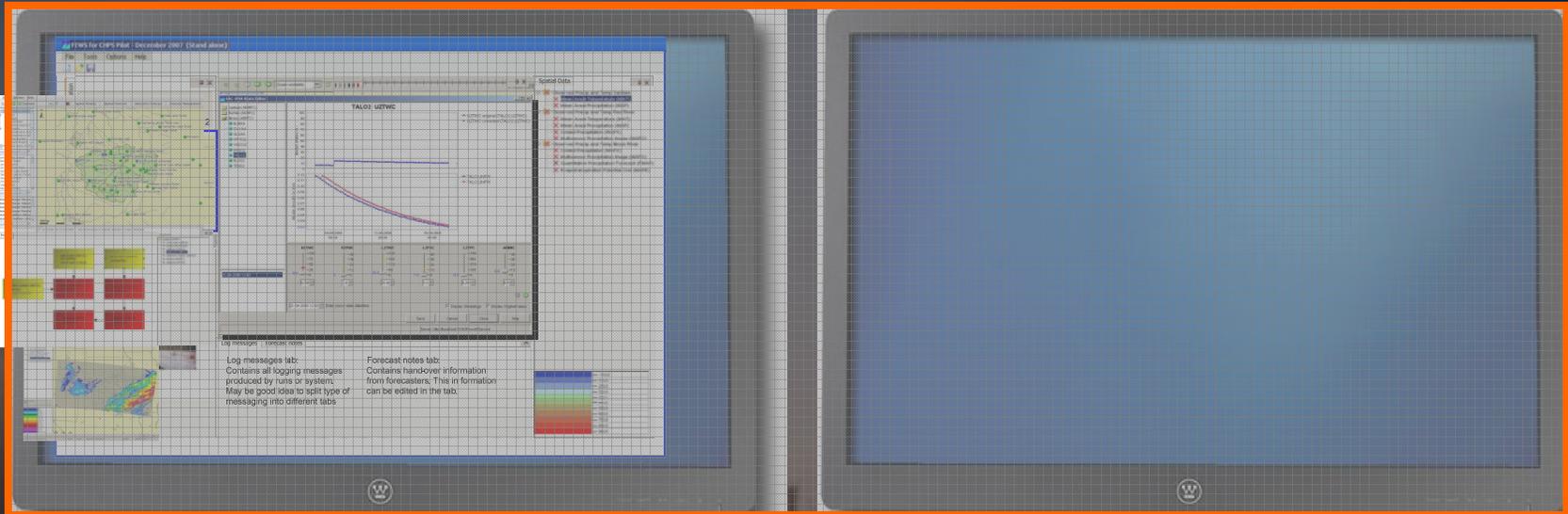
Forecaster Interactivity Expanded

- Polled all RFCs for form, fit, and function provided by local tools and applications and used parallel to NWSRFS
- NWS used analysis to integrate as many functions as possible within the FEWS system
- Deltares designed the interactivity based on input from the RFCs and current NWSRFS
- Functions will be included in future FEWS builds and available to all other (international) users



Display Concepts

Windows can be “undock”ed and can be repositioned anywhere

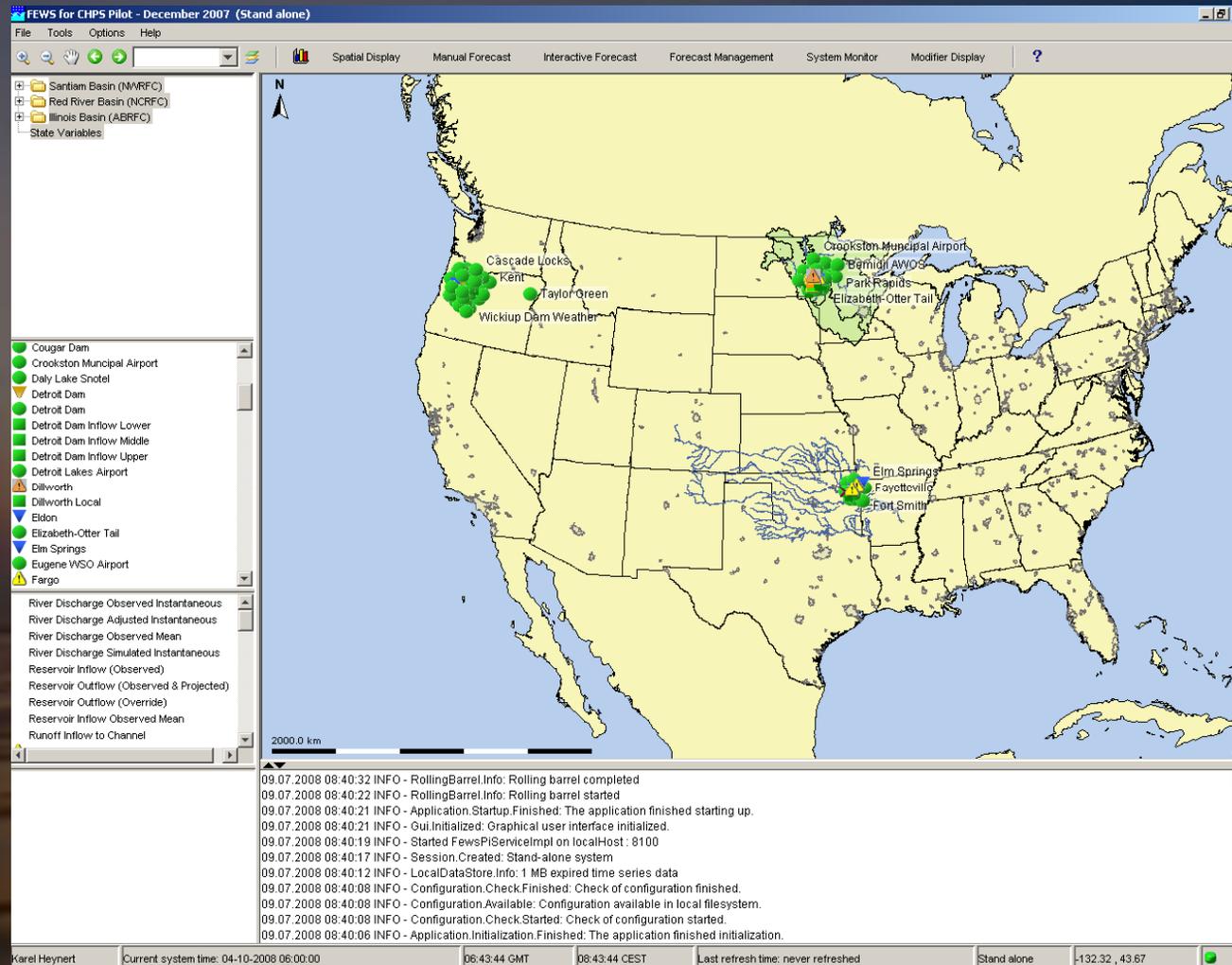


Twin view is 2 (or more) monitors configured as a single screen allowing more visual real estate



CHPS/FEWS System

Main Map Display





Display Concepts

FEWS for CHPS Pilot - December 2007 (Stand alone)

File Tools Options Help

Navigation Graph Selection

Forecast group: Coastal
Carry over group: NW_WEST
Carry over time: Jul 29, 2008 12

Zoom extents

100.0 km

Spatial Data

- Observed Precip and Temp Santiam
- Mean Areal Temperature (MAT)
- Mean Areal Precipitation (MAP)
- Observed Precip and Temp Red River
- Mean Areal Temperature (MAT)
- Mean Areal Precipitation (MAP)
- Gridded Precipitation (MAPX)
- Multisensor Precipitation Image (MAPG)
- Observed Precip and Temp Illinois River
- Gridded Precipitation (MAPX)
- Multisensor Precipitation Image (MAPC)
- Quantitative Precipitation Forecast (FMAP)
- Evapotranspiration Potential Grid (MAPE)

Log messages Forecast notes

Log messages tab:
Contains all logging messages produced by runs or system. May be good idea to split type of messaging into different tabs

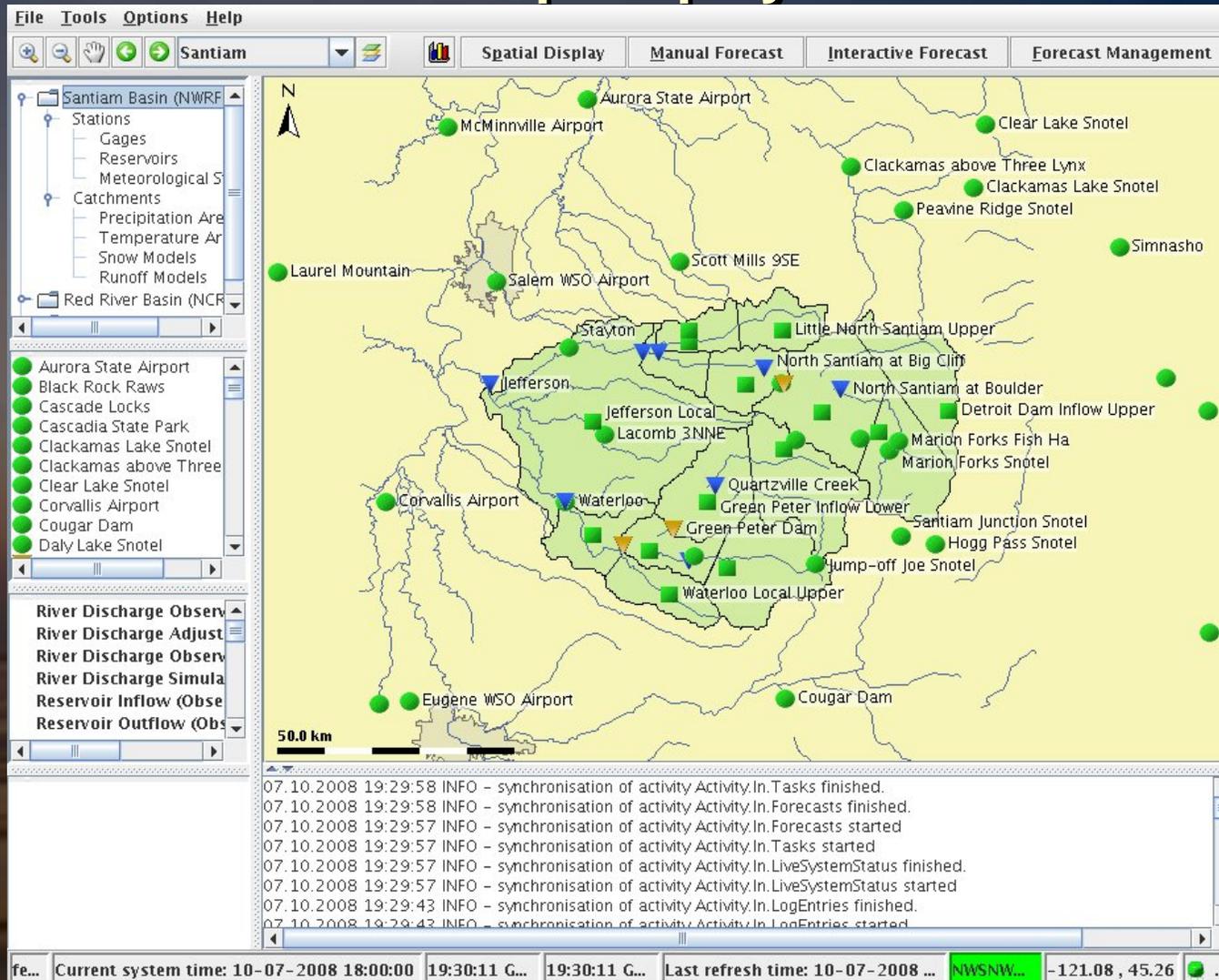
Forecast notes tab:
Contains hand-over information from forecasters. This information can be edited in the tab.

| | |
|--|----------|
| | >= -15.0 |
| | >= 15.0 |
| | >= 25.0 |
| | >= 32.0 |
| | >= 32.1 |
| | >= 40.0 |
| | >= 50.0 |
| | >= 60.0 |
| | >= 70.0 |
| | >= 80.0 |
| | >= 90.0 |



CHPS/FEWS System

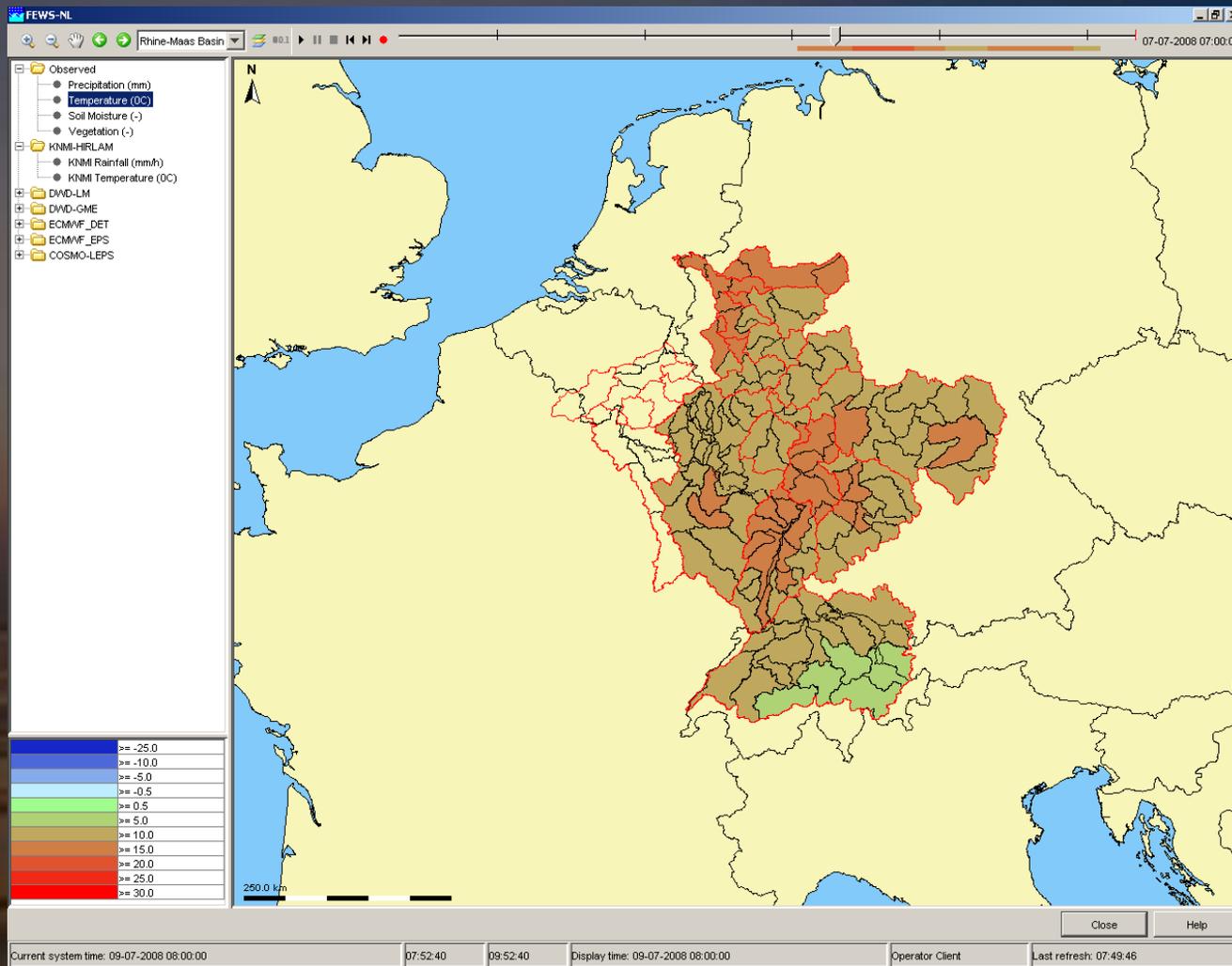
Main Map Display





Time Series Display

Areal Data (Catchments)

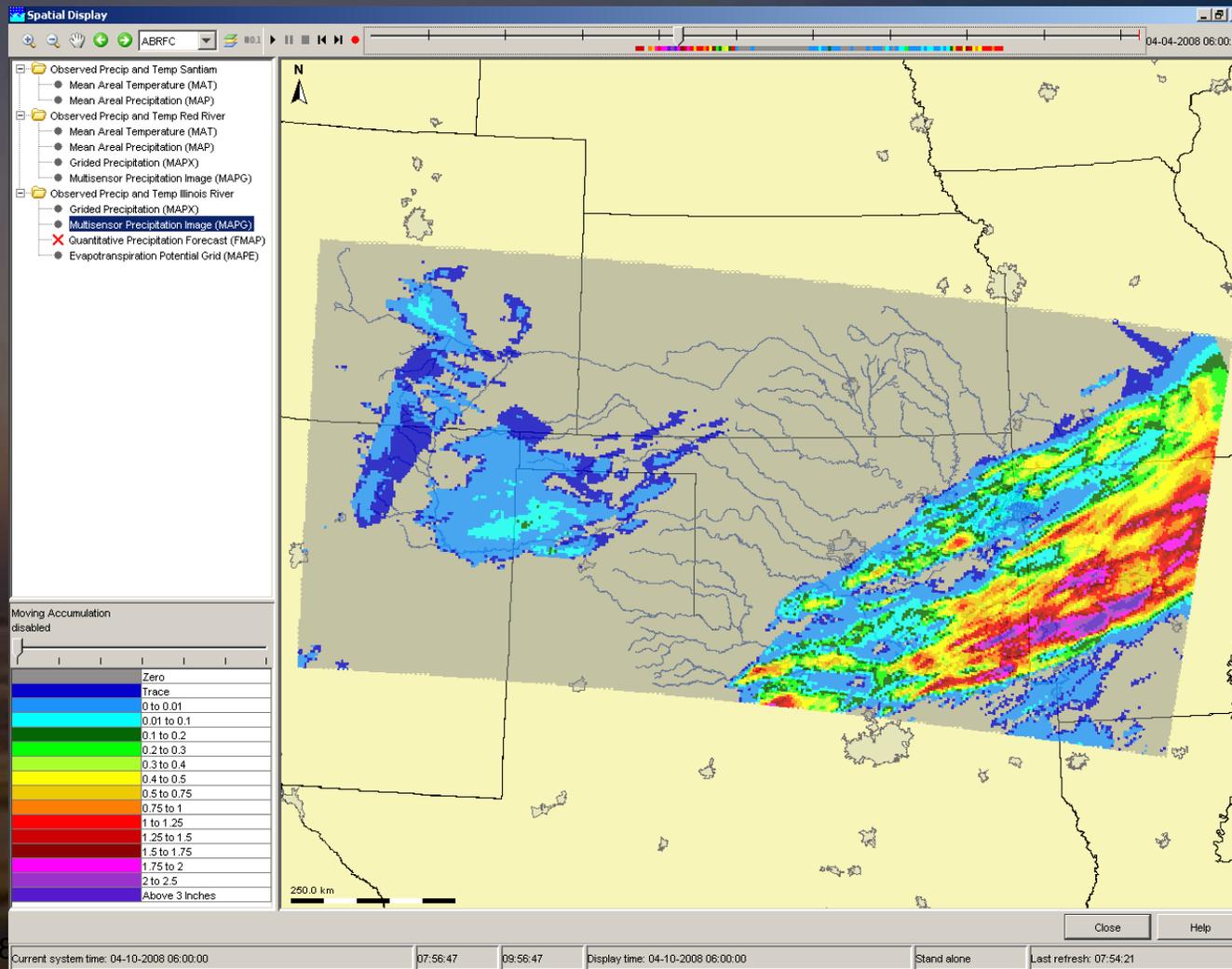


9 July 2008



Time Series Display

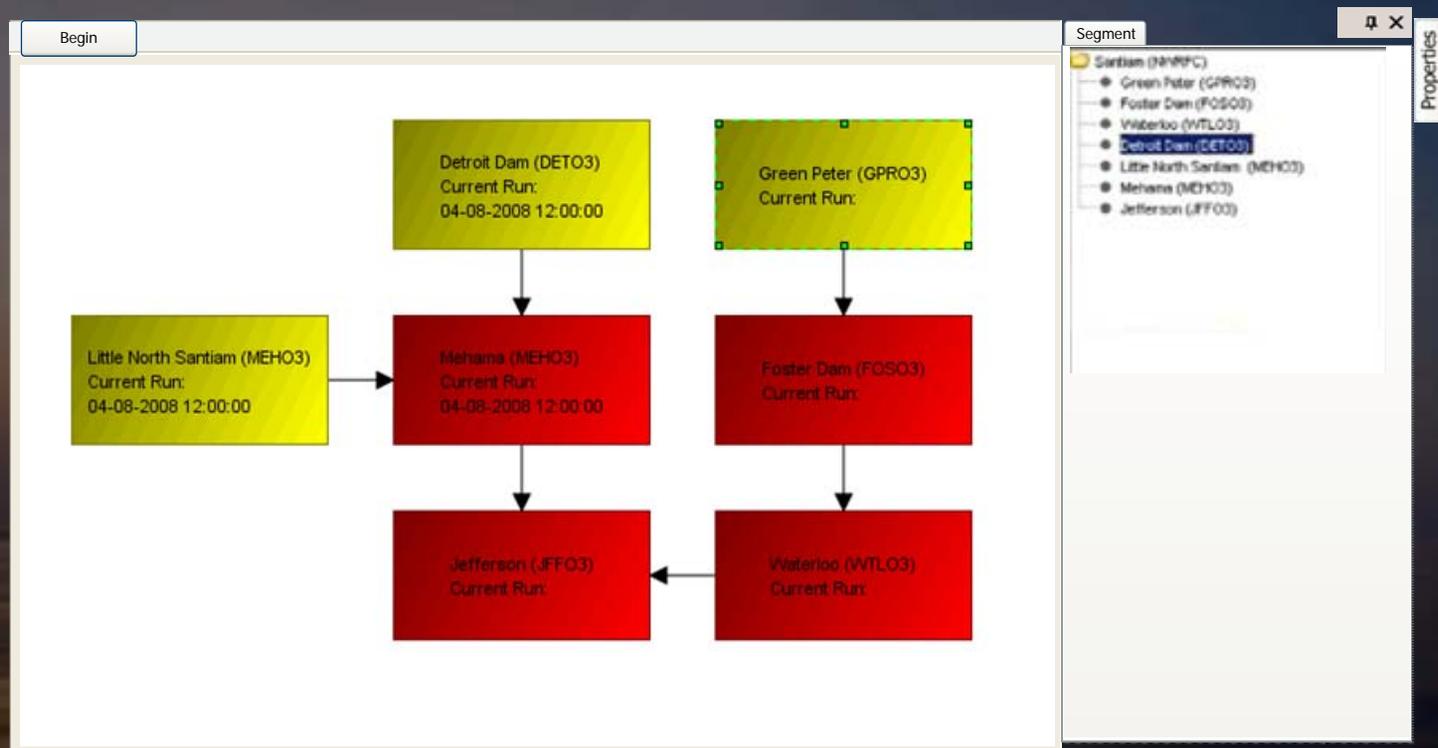
Spatial (Multi-Sensor)



9 July 2008

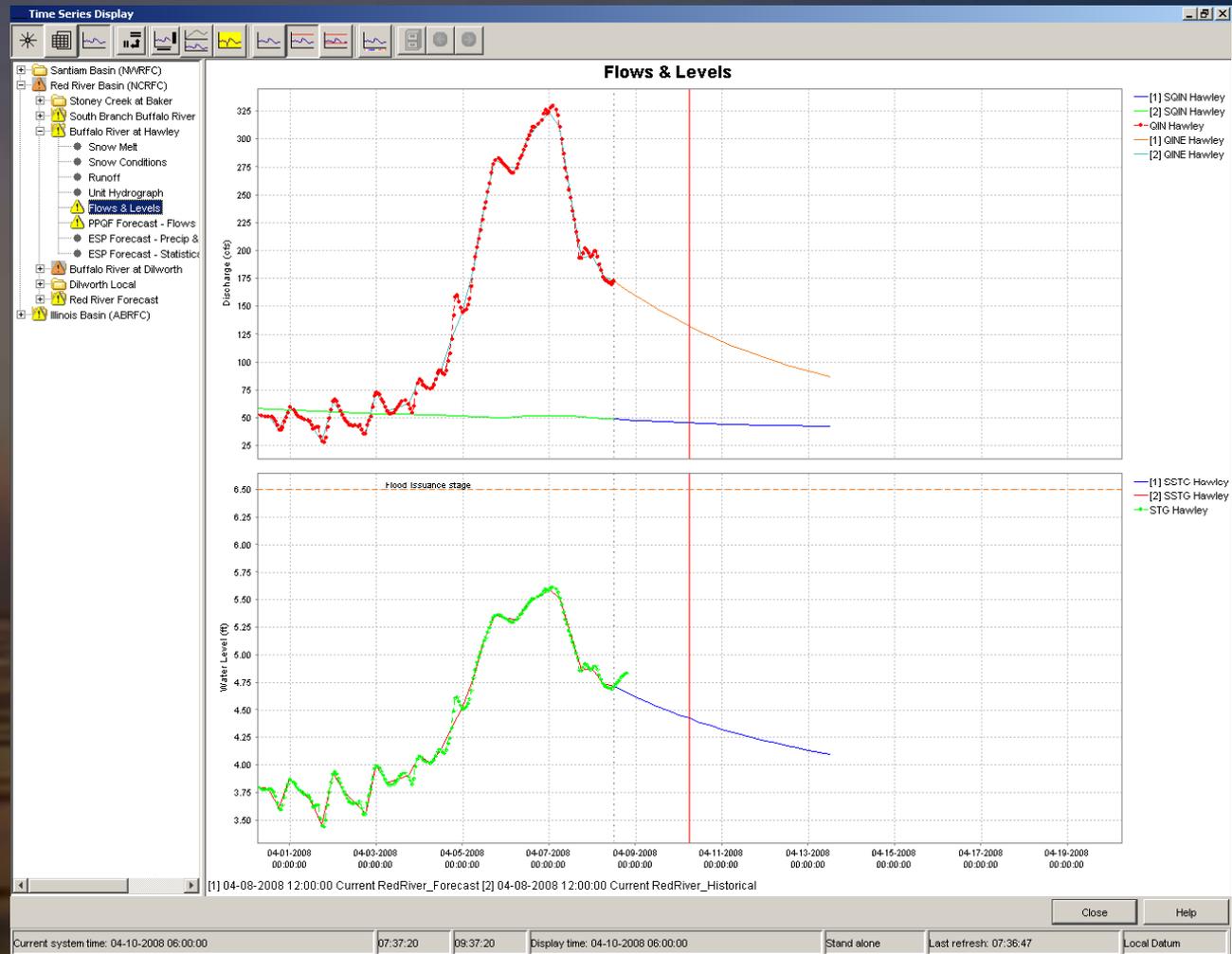


Forecast Topology “Mockup”





Time Series Display





NWSRFS MODs Display

NWSRFS MODs

Mods for: LAMC1

Available Operations
Show Mods for: ALL

Mod Value
1.000000
Dimensionless

Mod Dates
Start of Mod: Jun 13 2000 4 PST

Options
No options for this Mod
Apply to: SEGMENT

Available Run-time Mods
Mod selected: AESCCHNG

Operation
Type / Name
SNOW-17 LA

Time-series
No date values:

Display
 Show Mods

Operation List:
AESCCHNG
CHGBLEND
IGNORETS
MFC
RAINSNOW
ROCHNG
ROMULT
RRICHNG
RRIMULT
SACBASEF
SETMSNG
SETQMEAN
UADJ
UHGCHNG
WEADD
WECHNG
ZERODIFF

Buttons: Create, Close, Undo, Preferences, Help



Time Series Modifiers Display

Area

- Santiam Basin (NWRFC)
 - Green Peter
 - Rain-Snow Elevation and Freezing Levels
 - Snowmelt (Upper)**
 - Snow Conditions (Upper)
 - Snowmelt (Lower)
 - Snow Conditions (Lower)
 - Runoff (Upper)
 - Runoff (Lower)
 - Unit-HG Routing
 - Green Peter Dam - Inflows
 - Green Peter Dam - Pool Elevation
 - Green Peter Dam - Release
 - Foster Dam
 - South Santiam @ Waterloo
 - Detroit Reservoir
 - Little North Santiam near Mehama
 - North Santiam @ Mehama
 - Santiam @ Jefferson
 - Red River Basin (NCRFC)
 - Illinois Basin (ABRFC)

Locations

Green Peter Inflow Upper

Parameters

- Air Temperature Areal Mean
- Precipitation Areal Mean
- Precipitation Rain + Melt

Modifier Information

Modifiers | Create New | Upload modifiers

Name: RAIM_GPRO3IU

Start time: 03-31-2008 06:00:00 | End time: 04-20-2008 06:00:00

Enable from: 04-10-2008 06:00:00 | Disable after: 04-20-2008 06:00:00

Operation: Add | Value:

Description:

Parameter: Precipitation Rain + Melt (RAIM) | Location: Green Peter Inflow Upper (GPRO3IU)

⚠ Modifier value not valid!

Create

Modified Time Series

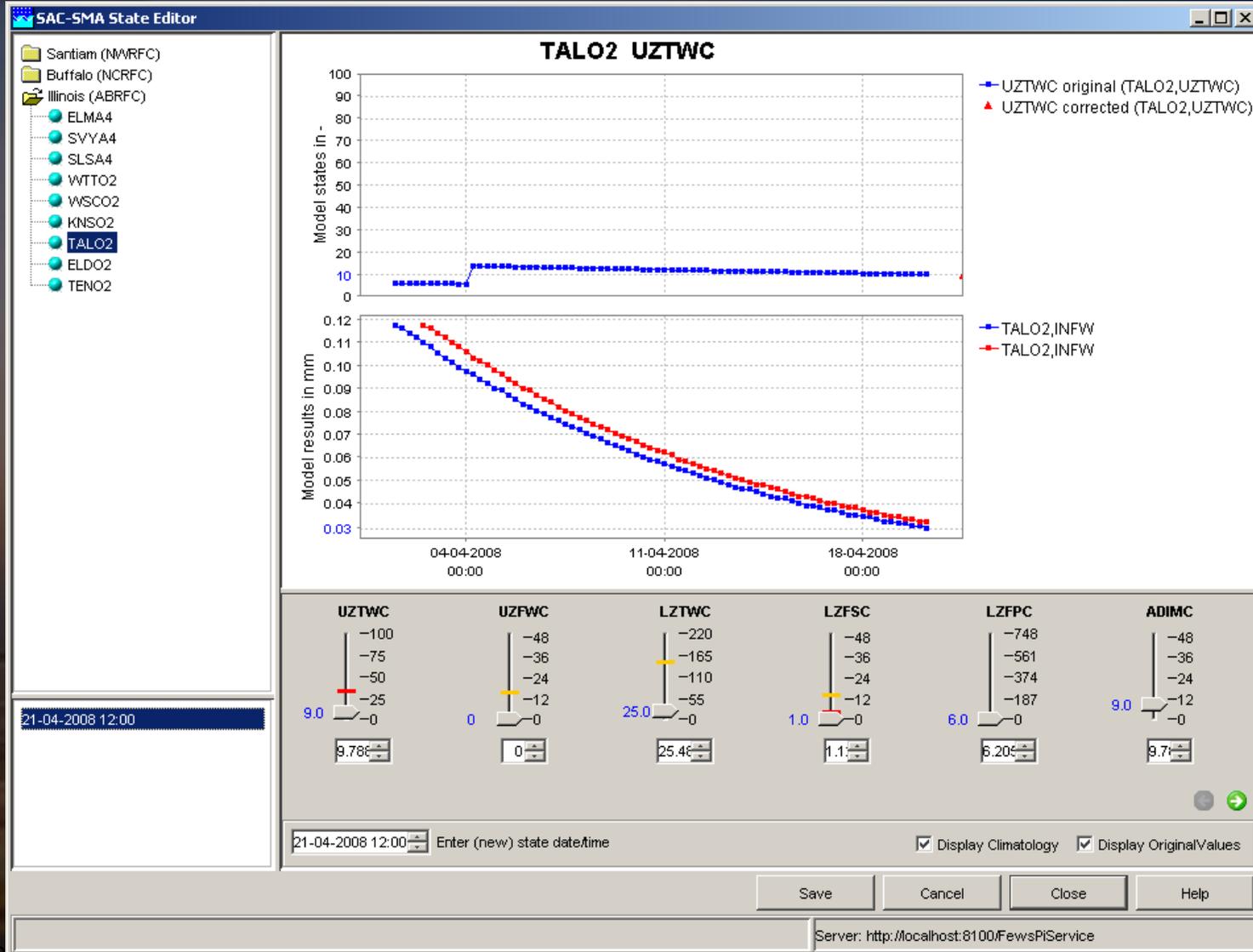
Snowmelt (Upper)

— Air Temperature Areal Mean Green Peter Inflow Upper — Air Temperature Areal Mean Green Peter Inflow Upper
■ Precipitation Areal Mean Green Peter Inflow Upper ■ Precipitation Areal Mean Green Peter Inflow Upper
■ Precipitation Rain + Melt Green Peter Inflow Upper ■ Precipitation Rain + Melt Green Peter Inflow Upper

Show all modifiers | Apply | Upload | Help | Close

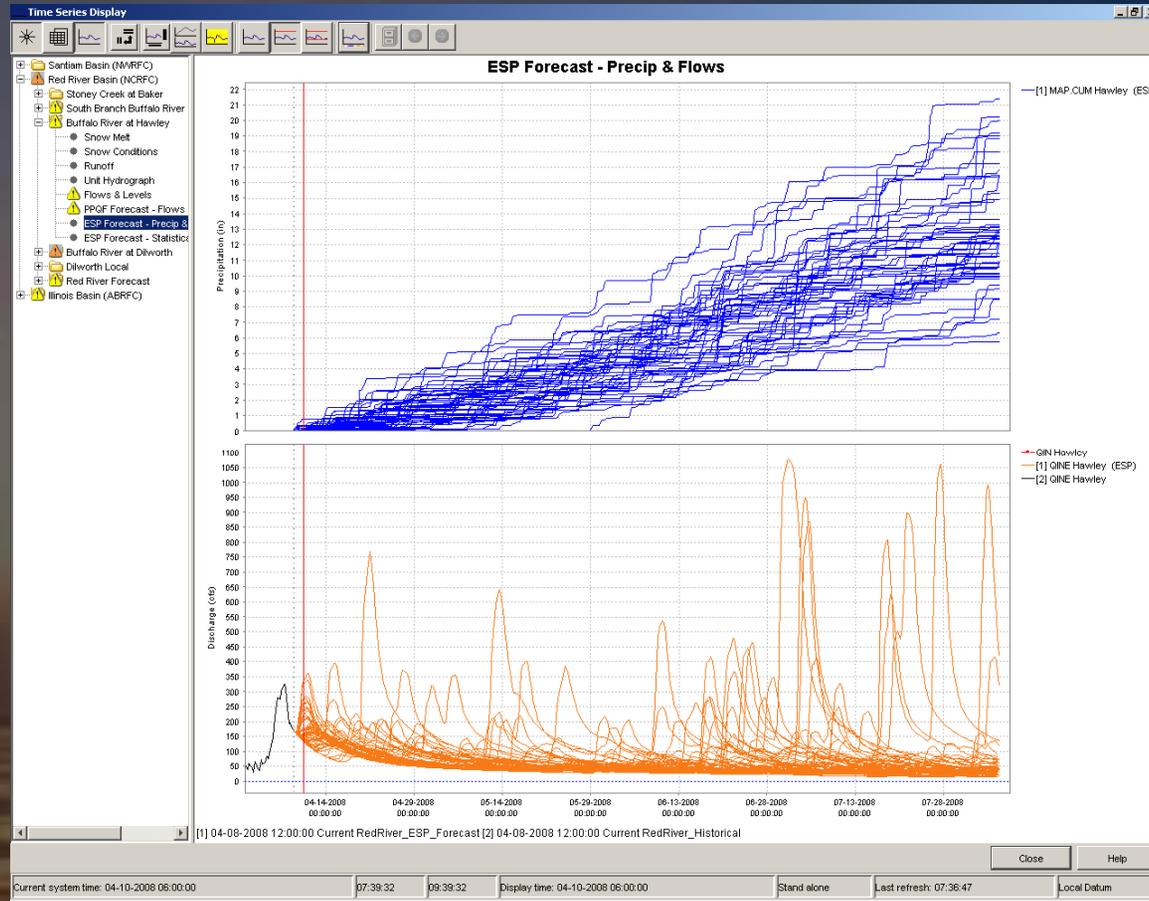


State Modifier Display





Time Series Display (ESP)

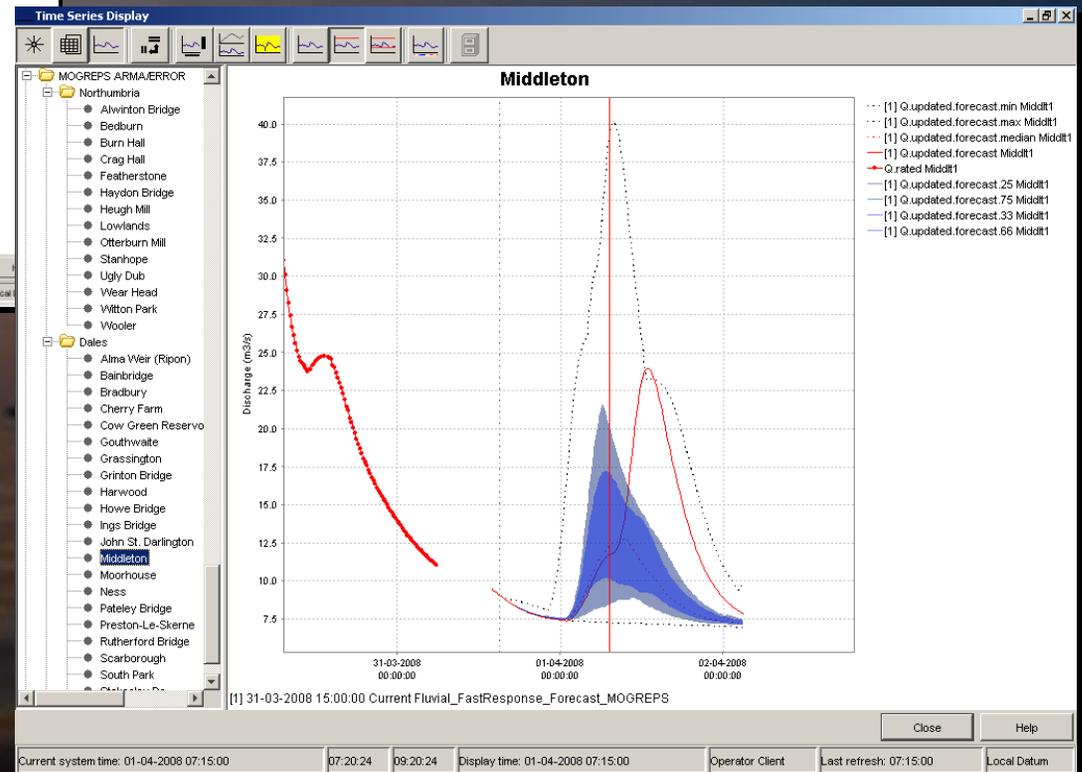
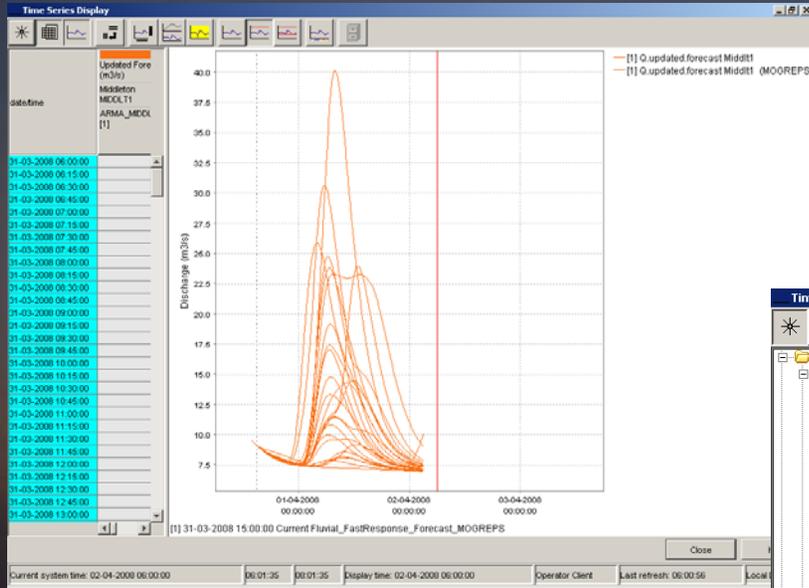


9 July 2008



Time Series Display

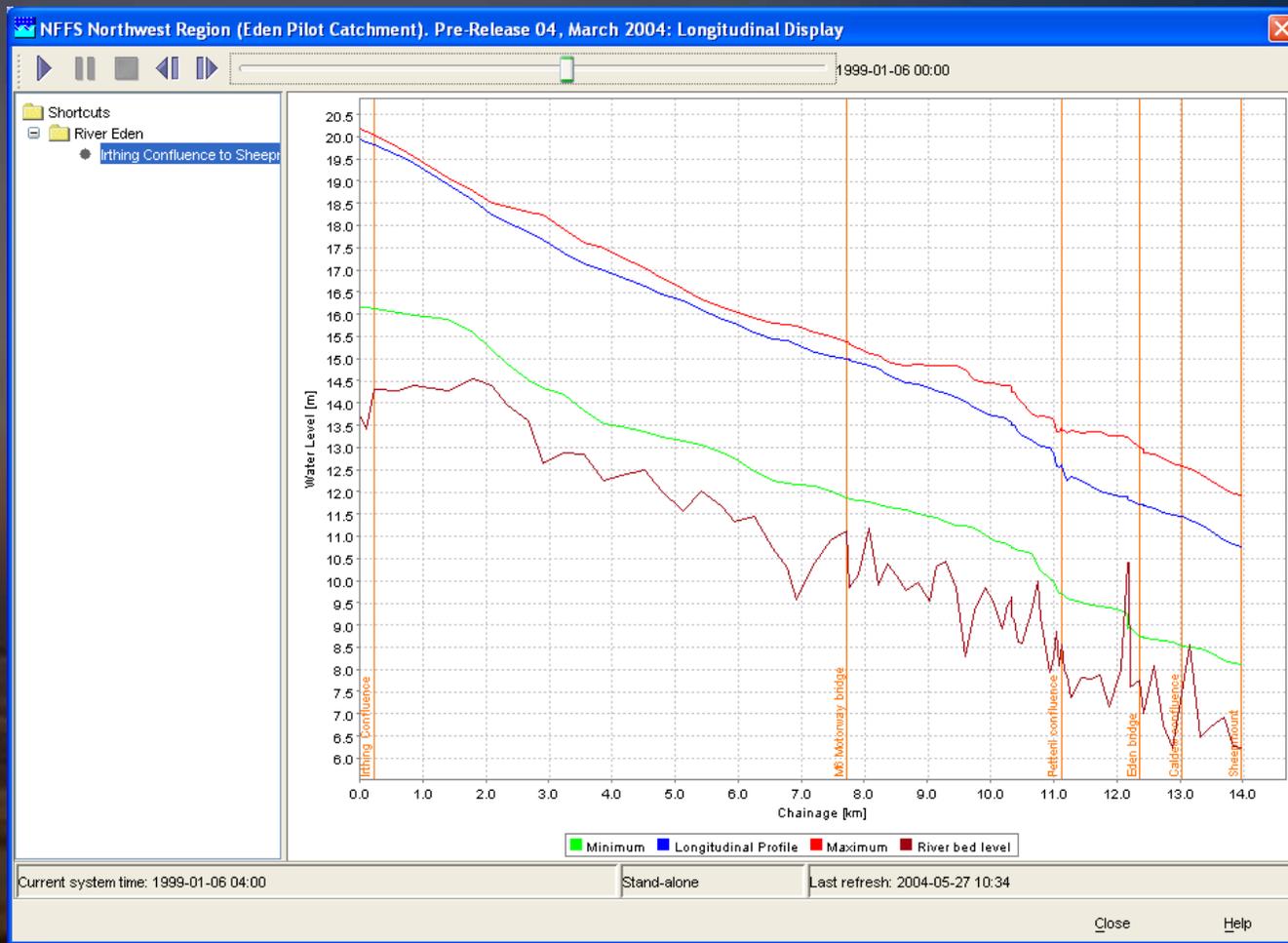
Probabilistic



9 July 2008

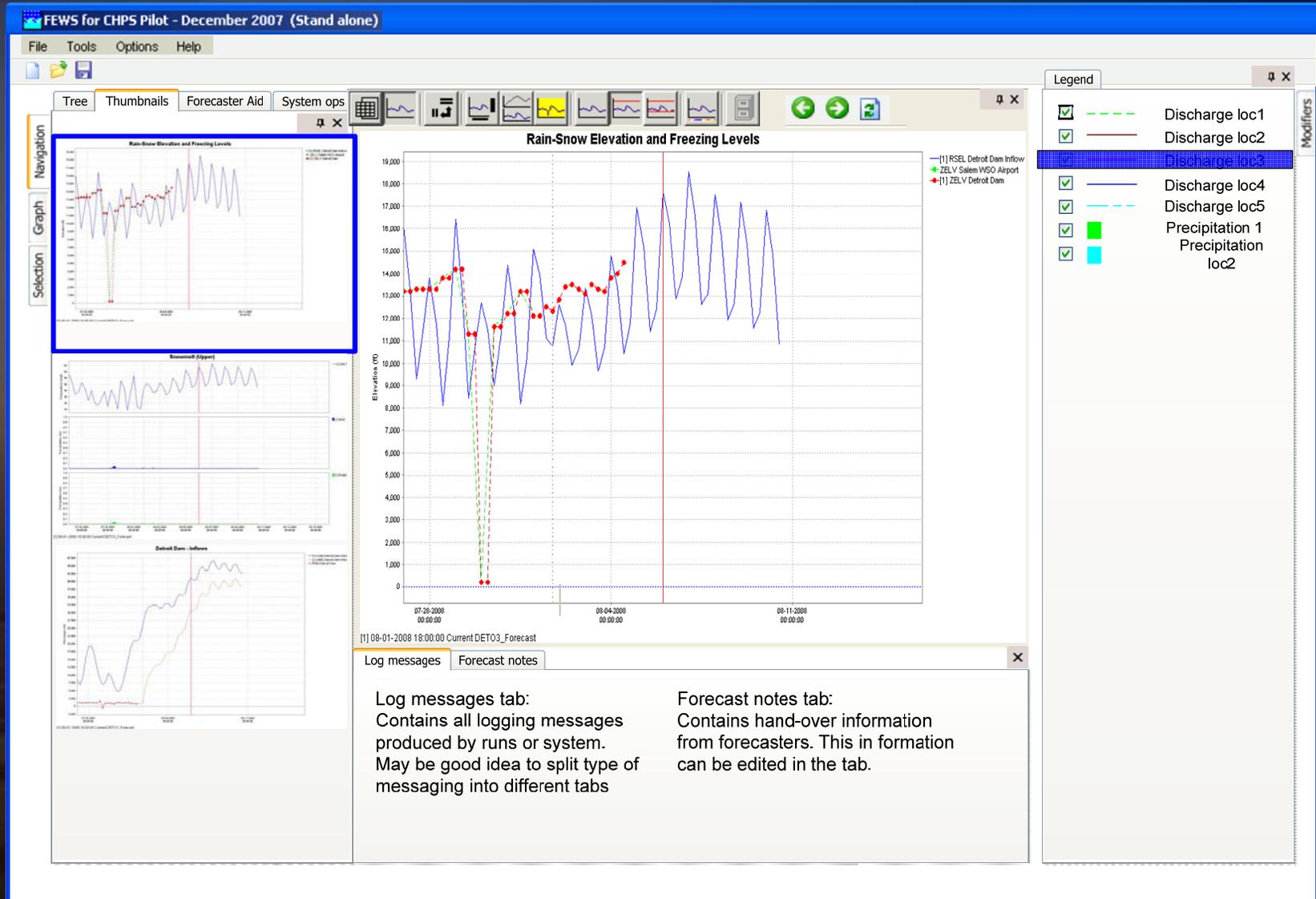


Time Series Display Longitudinal Data (Profiles)



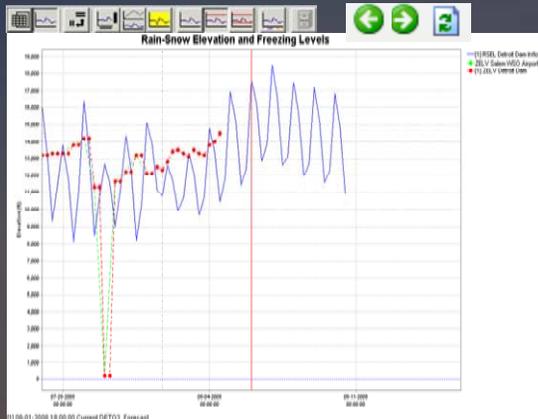


Forecast Plots





TS Modifiers "Mock-up"



This value is fixed depending on Mod type selected.

Toggle table/chart

A Mod only becomes available in the modifiers table and main window chart after rerun is pressed. This way the Mod is consistent with the forecast data. When editing in the main window, the mod is visible but only becomes persistent after rerun.

Modifier
Legend

Modifiers

| Mod Type | Start | End | Enable | Disable | Unit | Active | | |
|----------|----------------|----------------|----------------|----------------|------|-------------------------------------|-------------------------------------|--------------------------|
| IGNORETS | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| RAINSNOW | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| SACCO | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| MFC | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| RRICHNG | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| SSARREG | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| SETQMEAN | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| SETMSNG | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| UHGDATE | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

Create Mod
ReRun

Modifier properties

Name: TSADD Start time: Jul 28 2008 12 End time: Jul 28 2008 12 Undo

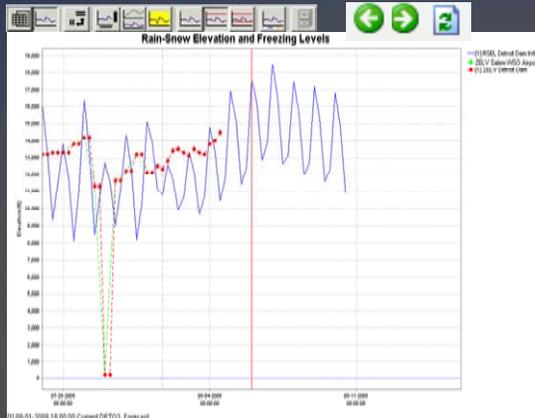
Enable time: Jul 28 2008 12 Disable time: Jul 28 2008 12

Operation: Add Value:

Modifier view



SACCO Modifier "Mock-up"



Do we require these?

Modifier

Modifiers
Legend

| Mod Type | Start | End | Enable | Disable | Unit | Active | | |
|----------|----------------|----------------|----------------|----------------|------|-------------------------------------|-------------------------------------|-------------------------------------|
| IGNORETS | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| RAINSNOW | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| SACCO | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| MFC | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| RRICHNG | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| SSARREG | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| SETQMEAN | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| SETMSNG | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| UHGDATE | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |

Create Mod
ReRun

Modifier properties

Name: SACCO Enable time: Jul 28 2008 12 Disable time: Jul 28 2008 12 Undo

Time Series

| | | | | | | |
|---------|-------|-------|-------|-------|-------|-------|
| DET03IM | UZWTC | UZFWC | LZWTC | LZFSC | LZFFC | ADIMC |
| DET03IU | 49.0 | 0 | 53.0 | 0 | 16.0 | 112 |
| DET03IU | 49.7 | 35 | 53.2 | 0.5 | 16.9 | 112 |

28-12-2004 18:00 Enter (new) state date/time Display Climatology Display Original Values

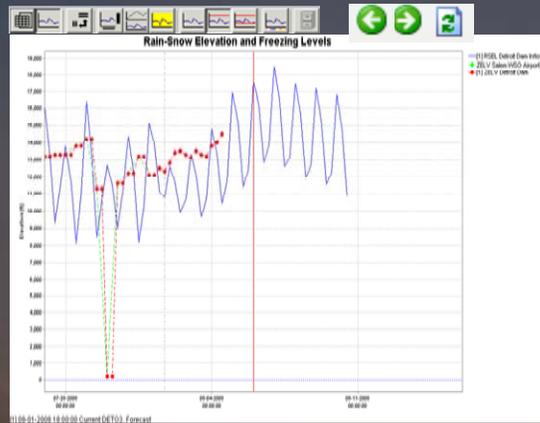
Modifier view

BKR5 UZWTC

Legend:
 - Blue line: UZWTC original (BKR5,UZWTC)
 - Red triangle: UZWTC corrected (BKR5,UZWTC)



SNOW Mods “Mock-up”



Question: Do we need to show timeseries in the modifier chart? Is so which series are these?

Legend

Modifier

Modifiers

| Mod Type | Start | End | Enable | Disable | Unit | Active | | |
|----------|----------------|----------------|----------------|----------------|------|-------------------------------------|-------------------------------------|--------------------------|
| IGNORETS | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| RAINSNOW | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| SACCO | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| MFC | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| RRICHNG | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| SSARREG | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| SETQMEAN | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| SETMSNG | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| UHGDATE | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

Create Mod ReRun

Modifier properties

Name: RAINSNOW Start time: Jul 28 2008 12 End time: Jul 28 2008 12

Time Series: DET03IM, **DET03IL**, DET03IU Enable time: Jul 28 2008 12 Disable time: Jul 28 2008 12

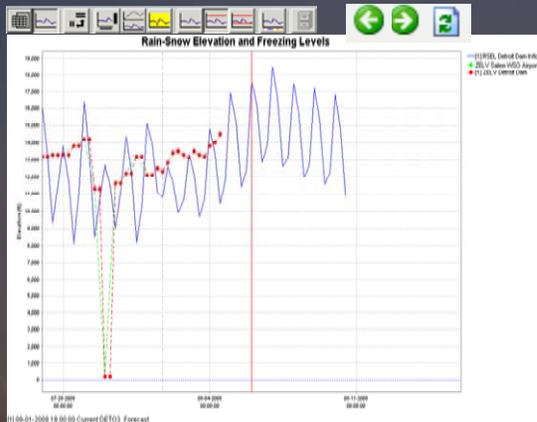
Value: RAIN

Undo
Apply

Modifier view



SSARREG "Mock-up"



Modifier

Modifiers

| Mod Type | Start | End | Enable | Disable | Unit | Active | | |
|----------|----------------|----------------|----------------|----------------|------|-------------------------------------|-------------------------------------|--------------------------|
| IGNORETS | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| RAINSNOW | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| SACCO | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| MFC | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| RRICHNG | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| SSARREG | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| SETQMEAN | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| SETMSNG | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| UHGDAT | Jul 28 2008 12 | Aug 05 2008 12 | Jul 30 2008 12 | Aug 01 2008 12 | ? | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

Create Mod

ReRun

Modifier properties

Name: SACCO

Enable time: Jul 28 2008 12

Disable time: Jul 28 2008 12

Undo

Reservoir

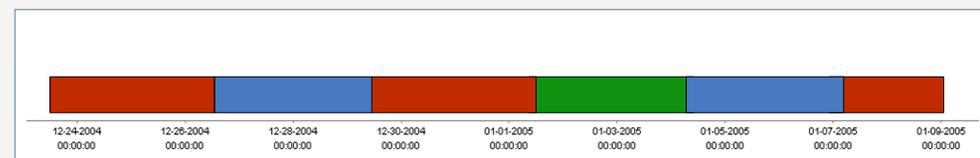
- DETO2
- DETO3

- US DS

| Time | Regulation | Value |
|----------------|------------|-------|
| Jul 01 2008 12 | FREEFLOW | |
| Jul 05 2008 12 | SETQ | |
| Jul 12 2008 12 | SETH | |
| Jul 20 2008 12 | SETS | |
| Jul 25 2008 12 | SETQD | |
| Aug 05 2008 12 | SETDH | |
| Aug 07 2008 12 | SETDS | |

Add
Remove
Insert

Modifier view



Legend



Logs and Notes “Mock-up”

Log Messages Forecast Notes

```
06.08.2008 02:47:30 INFO - Datastore.NewCurrentRun: Taskrun MEHO3_Forecast (T0=2008-08-06 00:00, Dispatch=2008-08-06 00:47, Id=23_2) is made current automatically
06.08.2008 02:47:30 INFO - Workflow.ActivityCompleted: Workflow 'MEHO3_Forecast' completed in 0 minutes and 1 seconds
06.08.2008 02:47:30 INFO - Completed Activity 'MEHO3_Natural_FlowToLevel_Forecast' completed in 0 minutes and 0 seconds
06.08.2008 02:47:30 INFO - Started Activity MEHO3_Natural_FlowToLevel_Forecast
06.08.2008 02:47:30 INFO - Completed Activity 'Santiam_Calculate_MEHO3N_Forecast' completed in 0 minutes and 0 seconds
06.08.2008 02:47:30 INFO - Started Activity Santiam_Calculate_MEHO3N_Forecast
06.08.2008 02:47:30 ERROR - Workflow 'MEHO3_Forecast' failed because activity 'ROUTE_DET03N_Forecast' failed. (Plugin 'ROUTE_DET03N_Forecast' failed, message was: 'Tir
ModuleConfigFiles/ROUTE_DET03N_Forecast 1.00 default.xml)
06.08.2008 02:47:30 INFO - Started Activity ROUTE_DET03N_Forecast
06.08.2008 02:47:30 INFO - Completed Activity 'MEHO3_FlowToLevel_Forecast' completed in 0 minutes and 0 seconds
06.08.2008 02:47:30 INFO - Started Activity MEHO3_FlowToLevel_Forecast
06.08.2008 02:47:30 INFO - Completed Activity 'MEHO3_Calculate_EffectiveLocal_Forecast' completed in 0 minutes and 0 seconds
06.08.2008 02:47:30 INFO - Started Activity MEHO3_Calculate_EffectiveLocal_Forecast
06.08.2008 02:47:30 INFO - Completed Activity 'ARMA_MEHO3_Forecast' completed in 0 minutes and 0 seconds
```

Log Messages Forecast Notes

| Time | Forecaster | Message |
|----------------|------------|---------|
| Jun 08 2008 12 | Paul | |
| Jul 10 2008 12 | Mike | |
| | | |
| | | |
| | | |

Add Remove Search: Next

Question:
- Should we allow images to be inserted here?
- Should we insert new messages to top of list or bottom? In any case new messages should be directly visible.



E-19 Info “Mock-up”

E19 view

Shows all available documentation for the selected forecast group. This view does not require any tool tabs.

All the document types will be opened in the view window with the use of embedded viewer components

E19 Forms

PDF Text Image

Eden at Sheepmount

| | |
|--------------------------------------|------------------------------|
| Station name | Sheepmount |
| ADFC reference | 2502 |
| Geoging authority | North West |
| Geoging authority reference | 10010 |
| Stream name | Eden |
| Area | 100% |
| Hydrographic Area | 71 - Eden |
| MRN | 000000000 |
| Construction area and source of info | 2001 (2007) (Eden Water Act) |
| Station type | GA |
| MRN | 000 |
| FRN (km ²) | 201 (km ²) |
| Notes | Reference |

Station description: Velocity area station at a deep, steep section downstream of Eden Falls. The gauge, flow float, channel, and storage are all situated by large flood storage area just upstream of Eden Falls. The station is situated on the left bank of the river, approximately 10 m north of the gauging station. The station is located at the Eden Falls.

Rating development: Rating derived from current meter gauging.

Indication reliability for Q95: Yes - Flow gauged with a float.

Indication reliability for Q10: Yes - Gauged to 95% of maximum recorded flow.



Other Features

- *E-19 Display Section*
 - “Canned” info, Intranet pages, etc.
- *Forecaster “Rules of Thumb”*
- *Crossplots*
- *Historic Event info*
- *And much more....*



Thank You

