

# Implementation of the Community Hydrologic Prediction System

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# Topics

- ▶ Background
- ▶ What is CHPS?
- ▶ Hydrology community benefits
- ▶ Development timeline
- ▶ Risk reduction forecast offices
- ▶ Transition challenges
- ▶ Operations benefits
- ▶ Global user community

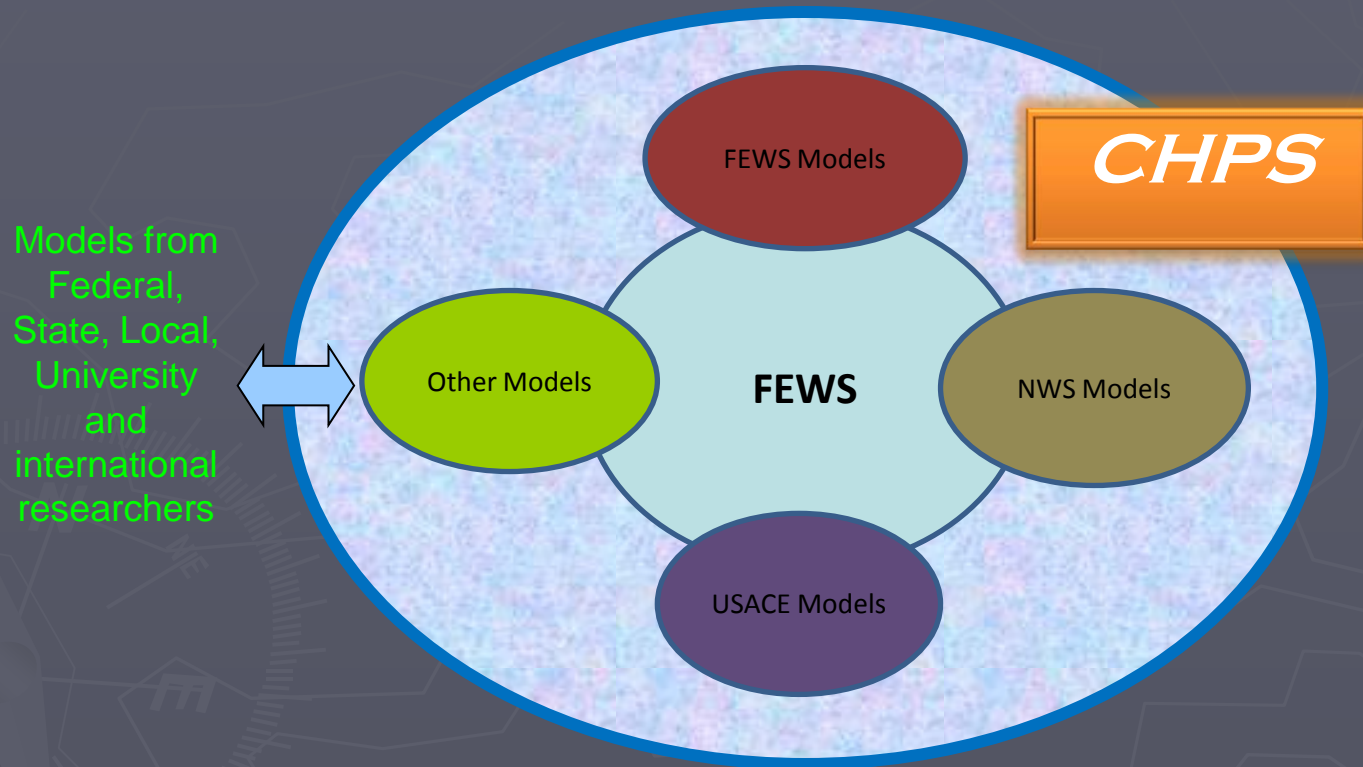
# Background

- ▶ Today's NWS River Forecast System (NWSRFS) has been the NWS hydrologic forecasting foundation for over 30 years
- ▶ NWSRFS architecture hinders use of recent advances in interactive forecasting and modeling
- ▶ NWS needs an improved hydrologic modeling infrastructure to leverage community operational concepts and models as well as provide future products and services
- ▶ The Community Hydrologic Prediction System (CHPS) will replace NWSRFS
- ▶ For more information, see the NWS OHD CHPS web site (<http://www.nws.noaa.gov/ohd/hrl/chps/index.html>)

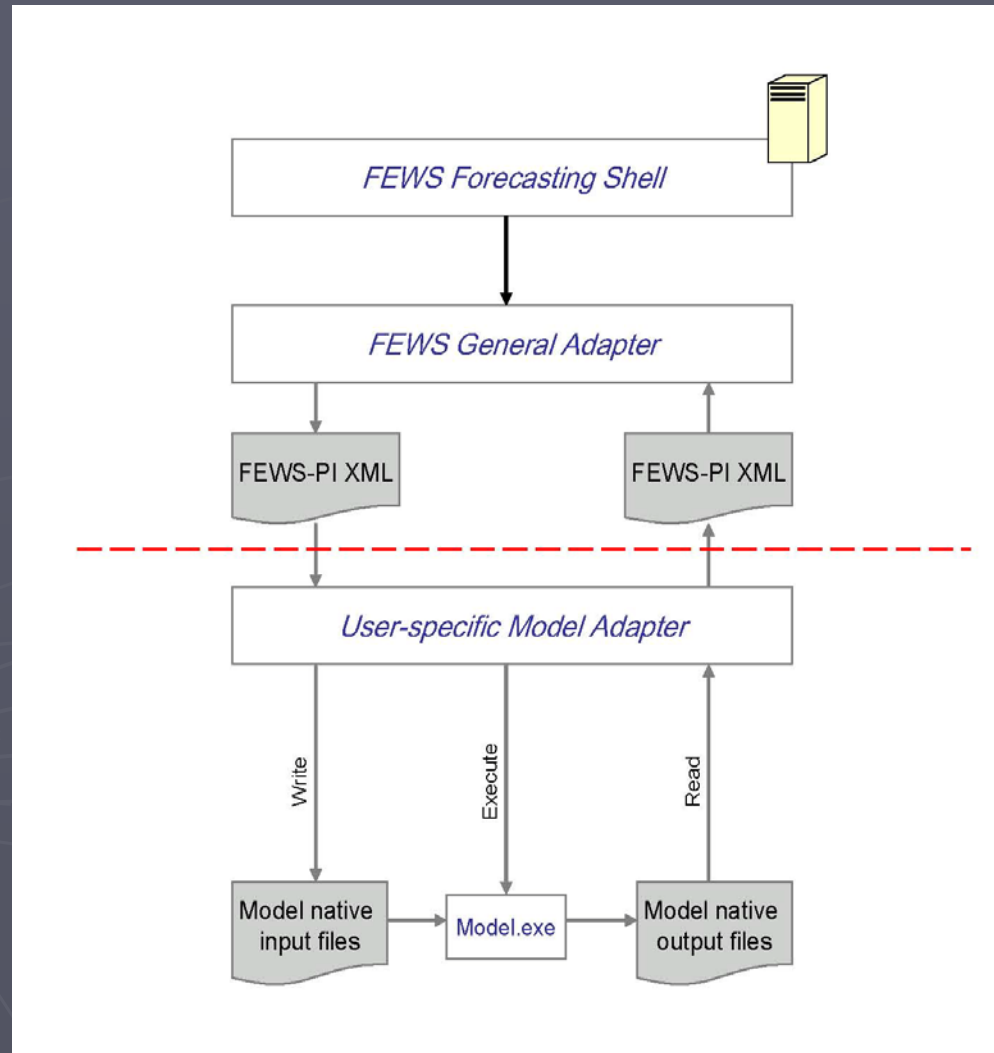
# What is CHPS?

- ▶ CHPS is both a system and a concept
  - Open forecasting system to promote model & data sharing
  - NOAA reaching out to hydro community
- ▶ CHPS uses Delft-FEWS from Deltares (Dutch Foundation) as core infrastructure
  - FEWS: Flood Early Warning System
  - Model adapter concept for algorithm modularity
  - Sophisticated data and workflow handling for models
  - Comprehensive forecaster user interface and displays (the IFD)
  - Highly configurable modeling environment via XML files
- ▶ Initially, includes NWSRFS models and USACE models (HEC-RAS and HEC-ResSim)
- ▶ Later, can include models from other providers

# CHPS and FEWS



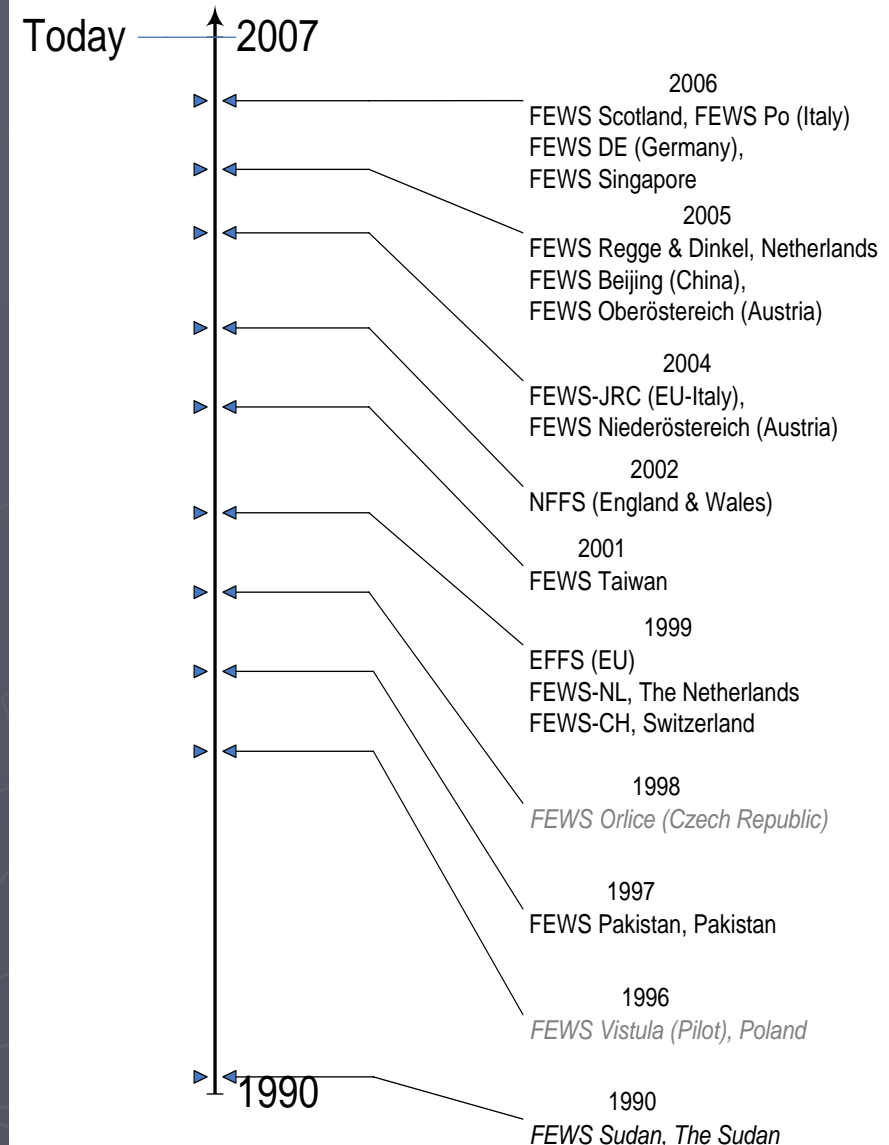
# FEWS Model Adapters



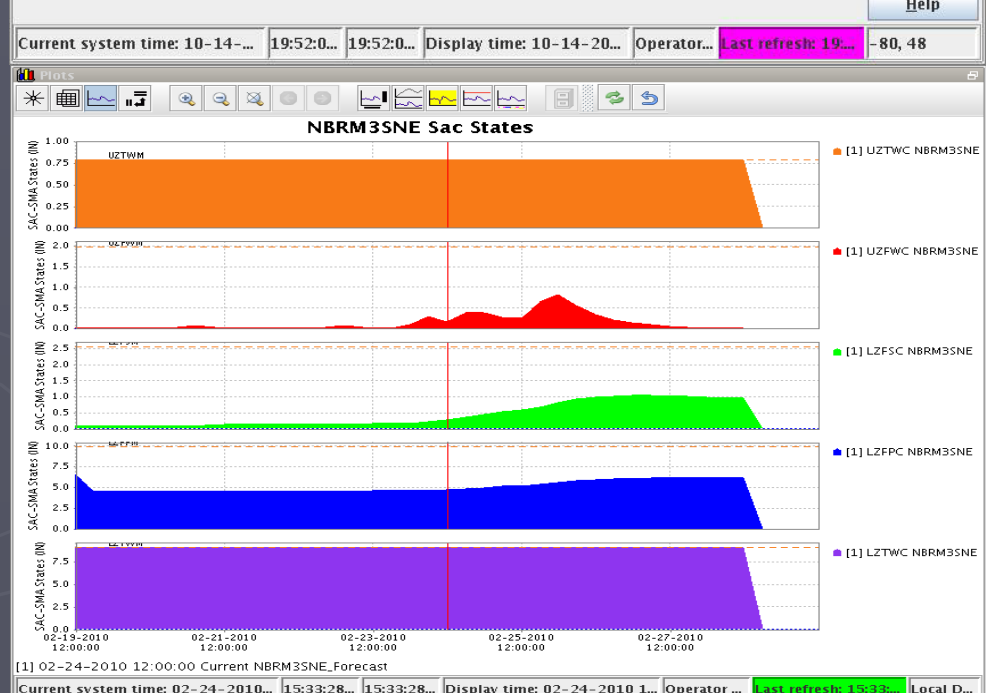
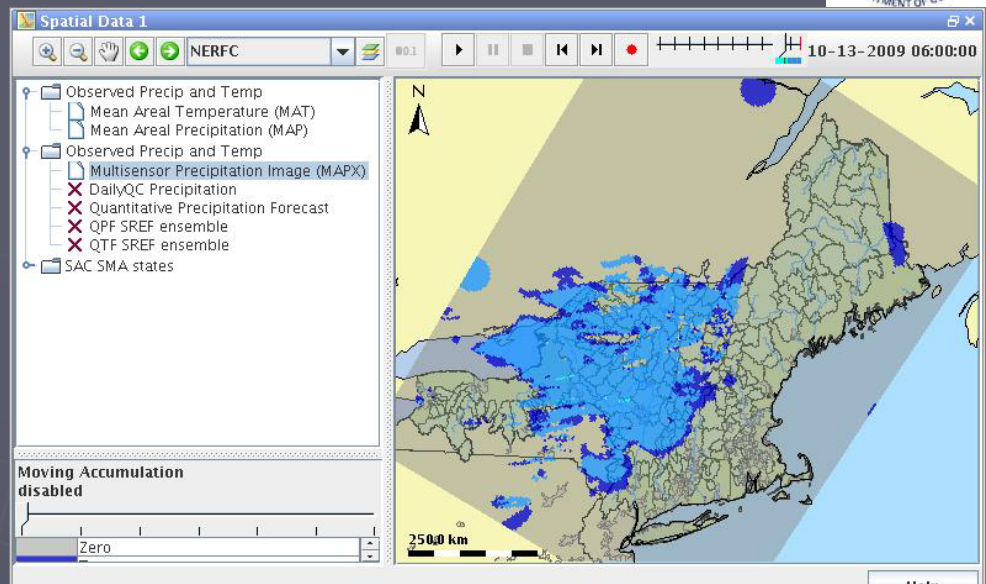
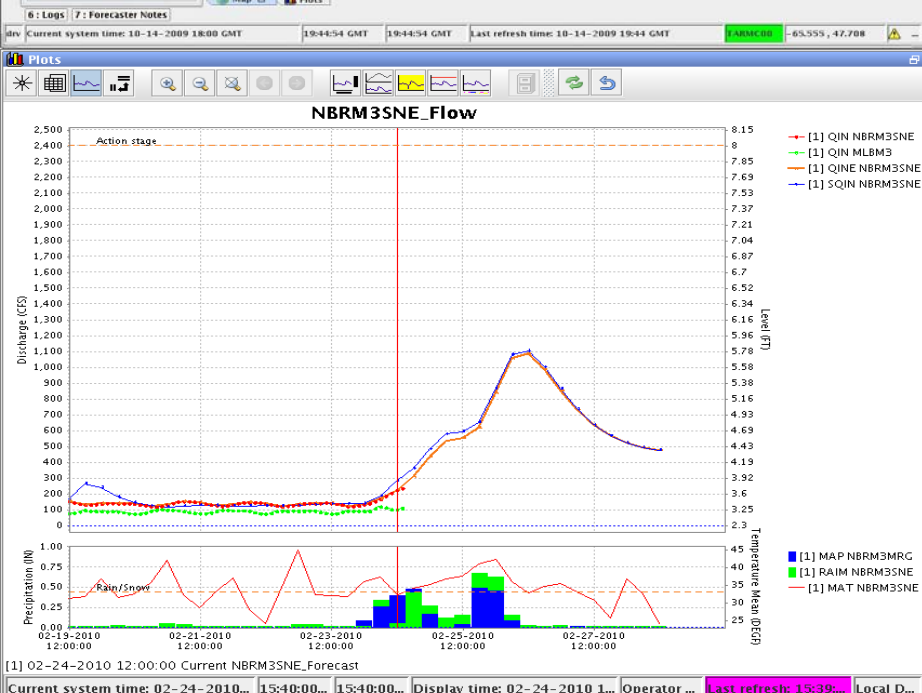
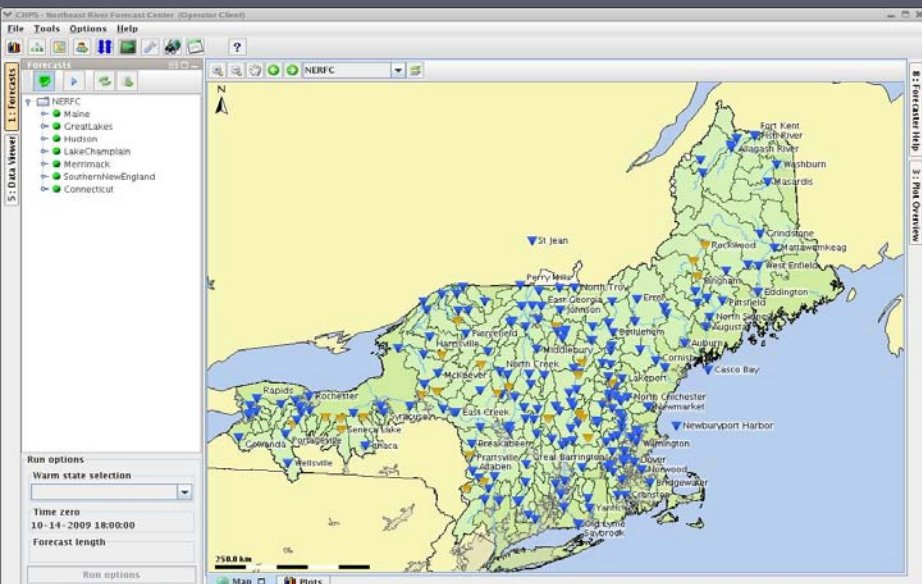


# FEWS Development – Past 10 Years

- ▶ First FEWS system: 1992 in Sudan
  - Blue Nile, Atbara & White Nile
  - Used Sacramento Rainfall-Runoff, HD routing & Reservoir models
- ▶ 1997/1998 more flexible FEWS system deployed in Pakistan & Czech Republic
- ▶ 1999 European Flood Forecasting System (EFFS) was developed
  - Modernize flood forecasting capabilities
  - Birth of the Java-based FEWS
  - Also became the operational system in Switzerland & the Netherlands
- ▶ 2002 Environment Agency, UK adopted FEWS as the infrastructure for NFFS
  - Birth of FEWS 2.0 – configured as a client-server system



# The CHPS Interactive Forecaster Display





# CHPS and AWIPS

- ▶ CHPS will be the river modeling and forecast component of AWIPS when it replaces NWSRFS
- ▶ CHPS will be integrated, as a large technology infusion, into AWIPS following AWIPS II (see paper 7B.4)
  - CHPS will be run in an AWIPS environment at NWS RFCs
  - Integration with AWIPS must be limited to allow CHPS to be made available as a forecasting environment for non-AWIPS based organizations (e.g., other countries)

# Hydrology Community Benefits

- ▶ Key motivation for community is to broaden and accelerate research to operations
  - Meteorological example: The Weather Research and Forecasting (WRF) Model (<http://www.wrf-model.org/index.php>)
  - Enhance understanding of hydrologic forecasting within hydrologic research community
  
- ▶ Hydrology community includes
  - NOAA line offices
  - other U.S. Federal agencies (e.g., USACE, USGS, USBR)
  - U.S. Universities (e.g., <http://www.cuahsi.org/>)
  - International researchers
  
- ▶ NWS to make CHPS and hydro models available

# The NWS Path to FEWS

- ▶ 2003: OHD initiated exploration of a replacement for NWSRFS
- ▶ 2005: Several candidates considered – including Delft-FEWS
- ▶ 2006: ABRFC, NCRFC, NWRFC and CNRFC volunteered to work with OHD to evaluate candidates
  - (CHPS Acceleration Team or CAT)
- ▶ 2006: Selected Delft-FEWS as the candidate for CHPS
- ▶ 2007: Built CHPS prototype on top of FEWS to prove viability
- ▶ 2008: OHD Director approved decision; proceed with implementation of Delft-FEWS as the CHPS software infrastructure
  - NERFC brought on board to replace NCRFC as a CAT member
  - NOHRSC added as well
  - NWSEO brought on board to help develop path toward operational testing, evaluation and impact and implementation

# Risk Reduction River Forecast Offices

- ▶ Goal to create and validate transition path for 9 follow-on RFCs based on CAT RFCs' experiences with one year lead in schedule
- ▶ Support for follow-on 9 RFCs from the 4 risk reduction RFCs
  - Each CAT RFC to assist 2 – 3 “buddies”
  - “Buddy” visits were conducted in March through July of 2010
  - Migration activities at these 9 RFCs are in progress
- ▶ Also key to risk reduction was establishment of a clear set of “Baseline” Operational Capabilities to avoid requirements creep
- ▶ CAT RFCs have moved into some degree of parallel execution with NWSRFS

# Transition Challenges

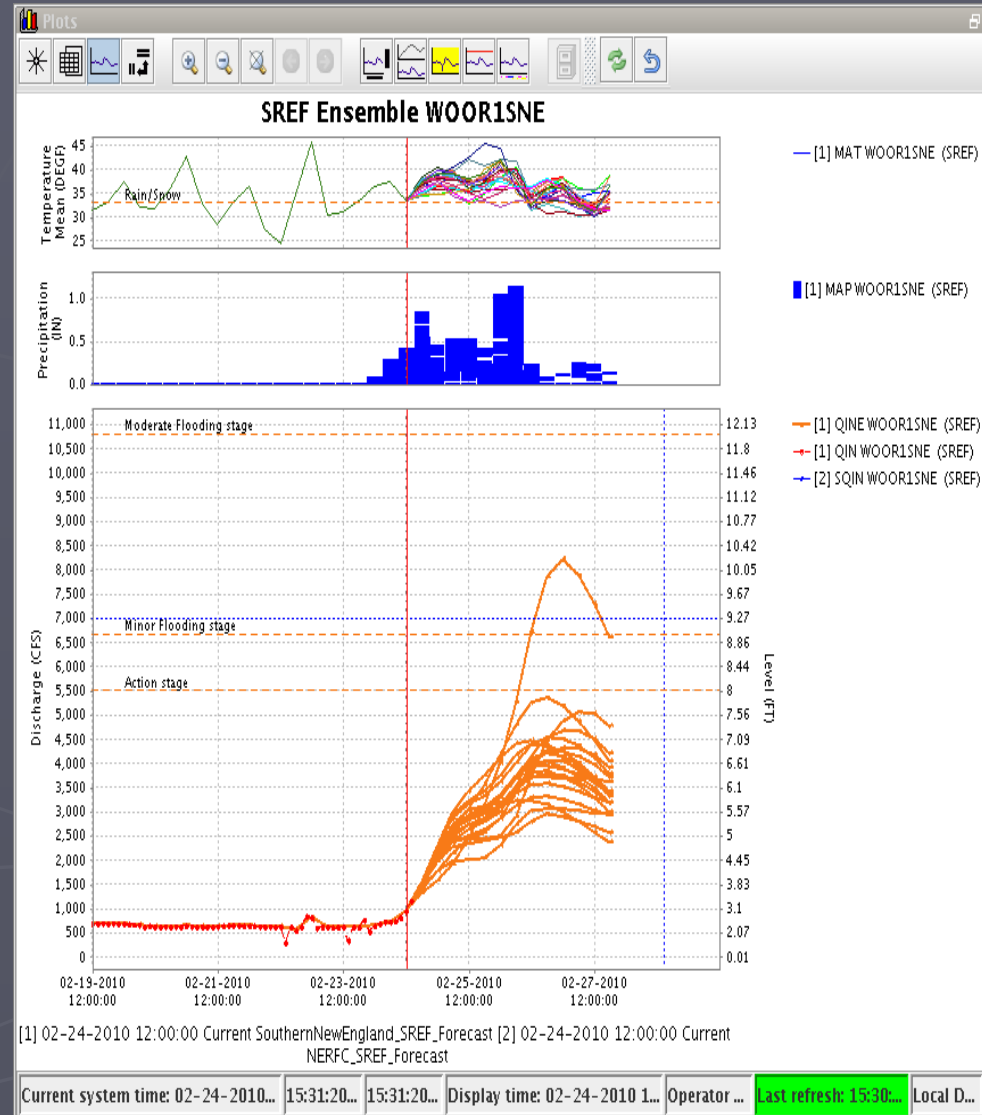
- ▶ Challenges are technical
  - Must not disrupt daily forecasting
  - Must assure hydro models perform the same within new infrastructure
  - Must assure model performance not degraded while taking opportunity to move to gridded meteorological forcings
- ▶ Challenges are cultural
  - NWS forecasters require training
  - NWS researchers and programmers need to re-orient to highly configurable environment
- ▶ Field support requires new paradigm that includes support of external models
- ▶ Operating in a truly community oriented environment within the U.S. and abroad



# Operations Benefits



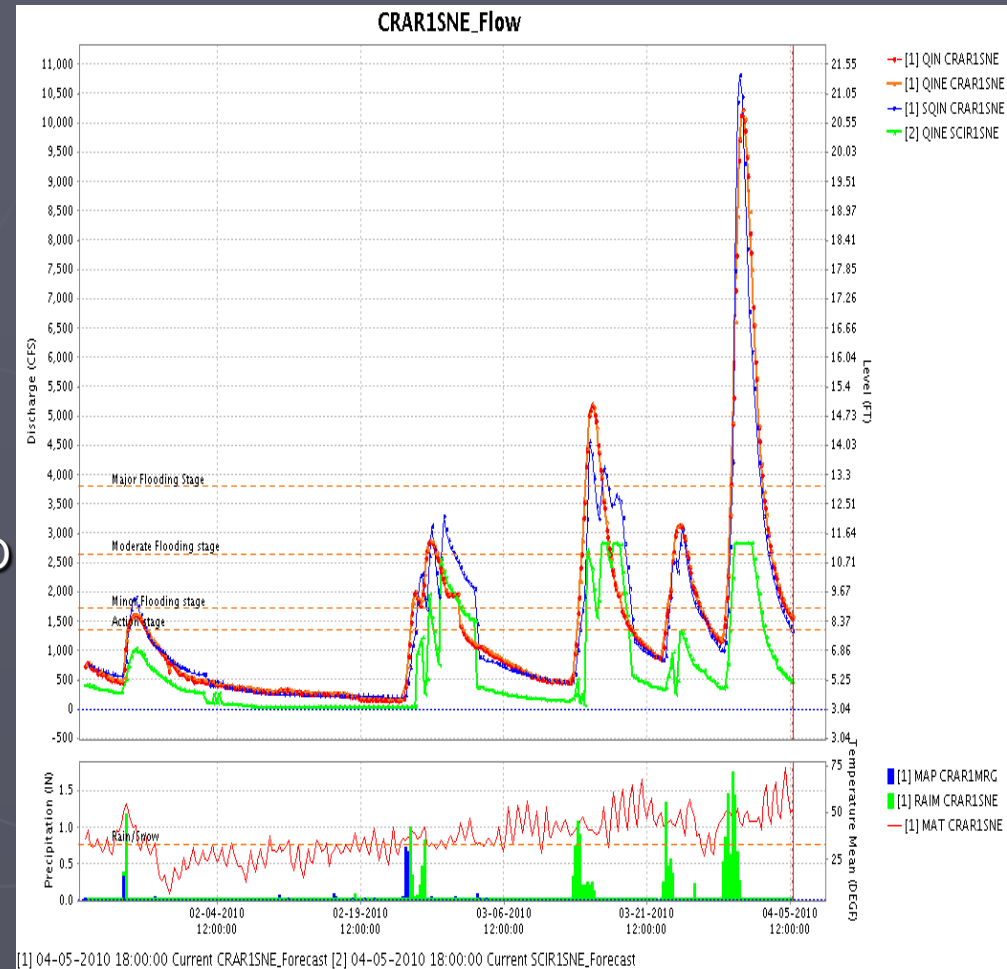
- More flexibility to address upcoming major service enhancements
  - Short term ensemble forecasts
  - Gridded hydrologic modeling
  - Gridded water resources forecasts
- Simpler and accelerated research to operations path
- Take advantage of community-developed models
- Simpler and lower cost of software maintenance and addition of small enhancements
  - NWS developers concentrate on hydrology not infrastructure



# WFO Benefits



- More efficient and timely delivery of forecasts
- With the infusion of new science and modeling – improved forecasts for short/long range
- Collaborative hydrologic/hydraulic modeling activities
  - Site Specific
  - International Partners – New Brunswick, Canada, NERFC and WFO Caribou, ME
- Potential for a CHPS Client to reside at the WFO
- Improved collaboration between RFCs and WFOs



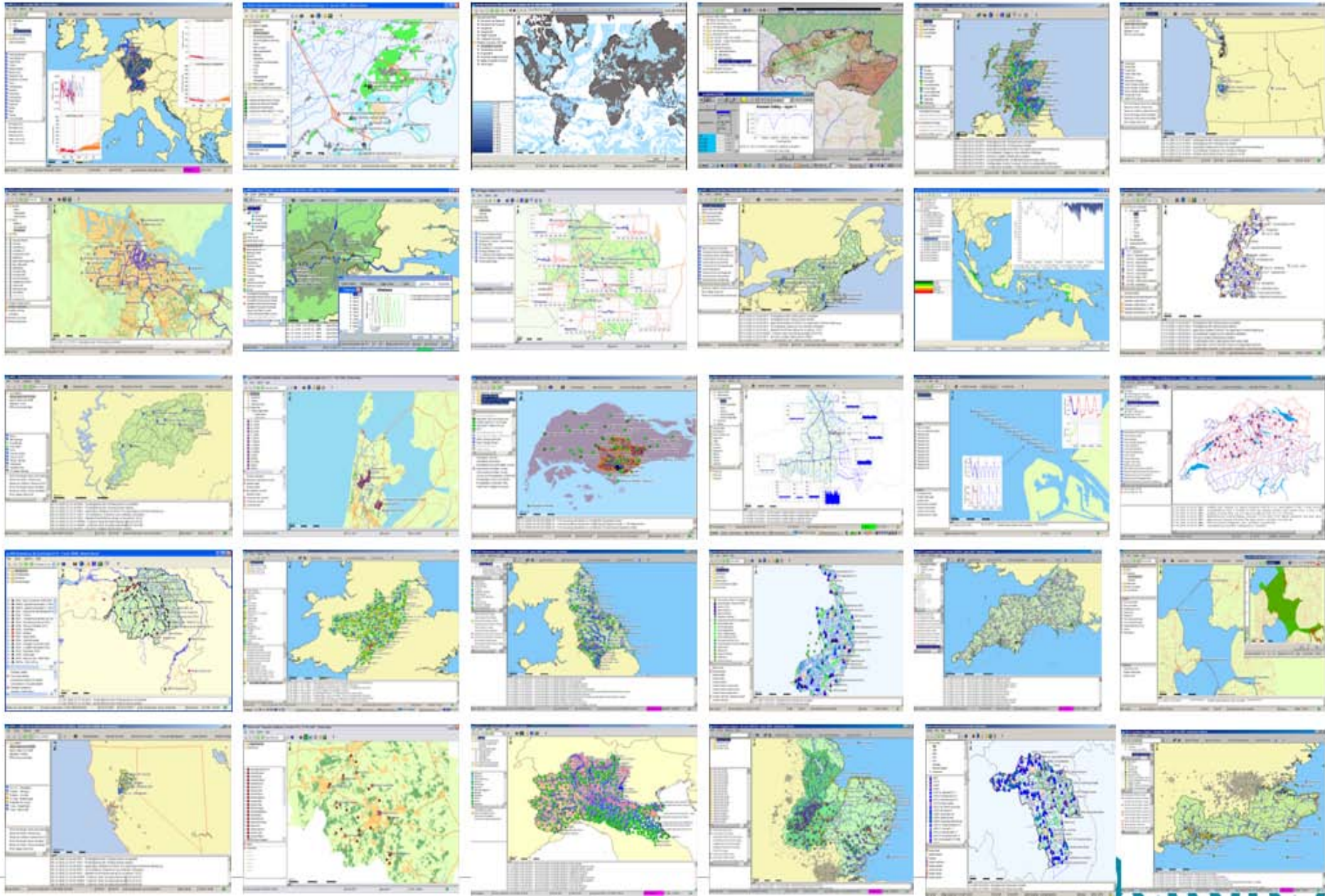
# Global User Community

- ▶ FEWS infrastructure and adapter mechanism is used today across Europe and in Asia
  - Many models from around the world have FEWS adapters
- ▶ Deltares views a major FEWS purpose as “exchanging ideas by incorporating them into software”
  - Example: IFD forecast modification enhancements via NWS now available to global users
  - Example: hydraulic profiles and skill scores added via U.K. National Flood Forecasting System now available to NWS
- ▶ International exchange of ideas will benefit NWS operations
- ▶ Deltares hosts an annual user group meeting in Delft, The Netherlands





# Global User Community



Questions????