HEPEX – What Lies Ahead?

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HEPEX WebEx Presentation

Outline

- What have we done so far?

- Where are we now?

- What do we need to do?

- A few science issues

- Opportunities looking forward

What Have We Done?

- 1st workshop at ECMWF, March 2004

- 9 more workshops since then. Last one in China, October, 2012 (http://hydro.bnu.edu.cn/meetings.html)

- EGU, AGU and AMS sessions and breakout meetings

- Journal Special Issues and Papers
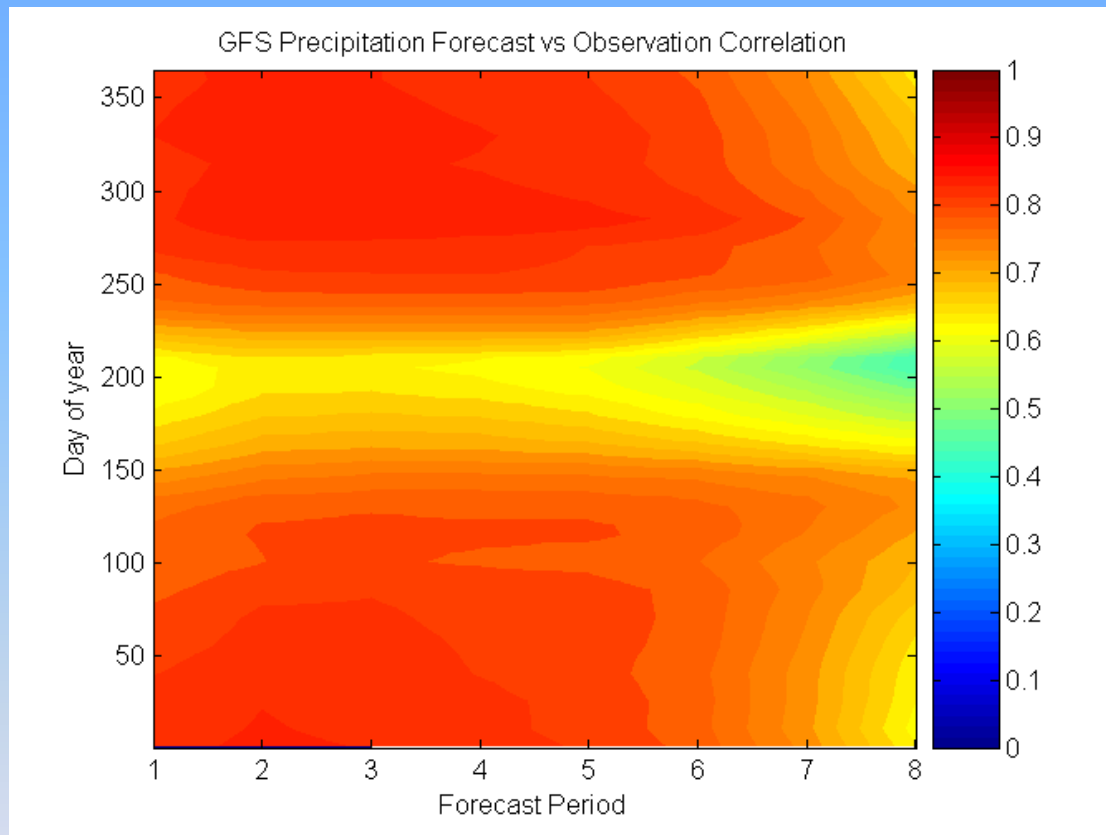
Where Are We Now?

- Ensemble Applications:
  - Europe – Implementing EFAS
  - U.S. – National implementation of HEFS
  - Other? – (e.g. NYC, BuRec, USCOE, Tampa, EDF)
- Greatest water resource management potential exists in **leveraging reliable uncertainty estimates in sector-specific decision support systems**
  - Balance trade-off between reducing risk and managing residual risk

CNRFC Ensemble Forecasts

http://www.cnrfc.noaa.gov/index.php?type=ensemble
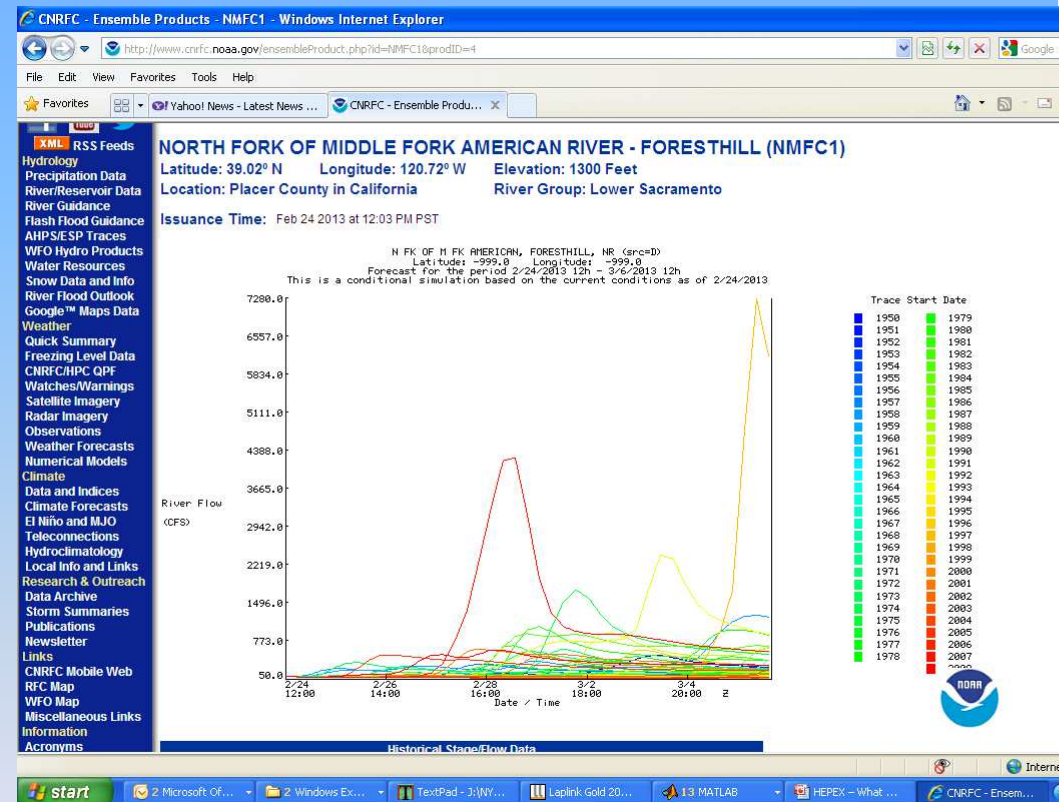
Example Correlation Plot for North Fork American River, CA

Forecast Period Definition

Period	Days
1	1
2	1-2
3	1-3
4	1-4
5	1-5
6	1-7
7	1-10
8	1-14

This plot shows how the coefficient of correlation between GFS forecast precipitation and observed precipitation varies during the year, depending on the event being forecast. This plot was constructed for each of the 24 selected MOPEX basins. Separate correlation plots were made for precipitation, tmin and tmax.
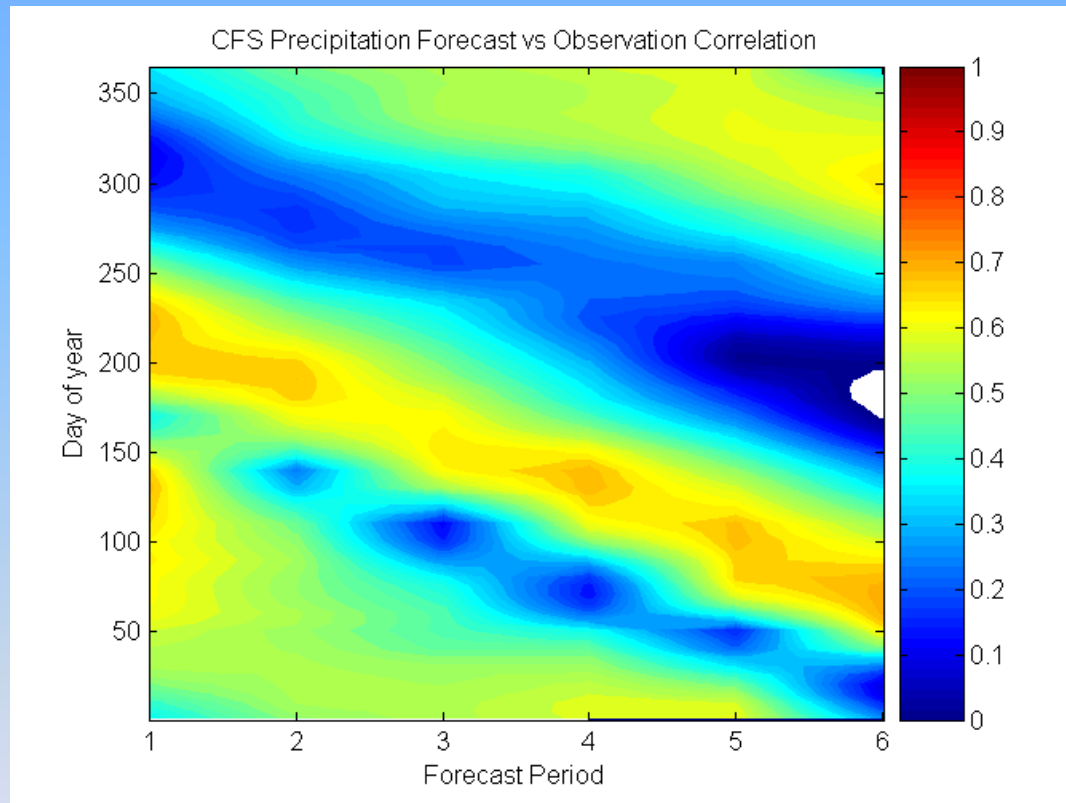
Skill of GFS Cumulative Pecipitation Forecasts
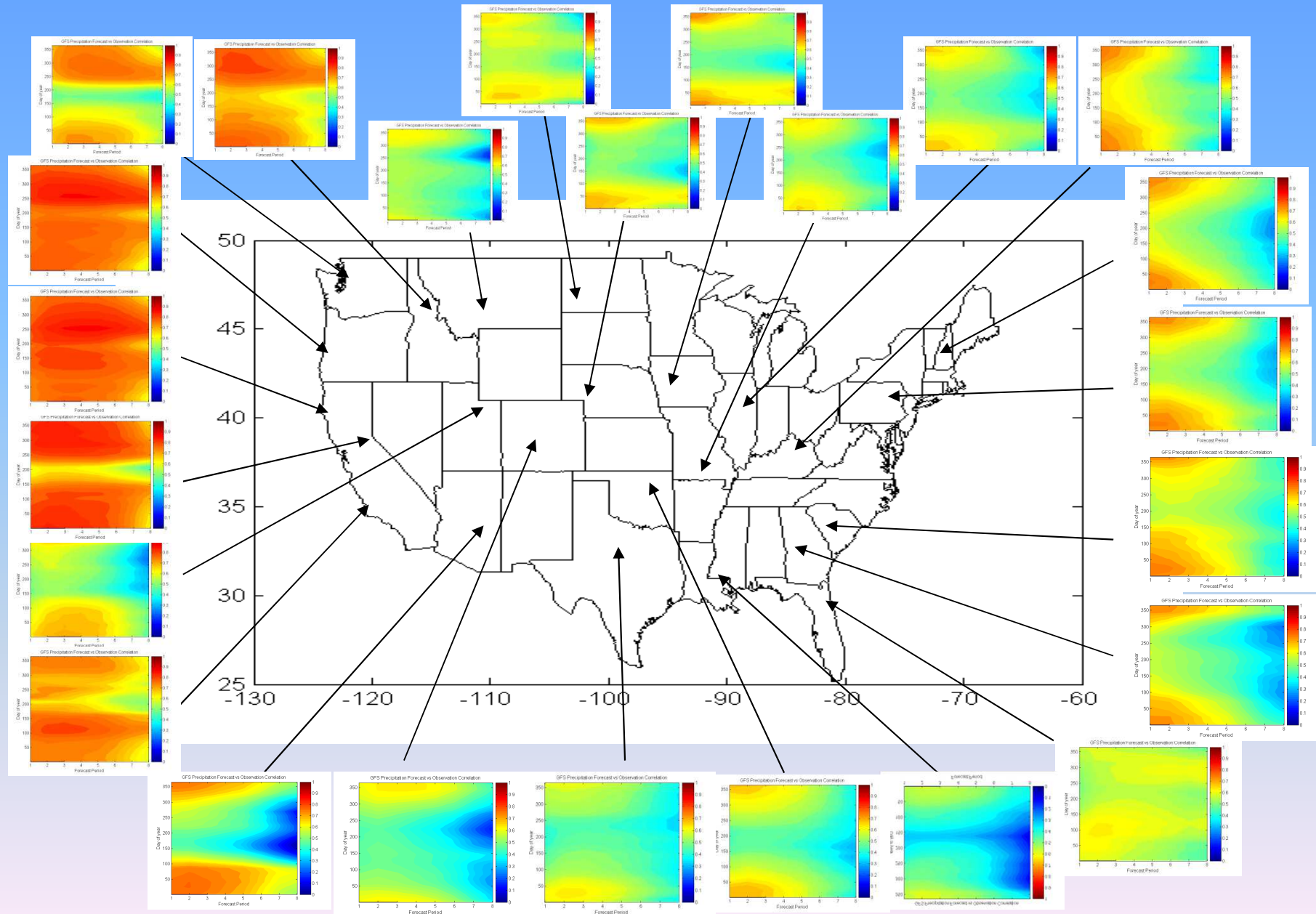
Skill of GFS average Tmax Forecasts

# Example Correlation Plot for North Fork American River, CA

CFS Precipitation Forecast vs Observation Correlation

Forecast Period Definition

Period	Months
1	1-3
2	2-4
3	3-5
4	4-6
5	5-7
6	6-8

This plot shows how the coefficient of correlation between CFS forecast precipitation and observed precipitation varies during the year, depending on the event being forecast. This plot was constructed for each of the 24 selected MOPEX basins. Separate correlation plots were made for precipitation, tmin and tmax.

# CFS Seasonal Forecast Skill - Precipitation
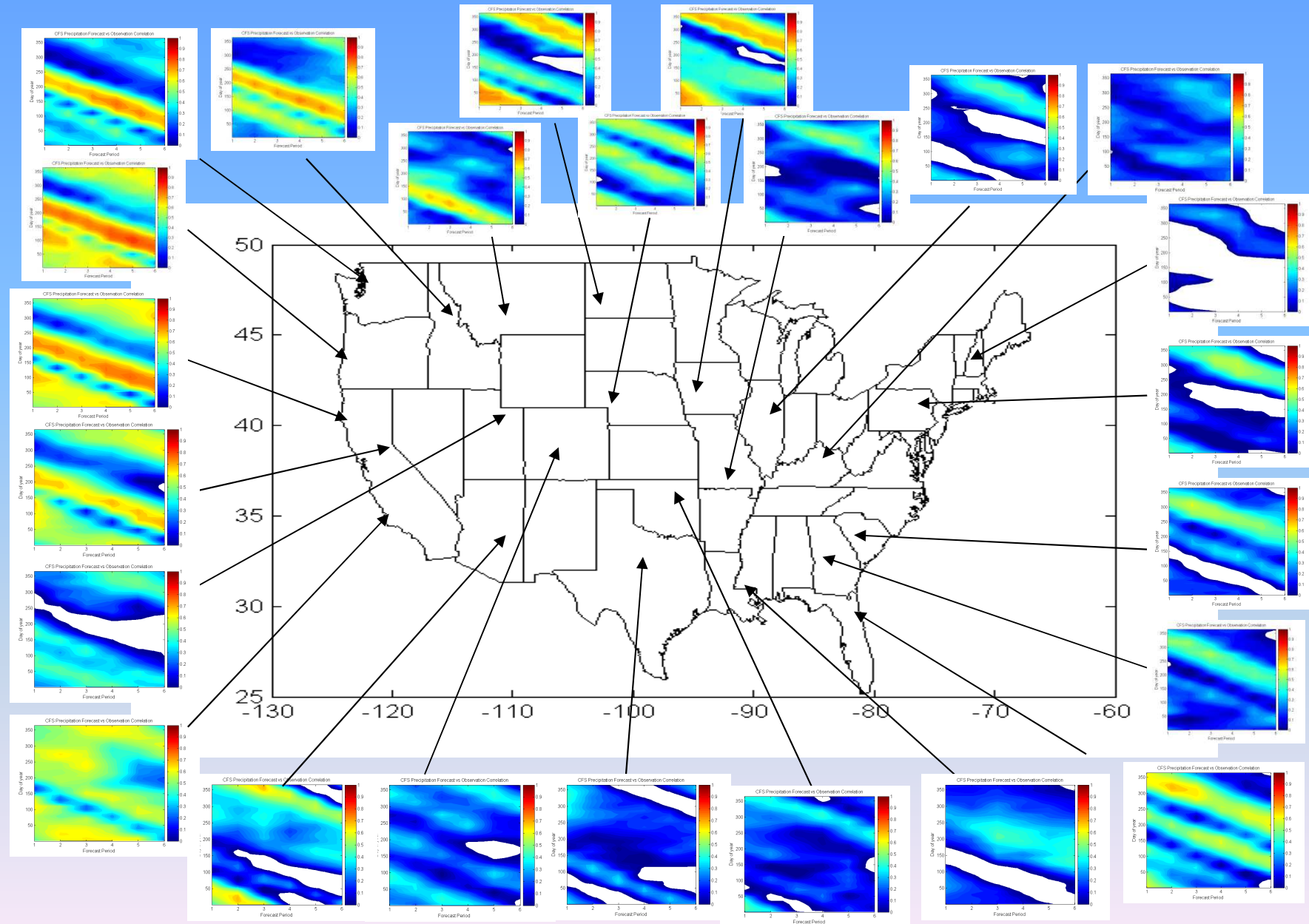
CFS Seasonal Forecast Skill - Tmin
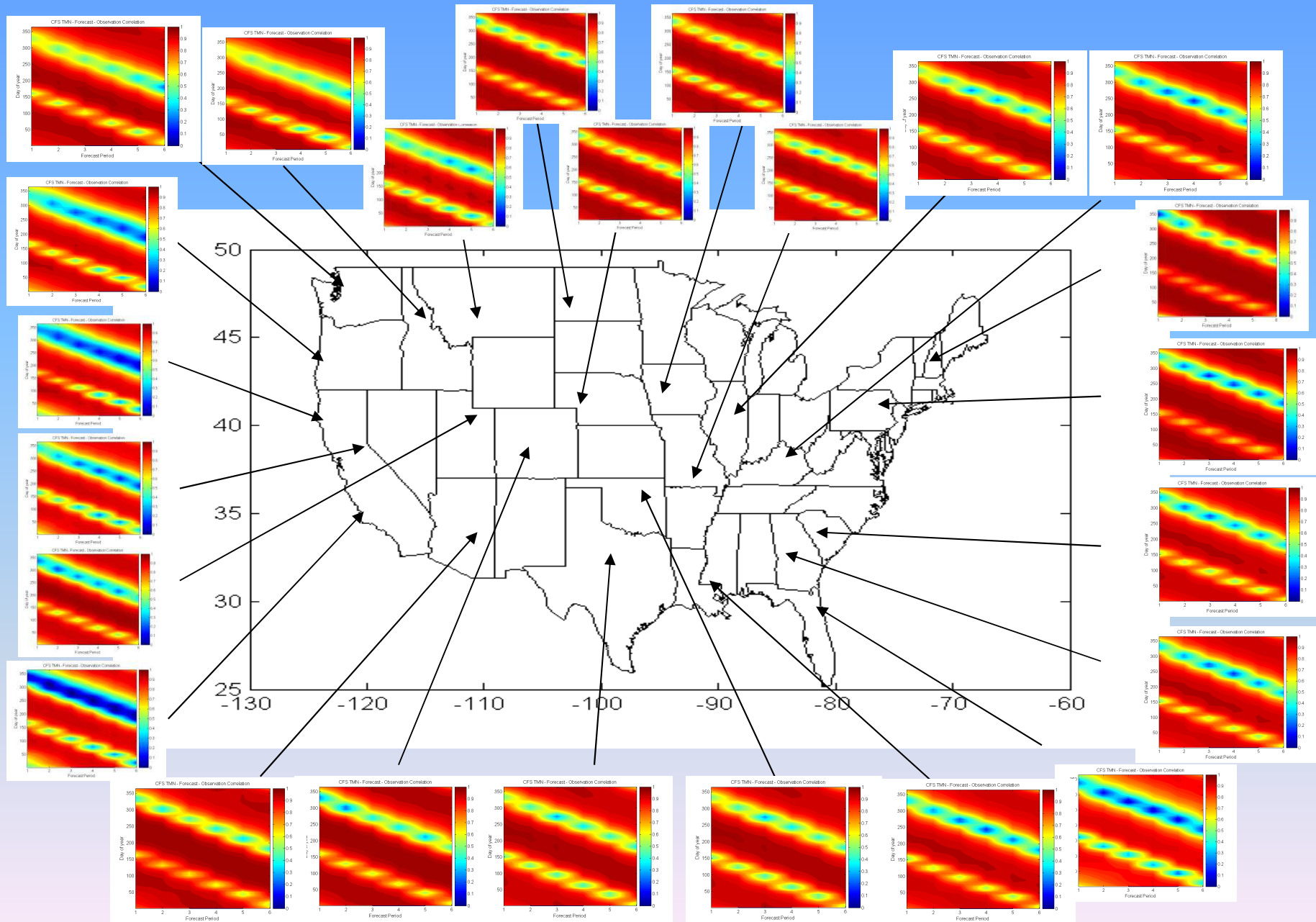
What Do We Need to Do?

- Users need to know how to use ensemble predictions
  - Decision rules?
  - Hindcast requirements?
- Operations Concepts/Procedures
  - Weather and Climate inputs
  - Hydrologic predictions to support user needs
- How well can we predict extreme events?
- Other?

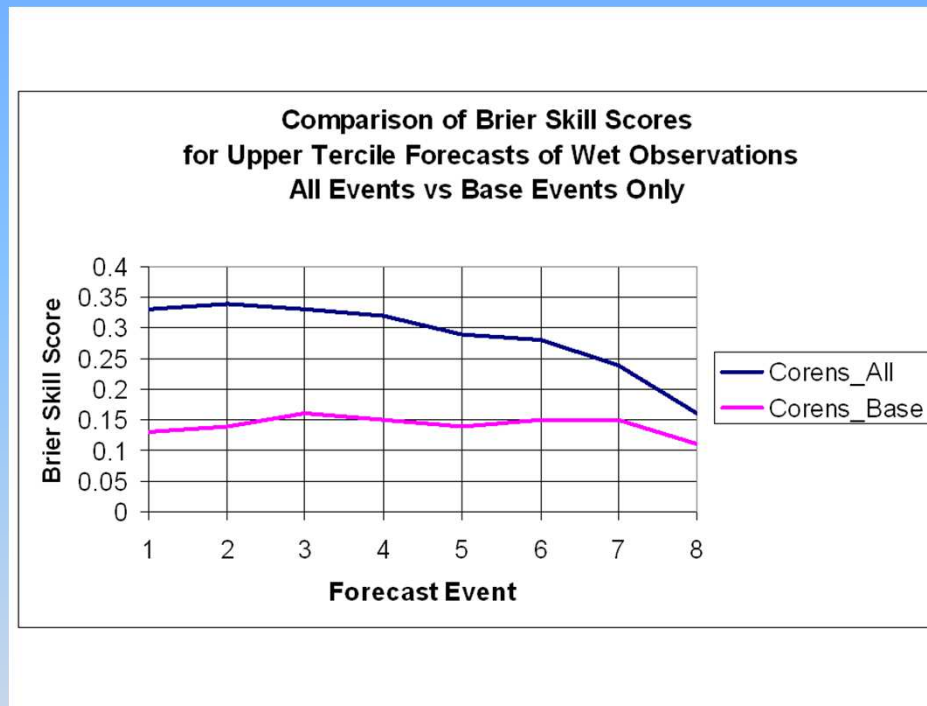# Ensemble Precipitation Forecast for NF American River, CA
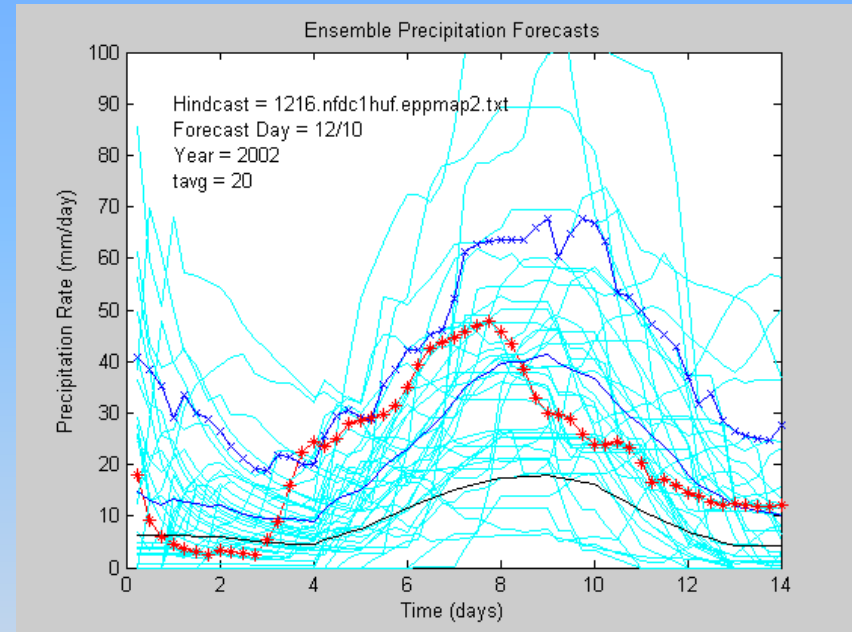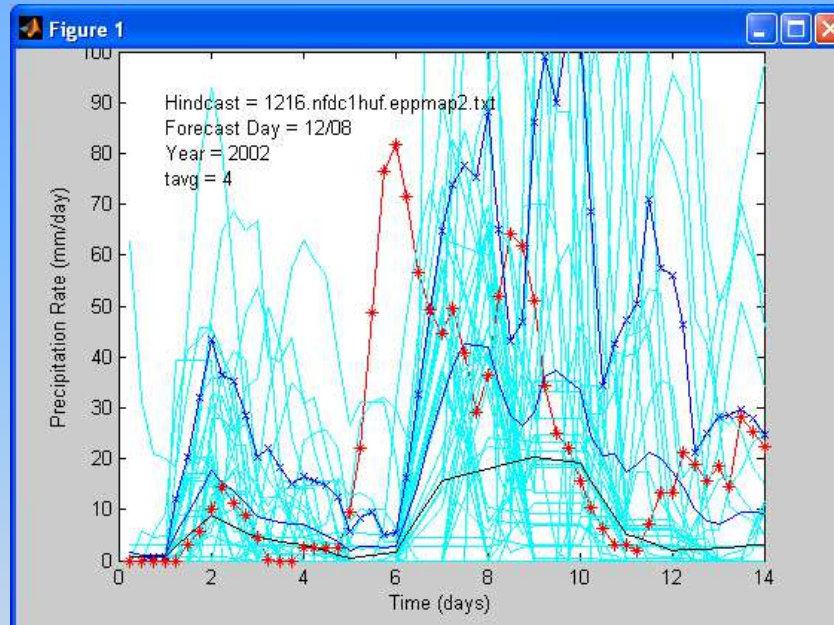
- Major Event – lasted ~5 days
- Predicted at least 5 days ahead (1998 GFS)
- Phase errors
- Scale-dependent properties
- Pre-processing is needed to extract information from GFS

A Few Science Issues

- Uncertainty and variability are space and time scale dependent. How can we account for effects of that on the quality of our predictions?

- How can we produce ensemble hydrologic forecasts? What are the options?

- How important is pre-processing weather and climate forecasts?

- How important is hydrologic post-processing and data assimilation?

- Ensemble verification . How can we measure our results?

- How to account for effects of upstream regulation?

- Can we use empirical relationships between variables that can be predicted and other variables of interest (e.g. turbidity, stream temperature, nutrient transport, etc.)

- How can we communicate uncertainty?

Effect of scale-dependent uncertainty on predictions of large precipitation events

**Comparison of Brier Skill Scores
for Upper Tercile Forecasts of Wet Observations
All Events vs Base Events Only**

- This example compares performance of two pre-processor configurations of "Canonical Events" in the NWS MEFS for a location in California.
- Bottom curve is for a configuration with base events only
- Top curve is for a configuration with both base and modulation events (modulation events are aggregates of base events)

How Well Can We Predict Extreme Events in California? Example ROC Scores
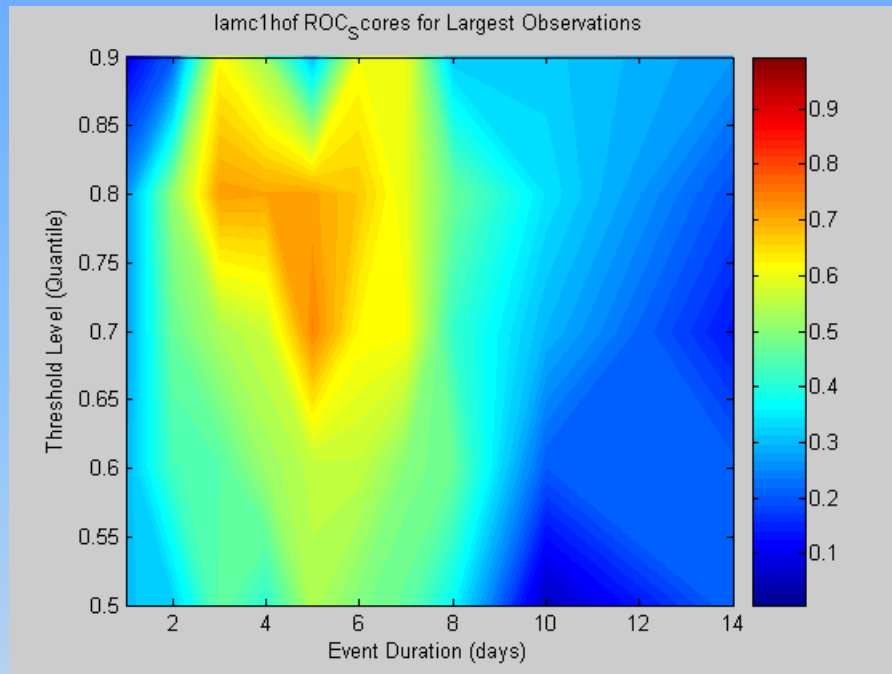
Largest Observations
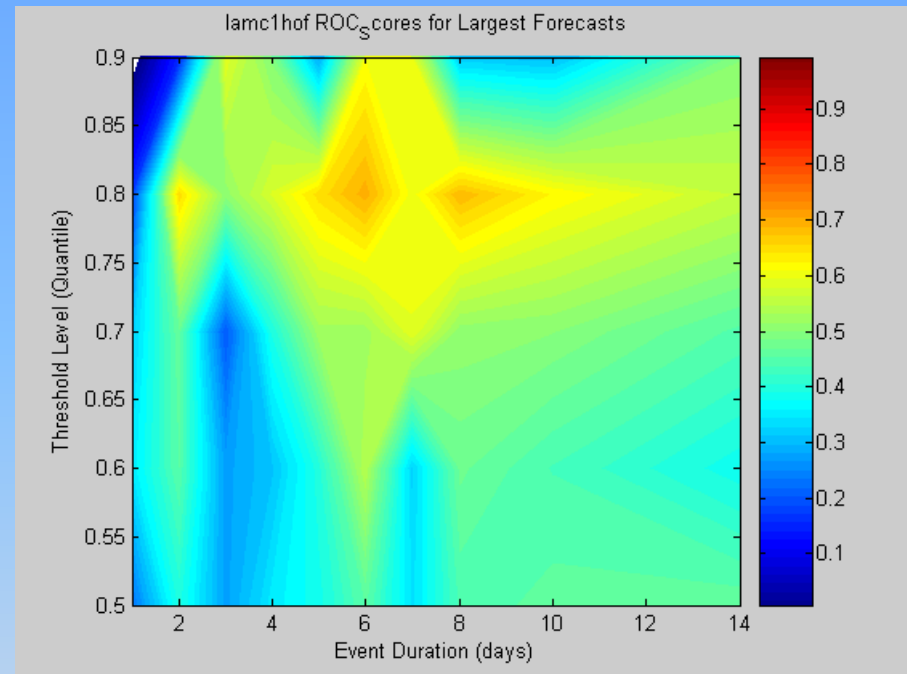
Largest Forecasts

Example is an analysis of ensemble hindcasts for the largest 100 precipitation events in 25 years for a location in northern California
- Results are temporally scale dependent
- Large events can be predicted better than small events
- Results depend on selection criteria

Opportunities Looking Forward

- Follow-up on recent workshops
  - Pre-processing
  - Post-processing and data assimilation
- User Workshops
- WebEx Presentations
- 10th Anniversary Workshop
- Ensemble Prediction Handbook (Duan, et al)
- Updated science plan
- Governance – Leading Co-Chairs & Regional Chairs
- Links to WMO, others?
- Other?