CBRFC MRF Project

DOH Meeting
June 2004

Steve Shumate

CBRFC AHPS PROJECT

A cooperative effort between:

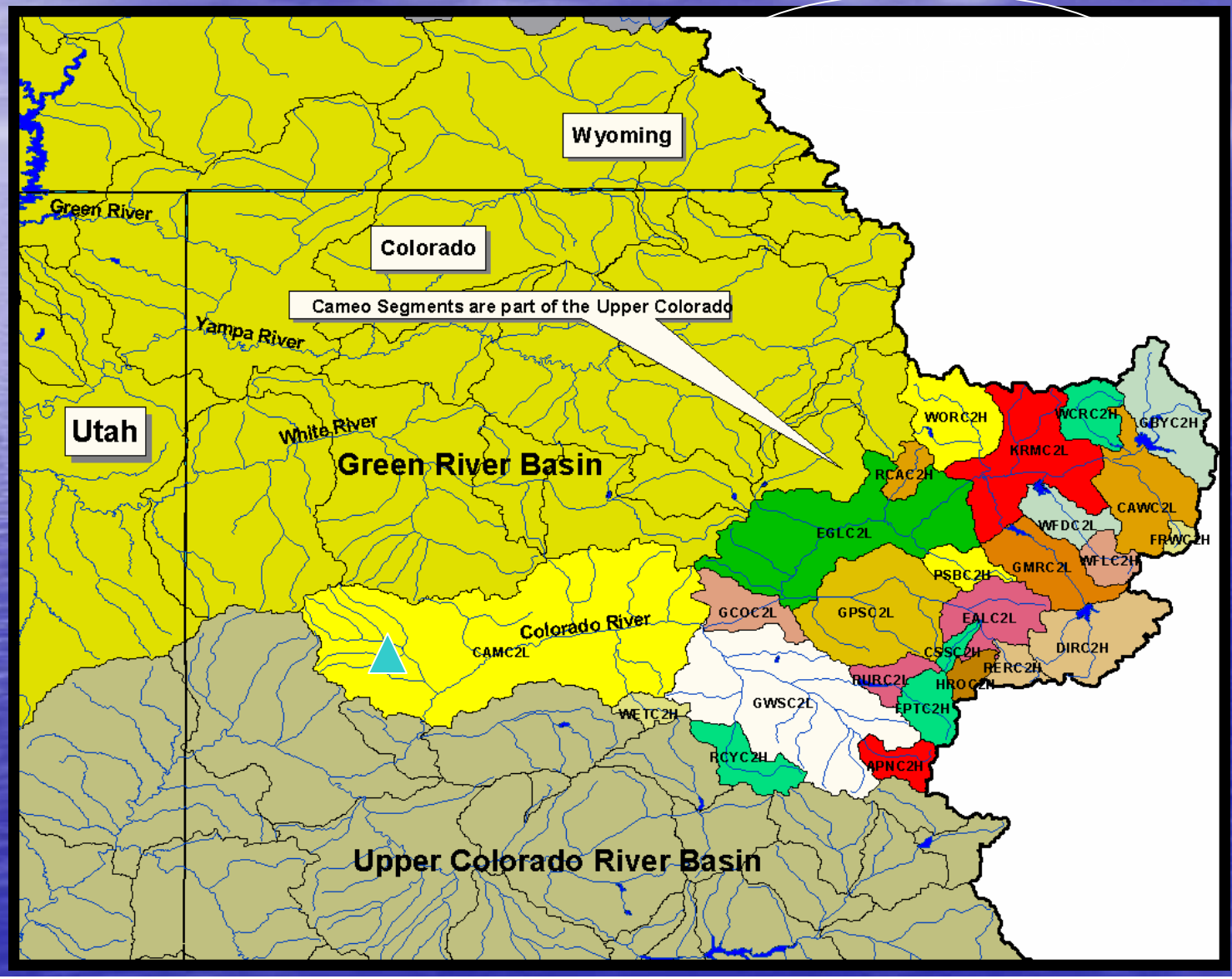
Goals

Introduce probabilistic 14 day meteorological forecasts (ensembles) into a river forecast system.

Capture and display the uncertainty.

Verify the process.

Project Area: 27 Segments Above Cameo, Colorado River



Method

Medium Range Forecast Model

Downscale to Model Variables

Mean Areal Temperature and Precipitation Ensembles

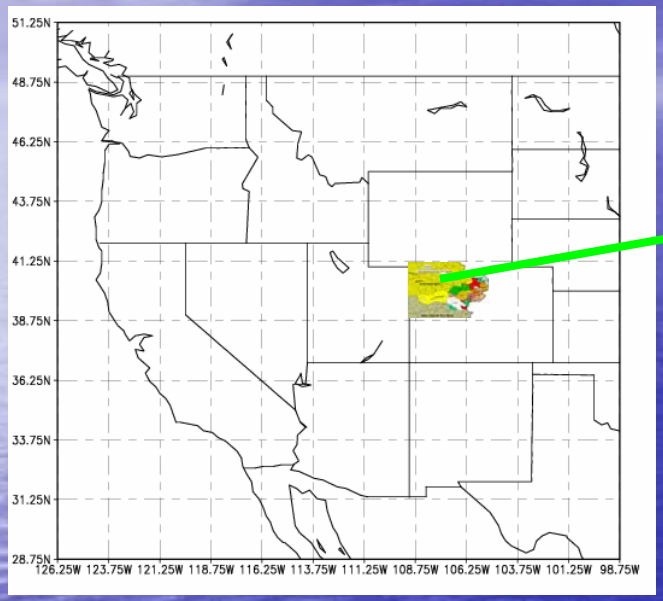
ESP Model

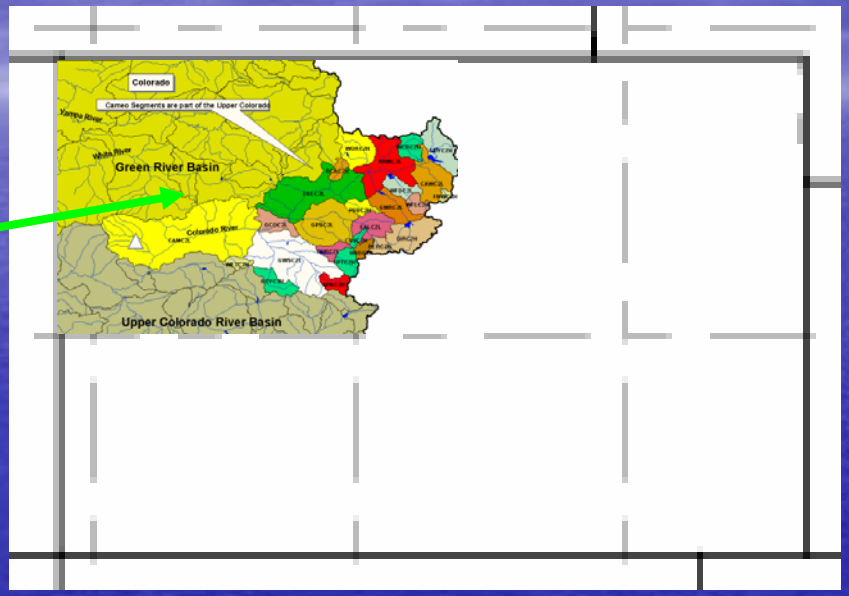
Probabilistic River Forecasts

Medium Range Forecast (MRF) Model

- Global Meteorological Model
- Many Atmospheric Variables
- Frozen Version
- Run Daily at CDC
- ~70km Spatial Resolution

MRF Spatial Resolution





WAY TOO LARGE!

Need to Relate to Basin…

ENSEMBLE RE-FORECASTING : IMPROVINGMEDIUM-RANGE FORECAST SKILL USING RETROSPECTIVE FORECASTS

Thomas M. Hamill1, Jeffrey S. Whitaker2, and XueWei1

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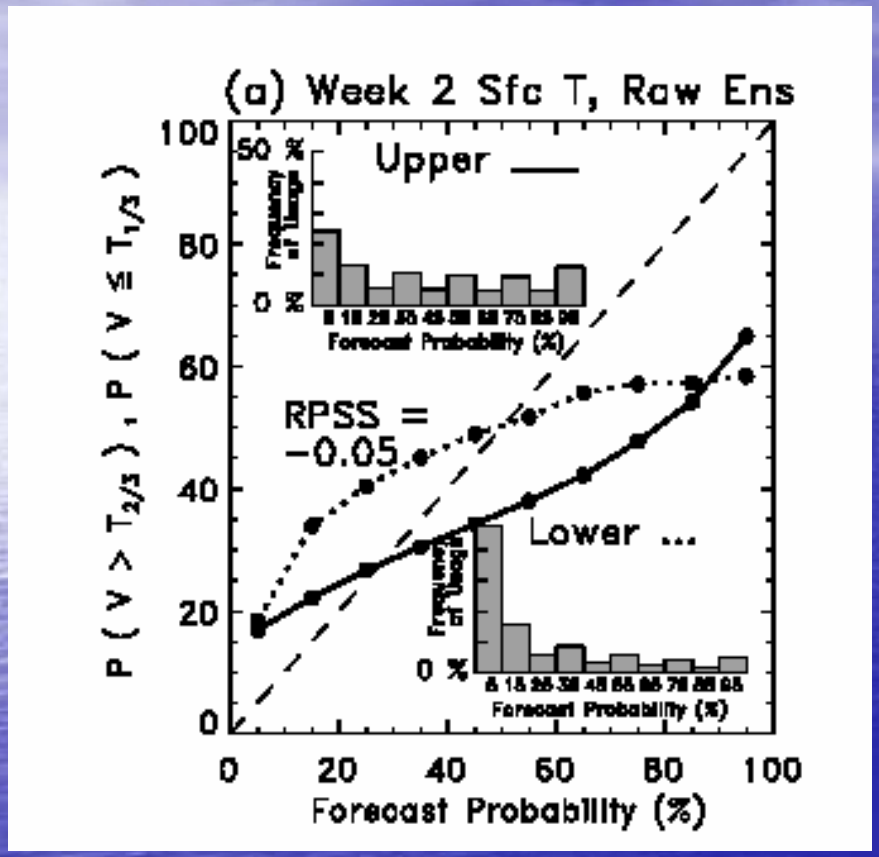
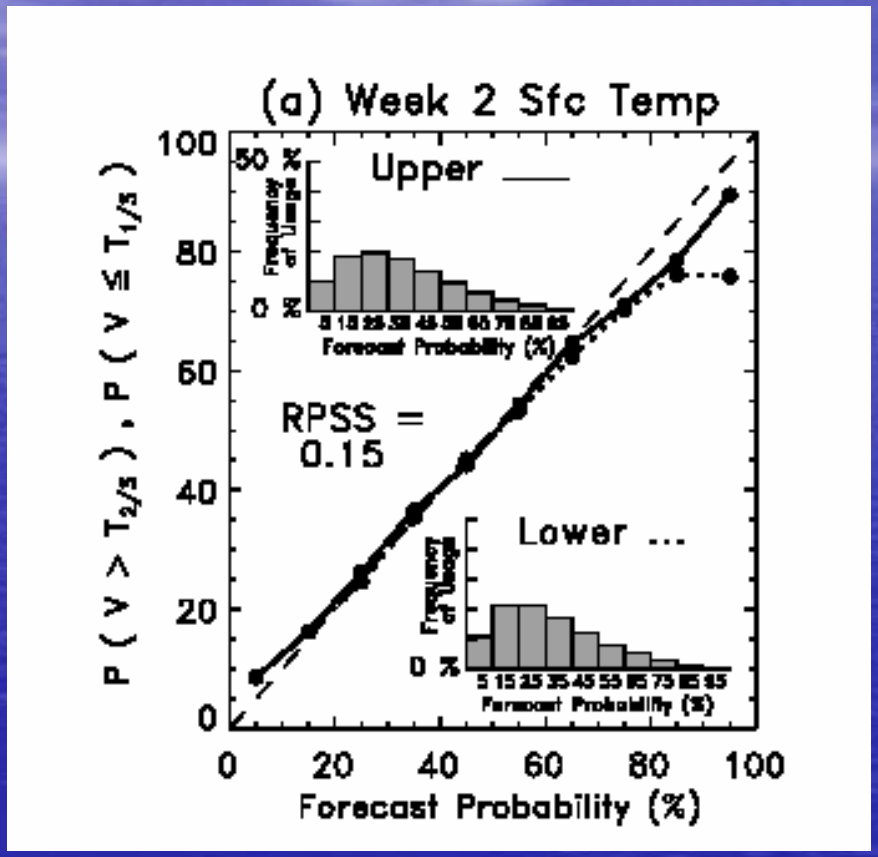
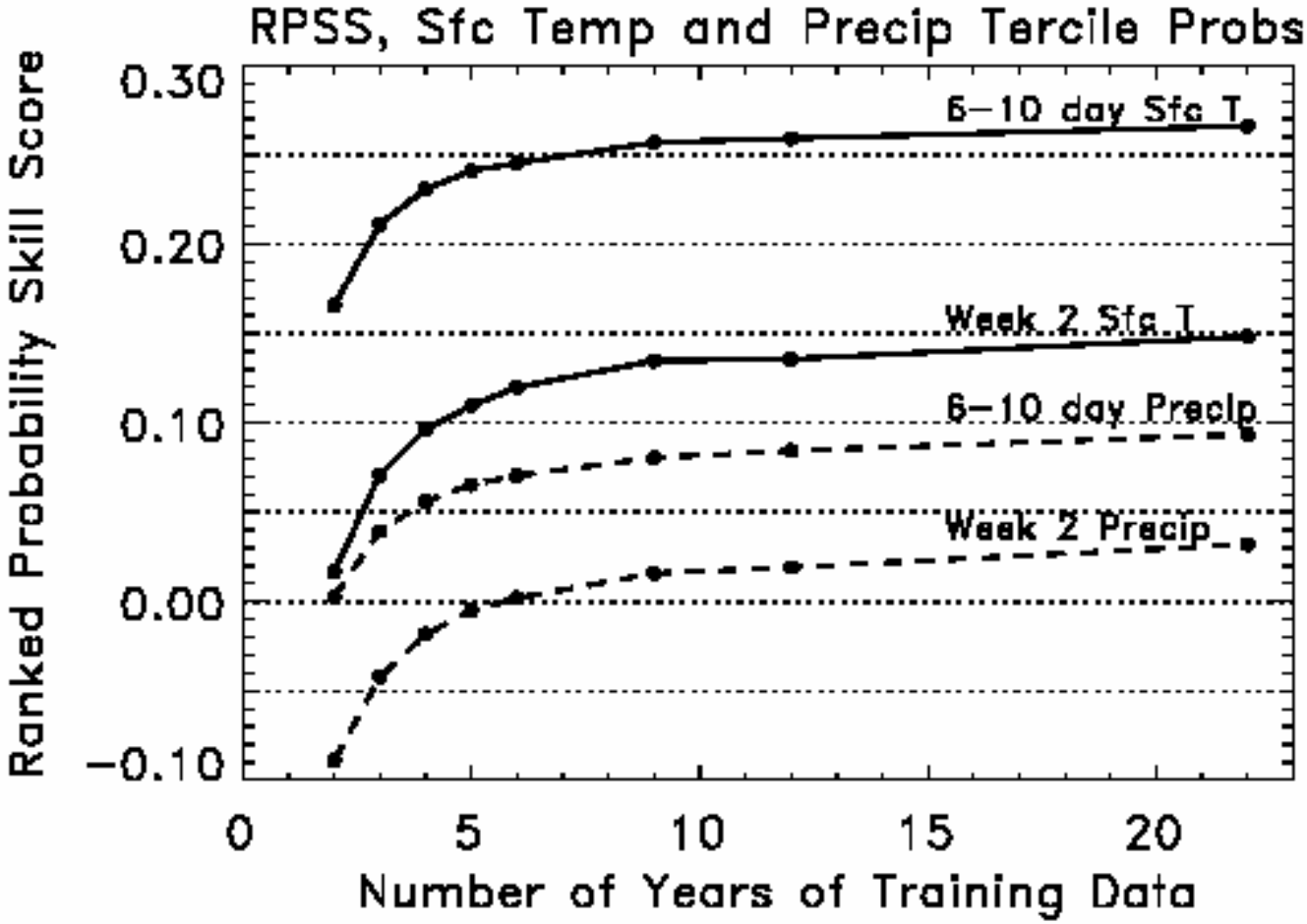
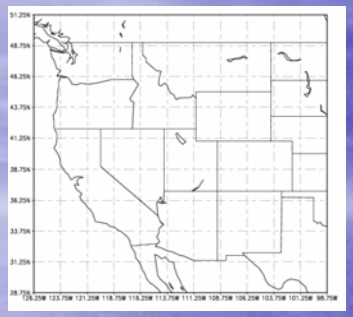
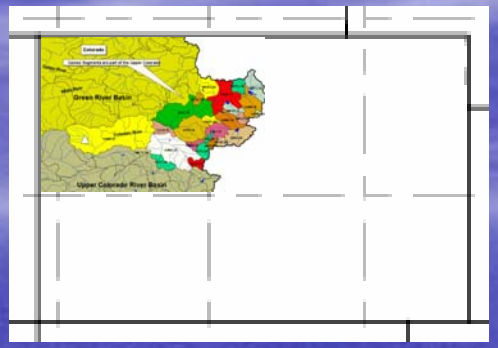

(a) Week 2 Sfc T, Raw Ens
Upper
Lower ...
RPSS = −0.05
P (V > T2/3) , P (V ≤ T1/3)
Forecast Probability (%)
Frequency of Usage
Forecast Probability (%)
0
20
40
60
80
100
50 %
0 %


(a) Week 2 Sfc Temp
Upper
Lower ...
RPSS = 0.15
P (V > T2/3) , P (V ≤ T1/3)
Forecast Probability (%)
Frequency of Usage
Forecast Probability (%)
0
20
40
60
80
100
50 %
0 %


RPSS, Sfc Temp and Precip Tercile Probs
Ranked Probability Skill Score
0.30
0.20
0.10
0.00
−0.10
0
5
10
15
20
Number of Years of Training Data
6−10 day Sfc T
Week 2 Sfc T
6−10 day Precip
Week 2 Precip

Downscaling





MRF Variables:

- 2m air temp
- Precipitation
- 700mb Relative Humidity
- Sea Level Pressure
- 10m Vector Wind
- Total Column Precipitable Water

Basin Scale Variables:

- Mean Areal Temperature
- Mean Areal Precipitation

Downscaling Method

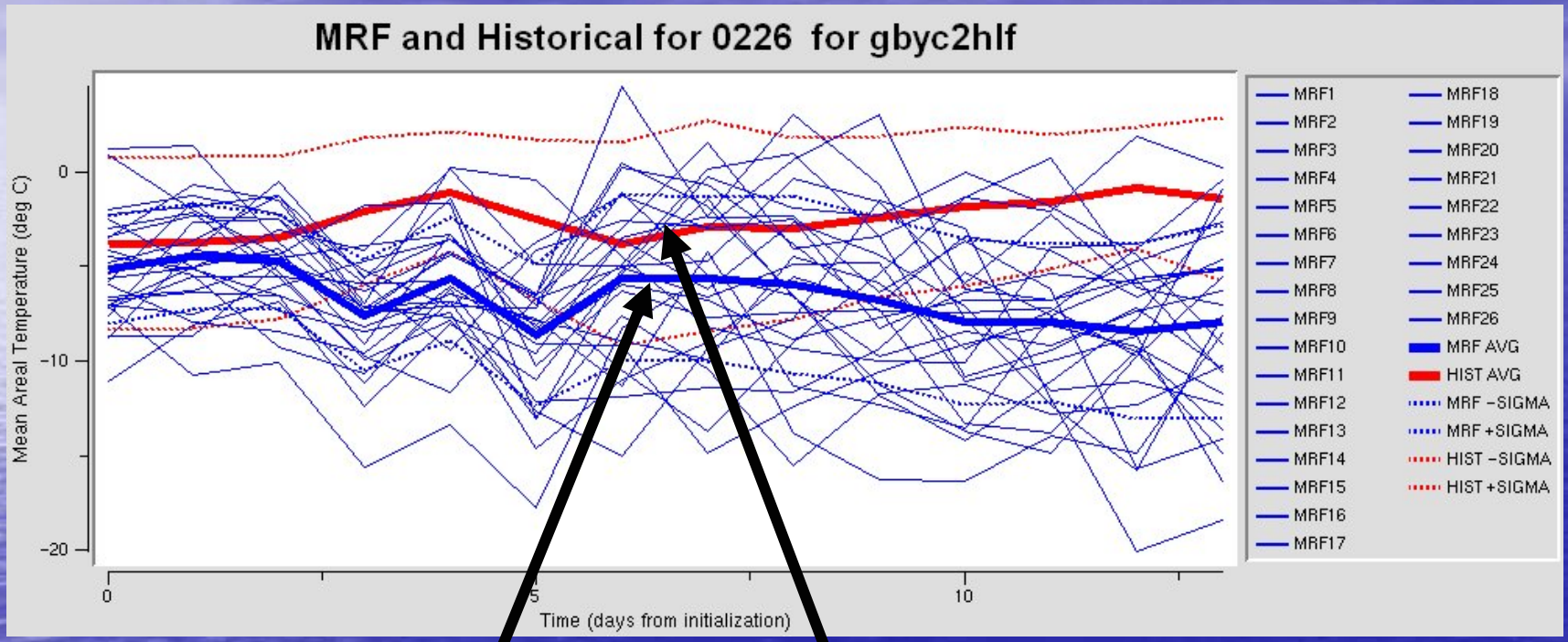
1. Relates historical MRF scale variable to historical basin scale variables through multivariate linear regression equations. For example:

   Basin MAP = a_1(MRF Precipitation) + a_2(MRF wind) + ...

2. Equations developed in (1) are applied to future MRF forecasts to produce forecasts of basin scale variables.

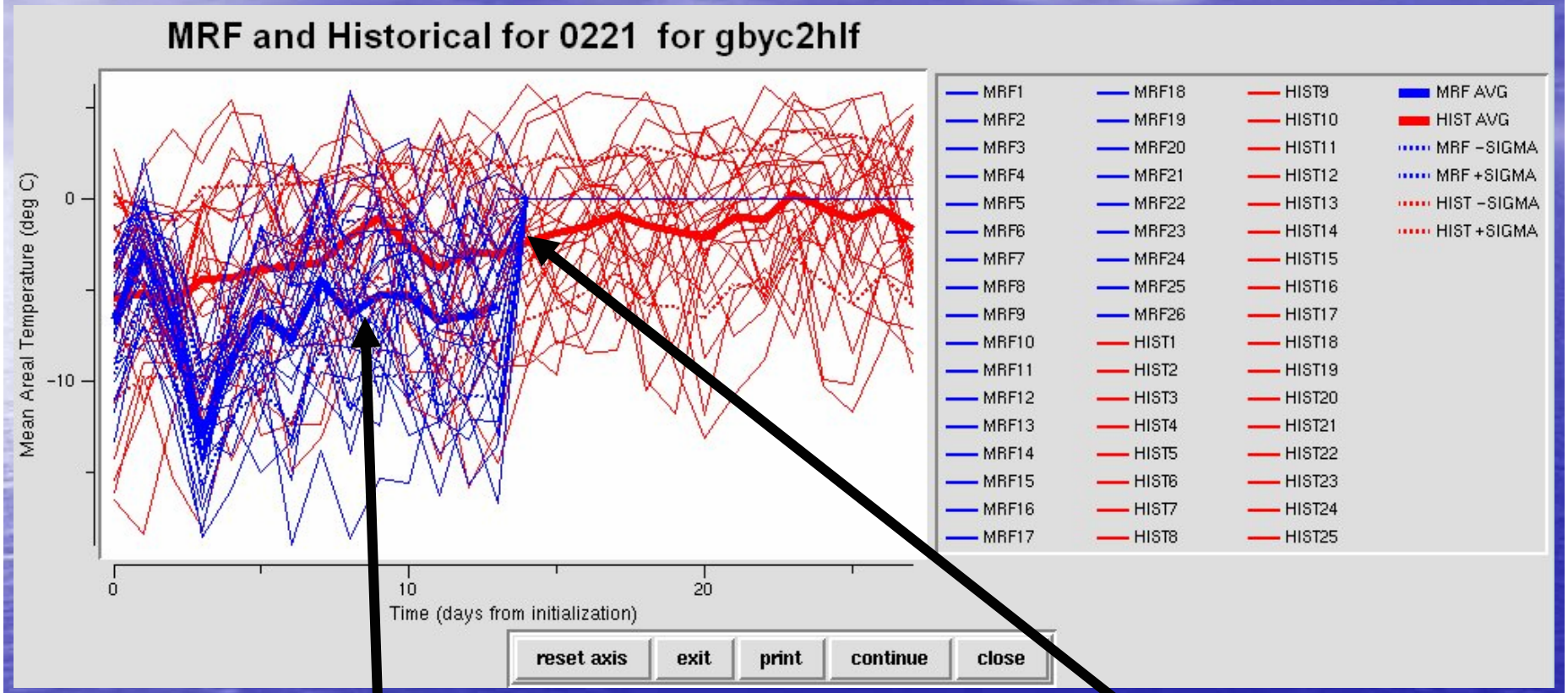
3. Multiple values at a particular time step are generated to create ensembles.

Downscaling Results



MRF is colder than normal in this case.

Input into ESP



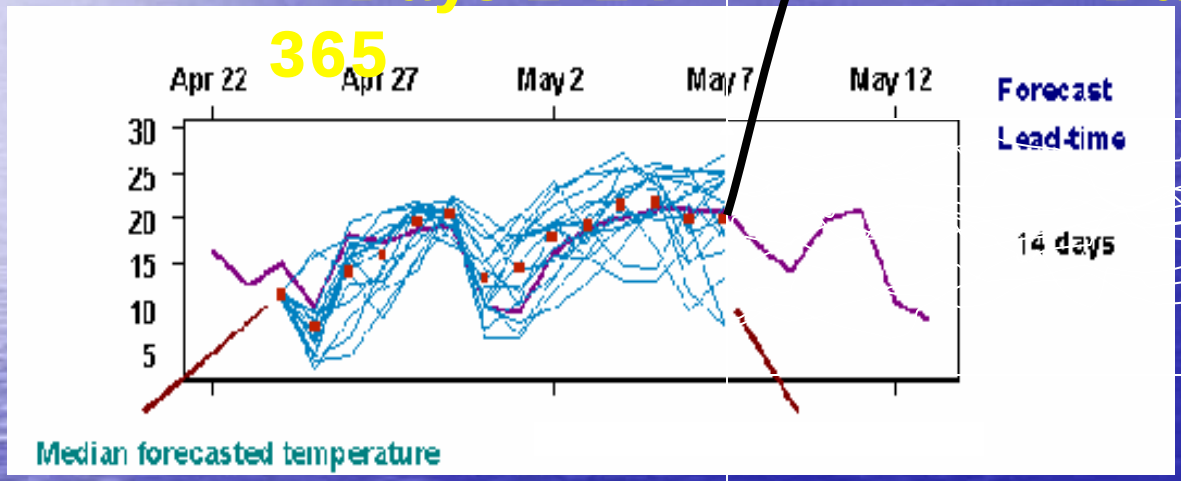
MRF derived MAT/MAPs are attached to historical years (“ensembles”) and ‘fed’ to ESP.

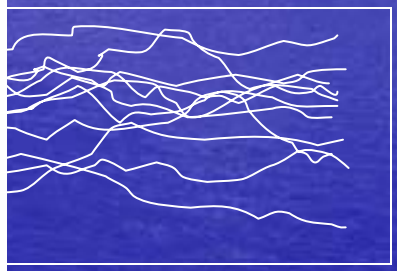
Schematic of Using Ensembles from MRF(day 1-14) As Input to ESP

Blending / Attachment

Days 1-14

Days 15-365

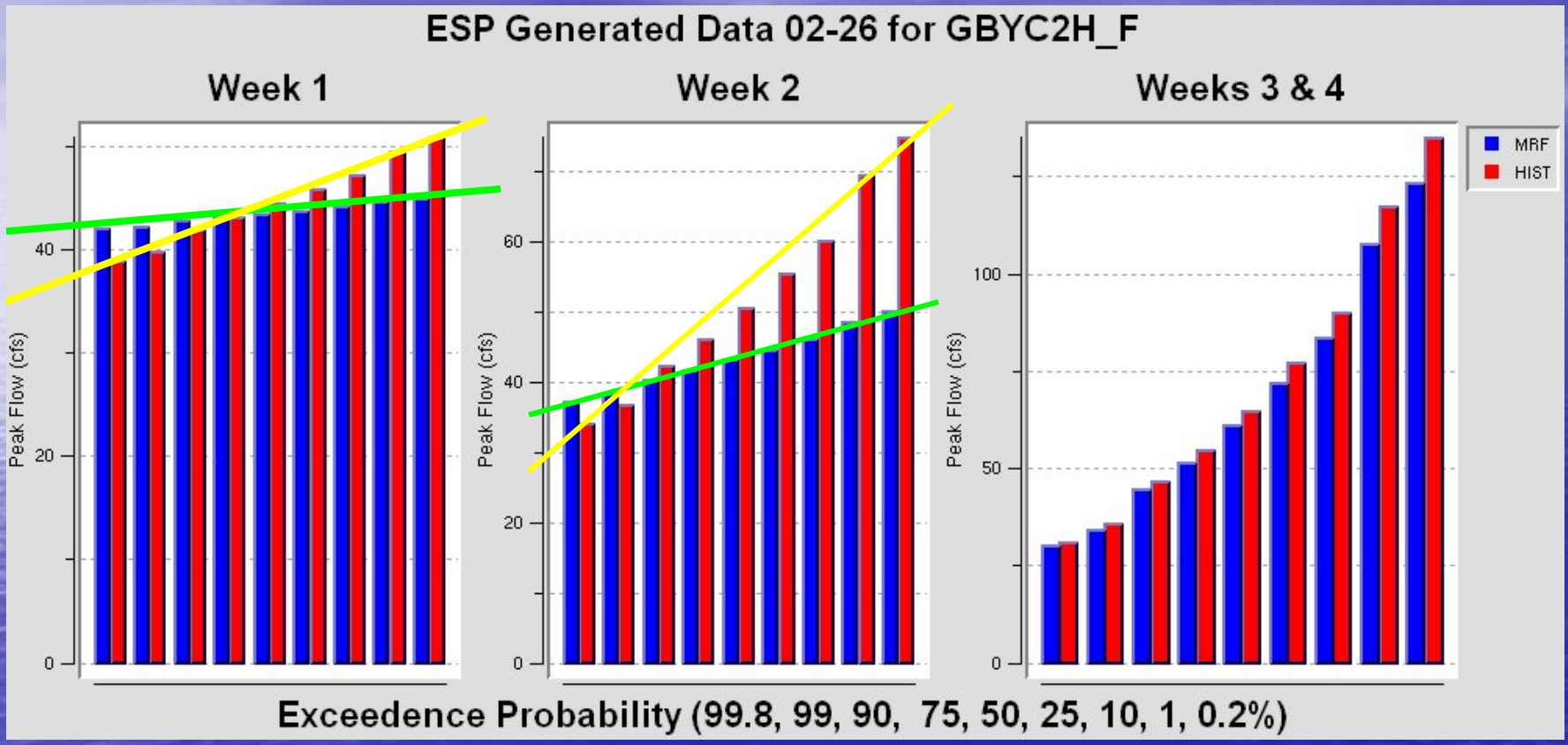




Ensembles From The 'Frozen' MRF

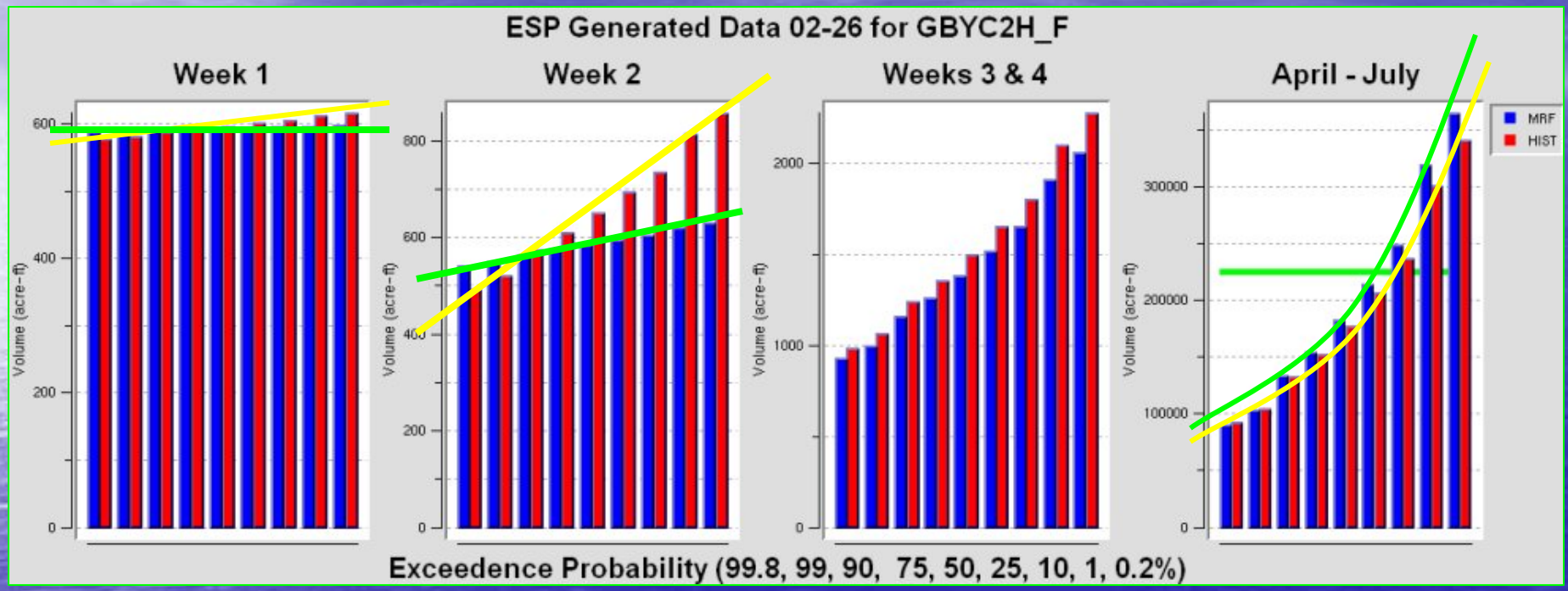
Ensembles From Historical Data

ESP peak flow



Smaller peaks because MRF is colder for first 14 days causes less melt.

ESP volumes



Smaller volumes through week 4 due to “banking” of water in colder than normal period leads to larger April – July volume.

Future Plans

- Use Statistical Weather/Climate GeneratorIn Lieu of Historical Ensembles
- Use Experimental Technique to Downscale CPC Forecasts/Apply to Historical and WX/Generator
- Use Finer Grid MM5 Forecasts to Produce Downscaled MAPS/MATs
- Investigate Downscale Errors – Lumps or Points