



Use of Weather and Climate Forecast Information in the California-Nevada River Forecast Center

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Mission of NWS Hydrologic Services Program

- Provide river and flood forecasts and warnings for the protection of lives and property.
- Provide basic hydrologic forecast information for the nation's environmental and economic well being.



NWS River Forecast Centers

CNRFC

- 245,000 sq. miles
- 182+ modeled basins
- 80+ flood forecast points
- 42+ reservoir inflows
- 50 water supply points
- Lots of people!





CNRFC Hydrologic Products and Services

Short Range Long Range

Local Flood Warning Systems Support

Flash Flood Guidance

Headwater Guidance

Flood Forecast Guidance

Reservoir Inflow Forecasts

Spring Snow Melt Forecasts

Water Supply Volume



CNRFC Hydrologic Modeling

Short Range Long Range

NWSRFS – OFS

6 hour time step, 5 day duration
modular, deterministic

NWSRFS - ESP.....

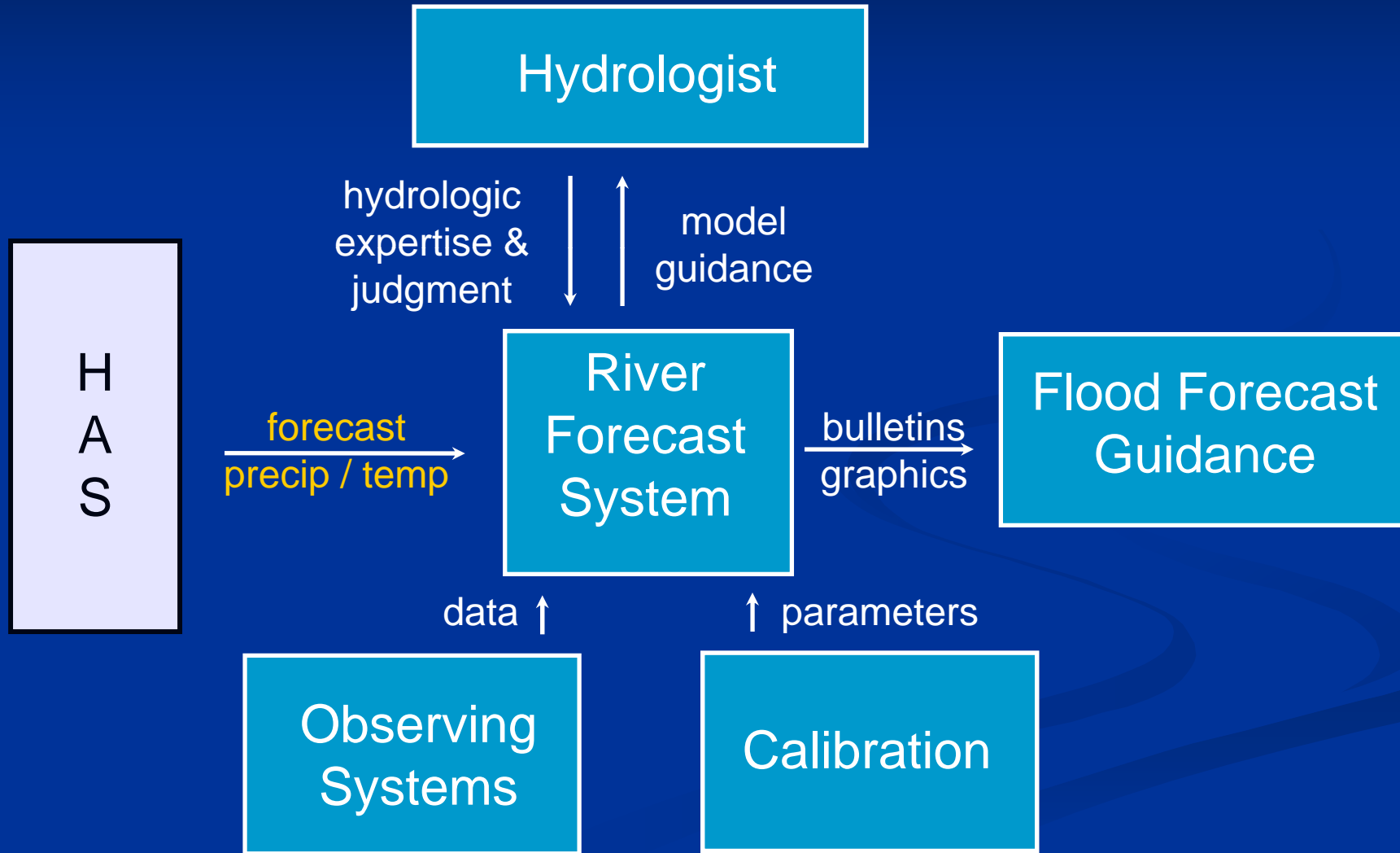
6 hour time step, ~ 1 year duration,
ensemble-based, probabilistic

Statistical

simple, efficient, inflexible
seasonal duration

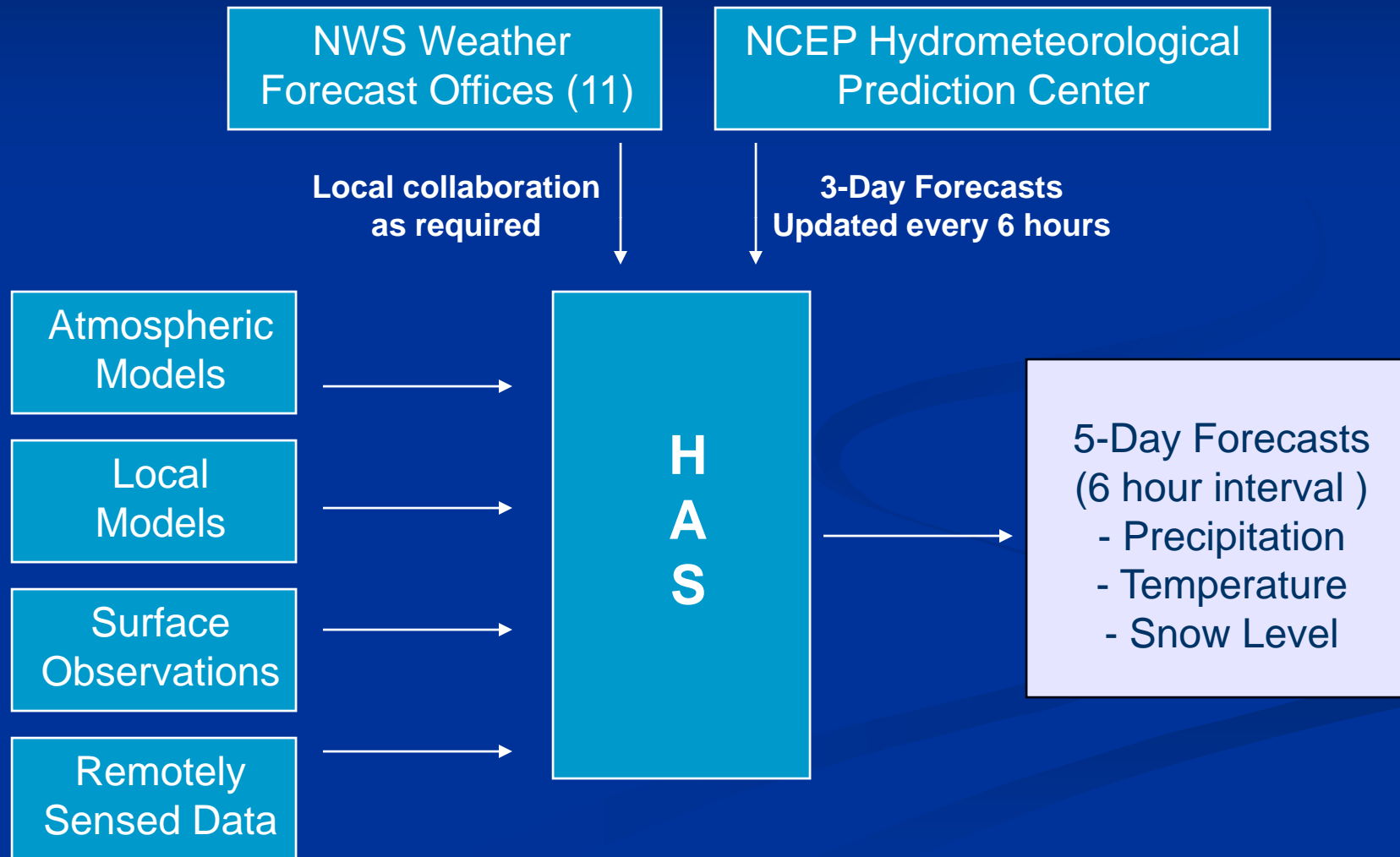


Operational Flood Forecasting





Operational HAS Function

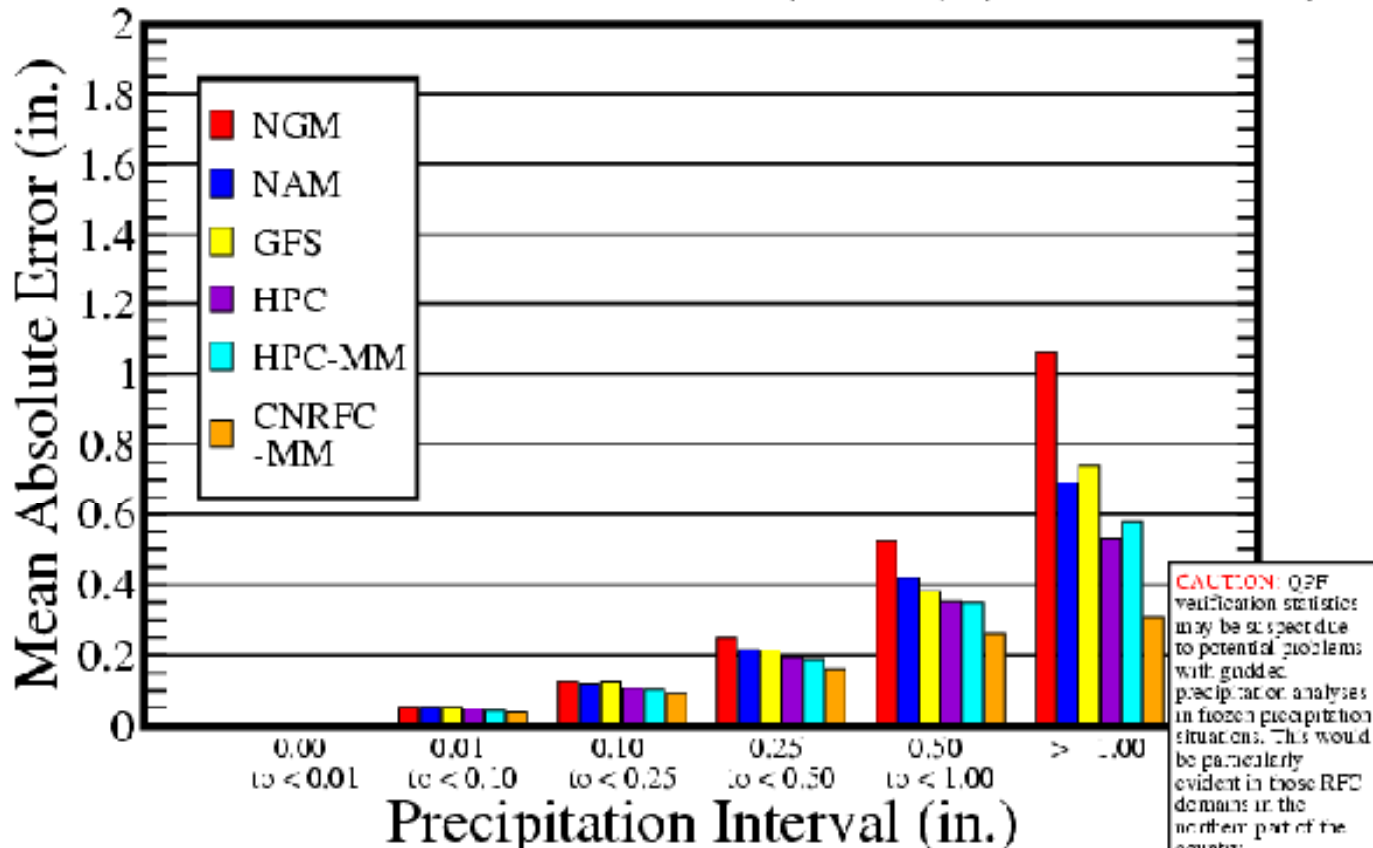




Day 1 QPF Error (Feb05)

California Nevada RFC - MAE

Feb2005 DAY1 06H GRD(32km) (OBS & FOR)



CAUTION: QPF verification statistics may be suspect due to potential problems with ground precipitation analyses in frozen precipitation situations. This would be particularly evident in those RFC domains in the northern part of the country.

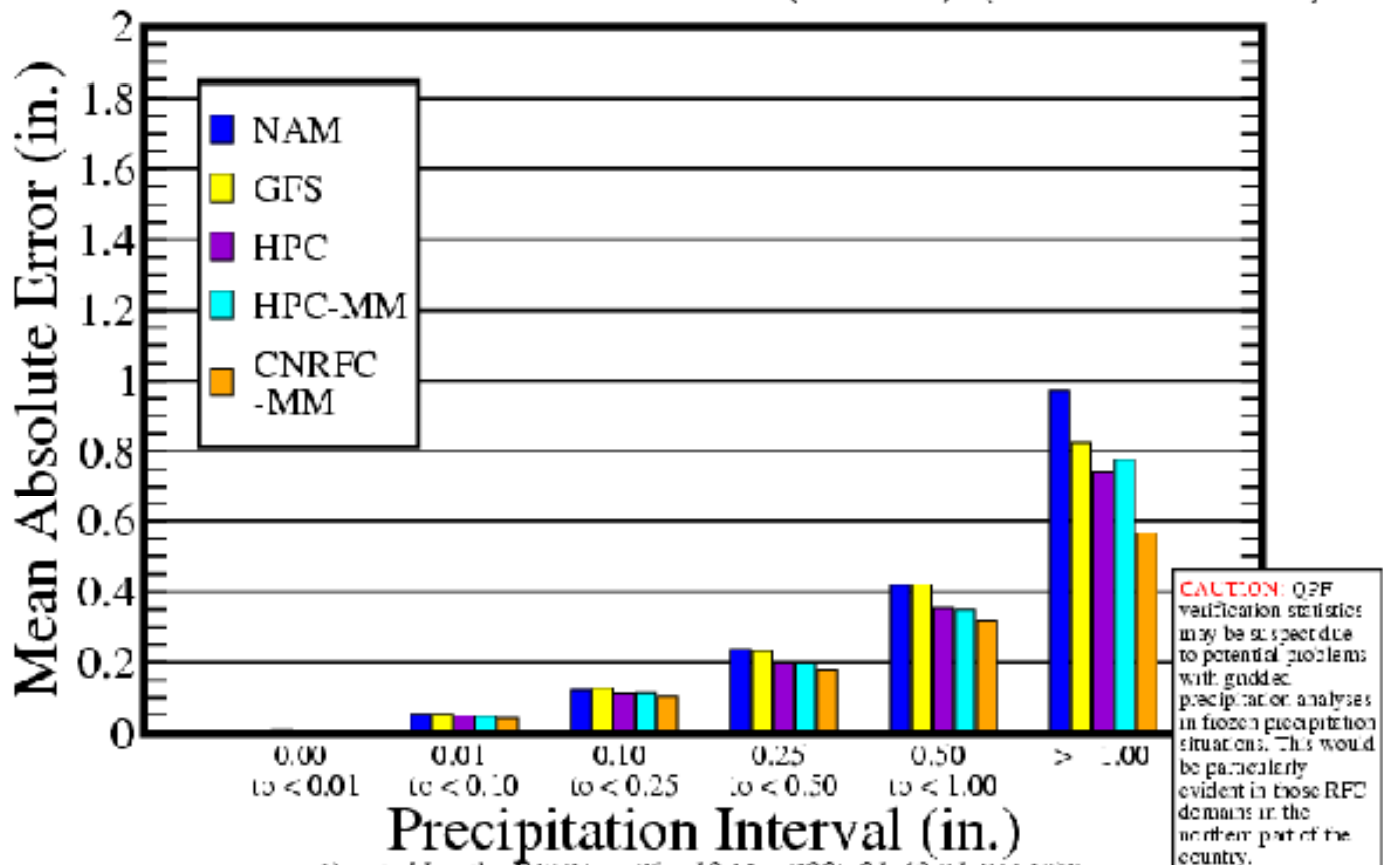
Created by the NFVU on Thu 10 Mar 2005 01:38:44 PM EST



Day 2 QPF Error (Feb05)

California Nevada RFC - MAE

Feb2005 DAY2 06H GRD(32km) (OBS & FOR)



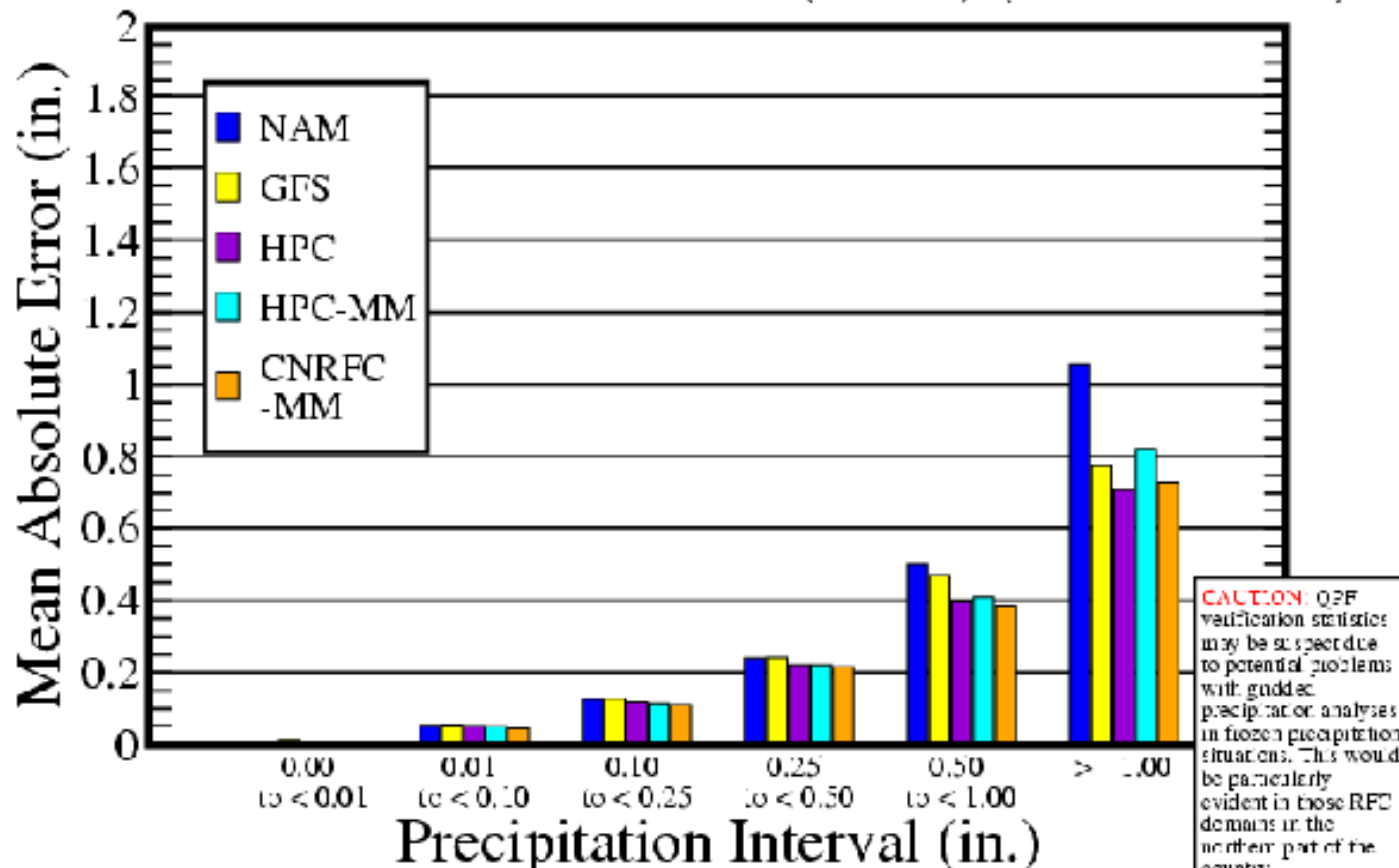
Created by the NFWU on Thu 10 Mar 2005 01:43:21 PM EST



Day 3 QPF Error (Feb05)

California Nevada RFC - MAE

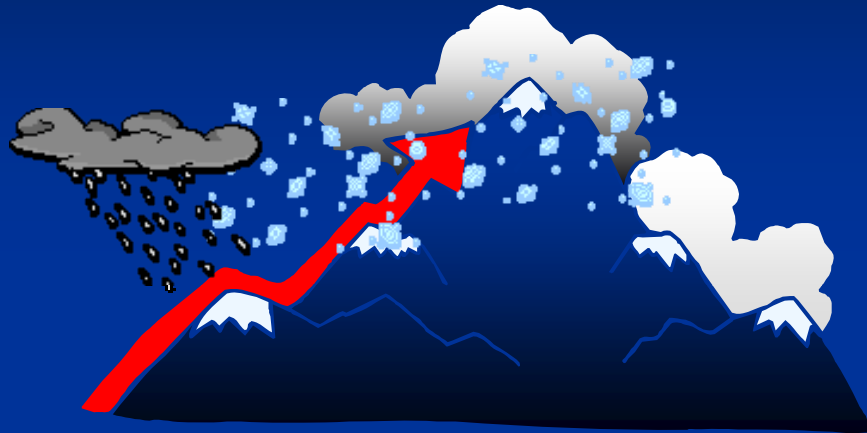
Feb2005 DAY3 06H GRD(32km) (OBS & FOR)



Created by the NFVU on Thu 10 Mar 2005 01:44:29 PM EST



Rhea Orographic Aid (Days 4-6)



- Objective tool
- Outputs 6-hour orographic QPF
- Input - NCEP gridded datasets from AWIPS
 - Eta and GFS
- Performed well during large-scale rain events in California (1986, 1997)
- Mesoscale resolution

Sample output...

```

==< SHASTA ABOVE SHASTA DAM - SHDC1
>=====
      STRDA  BEG-END  QPF  SLVL  FRZGLVL  700DIR  WIND&RH WK SSE-NNW PRDIF
6       19  16-22   .00  35     5.1   253-299  WIND&RH WK SSE-NNW PRDIF
12      19  22- 4   .04  28     4.3   299-257  WIND&RH WK SSE-NNW PRDIF

18      20   4-10   .13  26     4.1   257-228  RH ONLY NORMAL PGRAD
24      20  10-16   .17  27     4.3   228-210  RH ONLY NORMAL PGRAD
30      20  16-22   .09  28     4.4   210-109  WIND&RH WK SSE-NNW PRDIF
36      20  22- 4   .00*  30     4.6   109- 49  WIND&RH WK SSE-NNW PRDIF
MODIFIED TOTS 04-04   .38  MOD-FAC = .85  * = 700mbWD >344 or <155 DEG
42      21   4-10   .00*  38     5.4   49- 15  WIND&RH WK SSE-NNW PRDIF
48      21  10-16   .00*  51     6.6   15- 14  WIND&RH WK SSE-NNW PRDIF
54      21  16-22   .00*  57     7.3   14- 7   WIND&RH WK SSE-NNW PRDIF
60      21  22- 4   .00*  56     7.1   7-303  WIND&RH WK SSE-NNW PRDIF
MODIFIED TOTS 04-04   .00  MOD-FAC = .85  * = 700mbWD >344 or <155 DEG

```



Rhea Orographic Aid Performance

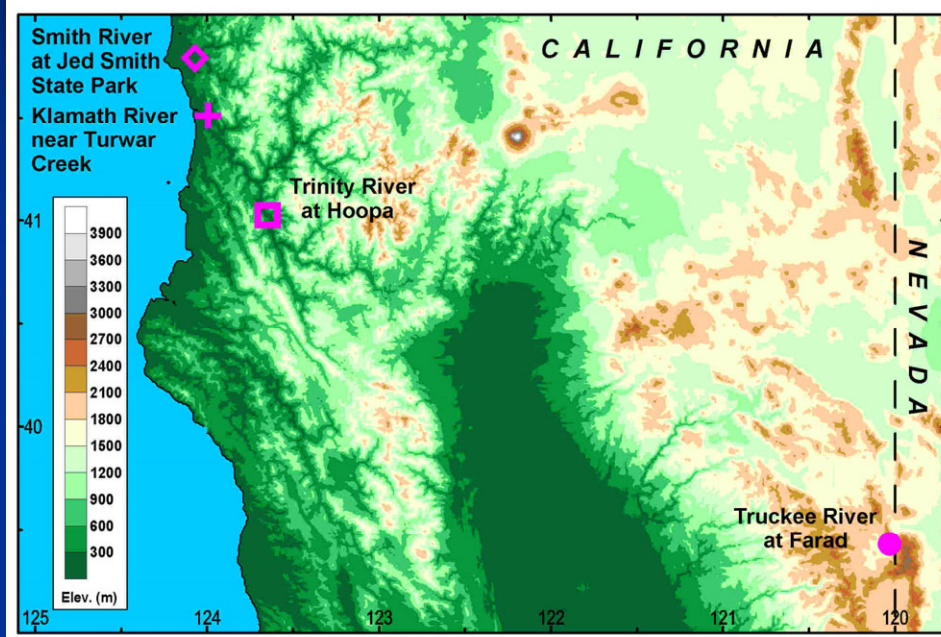
New Year's Flood 1997 – Feather River Basin

Feather River Basin - Dec/Jan 1996-97 Flood Event

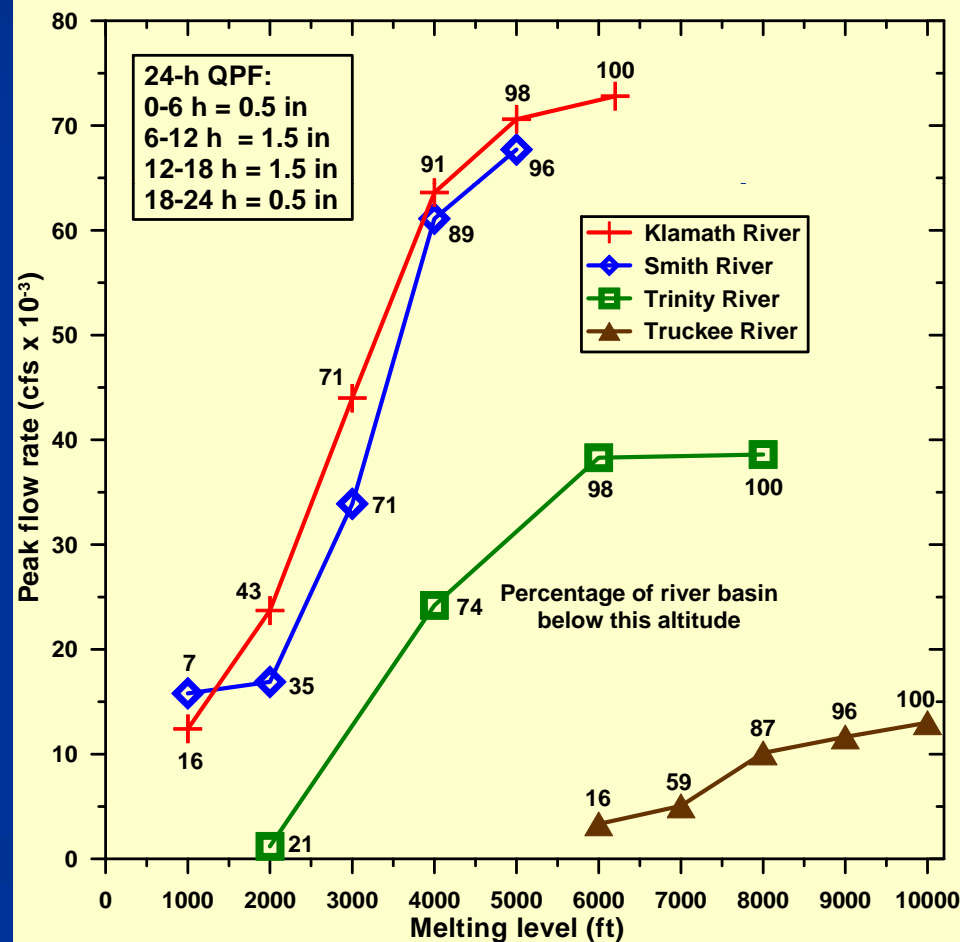
MRF Model 00 UTC	Dec 24-25	Dec 25-26	Dec 26-27	Dec 27-28	Dec 28-29	Dec 29-30	Dec 30-31	Dec 31 -Jan 01	Jan 01-02	Jan 02-03	Total Orog	Total Obsvd
12/24/96	0.0	0.2	2.1	1.0	>.3						>3.6	5.6
12/25/96		0.2	2.2	1.8	4.3	>4.6					>13.1	8.3
12/26/96			2.6	1.4	4.0	4.2	>2.1				>14.3	13.9
12/27/96				1.4	3.4	4.2	5.4	>2.2			>16.6	15.5
12/28/96					3.2	3.8	4.4	3.2	>4.3		>18.9	20.8
12/29/96						4.2	4.1	5.8	4.7	>2.7	>21.5	21.2
12/30/96							3.5	6.2	5.4	1.3	16.4	18.5
12/31/96								5.4	6.2	3.3	14.9	12.8
01/01/96									6.3	4.2	10.5	8.0
01/02/96										3.1	3.1	1.3
Observed	0.0	0.1	3.2	1.4	0.9	2.7	5.7	4.8	6.7	1.3	--	--
00 UTC Eta Model 12-36 Hour QPF												
12-36hr	0.0	0.4	2.4	*	2.8	4.1	4.3	3.7	5.7	3.4	26.8	--
Observed	0.0	0.1	3.2	1.4	0.9	2.7	5.7	4.8	6.7	1.3	--	26.8



The melting level strongly influences runoff In mountainous watersheds



CNRFC River Forecasting System
The sensitivity of watershed runoff to changes in melting level for a given 24-h QPF

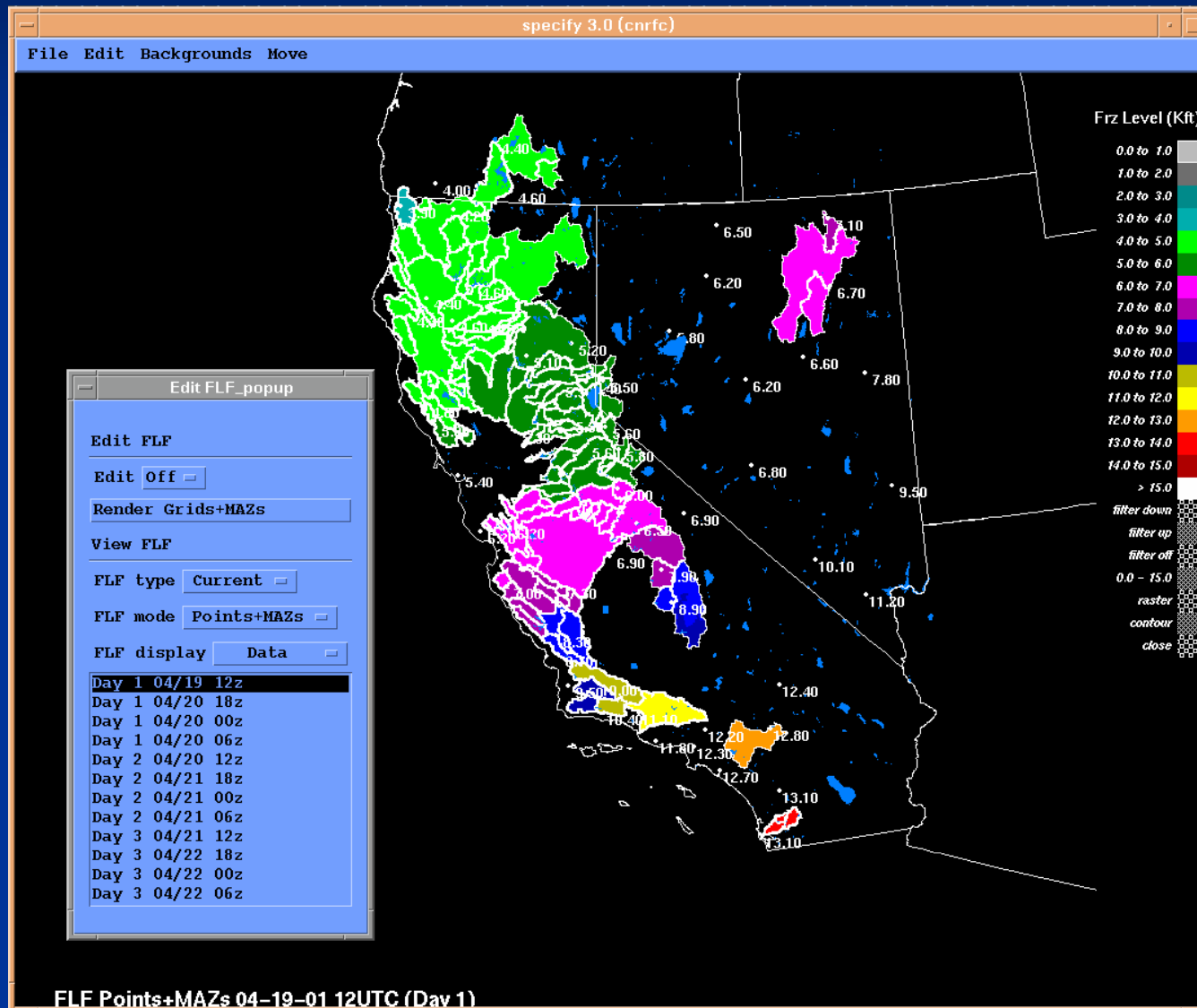


River/Basin	Area (mi ²)	Precip. (in)
Klamath	772	70
Smith	614	103
Trinity	650	63
Truckee	204	41

White et al., *JTech*, 2002



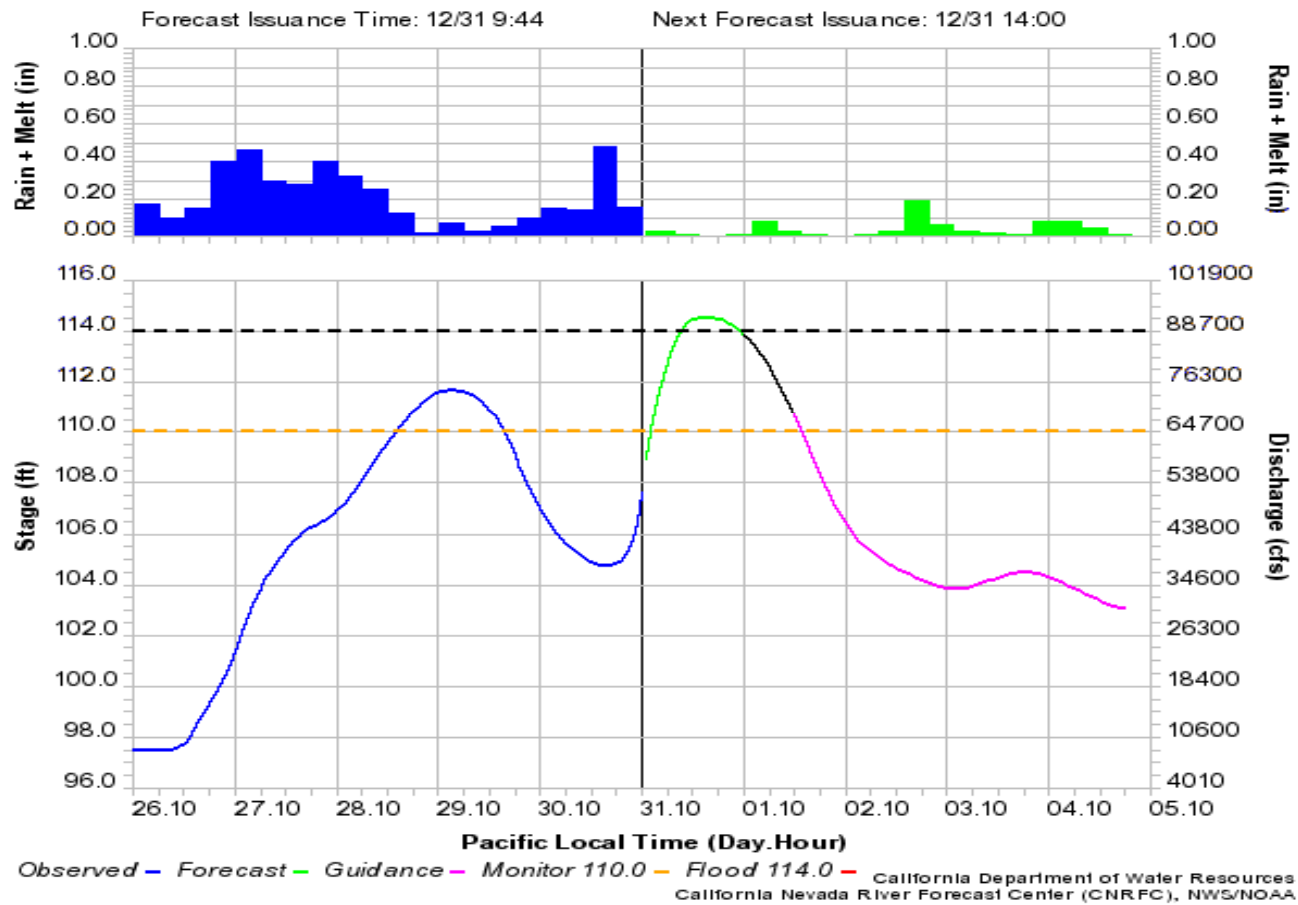
Rain-Snow Elevation Forecasts





Flood Forecast Guidance

ORFC1 - SACRAMENTO RIVER - Ord Ferry

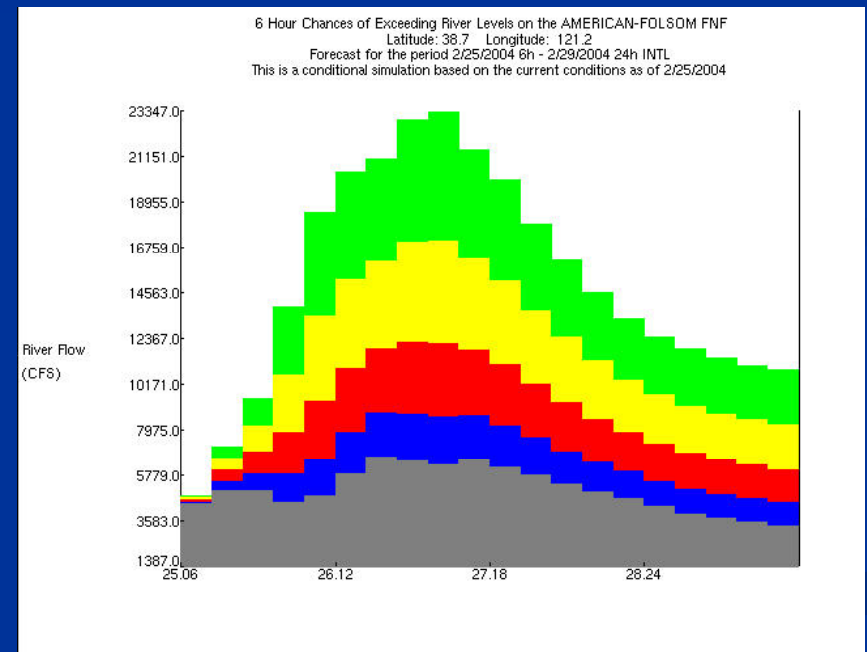
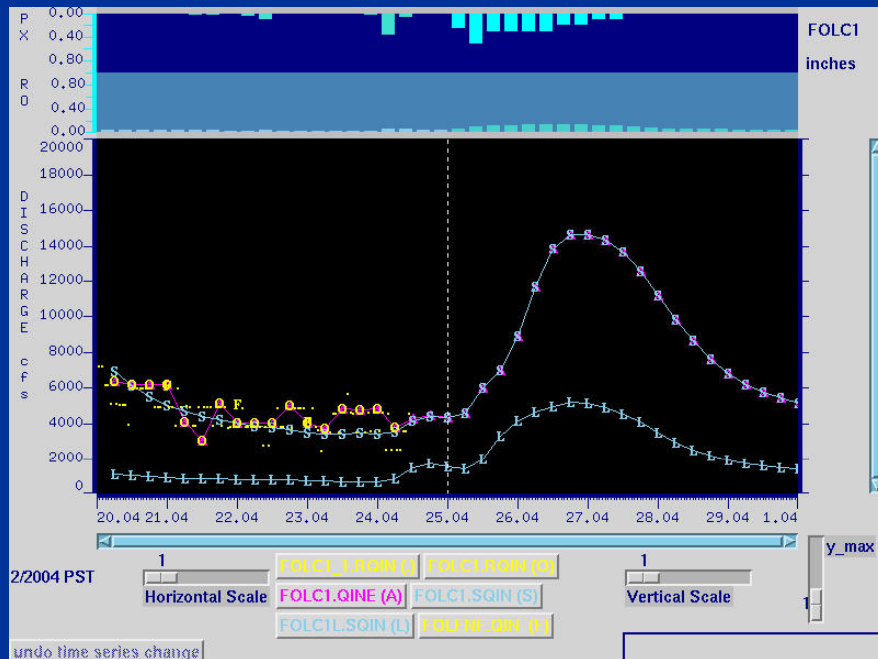


Monitor Stage: 110 feet
Flood Stage: 114 feet



Ensemble Challenges

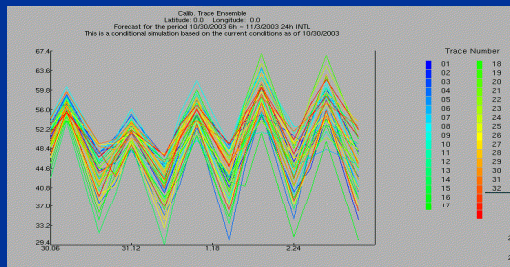
- Maintain coherence between deterministic and ensemble forecasts



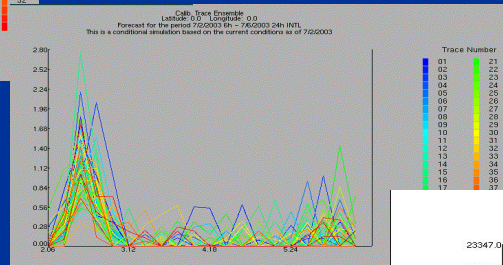


5-Day Ensemble Prototype

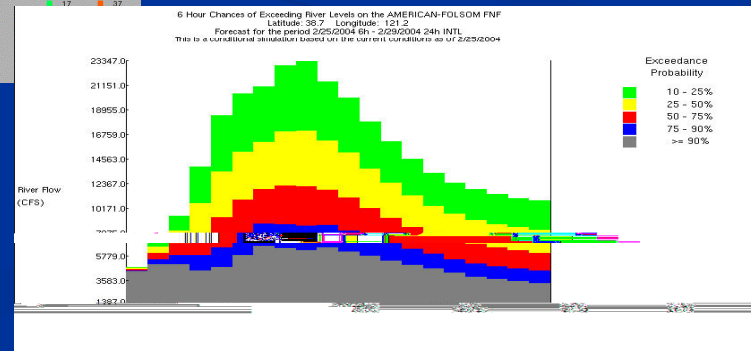
- **Status:**
 - Several RFCs collaborating with OHD on short-term prototype



Forecast Temperature Ensembles



Forecast Precipitation Ensembles



Probabilistic Reservoir Inflow



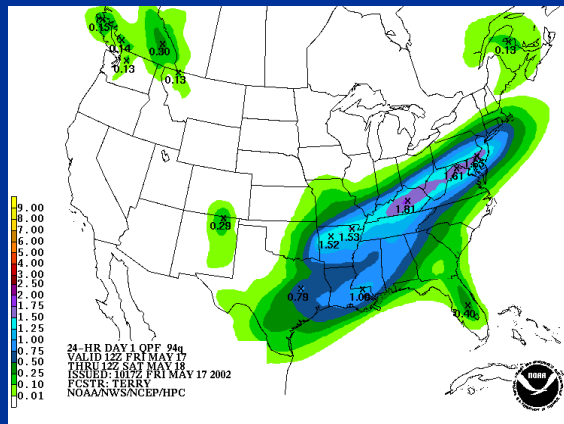
ESP Use of Weather and Climate Forecasts

Historical MAT and MAP

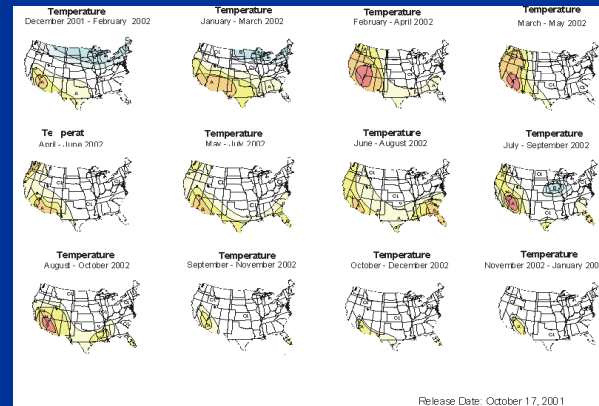
Adjustment System

Adjusted Historical MAP and MAT

Weather Forecasts



Climate Forecasts





ESP Pre-Adjustment Technique

CPCPreAdj

Initial Parameters

Contributing Region: pftc1

Initial Date (m/d/y): 5/21/2005

1-5 Day Forecast

Start Day: 21 Start Month: 5

Temp Min Anomaly (degF): 0.00

Temp Max Anomaly (degF): 0.00

Precipitation Total (inches): 0.00

6-10 Day Forecast

Start Day: 27 Start Month: 5

Temperature: below_normal

Precipitation: near_normal

Seasonal Forecast

Initial Period: Apr 2005

Period	Precipitation		Temperature	
	Category	Probability (%)	Category	Probability (%)
Apr 2005	climatology	0.00	climatology	0.00
Apr - Jun (AMJ) 2005	climatology	0.00	climatology	0.00
May - Jul (MJJ) 2005	climatology	0.00	climatology	0.00
Jun - Aug (JJA) 2005	climatology	0.00	climatology	0.00
Jul - Sep (JAS) 2005	climatology	0.00	climatology	0.00
Aug - Oct (ASO) 2005	climatology	0.00	climatology	0.00
Sep - Nov (SON) 2005	climatology	0.00	climatology	0.00
Oct - Dec (OND) 2005	climatology	0.00	climatology	0.00
Nov - Jan (NDJ) 2005	climatology	0.00	climatology	0.00
Dec - Feb (DJF) 2005	climatology	0.00	climatology	0.00
Jan - Mar (JFM) 2006	climatology	0.00	climatology	0.00
Feb - Apr (FMA) 2006	climatology	0.00	climatology	0.00
Mar - May (MAM) 2006	climatology	0.00	climatology	0.00
Apr - Jun (AMJ) 2006	climatology	0.00	climatology	0.00

Read Adjustment File Write Adjustment File Cancel

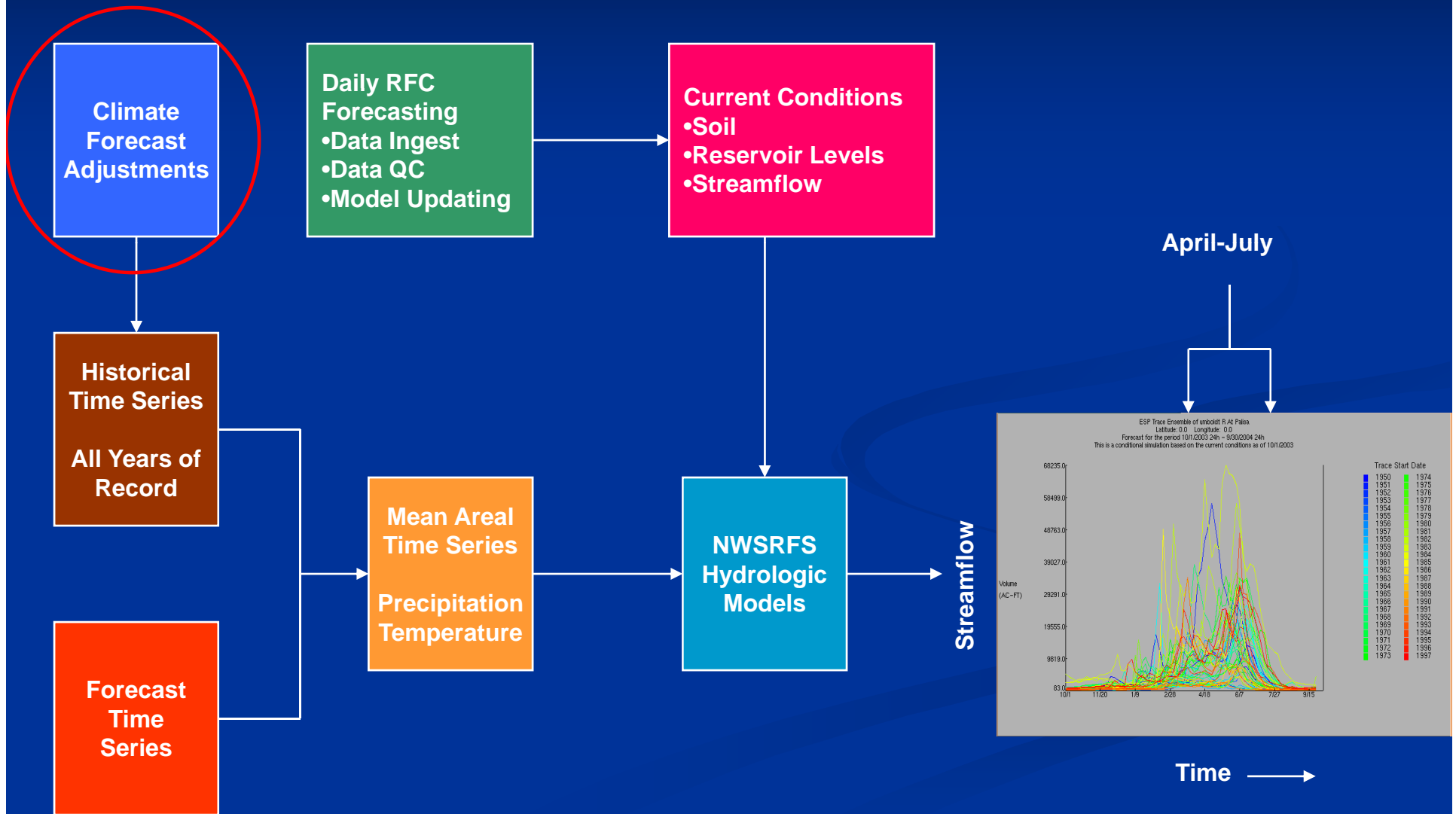
1-5 Day

Long-range

6-10 Day



Ensemble Streamflow Prediction





Thank You