Operational River Forecast Process

NWS Workshop on Hydrologic Forecasting
Prague Campus
Czech University of Agriculture
June 20-24, 2005

Two Kinds of Positions and Responsibilities in the Forecast Process

- Hydrometeorologists
  HAS Responsibility (Hydrometeorological Analysis Support)
  - Educational Background: Meteorology
  - Experts in the Meteorological Inputs
  - Intensive Quality Control
  - Future Inputs for the Hydrologic Model

- Hydrologists
  River Forecast Responsibility
  - Educational Background: Hydrology, Water Resources, Civil Engineering, Meteorology
  - Experts Using the Hydrologic Models
  - Perform real time modifications to the models if needed
  - Prepare the operational river forecasts

Operational River Forecast Process

HYDROMETEOROLOGISTS HAS RESPONSIBILITY

HYDROLOGISTS

RIVER FORECAST RESPONSIBILITY

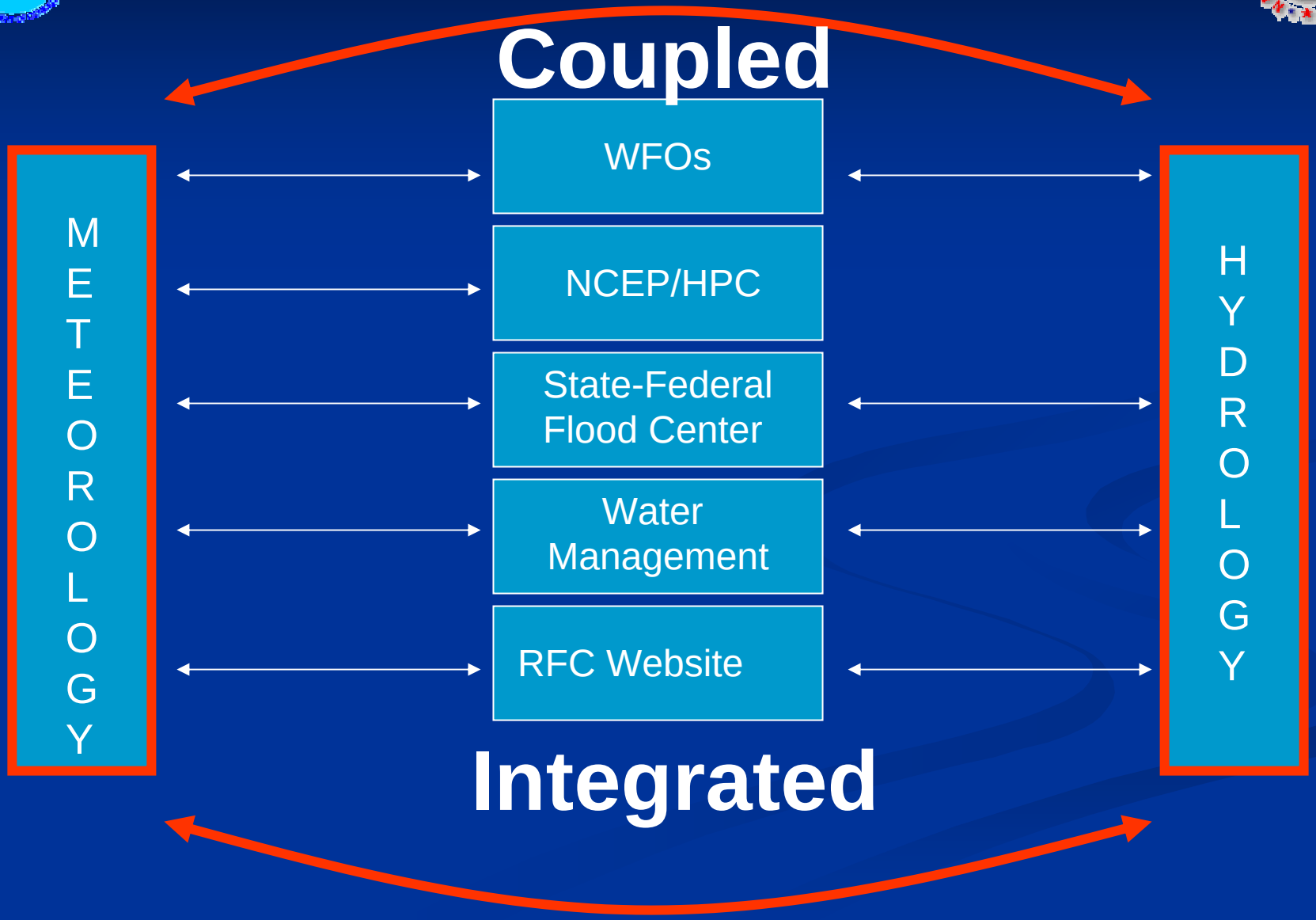
hydrologic expertise & judgment ↓ ↑ model guidance

Forecast precip / temp → River Forecast System NWSRFS → Outputs Graphics → River Forecasts

data ↑ Observed Data

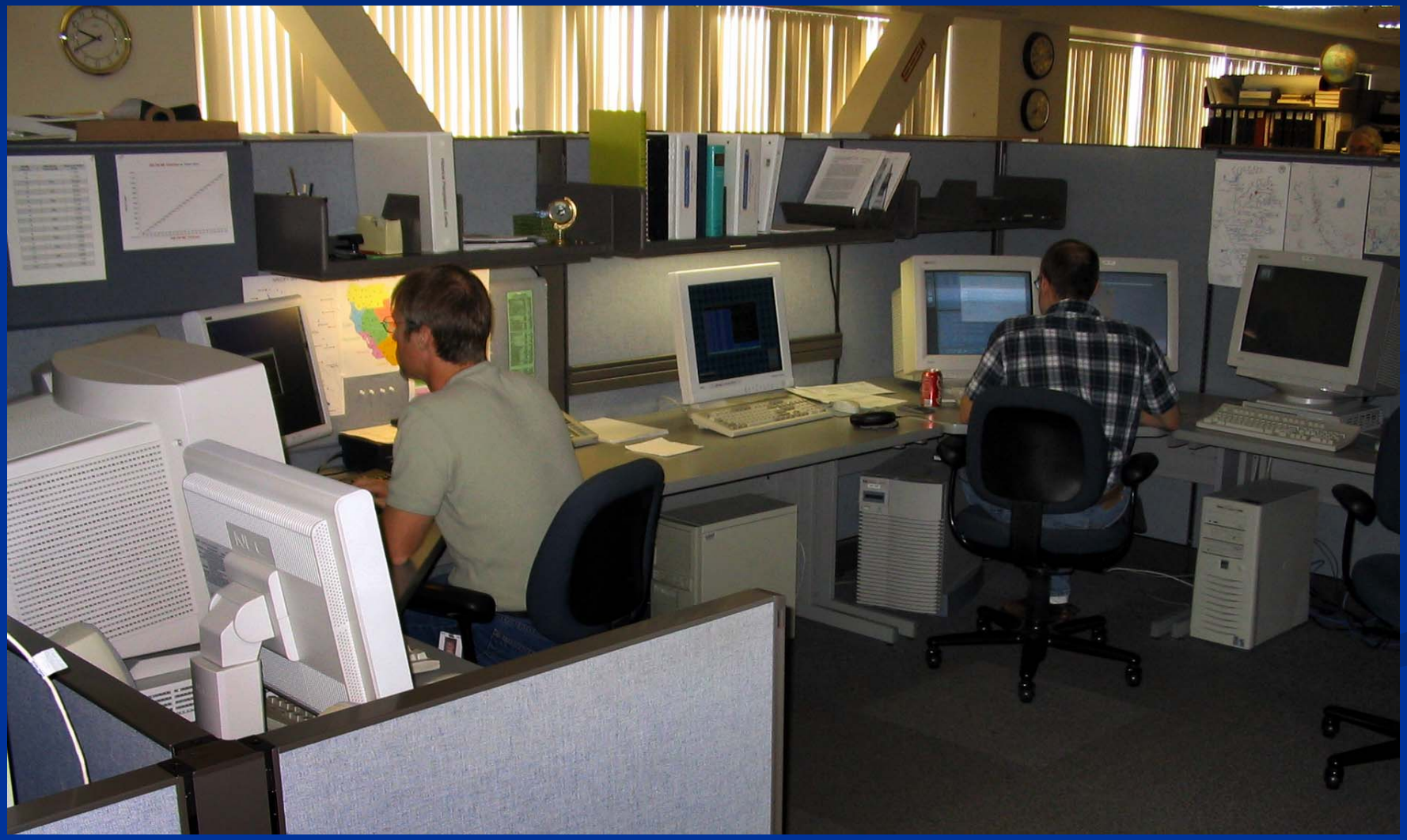
↑ parameters Calibration

RFC
Hydrometeorolgicial Operations



HAS Operations

Hydrometeorological Analysis and Support



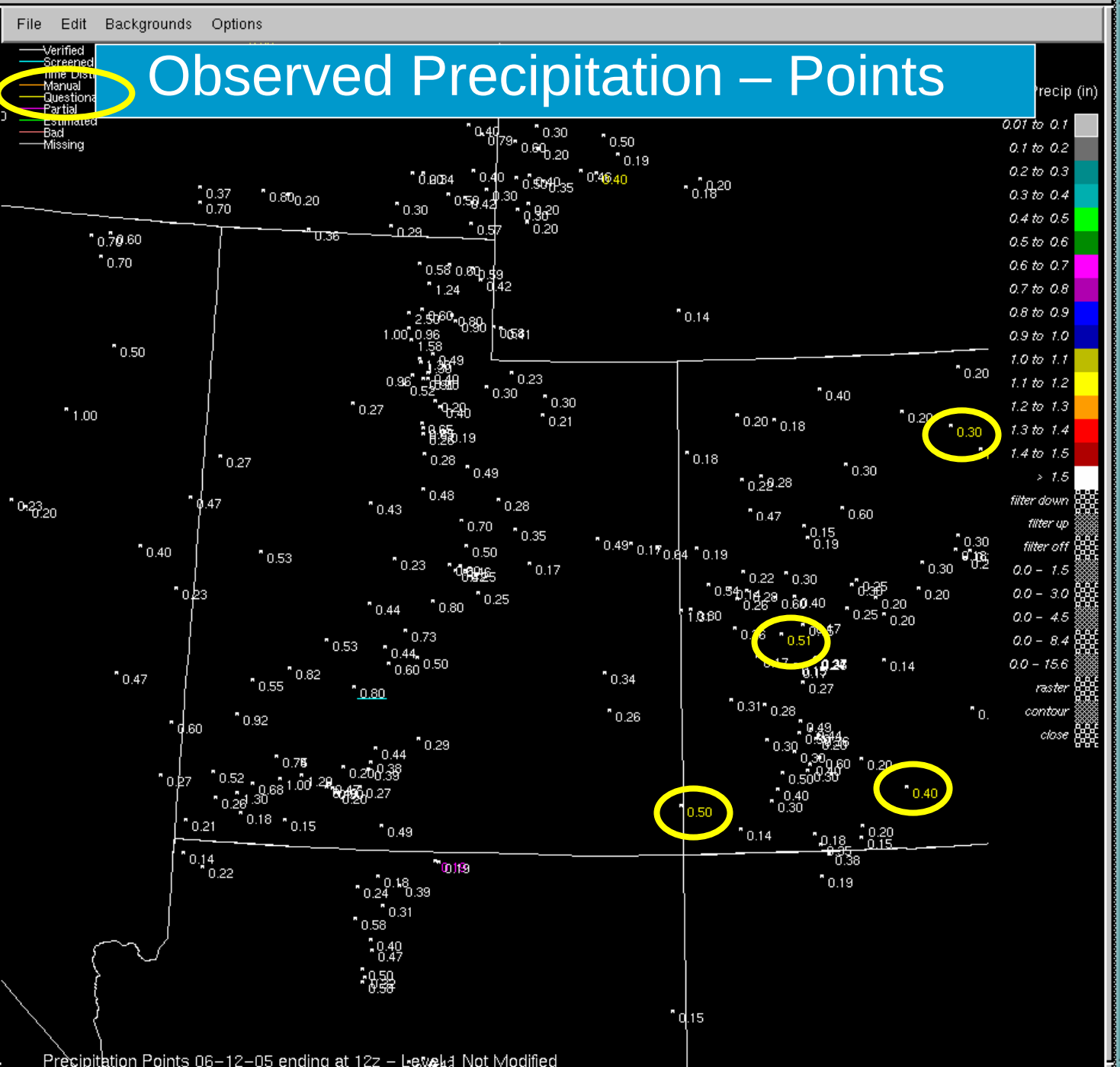
Hydrometeorologist
Hydrometeorological Analysis Support

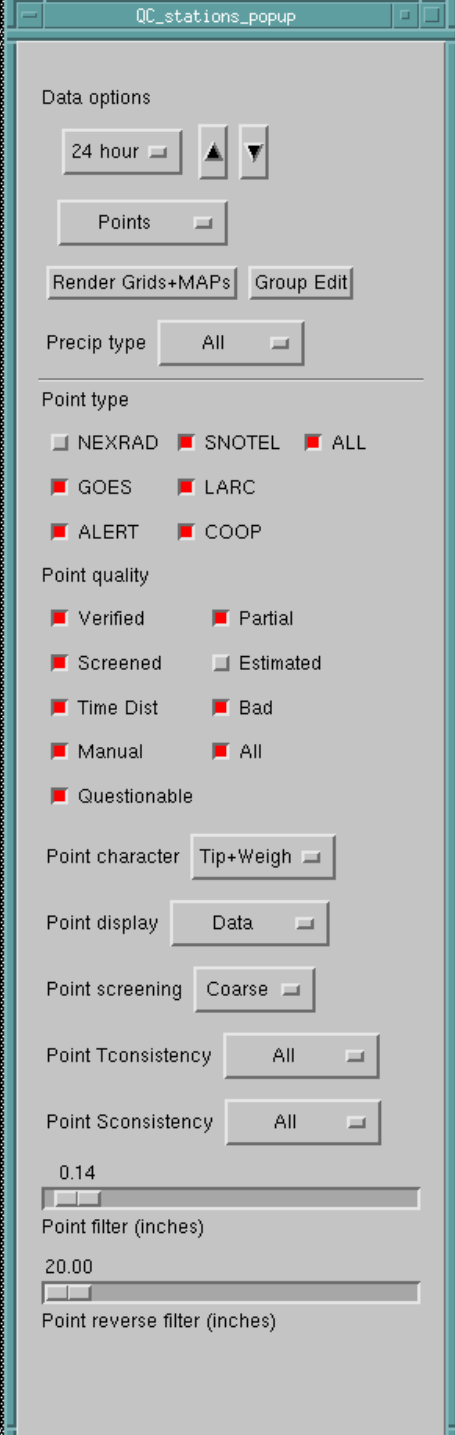
- Principle Responsibility in RFC Operations
- Duties Can Vary Among RFCs
- Focuses on Meteorological Inputs
  - Quality Control Current Precipitation/Temperature
  - Prepare Future Precipitation (QPF)
  - Prepare Future Temperature (QTF)
  - Prepare Future Freezing Level

Quality Control Weather Inputs

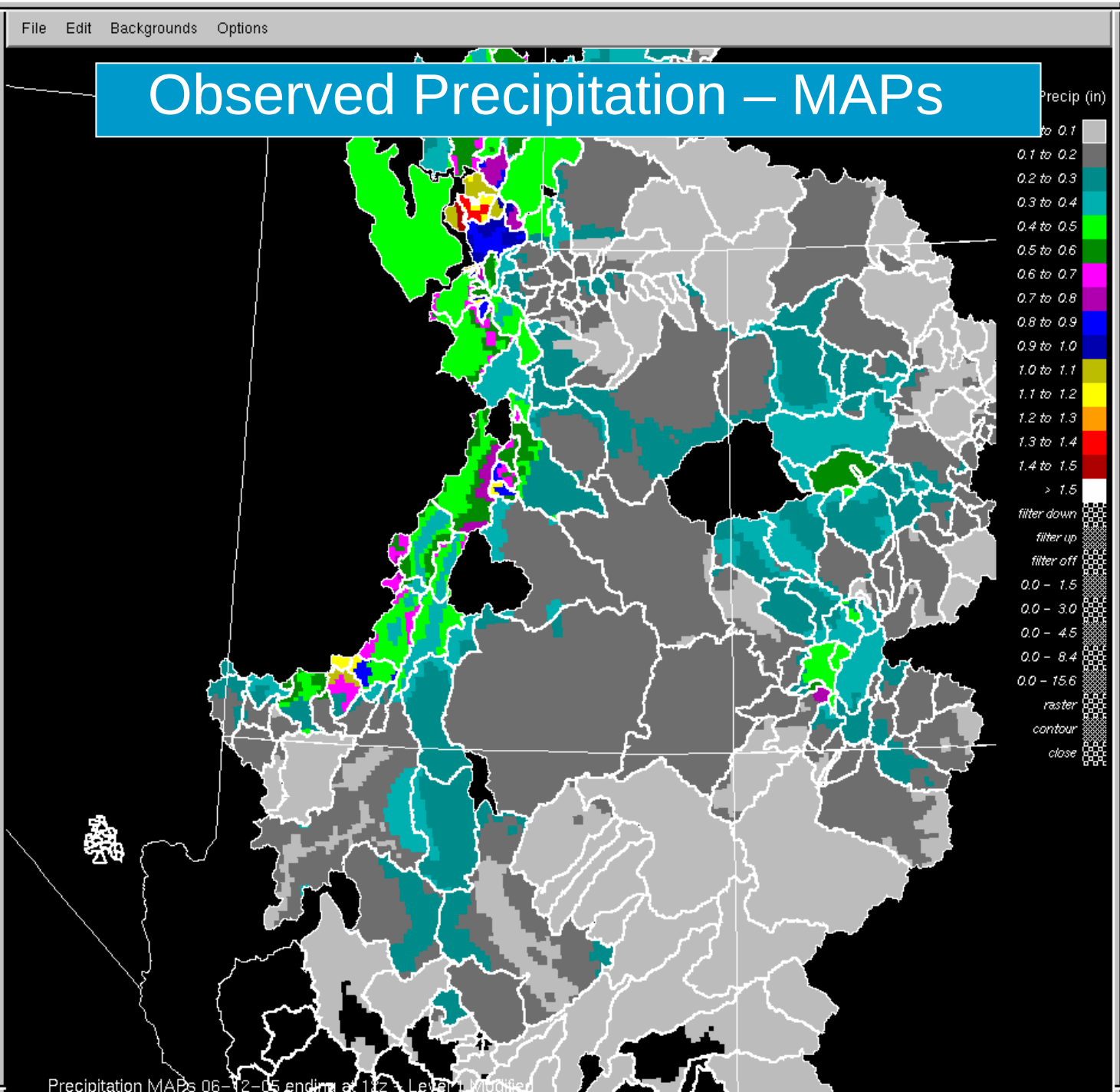
- Observed Precipitation
- Observerd Temperature
- Observed Freezing Level

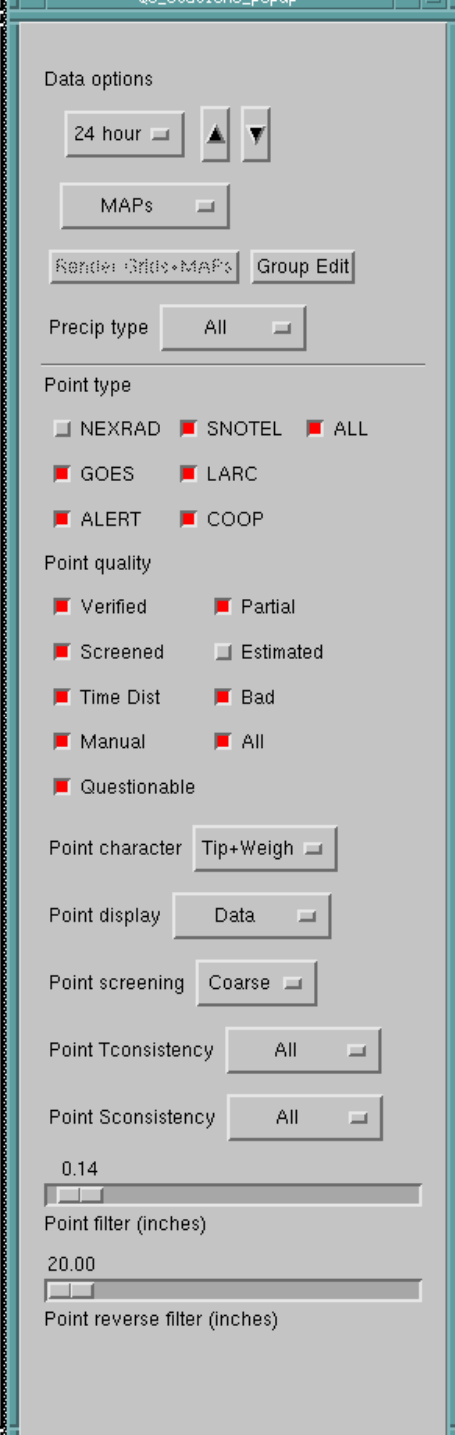
Observed Precipitation – Points



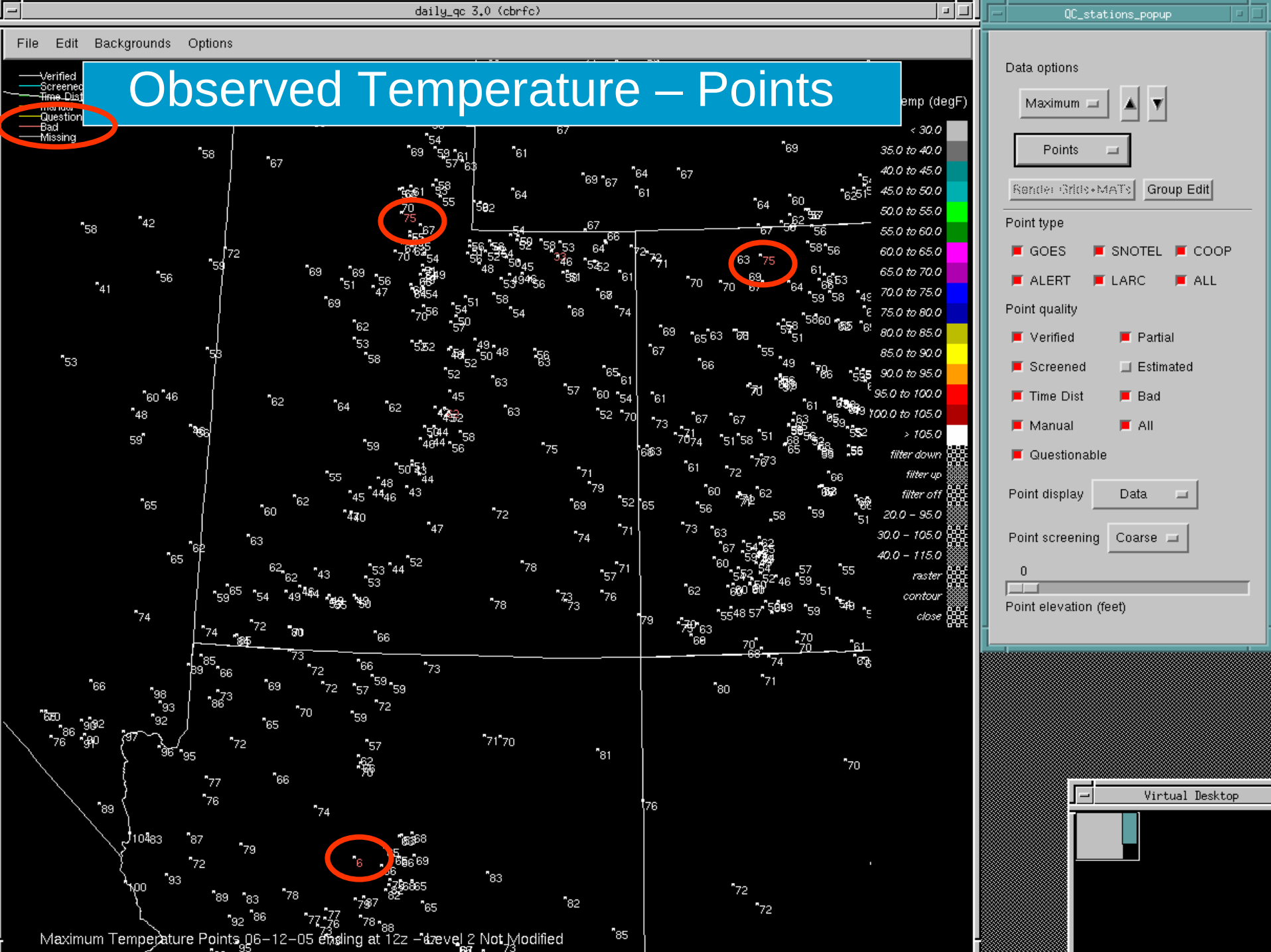


Observed Precipitation – MAPs

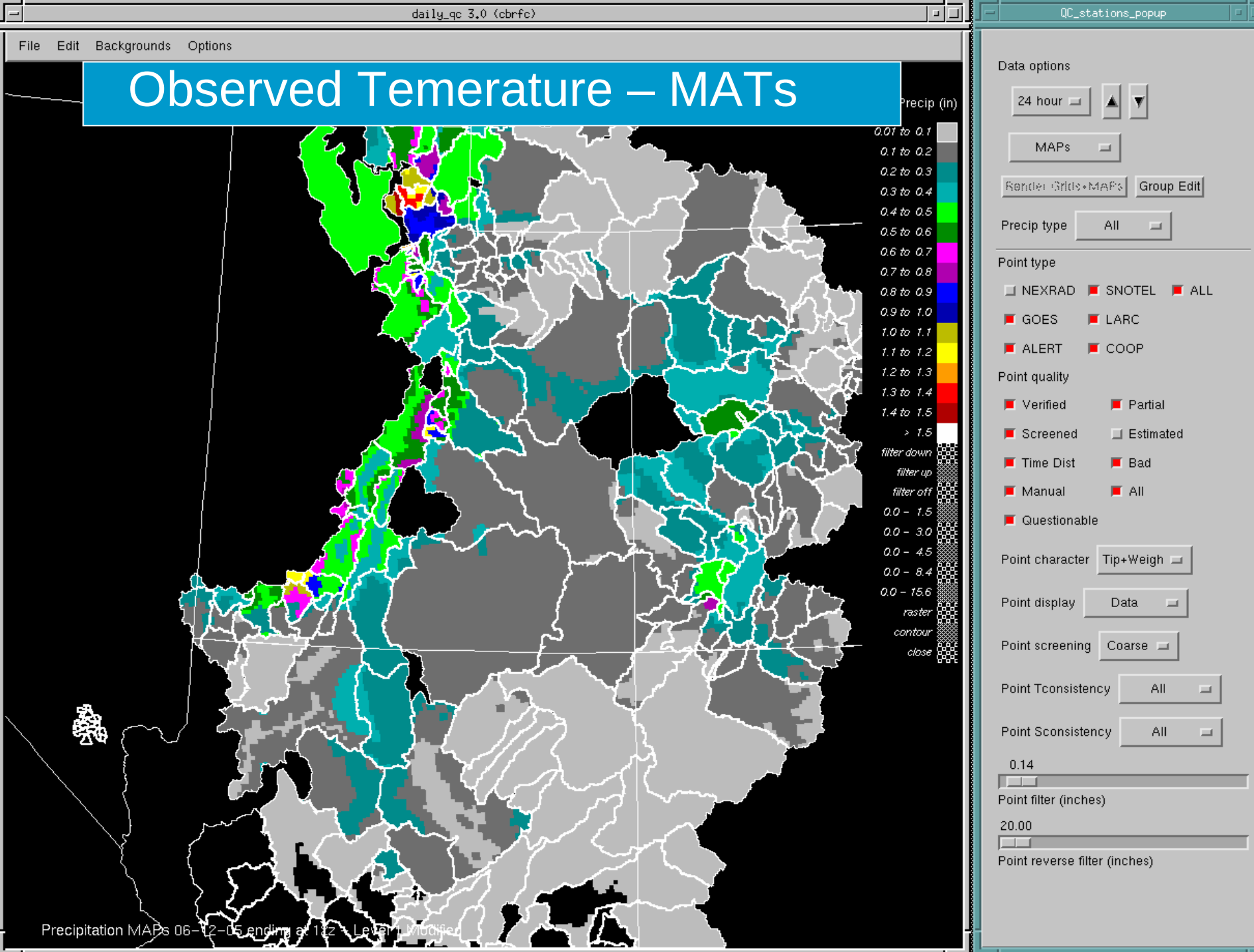




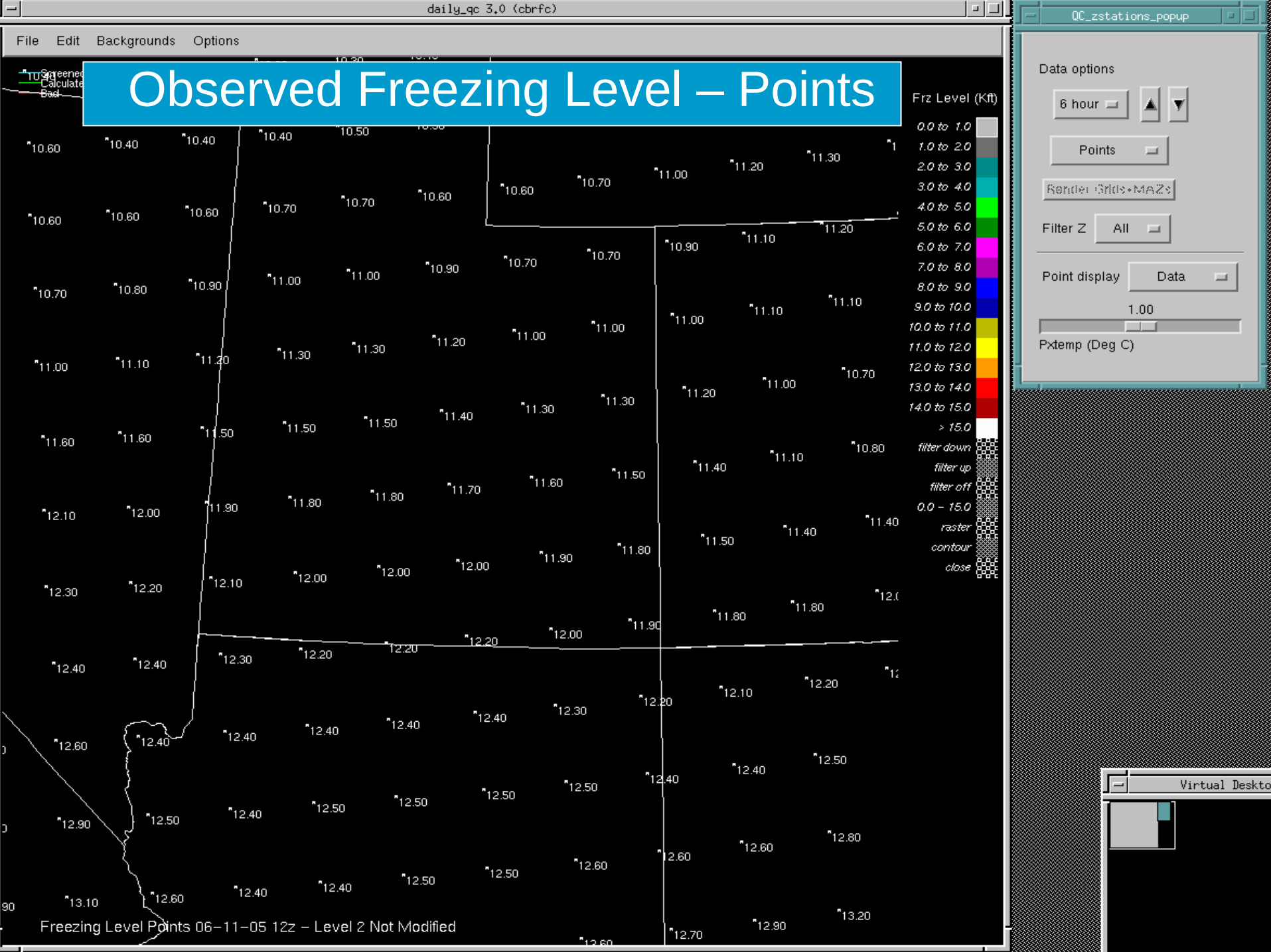
Observed Temperature – Points



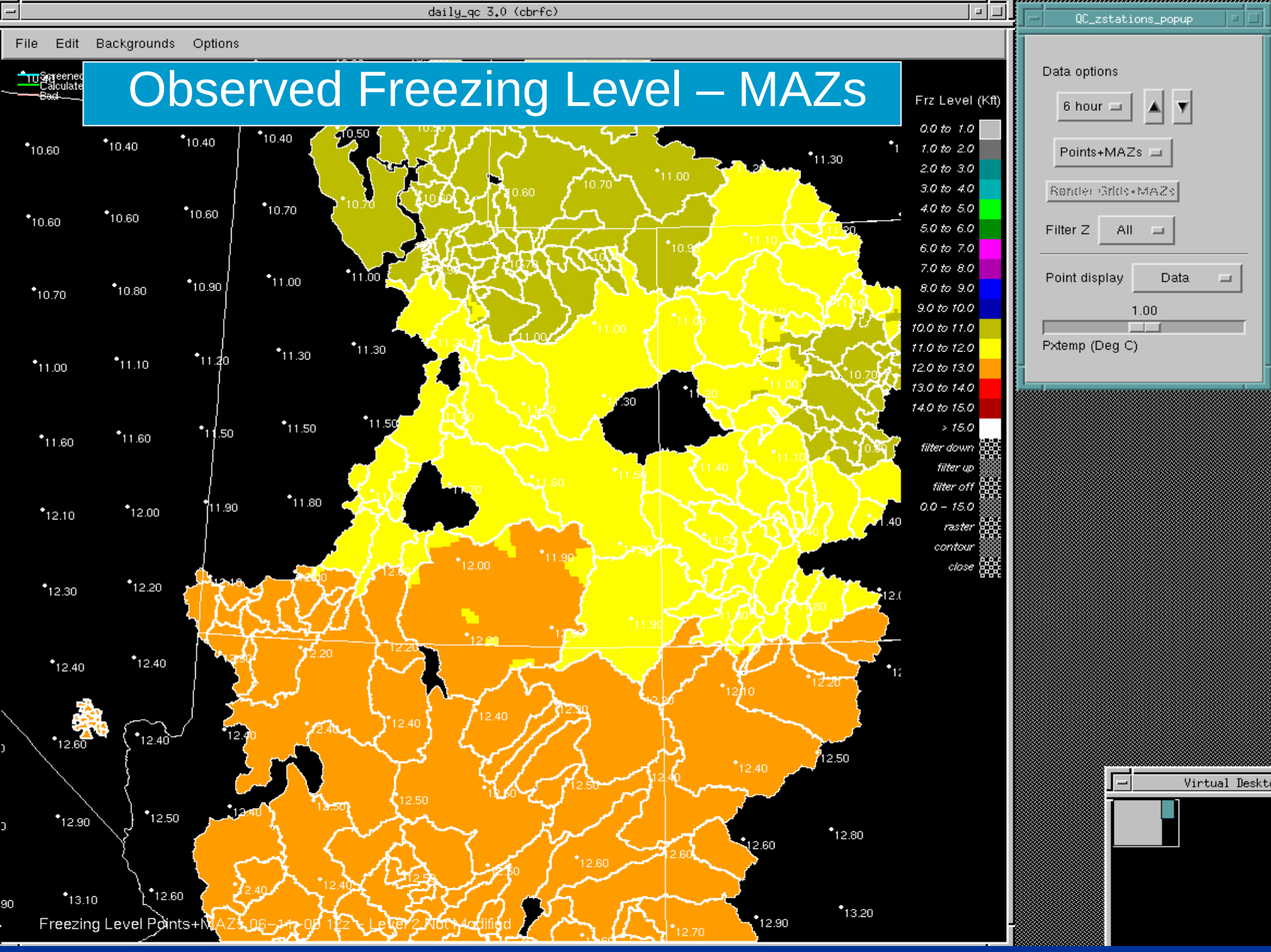
Observed Temerature – MATs



Observed Freezing Level – Points



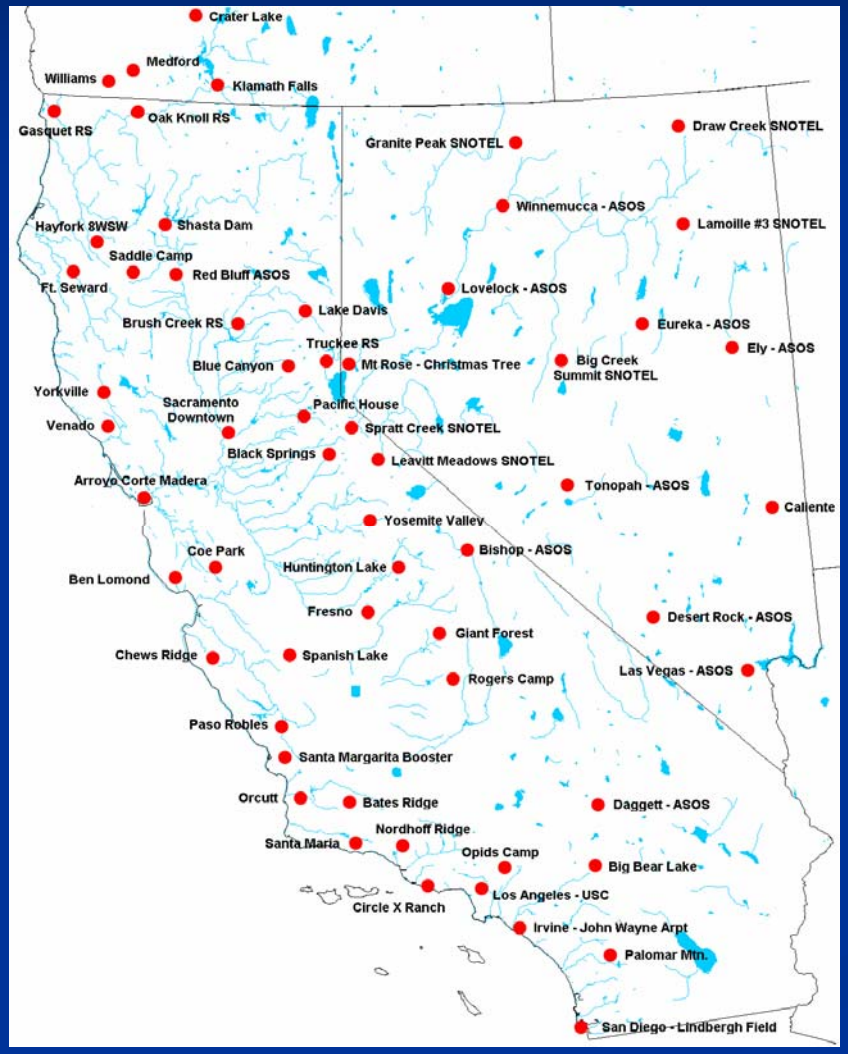
Observed Freezing Level – MAZs



Future Weather Inputs

- Precipitation Forecasts (QPF)
- Temperature Forecasts (QTF)
- Freezing Level Forecasts

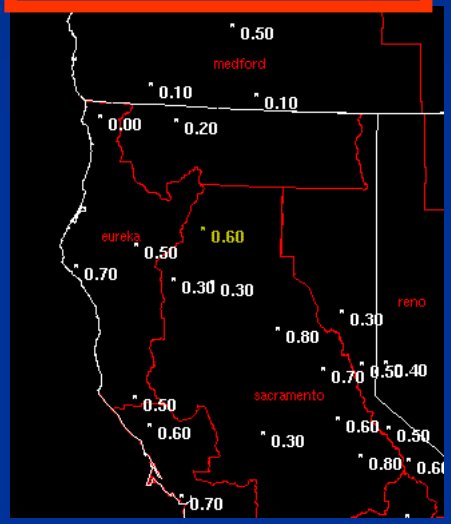
National NCEP-HPC Support



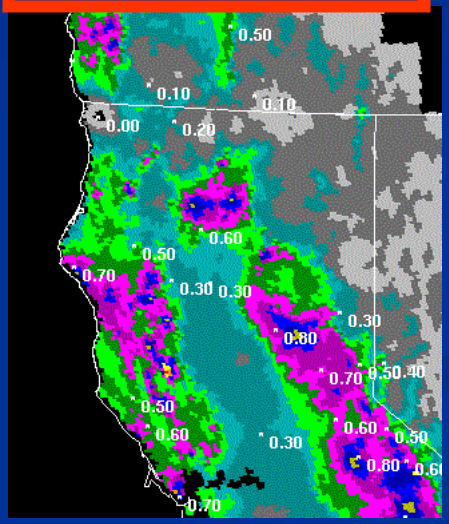
- HPC contours QPF in 6 hour time steps for 72 hours
- Contoured QPF converted to grids
- Grids converted to QPF points
- Updates every 6 hours

Quantitative Precipitation Forecasts

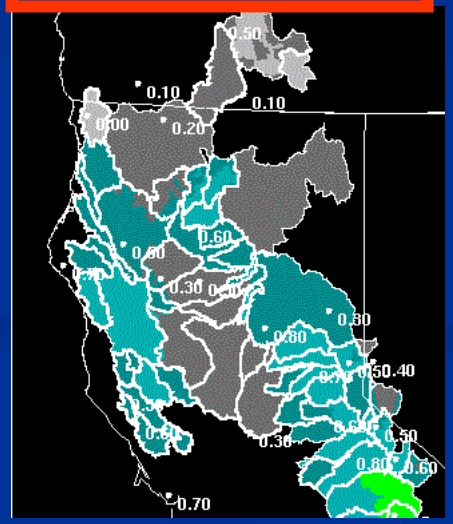
Points



Grids



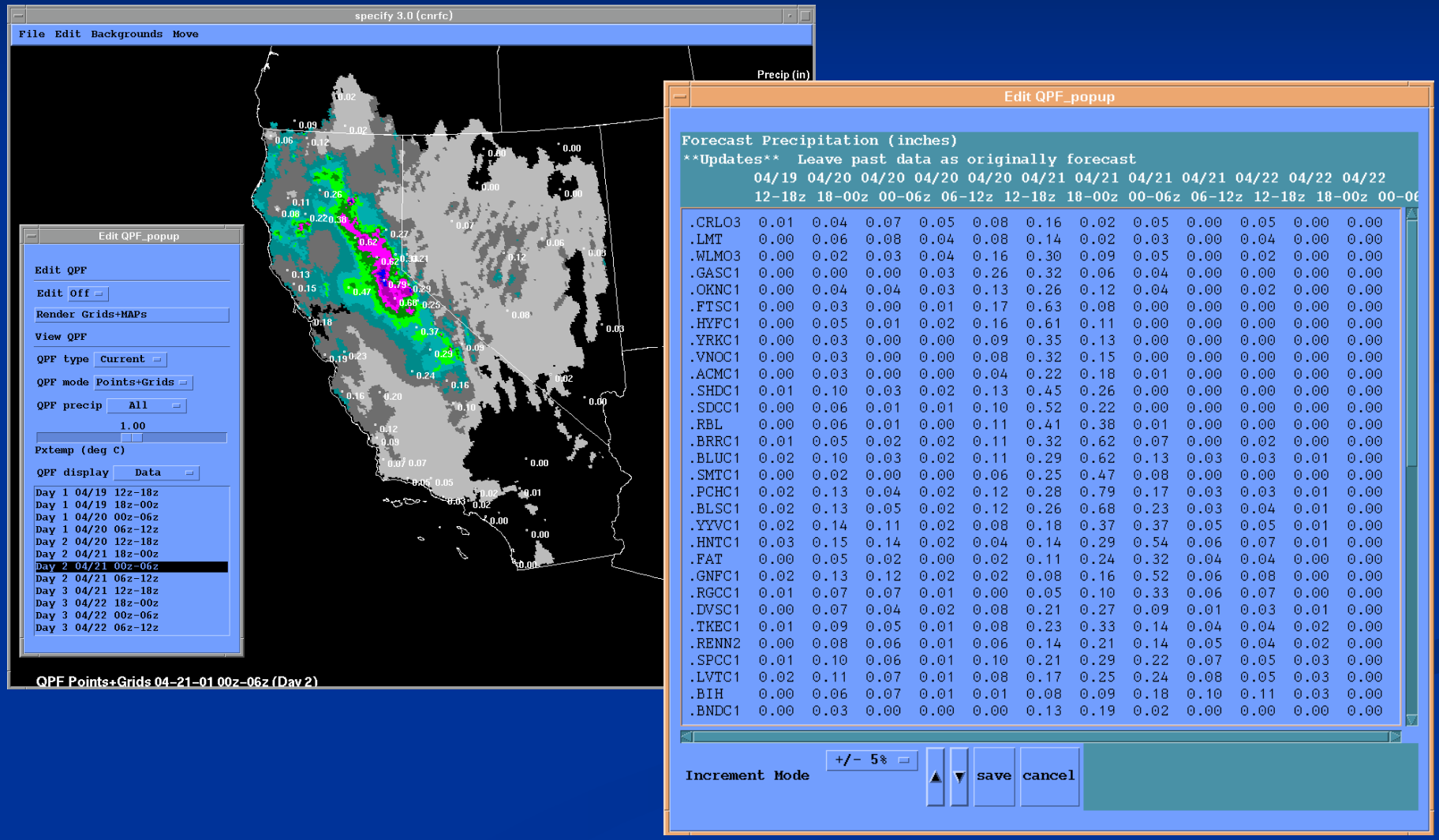
MAPs



Climatological Normalization and Distance Weighting

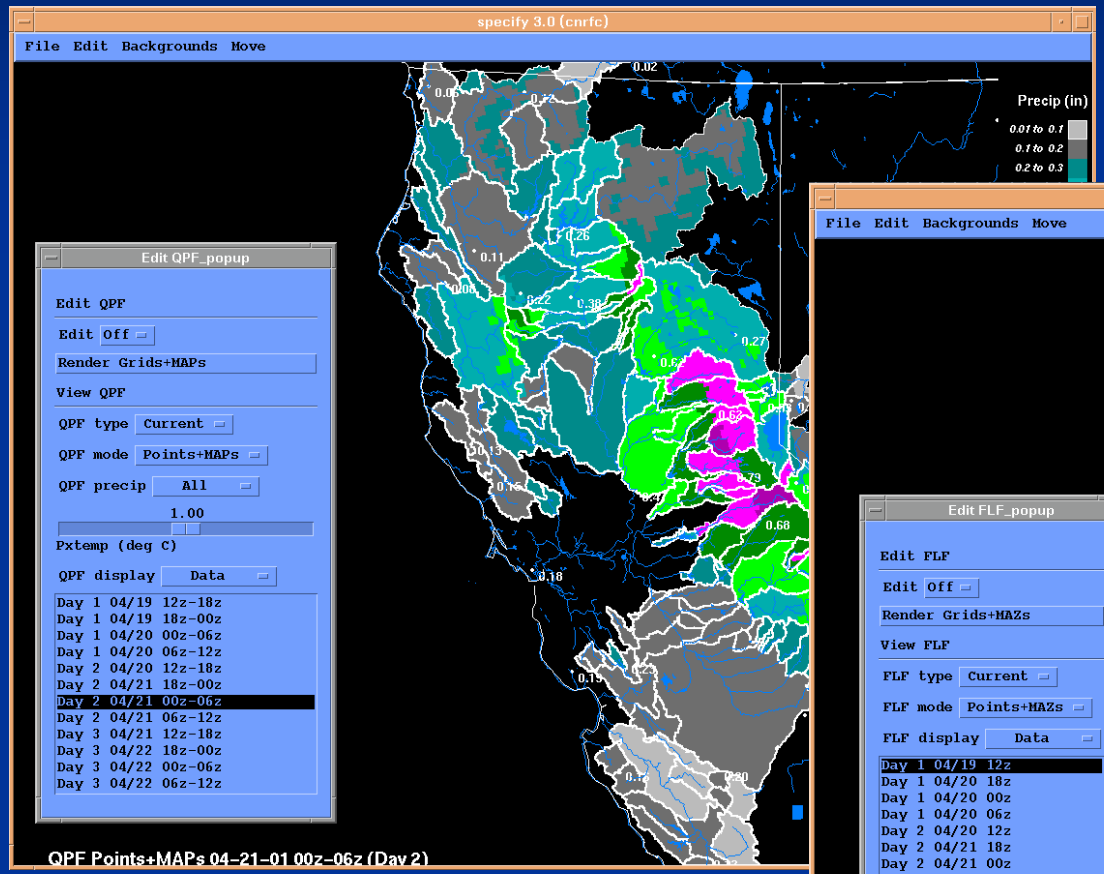
Integration within Basin Boundaries

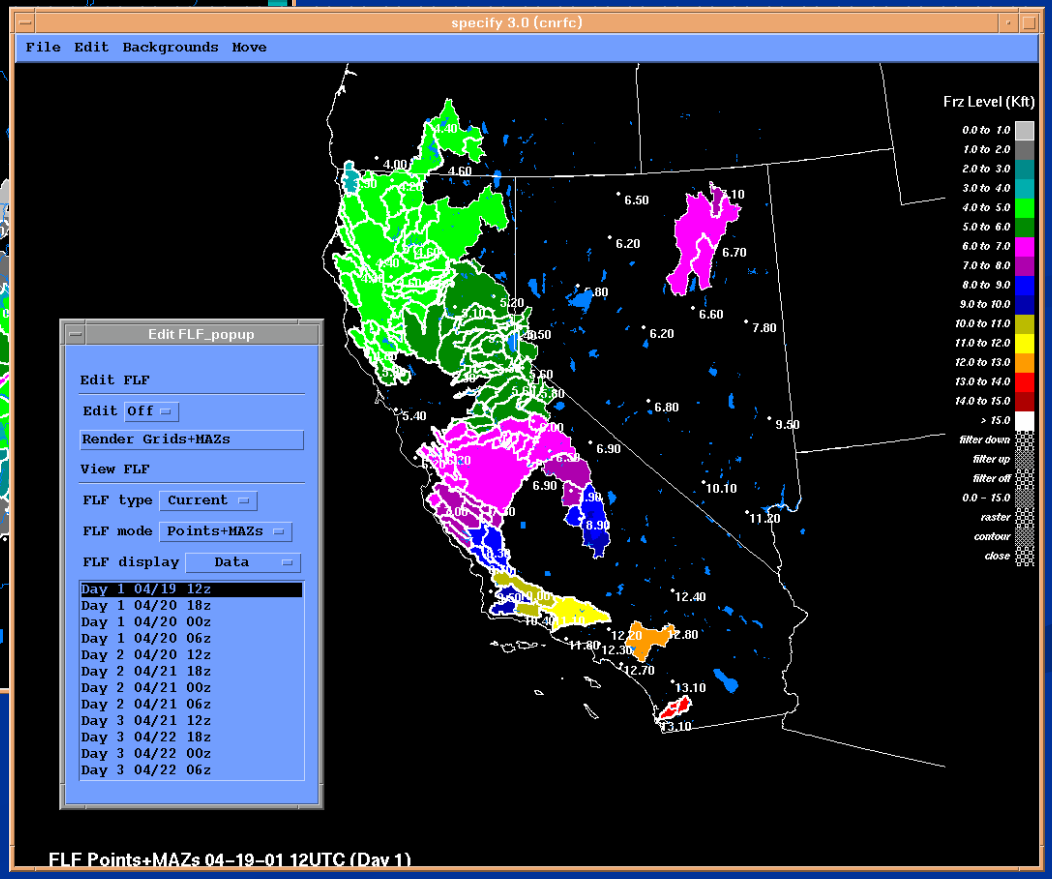
Mountain ***MAP***per
Produces MAPs From Point Data



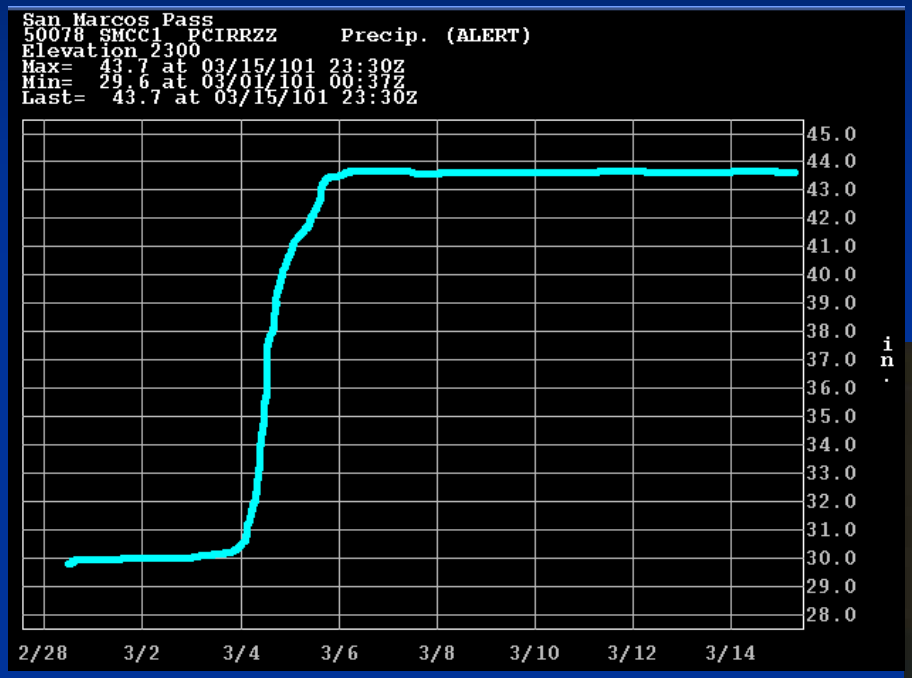
	04/19 12-18z	04/20 18-00z	04/20 00-06z	04/20 06-12z	04/20 12-18z	04/21 18-00z	04/21 00-06z	04/21 06-12z	04/21 12-18z	04/22 18-00z	04/22 00-06
.CRLO3	0.01	0.04	0.07	0.05	0.08	0.16	0.02	0.05	0.00	0.05	0.00	0.00
.LMT	0.00	0.06	0.08	0.04	0.08	0.14	0.02	0.03	0.00	0.04	0.00	0.00
.WLMO3	0.00	0.02	0.03	0.04	0.16	0.30	0.09	0.05	0.00	0.02	0.00	0.00
.GASC1	0.00	0.00	0.00	0.03	0.26	0.32	0.06	0.04	0.00	0.00	0.00	0.00
.OKNC1	0.00	0.04	0.04	0.03	0.13	0.26	0.12	0.04	0.00	0.02	0.00	0.00
.FTSC1	0.00	0.03	0.00	0.01	0.17	0.63	0.08	0.00	0.00	0.00	0.00	0.00
.HYFC1	0.00	0.05	0.01	0.02	0.16	0.61	0.11	0.00	0.00	0.00	0.00	0.00
.YRKC1	0.00	0.03	0.00	0.00	0.09	0.35	0.13	0.00	0.00	0.00	0.00	0.00
.VNOC1	0.00	0.03	0.00	0.00	0.08	0.32	0.15	0.00	0.00	0.00	0.00	0.00
.ACMC1	0.00	0.03	0.00	0.00	0.04	0.22	0.18	0.01	0.00	0.00	0.00	0.00
.SHDC1	0.01	0.10	0.03	0.02	0.13	0.45	0.26	0.00	0.00	0.00	0.00	0.00
.SDCC1	0.00	0.06	0.01	0.01	0.10	0.52	0.22	0.00	0.00	0.00	0.00	0.00
.RBL	0.00	0.06	0.01	0.00	0.11	0.41	0.38	0.01	0.00	0.00	0.00	0.00
.BRRC1	0.01	0.05	0.02	0.02	0.11	0.32	0.62	0.07	0.00	0.02	0.00	0.00
.BLUC1	0.02	0.10	0.03	0.02	0.11	0.29	0.62	0.13	0.03	0.03	0.01	0.00
.SMTC1	0.00	0.02	0.00	0.00	0.06	0.25	0.47	0.08	0.00	0.00	0.00	0.00
.PCHC1	0.02	0.13	0.04	0.02	0.12	0.28	0.79	0.17	0.03	0.03	0.01	0.00
.BLSC1	0.02	0.13	0.05	0.02	0.12	0.26	0.68	0.23	0.03	0.04	0.01	0.00
.YYVC1	0.02	0.14	0.11	0.02	0.08	0.18	0.37	0.37	0.05	0.05	0.01	0.00
.HNTC1	0.03	0.15	0.14	0.02	0.04	0.14	0.29	0.54	0.06	0.07	0.01	0.00
.FAT	0.00	0.05	0.02	0.00	0.02	0.11	0.24	0.32	0.04	0.04	0.00	0.00
.GNFC1	0.02	0.13	0.12	0.02	0.02	0.08	0.16	0.52	0.06	0.08	0.00	0.00
.RGCC1	0.01	0.07	0.07	0.01	0.00	0.05	0.10	0.33	0.06	0.07	0.00	0.00
.DVSC1	0.00	0.07	0.04	0.02	0.08	0.21	0.27	0.09	0.01	0.03	0.01	0.00
.TKEC1	0.01	0.09	0.05	0.01	0.08	0.23	0.33	0.14	0.04	0.04	0.02	0.00
.RENN2	0.00	0.08	0.06	0.01	0.06	0.14	0.21	0.14	0.05	0.04	0.02	0.00
.SPCC1	0.01	0.10	0.06	0.01	0.10	0.21	0.29	0.22	0.07	0.05	0.03	0.00
.LVTC1	0.02	0.11	0.07	0.01	0.08	0.17	0.25	0.24	0.08	0.05	0.03	0.00
.BIH	0.00	0.06	0.07	0.01	0.01	0.08	0.09	0.18	0.10	0.11	0.03	0.00
.BNDC1	0.00	0.03	0.00	0.00	0.00	0.13	0.19	0.02	0.00	0.00	0.00	0.00

Mean Areal Precipitation and Freezing Level Forecasts





Models are not Perfect ! Forecaster Experience Is Important



Pattern recognition - historical case studies

Gain familiarity with topography and gage network

Develop knowledge base on:
…NCEP model performance

Hydrologic Operations
River Forecasting

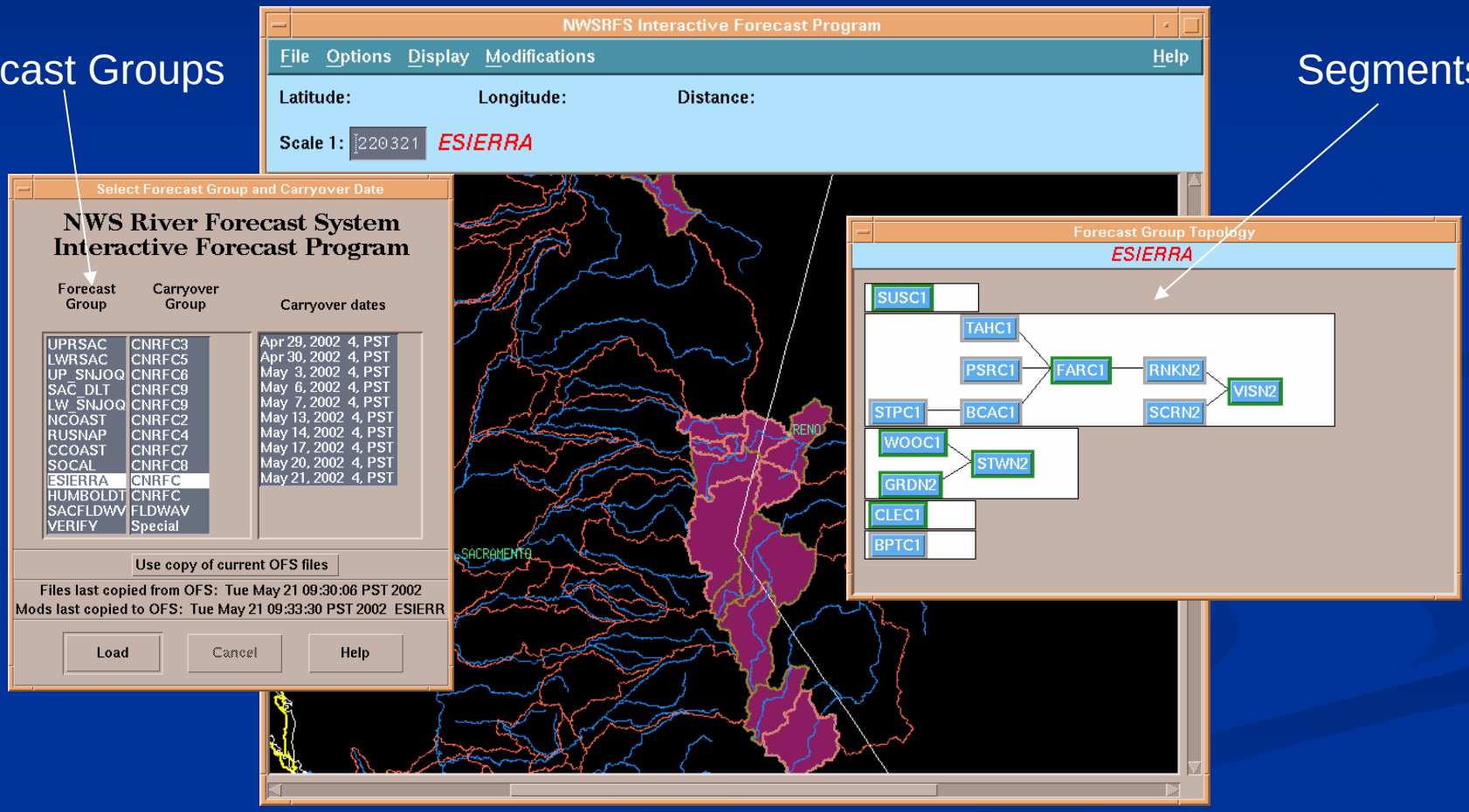
Hydrologists

- Principle Responsibility in RFC Operations
- Focuses on the Hydrologic Model
  - Quality Control of Observed River Flow Data
  - Quality Control of Observed Reservoir Data
  - Runs Forecast System and Makes Modifications At Run Time If Needed
  - Prepare River Forecasts

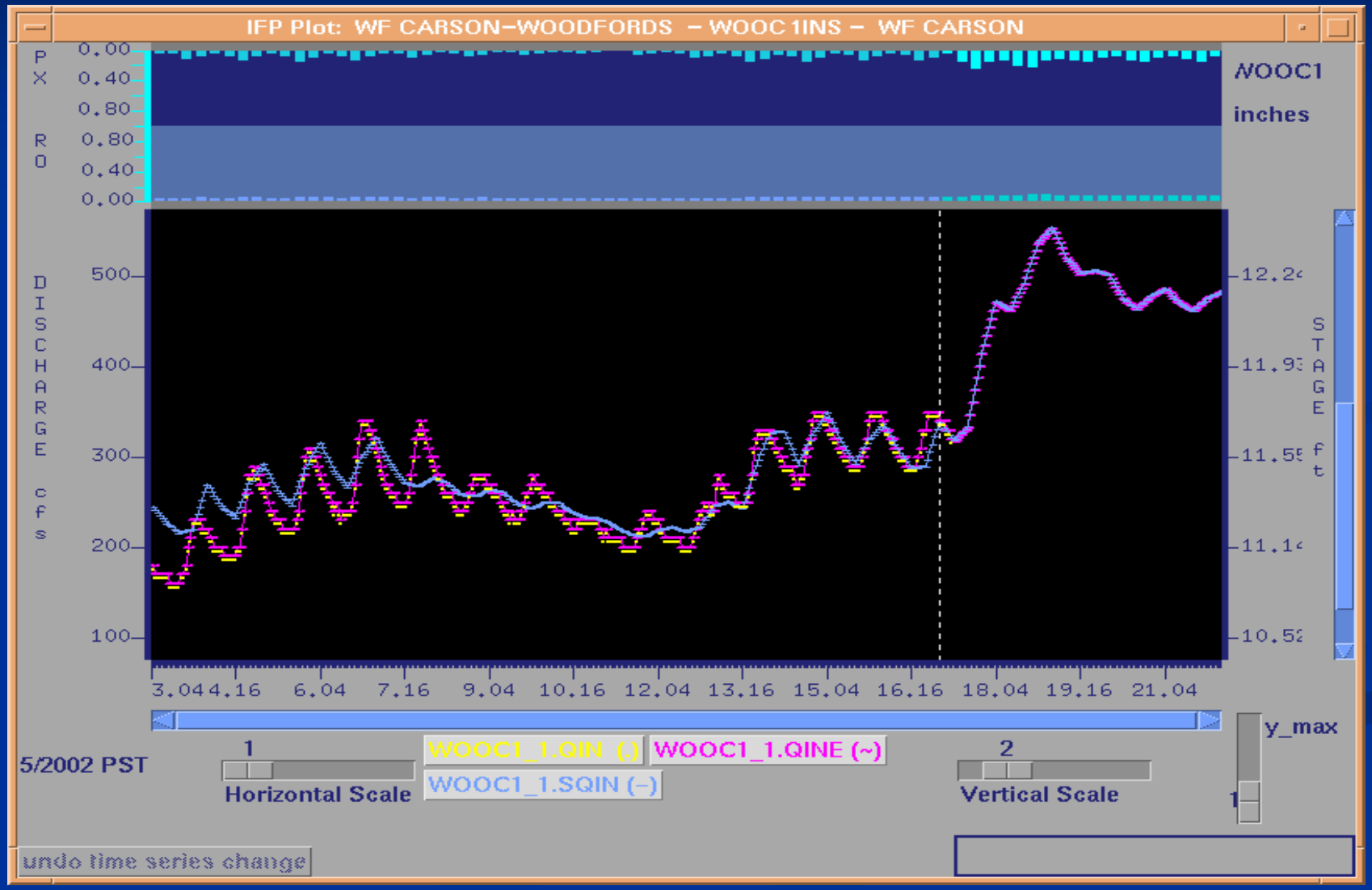
Processing
Interactive Forecast Program (IFP)

Forecast Groups

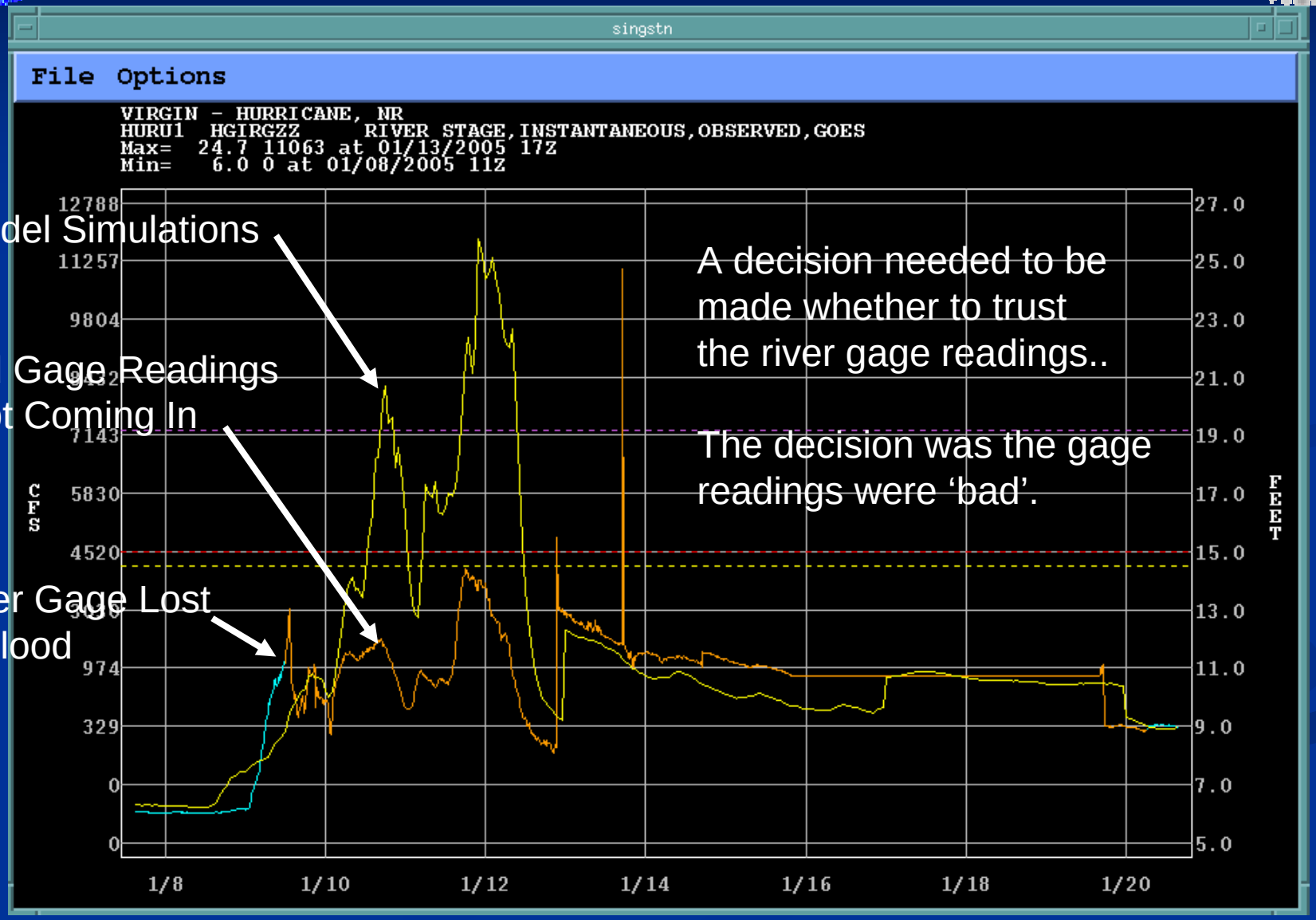
Segments



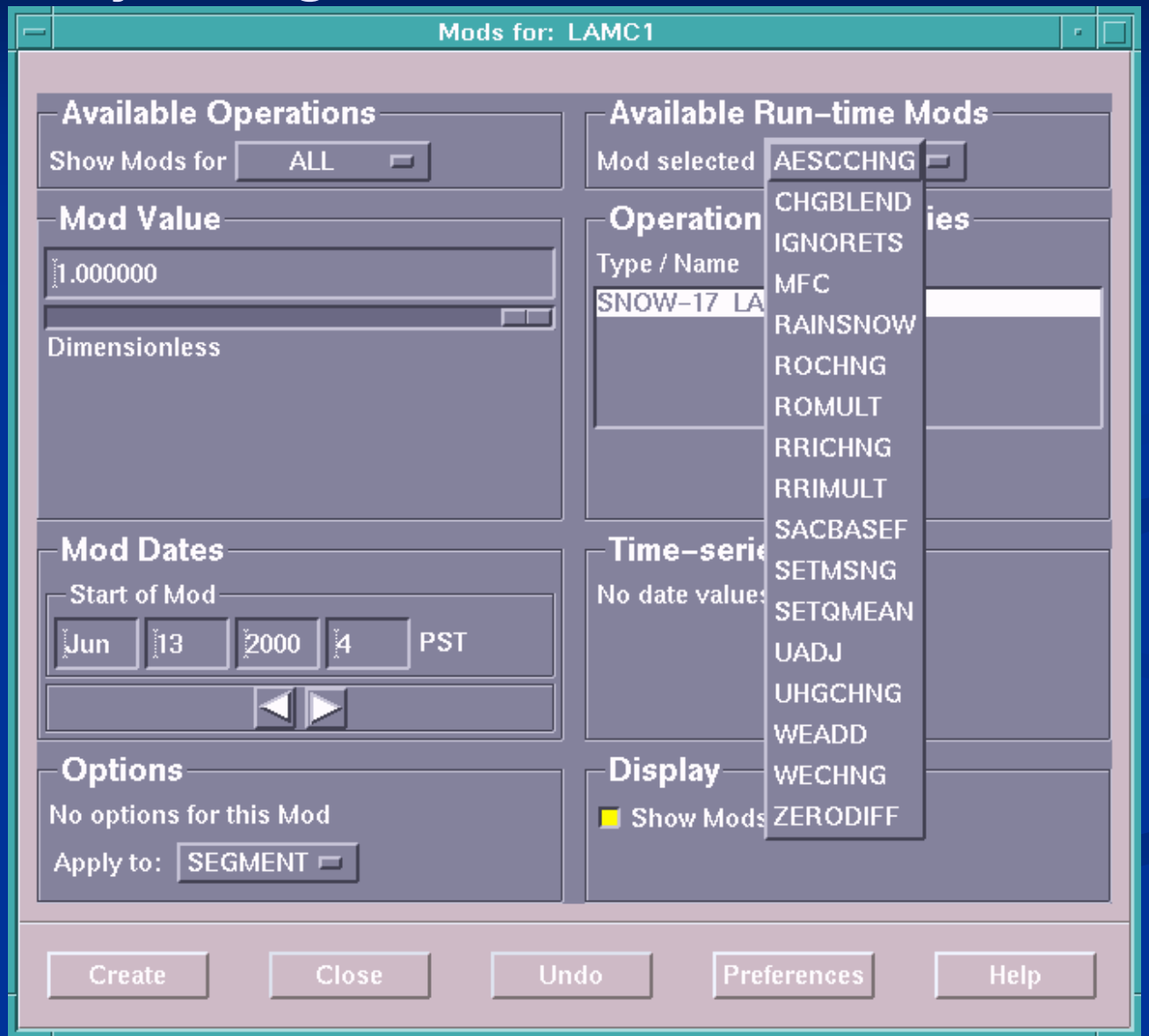
Processing
IFP Hydrograph Display



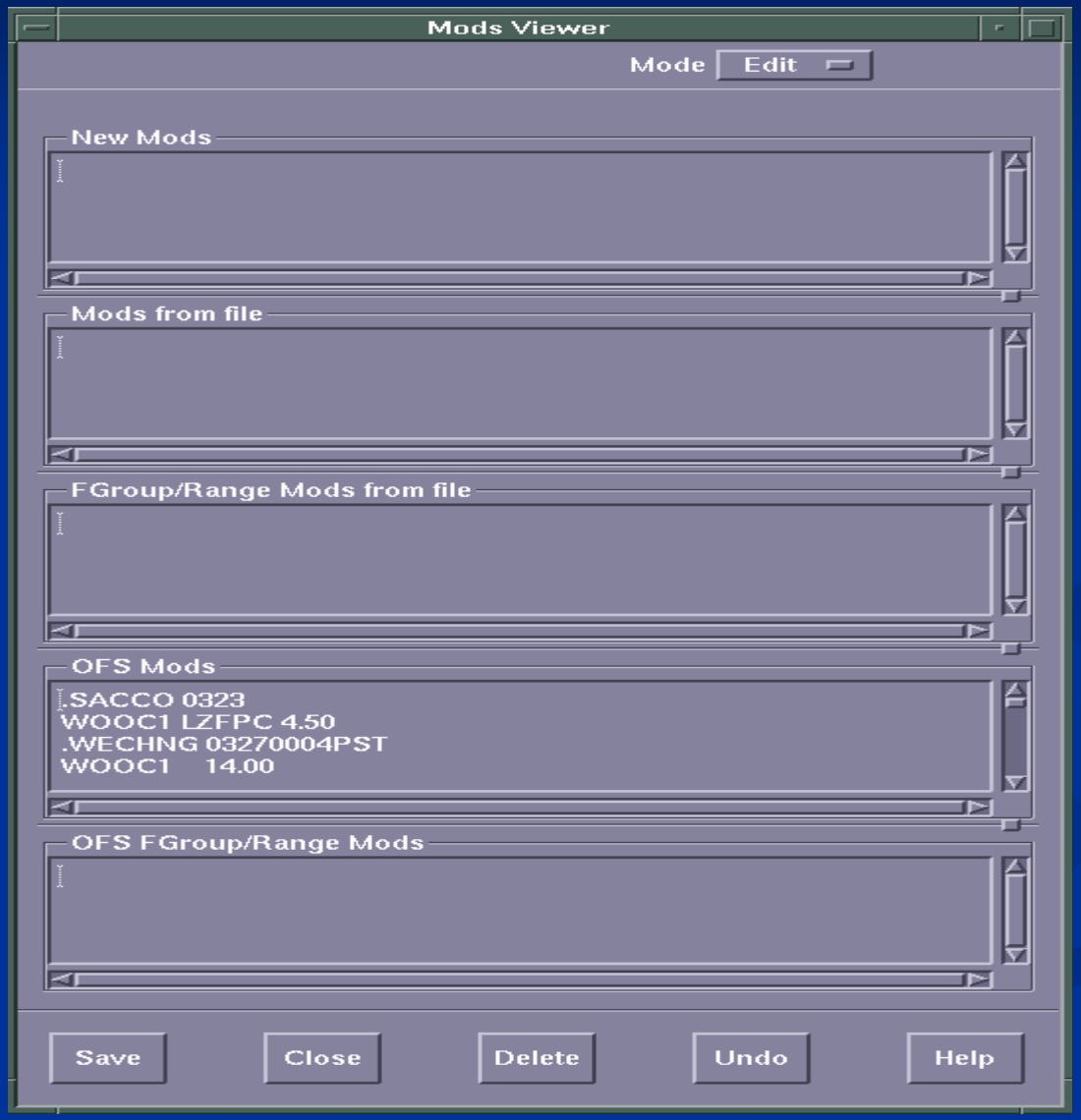
Quality Control of Stage Data



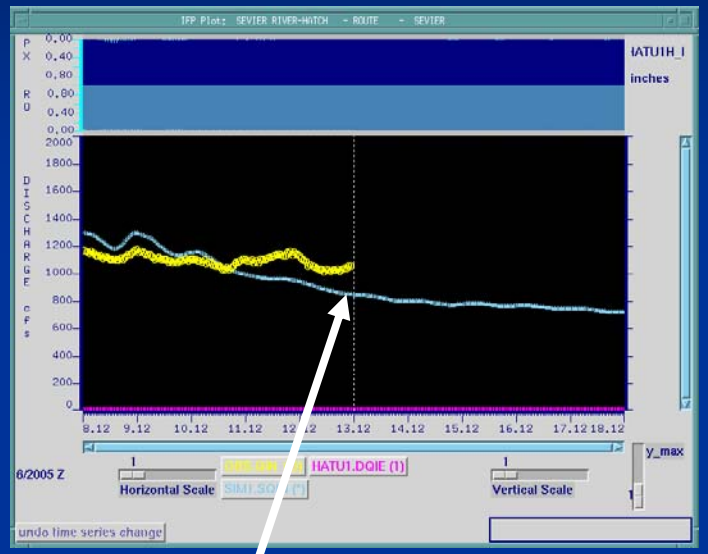
Runtime Modifications
Adjusting the Model in Real-Time



Viewing the Run_Time Modifications To the Model

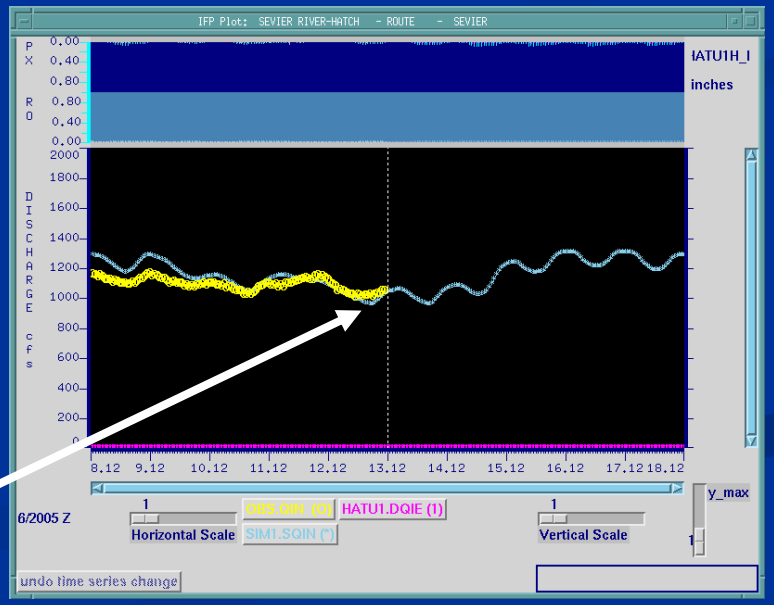


Run Time Modifications to the Snow Model



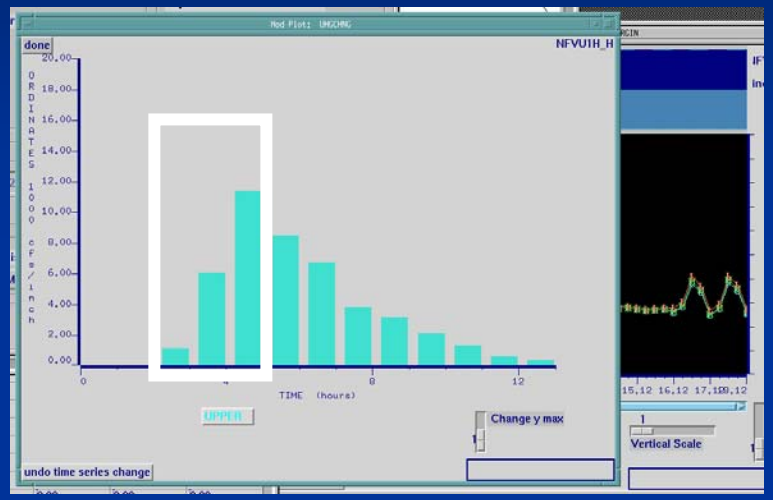
(2) Hydrologist Made a Run-Time modification to the Snow Model and Increased the snow Melt Correction Factor

(1) Observed and Simulated Not Tracking



(3) Result: Observed and Simulated is now on track

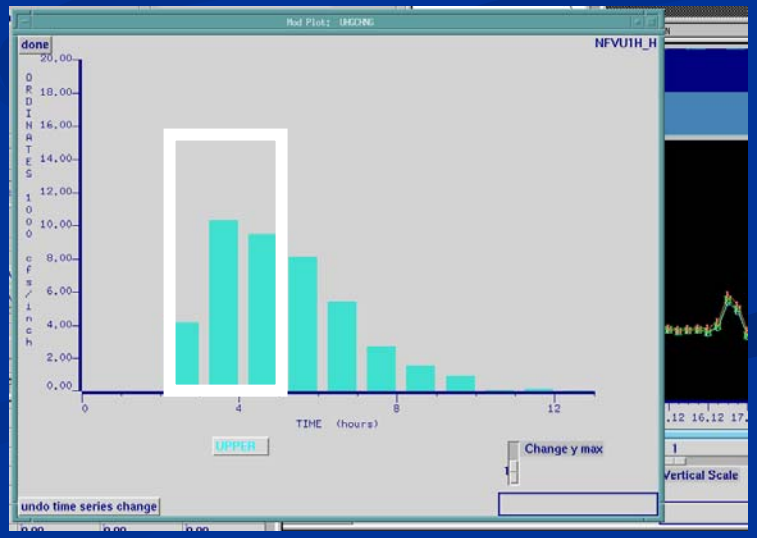
Run Time Modification to the Unit-Hydrograph



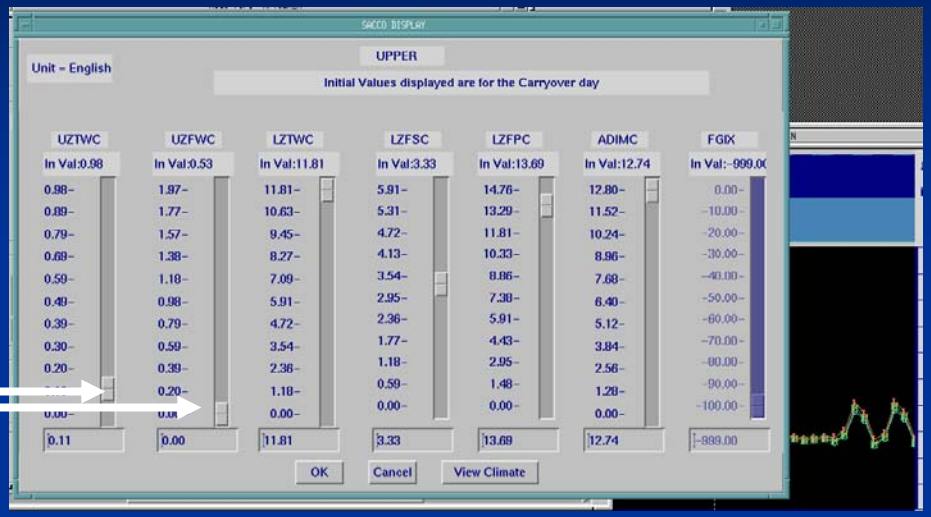
(2) The river stage is peaking higher and earlier…Hydrologist makes a Run-Time Modification to adjust the Unit-Hydrograph

(1) Original 1-hour Unit-Hydrograph

(3) Modified 1-hour Unit-Hydrograph will force a higher and earlier peak



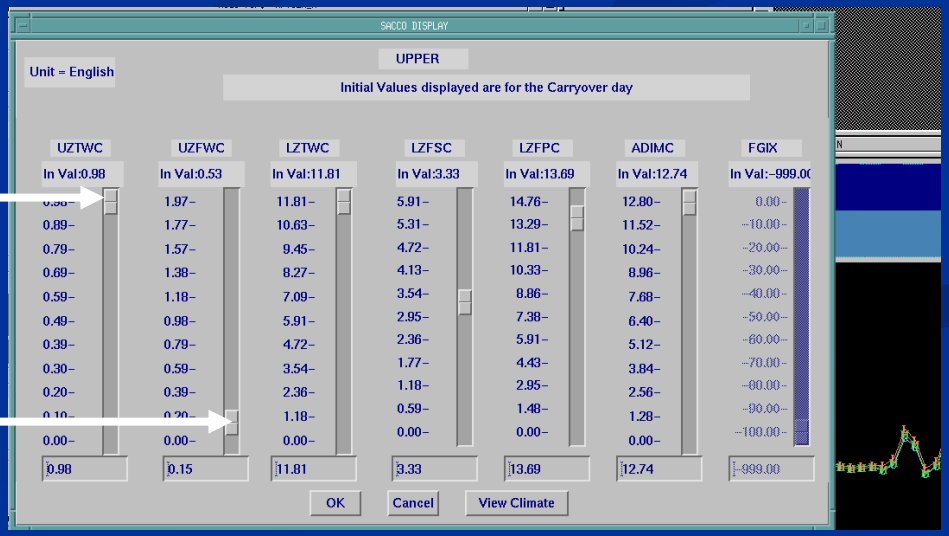
Run Time Modification to Sacramento Soil Moisture Model



(2) In order to get more runoff The hydrologist makes a Run-time modification and Adds water to the Soil Moisture model

(1) Water Contents in the Upper Zones are too low

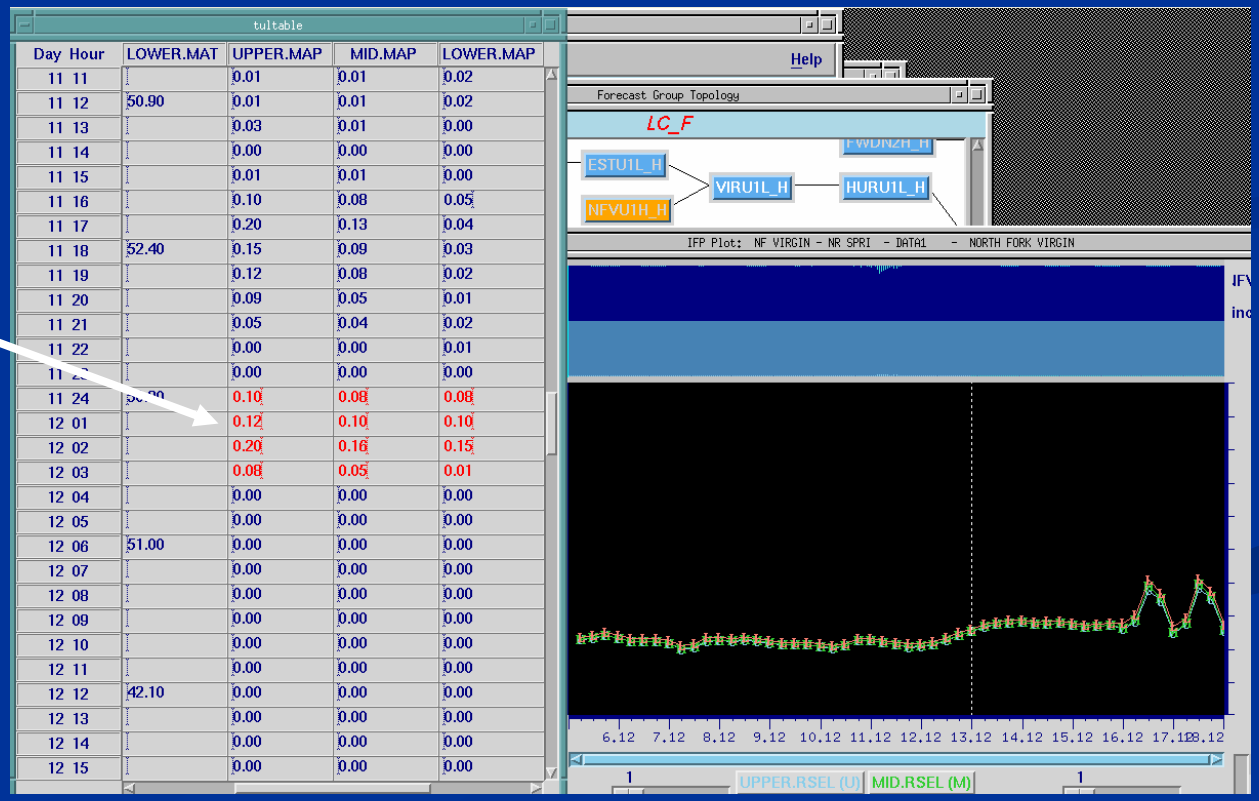
(3) The Upper Zone is Set to full and the Free Water Is Slightly Increased



Run Time Modification to Precipitation Table

The Soil Moisture Model is full but the simulation is still below the observed in a heavy rainfall event. The hydrologist may need to add more precipitation in the model for the observed and future time periods.

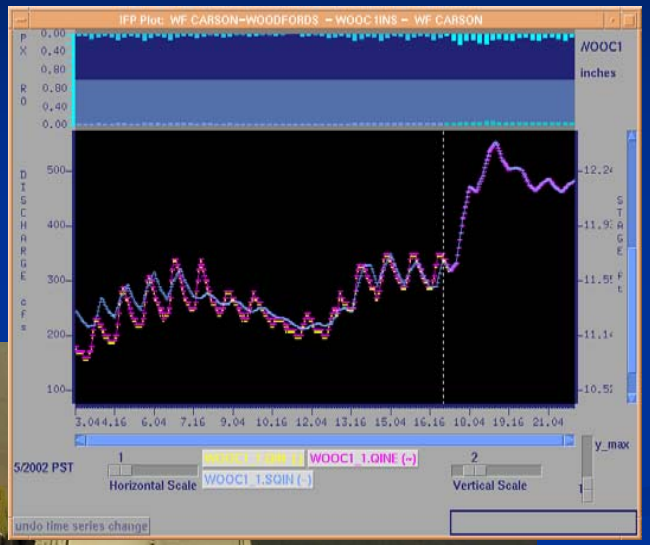
The hydrologist can add precipitation for each hour. This is ahown in Red.

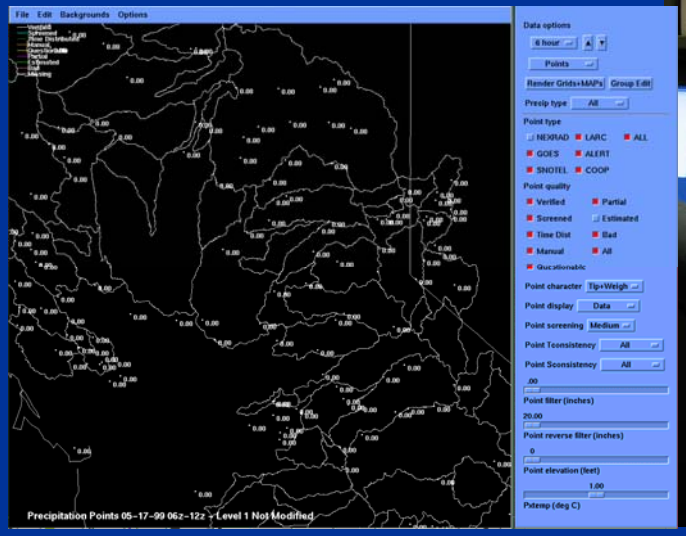


Day	Hour	LOWER.MAT	UPPER.MAP	MID.MAP	LOWER.MAP
11	11		0.01	0.01	0.02
11	12	50.90	0.01	0.01	0.02
11	13		0.03	0.01	0.00
11	14		0.00	0.00	0.00
11	15		0.01	0.01	0.00
11	16		0.10	0.08	0.05
11	17		0.20	0.13	0.04
11	18	52.40	0.15	0.09	0.03
11	19		0.12	0.08	0.02
11	20		0.09	0.05	0.01
11	21		0.05	0.04	0.02
11	22		0.00	0.00	0.01
11	[illegible]		0.00	0.00	0.00
11	24	[illegible]	0.10	0.08	0.08
12	01		0.12	0.10	0.10
12	02		0.20	0.16	0.15
12	03		0.08	0.05	0.01
12	04		0.00	0.00	0.00
12	05		0.00	0.00	0.00
12	06	51.00	0.00	0.00	0.00
12	07		0.00	0.00	0.00
12	08		0.00	0.00	0.00
12	09		0.00	0.00	0.00
12	10		0.00	0.00	0.00
12	11		0.00	0.00	0.00
12	12	42.10	0.00	0.00	0.00
12	13		0.00	0.00	0.00
12	14		0.00	0.00	0.00
12	15		0.00	0.00	0.00

Models Are Not Perfect ! Forecaster Experience Is Important !

- Watershed characteristics
- Model idiosyncrasies
- Data and gage issues
- Customer and partner needs





The End
Forecast Process