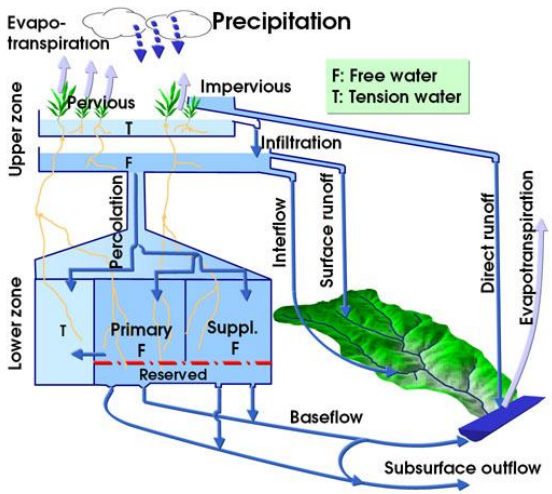
Temperature and Precipitation Data

CBRFC Stakeholder Forum
July 31, 2012

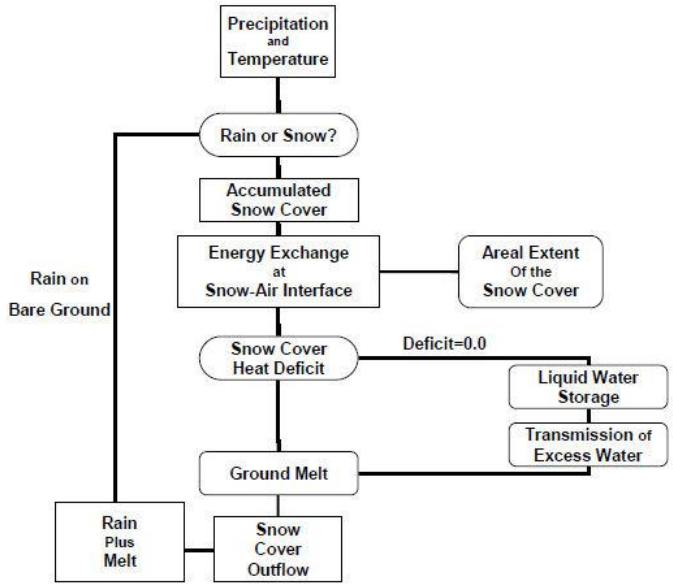
PRECIPITATION DATA– WHY IS THIS IMPORTANT ?



A <u>direct input</u> into the operational soil moisture & snow model

Primary Impacts:
Immediate runoff from rainfall events
Affects soil moisture conditions and seasonal volume forecasts
Combined with temperature to build snowpack in the model

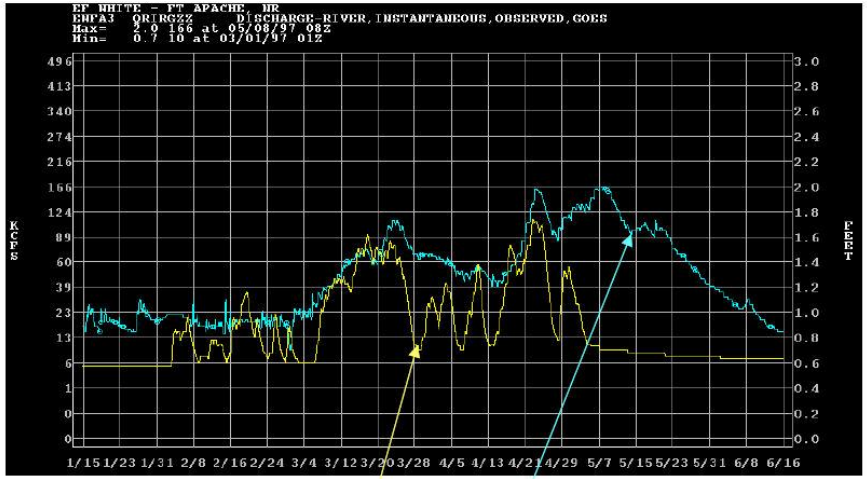
TEMPERATURE DATA– WHY IS THIS IMPORTANT ?



A <u>direct input</u> into the snow-17 operational model

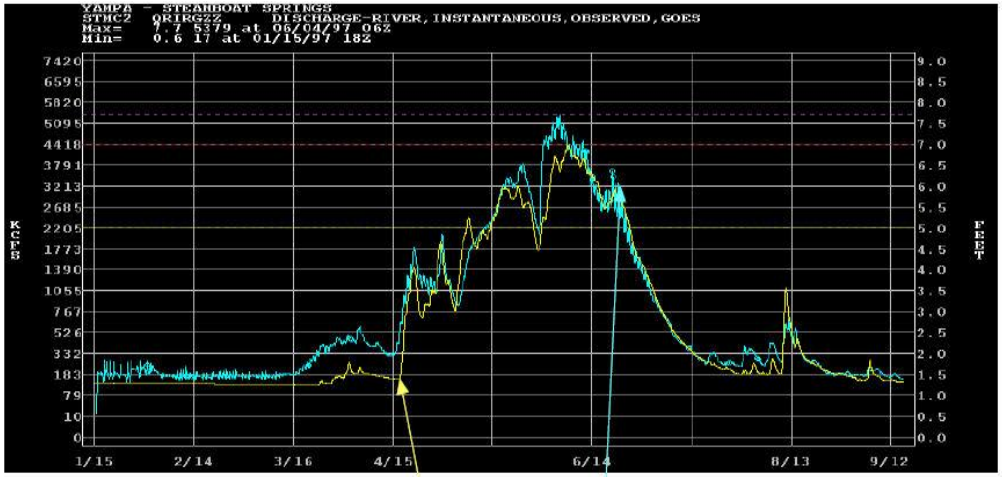
Primary Impacts:
Determine precipitation type -> builds the snowpack
Energy and heat transfer properties:
- Extent of snow cover
- When the snowpack ripens in the spring
- Process of melting the snowpack

Selection of Temperature & Precipitation Stations Starts with Calibration of the Model



Simulated (yellow)

Observed (blue)



Simulated (yellow)

Observed (blue)

Data Site Requirements:

Relevant location to the river basin and sufficient historical period of record.
Must be stable through time (spent weeks verifying this through double mass analysis)
Maintain consistency between calibration and daily operations (use same data sites)

These requirements above tend to eliminate many candidates

DATA NETWORKS

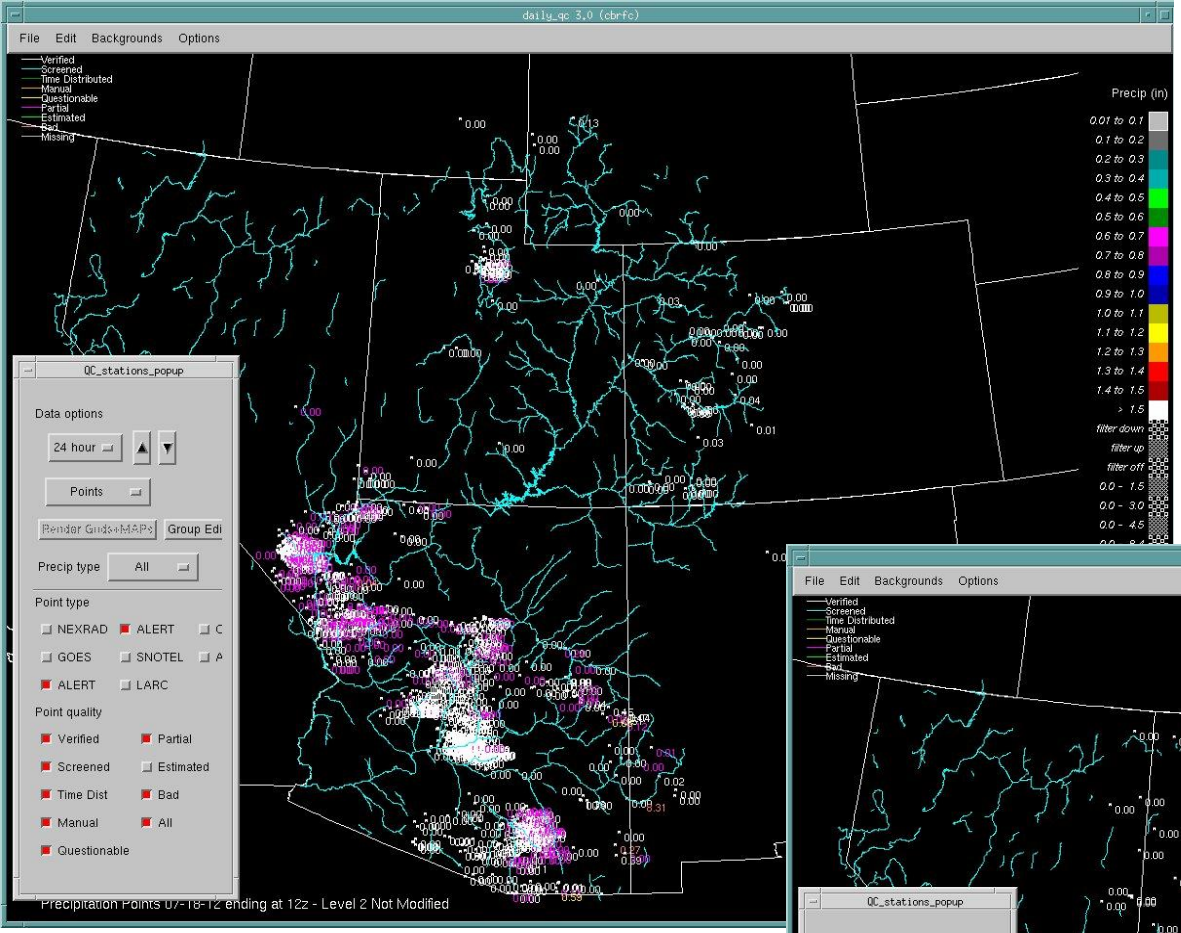
SOURCES (Precipitation)

ALERT Networks (Automated Local Evaluation in Real Time-Radio)
GOES Data Collection Platforms (DCP) – includes Upper Colorado Network/RAWS/etc.
SNOTEL *
Cooperators *
CoCoRaHS (Community Collaborative Rain, Hail & Snow Network)
NEXRAD (Radar Products)
Satellite Derived

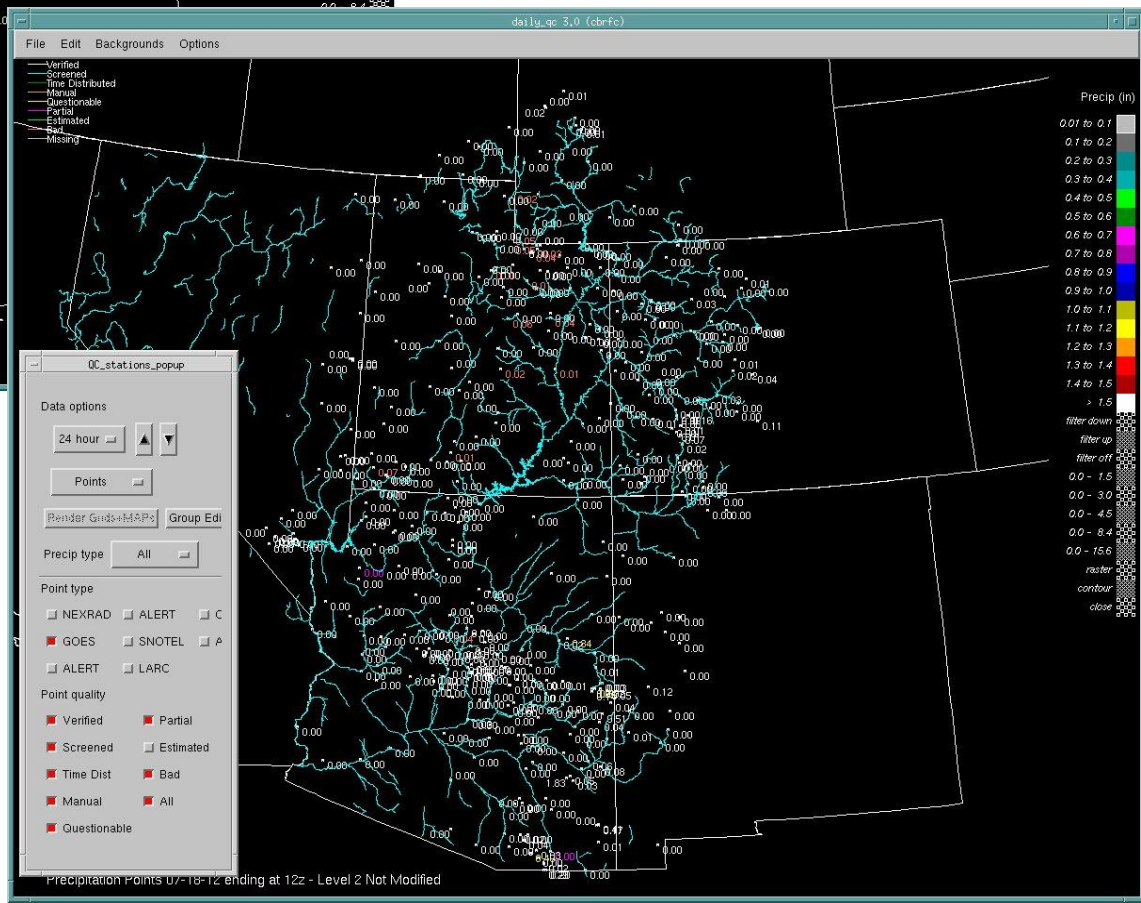
SOURCES (Temperature)

GOES Data Collection Platforms (DCP) – includes Upper Colorado Network/RAWS/etc. *
SNOTEL *
Cooperators *

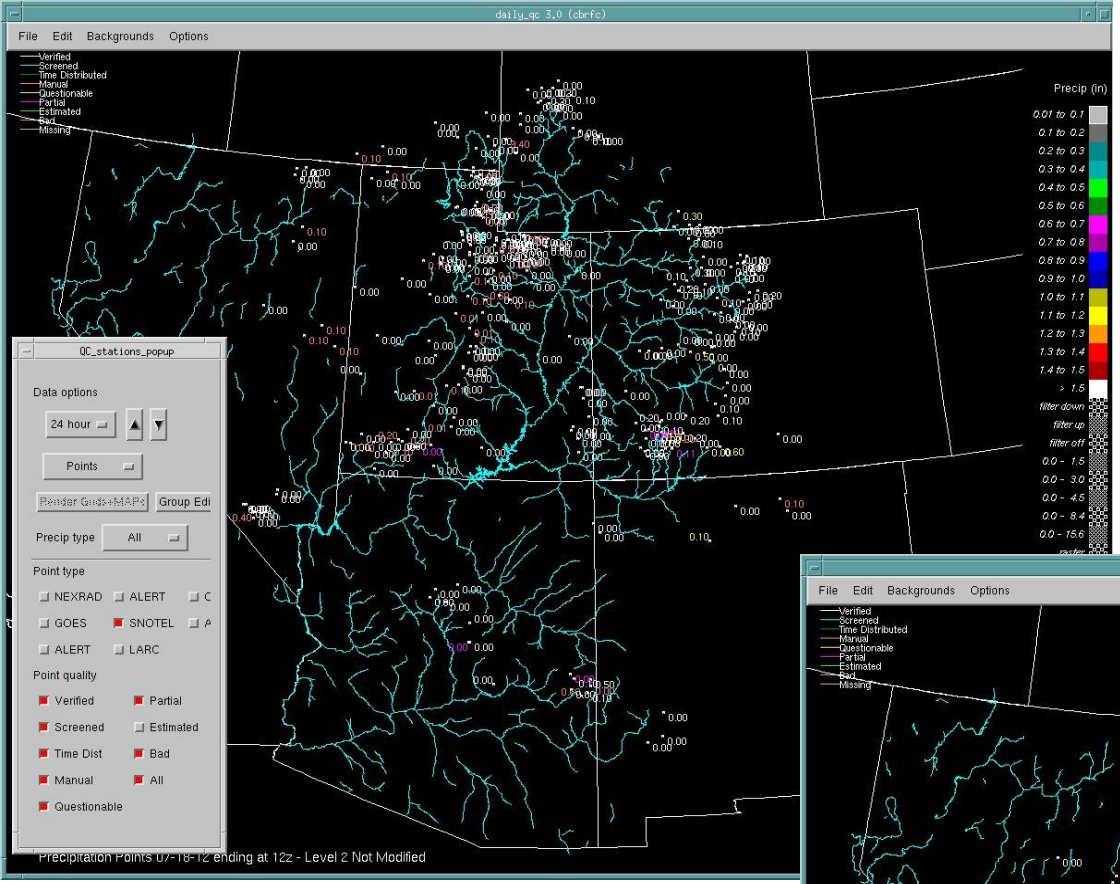
* Data sources for model calibration



ALERT & CoCoRaHS Precipitation Data

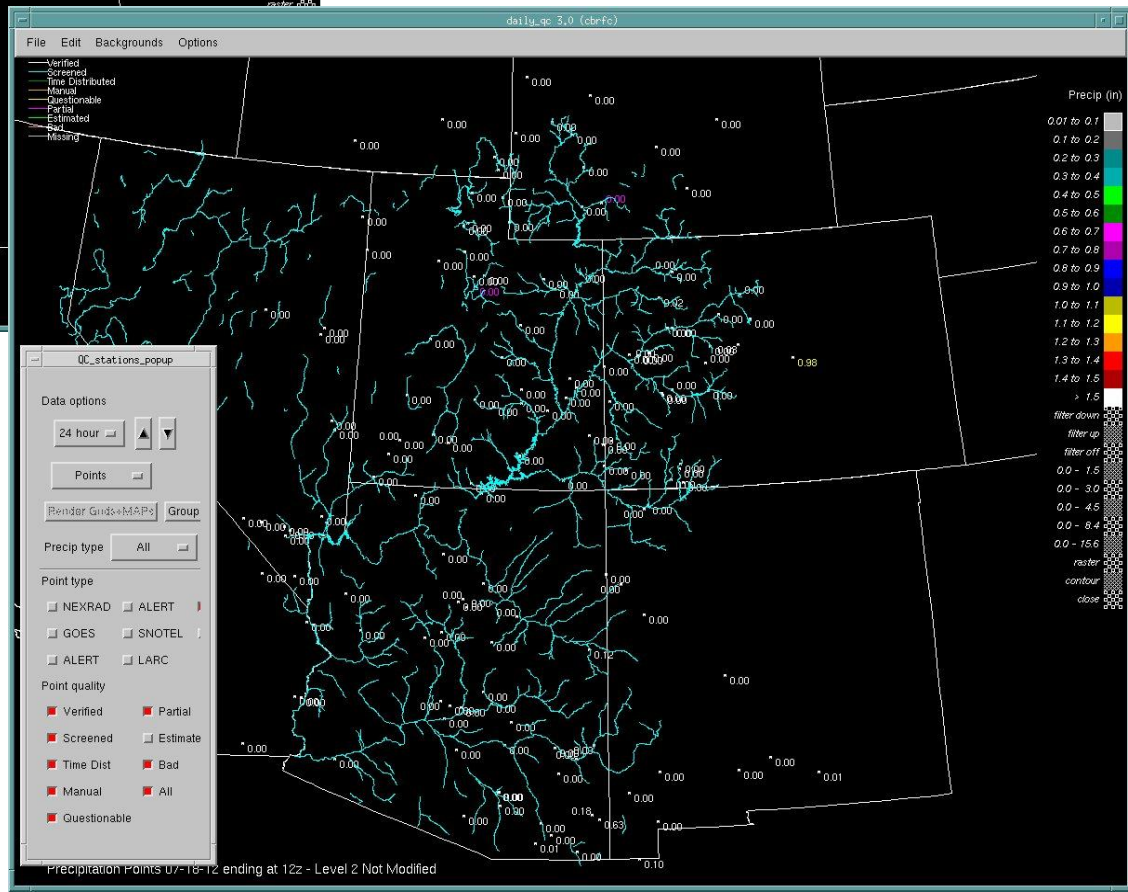


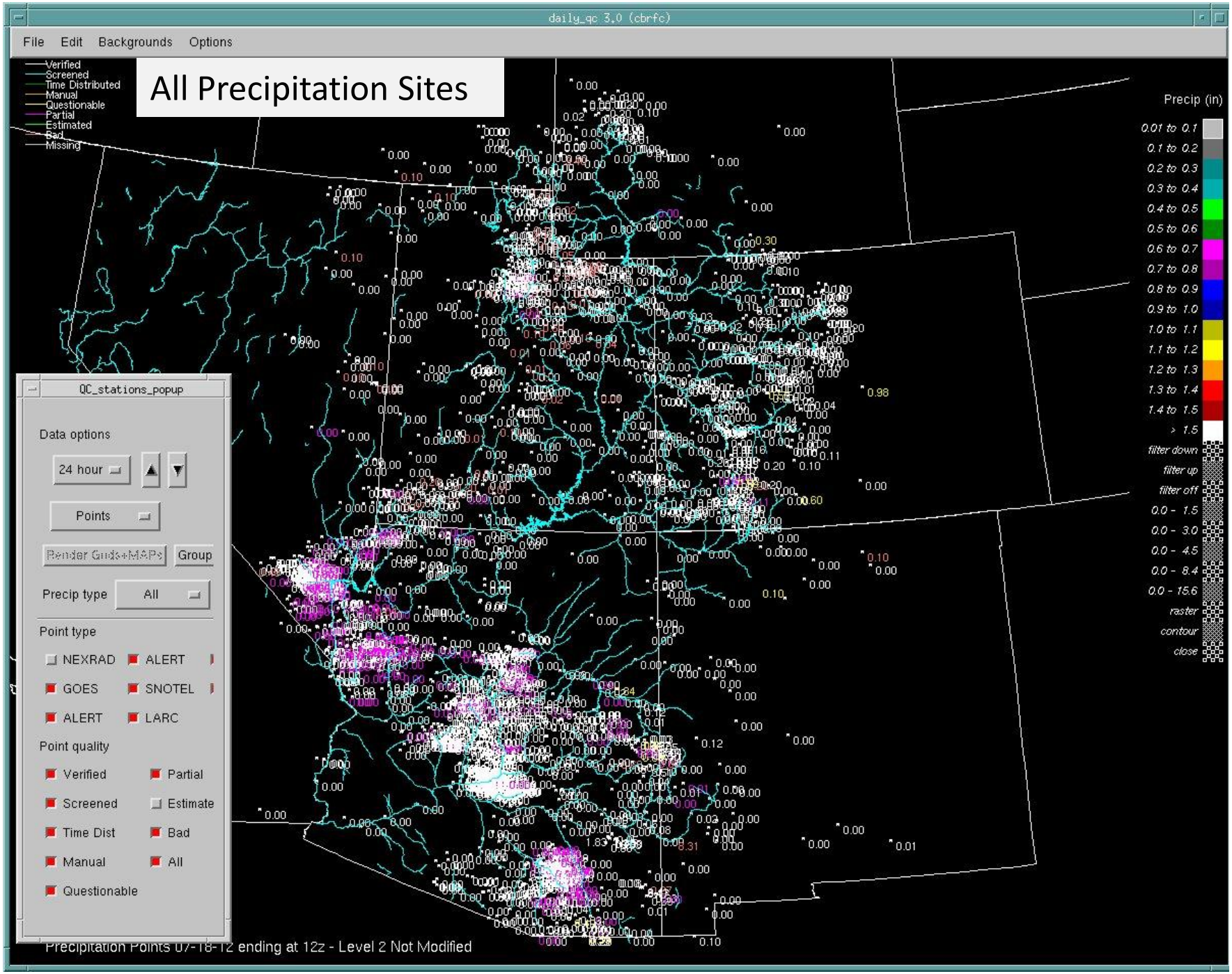
GOES DCP Precipitation Data



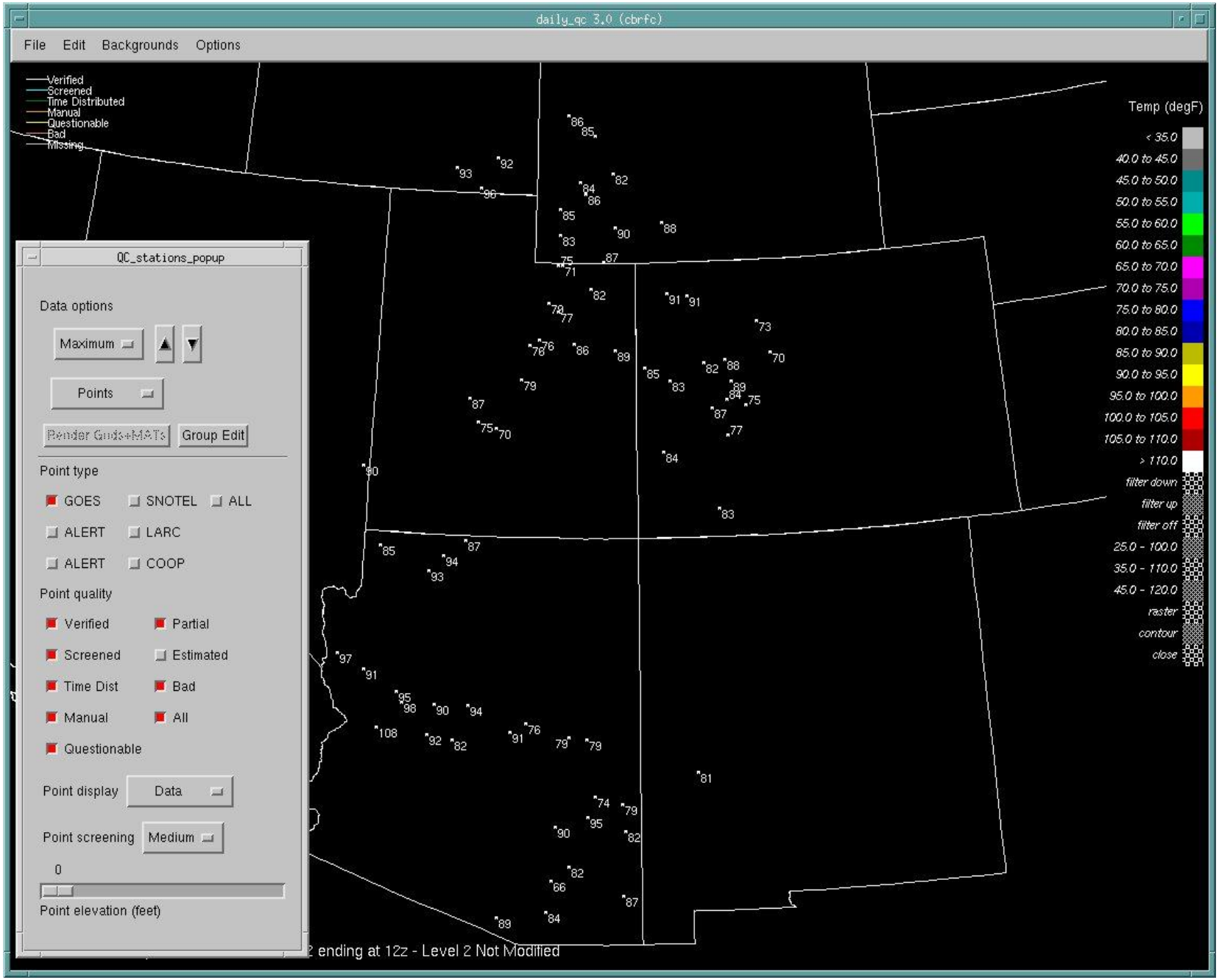
SNOTEL Precipitation Data

Cooperator Network

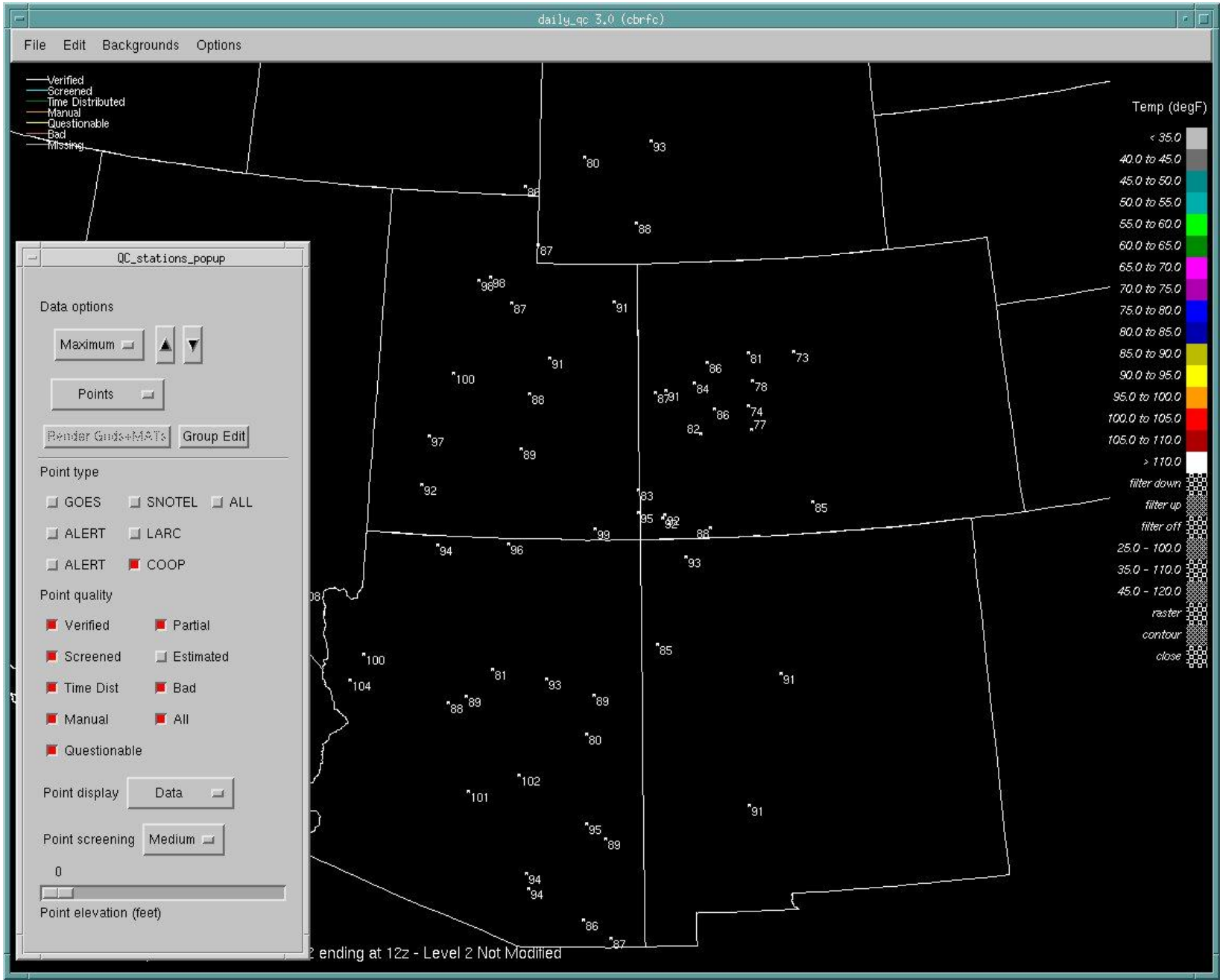



daily_qc 3.0 (cbrfc)
File Edit Backgrounds Options
Verified
Screened
Time Distributed
Manual
Questionable
Partial
Estimated
Bad
Missing
All Precipitation Sites
Precip (in)
0.01 to 0.1
0.1 to 0.2
0.2 to 0.3
0.3 to 0.4
0.4 to 0.5
0.5 to 0.6
0.6 to 0.7
0.7 to 0.8
0.8 to 0.9
0.9 to 1.0
1.0 to 1.1
1.1 to 1.2
1.2 to 1.3
1.3 to 1.4
1.4 to 1.5
> 1.5
filter down
filter up
filter off
0.0 - 1.5
0.0 - 3.0
0.0 - 4.5
0.0 - 8.4
0.0 - 15.6
raster
contour
close
QC_stations_popup
Data options
24 hour
Points
Render Grids+MAPs
Group
Precip type
All
Point type
NEXRAD
ALERT
GOES
SNOTEL
ALERT
LARC
Point quality
Verified
Partial
Screened
Estimate
Time Dist
Bad
Manual
All
Questionable
Precipitation Points 07-18-12 ending at 12z - Level 2 Not Modified

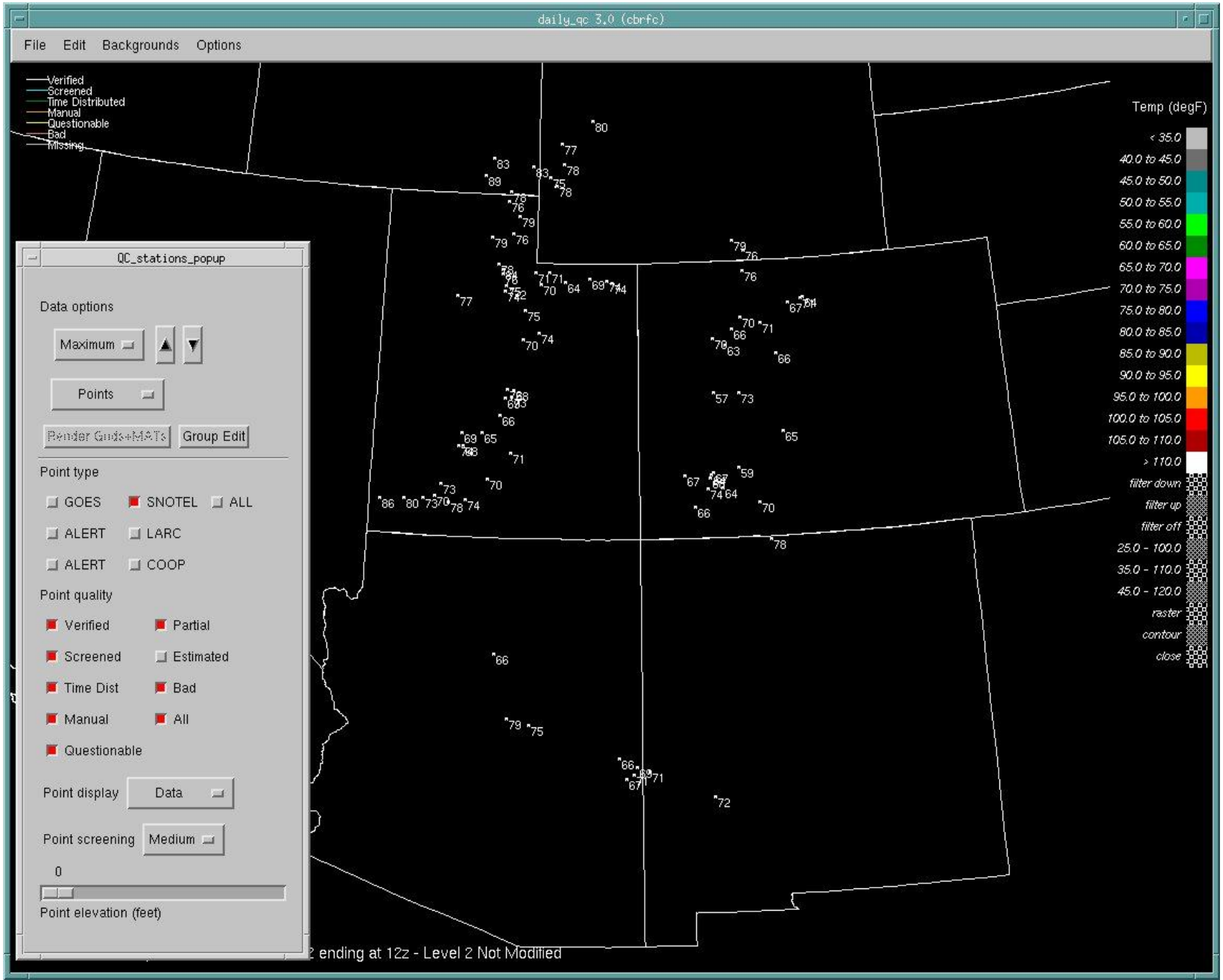
GOES DCP Temperature Data



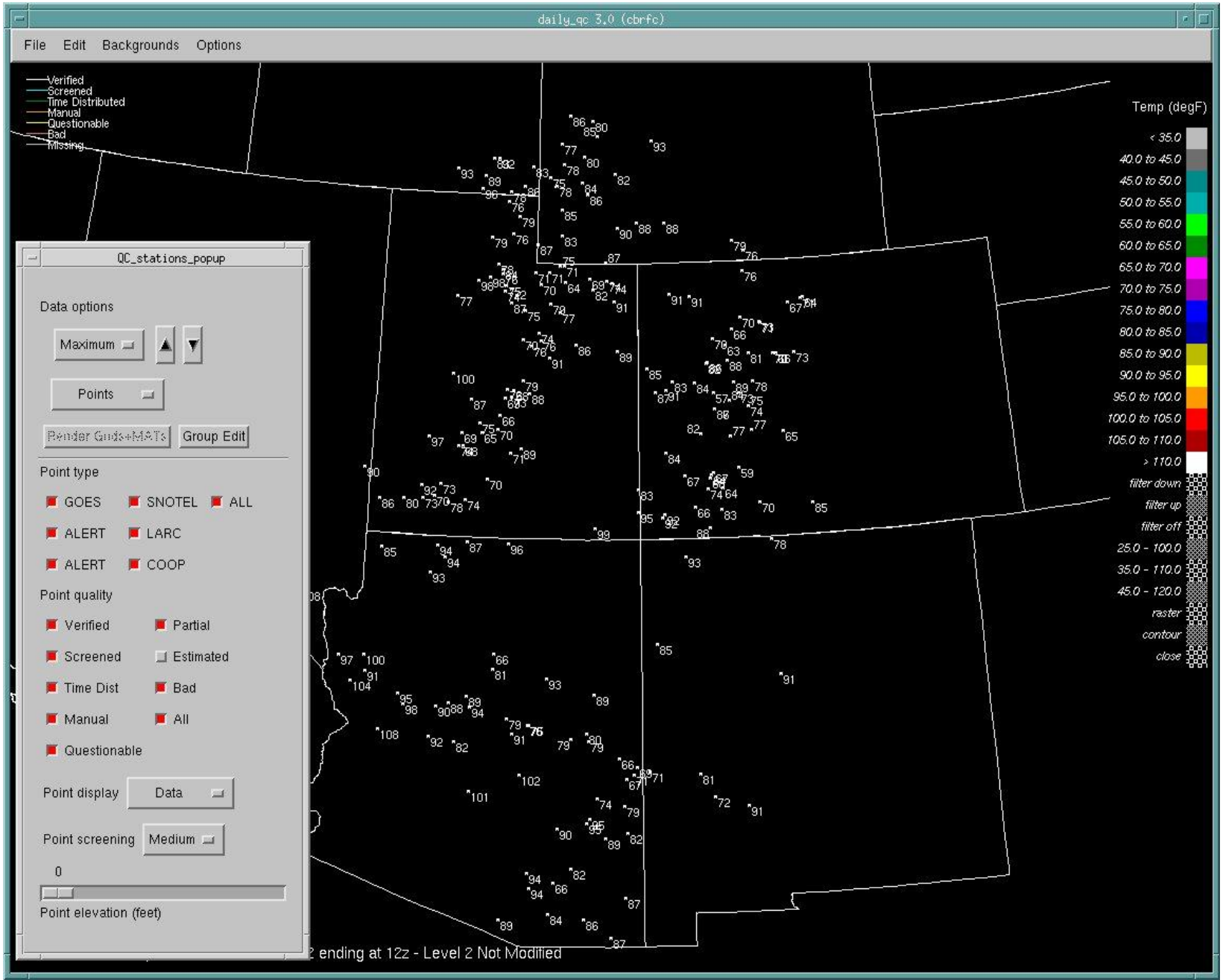
Cooperator Network Temperature Data



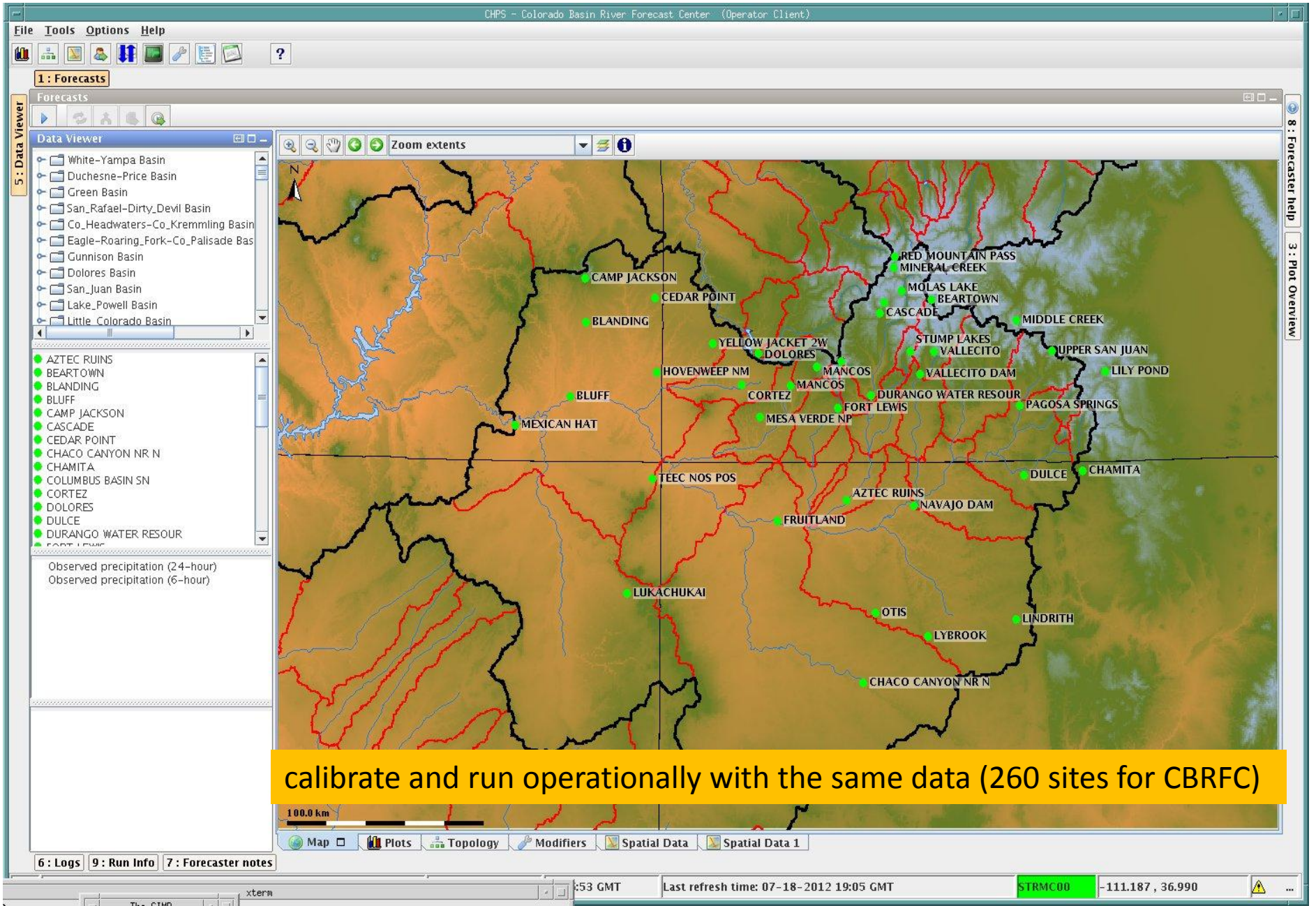
SNOTEL Network Temperature Data



All Temperature Data Networks

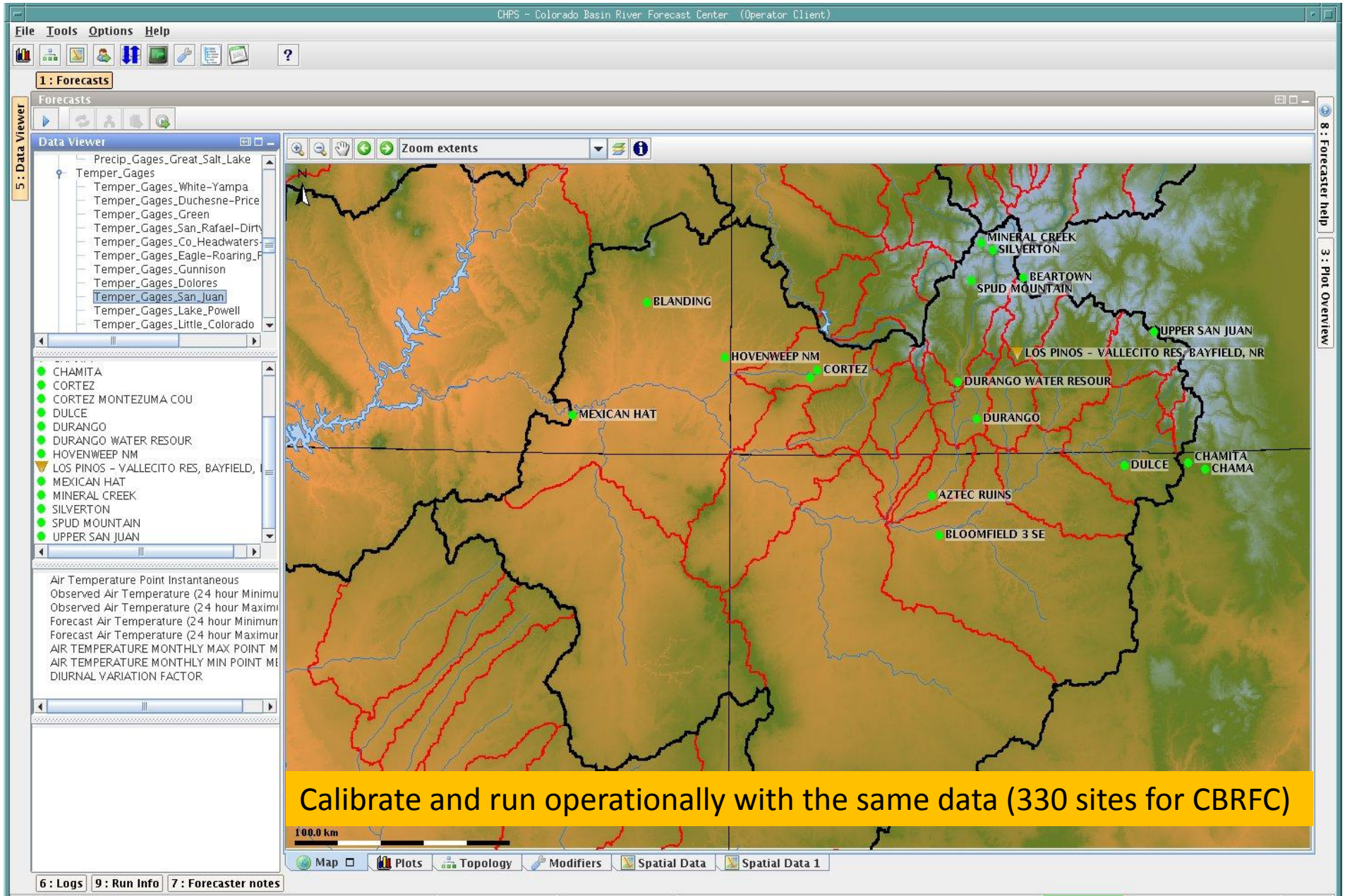


Precipitation gauge sites used in our model for the San Juan Basin (subset of all available)

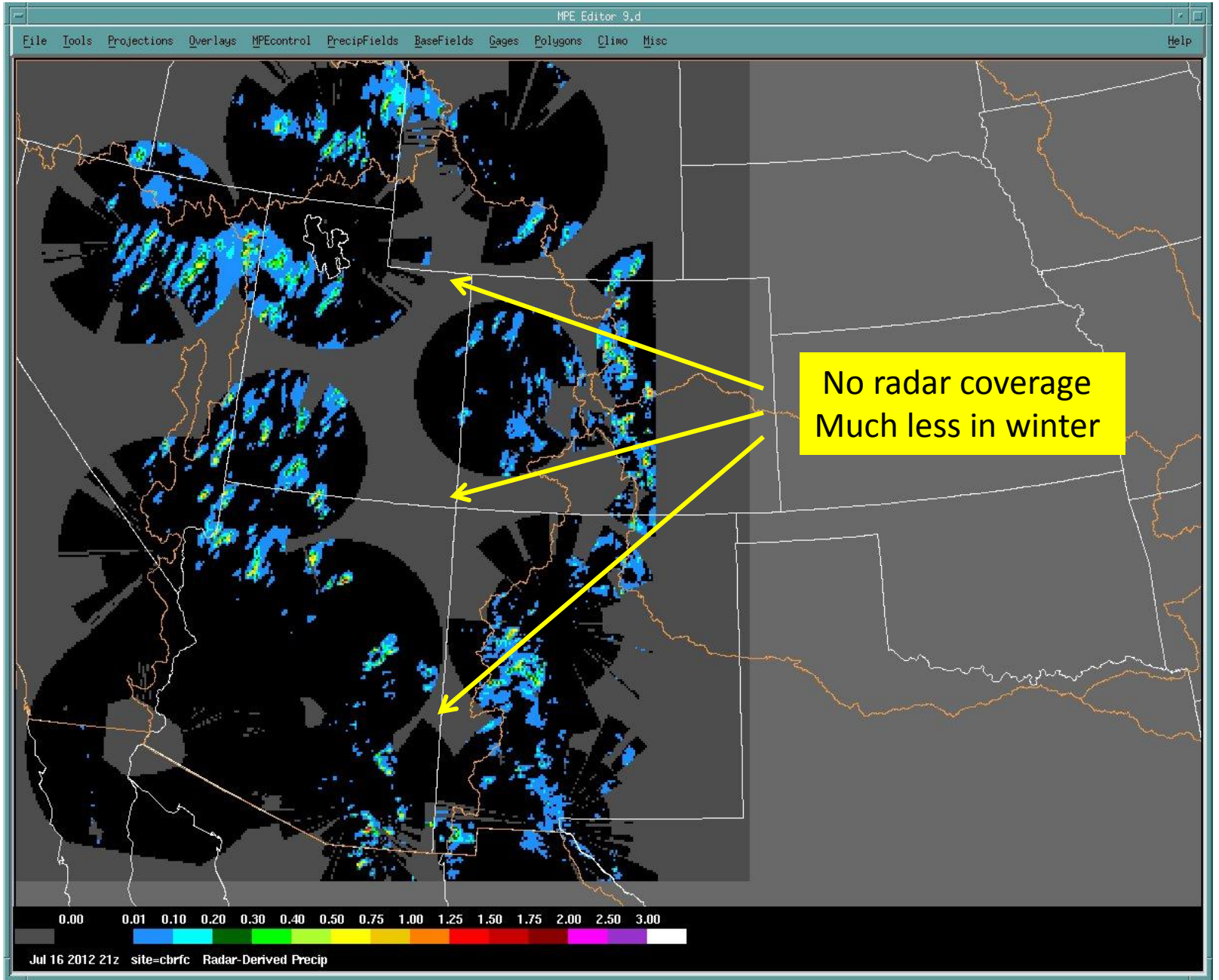


calibrate and run operationally with the same data (260 sites for CBRFC)

Temperature sites in the model for the San Juan Basin

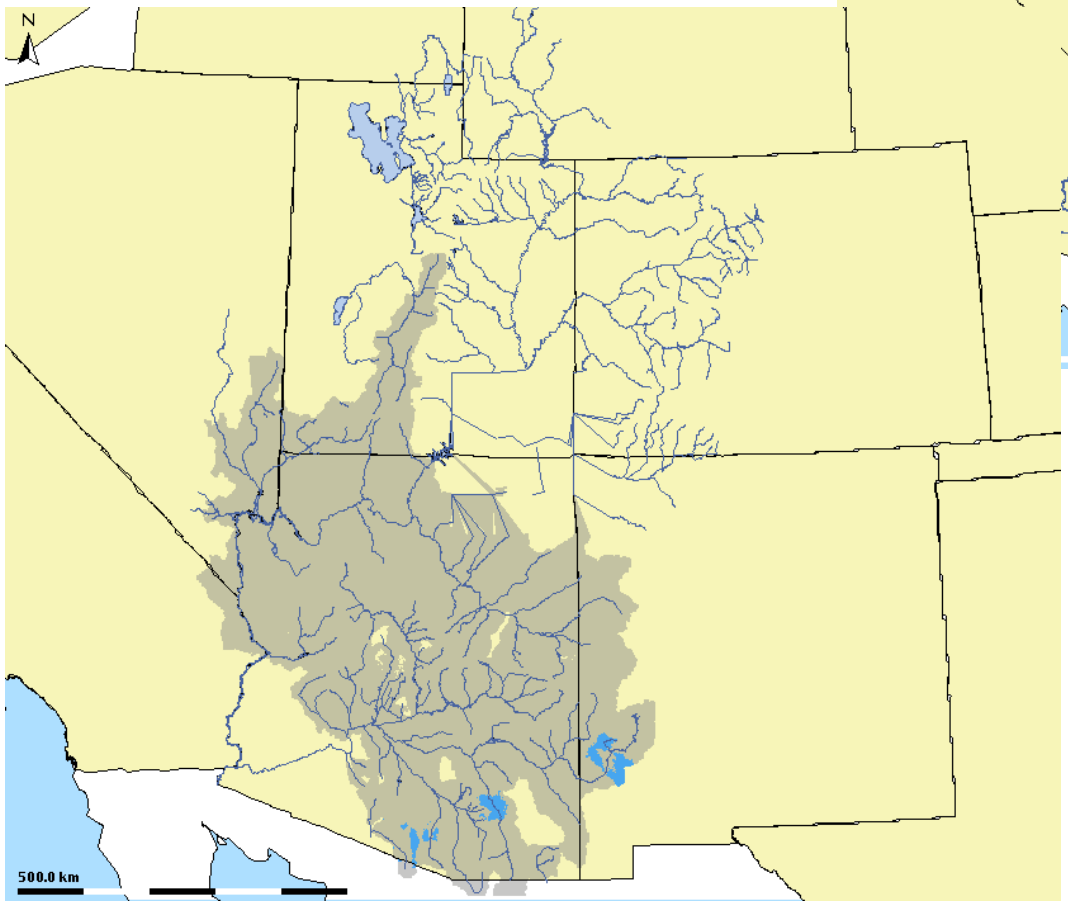


Additional Precipitation Source – NEXRAD Radar Derived Precipitation



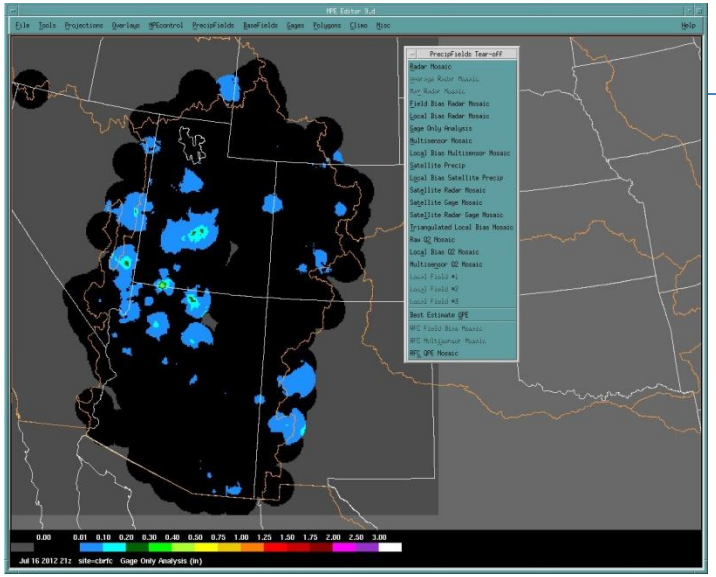
Areas where radar precipitation data may be used (rainfall-runoff hydrology dominates) as input to the hydrologic model.

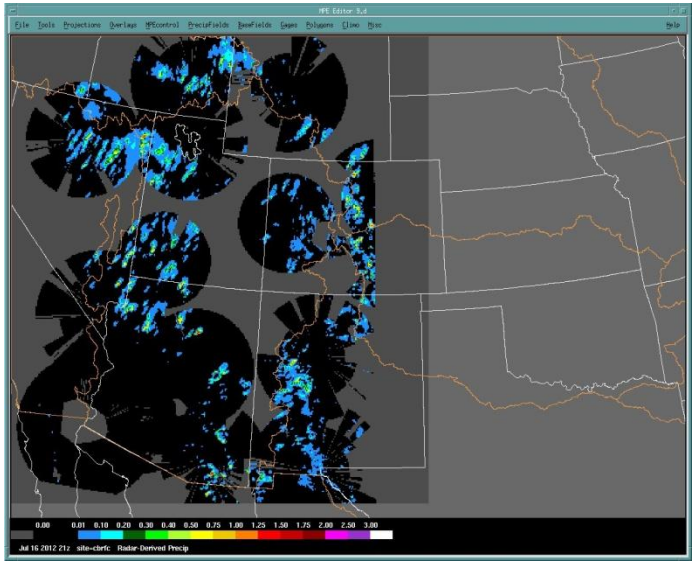
Hourly radar precipitation data is used in southern Utah, Arizona, and New Mexico (1-hour segments)



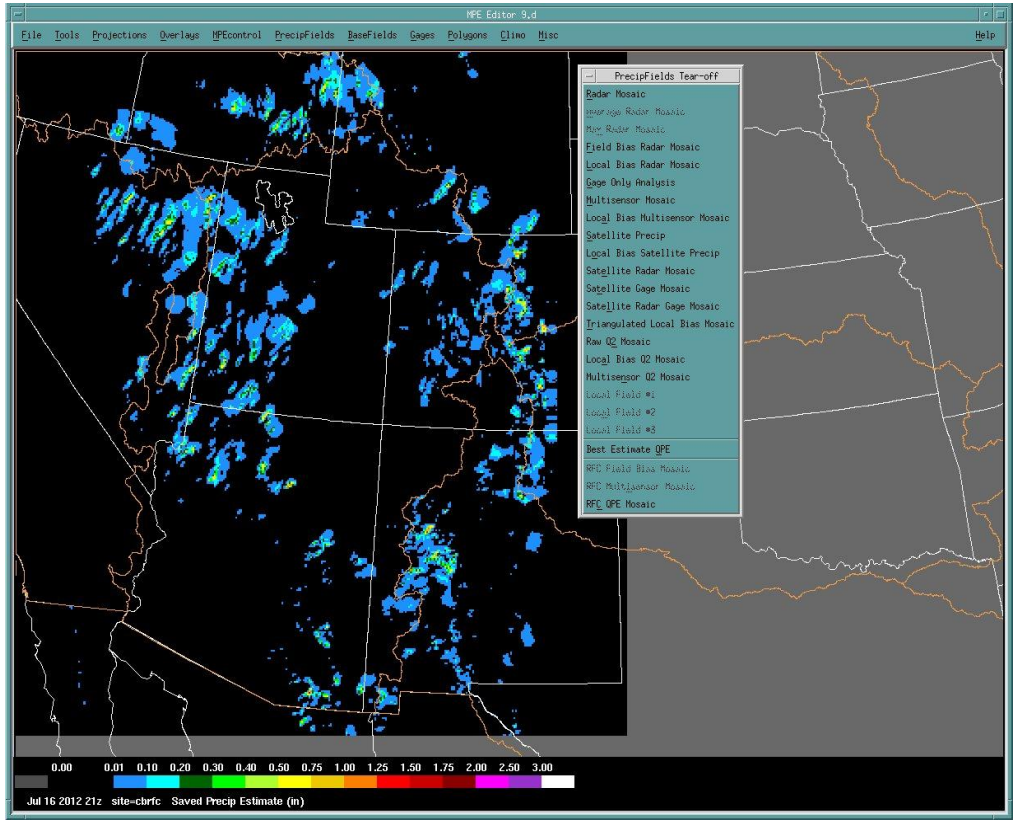
The option exists to use radar precipitation data in northern Utah and Colorado during summer months (6-hour segments)

Precipitation Source – Hourly Multi-Precipitation Editor (MPE generated Precipitation)



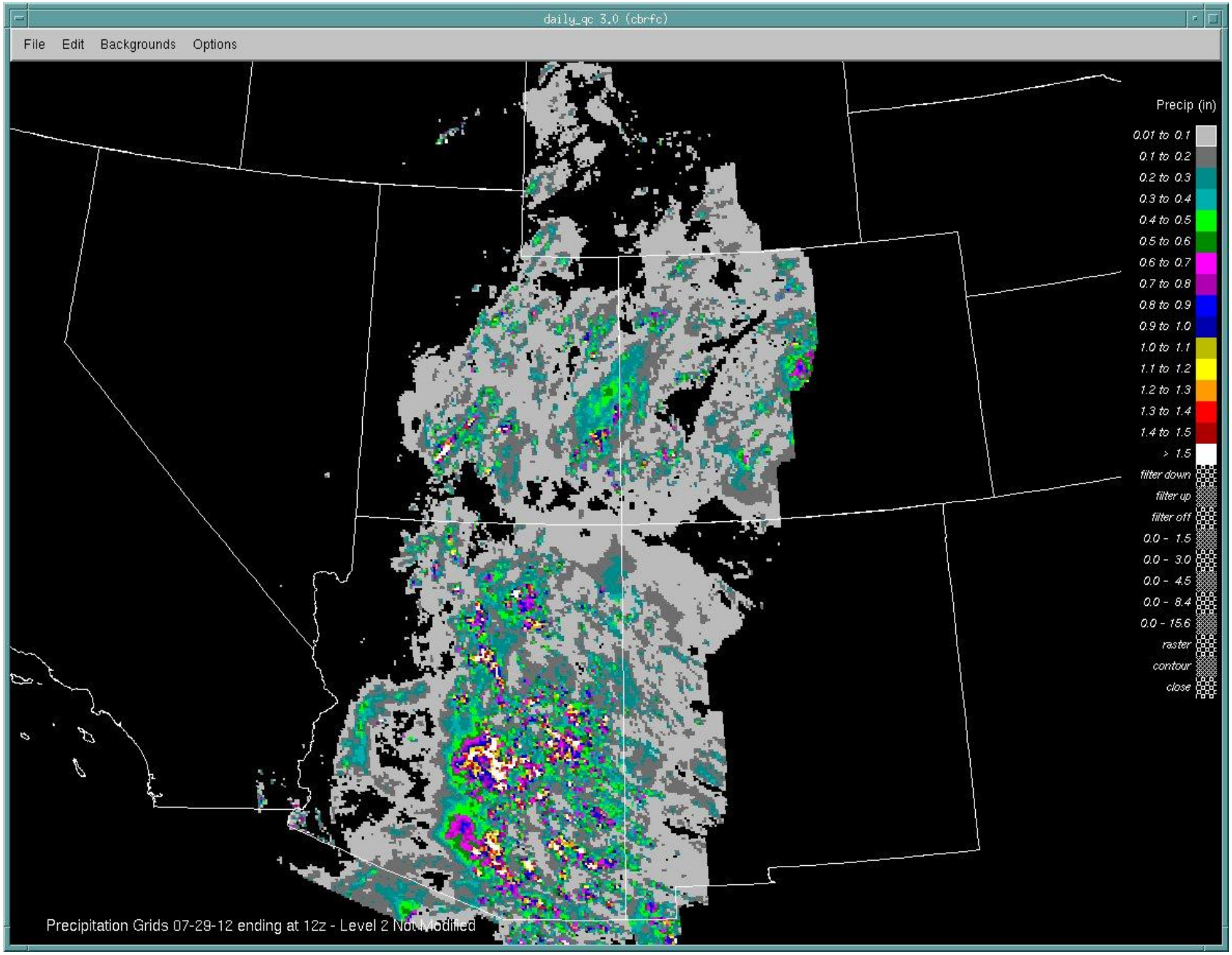


Radar derived precipitation and gage precipitation are combined to generate an hourly gridded product ingested by our hydrologic model

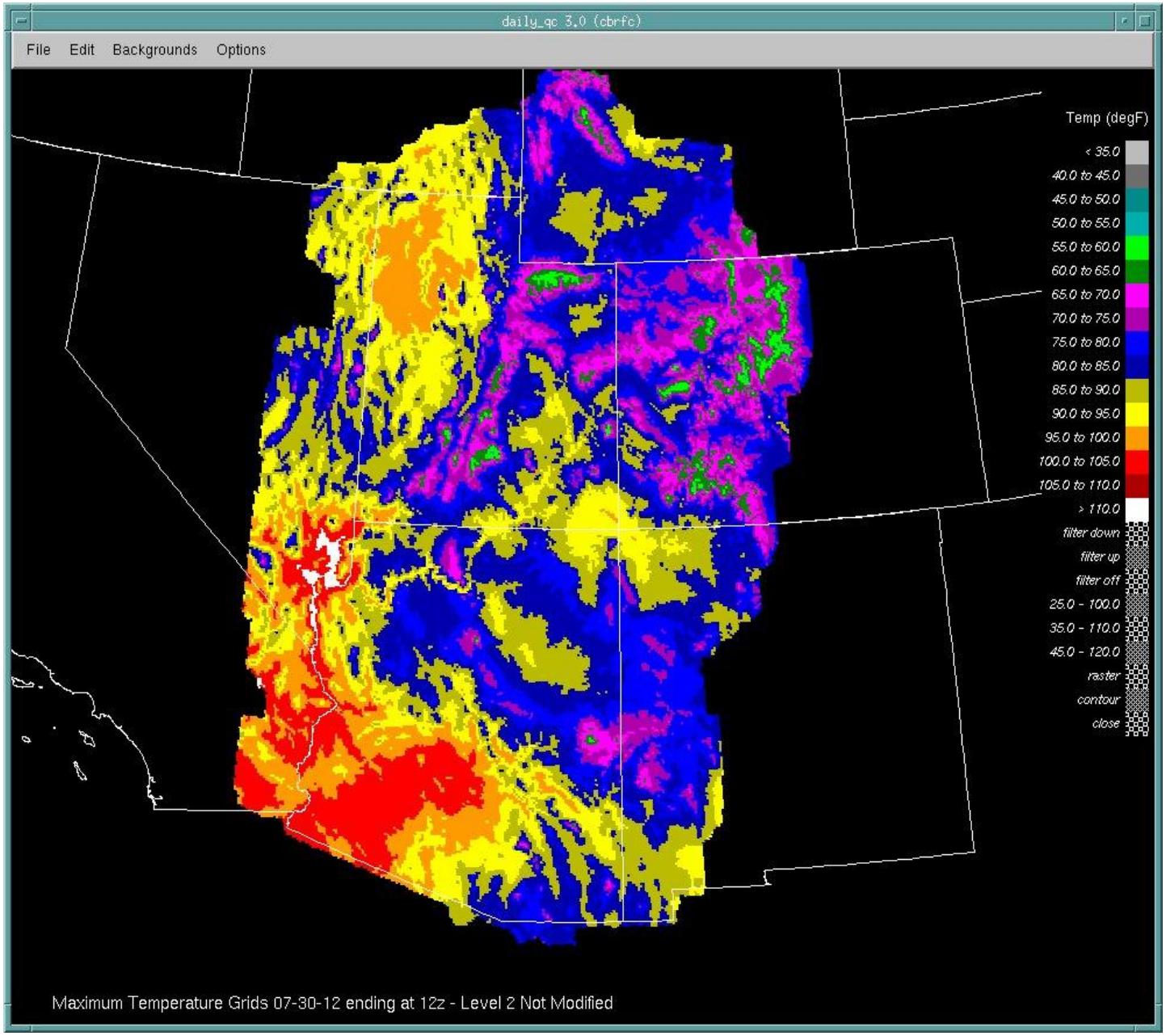


Satellite derived precipitation is available

Goal: Combine all precipitation sources into to a coherent precipitation product



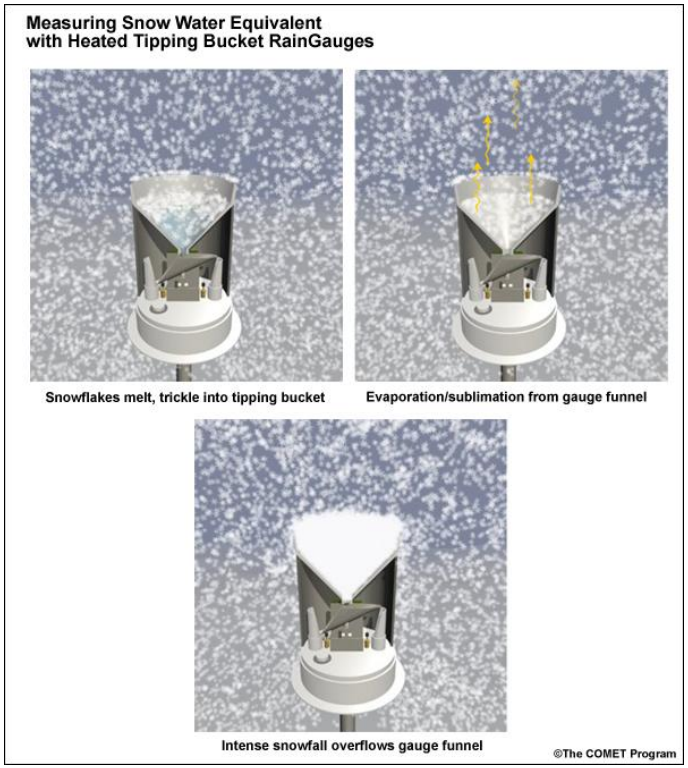
… same goal with temperature

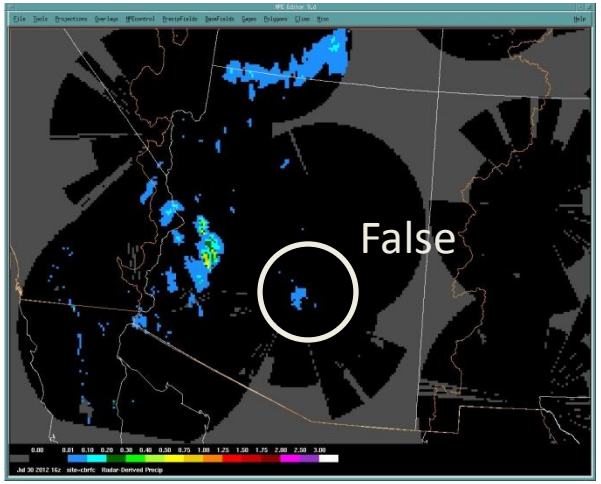


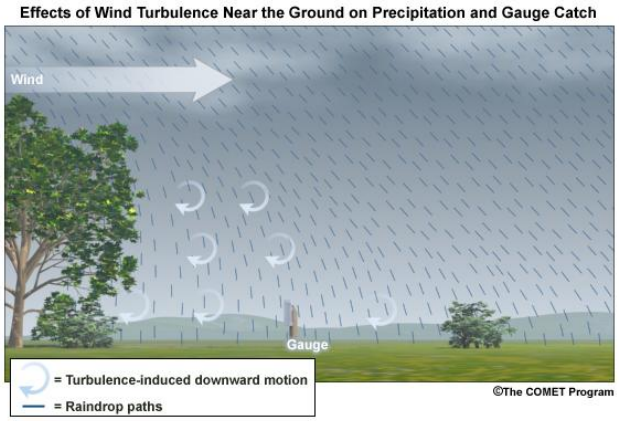
Goal: Combine all precip & temperature data sources into a coherent product

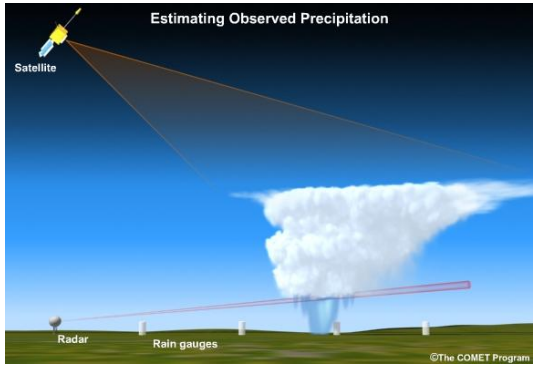
Quality Check All Data

- Use all sites all sources
- Meteorological situation
  - Affects gauge performance
  - Expected precipitation patterns









So what gets in the Model (and Forecast) ?

Quality Check All Data
- Use all sites all sources
- Meteorological situation
  - Affects gauge performance

Convert point 24/6 hour gauge data, to a Mean Areal Precipitation value (MAP).
Uses only a subset of all sites available.
Time step = 6 hours.

Convert point data to Mean Areal Temperature (MAT).
Time step = 6 hours.

Incorporates radar data (MPE) to create a Mean Areal Precipitation (MAP) value.
Time step = 1 hour.

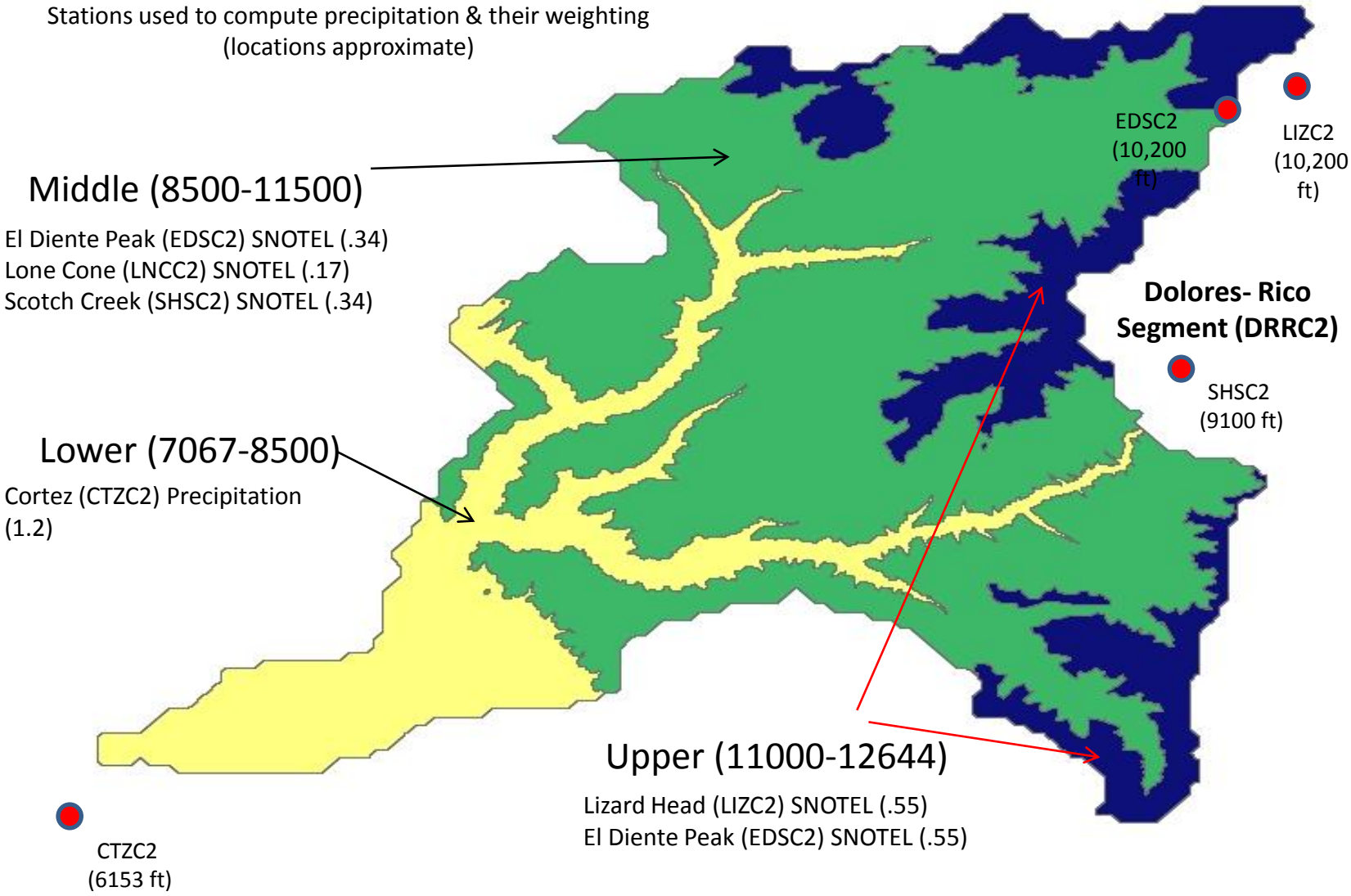
Observed data (and Forecast precipitation & temperature) are re-evaluated by forecaster interacting with the model during the daily operational run.

What is a MAP? Example of Stations used to generate Mean Areal Precipitation

Dolores – Dolores (DOLC2) Segment (below Rico)

SAC-SMA Model Sub-Areas

Stations used to compute precipitation & their weighting
(locations approximate)



Middle (8500-11500)

El Diente Peak (EDSC2) SNOTEL (.34)
Lone Cone (LNCC2) SNOTEL (.17)
Scotch Creek (SHSC2) SNOTEL (.34)

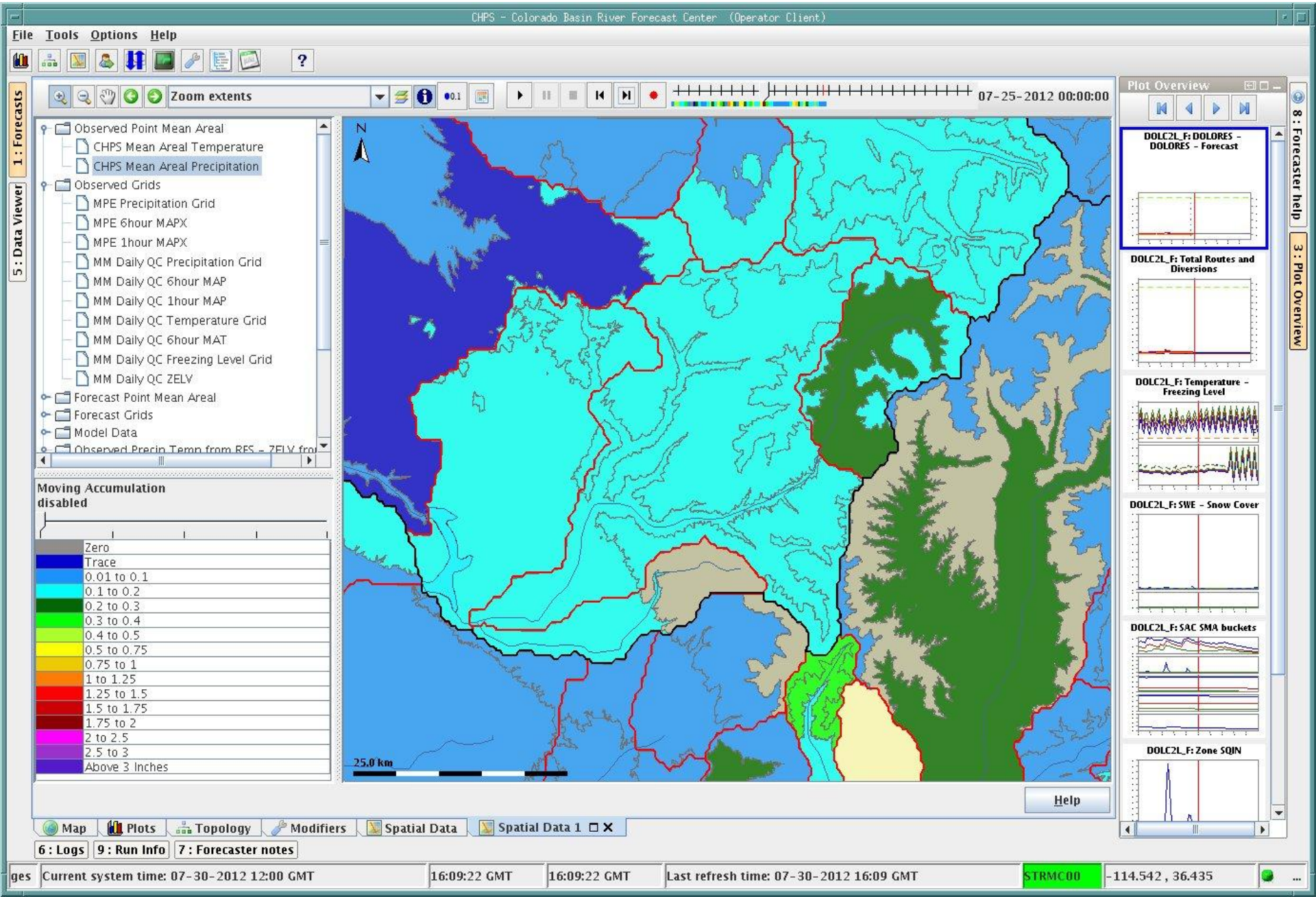
Lower (7067-8500)

Cortez (CTZC2) Precipitation
(1.2)

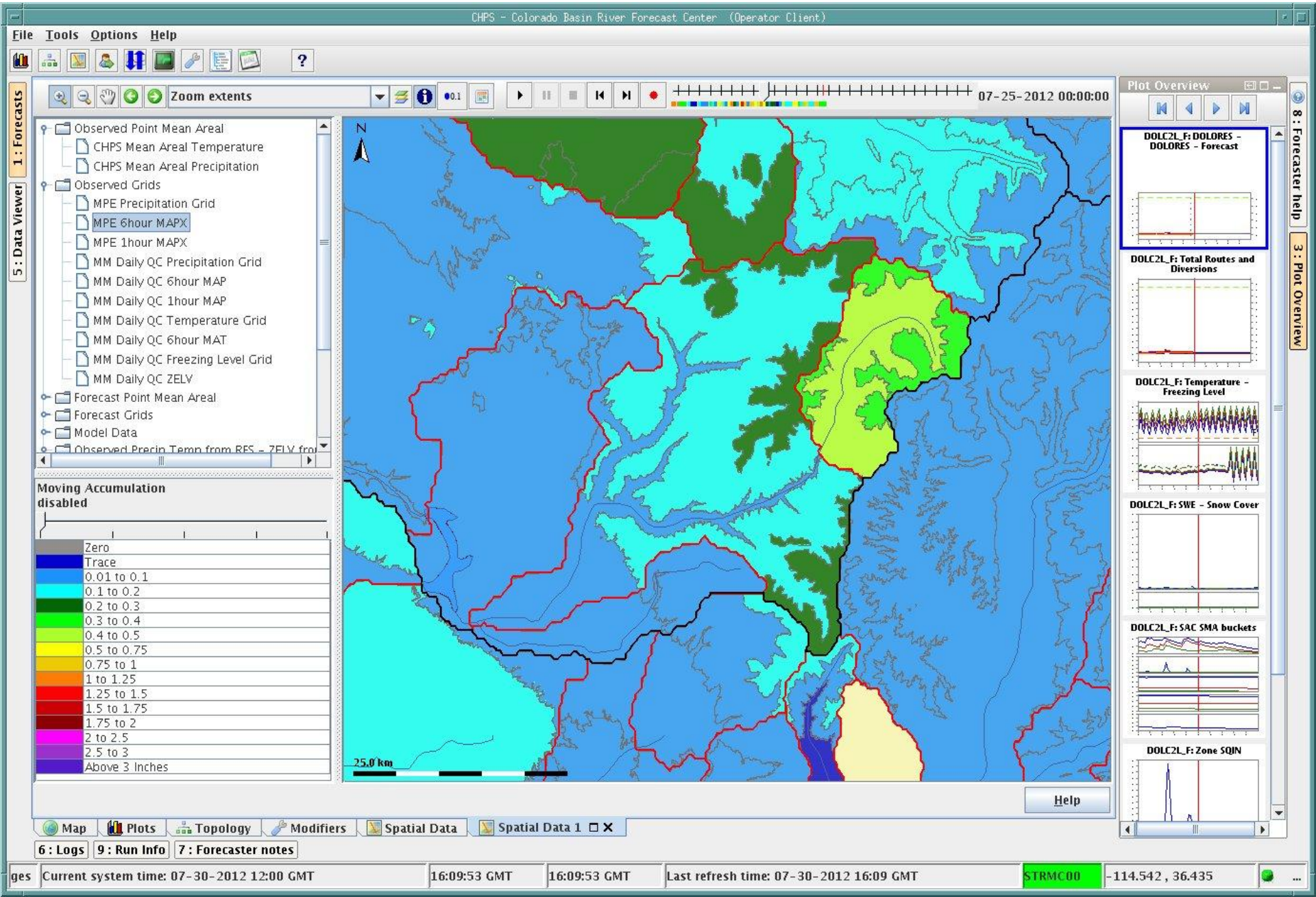
Upper (11000-12644)

Lizard Head (LIZC2) SNOTEL (.55)
El Diente Peak (EDSC2) SNOTEL (.55)

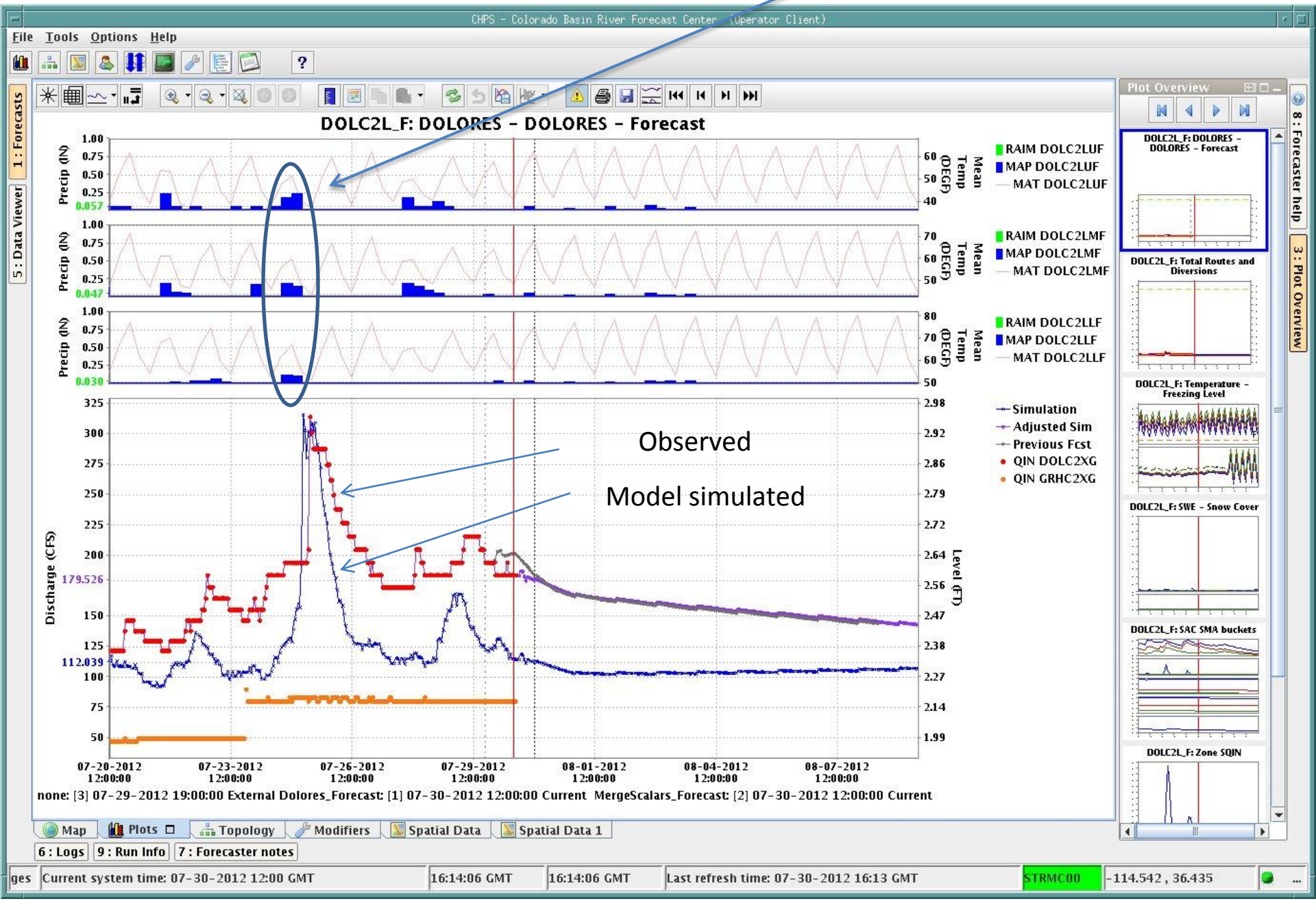
Operational Model Run 07/25 Noon-6 pm Precipitation for Dolores @ Dolores



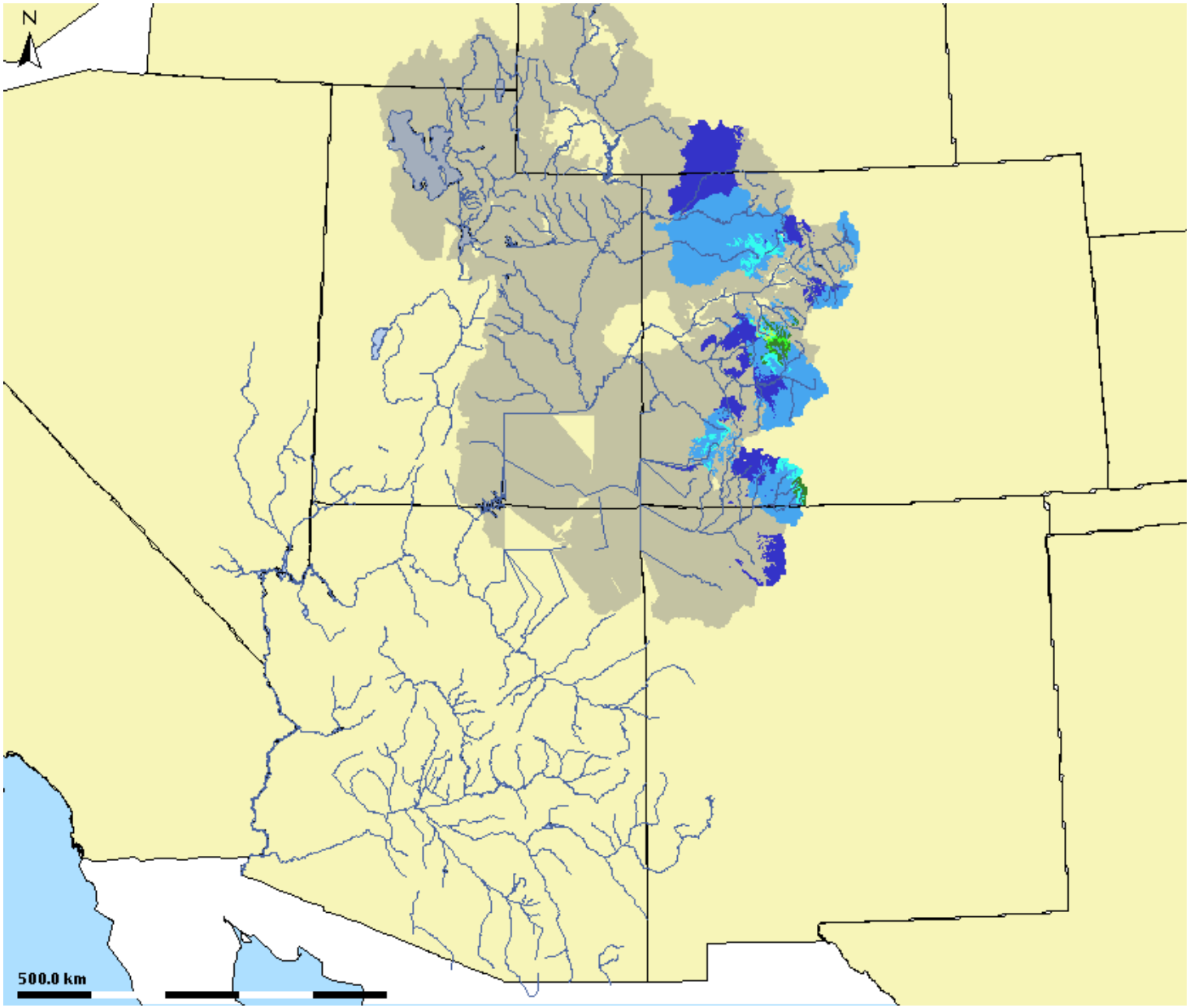
Operational Model Run 07/25 6pm-Midnight Precipitation for Dolores @ Dolores



Operational Model Run for Dolores @ Dolores / Precipitation 07/25 Noon-Midnight



6/24 hour gauge data is used to create MAP's in the Great Basin and Upper Colorado Basin



SUMMARY

Temperature and Precipitation observing networks are critical as they provide direct inputs into our hydrologic models and drive the streamflow forecasts.

- Immediate direct runoff (rainfall-runoff situation)
- Soil moisture states (long term volumes & peaks)
- Snowpack

Maintaining existing networks is critical to our forecast abilities

- Great deal of effort verifying gauge is stable through time.
- Priority given to those sites utilized in calibration / long period of records
    - ***SNOTEL Network our most critical network***
- The loss of any site risks degradation of overall data quality & resulting forecasts
- Surface network especially critical in West due to radar limitations

Consequences of bad (or limited data) are somewhat obvious

- Negatively impact ability to quality control observed data
- Misrepresentation of snowpack (seasonal & peak flow implications)
- Incorrect classification of precipitation types (further impact model states)
- Results: Poor model simulations, missed flood events, poor seasonal forecasts.