# NOAA's Colorado Basin River Forecast Center

## Quality Control

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2016 Stakeholder Open House

# Quality Control of Data



- Why do we quality control data?
  - To attempt to duplicate in realtime what we have accomplished in the calibrations.

# Quality Control of Data

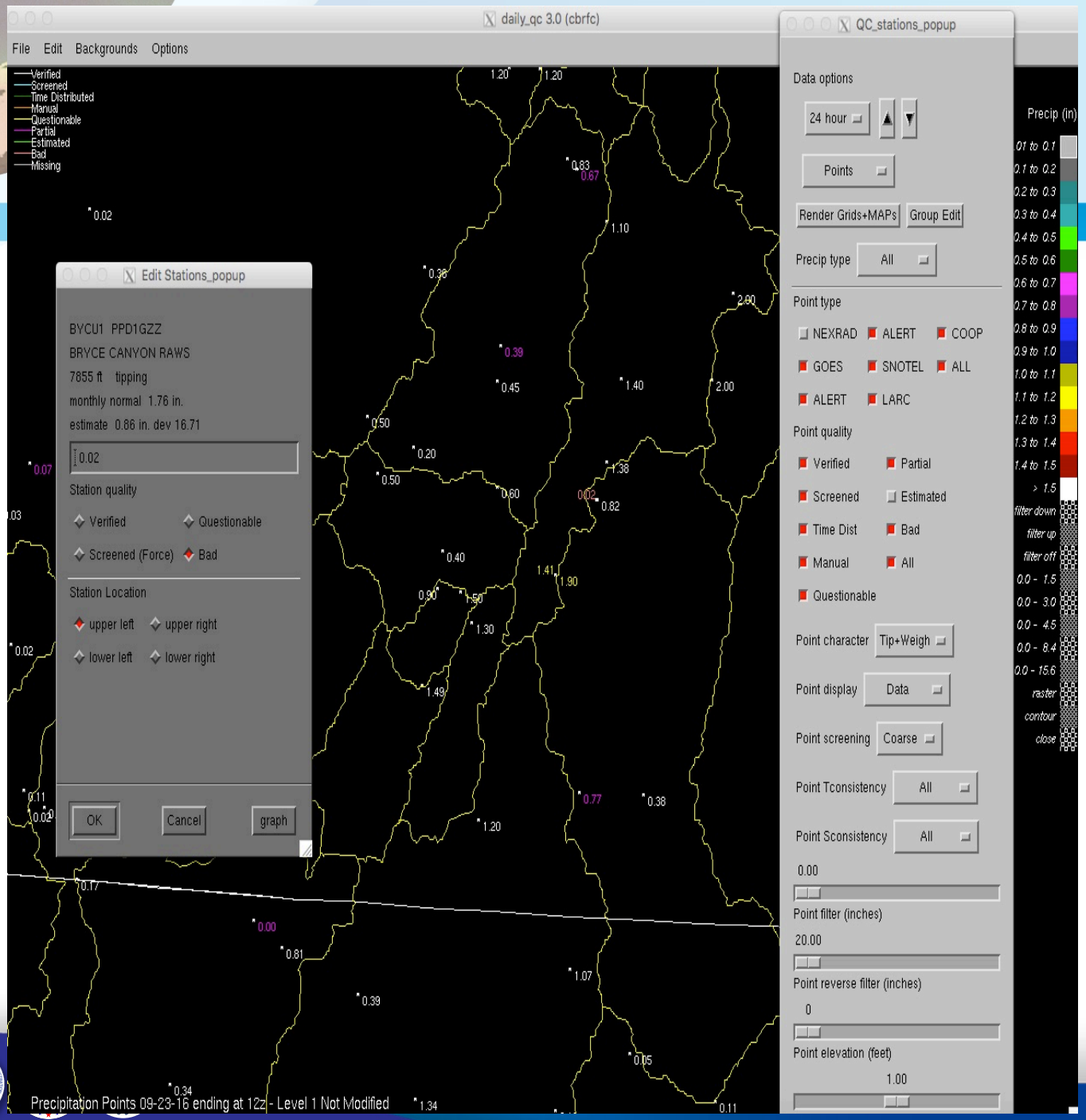


- Daily/Hourly
  - daily_qc (MM): quality control point precipitation and temperature data at a daily timestep
  - multi-sensor (MPE): quality control radar and point precipitation data at an hourly timestep
- Weekly
  - model snow update (seus_lite): quality control precipitation on a scale between daily and monthly
- Monthly
  - monthly_qc (MM): quality control precipitation and temperature point data on a monthly (and seasonal) time step
  - check for under-reporting gages (mainly) in southern basin by summing daily values to monthly
- Years
  - double mass analysis (IDMA): check for sensor consistency over the calibration period (30-35 years)

# Daily Quality Control



- Uses the following techniques to find bad gage data:
  - Nearest neighbor
  - Tipping bucket gages above freezing level
  - Plot time series of data
  - Allow substitution of snow pillow for precipitation gage for SNOTELs
  - Display of gridded field to help determine low/high catch gages
  - Compare with raw radar precipitation


daily_qc 3.0 (cbrfc)
File Edit Backgrounds Options
Verified
Screened
Time Distributed
Manual
Questionable
Partial
Estimated
Bad
Missing
Edit Stations_popup
BYCU1 PPD1GZZ
BRYCE CANYON RAWS
7855 ft tipping
monthly normal 1.76 in.
estimate 0.86 in. dev 16.71
0.02
Station quality
Verified
Questionable
Screened (Force)
Bad
Station Location
upper left
upper right
lower left
lower right
OK
Cancel
graph
QC_stations_popup
Data options
24 hour
Points
Render Grids+MAPs
Group Edit
Precip type
All
Point type
NEXRAD
ALERT
COOP
GOES
SNOTEL
ALL
ALERT
LARC
Point quality
Verified
Partial
Screened
Estimated
Time Dist
Bad
Manual
All
Questionable
Point character
Tip+Weigh
Point display
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All
Point Sconsistency
All
0.00
Point filter (inches)
20.00
Point reverse filter (inches)
0
Point elevation (feet)
1.00
Precip (in)
.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
Precipitation Points 09-23-16 ending at 12z - Level 1 Not Modified

# Hourly Quality Control



- Uses radar data that is bias adjusted
  - Compares gage values to radar values
  - Radar data is trimmed to only use the part that is below the freezing level. In the winter, the MPE usually becomes a gage only field.
- Gage data is from quality controlled daily_qc
- Compare summed 24 hourly fields with 24 hour daily_qc grid

# Quality Control between a day and a month

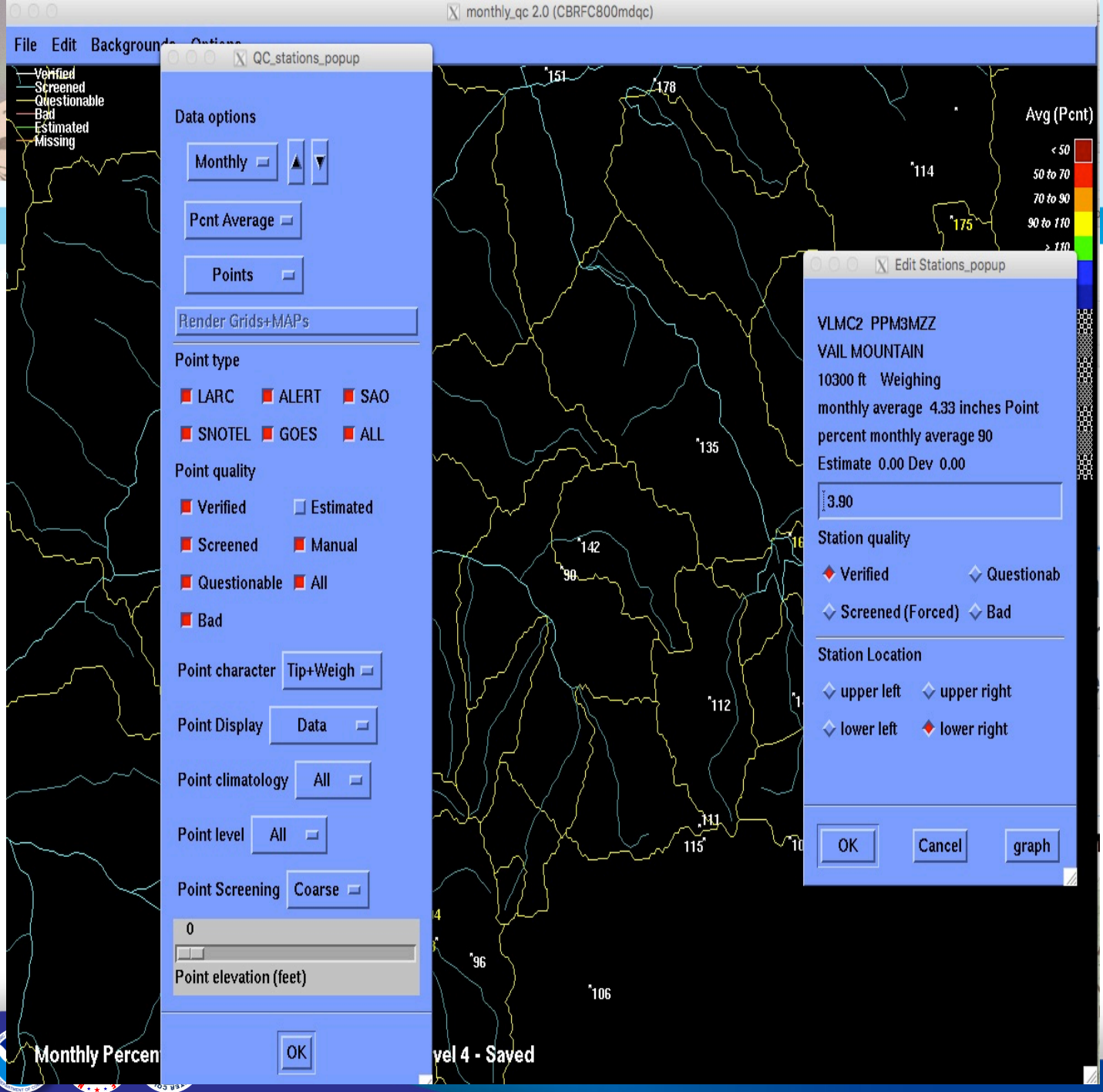


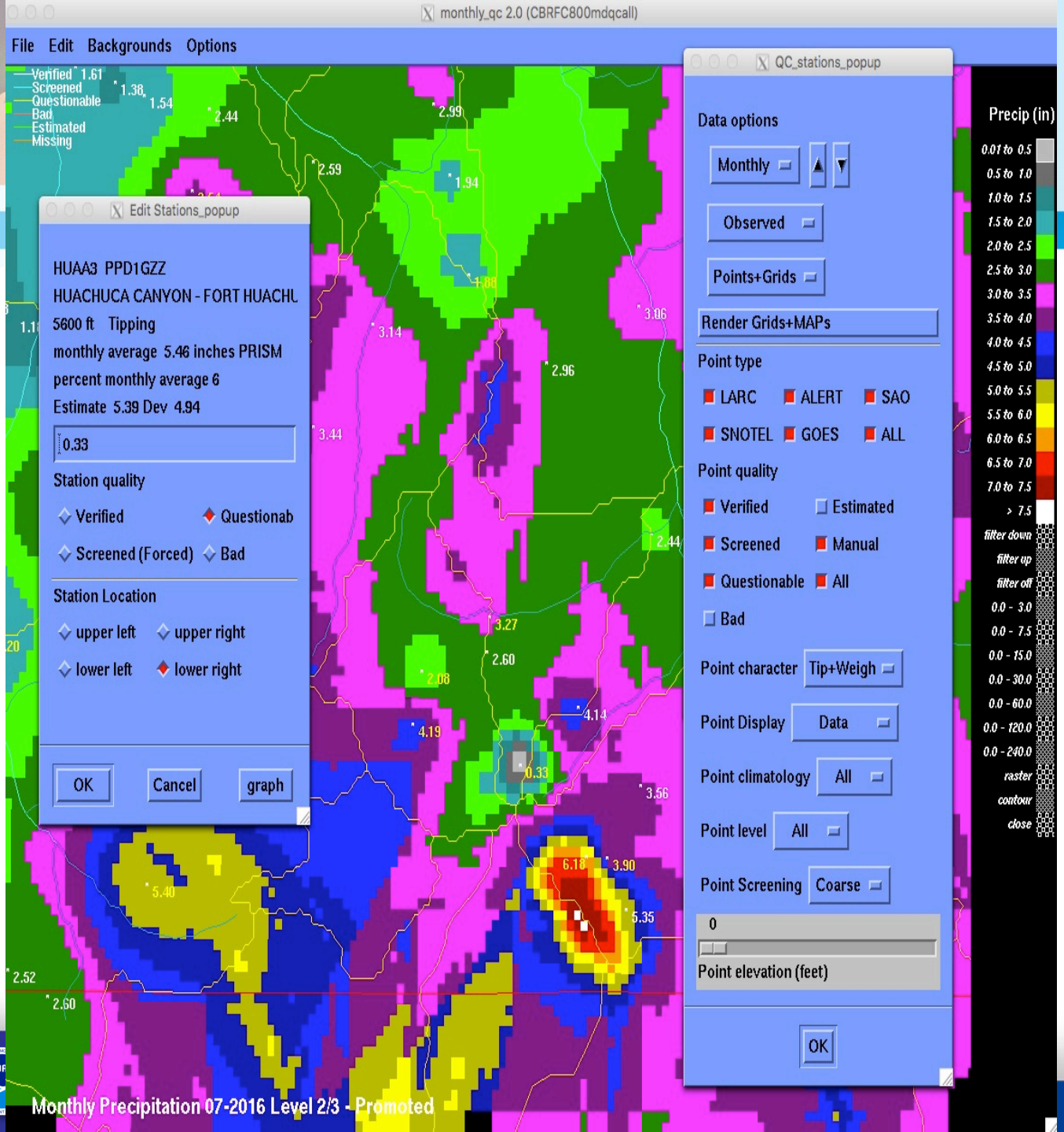
- Daily values of SNOTEL precipitation are often inaccurate
  - Calculates the precipitation values over a longer period (days to a month)
  - Updates the model SWE above 8000 feet in each basin. This is possible because
    - Precipitation is calculated through fixed weights of gages for each basin and area
    - During November 1 through April 1 (typically) most areas have frozen precipitation only (no rain)
- This technique greatly improves model performance in basins dominated by snowmelt and ensures that the model will perform operationally the same as it does in the calibration period

# Monthly Quality Control



- Displays/calculates monthly/seasonal temperature and precipitation
  - Calculates amounts and percent of average
  - Helps to identify gages that are not functioning correctly
    - Gages that are outliers will be estimated. The snow states will be updated with these estimates
    - In the southern basins, helps to identify gages that are under/over reporting.These can be difficult to find in daily_qc

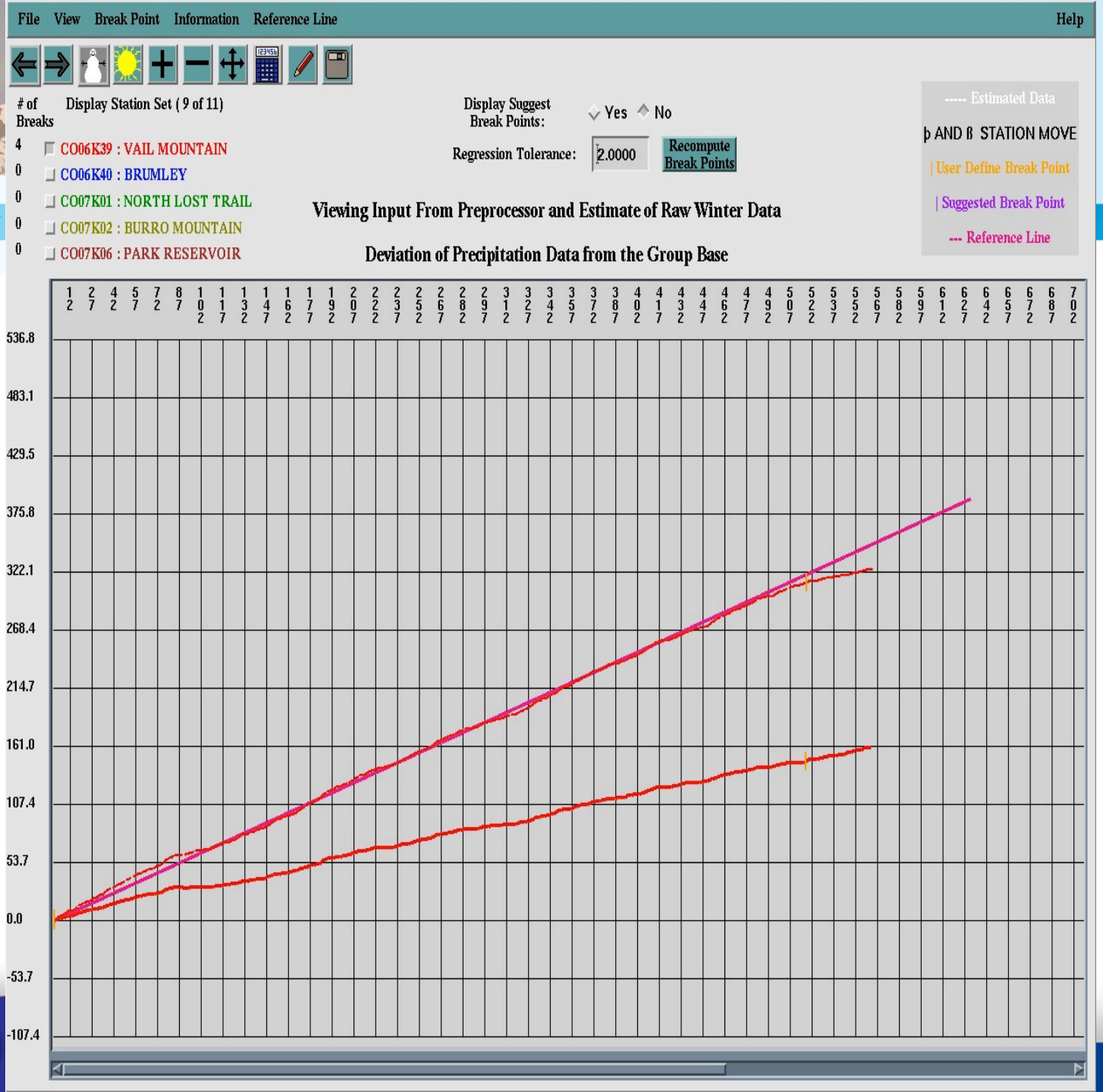

monthly_qc 2.0 (CBRFC800mdqc)
File Edit Backgrounds Options
Verified
Screened
Questionable
Bad
Estimated
Missing
QC_stations_popup
Data options
Monthly
Pcnt Average
Points
Render Grids+MAPs
Point type
LARC ALERT SAO
SNOTEL GOES ALL
Point quality
Verified Estimated
Screened Manual
Questionable All
Bad
Point character Tip+Weigh
Point Display Data
Point climatology All
Point level All
Point Screening Coarse
0
Point elevation (feet)
OK
Avg (Pcnt)
< 50
50 to 70
70 to 90
90 to 110
> 110
Edit Stations_popup
VLMC2 PPM3MZZ
VAIL MOUNTAIN
10300 ft Weighing
monthly average 4.33 inches Point
percent monthly average 90
Estimate 0.00 Dev 0.00
3.90
Station quality
Verified Questionab
Screened (Forced) Bad
Station Location
upper left upper right
lower left lower right
OK
Cancel
graph
Monthly Percen
vel 4 - Saved


monthly_qc 2.0 (CBRFC800mdqcall)
File Edit Backgrounds Options
Verified
Screened
Questionable
Bad
Estimated
Missing
Edit Stations_popup
HUAA3 PPD1GZZ
HUACHUCA CANYON - FORT HUACHU
5600 ft Tipping
monthly average 5.46 inches PRISM
percent monthly average 6
Estimate 5.39 Dev 4.94
0.33
Station quality
Verified
Questionab
Screened (Forced)
Bad
Station Location
upper left
upper right
lower left
lower right
OK
Cancel
graph
QC_stations_popup
Data options
Monthly
Observed
Points+Grids
Render Grids+MAPs
Point type
LARC
ALERT
SAO
SNOTEL
GOES
ALL
Point quality
Verified
Estimated
Screened
Manual
Questionable
All
Bad
Point character
Tip+Weigh
Point Display
Data
Point climatology
All
Point level
All
Point Screening
Coarse
0
Point elevation (feet)
OK
Precip (in)
0.01 to 0.5
0.5 to 1.0
1.0 to 1.5
1.5 to 2.0
2.0 to 2.5
2.5 to 3.0
3.0 to 3.5
3.5 to 4.0
4.0 to 4.5
4.5 to 5.0
5.0 to 5.5
5.5 to 6.0
6.0 to 6.5
6.5 to 7.0
7.0 to 7.5
> 7.5
filter down
filter up
filter off
0.0 - 3.0
0.0 - 7.5
0.0 - 15.0
0.0 - 30.0
0.0 - 60.0
0.0 - 120.0
0.0 - 240.0
raster
contour
close
Monthly Precipitation 07-2016 Level 2/3 - Promoted

# Yearly Quality Control



- Double Mass Analysis
- Compares gages to a single or group of gages that should have similar characteristics
- The mass (precipitation or max/min temperature) is added over a period of several years (30-35)
- The plot of the mass should be linear compared with the reference gage(s) if the gage characteristic has not changed
- What can change the gage characteristics?
  - Re-positioning (horizontal and vertical)
  - Change in reporting method (Gage construction)
  - Vegetation
- If needed, a correction can be made to ensure the gage has similar characteristics over time


File View Break Point Information Reference Line Help
# of Breaks
Display Station Set ( 9 of 11)
4 CO06K39 : VAIL MOUNTAIN
0 CO06K40 : BRUMLEY
0 CO07K01 : NORTH LOST TRAIL
0 CO07K02 : BURRO MOUNTAIN
0 CO07K06 : PARK RESERVOIR
Display Suggest Break Points: Yes No
Regression Tolerance: 2.0000
Recompute Break Points
----- Estimated Data
þ AND ß STATION MOVE
| User Define Break Point
| Suggested Break Point
--- Reference Line
Viewing Input From Preprocessor and Estimate of Raw Winter Data
Deviation of Precipitation Data from the Group Base
536.8
483.1
429.5
375.8
322.1
268.4
214.7
161.0
107.4
53.7
0.0
-53.7
-107.4