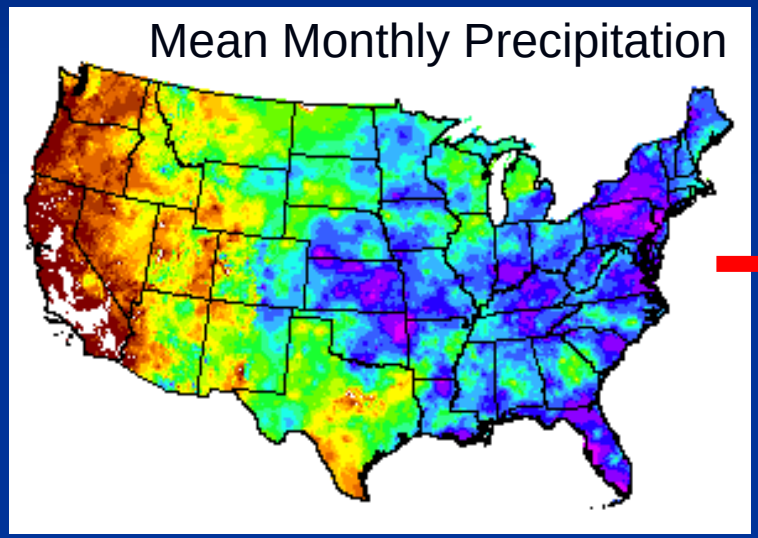
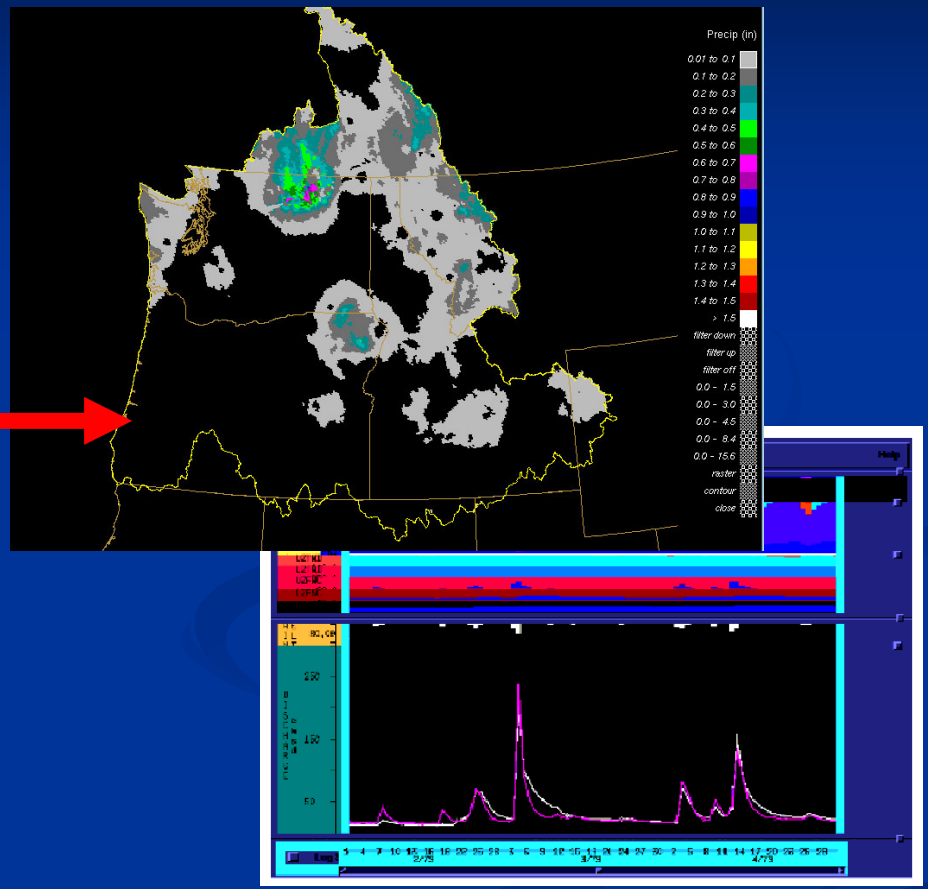
RFC Use of PRISM Data





Overview of Presentation

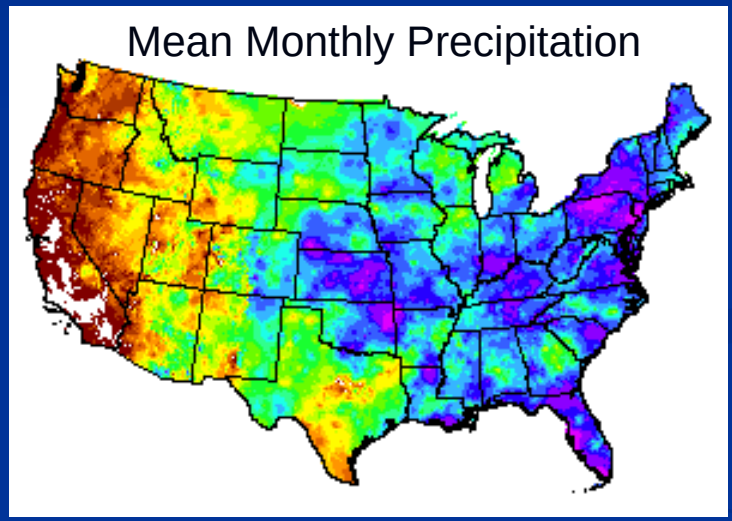
What is PRISM?

Why is PRISM important to River Forecast Centers?

How is PRISM used by RFC's?

What is PRISM?

Parameter-elevation Regressions on Independent Slopes Model



developed by

Dr. Christopher Daly

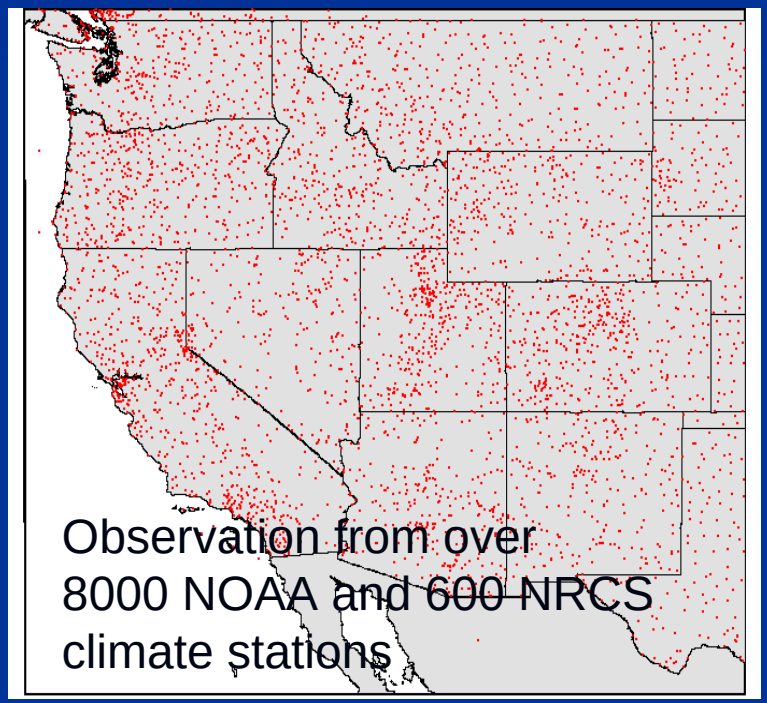
Spatial Climate Analysis Service

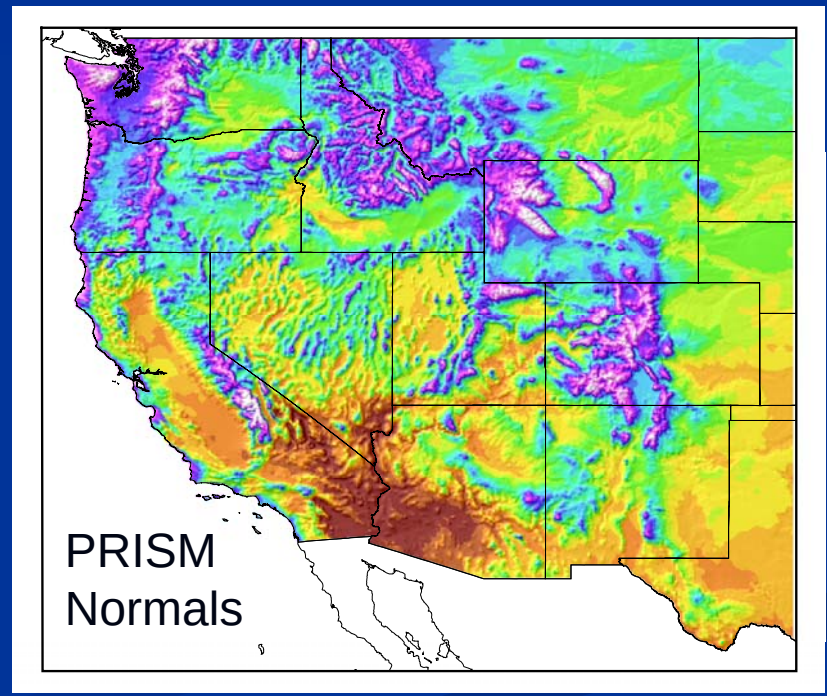
Oregon State University

PRISM Summary

PRISM is a hybrid statistical-geographic approach to mapping climate

PRISM combines point measurements of climate data with a digital elevation model to generate estimates of annual, monthly, and event-based climatic elements including precipitation and temperature.





PRISM output includes gridded datasets that are easily digested by computer applications

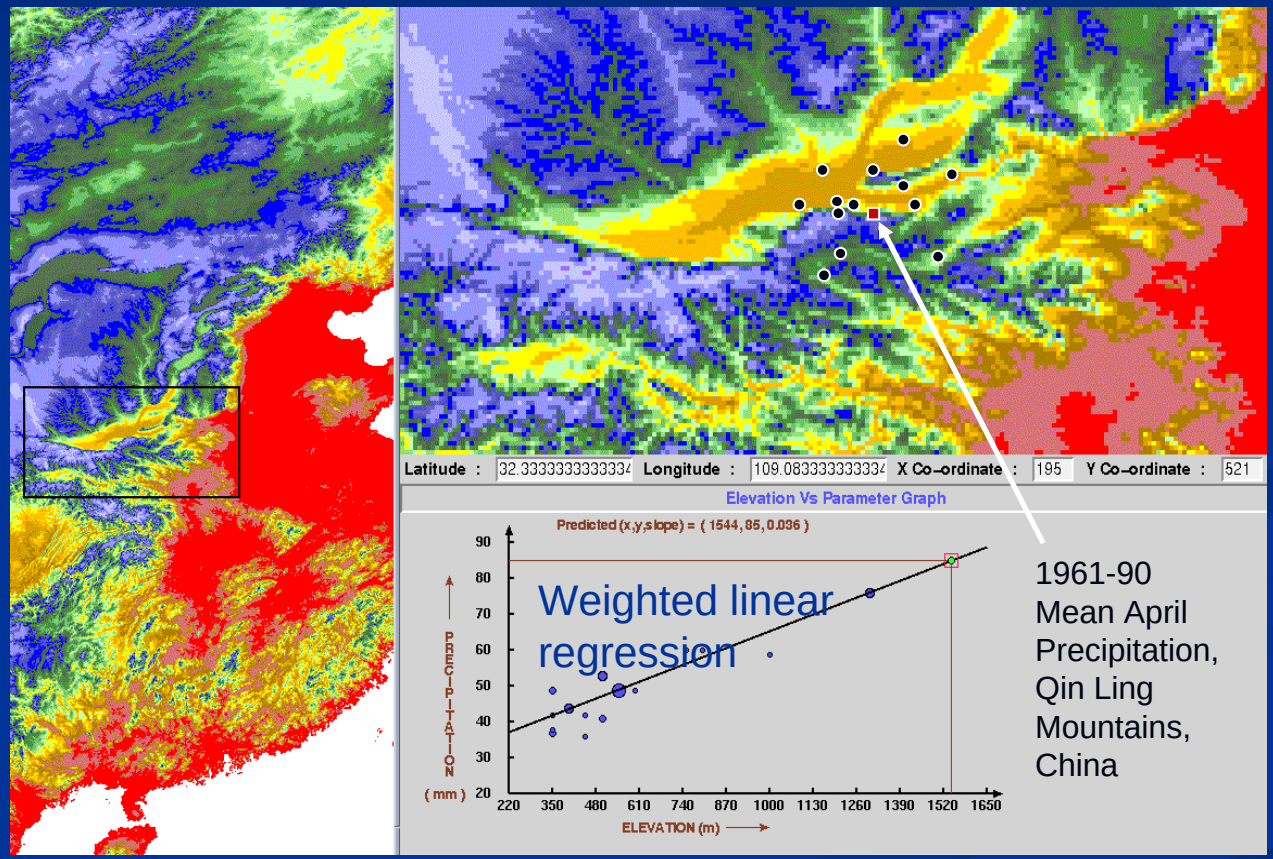
PRISM Summary

PRISM accounts for spatial variations in climate due to:

- Elevation (digital elevation grid)
- Terrain orientation (topographic facet grid)
- Terrain steepness (terrain profile grid)
- Moisture regime (storm trajectory grid)
- Coastal proximity (coastal trajectory grid)
- Inversion layer (inversion height grid)

Development of PRISM Precipitation Maps

Here is partial output from the PRISM Graphical User Interface (GUI), showing a precipitation-elevation regression function for the north slope of the Qin Ling Mountains in central China. The red square is the target pixel, and the black dots are the surrounding station locations.

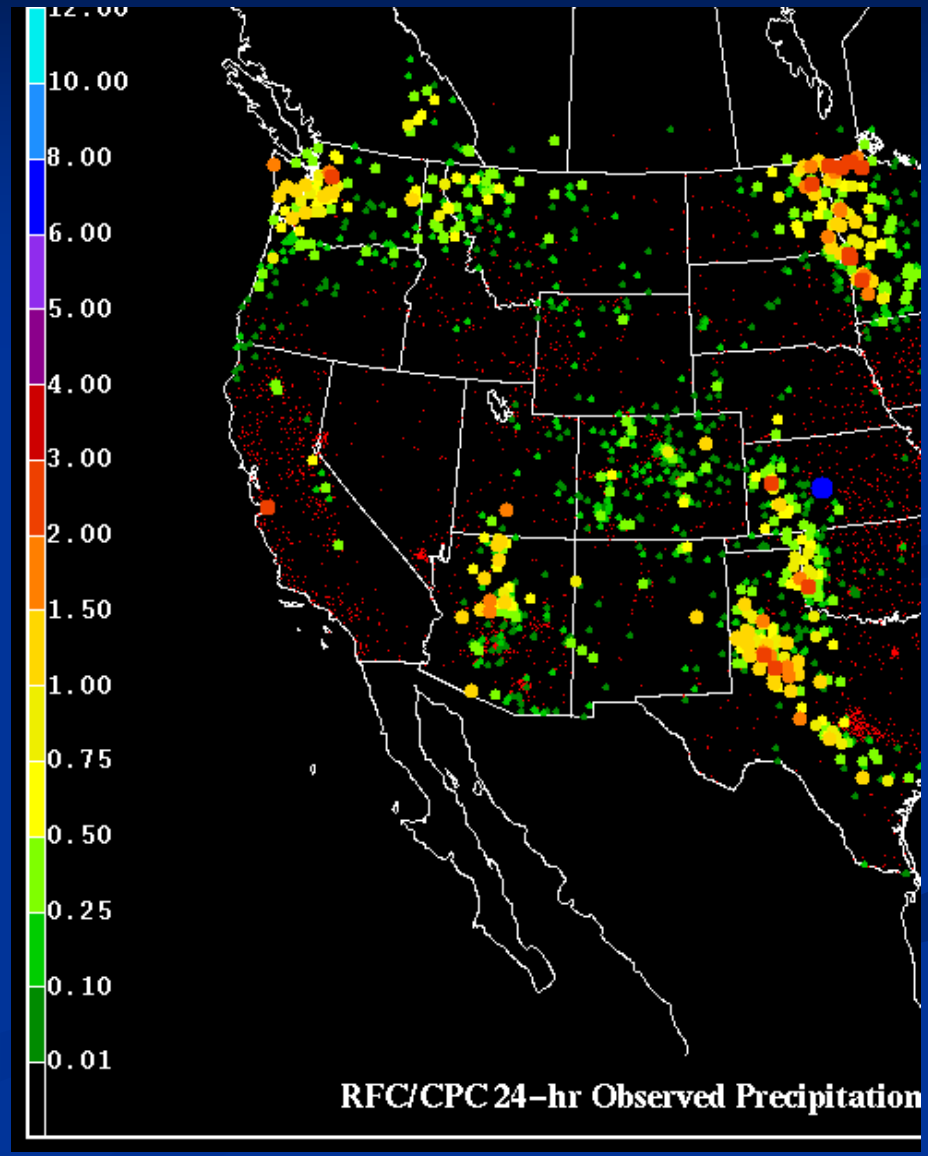


On the scatterplot, the blue dots represent the stations, plotted by elevation on the x-axis and precipitation on the y-axis. The size of each dot represents the relative weight of the station in the regression function.

Why is PRISM Important to RFC's

A common lament among hydrologic forecasters is the lack of climate observations just where they are needed most…often in mountainous regions, or rural areas.

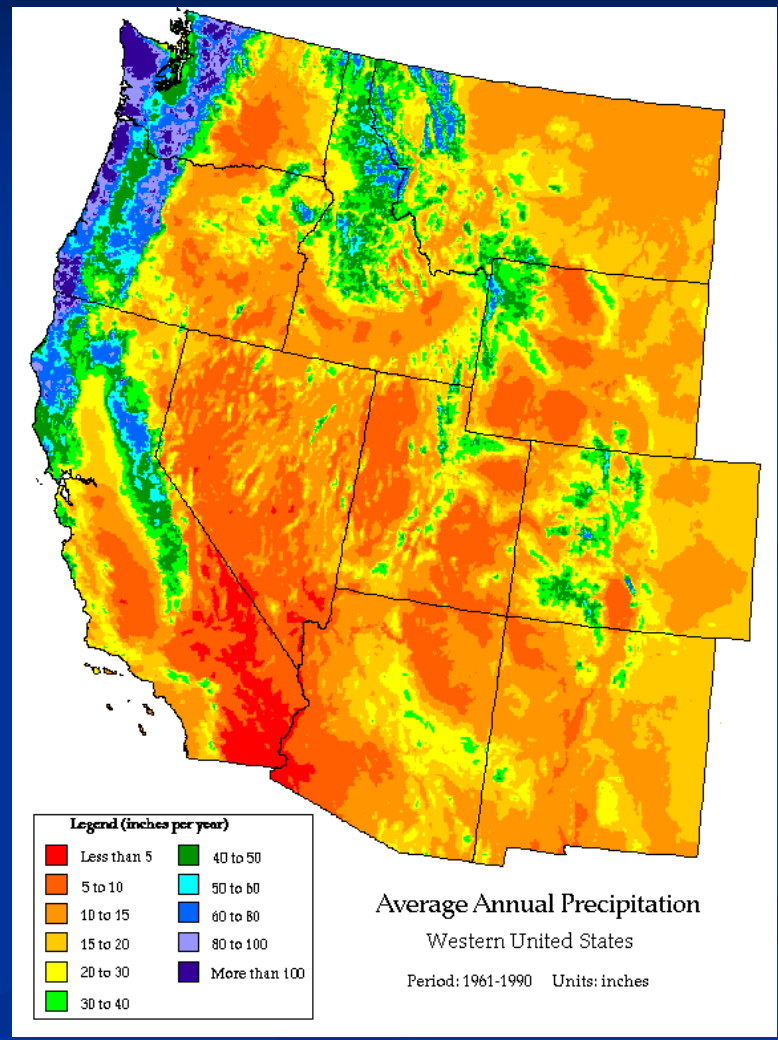
An irony of precipitation measurement is that most observations are made in lower elevations where people live, while the greatest precipitation falls in higher elevations



Why is PRISM Important to RFC's

PRISM datasets provide quality estimations of normal precipitation at ungaged locations

Gridded PRISM products are available for all 50 States and for major US river basins extending to Canada



Why is PRISM Important to RFC's

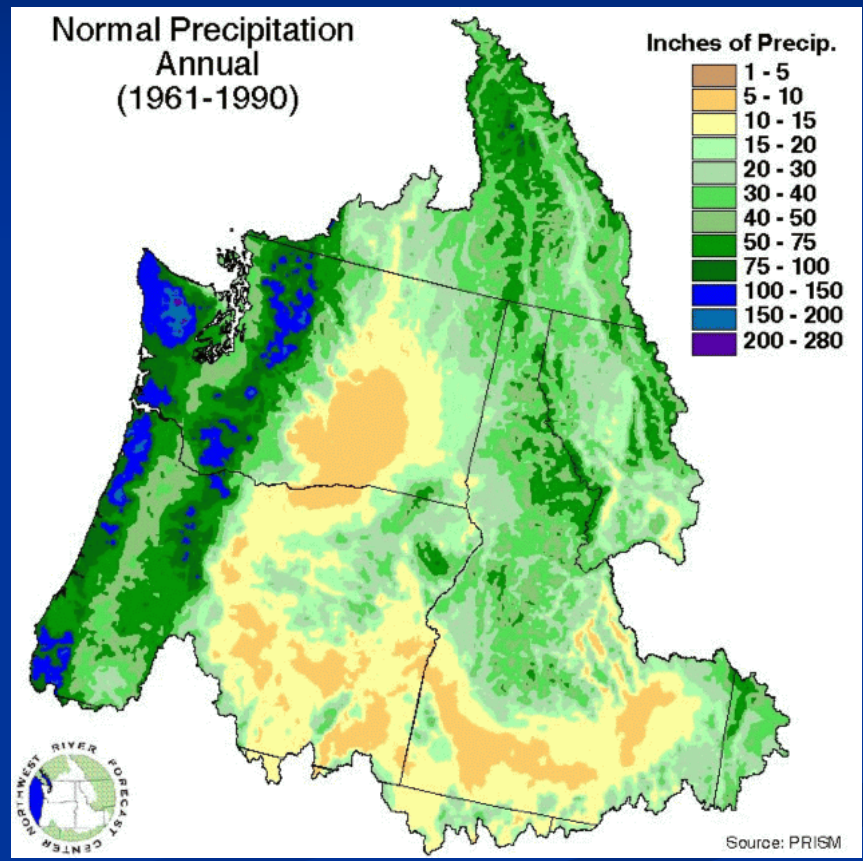
RFC's rely heavily on realtime and historical precipitation records for their modeling efforts.

Precipitation gages provide information about points, however river models require a spatial estimation of precipitation.

PRISM data can be used by RFC's to produce spatially gridded estimates of operational daily or monthly data.

PRISM datasets assist RFC's in quality controlling point precipitation data.

PRISM information helps RFC's to better assess the water balance at a watershed scale.



RFC Use of PRISM Data

RFCs have a variety of software applications that assist with precipitation quality control and precipitation preprocessing for model calibration

PRISM precipitation normals may be incorporated at various levels into these applications

RFC Use of PRISM Data

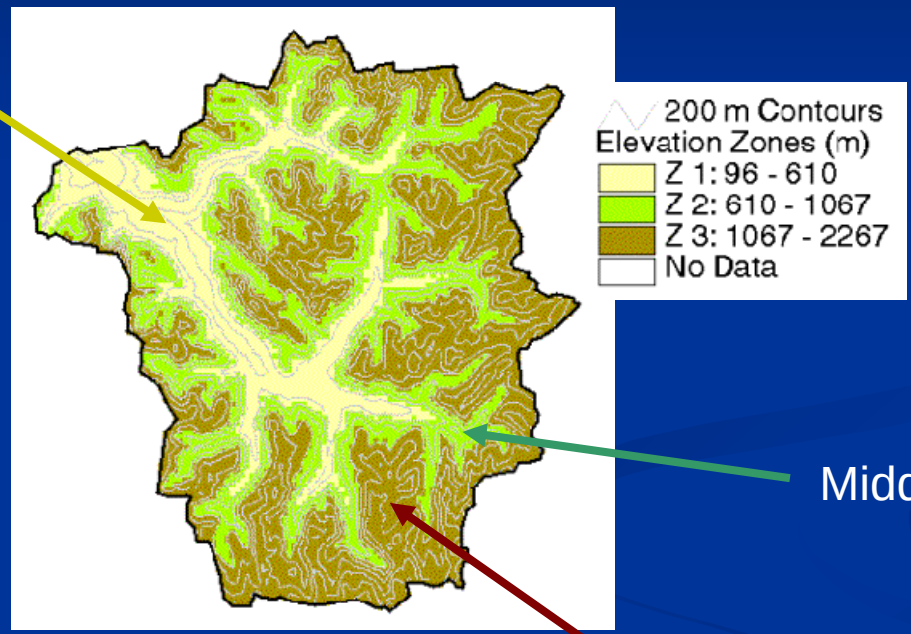
For Hydrologic Model Calibration

An important component of hydrologic model calibration is preparation of a mean areal precipitation (MAP) time series.

When a basin is subdivided into elevation zones, an MAP time series must be created for each zone.

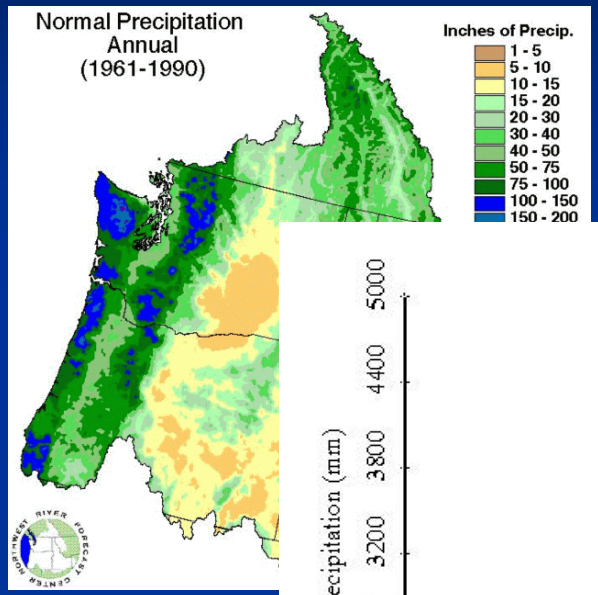
Using the Calibration Assistance Program (CAP) PRISM data is used to relate historical gage data to zone climatology.

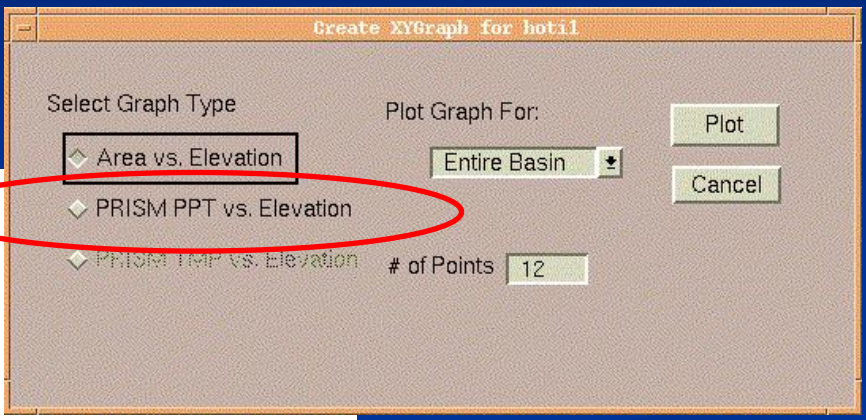
RFC Use of PRISM Data For Hydrologic Model Calibration

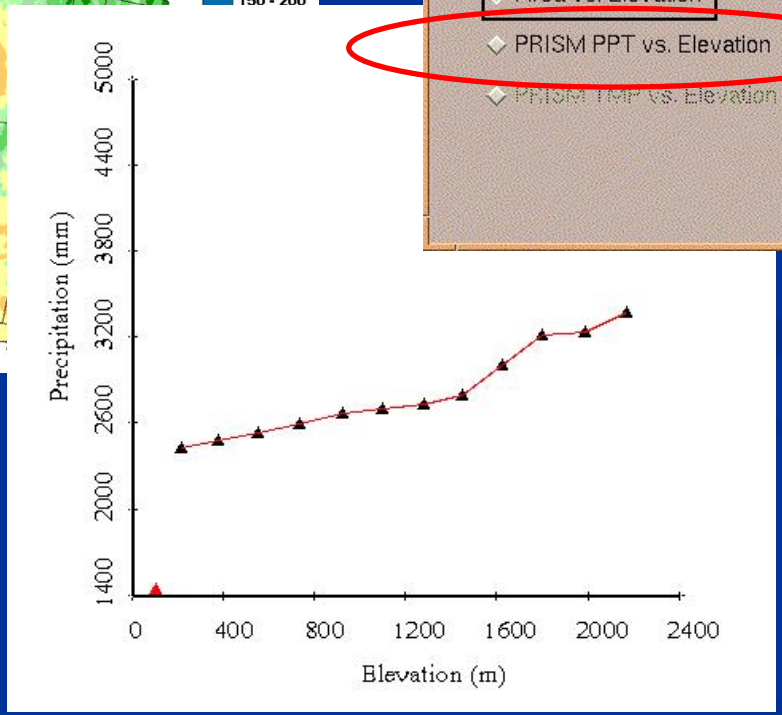


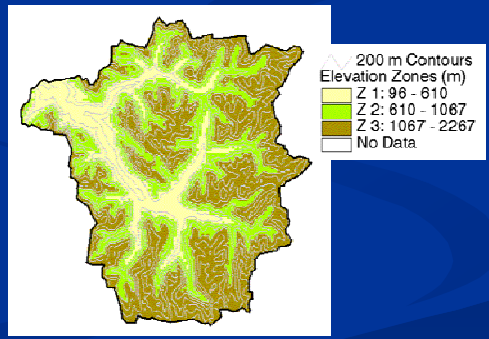
During Calibration, basins are typically divided into elevation zones. PRISM is used in conjunction with the zones to determine areal zonal precipitation as well as the distribution of precipitation with elevation

RFC Use of PRISM Data
For Hydrologic Model Calibration









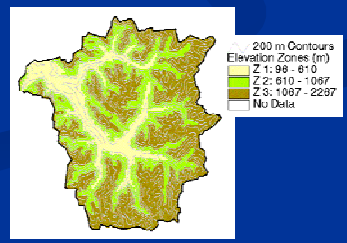
PRISM is used to examine the spatial distribution of precipitation verses elevation

RFC Use of PRISM Data
For Hydrologic Model Calibration

Statistics: LEDC2 2000:09:22-04:04:20

Data Name	Basin Mean	Basin Min	Basin Max	Zone1 Mean	Zone1 Min	Zone1 Max	Zone2 Mean	Zone2 Min	Zone2 Max
Elevation (m)	3388.38	2986.00	4112.00	3257.68	2986.00	3549.00	3713.33	3550.00	4112.00
Annual Precip (in)	24.85	16.10	34.14	23.65	16.10	34.14	27.86	22.19	34.14
Precip-->Jan	2.05	1.25	2.89	1.93	1.25	2.89	2.36	1.82	2.89
Precip-->Feb	2.08	1.10	3.03	1.95	1.10	3.03	2.39	1.80	3.03
Precip-->Mar	2.46	1.36	3.79	2.31	1.36	3.79	2.85	2.11	3.79
Precip-->Apr	2.46	1.32	3.64	2.27	1.32	3.64	2.92	2.10	3.64
Precip-->May	2.05	1.24	2.95	1.93	1.24	2.95	2.36	1.80	2.95
Precip-->Jun	1.42	1.08	1.96	1.38	1.08	1.96	1.54	1.32	1.96
Precip-->Jul	2.51	1.88	3.34	2.46	1.88	3.34	2.61	2.00	3.34
Precip-->Aug	2.28	1.99	2.48	2.26	1.99	2.48	2.32	2.09	2.48
Precip-->Sep	1.60	1.36	2.00	1.58	1.36	2.00	1.65	1.45	2.00
Precip-->Oct	1.53	1.07	2.22	1.47	1.07	2.22	1.69	1.40	2.22
Precip-->Nov	2.09	1.17	3.16	1.96	1.17	3.16	2.43	1.78	3.16
Precip-->Dec	2.33	1.28	3.43	2.16	1.28	3.43	2.75	1.89	3.43
Ppt-->Winter	11.01	6.16	15.79	10.30	6.16	15.79	12.77	9.41	15.79
Ppt-->Summer	13.84	9.94	18.36	13.34	9.94	18.36	15.09	12.78	18.36

PRISM is used to estimated monthly, seasonal, and annual precipitation amounts for each elevation zone within a basin



RFC Use of PRISM Data
For Quality Control of Precipitation Observations

PRISM is used by the RFC's to assist with quality control of point precipitation estimates.

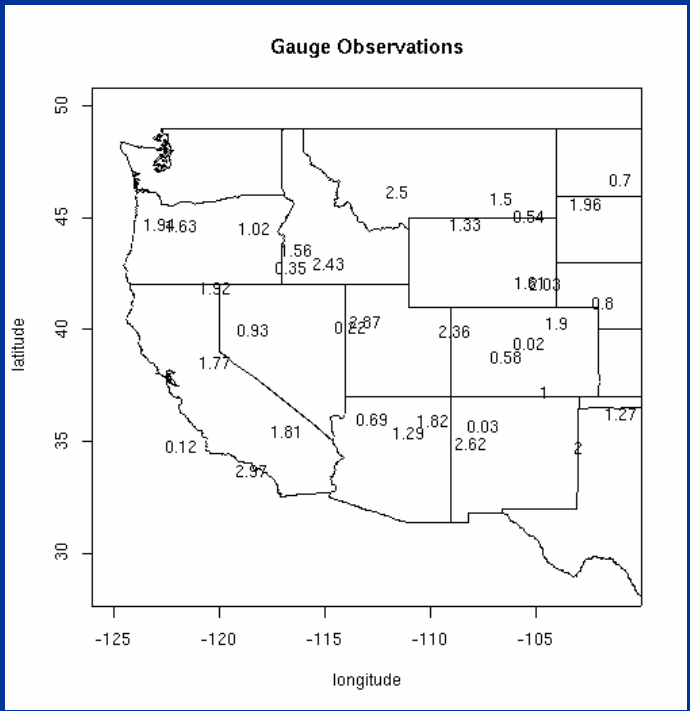
Normalized PRISM datasets can be used to create spatially distributed precipitation fields from point values.

Both of these tasks are can be accomplished using the Mountain Mapper application.

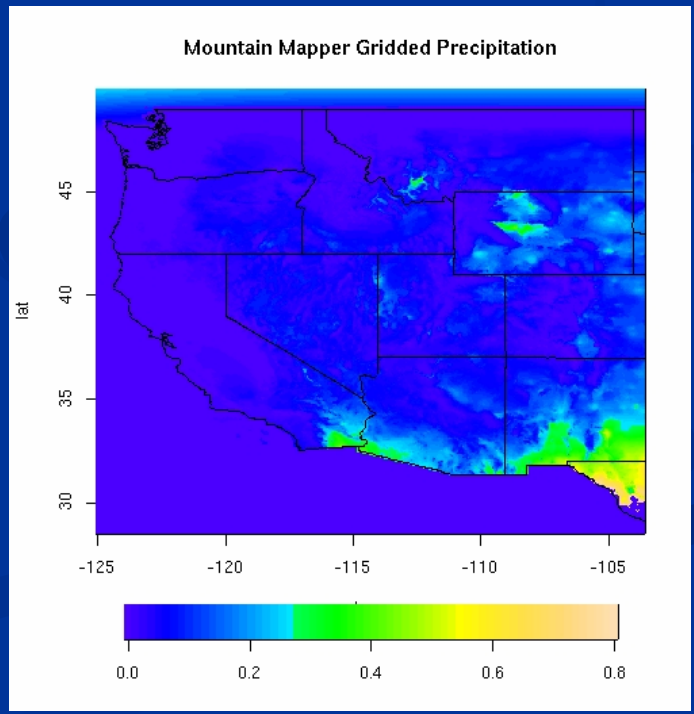
Mountain Mapper

Challenge: How to intelligently fill in gaps when producing a gridded analysis between gauges over complex terrain.

How to go from this

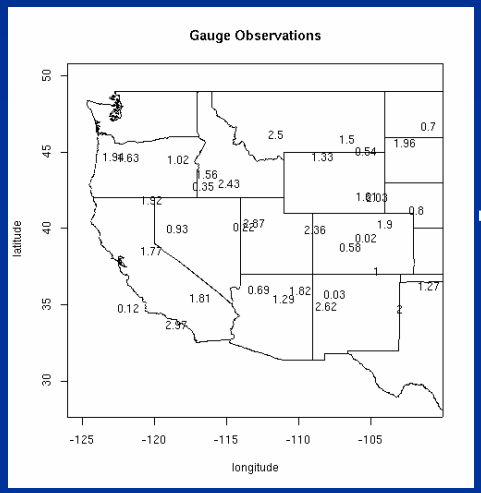


To this…



Mountain Mapper

1. Determine a percent of normal grid



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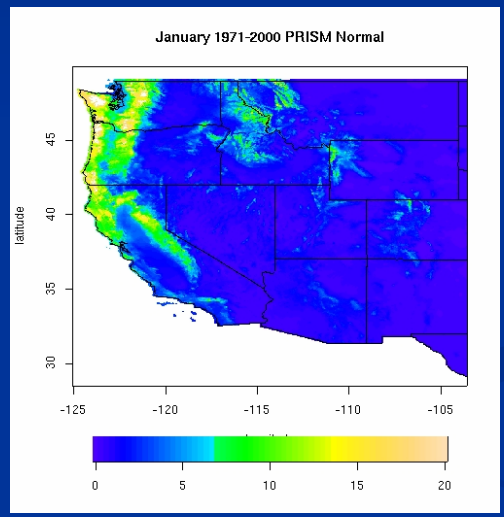

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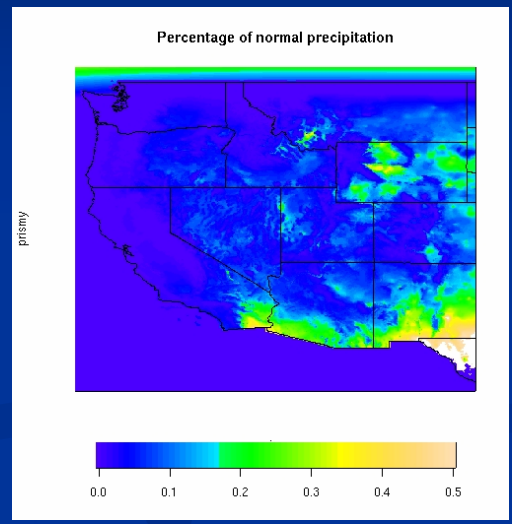


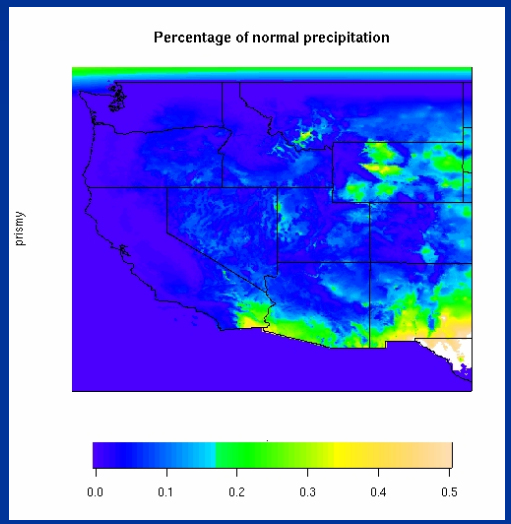
Gauge observations

PRISM monthly normal

Percent of normal in grid boxes with a gauge… interpolate percentage to all other grid boxes

Mountain Mapper

2. Multiply percent normal by PRISM normal grid



Percentage of normal grid

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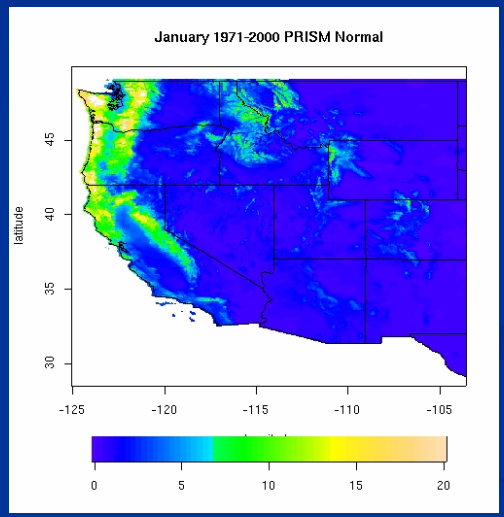

PRISM normal grid

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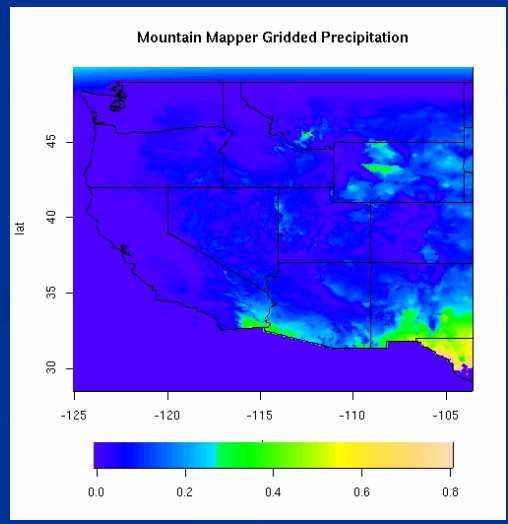
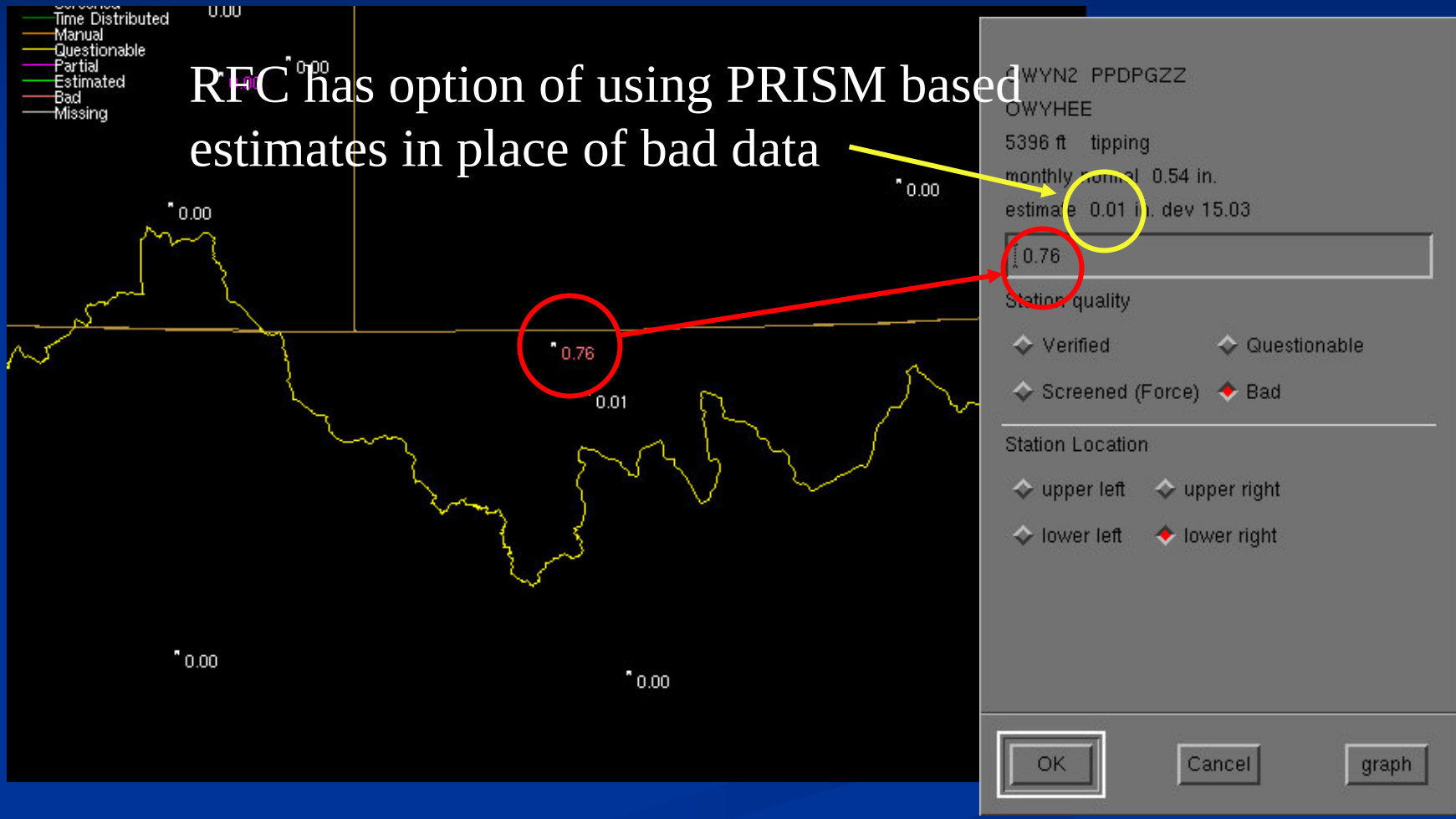
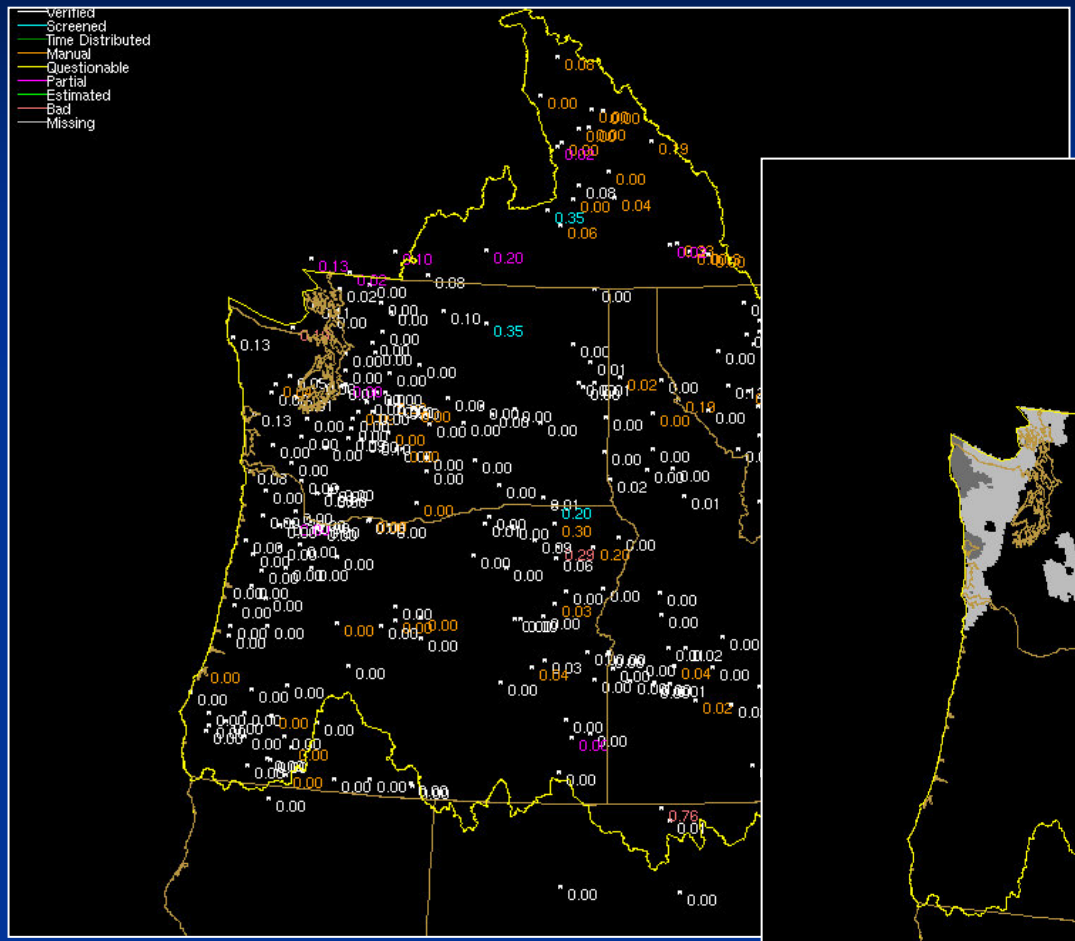


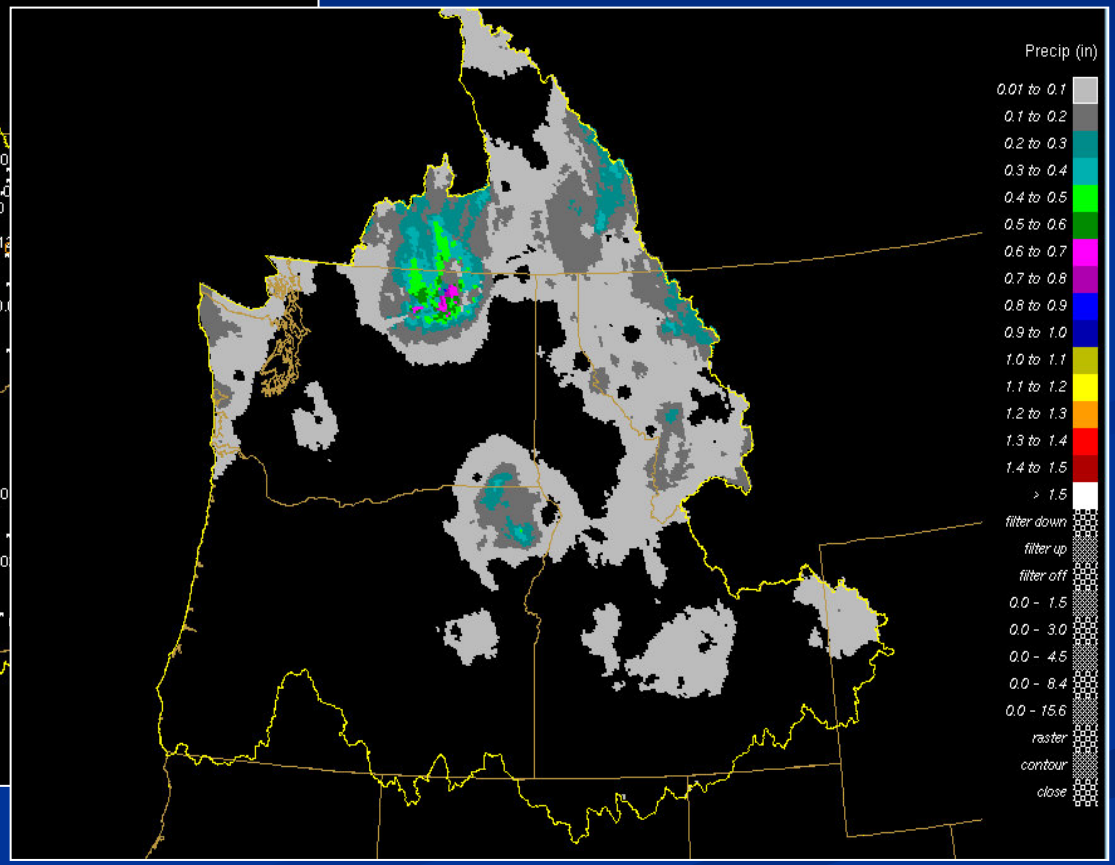
Mountain Mapper QPE grid

Mountain Mapper



Mountain Mapper





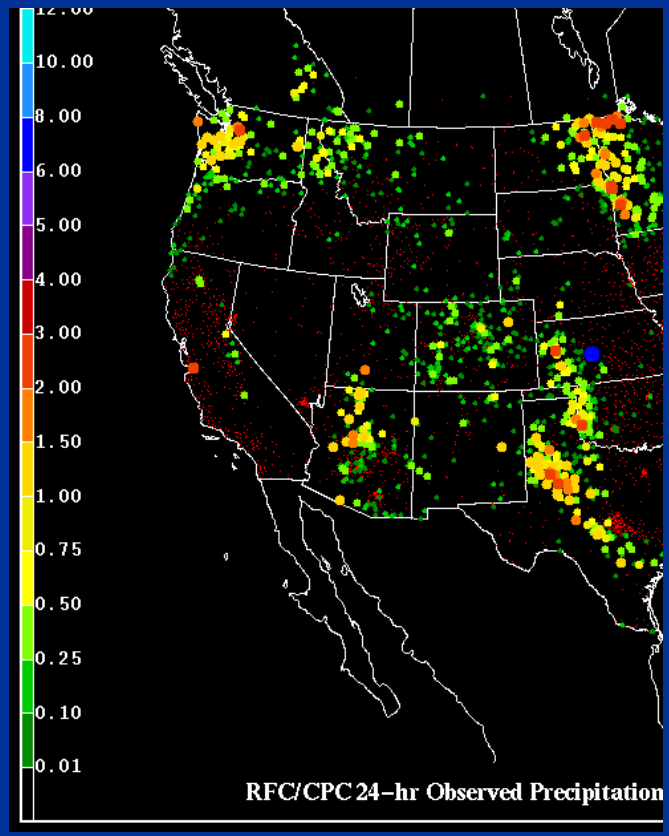
RFC's may use PRISM to create gridded estimates of precipitation from QC'd point values

Limitations of RFC use of PRISM

Mountain Mapper uses climatological precipitation PATTERNS to compute individual storm precipitation grids that may be very different from climatology…

Limitations of RFC use of PRISM

On this particular day, the precipitation pattern did not resemble normal at all…



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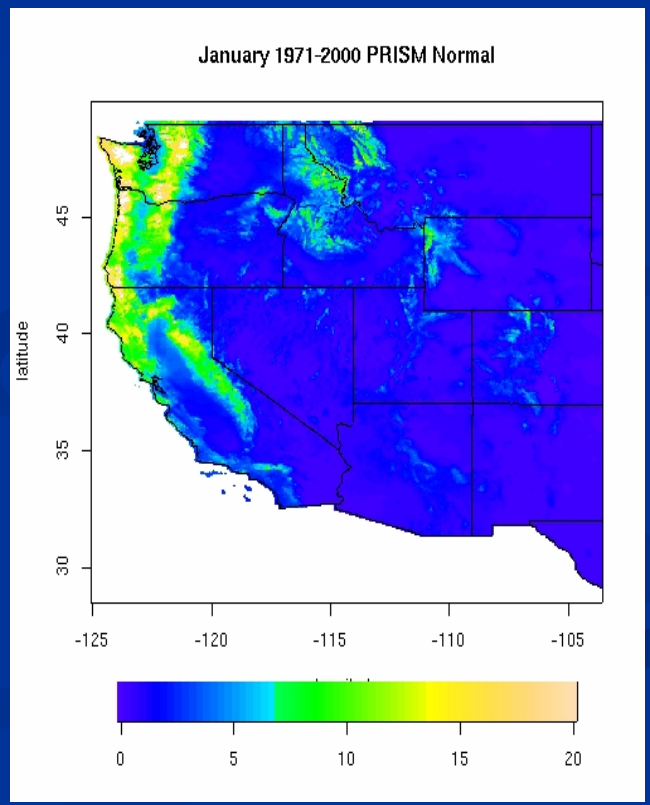


RFC's are interested in the creation of a "Smart" PRISM

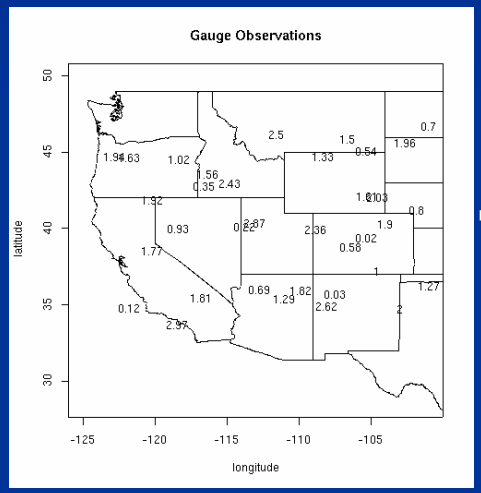
Definition: A climatology targeted to a specific meteorological condition rather than a specific time period.

"Smart" MM Concept: Instead of using monthly means for a background map, MM would use the appropriate "smart" PRISM map(s) to capture the storm scale precipitation based on synoptic conditions.

“Smart” PRISM MM

MM Works the same but with “smart” PRISM grids instead of monthly normals…

1. Determine a percent of “normal” grid



Gauge observations

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UNDER DEVELOPMENT

“Smart” PRISM

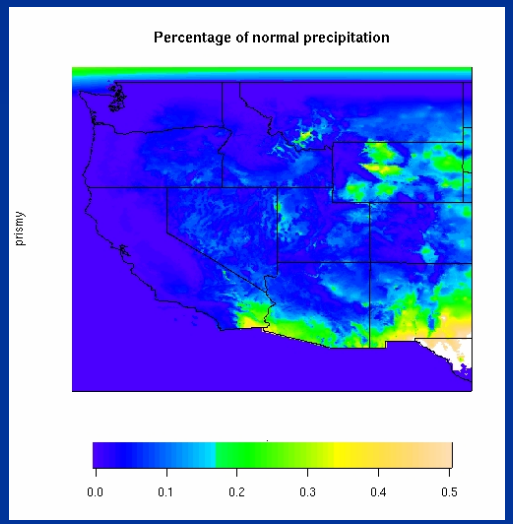
=

UNDER DEVELOPMENT

Percent of “normal” in grid boxes with a gauge… interpolate percentage to all other grid boxes

“Smart” PRISM MM

2. Multiply by “smart” PRISM grid



Percentage of normal grid

*

UNDER DEVELOPMENT

“Smart” PRISM normal grid

=

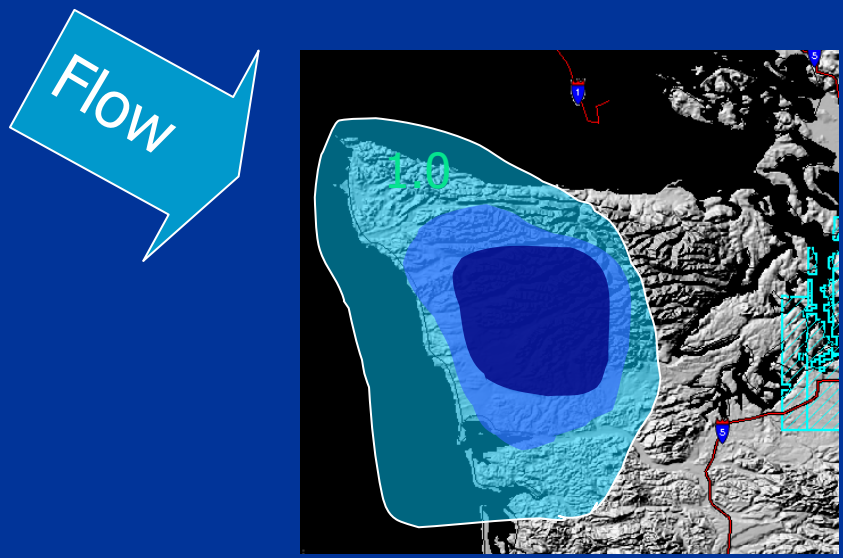
UNDER DEVELOPMENT

“Smart” Mountain Mapper QPE grid

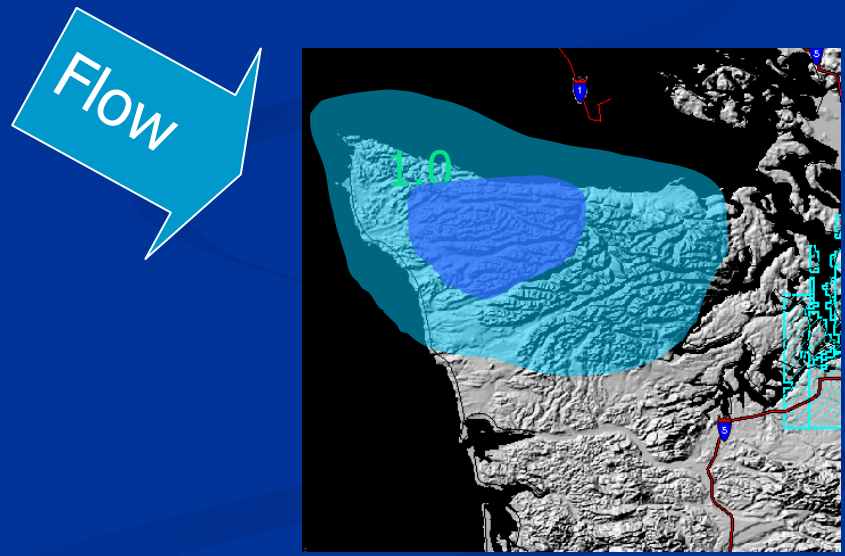
"Smart" PRISM

With a Northwest flow, QPE grids may look like this…

PRISM-based MM



Smart PRISM-based MM

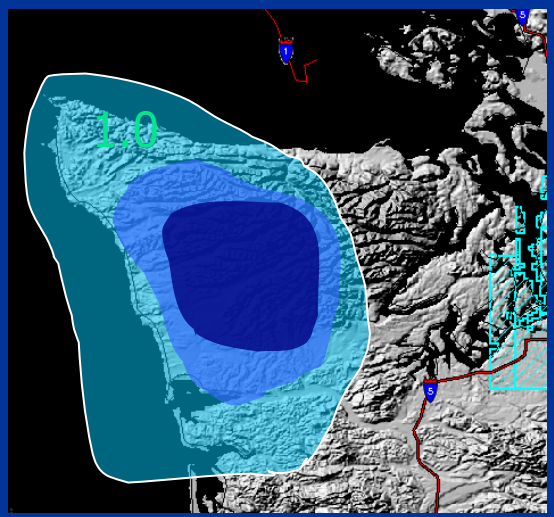


"Smart" PRISM

With a Northeast flow, QPE grids may look like this…

PRISM-based MM

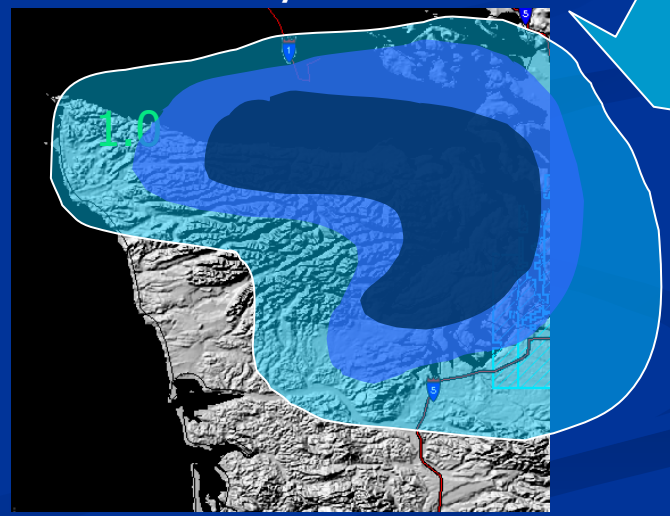
Same as before



Flow

Smart PRISM-based MM

Modulated by flow direction



Flow

Summary

PRISM combines point measurements of climate data with a digital elevation model to generate estimates of annual, monthly, and event-based climatic elements including precipitation and temperature.

RFC's require high quality estimates of areal precipitation for use as inputs to hydrologic models

PRISM is important to RFCs because it provides high resolution, nationally available, gridded datasets that account for orographic and other terrain based influences.

RFC's use PRISM to assist with:

- Hydrologic Model Calibration
- Water Balance Assessment
- Quality Control of Precipitation Data