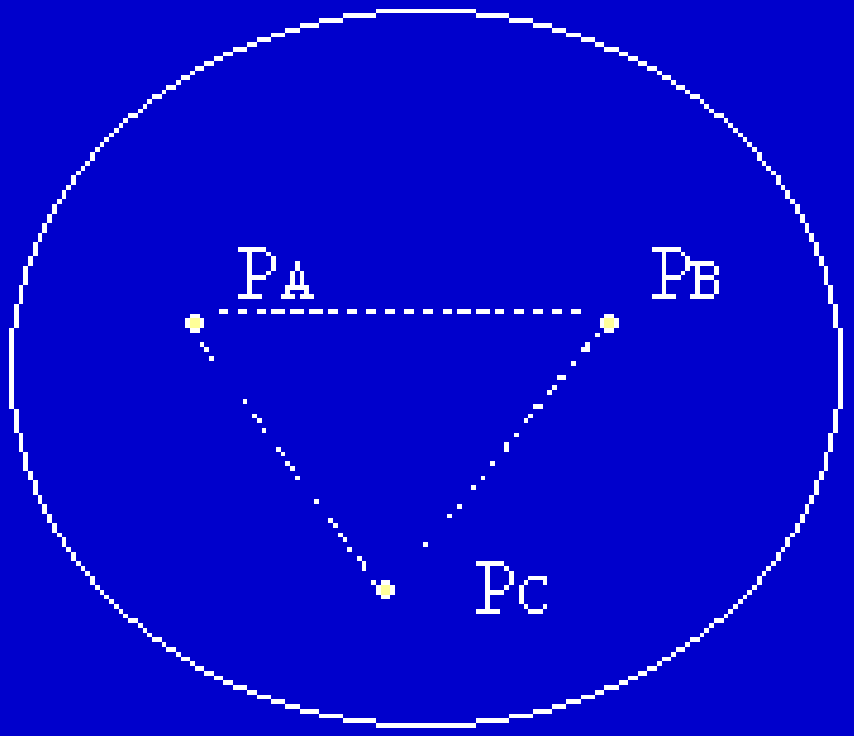
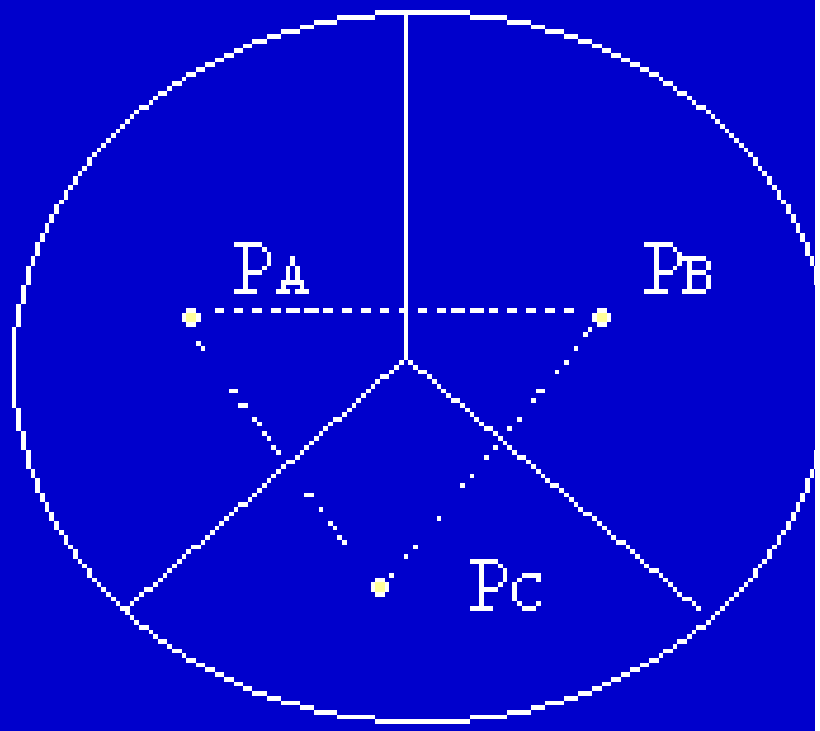
Thiessen Polygon Method - Procedure

- Draw dashed lines between ppt measurements



Thiessen Method - Procedure

- Draw perpendicular bisectors
- Determine areas (A_A, A_B, and A_C)

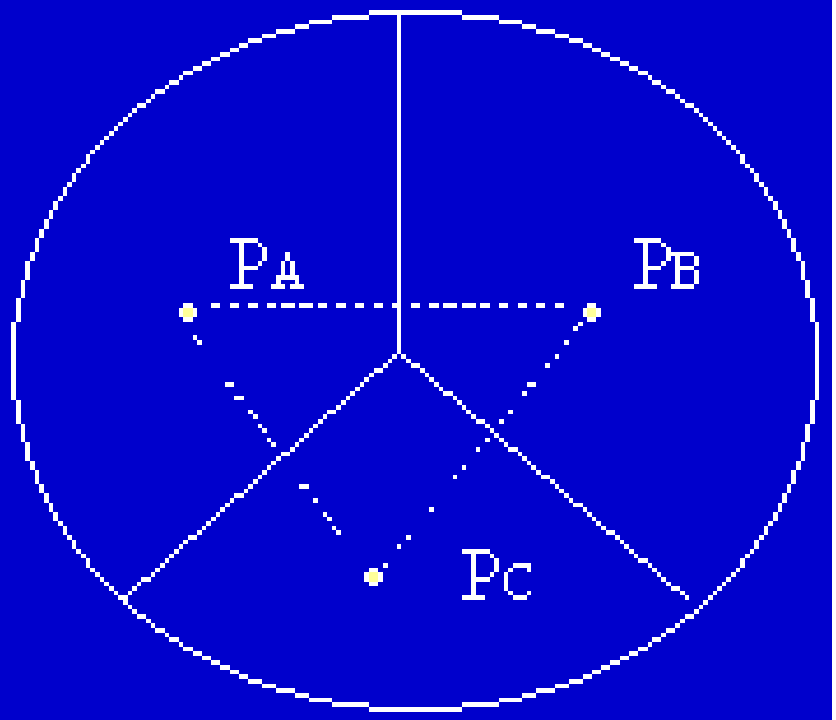


Thiessen Polygon Method Procedure

- Calculate

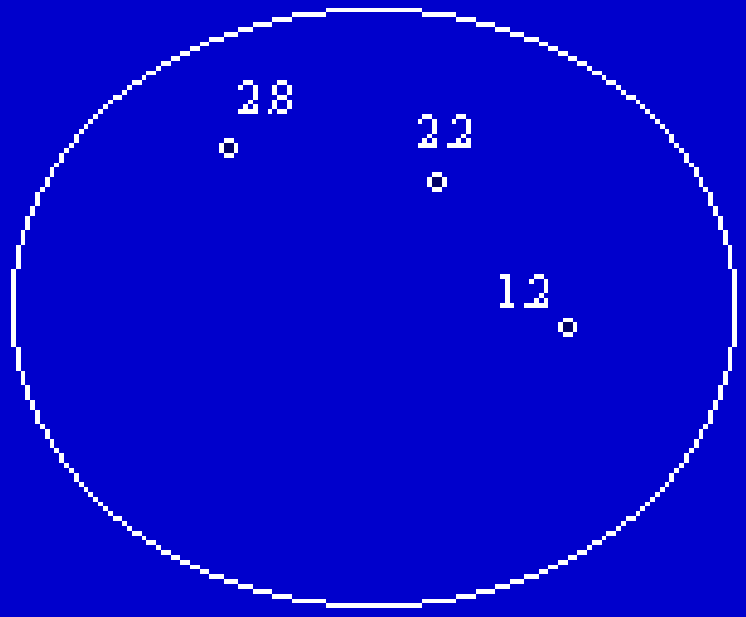
$$\overline{P} = \sum_{I=1}^{n} P_i \frac{A_i}{A_T}$$

$$= P_A \frac{A_A}{A_T} + P_B \frac{A_B}{A_T} + P_C \frac{A_C}{A_T}$$



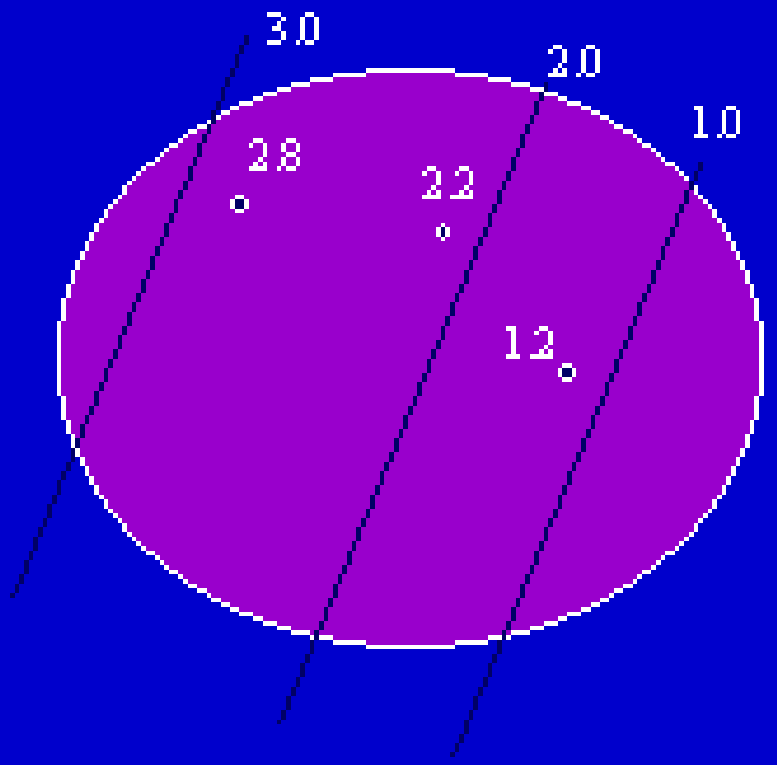
Estimating Areal Ppt

- Isohyetal method



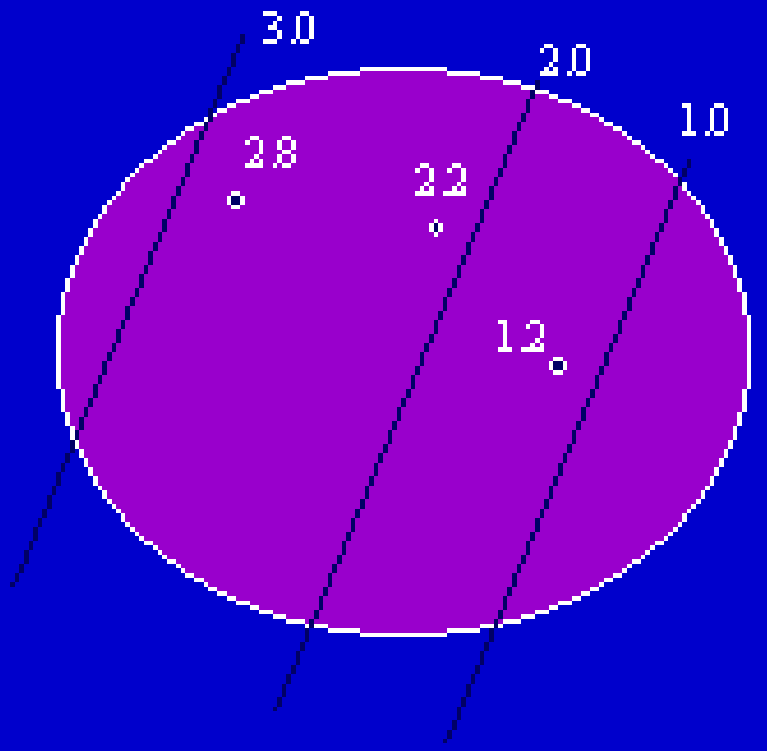
Isohyetal Method - Procedure

- Determine contours of equal precipitation (isohyetal lines)



Isohyetal Method - Procedure

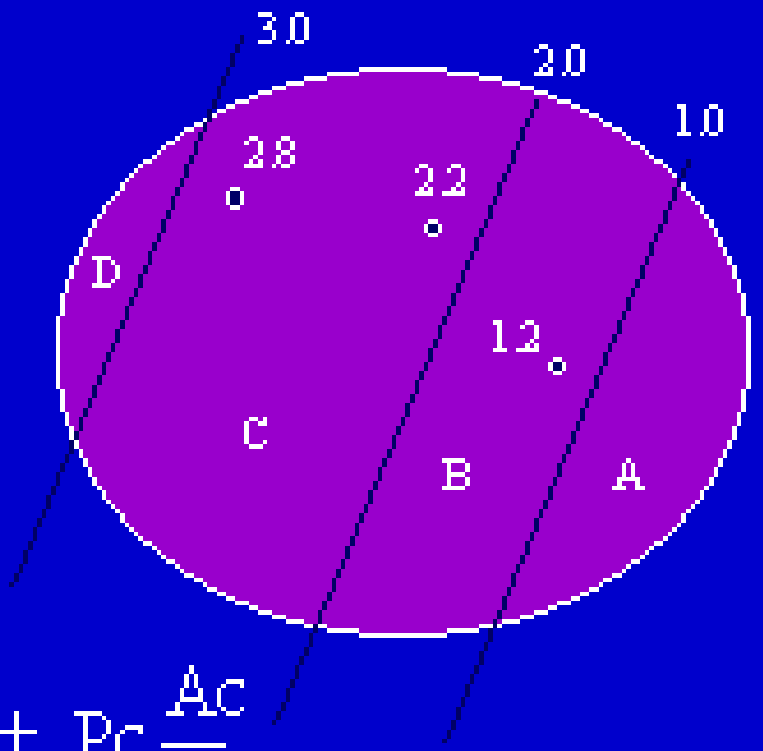
- Determine areas between each isohyetal
- Estimate representative ppt for each region
- Calculate



Isohyetal Method - Procedure

- Calculate

$$\overline{P} = \sum_{I=1}^{n} P_{avg,i} \frac{A_i}{A_T}$$



$$= P_A \frac{A_A}{A_T} + P_B \frac{A_B}{A_T} + P_C \frac{A_C}{A_T} + P_C \frac{A_C}{A_T}$$

Least Squares

$$M = \sum_{g=1}^{G} (\hat{p}_g - P_g)^2$$

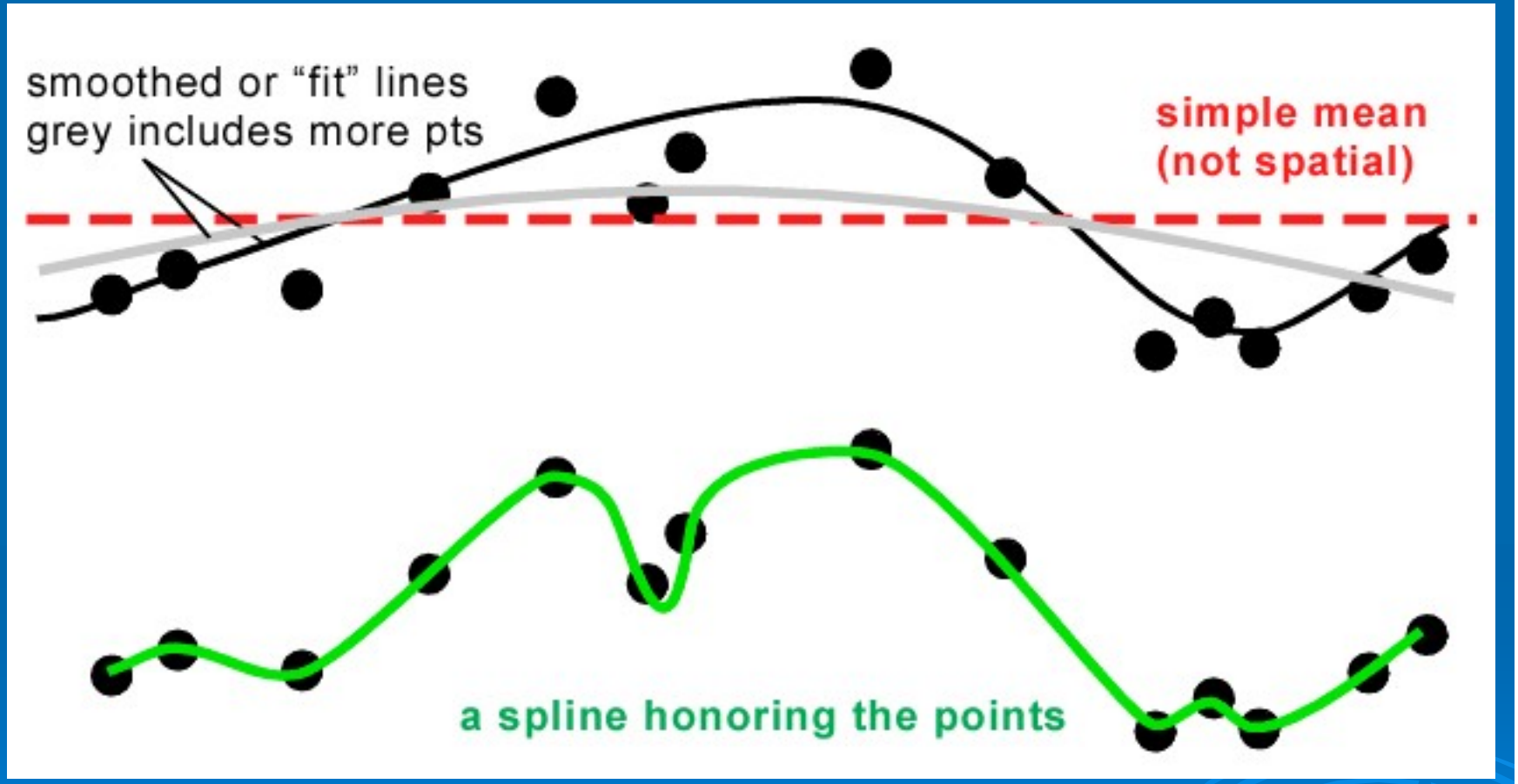
Similar to the isohyetal method, except that the weight
determined by fitting a trend surface to the measured
such that the error (M) is minimized:

P_g is measured value

p_g is weight

g is an individual gauge

Spline-Surface Method



A spline surface is similar to the least squared method. However, it finds the surface with minimum curvature that fits exactly through the measured values. It is computation burdensome. However, that is no longer a problem with todays computational power.

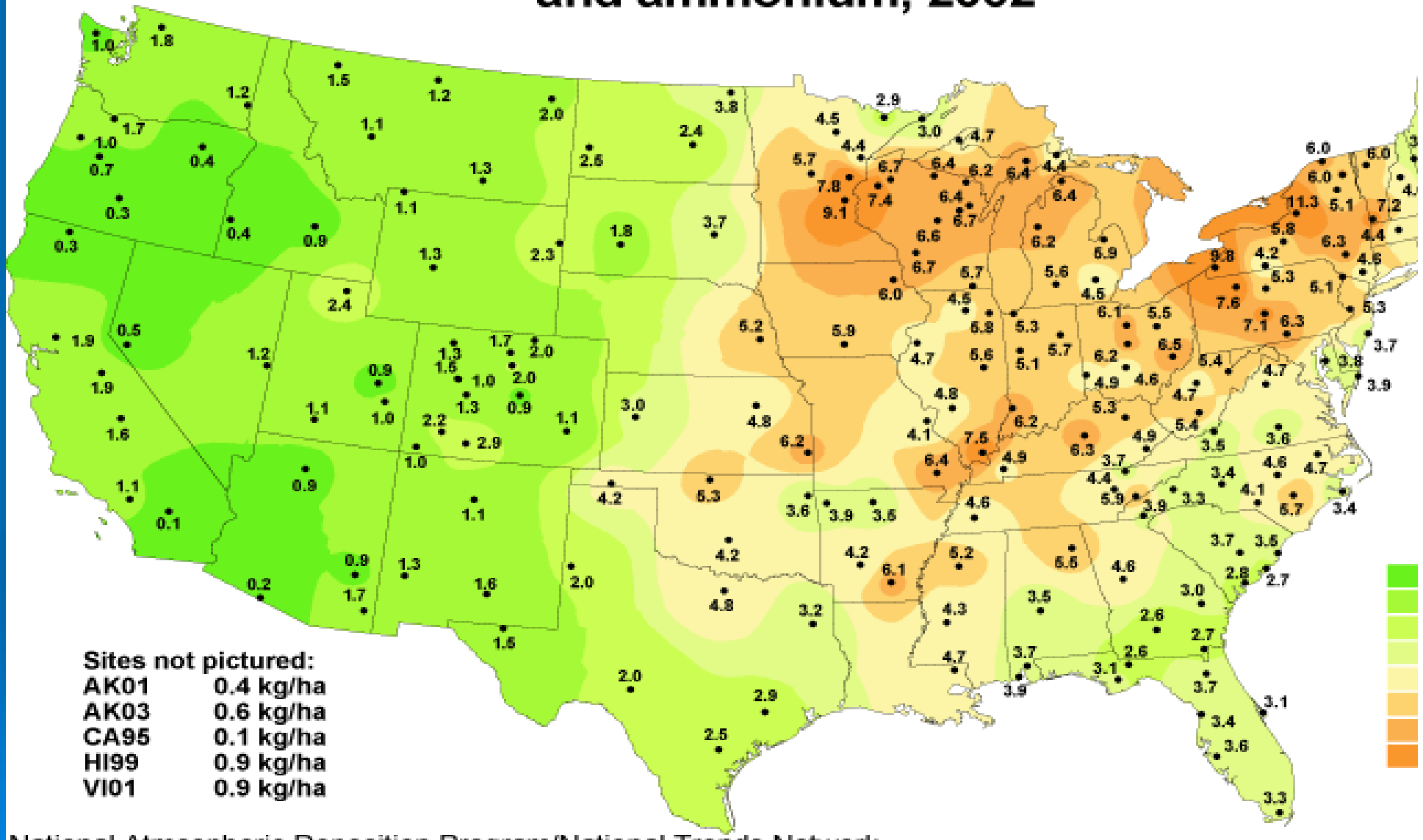
Inverse-Distance Interpolation

$$w(d) = 1/d^p$$

d is distance; p is the weighting function, often p = 2

Interpolation of the weights are a function only of the distance be each of the grid points and each of the G gauge locations.
Inverse distance weighting is the simplest interpolation method.

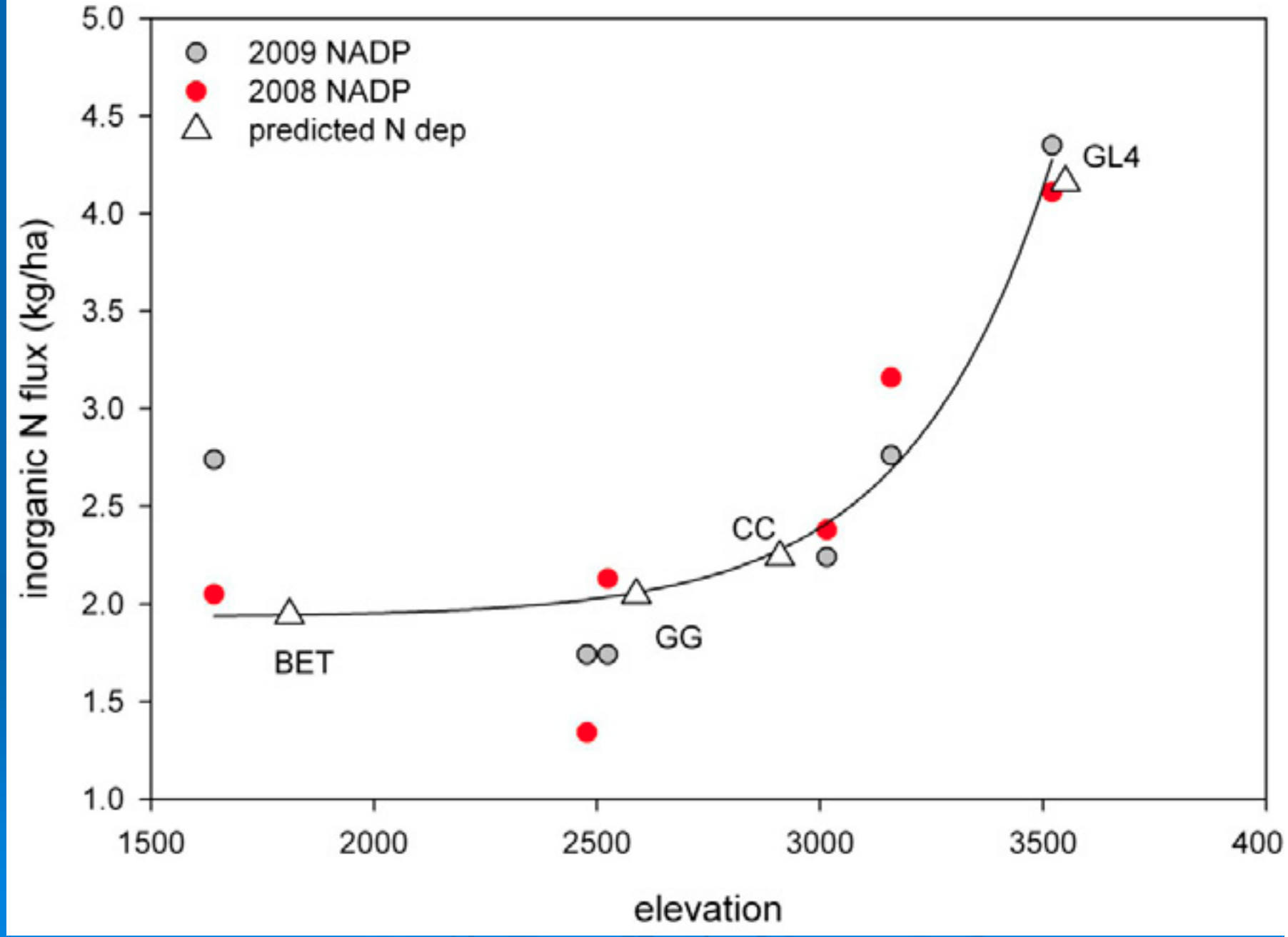
Inorganic nitrogen wet deposition from nitrate and ammonium, 2002



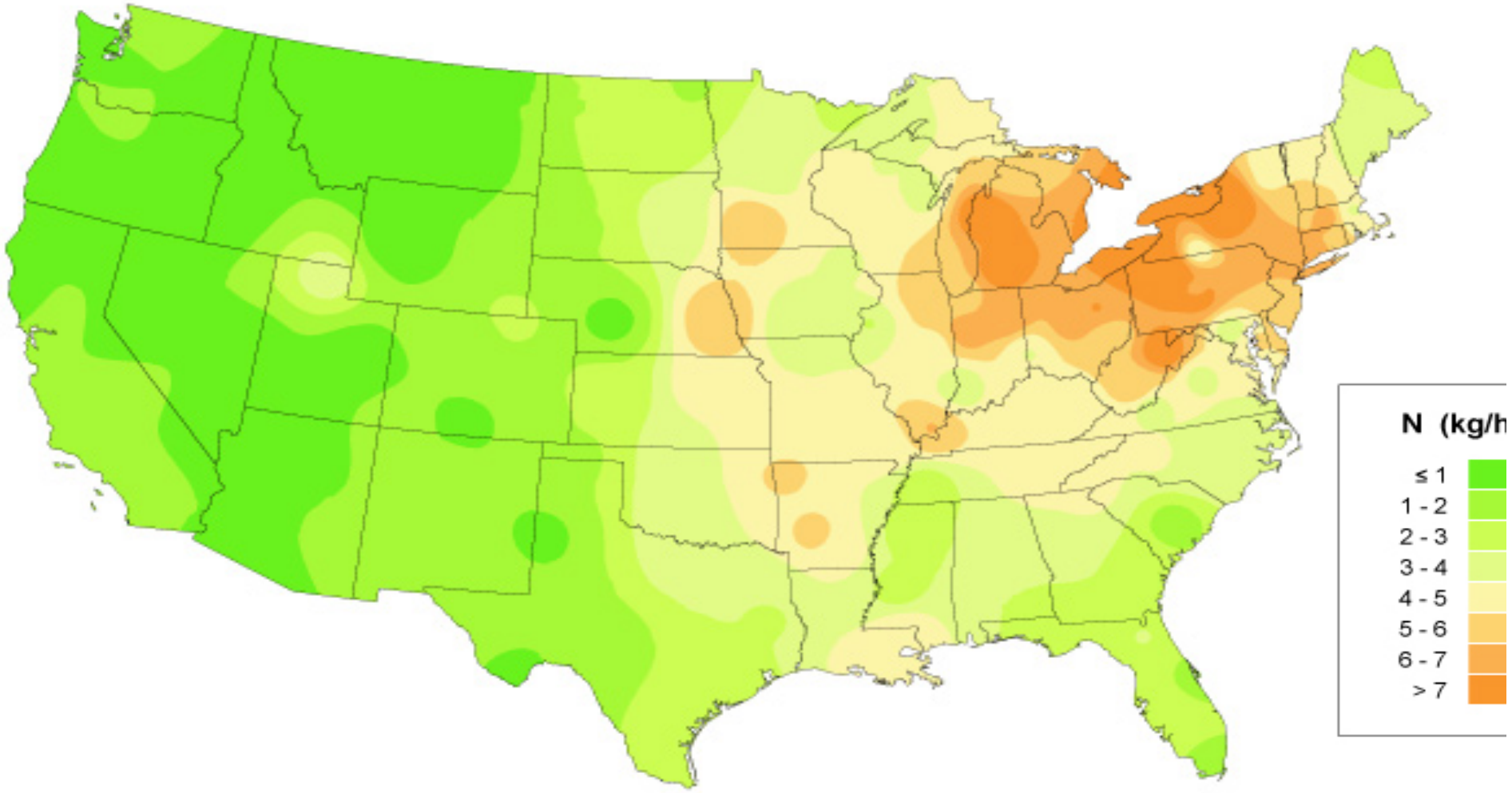
Sites not pictured:

AK01	0.4 kg/ha
AK03	0.6 kg/ha
CA95	0.1 kg/ha
HI99	0.9 kg/ha
VI01	0.9 kg/ha

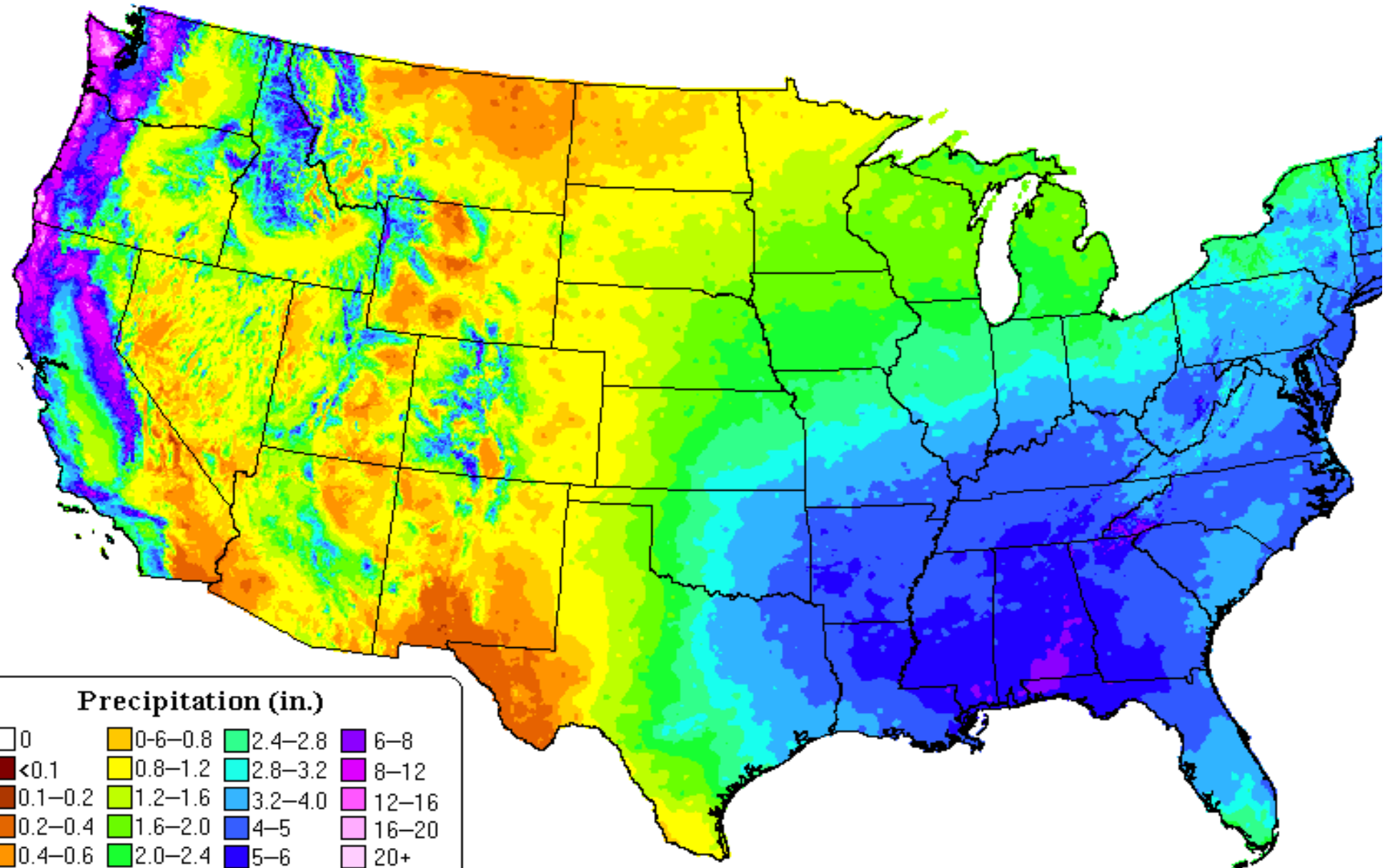
National Atmospheric Deposition Program/National Trends Network
http://nadp.sws.uiuc.edu


2009 NADP
2008 NADP
predicted N dep
inorganic N flux (kg/ha)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
1500
2000
2500
3000
3500
400
elevation
BET
GG
CC
GL4

Inorganic Nitrogen Wet Deposit



Precipitation: March Climatology (1981-2010)

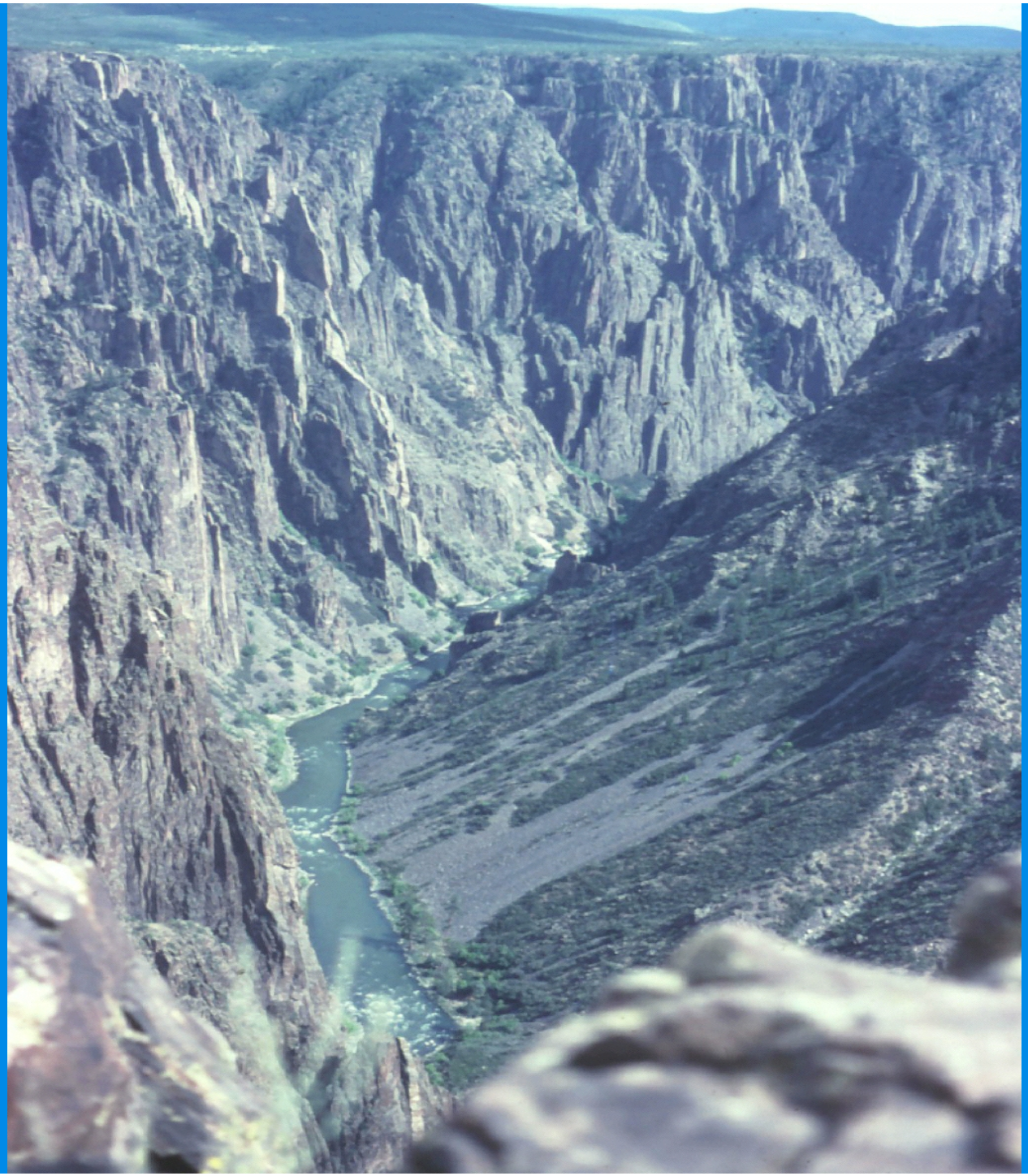


http://prism.oregonstate.edu - Map created Jul 10 2012

The PRISM Approach to Mapping Climate in Complex Regions

Christopher Daly
Director, PRISM Group

Northwest Alliance for Computational Science and Engineering
Department of Geosciences
Oregon State University
Corvallis, Oregon, USA



Rationale

- Observations are rarely sufficient to directly represent the spatial patterns of climate

- Human-expert mapping methods often produce the best products, but are slow, inconsistent, and non-repeatable

- Purely statistical mapping methods are fast and repeatable, but rarely provide the best accuracy, detail, and realism

Therefore…

- The best method may be a statistical approach that is automated, but developed, guided and evaluated with expert knowledge

Knowledge-Based System KBS

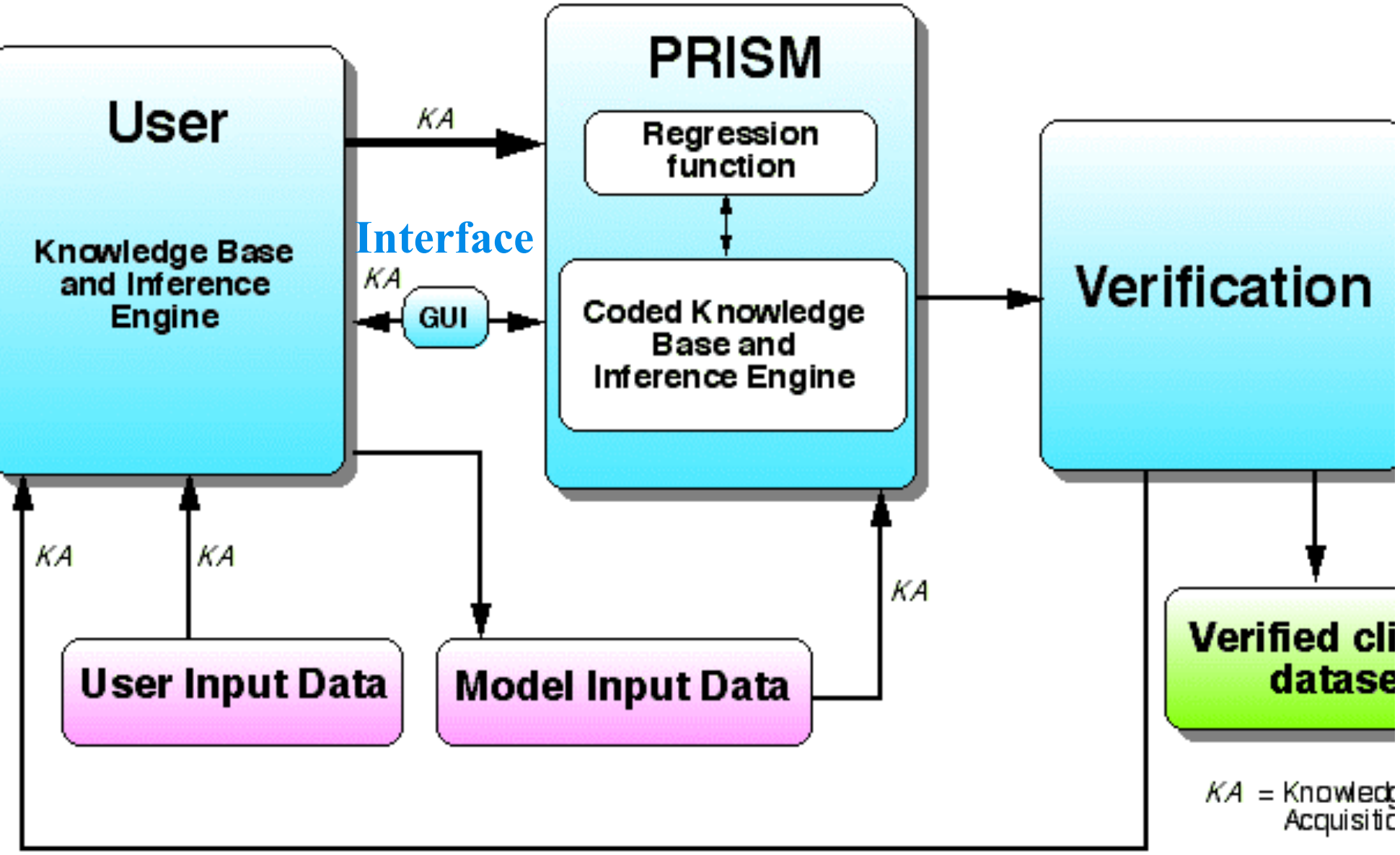
- Knowledge acquisition capability – Elicit expert information
- Knowledge base – Store of knowledge
- Inference Engine – Infer solutions from stored knowledge
- User interface – Interaction and explanation
- Independent verification – Knowledge refinement

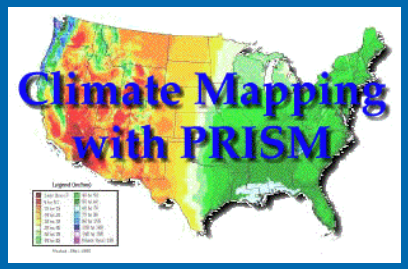
PRISM

Parameter-elevation Regressions on Independent Slopes Mo

- Generates gridded estimates of climatic parameters
- Moving-window regression of climate vs. elevation for each grid cell
  - Uses nearby station observations
- Spatial climate knowledge base weights stations in the regression function by their physiographic similarity to the target grid cell

The PRISM Knowledge-Based System



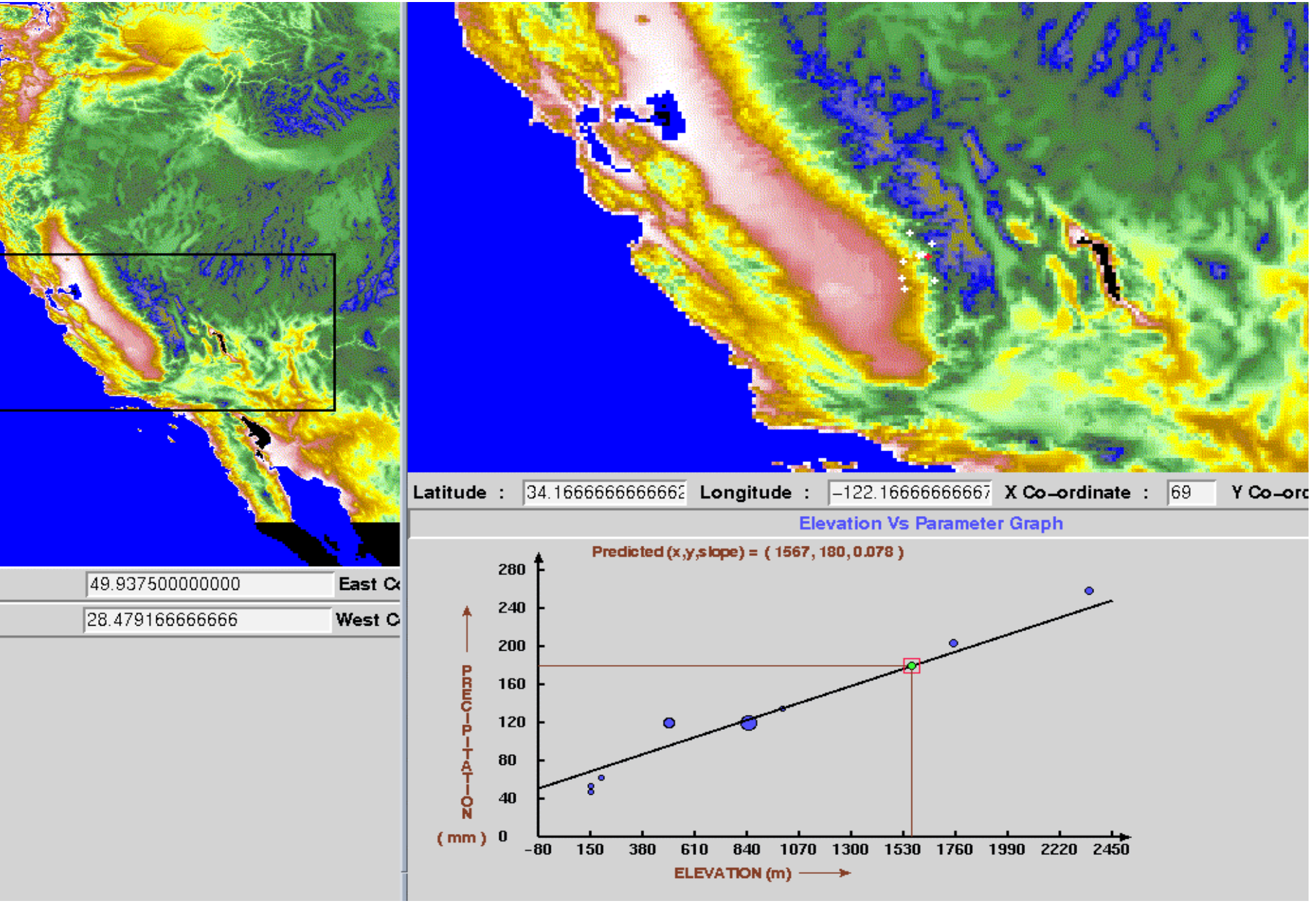


PRISM

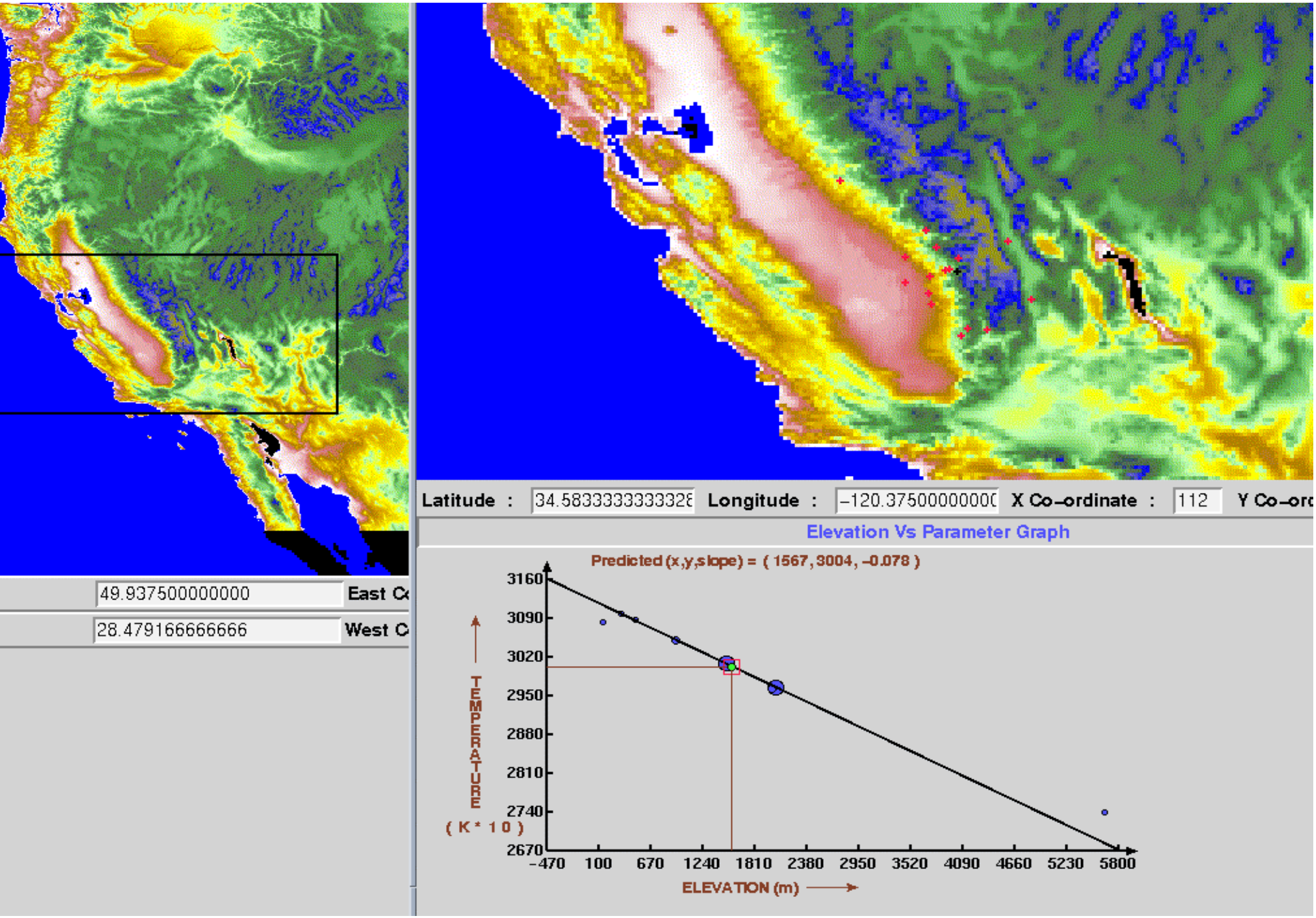
Knowledge Base

- Elevation Influence on Climate

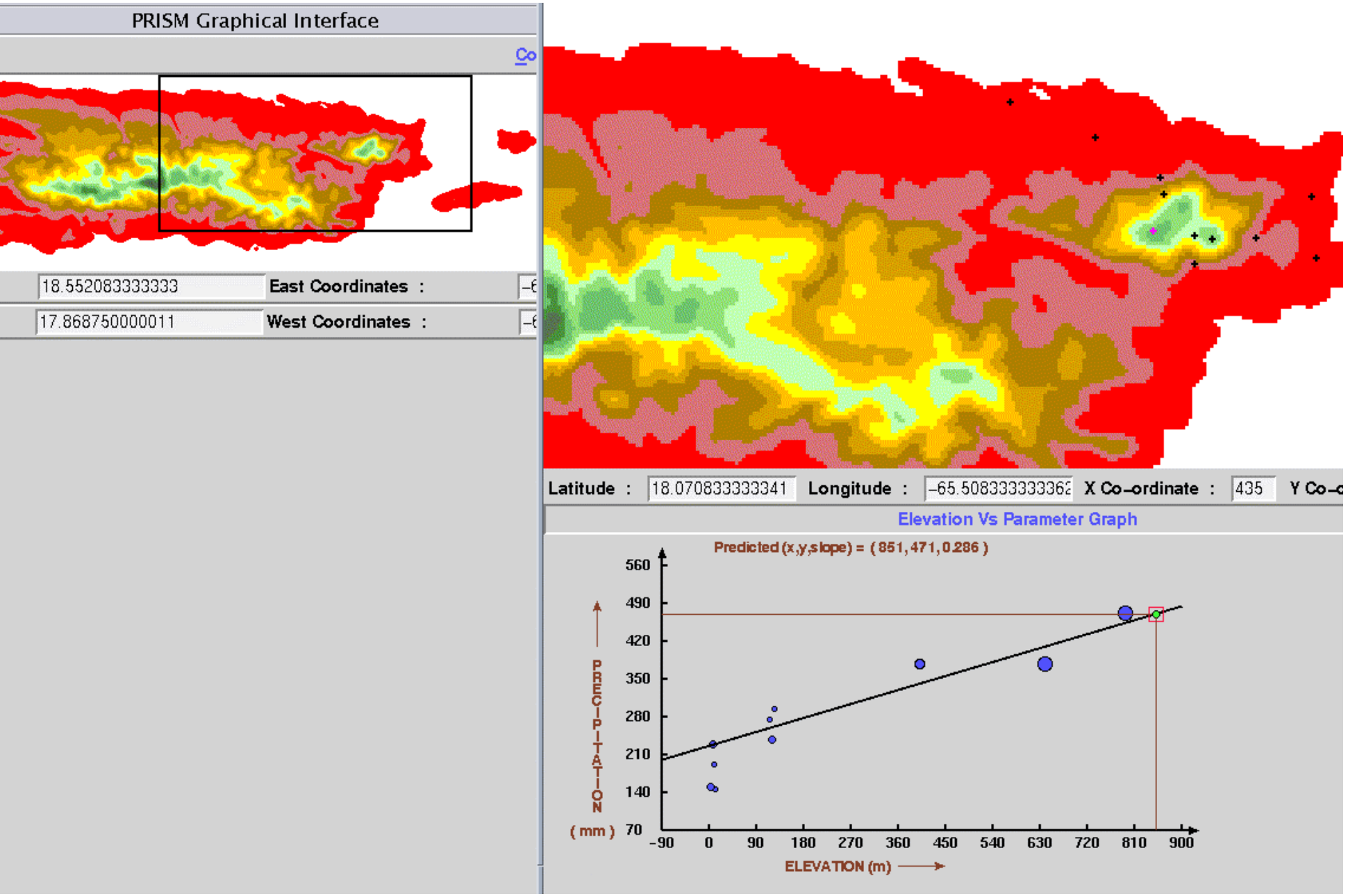
1961-90 Mean January Precipitation, Sierra Nevada, CA, USA



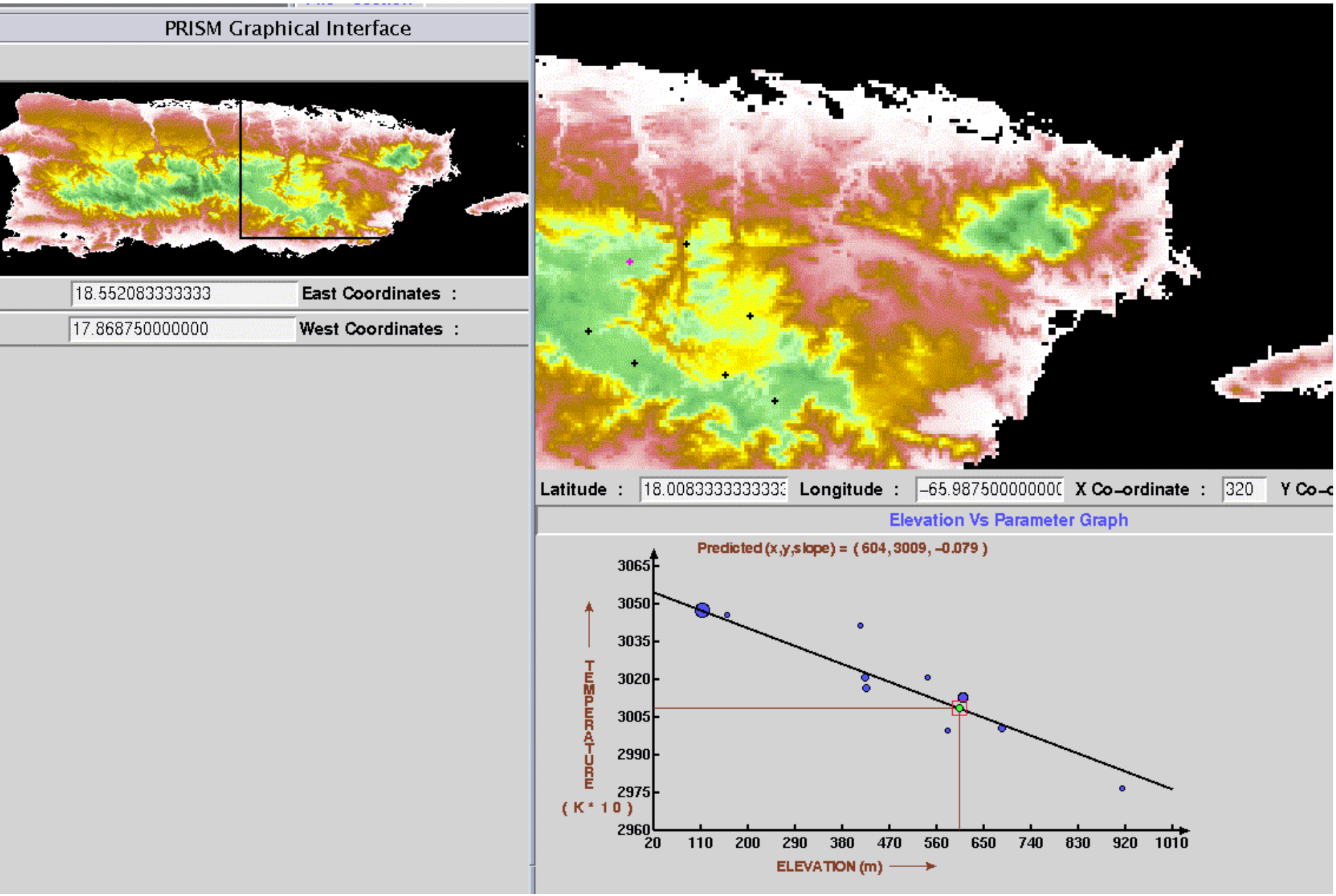
1961-90 Mean August Max Temperature, Sierra Nevada, CA, USA



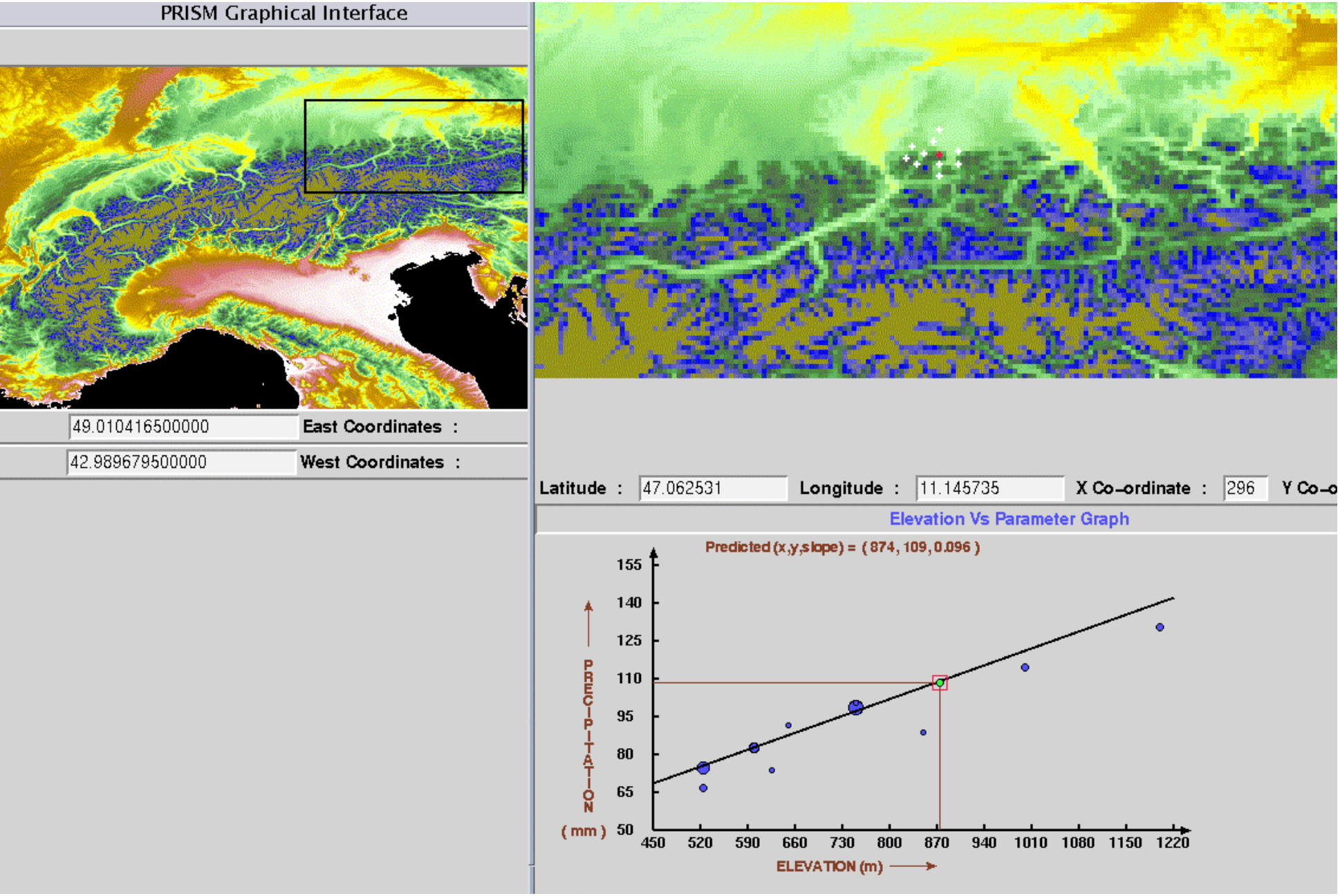
1963-1993 Mean November Precipitation, Puerto Rico



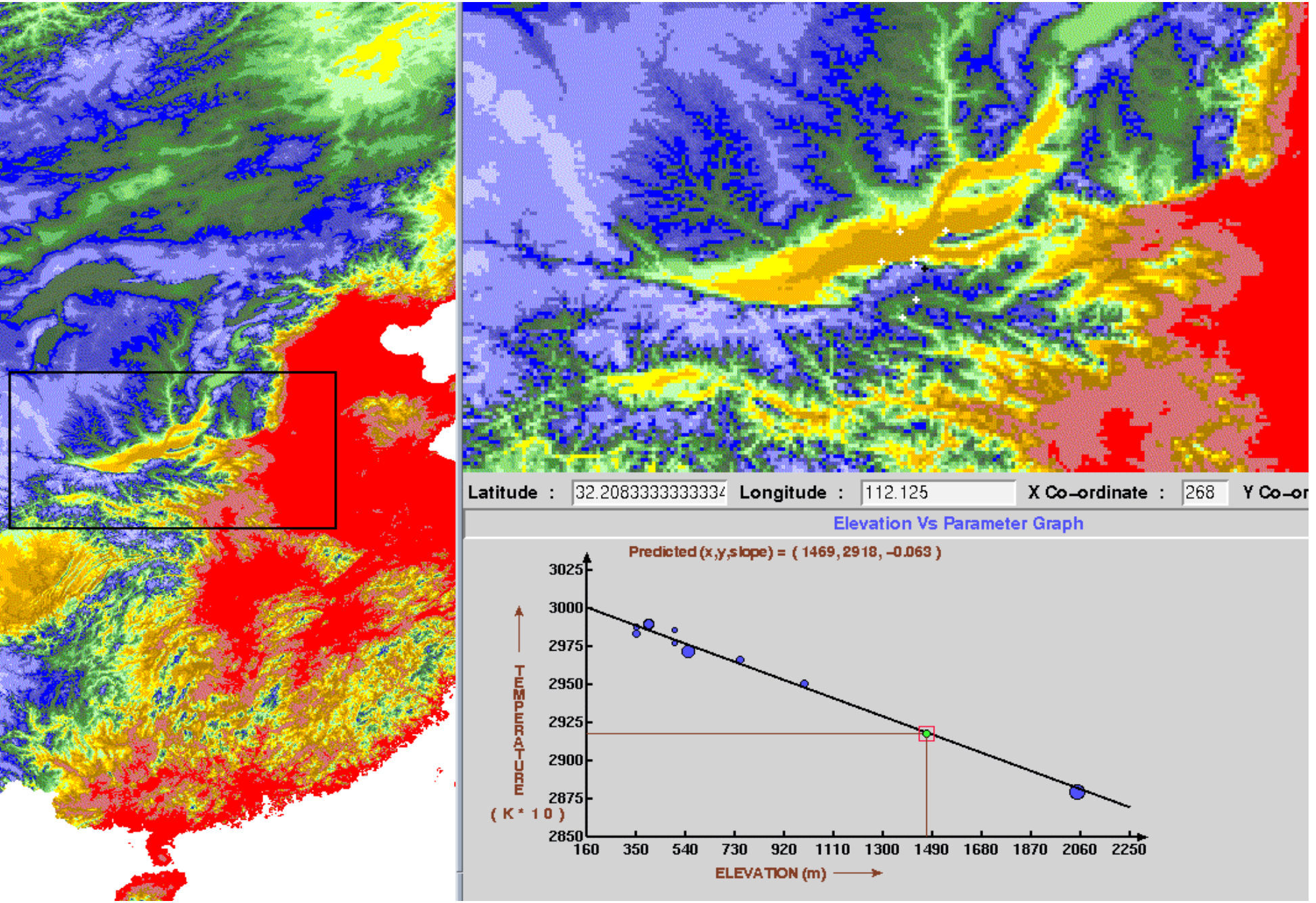
1963-93 Mean June Maximum Temperature, Puerto Rico



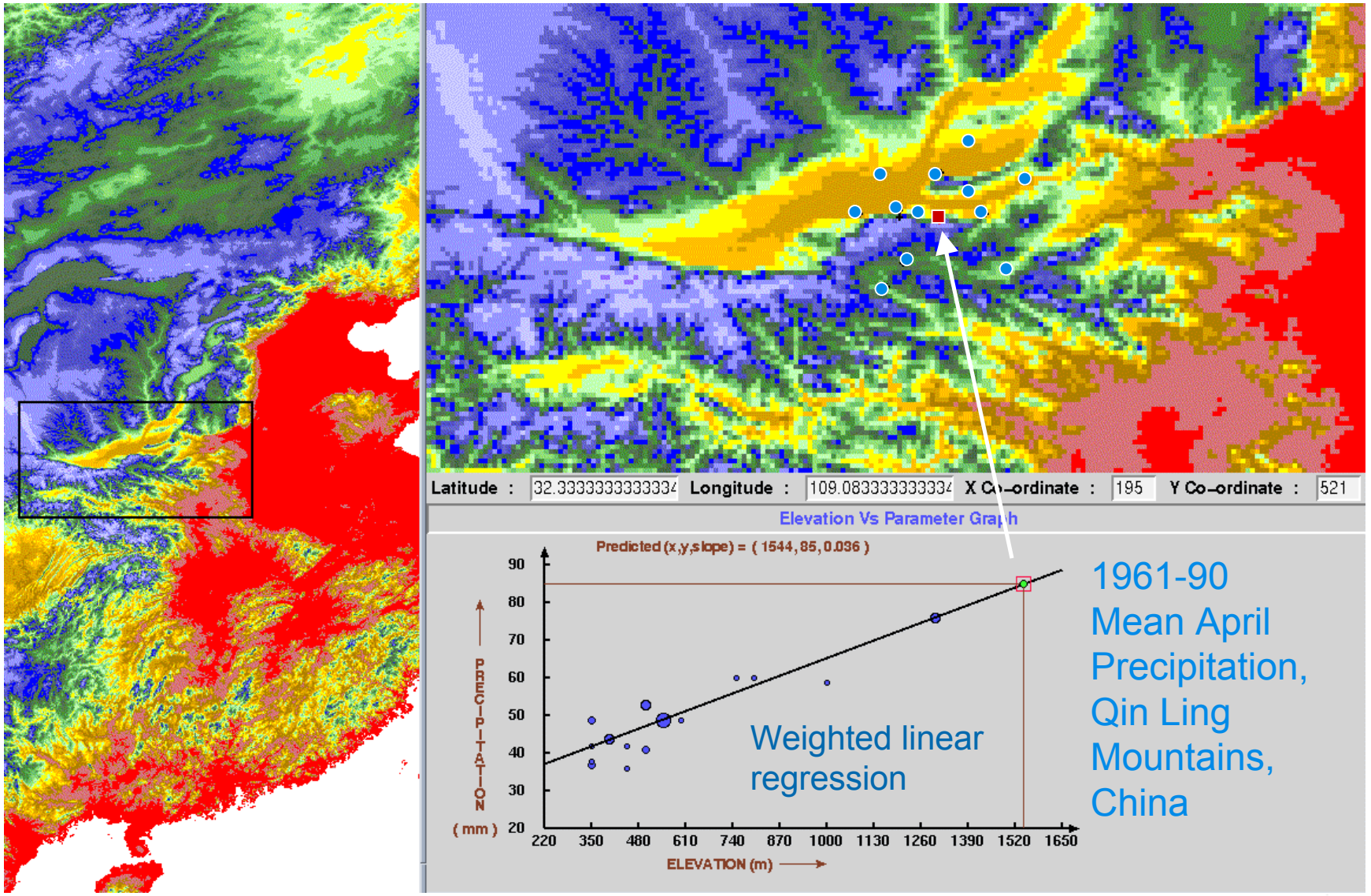
1971-90 Mean February Precipitation, European Alps



1961-90 Mean September Max Temperature, Qin Ling Mountains, Chi



PRISM Moving-Window Regression Function



Governing Equation

Moving-window regression of climate vs elevation

$$y = \beta_1 x + \beta_0$$

Y = predicted climate element

x = DEM elevation at the target cell

β_0 = y-intercept

β_1 = slope

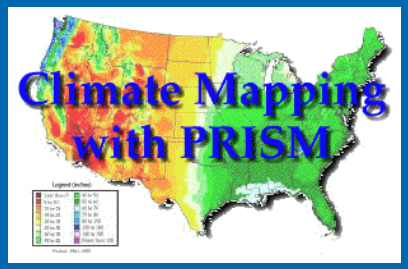
x,y pairs - elevation and climate observations from nearby climate stations

Station Weighting

Combined weight of a station is:

$$W = f\{W_d\ W_z\ W_c\ W_f\ W_p\ W_l\ W_t\ W_e\}$$

- Distance
- Elevation
- Clustering
- Topographic Facet (orientation)
- Coastal Proximity
- Vertical Layer (inversion)
- Topographic Index (cold air pooling
- Effective Terrain Height (orographi profile)

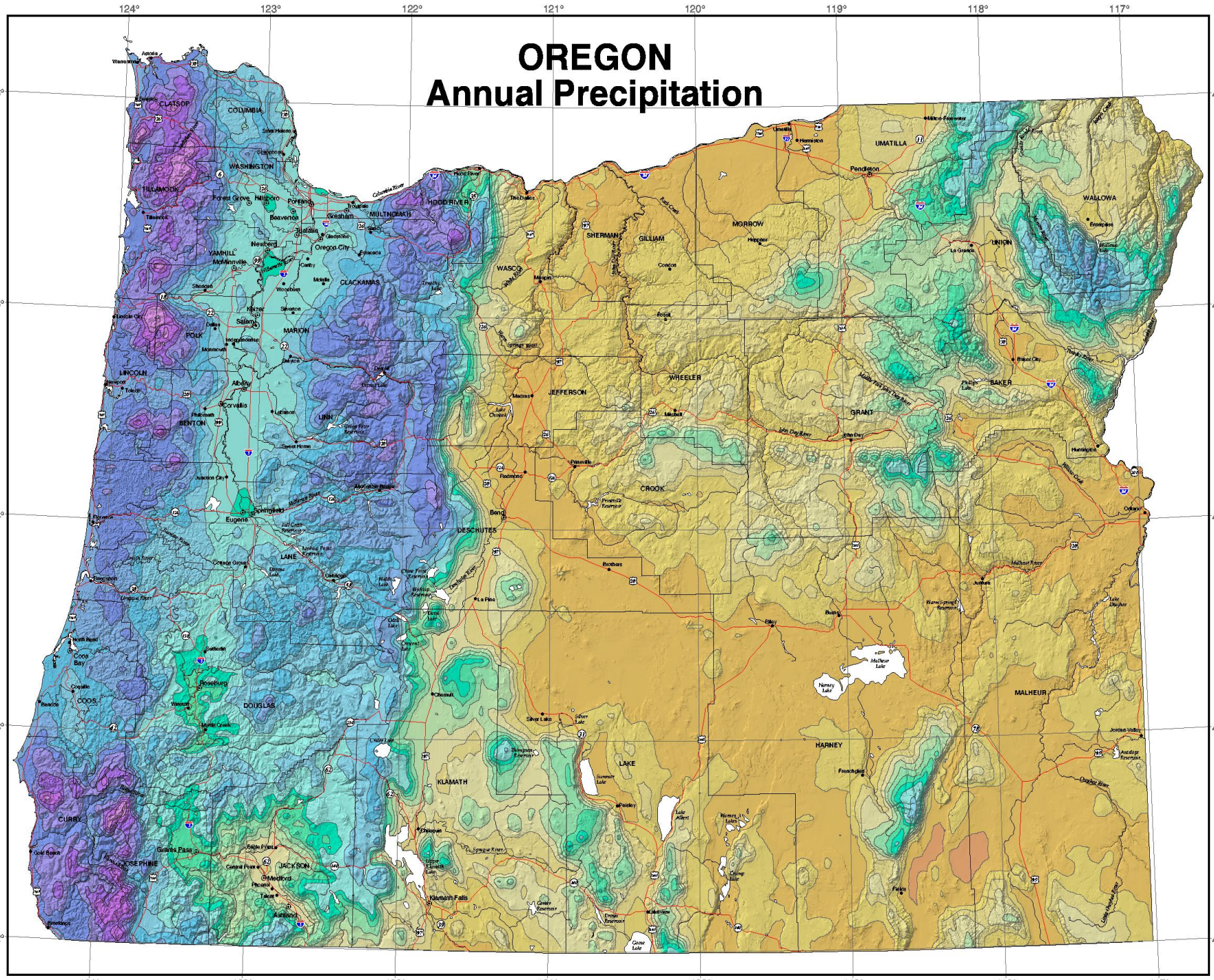


PRISM

Knowledge Base

- Elevation Influence on Climate
- Terrain-Induced Climate Transitions (topographic facets, moisture index)

OREGON
Annual Precipitation



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28 - 3
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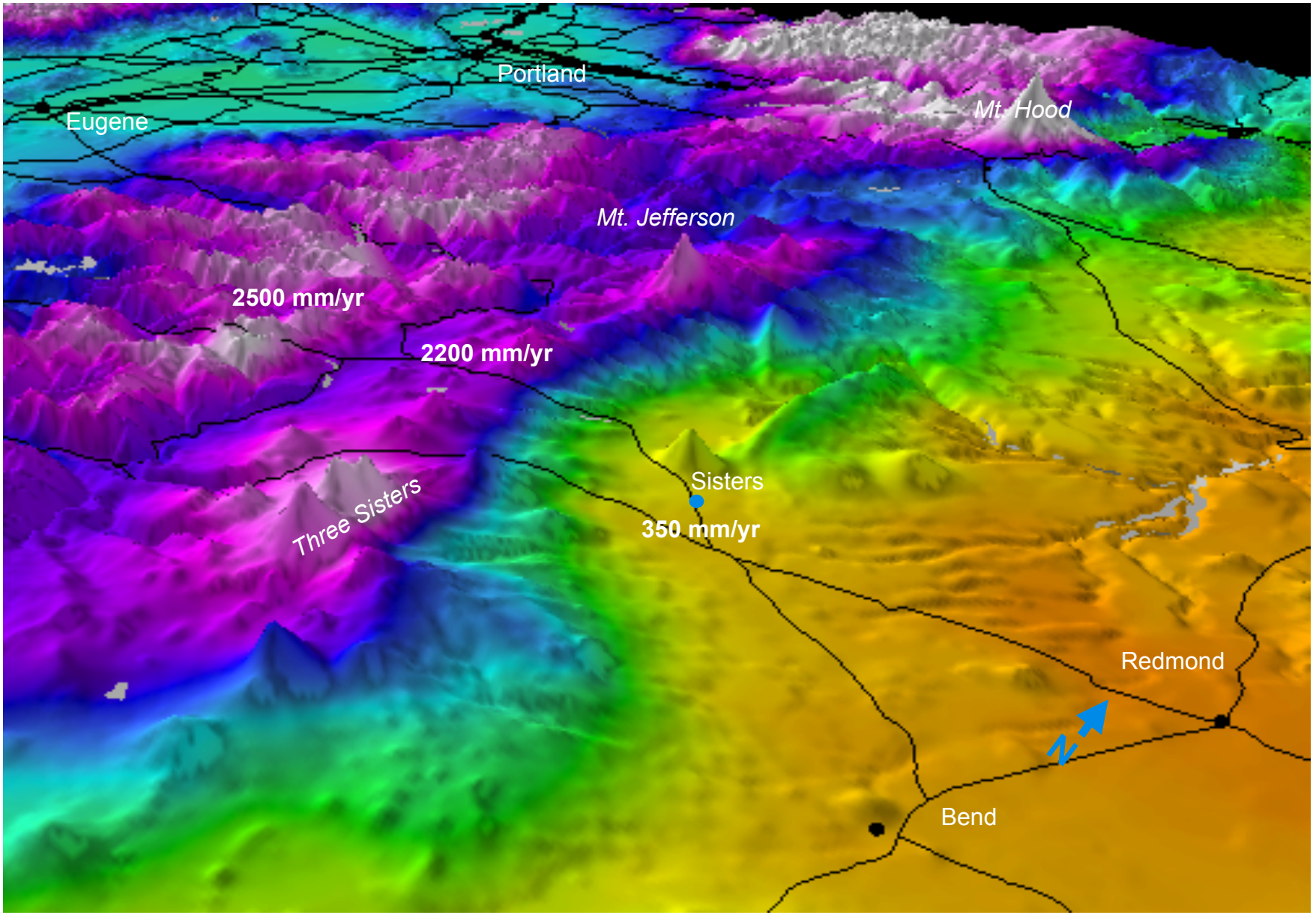
69 - 7
79 - 9
98 - 11
118 - 13
138 - 15
158 - 17
> 17

30 0

Map prepared with the PRI
Spatial Climate Analysis Se
http://www.ocs.orst.edu/pri

Rain Shadow: 1961-90 Mean Annual Precipitation Oregon Cascades



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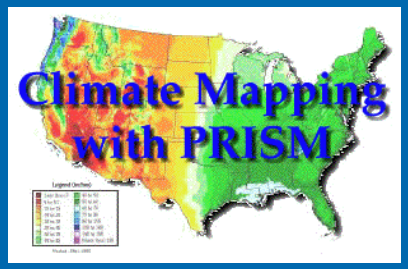
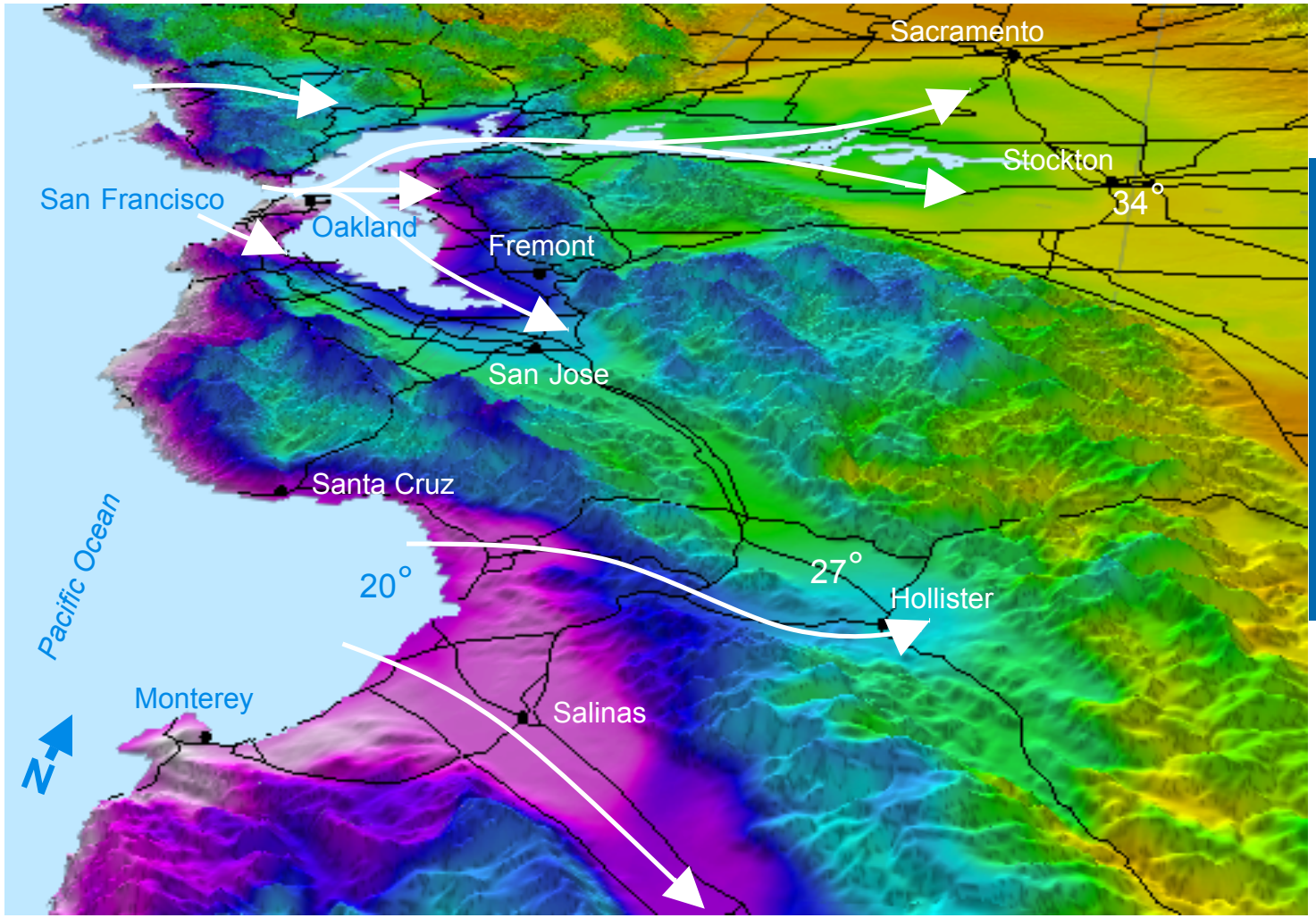


PRISM

Knowledge Base

- Elevation Influence on Climate
- Terrain-Induced Climate Transitions (topographic facets, moisture index)
- Coastal Effects

Coastal Effects: 1971-00 July Maximum Temperature
Central California Coast – 1 km



Preferred Trajectories →

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