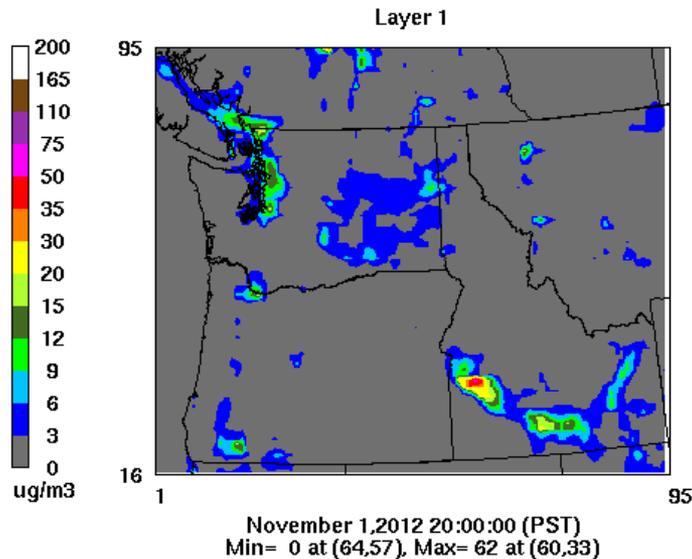


Update: ~~Background concentration~~ “design value” maps of criteria pollutants in WA, OR, and ID

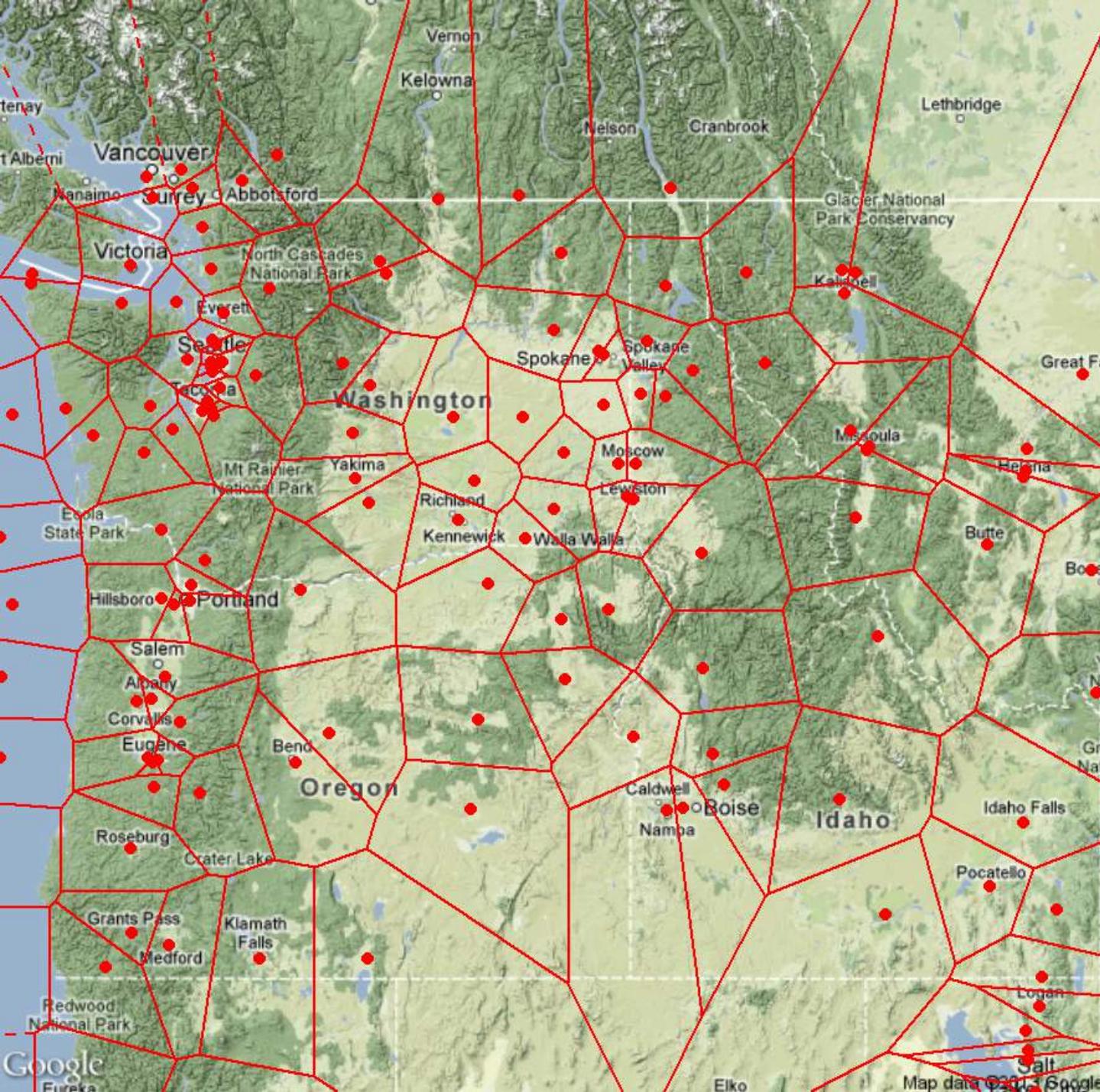
CMAQ PM2.5



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Context

- Permitting work requires a knowledge of existing concentrations for all criteria pollutants (Design Values, aka “backgrounds” in permitting jargon)
- Without realistic background in rural areas, urban values are often applied, or the monitor deemed most representative/conservative
- These backgrounds are often higher and end up unfairly restricting businesses
- To obtain “paired-in-space” background concentrations for all criteria pollutants, we use AIRPACT-3 archives melded with monitor data



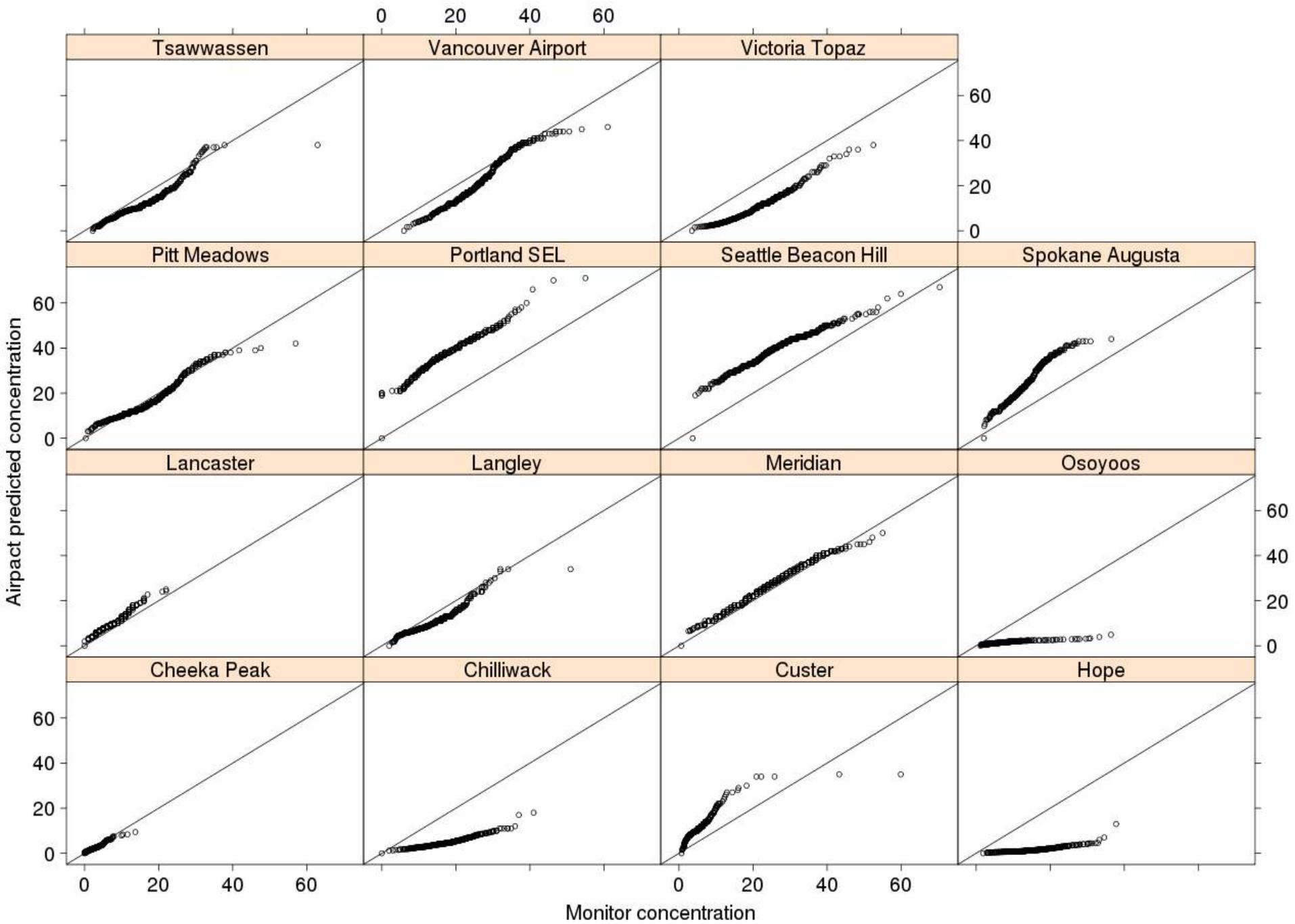
Voronoi polygons for
NO₂ monitors
ben
CO, SO₂

Voronoi polygons for
PM_{2.5} monitors

Some checks and balances

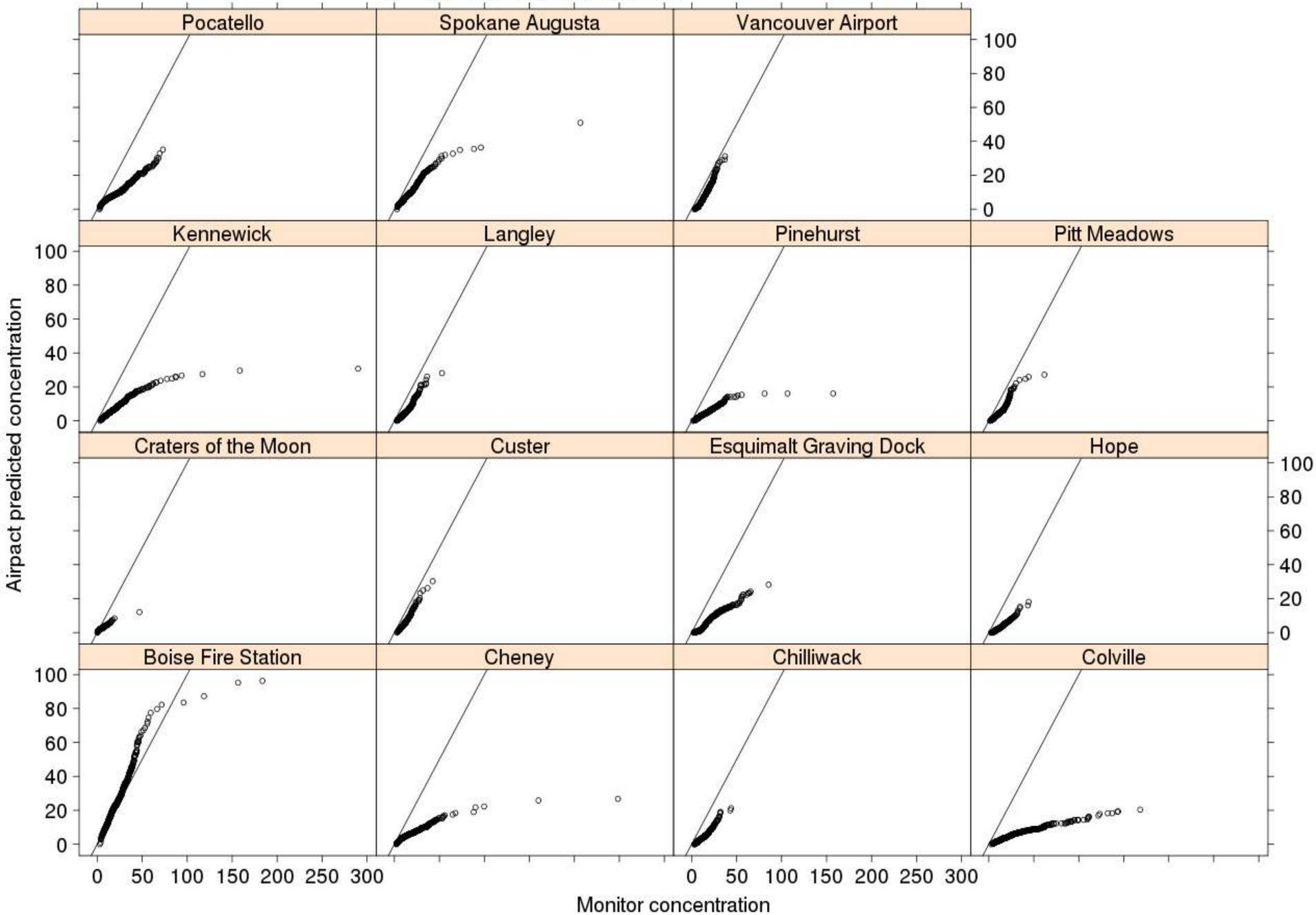
- Model performance is important when monitor coverage is poor (e.g. NO_2 , CO , SO_2)
- Pay attention when selecting observation sites
 - Source compliance monitors
 - Quality of Emissions Inventory
 - Model resolution

QQPLOTS of NO2 ppb.daily max: 2009-2011 data



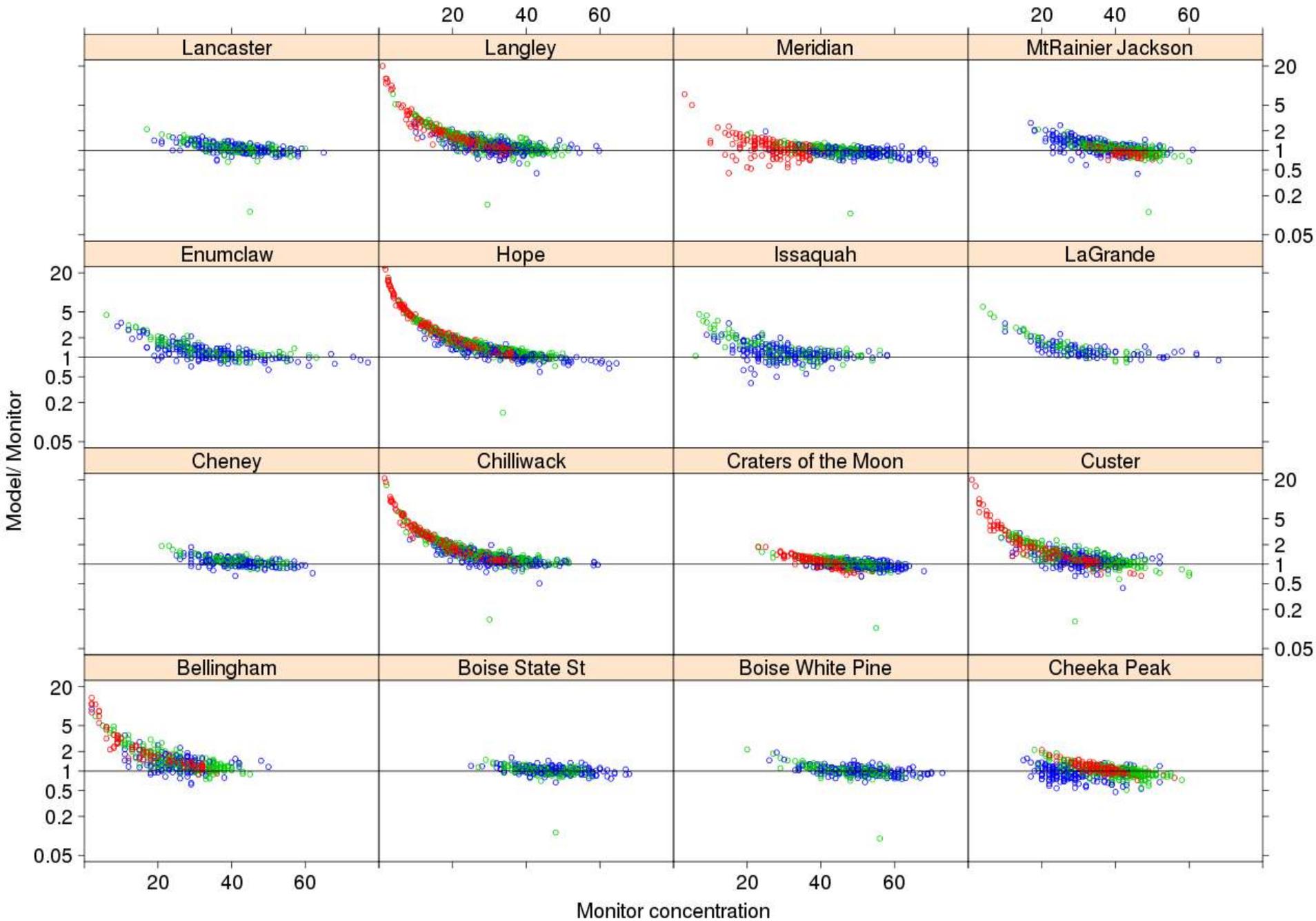
QQPLOTS of PM10 ugm3.daily mean: 2009-2011 data

0 50 100 150 200 250 300

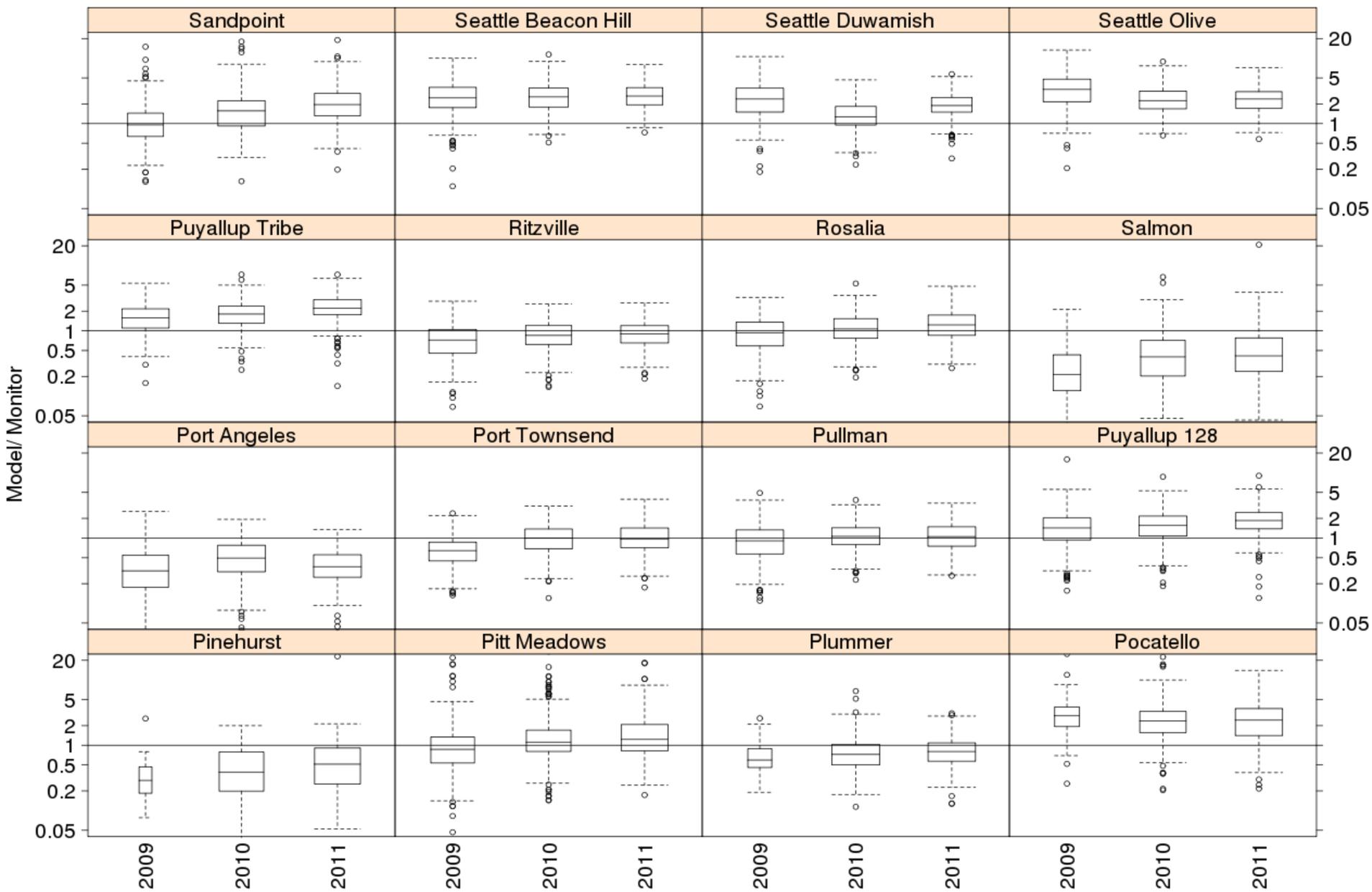


Model performance plots by season for O3 ppb.8hr runmean.daily max: 2009-2011 data

Mar-May & Sept-Oct Nov-Feb Jun-Aug



Yearly model performance boxplots of PM2.5 ugm3.daily mean



Some checks and balances

- Model performance is important when monitor coverage is poor (e.g. NO_2 , CO , SO_2)
- Pay attention when selecting observation sites
 - Source compliance monitors
 - Quality of Emissions Inventory
 - Model resolution
- Choosing distance weighting factor
 - $1/D^2$ for $\text{PM}_{2.5}$, $1/D$ for rest. Cannot pick & choose distance weighting for select monitors.
 - Beware of off-grid observations!

Layers

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- NO2_ppb.Hourly_me

NO2_ppb.Hourly_me

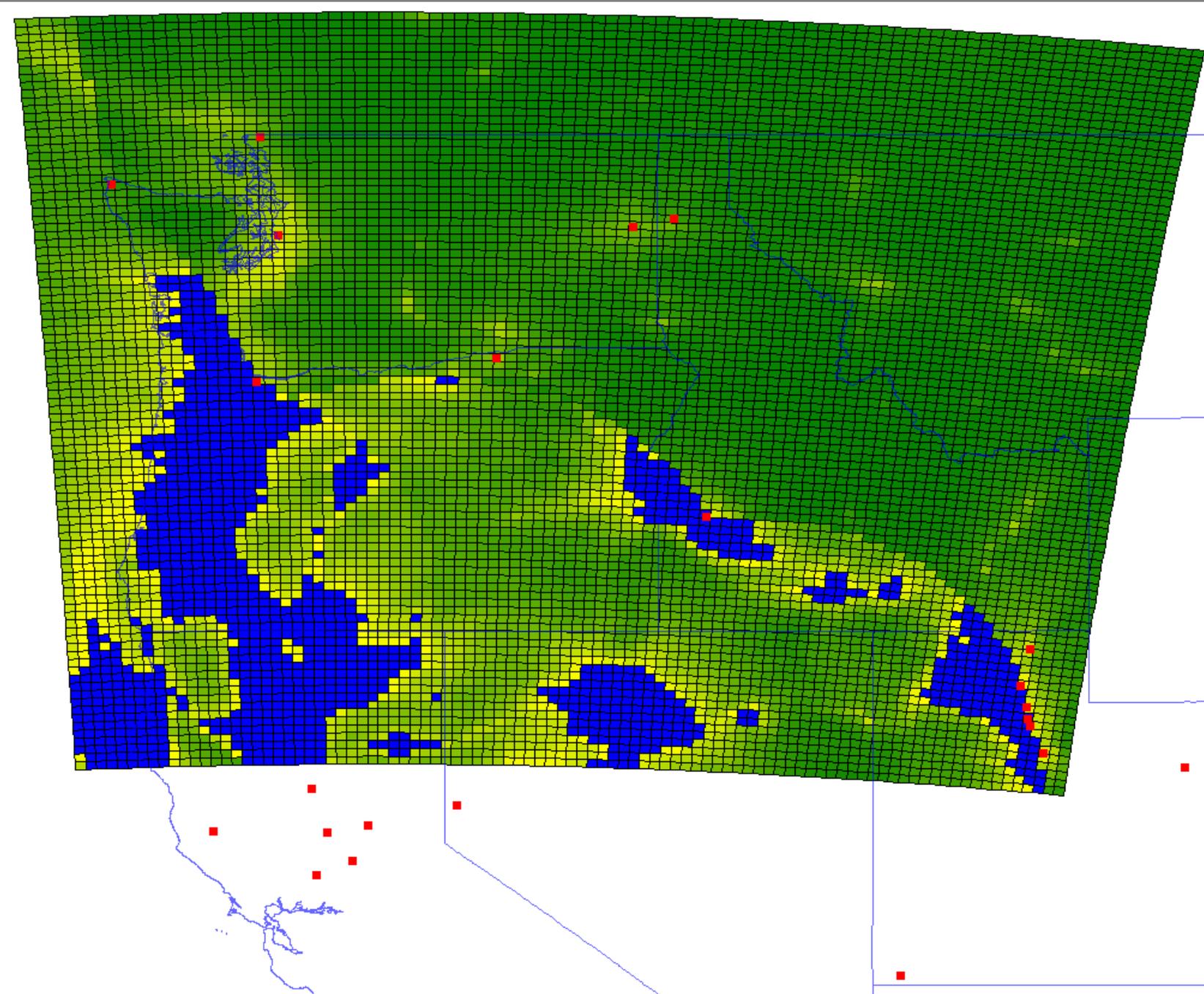
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NO2_ppb.Hourly_me

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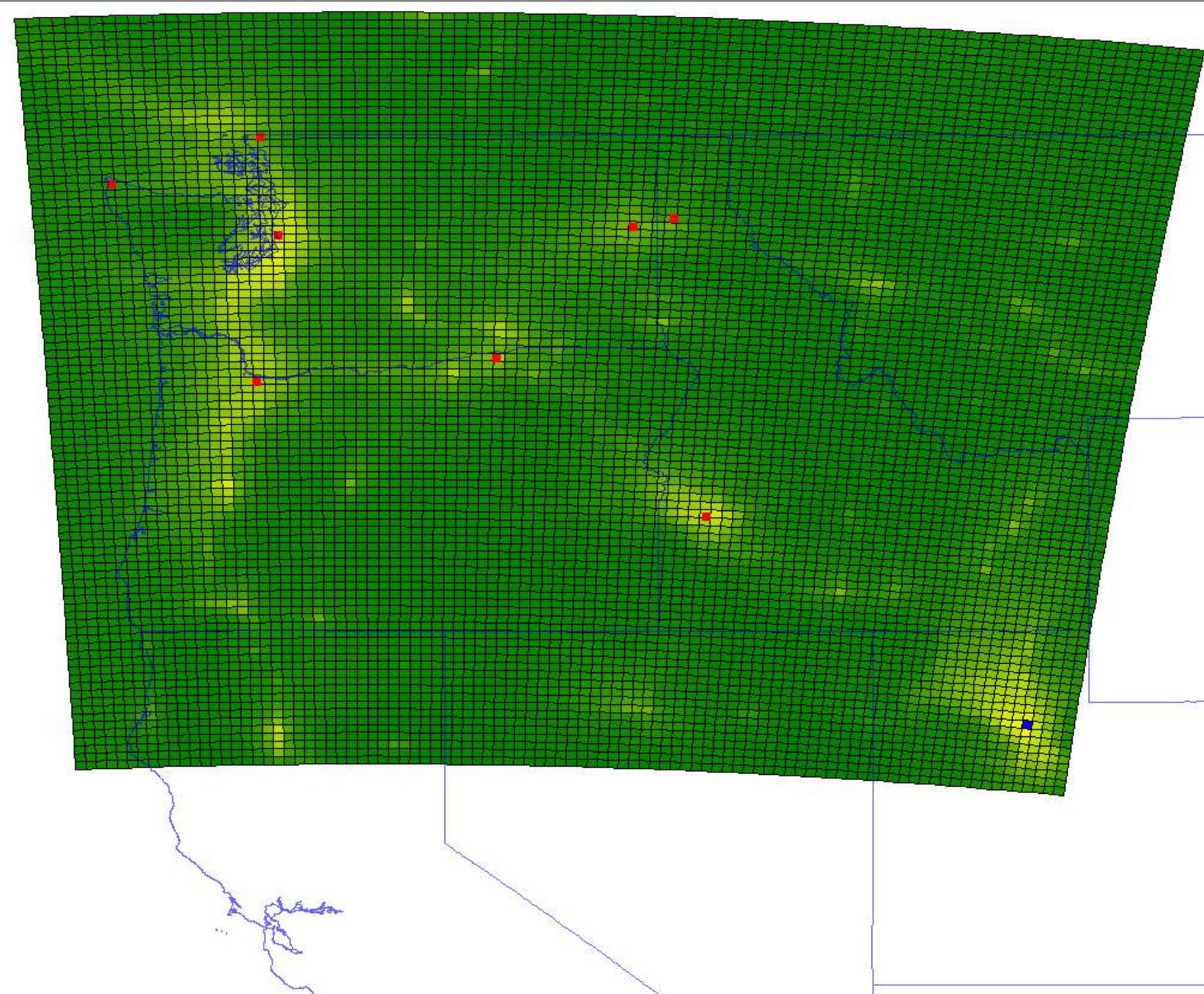
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NO2_ppb.Hourly_ma

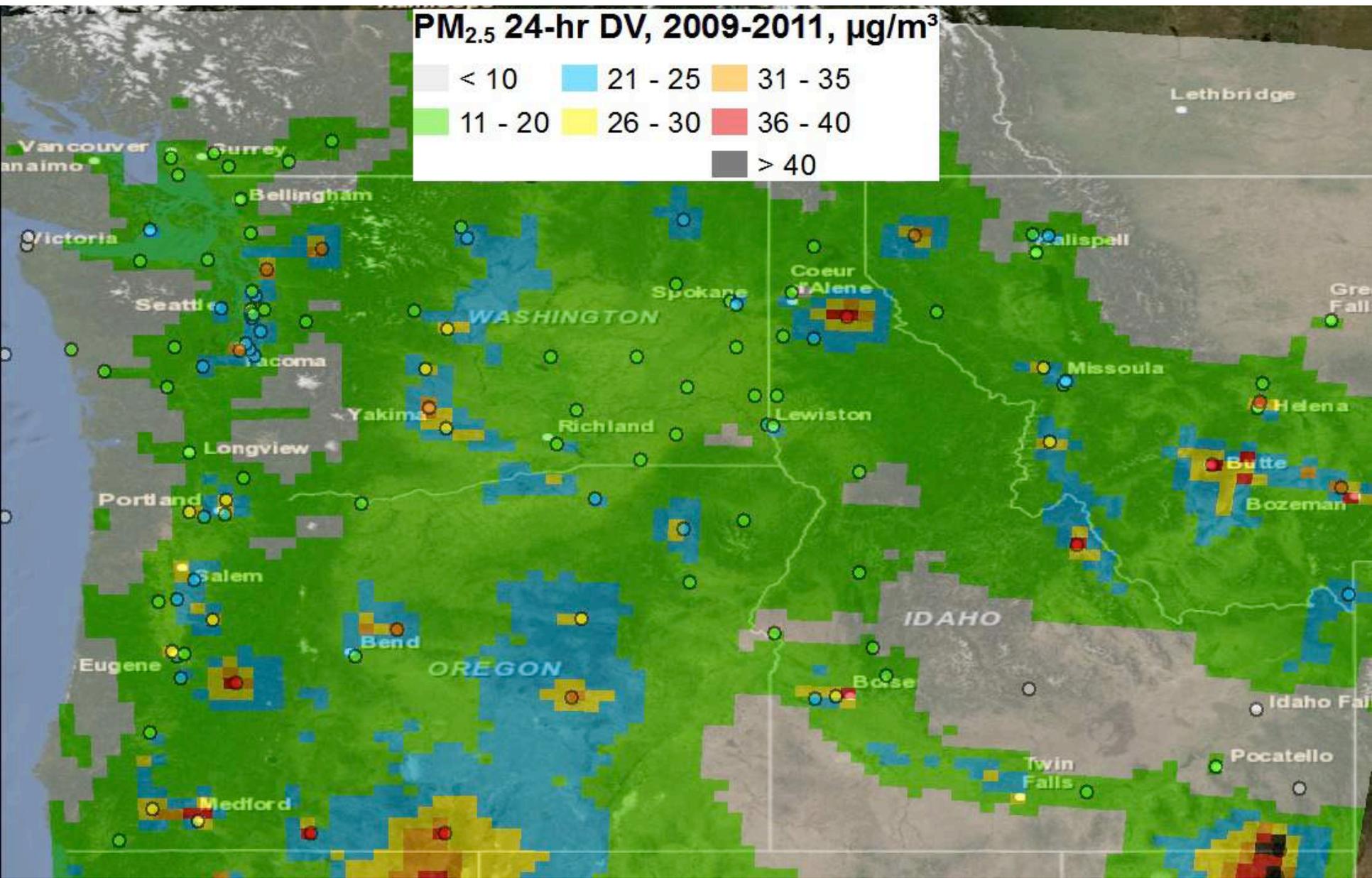
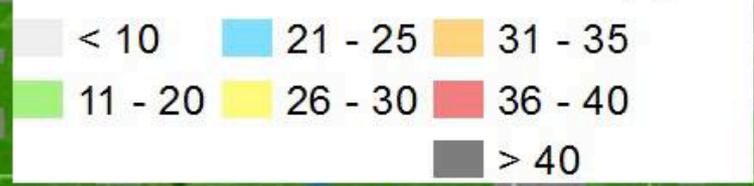
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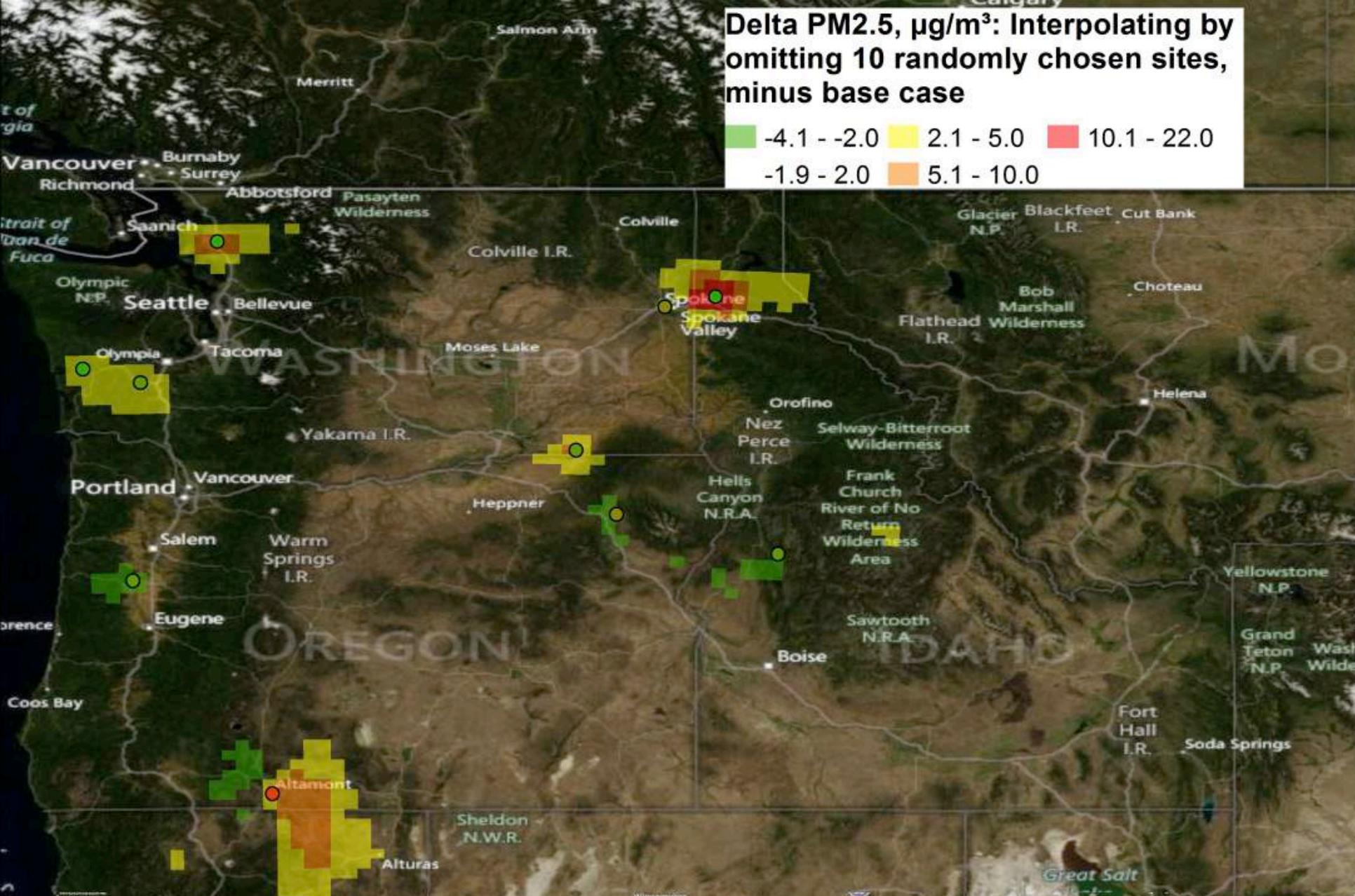
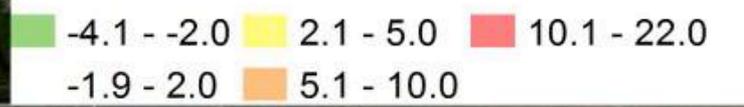
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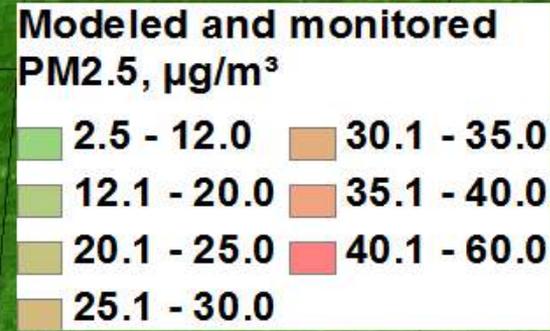


PM_{2.5} 24-hr DV, 2009-2011, $\mu\text{g}/\text{m}^3$

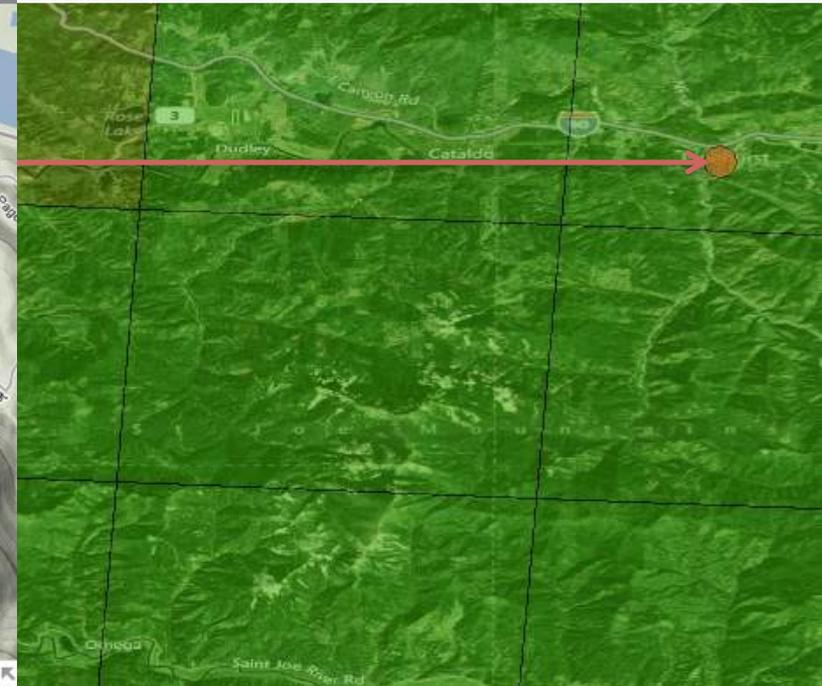


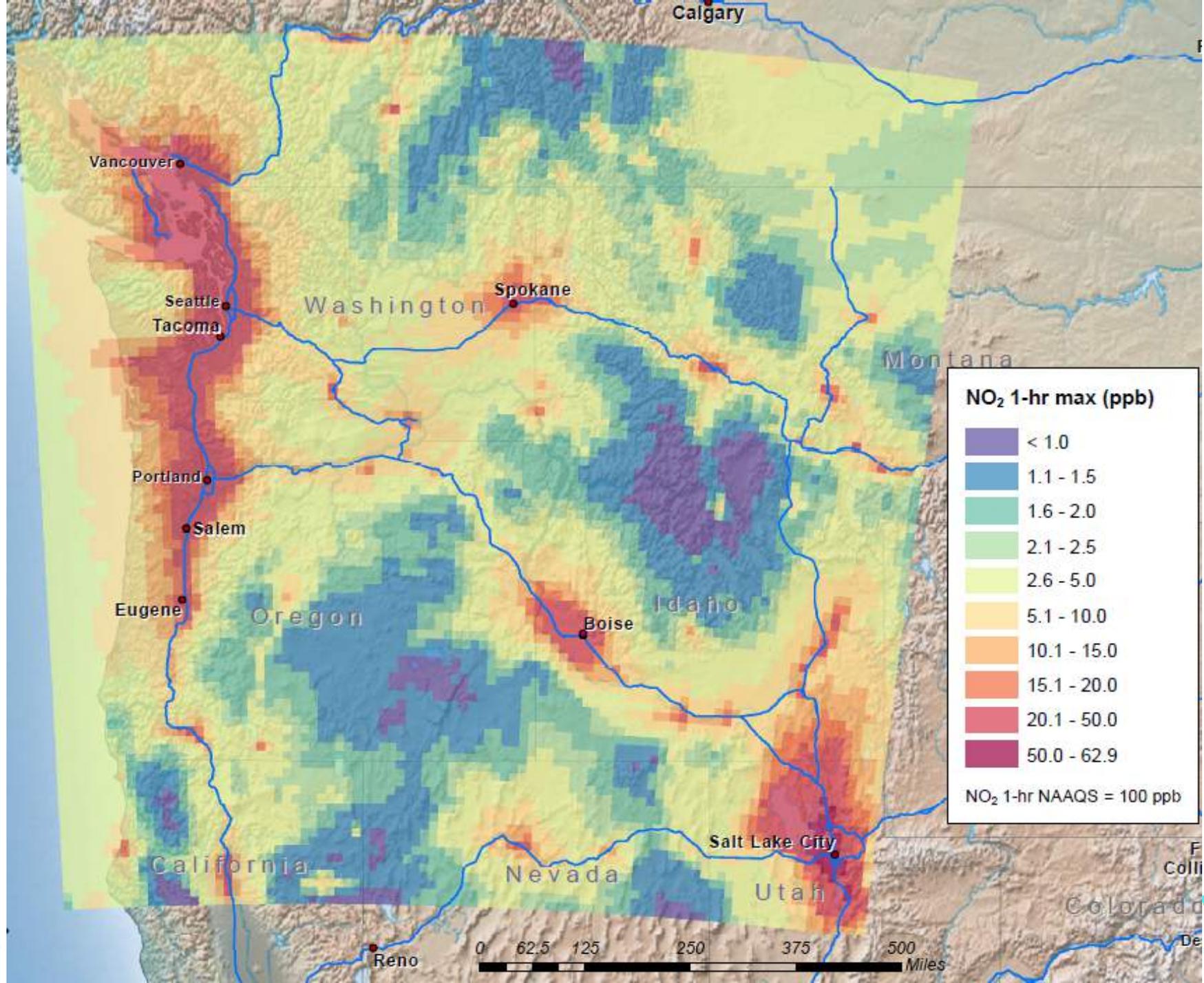
Delta PM2.5, $\mu\text{g}/\text{m}^3$: Interpolating by omitting 10 randomly chosen sites, minus base case





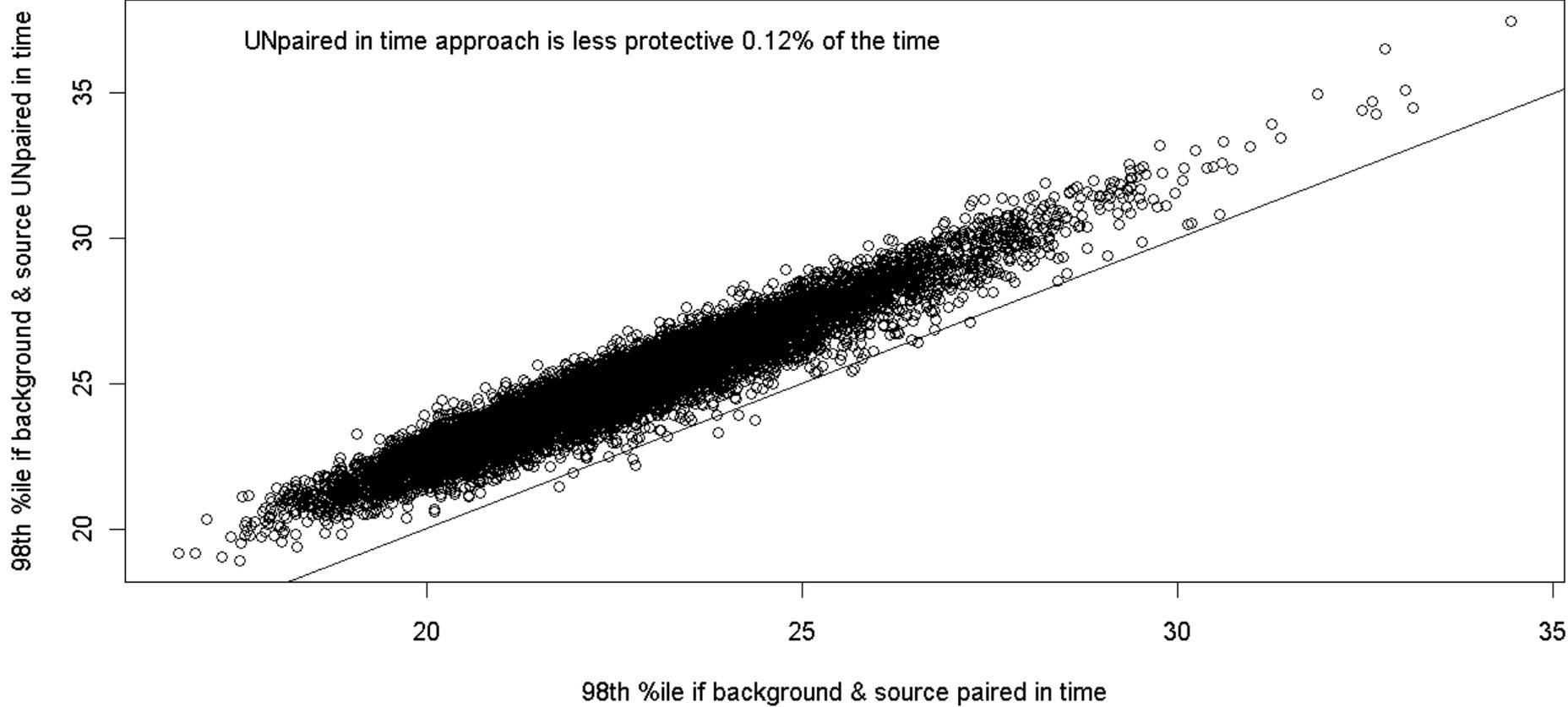
Model	Verdict
	Peg down tent
	Raise tent frame

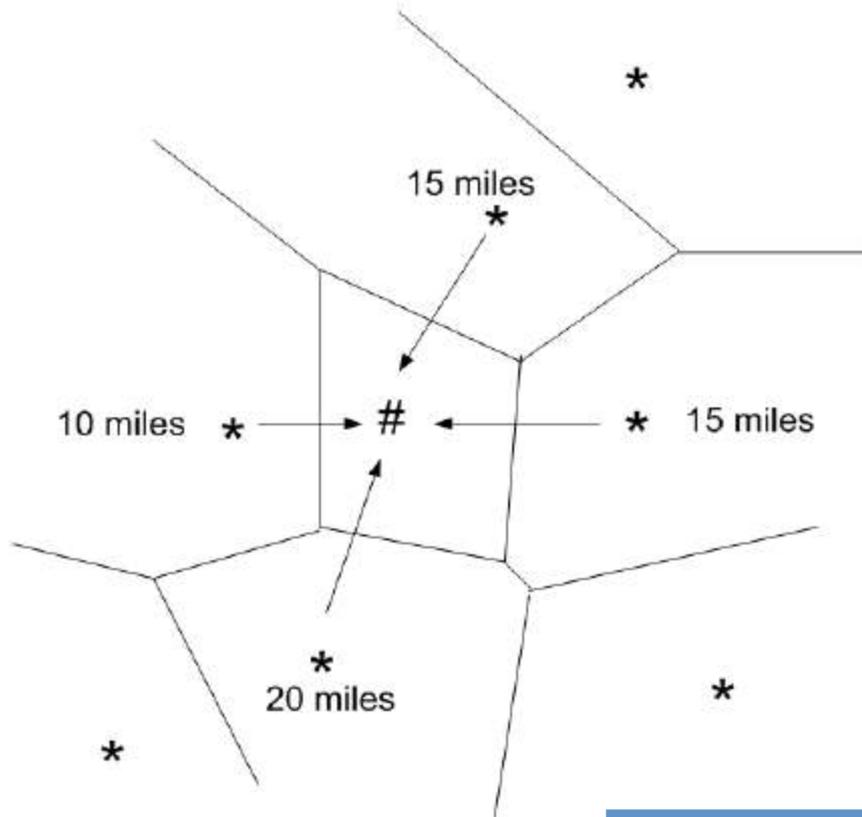




Conclusions and work remaining

- Process is sensitive to presence of monitors, especially where the model does not do a good job
- Can guide the deployment of monitoring resources
- A web based tool to look up the background concentrations at locations of interest, is available at <http://lar.wsu.edu/nw-airquest/lookup.html>





= Center Grid-Cell "E"
 * = Air Pollution Monitor

Relative weight of a monitor 10 miles away (using inverse distance squared weighting) is:

$$\frac{1/10^2}{\left(\frac{1}{10^2}\right) + \left(\frac{1}{15^2}\right) + \left(\frac{1}{15^2}\right) + \left(\frac{1}{20^2}\right)}$$

Distance from grid center to monitor	1/D relative weight	1/D ² relative weight
10	0.35	0.47
15	0.24	0.21
20	0.18	0.12

$$Forecast_{1995} = \left(0.35 \cdot 80 \cdot \frac{85}{95}\right) + \left(0.24 \cdot 90 \cdot \frac{85}{100}\right) + \left(0.24 \cdot 60 \cdot \frac{85}{80}\right) + \left(0.18 \cdot 100 \cdot \frac{85}{120}\right) = 70.8 \text{ ppb}$$

A	Model: B 1995 100 ppb Monitor: 1995 90 ppb * 15 miles	C
Model: D 1995 95 ppb Monitor: * 1995 80 ppb 10 miles	Model: E 1995 85 ppb #	Model: F 1995 80 ppb Monitor: * 1995 60 ppb 15 miles
G	Model: H 1995 120 ppb * Monitor: 1995 100 ppb 20 miles	I

= Center Grid-Cell "E"

* = Air Pollution Monitor

0.1ppb more if interpolated with 1/D² weighting

- For pollutants likely to be concentrated into confined areas (PM_{2.5}, CO, SO₂ and NO₂), exponent= 2. For O₃ and PM₁₀, exponent=1.

Pollutant	Averaging period				
	Annual	24hr	Max daily 8hr running mean	Max daily 3hr running mean	Max daily 1hr
PM _{2.5}	15 µg/m ³	35 µg/m ³			
PM ₁₀		150 µg/m ³			
NO ₂	53 ppb				100 ppb
SO ₂				500 ppb*	75 ppb
CO			9 ppm*		35 ppm*
O ₃			75 ppb		

NAAQS compliance is determined by calculating design values, which are mostly 3 year averages of annual 98th or 99th percentiles.

* Not to be exceeded more than once a year