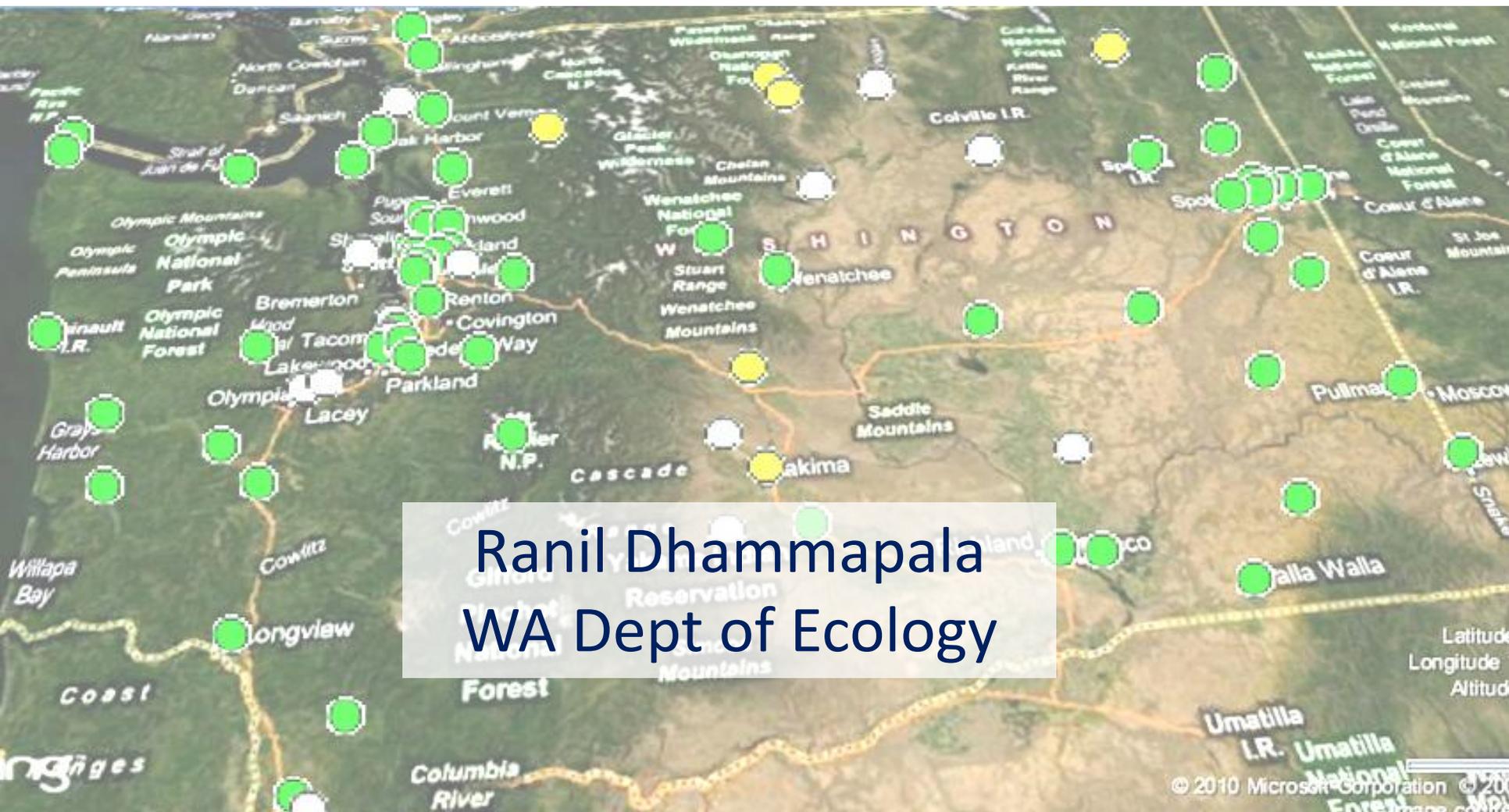


Analysis of nitrate in the Columbia Basin



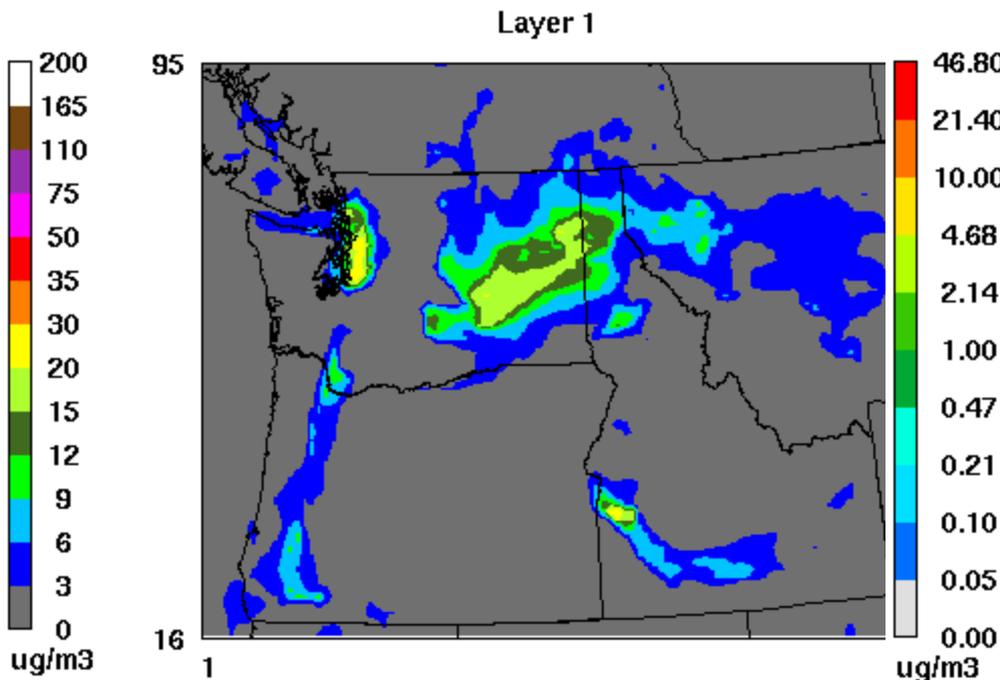
Ranil Dhammapala
WA Dept of Ecology

Background

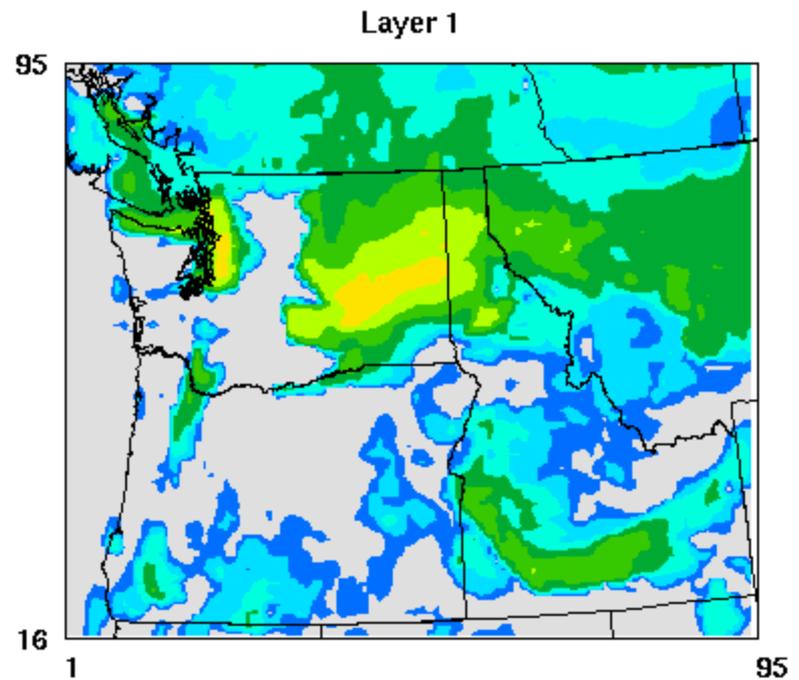
Airpact (daily forecast model running CMAQ @ 12km) was often showing high fractions of aerosol nitrate during winter, in the Columbia basin

CMAQ PM2.5

CMAQ NO3



December 14, 2009 3:00:00 (PST)
Min= 0 at (14,52), Max= 27 at (22,66)



December 14, 2009 3:00:00 (PST)
Min= 0.00 at (20,60), Max= 9.13 at (23,70)

Summary of previous work

Visibility in the Columbia River Gorge National Scenic Area has been studied. Reports available at <http://www.swcleanair.org/gorgereports.html>

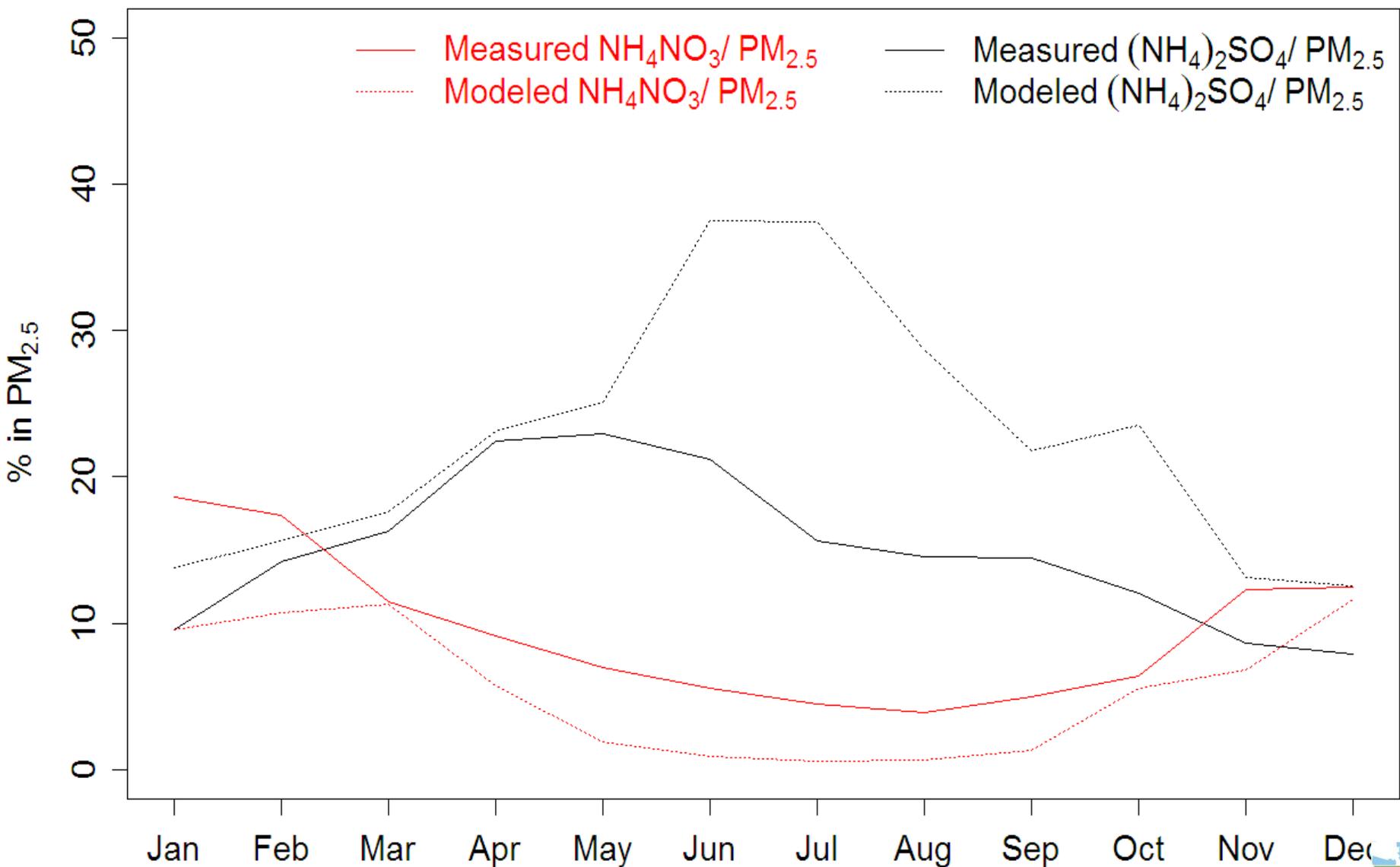
ENVIRON ran CAMx at 4km, for Aug and Nov 2004 episodes. East end of the gorge usually has excess ammonia, although the west end does not.

CAMx PM Source Apportionment Technology (PSAT) as well as PMF source apportionment work attributed high nitrate concentrations at Wishram during easterly flow, to NO_x from on-road sources and PGE/ Boardman power plant, and NH_3 from agricultural activities.

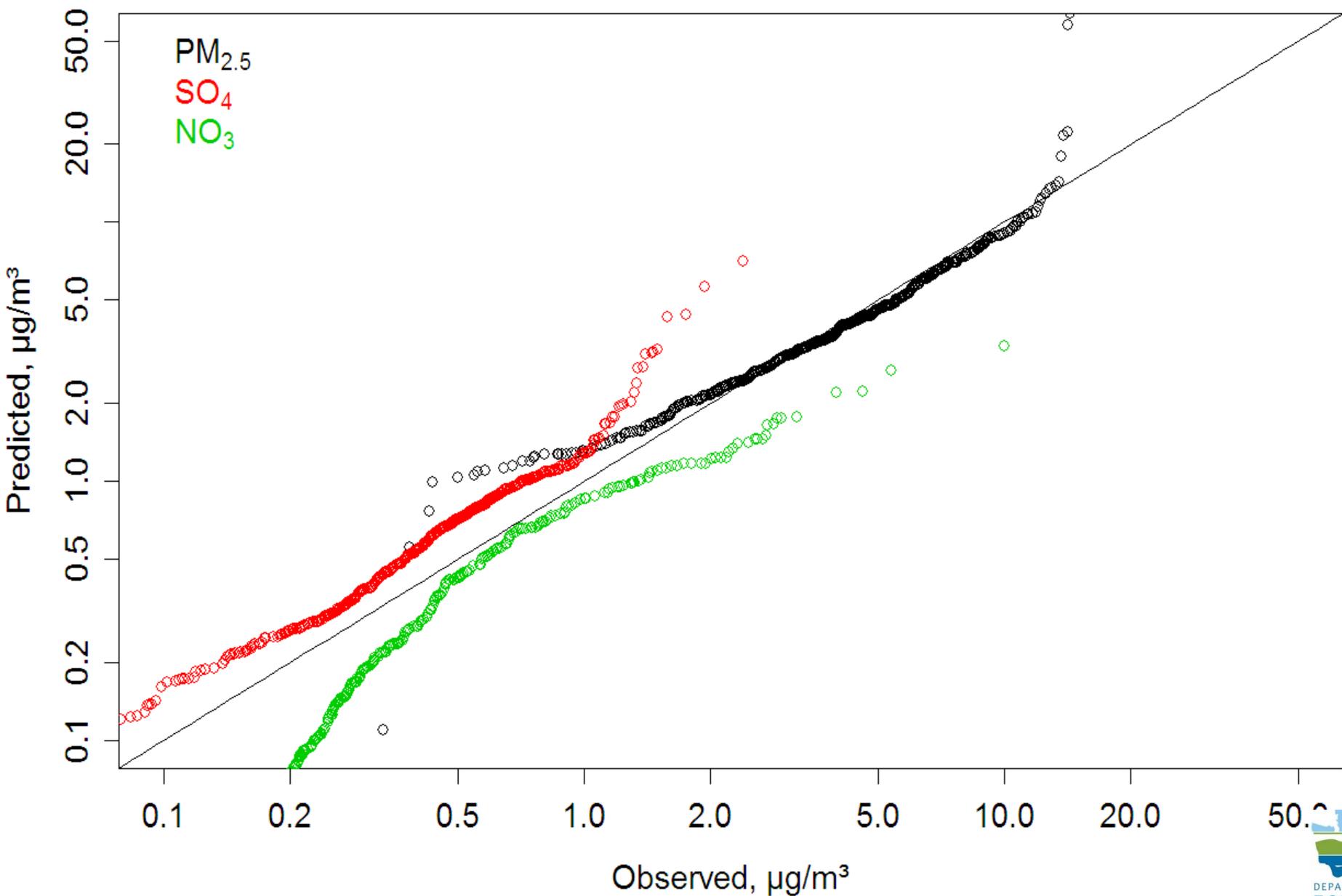
There are no long term gaseous ammonia measurements in the area.

Using CSN and IMPROVE speciation data from around the Columbia Basin to verify Airpact predictions

Median SO_4 and NO_3 fractions in $\text{PM}_{2.5}$ in Columbia basin, since 2006

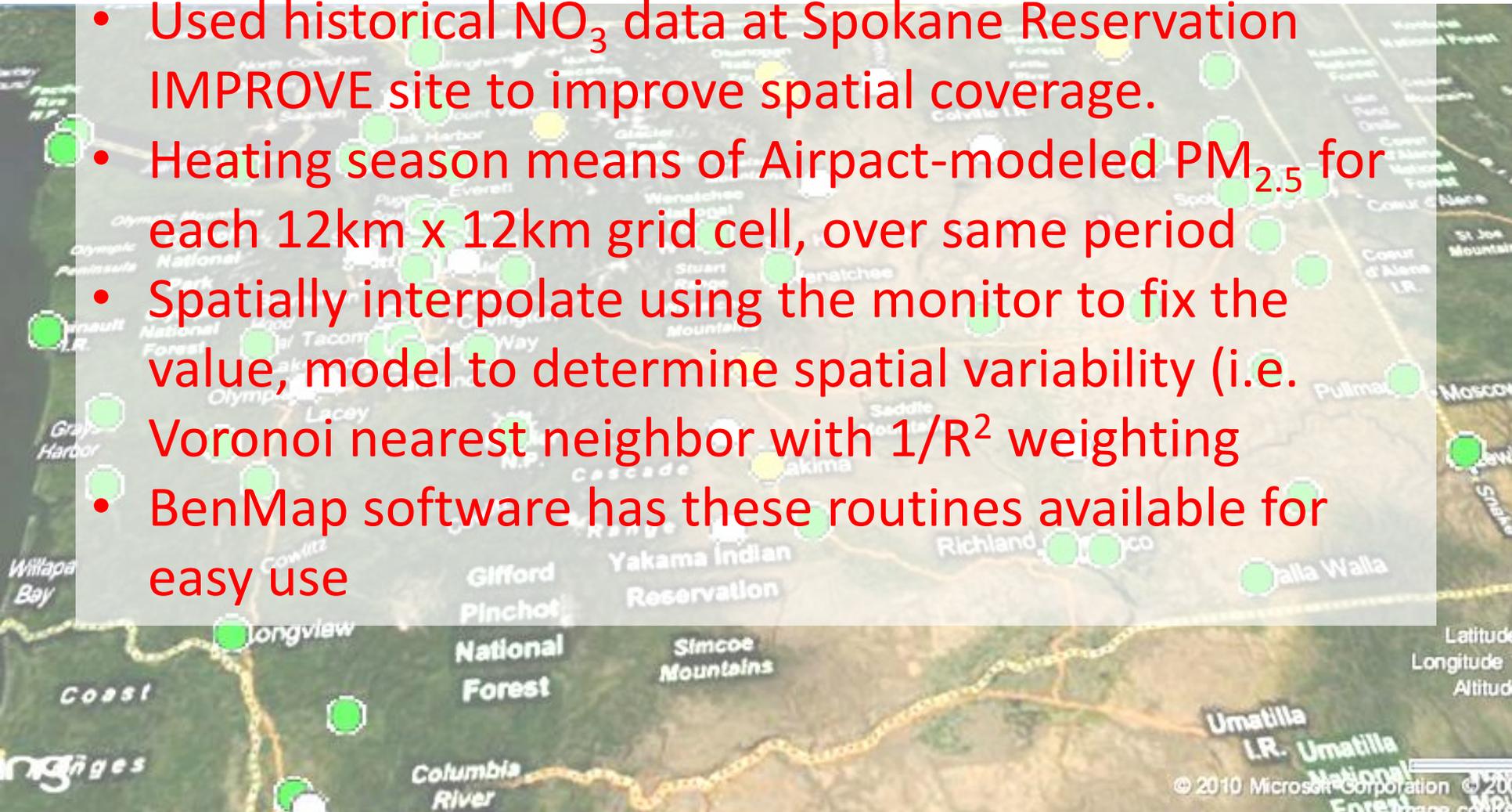


QQPLOT of modeled and measured SO_4 , NO_3 , and $\text{PM}_{2.5}$ in Columbia basin, since 2006

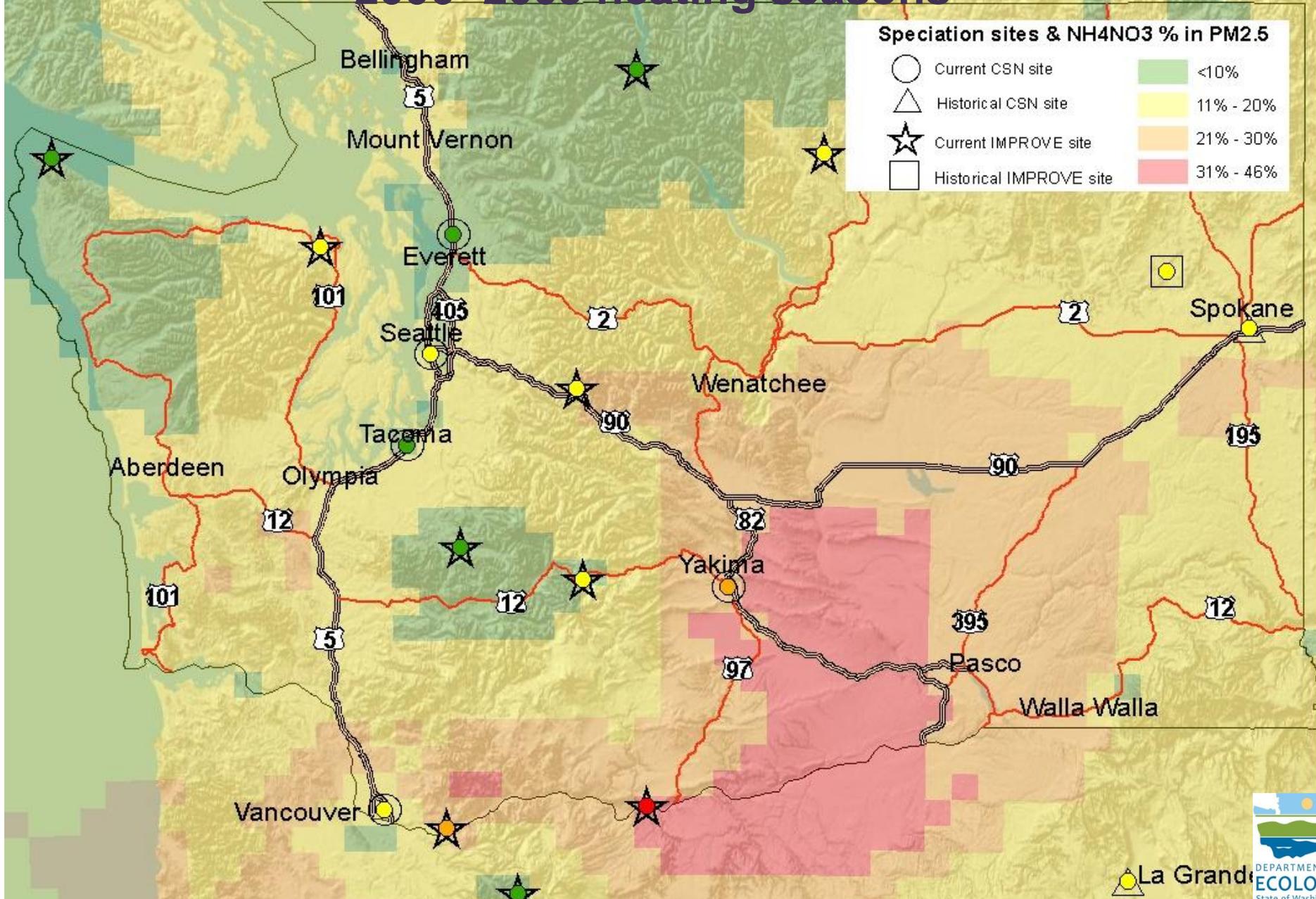


To determine spatial variability of NO_3 , we used:

- NO_3 and $\text{PM}_{2.5}$ data collected during the 2006- 2009 heating seasons, at each speciation site.
- Used historical NO_3 data at Spokane Reservation IMPROVE site to improve spatial coverage.
- Heating season means of Airpact-modeled $\text{PM}_{2.5}$ for each 12km x 12km grid cell, over same period
- Spatially interpolate using the monitor to fix the value, model to determine spatial variability (i.e. Voronoi nearest neighbor with $1/R^2$ weighting
- BenMap software has these routines available for easy use



Model- monitor interpolated $\text{NO}_3/\text{PM}_{2.5}$ ratios 2006- 2009 heating seasons

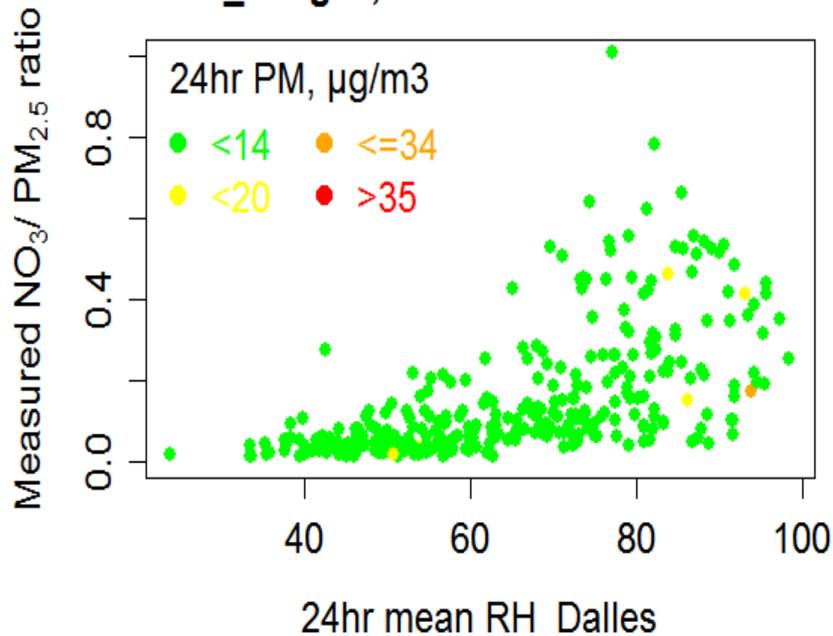


Conclusions

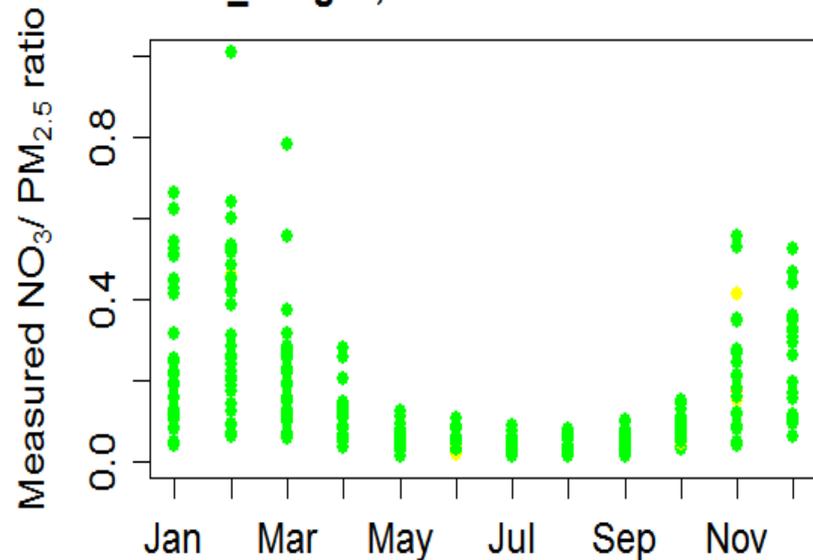
- There does appear to be a sizeable fraction of aerosol nitrate in the Columbia basin
- Not all nitrate can be explained by the large point source (HNO₃ facility, ~ 100 tons primary NO₃ per year in the Airpact inventory- *these emissions have since been reduced but monitors continue to record high NO₃*)
- In case of nonattainment areas, the SIP will have to deal with this
- Speciation monitor and/ or detailed modeling study in Columbia basin might be in order.

Questions?

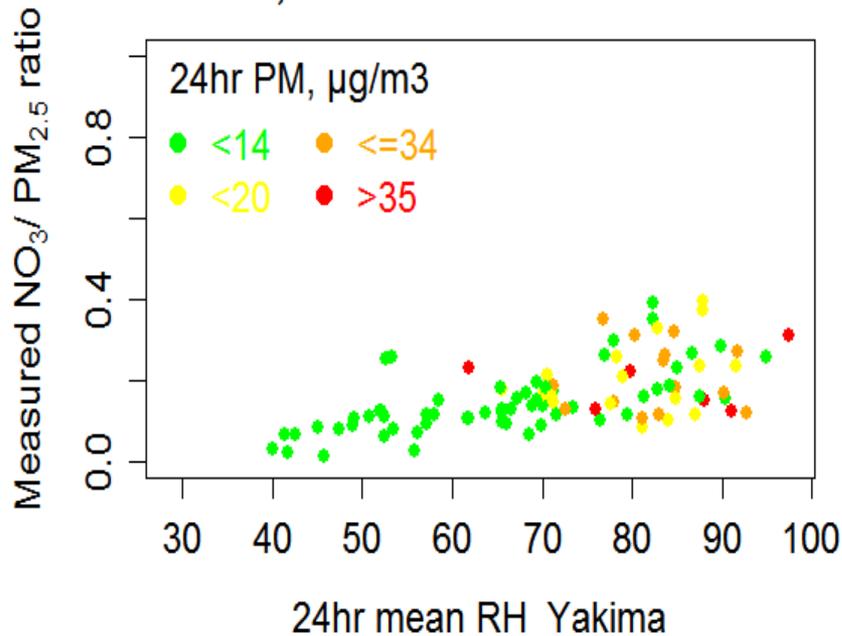
Columbia_Gorge2, from 2006-01-02 to 2009-03-29



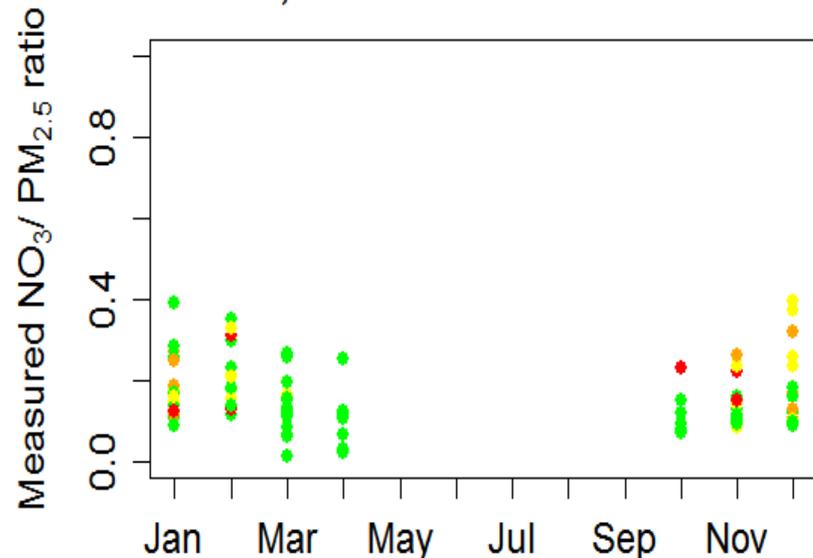
Columbia_Gorge2, from 2006-01-02 to 2009-03-29



Yakima, from 2007-11-08 to 2009-03-29



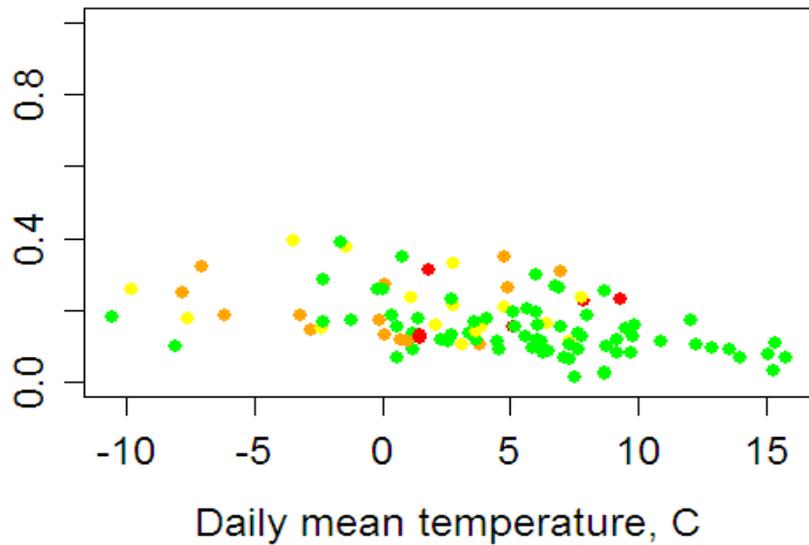
Yakima, from 2007-11-08 to 2009-03-29



Measured NO₃/ PM_{2.5} ratio

Yakima

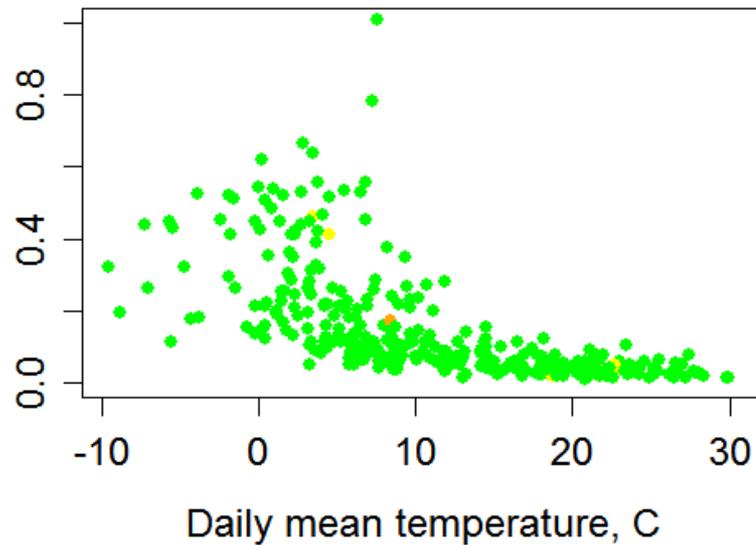
2007-11-08-> 2009-11-09



Wishram

2006-01-02 -> 2009-03-29

Measured NO₃/ PM_{2.5} ratio

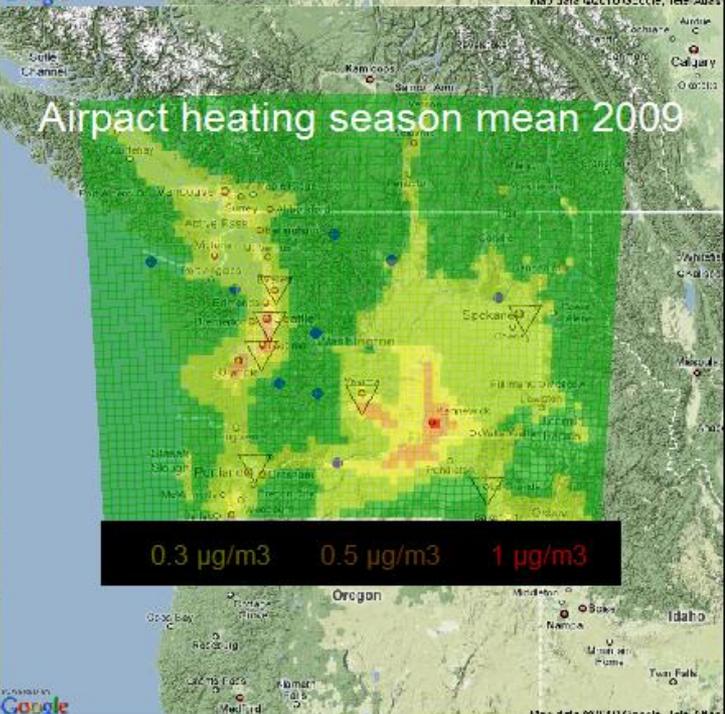
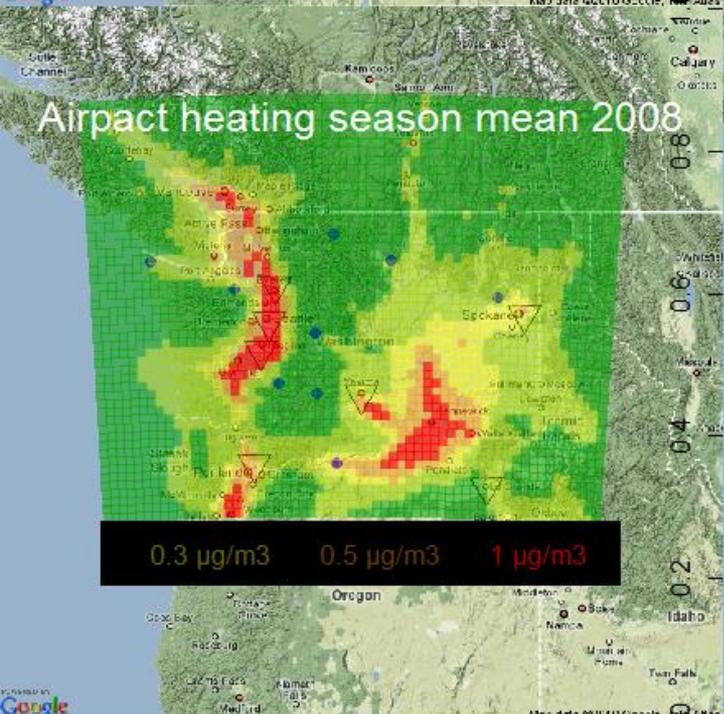
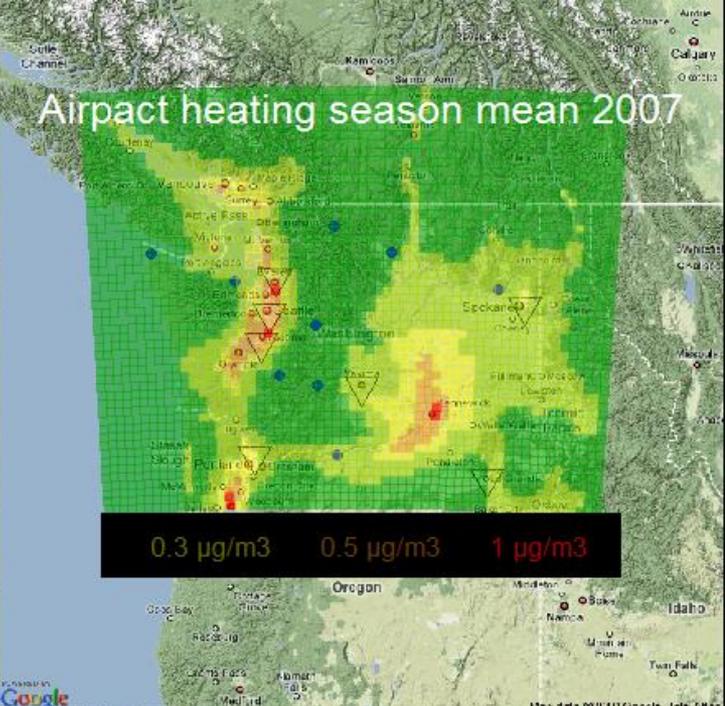
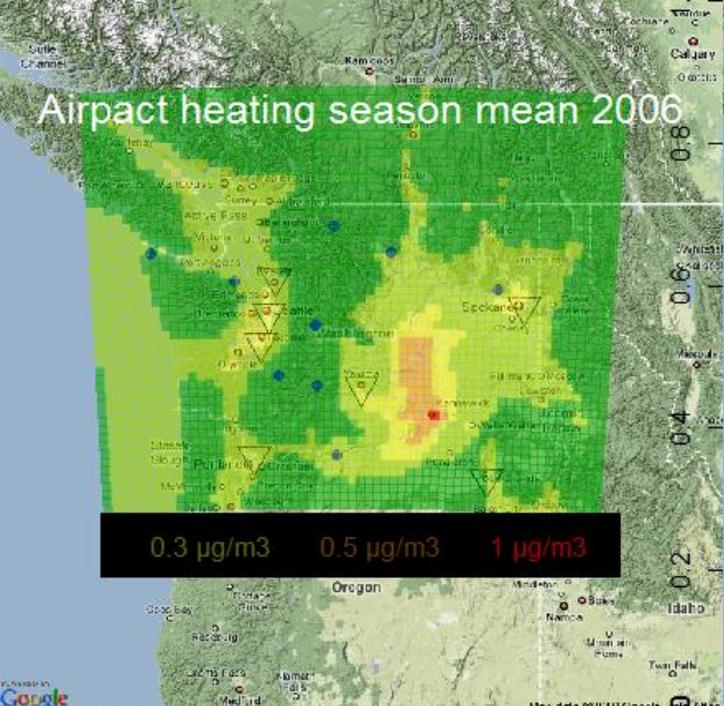


Airport heating season mean 2006

Airport heating season mean 2007

Seasonal means of modeled ANO₃, by year.

Not interpolated with monitors.



Model- monitor interpolated NO_3 concentrations 2006- 2009 heating seasons

