

Analysis of nitrate in the Columbia Basin

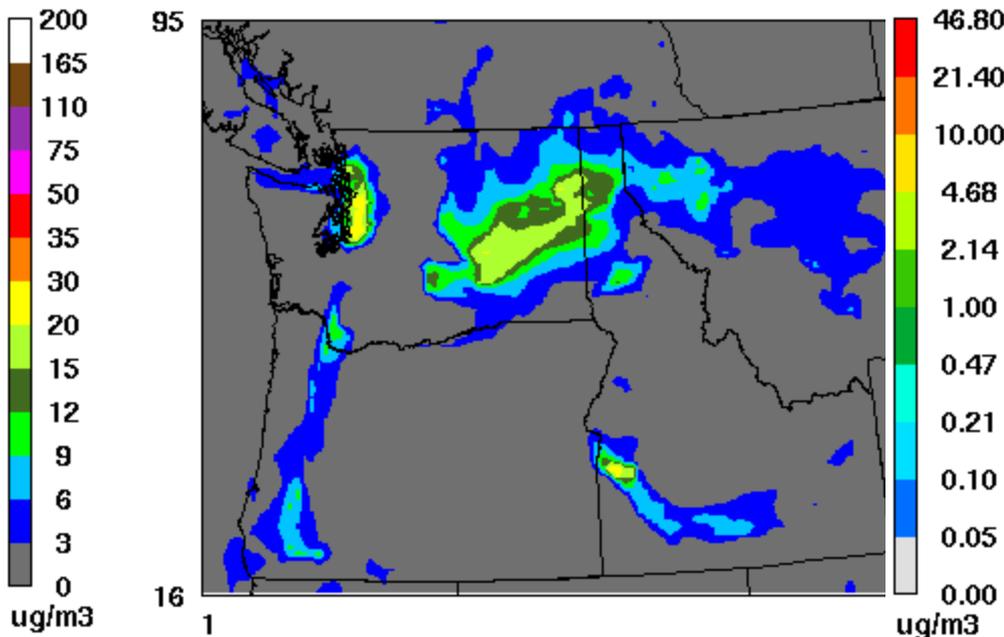
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Background

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

CMAQ PM2.5

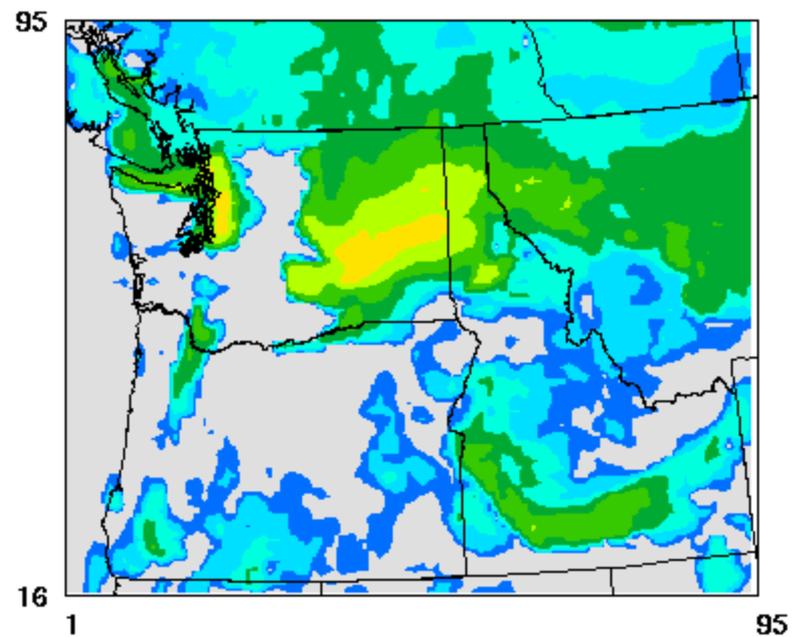
Layer 1



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

CMAQ NO3

Layer 1



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

Summary of previous work

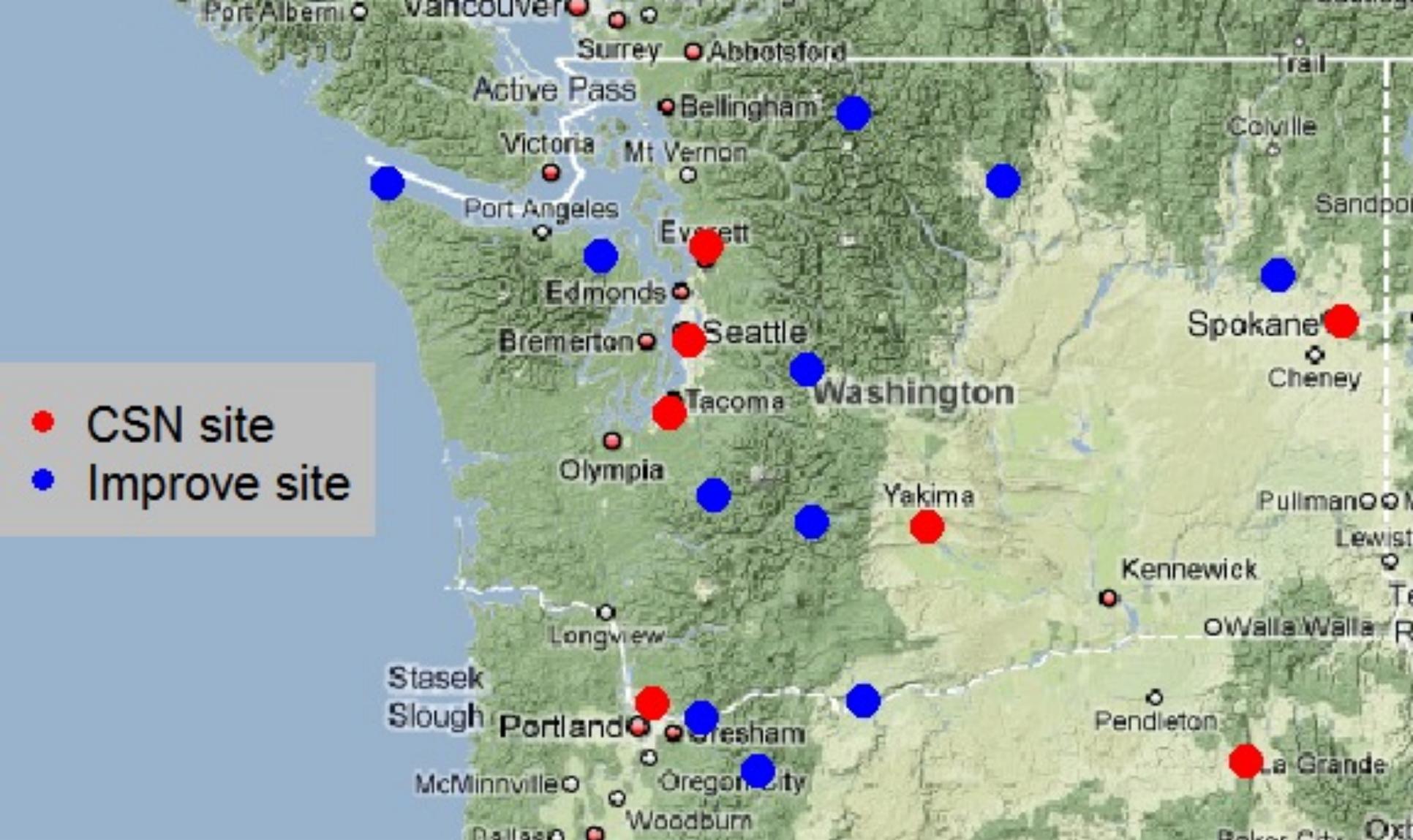
Visibility in the Columbia River Gorge National Scenic Area has been studied. Reports available at <http://www.swcleanair.org/gorgereports.html>

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.

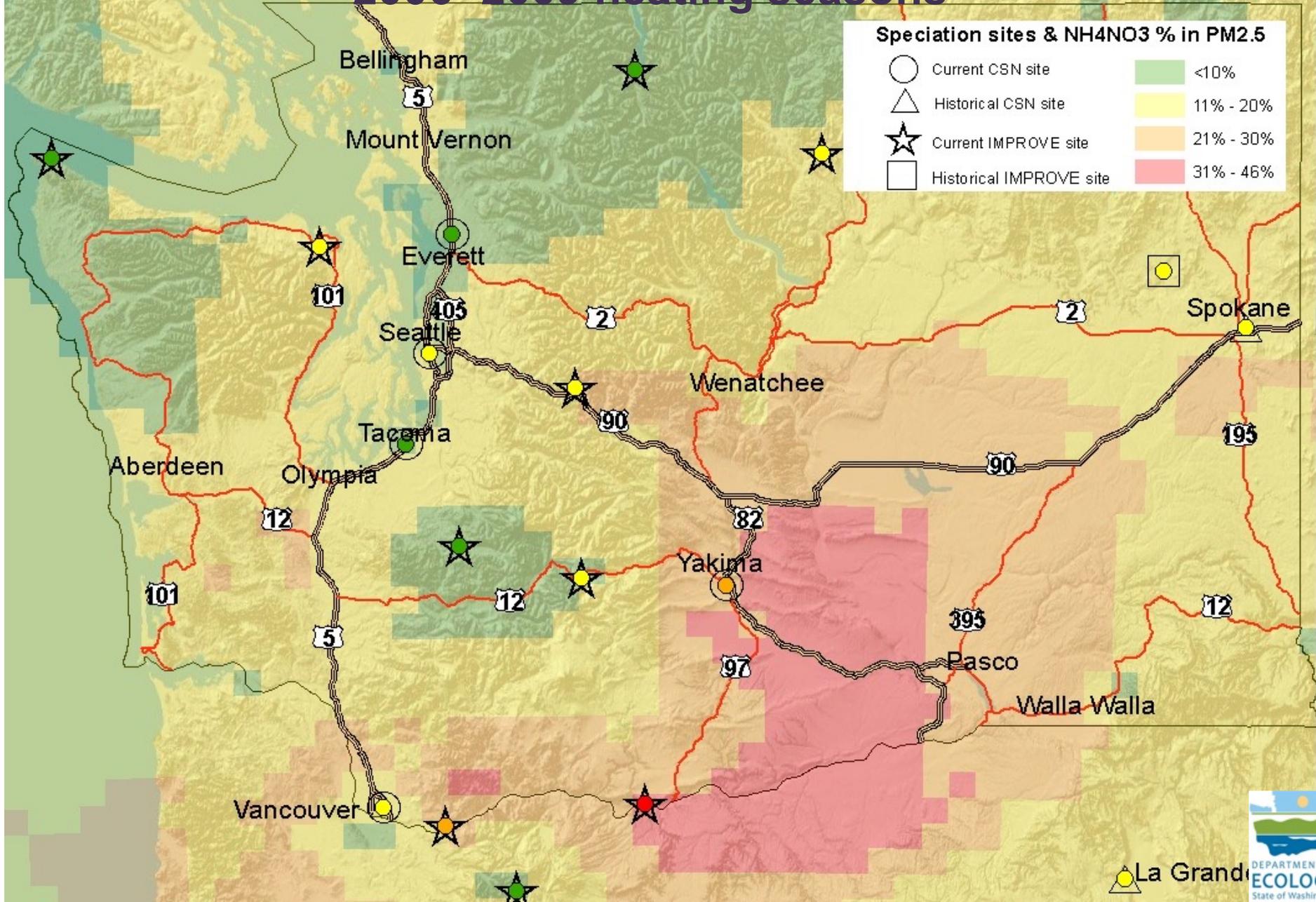
There are no long term gaseous ammonia measurements in the area.

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



- Spokane and La Grande (OR) CSN sites terminated in Jan '09 and Nov '07.
- IMPROVE data from Spokane reservation terminated in June '05.
- Obtained IMPROVE data through Mar '09 and CSN data upto Nov '09.

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



Subsequent work

Had a conference call in October to discuss the matter. Decided to tabulate the available measurements and perform some model sensitivity analyses.

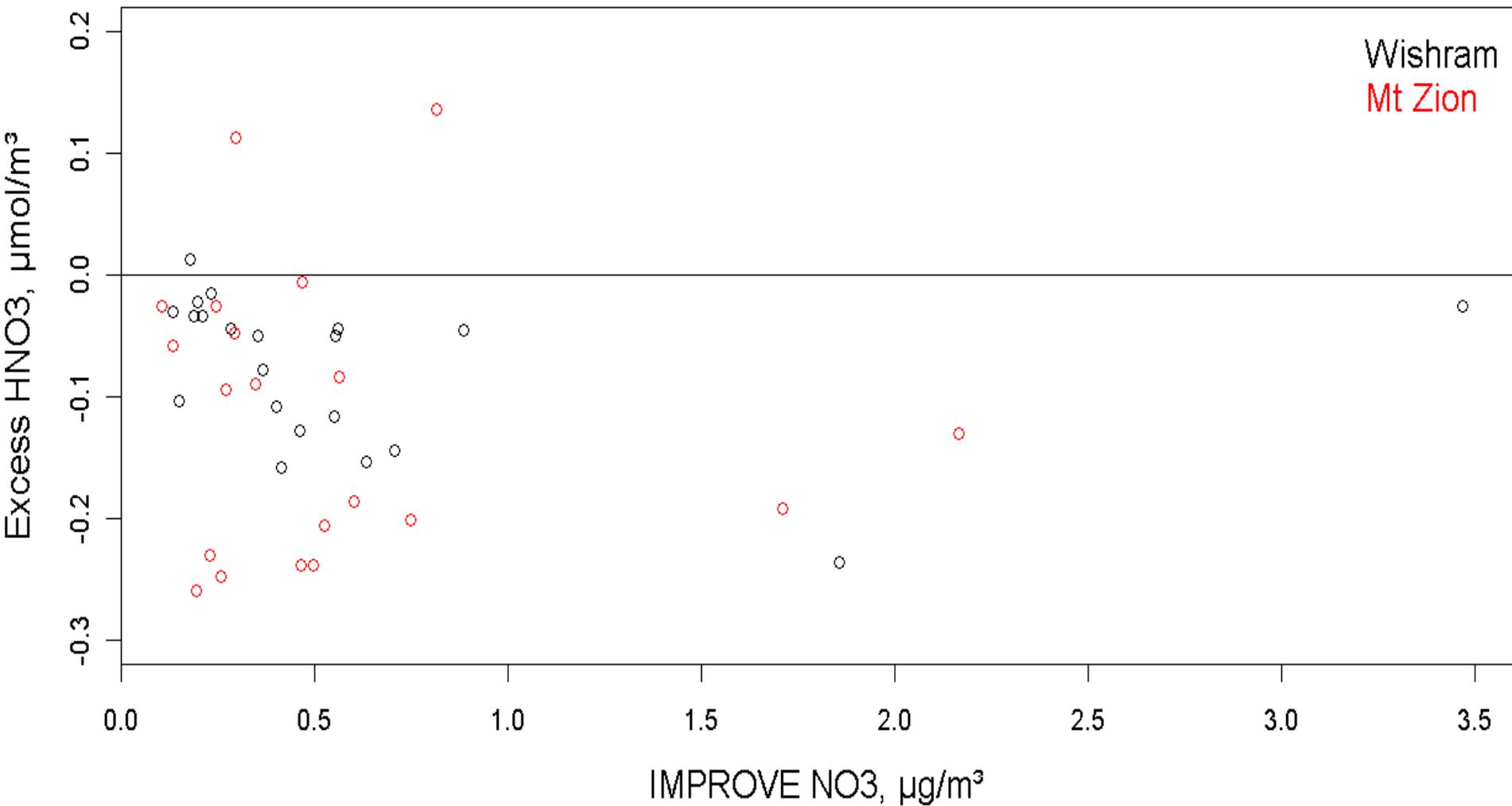
USFS has some passive NH_3 , HNO_3 and NO_x measurements from Jan- Dec 2006.

WSU ran CMAQ to assess the model sensitivity to various controls, during a stagnation event of December 2009.

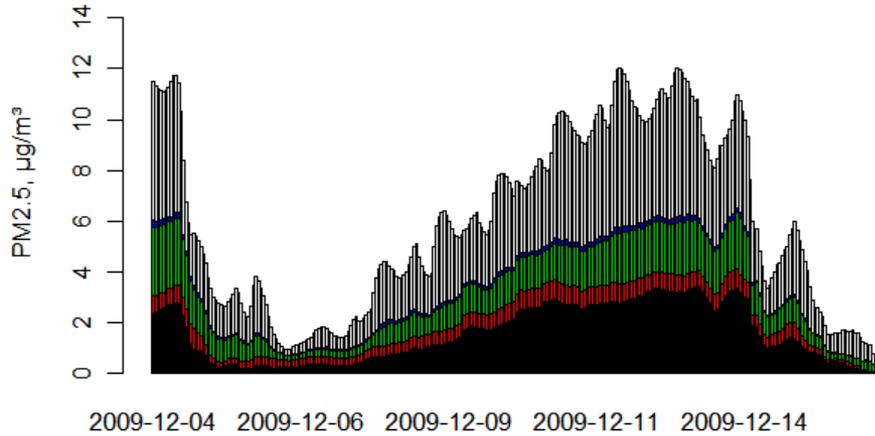
Data compiled but not fully analyzed yet.

Excess HNO₃? (i.e. not neutralized by NH₃)

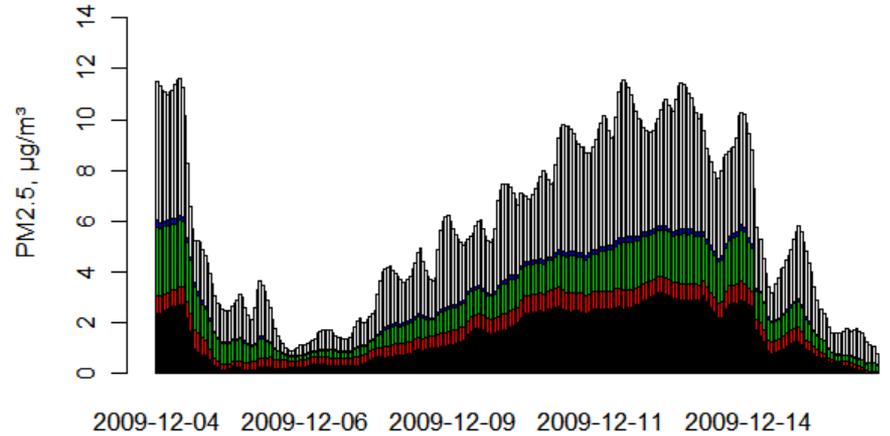
USFS passive sampling, Jan-Dec 2006



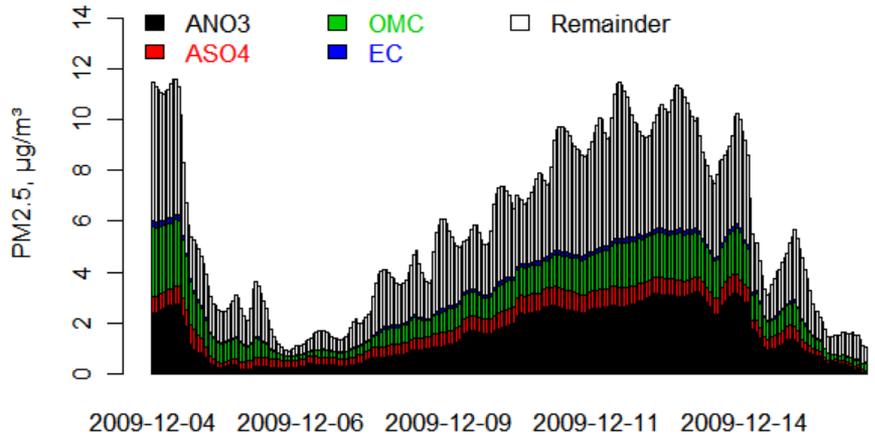
Basinwide 75%ile: base case



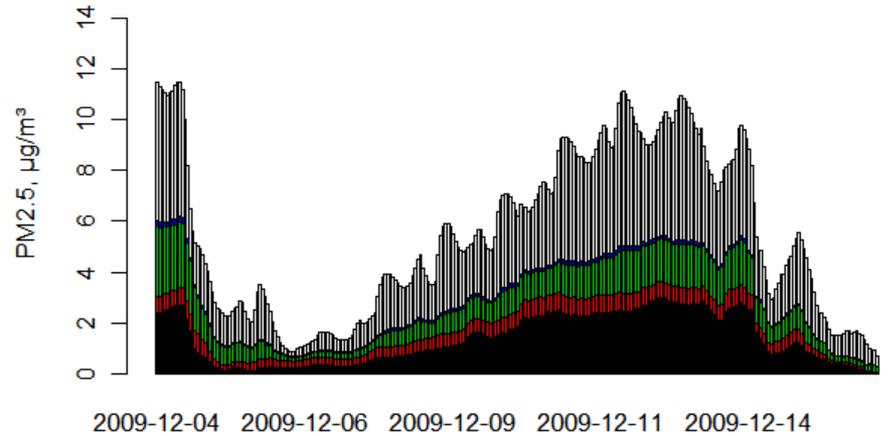
**Basinwide 75%ile: -30%WS
& -50% area source NH3**



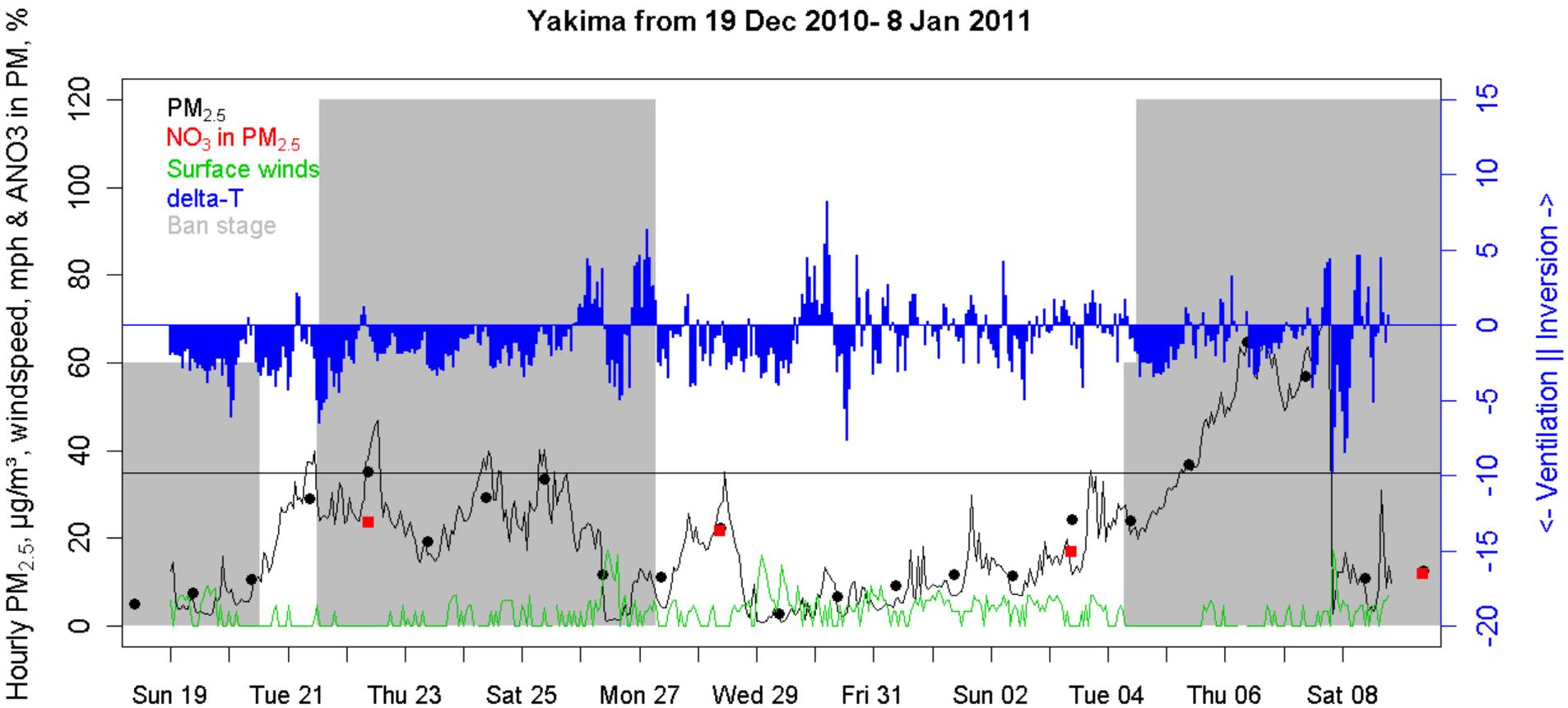
**Basinwide 75%ile: -50%WS &
-50% EGU NOx**



**Basinwide 75%ile: -70%WS,
-50% NH3 & -50% NOx**



Yakima during 2010-2011 stagnation episode



Burn ban efficiency evaluation

- What would the concentration have been “but for” the burn ban?
- Tried GLM and GAMMs. Variables used were
 - Windspeed
 - Temperature
 - Previous day PM conc.
- Tried including the following at Tacoma and Darrington for a short period: BV index, daytime ventilation, evening minimum 3-hour running avg windspeed, minimum overnight temperature, day of week, month, year
- Did it site-by-site, and on all sites. The last 3 variables were rarely significant, but havent yet evaluated the importance of variables.

Way forward?