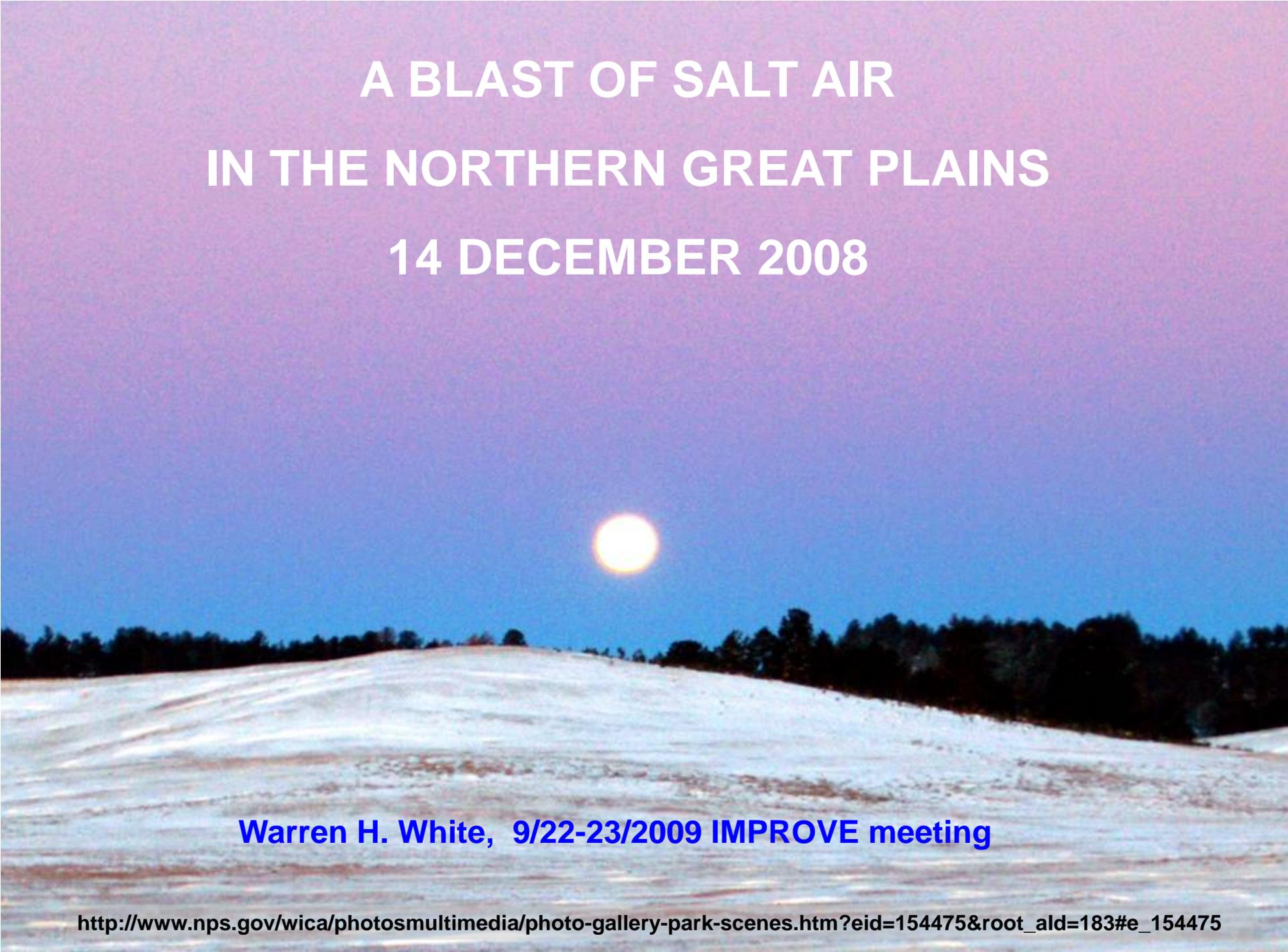
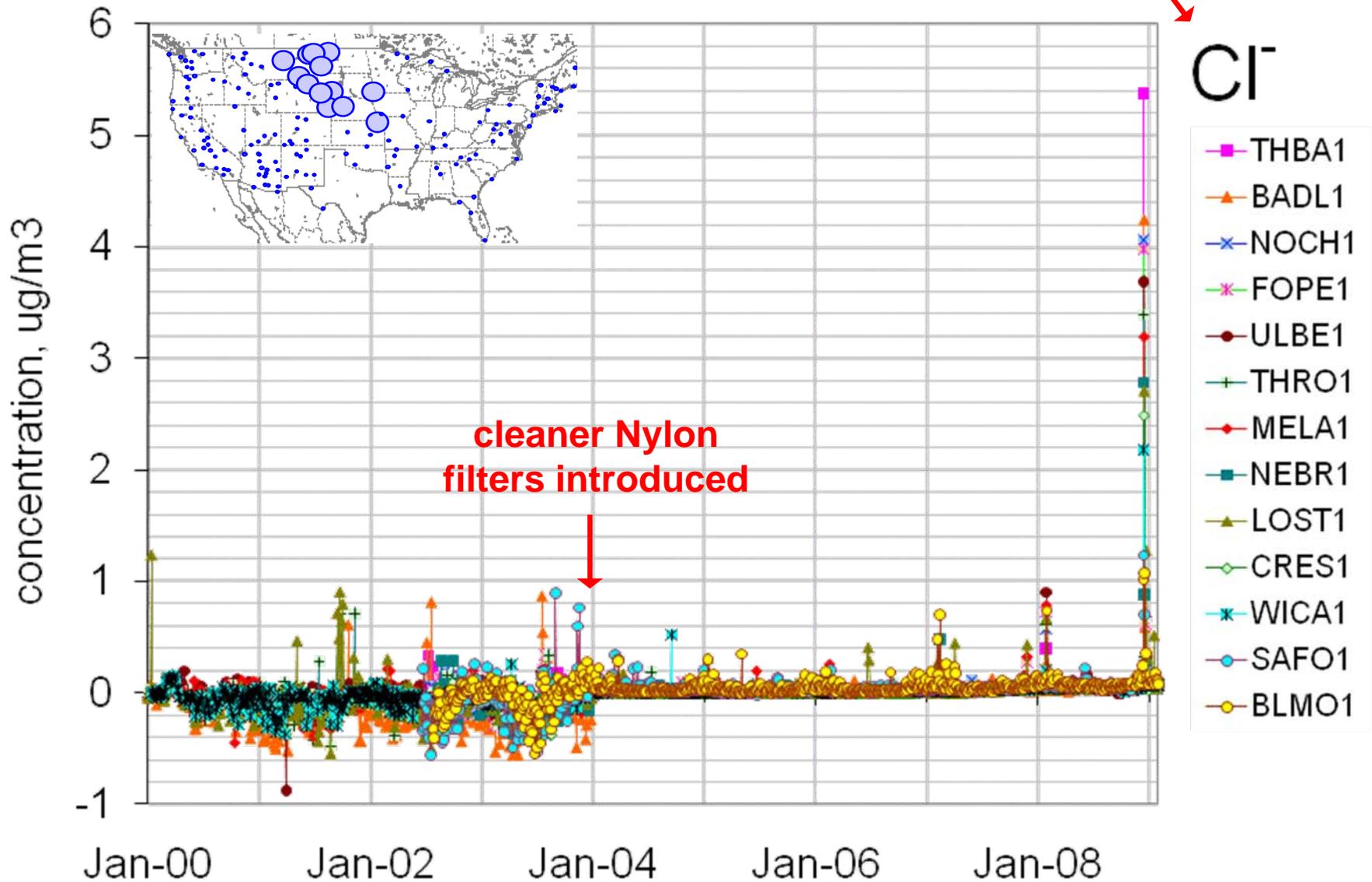


**A BLAST OF SALT AIR
IN THE NORTHERN GREAT PLAINS
14 DECEMBER 2008**

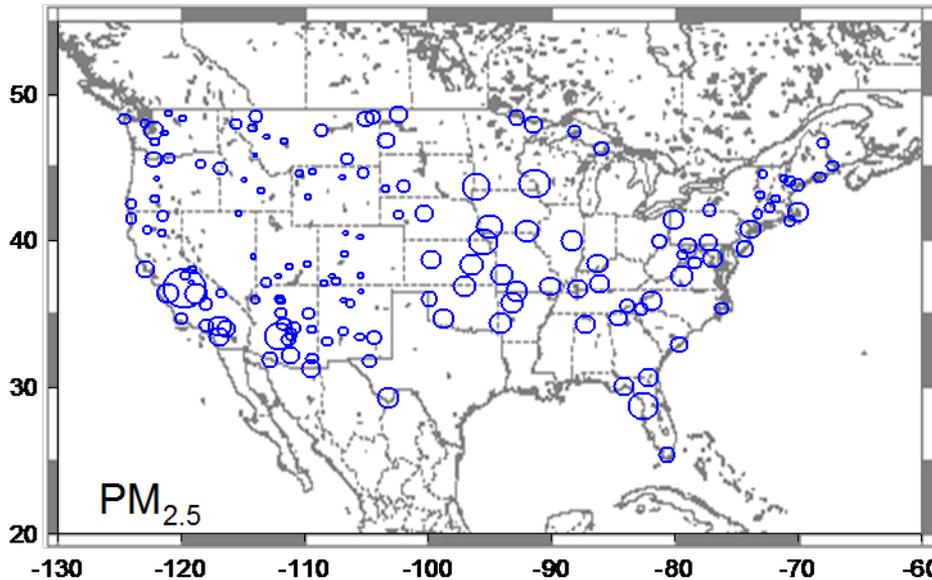
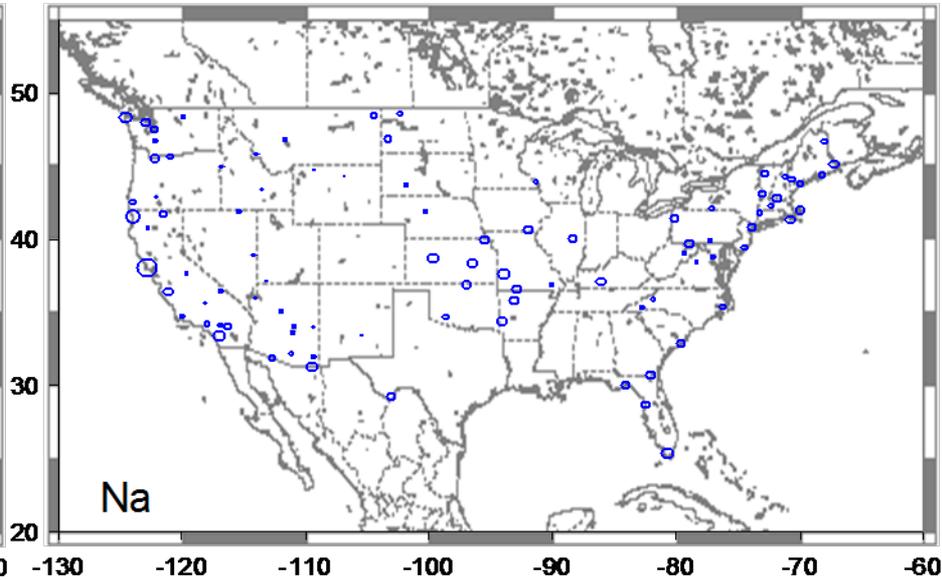
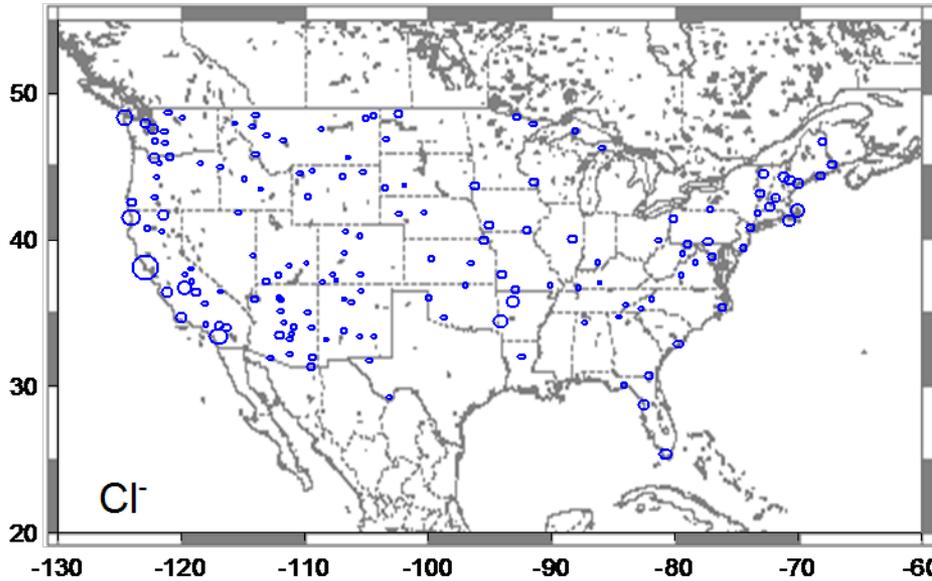


Warren H. White, 9/22-23/2009 IMPROVE meeting

Chloride ion (IC on Nylon), corrected as per data advisory # da0024



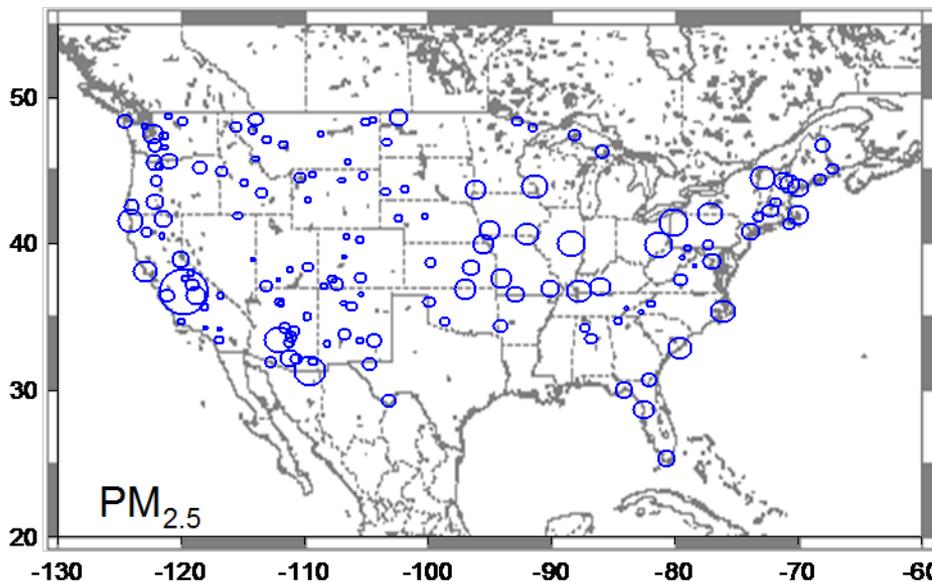
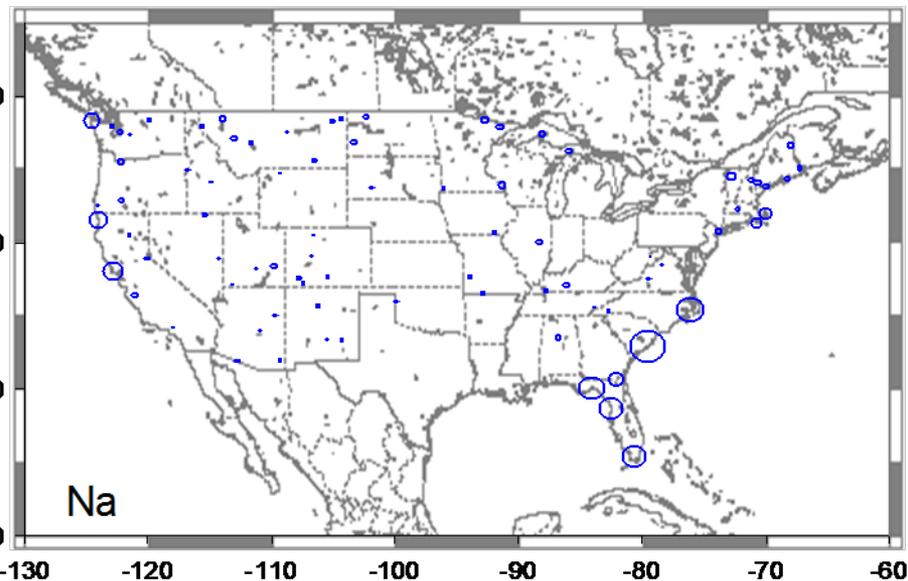
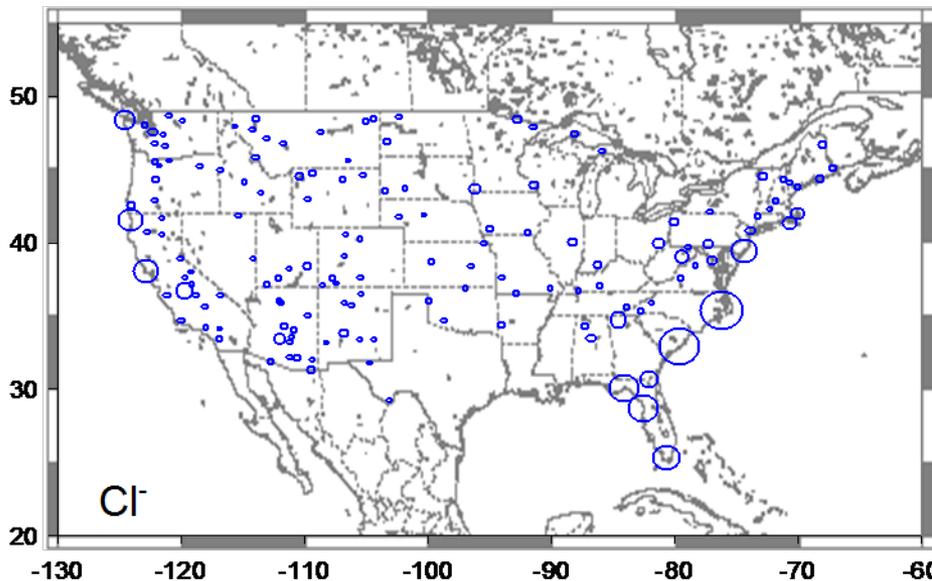
12/8/08



Bubble areas are proportional to concentrations.
(Different scales for different species.)

Painted Canyon, Theodore Roosevelt NP
2:00 PM MST

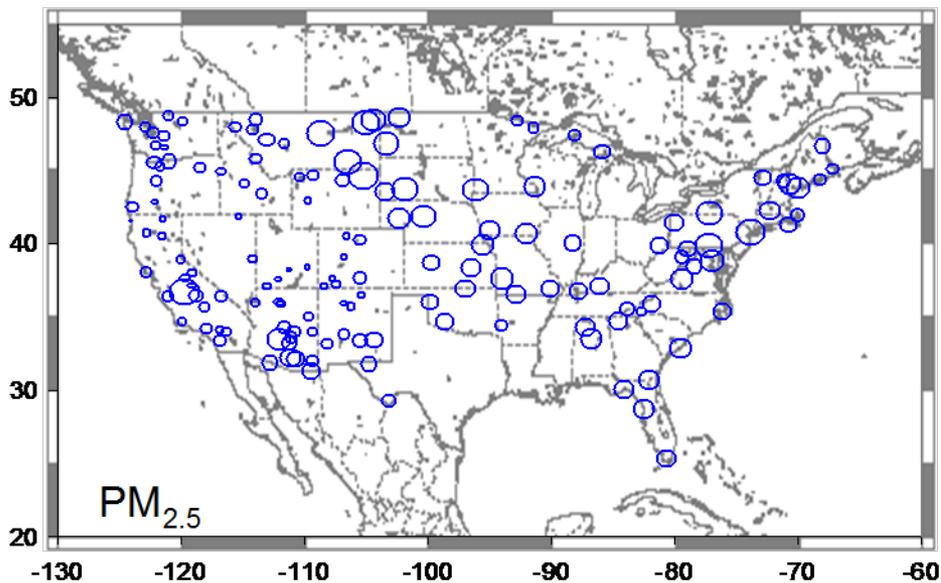
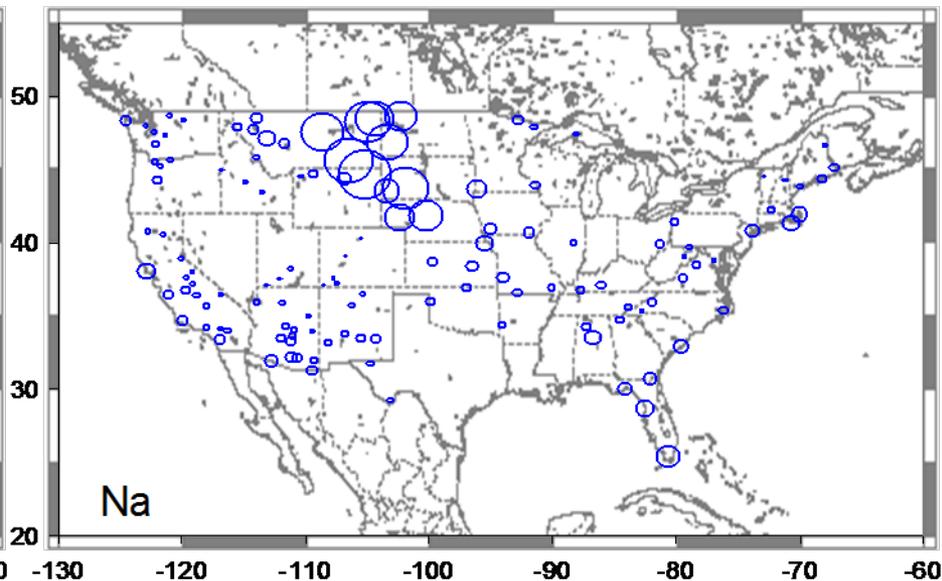
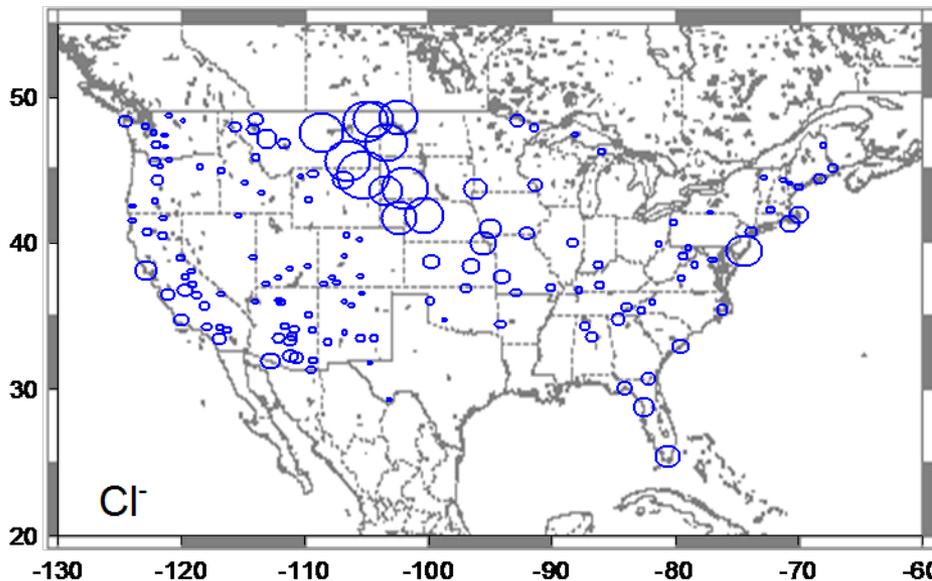
12/11/08



Scales are consistent across days.

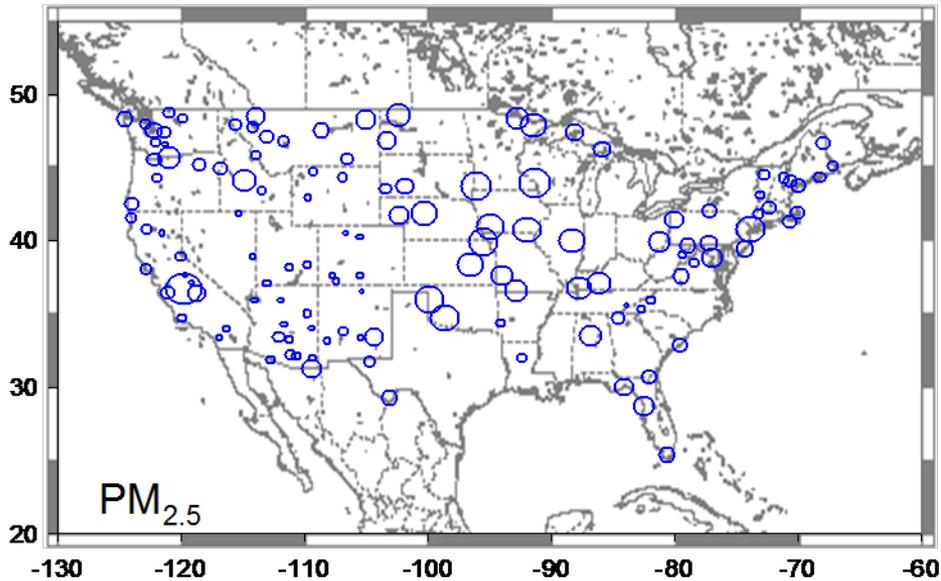
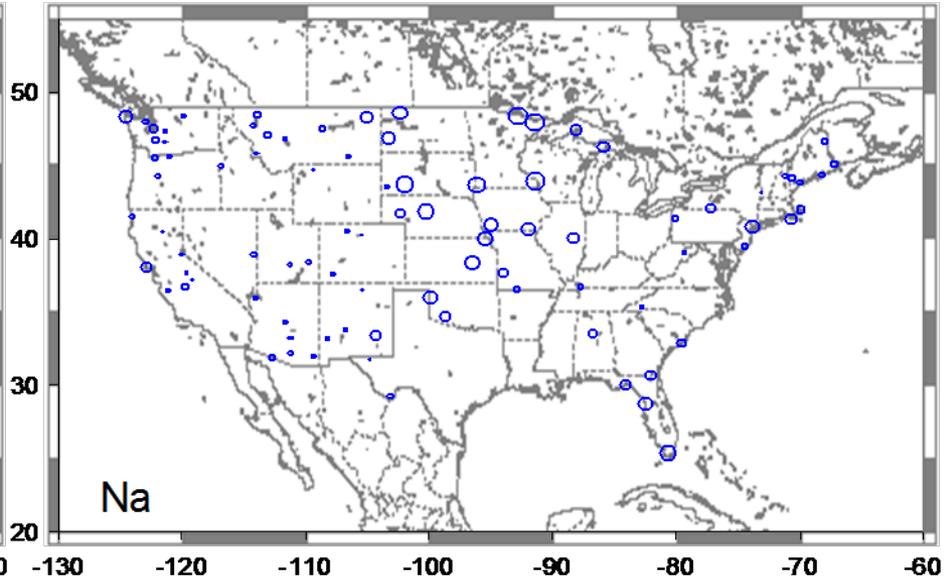
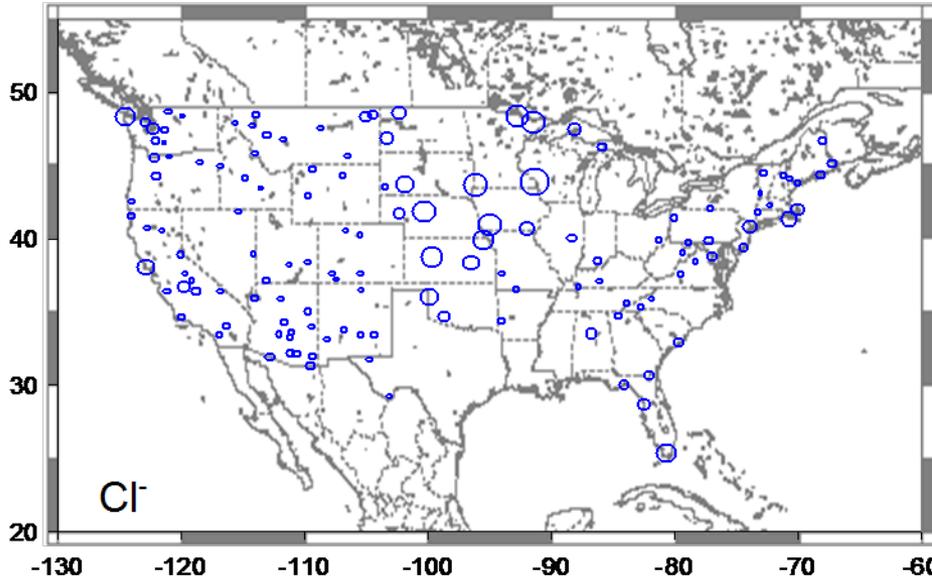
Painted Canyon, Theodore Roosevelt NP
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12/14/08



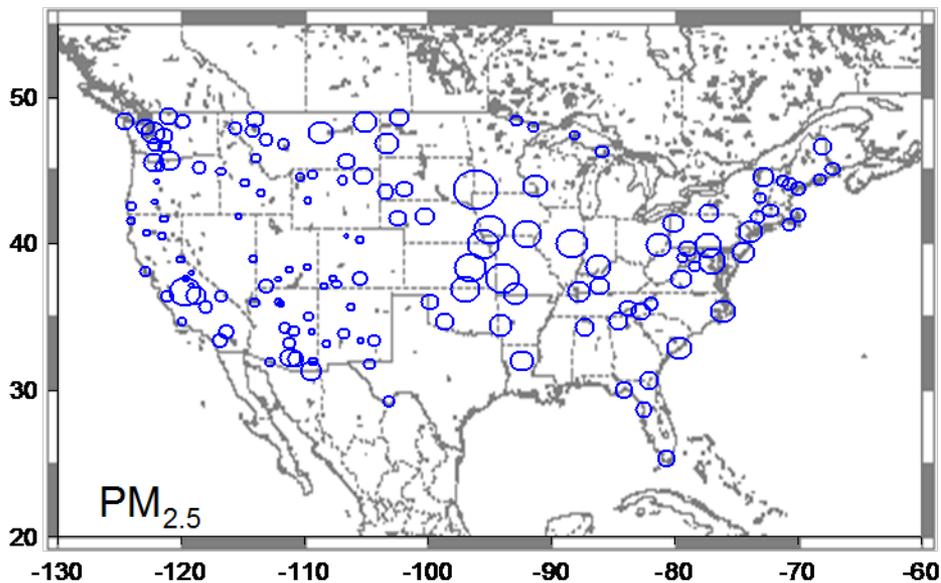
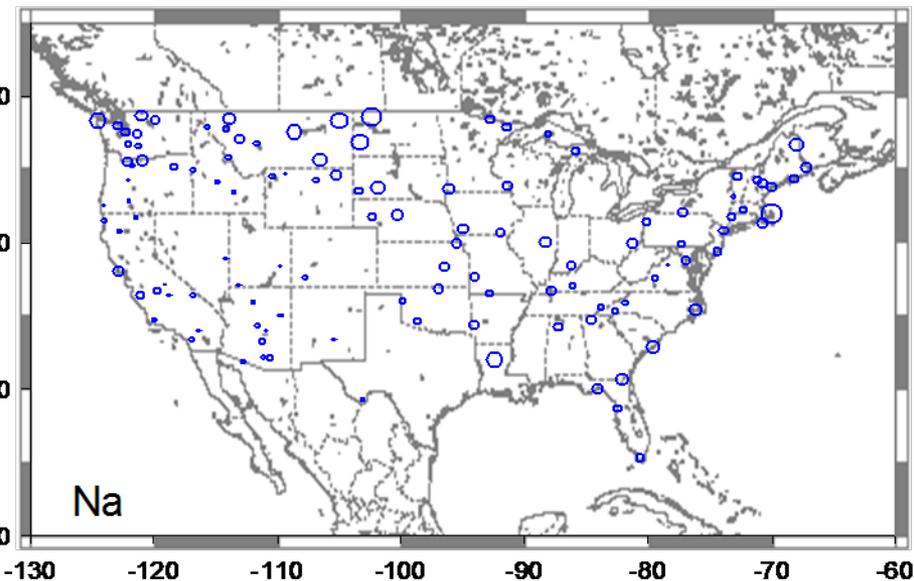
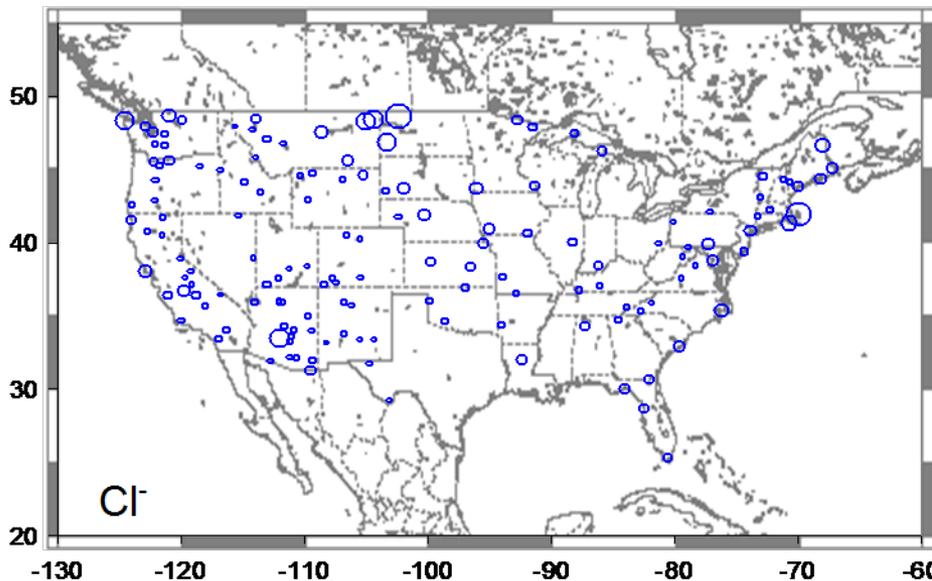
Painted Canyon, Theodore Roosevelt NP
2:00 PM MST

12/17/08



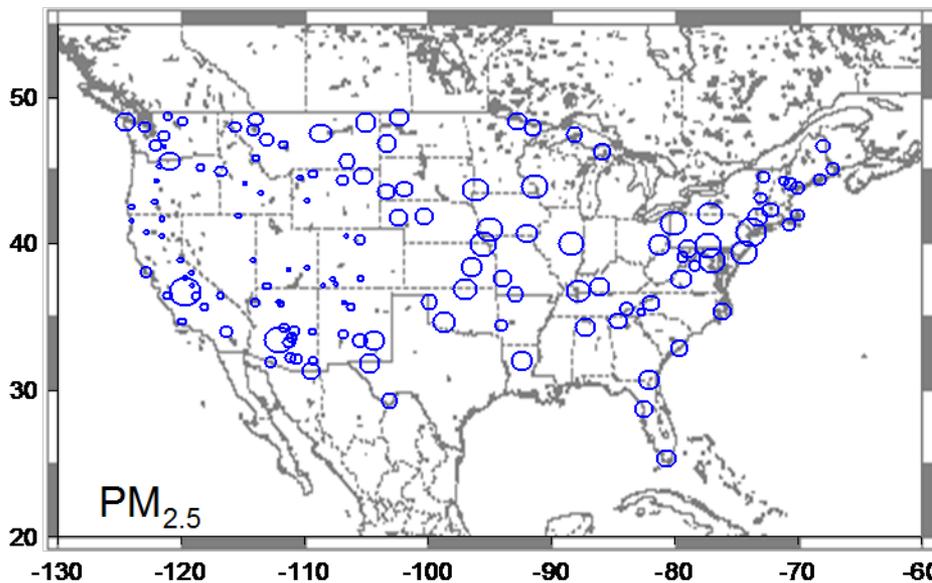
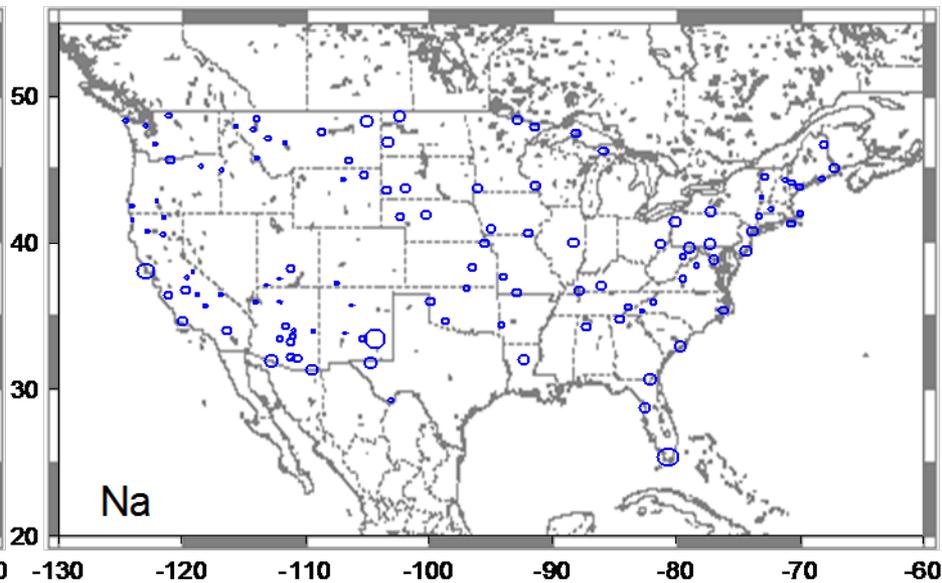
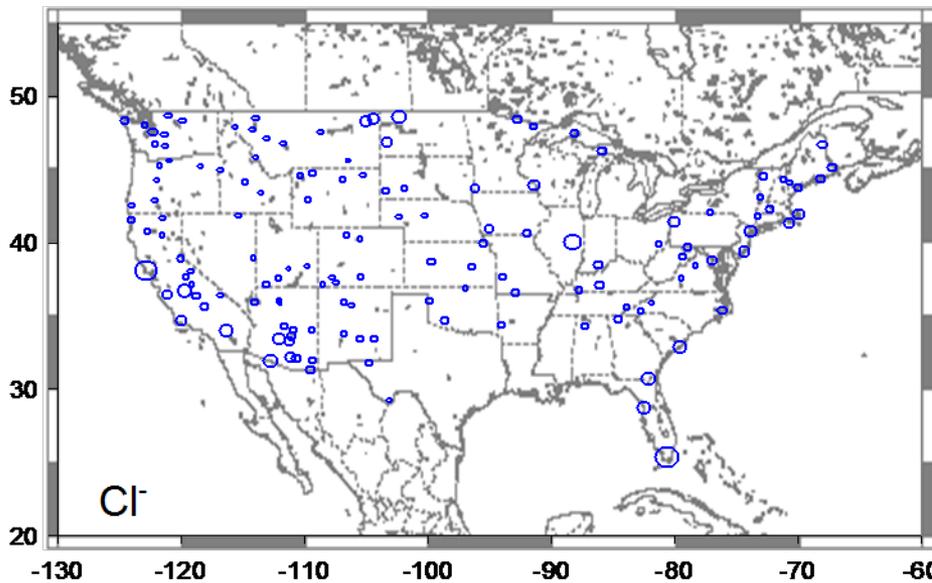
Painted Canyon, Theodore Roosevelt NP
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12/20/08



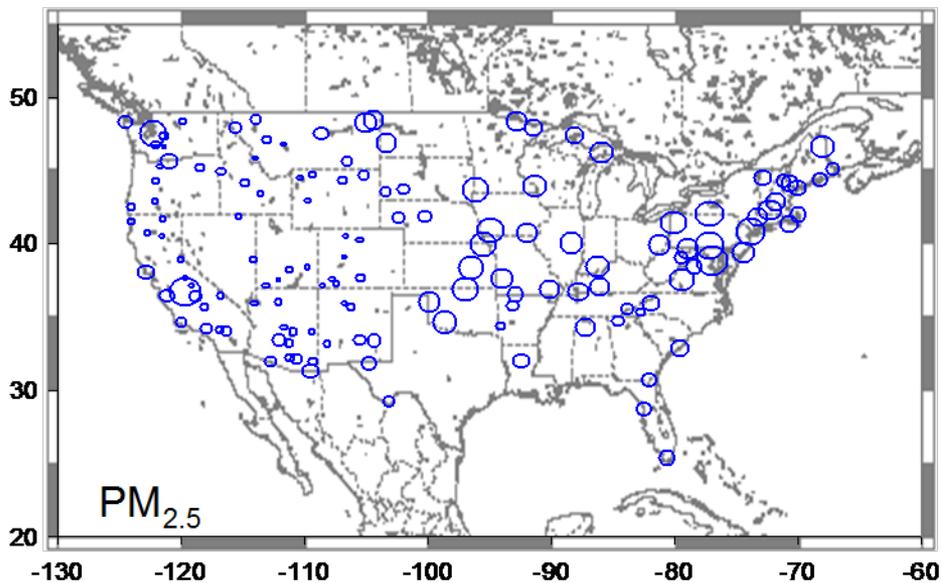
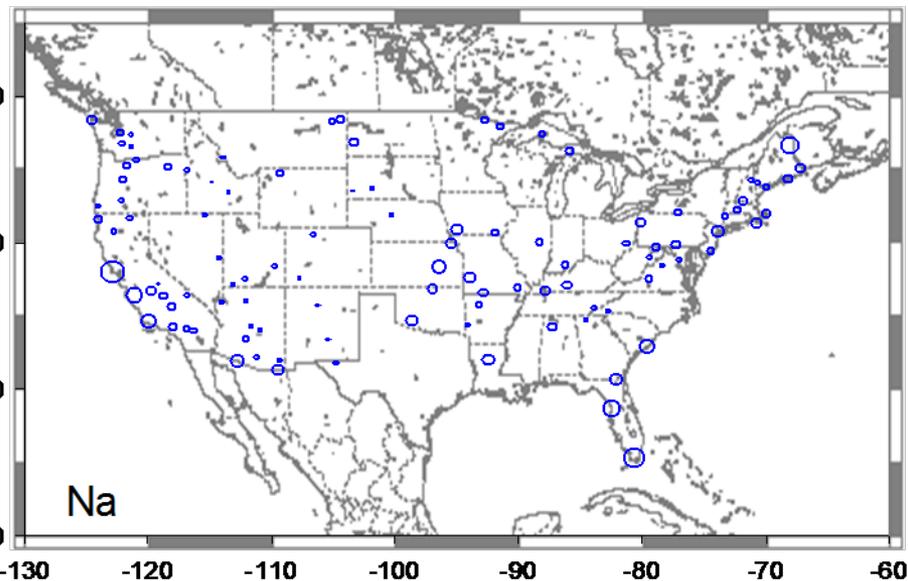
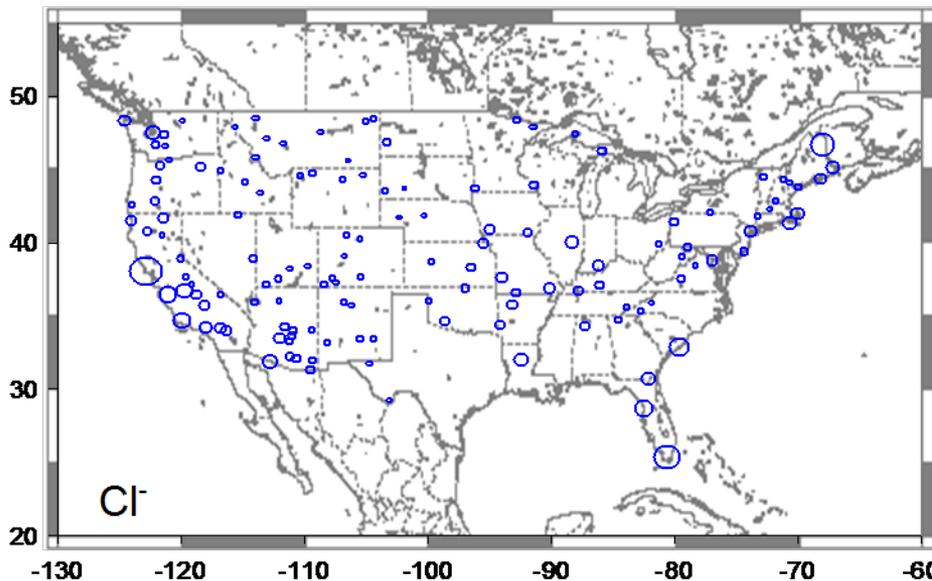
Painted Canyon, Theodore Roosevelt NP
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12/23/08



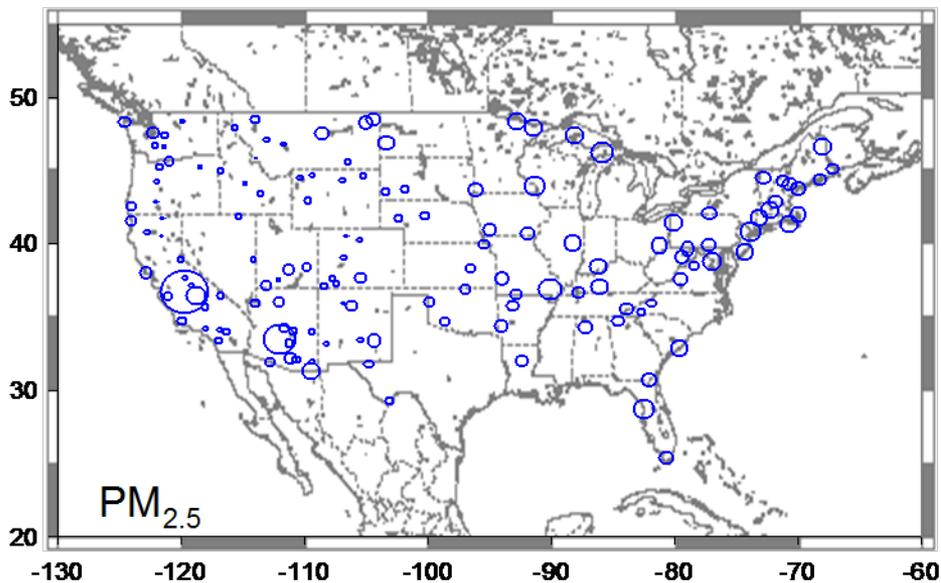
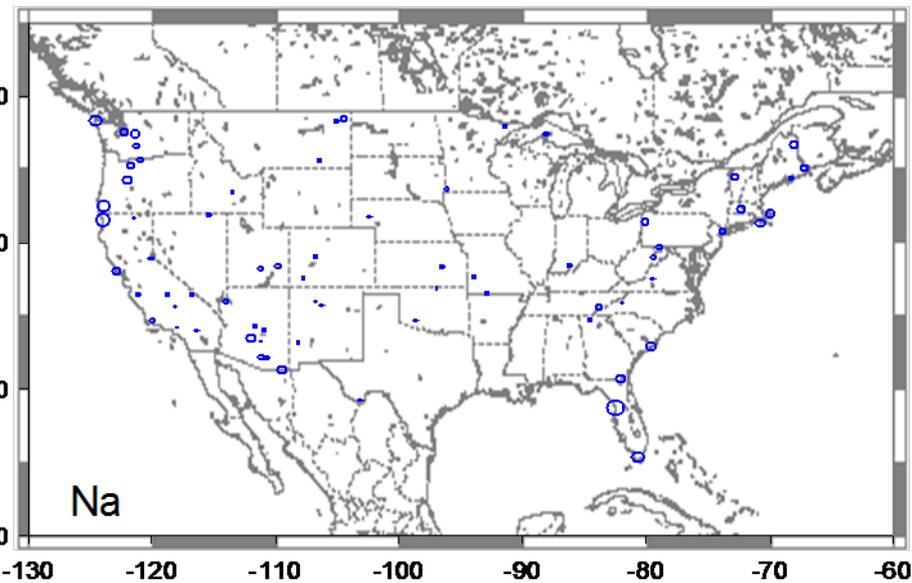
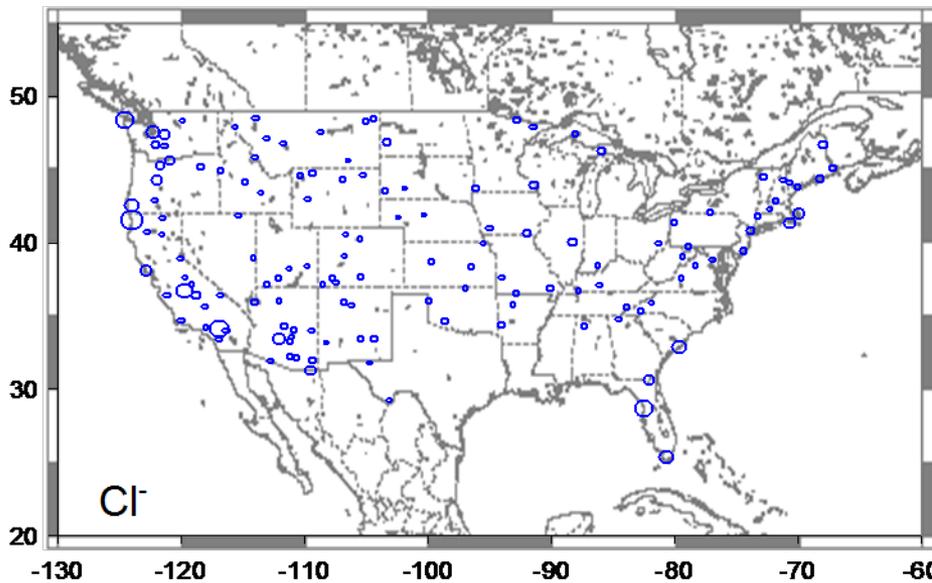
Painted Canyon, Theodore Roosevelt NP
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12/26/08



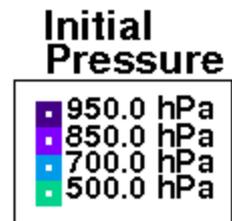
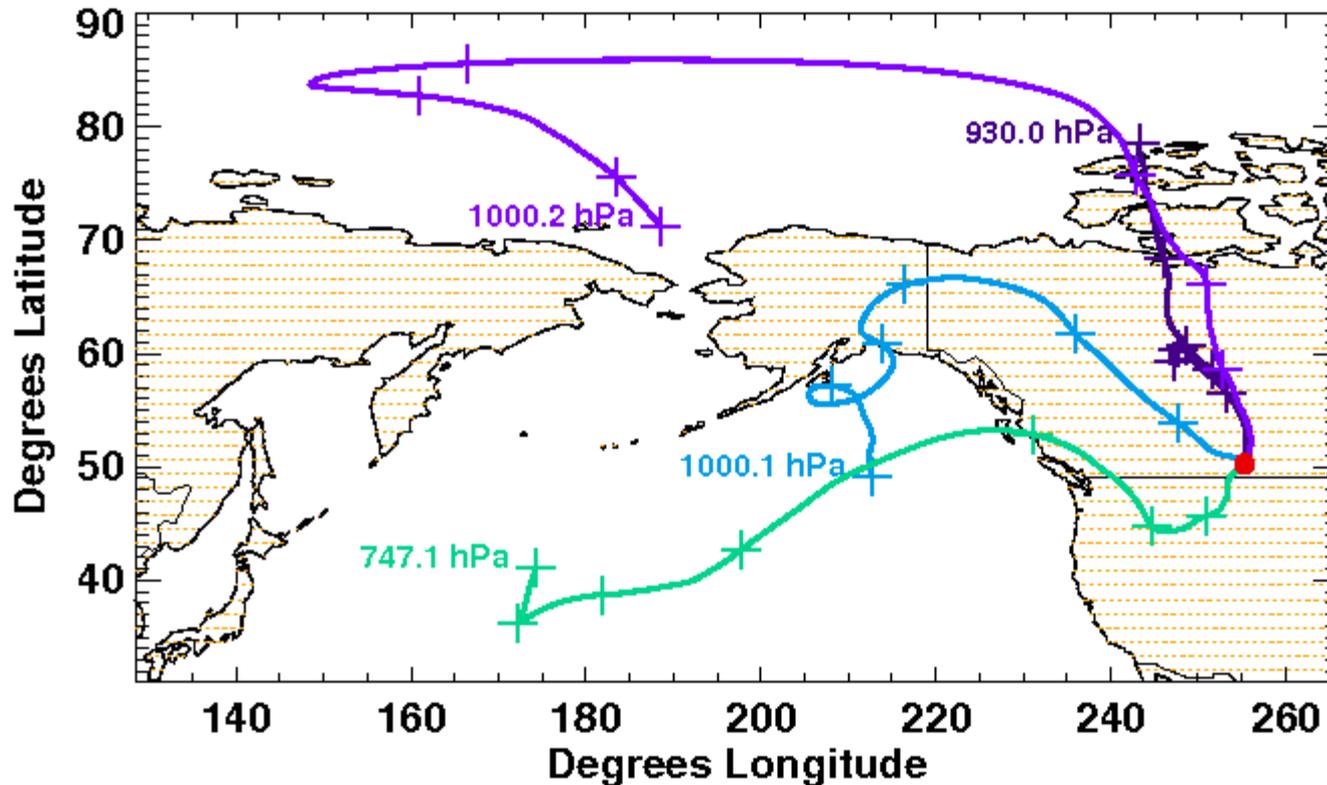
Painted Canyon, Theodore Roosevelt NP
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12/29/08

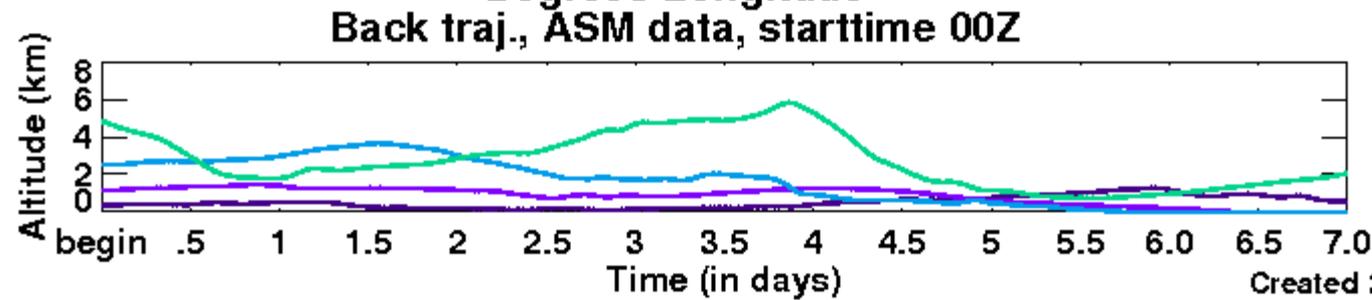


Painted Canyon, Theodore Roosevelt NP
2:00 PM MST

Starting Location Station (red dot): Bratts Lake 7-Day Back-Trajectories: kinematic, 2008-12-14



**5 pm
12/13/08**

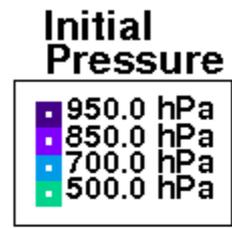
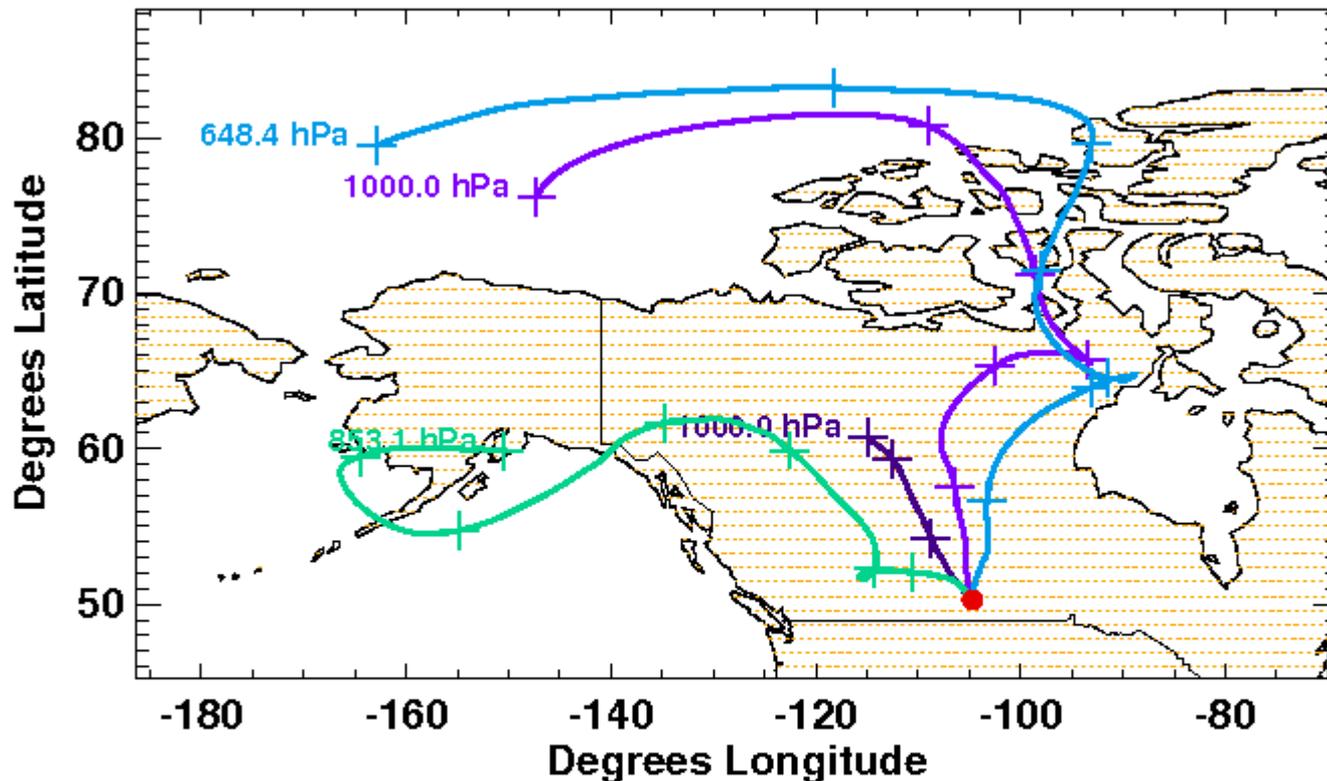


NASA/GSFC
T.Kucsera

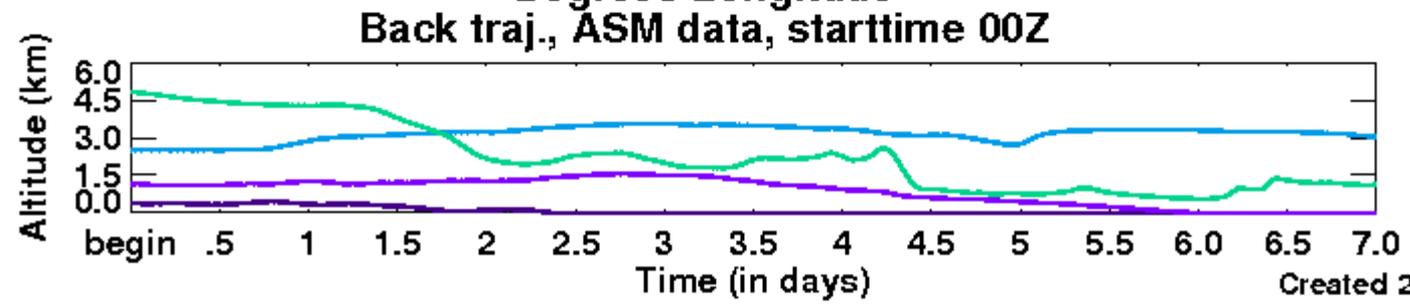
Created 2009-01-05

<http://croc.gsfc.nasa.gov/aeronet/index.html>

Starting Location Station (red dot): Bratts Lake 7-Day Back-Trajectories: kinematic, 2008-12-15



**5 pm
12/14/08**



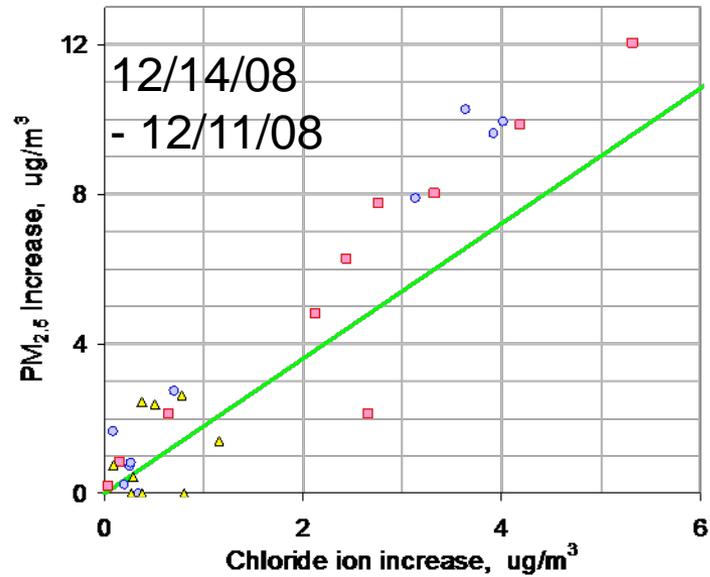
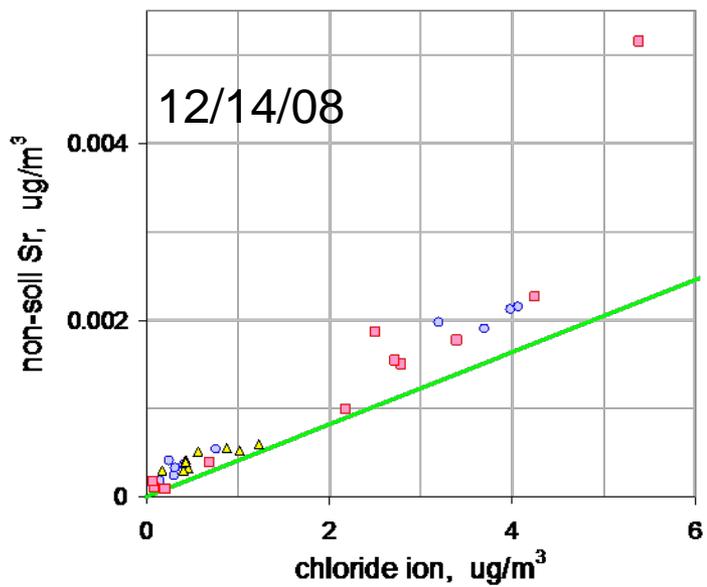
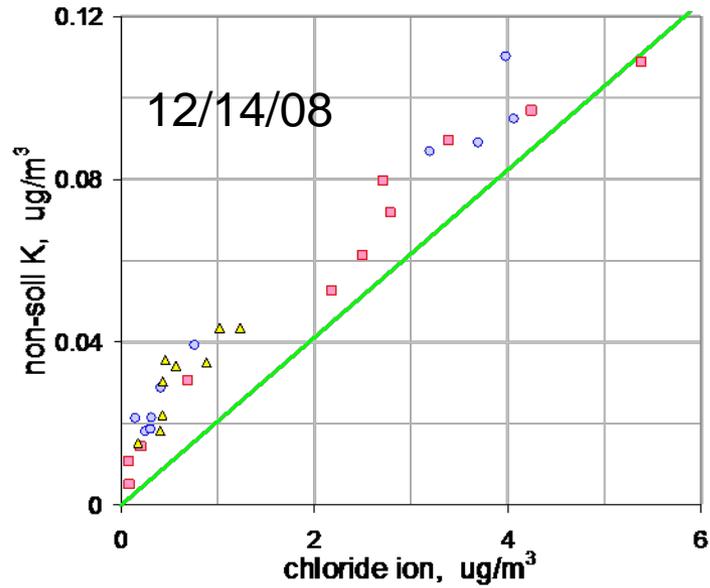
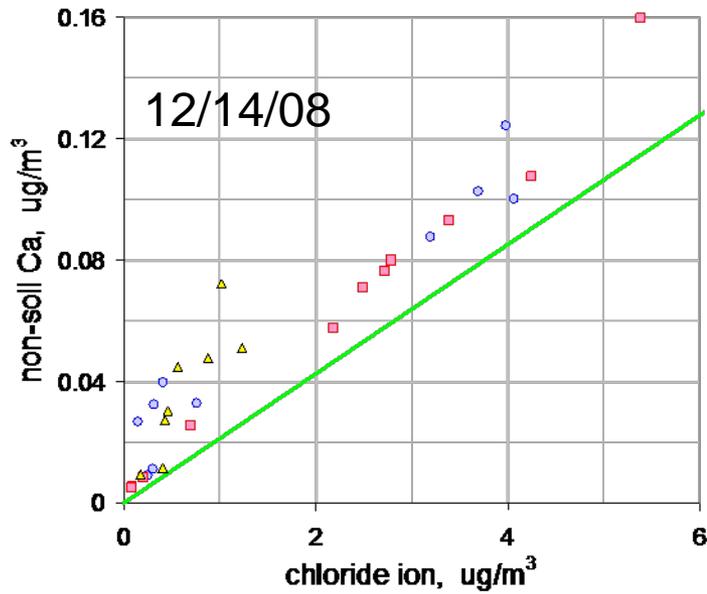
NASA/GSFC
T.Kucsera

Created 2009-01-06

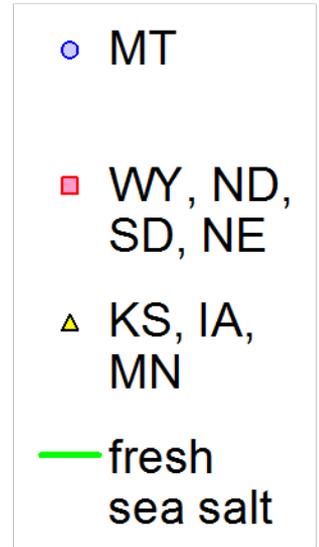
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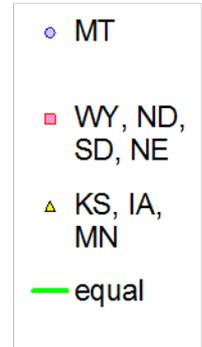
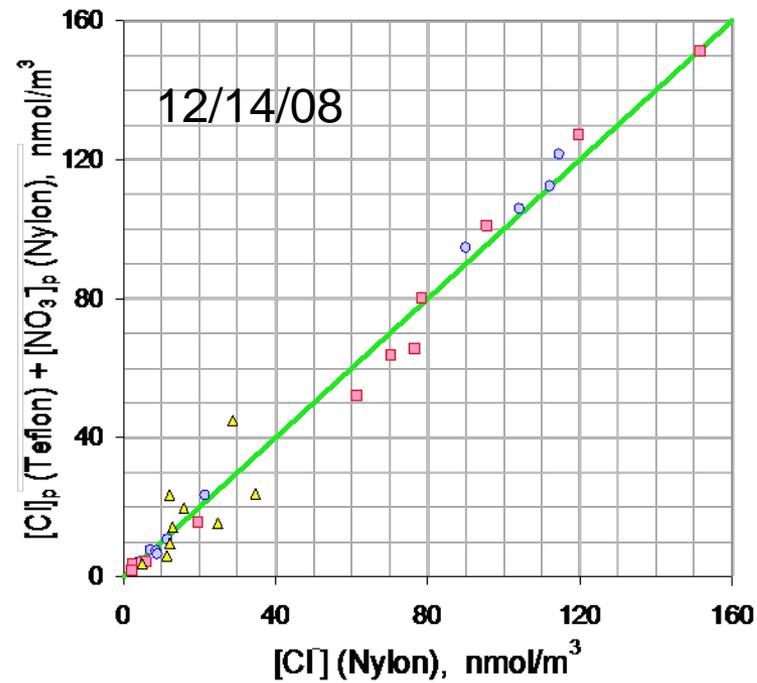
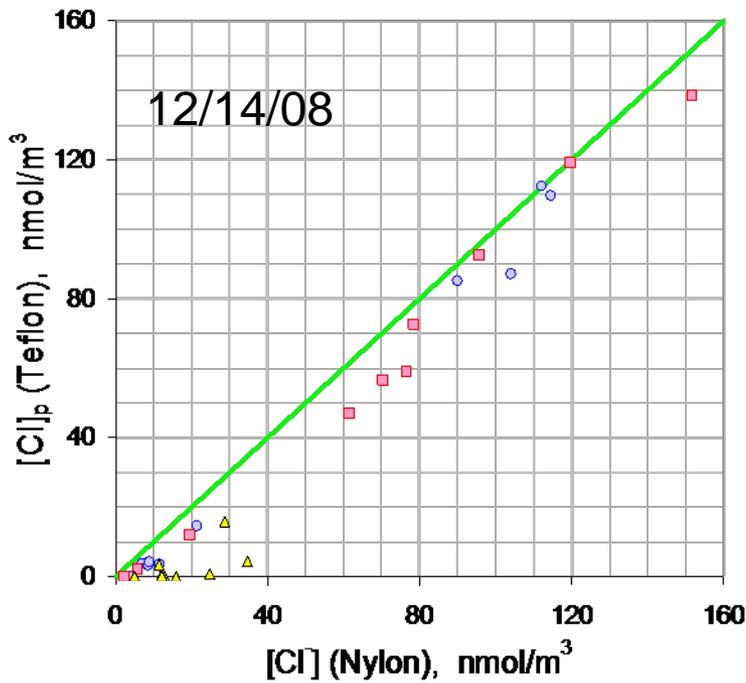
Relatively high PM_{2.5} concentrations (~10 ug/m³ over frozen ground) were measured throughout much of the northern plains on 12/14/08.

The collected material showed high concentrations of multiple chemical markers for sea salt. For the species considered to be quantitative in IMPROVE data, its measured composition was fairly close to that of seawater ...



All samples
from 8 states:

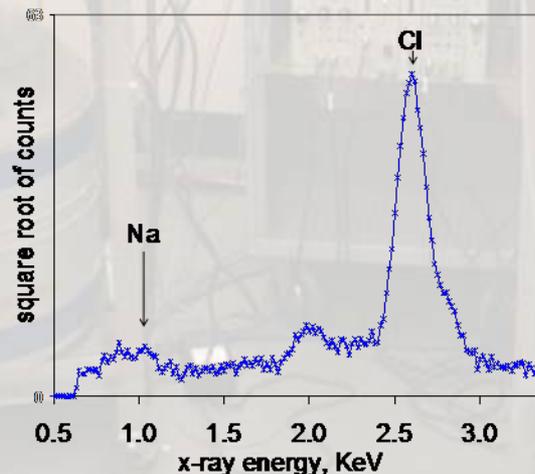


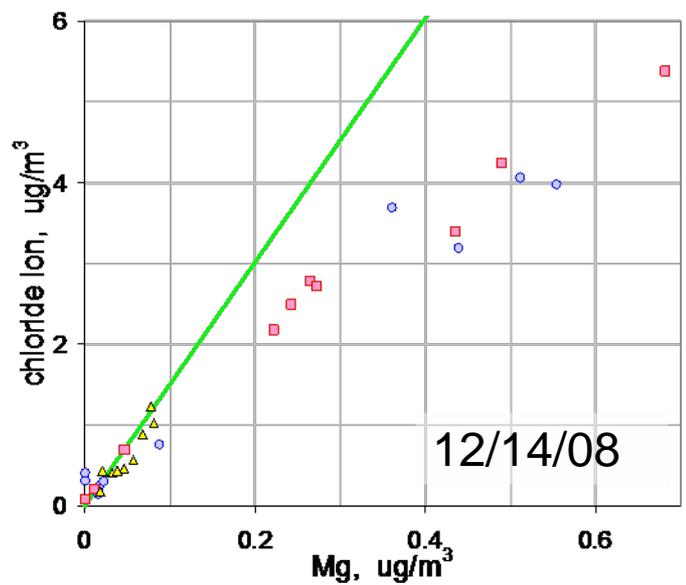
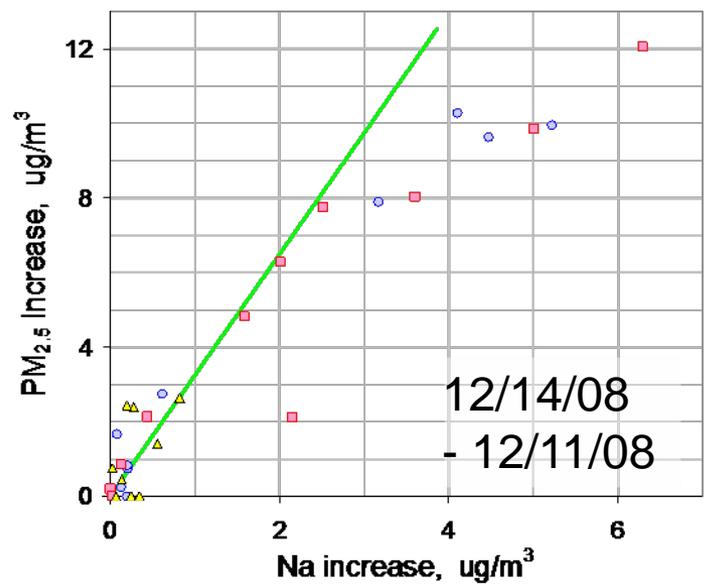
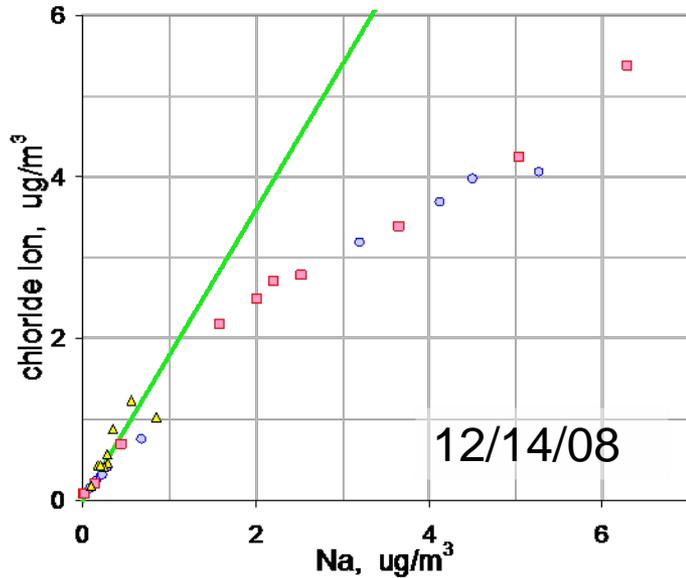


There is evidence of some replacement of chloride by nitrate, as previously observed at coastal locations. This is most pronounced in the downwind states KS, IA and MN.

Sodium is used by many analysts as a conservative tracer for sea salt, but the XRF measurement used by IMPROVE is considered less than fully quantitative for Na (and for Mg, another constituent of seawater).

As the lightest elements reported by the XRF system, fluorescing the softest X-rays, Na and Mg require disproportionately large corrections for matrix effects. These corrections are an inherent source of uncertainty in the measurement.

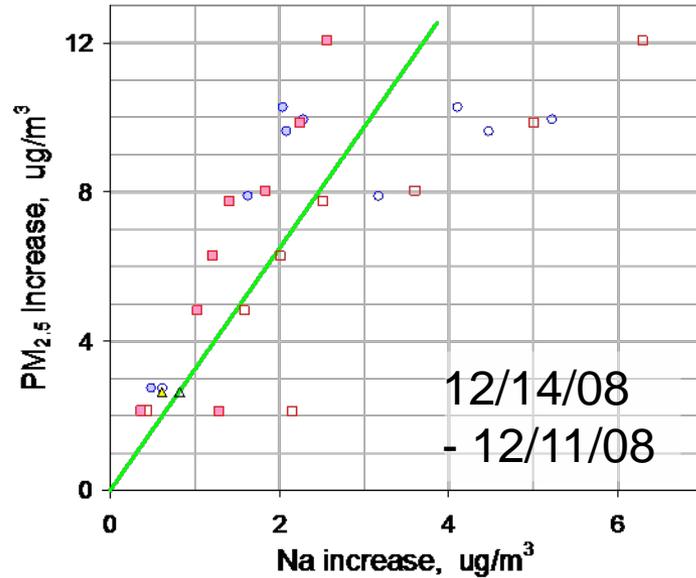
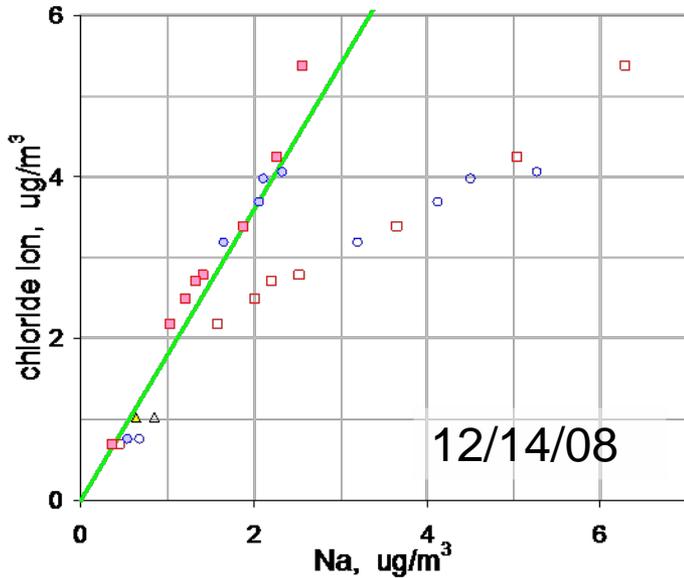




All samples from 8 states:

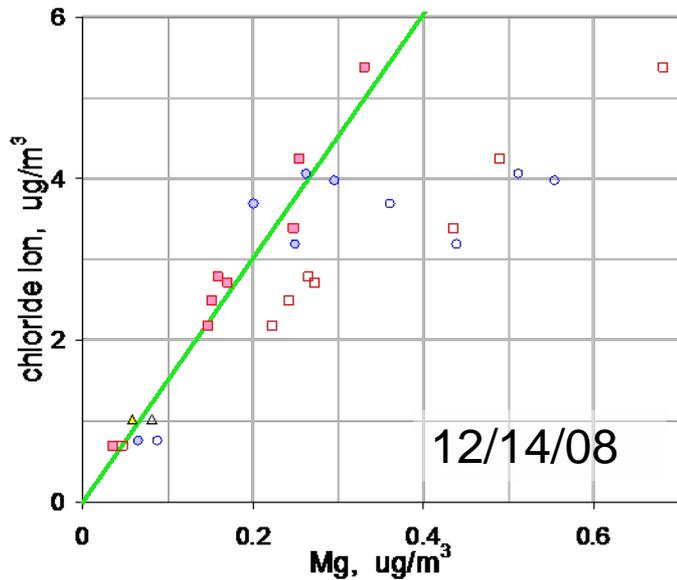
- MT
- WY, ND, SD, NE
- △ KS, IA, MN
- fresh sea salt

The reported 12/14/08 concentrations of Na and Mg are high relative to other indicators of sea salt mass.



All samples from 8 states:

- MT
- WY, ND, SD, NE
- △ KS, IA, MN
- fresh sea salt



Reported Na and Mg concentrations show excellent agreement with other sea salt markers when the matrix “corrections” are **removed** from the data. The algorithm behind these “corrections” is accordingly now under review.

From the most recent review of the IMPROVE matrix corrections (Bob Eldred, 2004):

“Some laboratories choose not to apply corrections, in part because they involve several major assumptions and are not very precise. However, failure to include them ensures that there will be a bias in the resulting x-ray measurements. ... The real problem with matrix effects is that they are highly variable. Omitting the corrections will not decrease these uncertainties.”

Summary bullets (for you note-takers)

- ✓ The northern plains were flooded by a remarkable marine airmass on December 14, 2008. Unprecedentedly high concentrations of largely un-reacted sea salt were observed throughout the region.
- ✓ The widespread availability of this “Standard Reference Material” provides the basis for a system-level (combined sampling, analysis, and reporting) audit of our measurements.
- ✓ This audit turned out pretty well! And identified ways to do still better.