

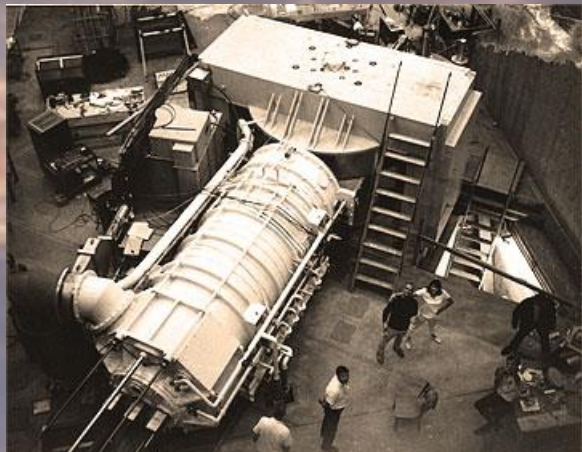
Reanalysis of a 15-year archive of IMPROVE samples

Nicole Hyslop, Krystyna Trzepla-Nabaglo, and Warren White

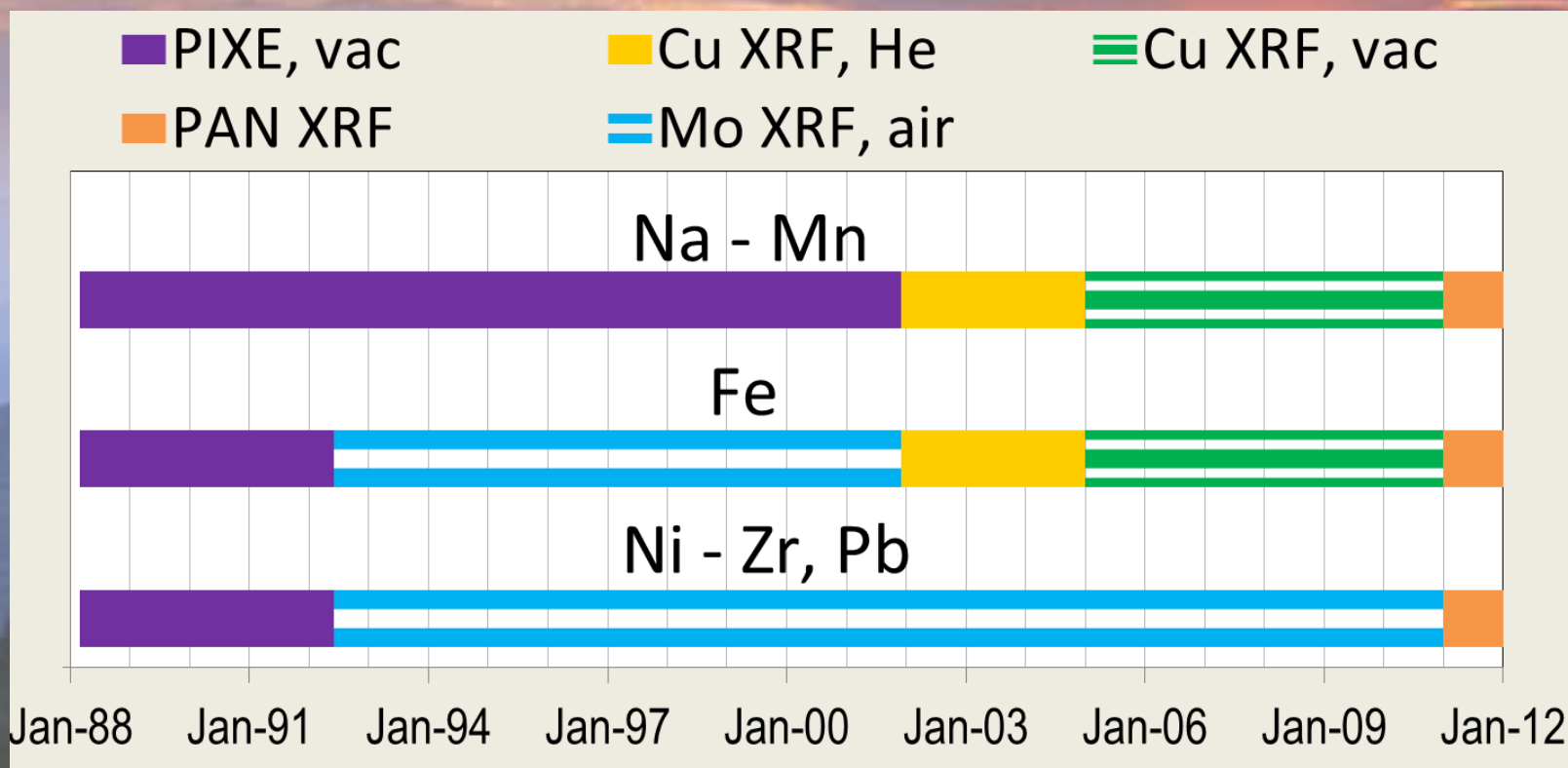
Work supported by United States National Park
Service Contract C2350-04-0050 to UC Davis

October 2013

IMPROVE Elemental Analysis Methods



Crocker Nuclear Laboratory



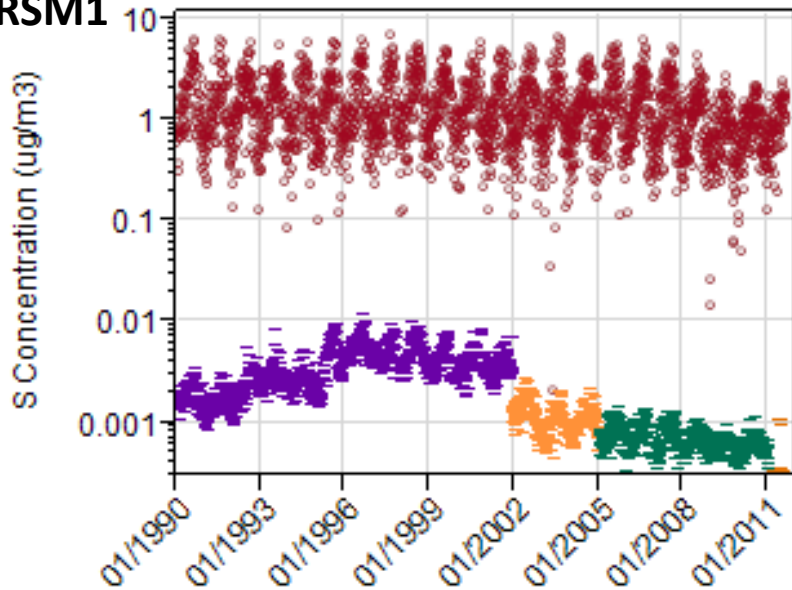


ORIGINAL CONCENTRATION MEASUREMENTS

Data downloaded from FED website

<http://views.cira.colostate.edu/fed/DataWizard/Default.aspx/>

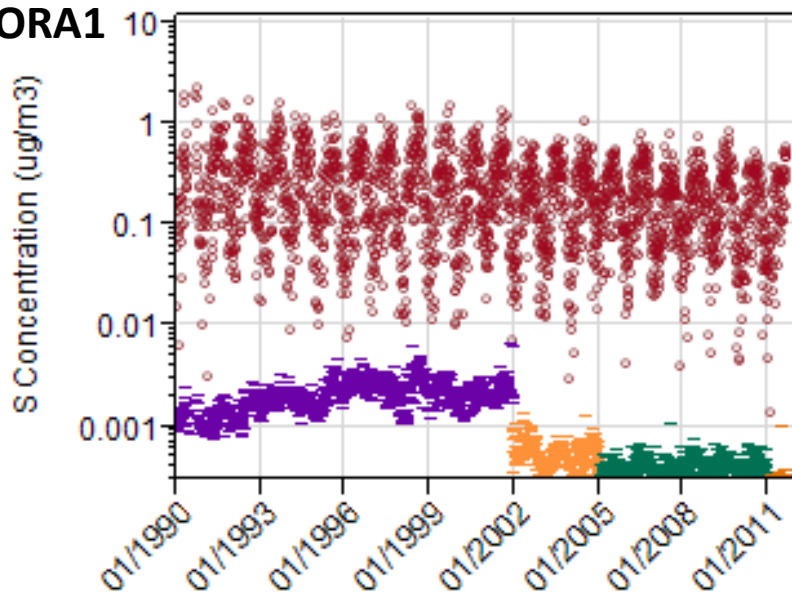
GRSM1



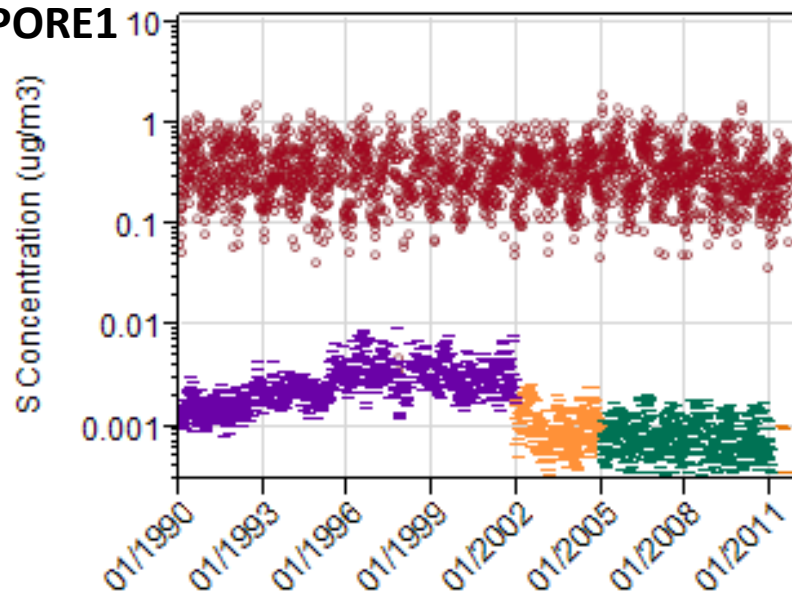
Analytical Method Changes: Sulfur

-Measured well above detection limits

MORA1

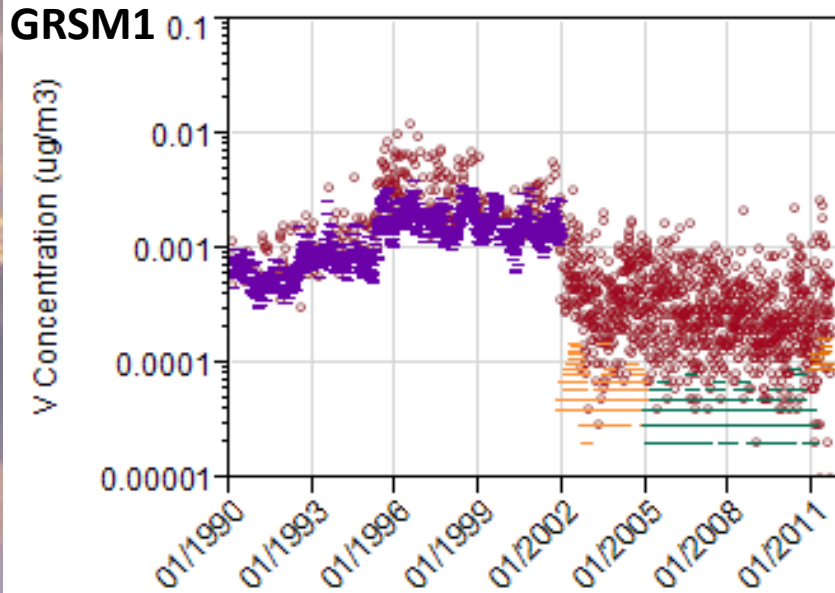


PORE1

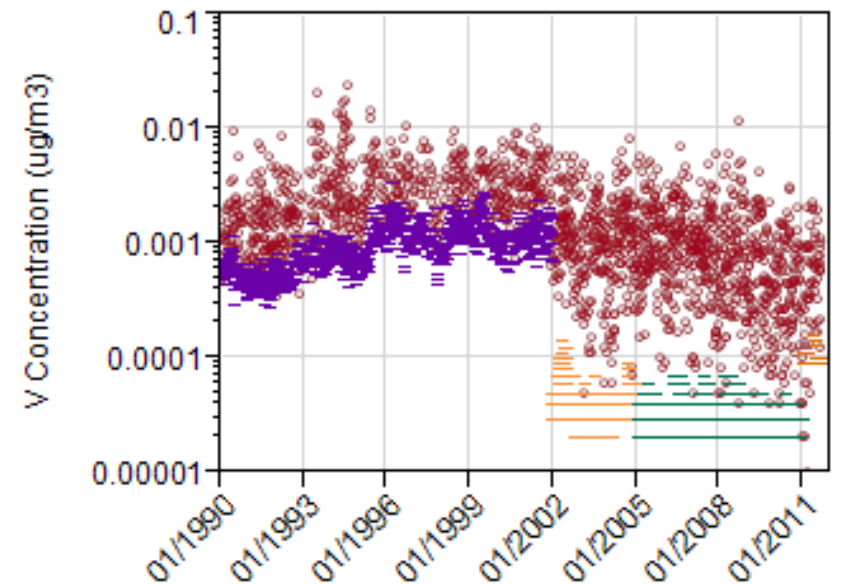
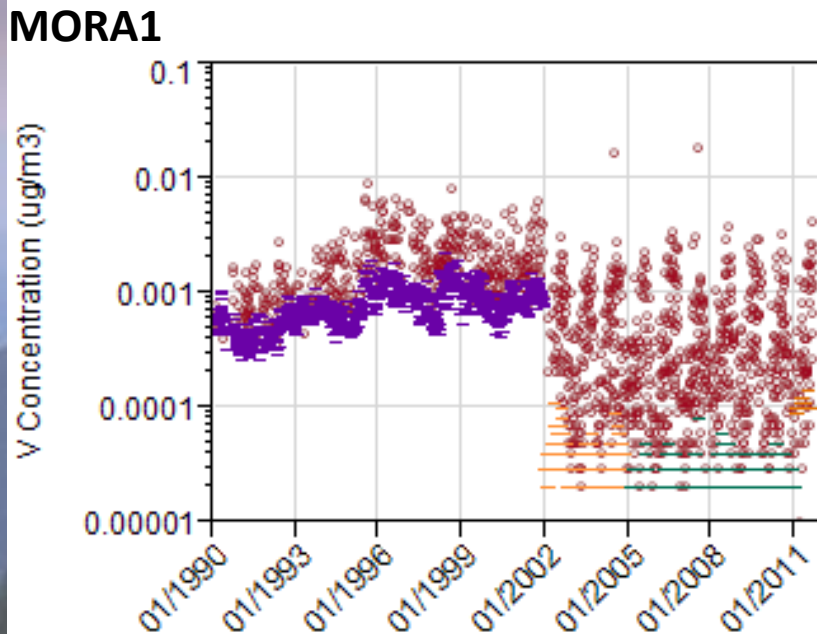


○ Value — PIXE mdl — Cu XRF He mdl — Cu XRF vac mdl — PAN mdl

Analytical Method Changes: Vanadium

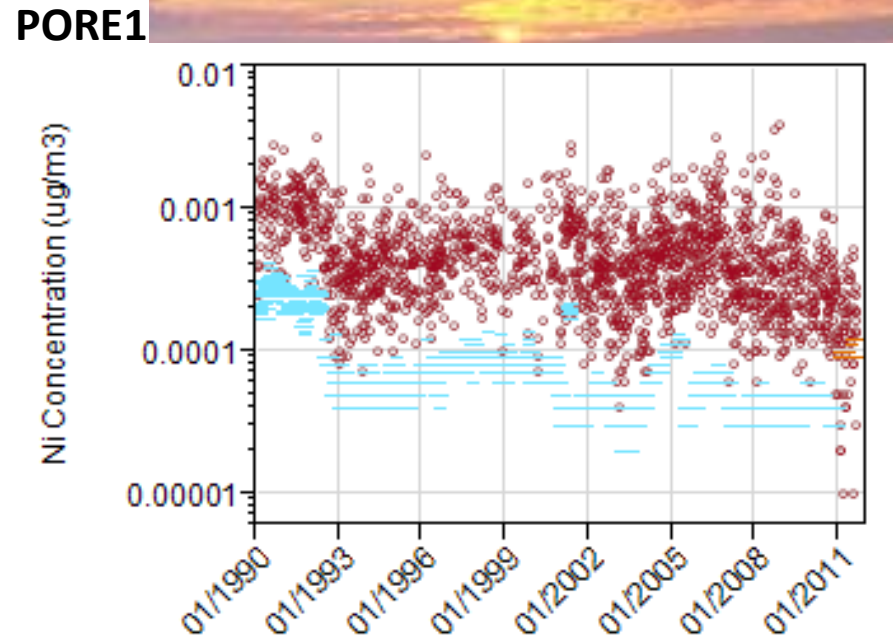
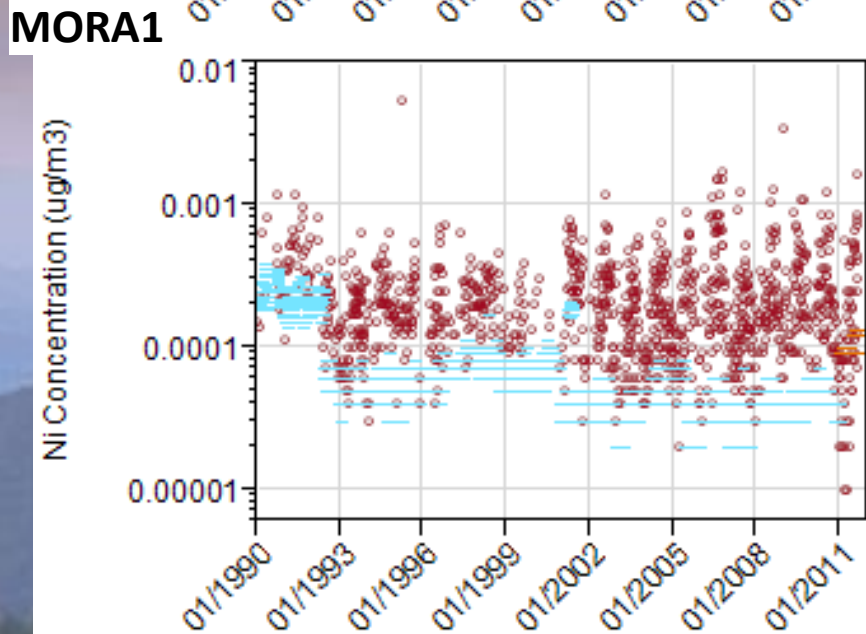
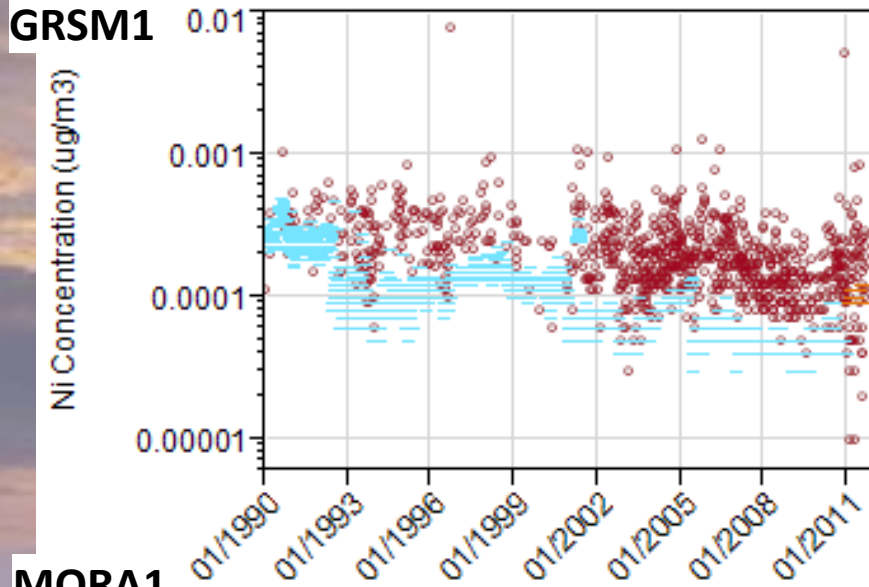


PORE1

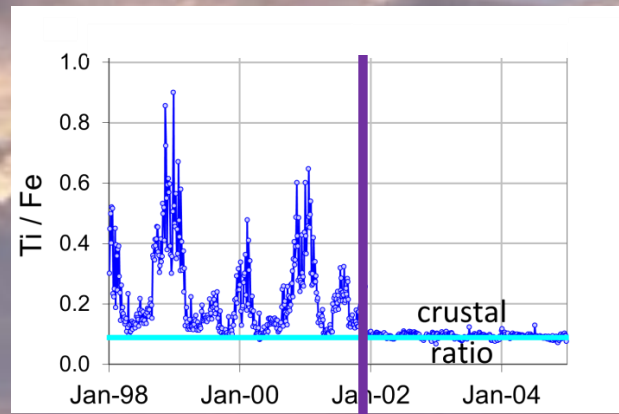
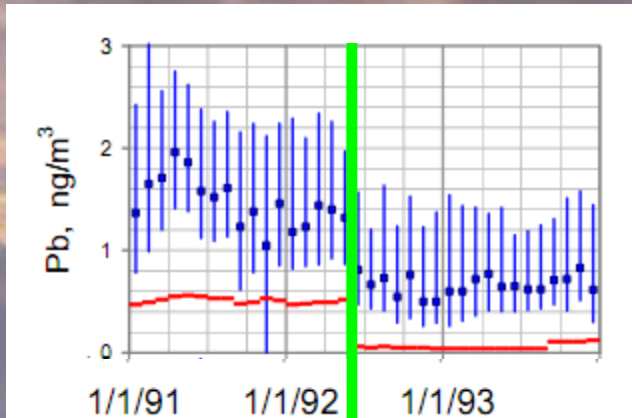


○ Value — PIXE mdl — Cu XRF He mdl — Cu XRF vac mdl — PAN mdl

Analytical Method Changes: Nickel



○ Value — Mo XRF air mdl — PAN XRF mdl



Samples of specific advisories posted at data portal

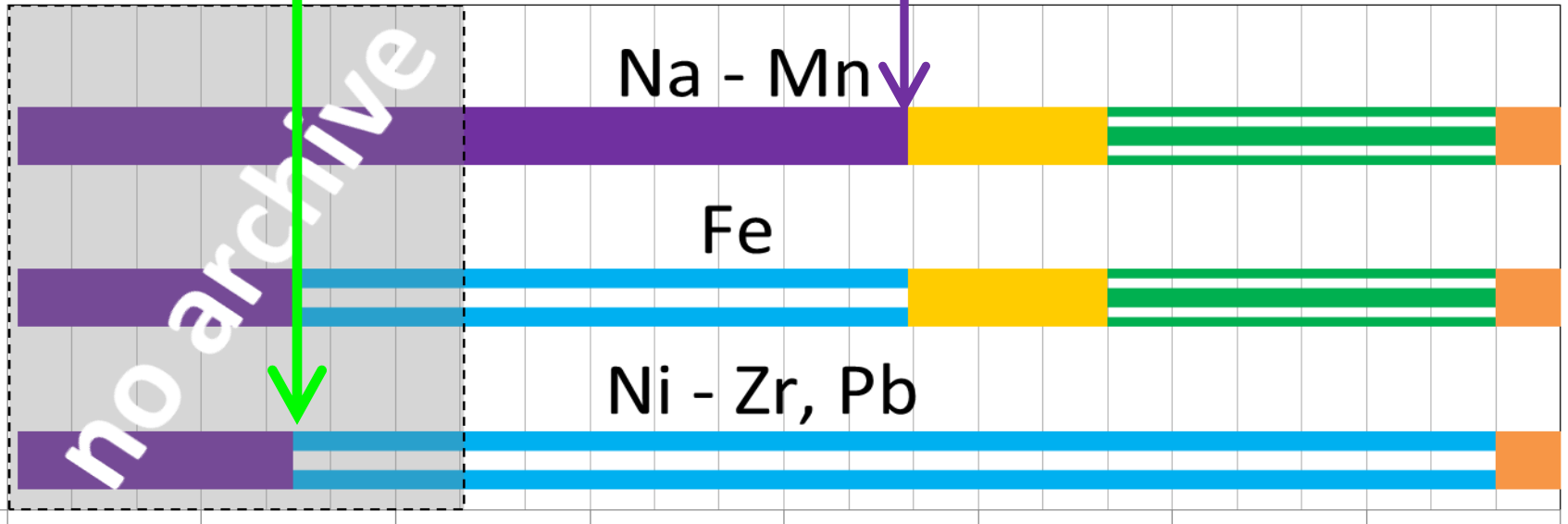
PIXE, vac

Cu XRF, He

Cu XRF, vac

PAN XRF

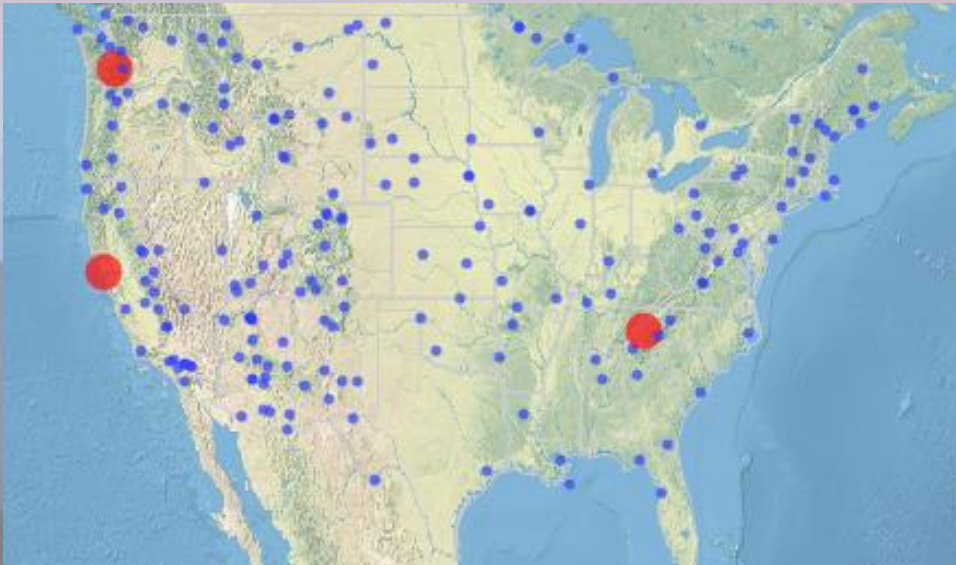
Mo XRF, air



Jan-88 Jan-91 Jan-94 Jan-97 Jan-00 Jan-03 Jan-06 Jan-09 Jan-12

Feasibility of Reanalyzing Filters

- The IMPROVE network has
 - Used the same size selective inlets and Teflon filters to collect 24h PM_{2.5} samples for elemental analyses
 - Used non-destructive analytical methods on the Teflon filters
- We were able to recover filters back to 1995
- We can analyze archived filters with current analytical protocol in a single analytical batch



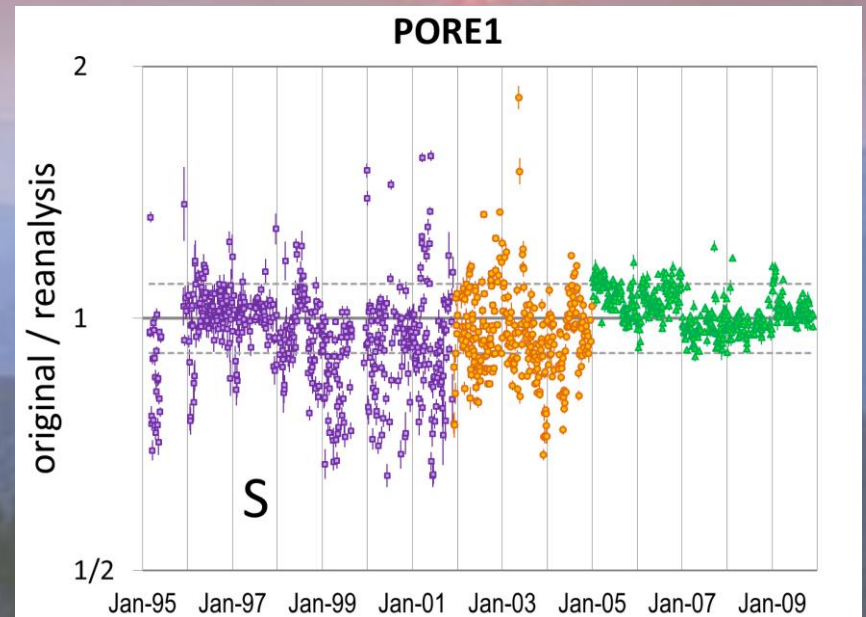
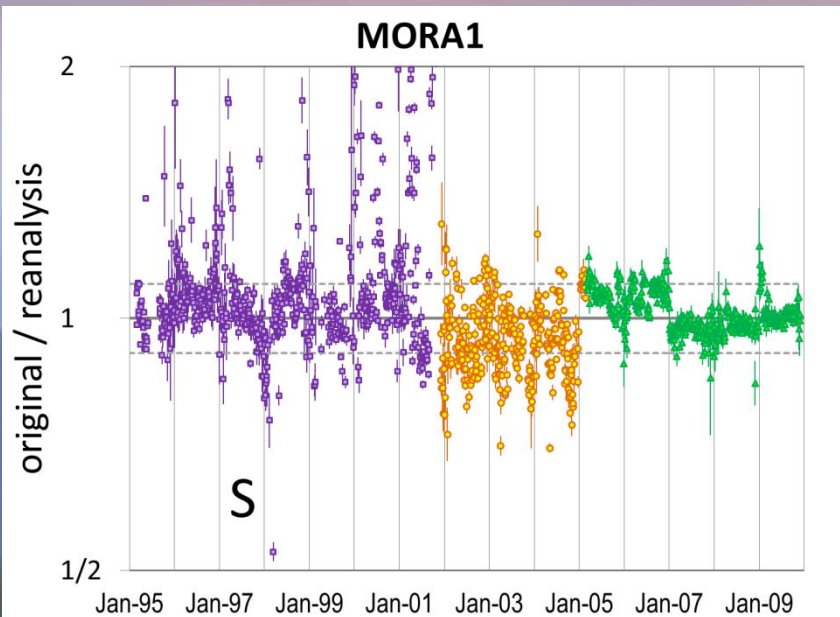
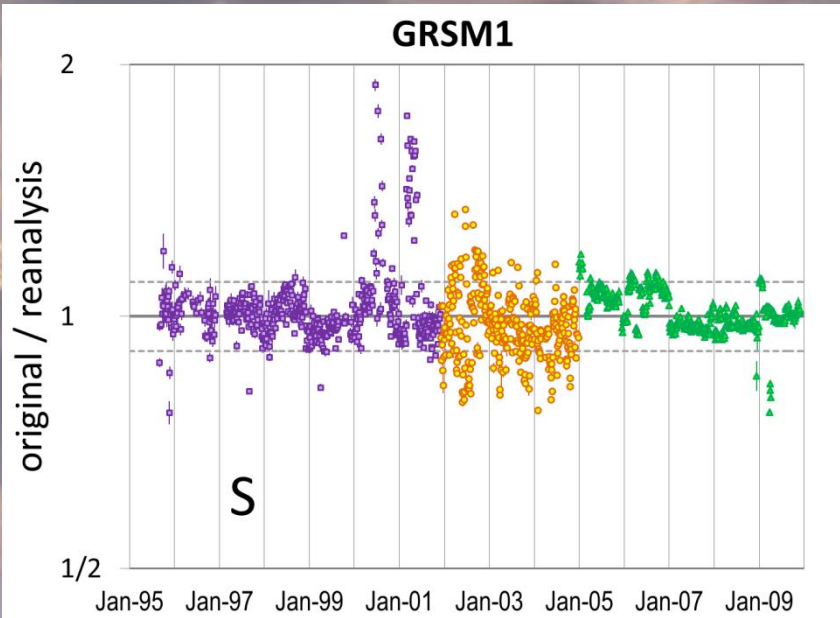
Sites selected for reanalysis:

Great Smoky Mountains (GRSM1)
Mount Rainier (MORA1)
Point Reyes (PORE1)

REANALYSIS RESULTS

Shown as ratios to original concentration measurements

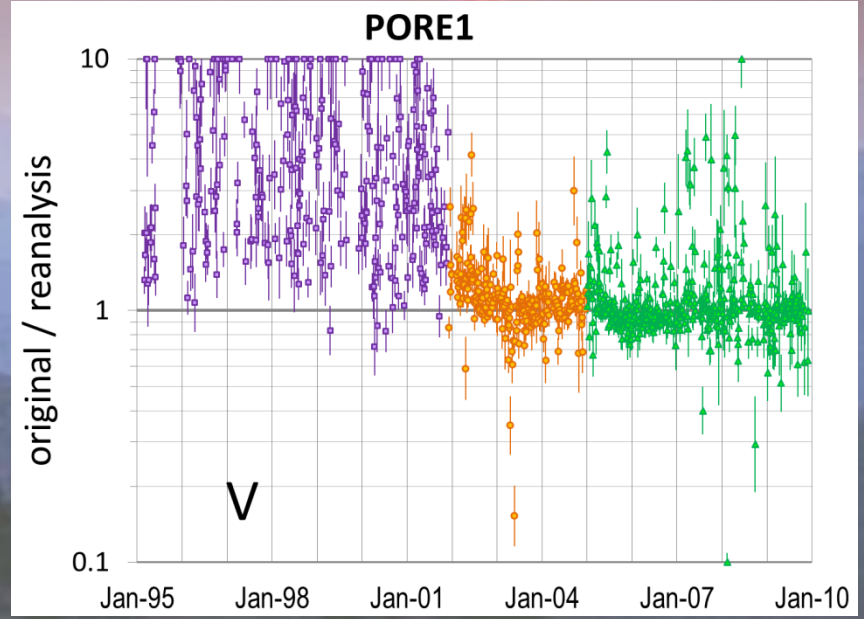
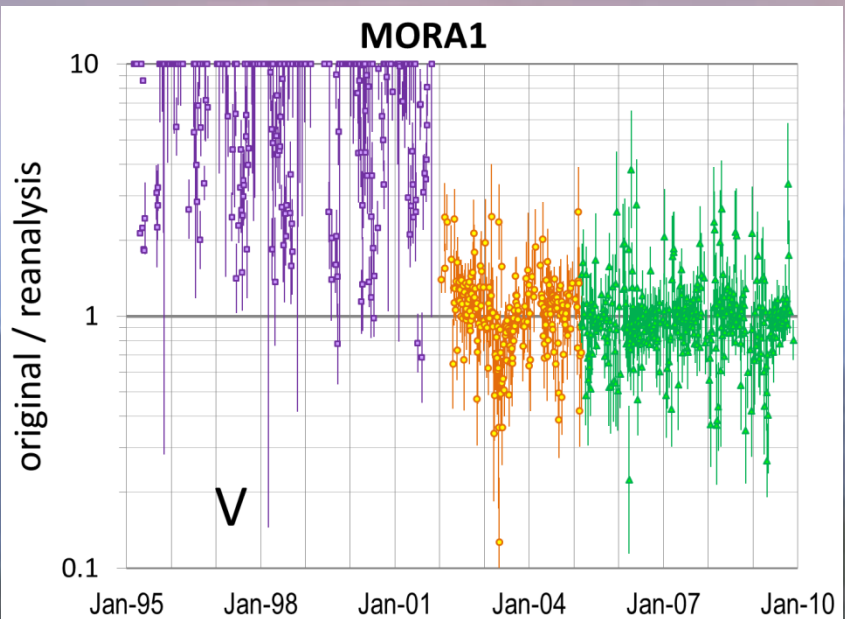
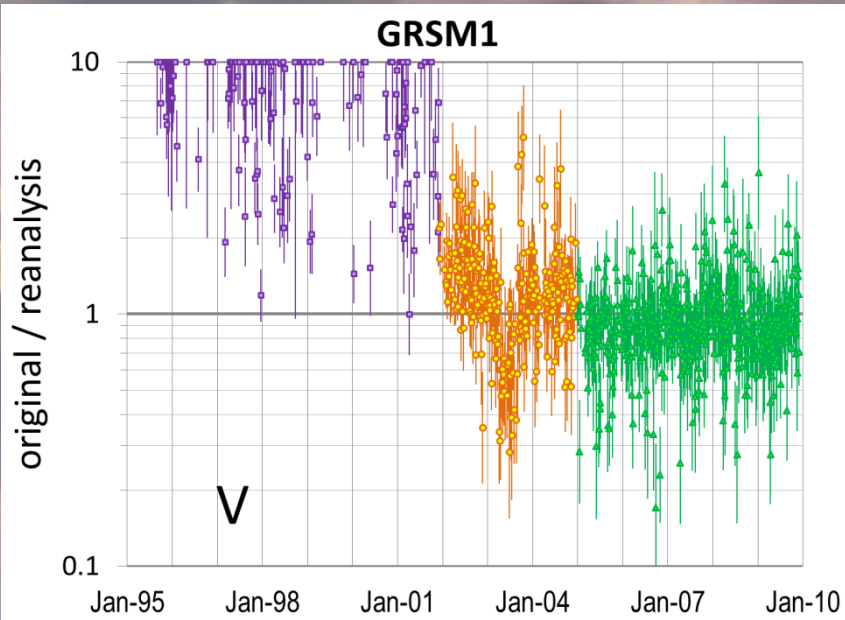
Reanalysis Results: Sulfur



□ PIXE, vac ● Cu XRF, He ▲ Cu XRF, vac

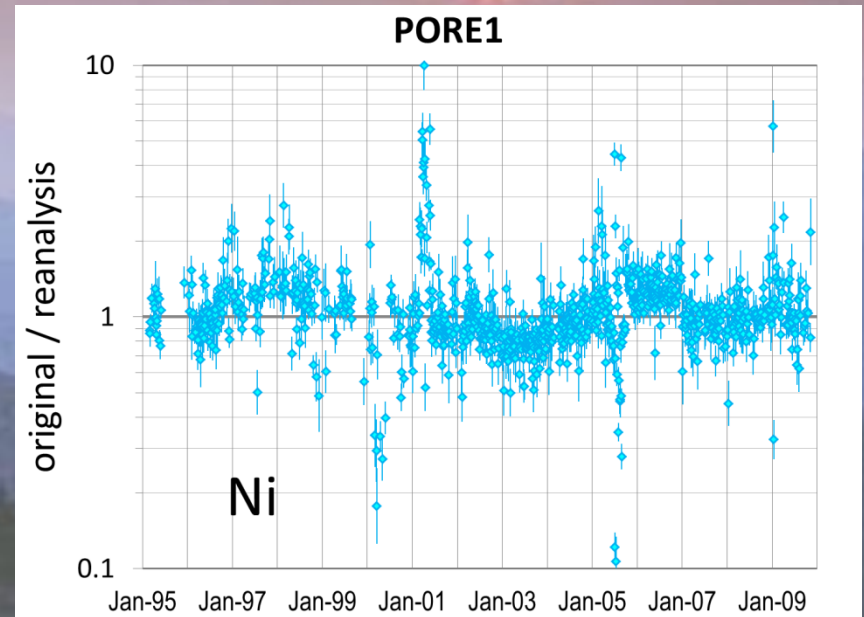
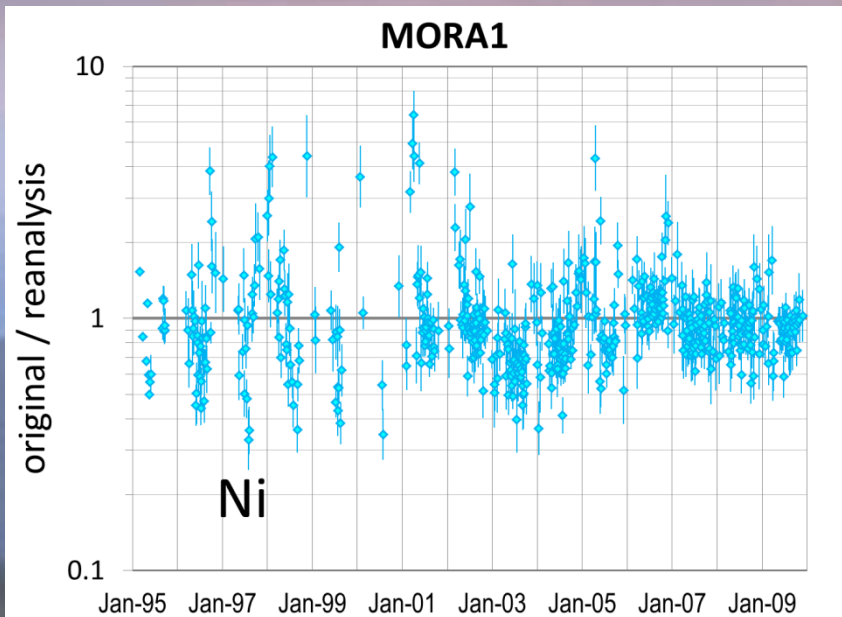
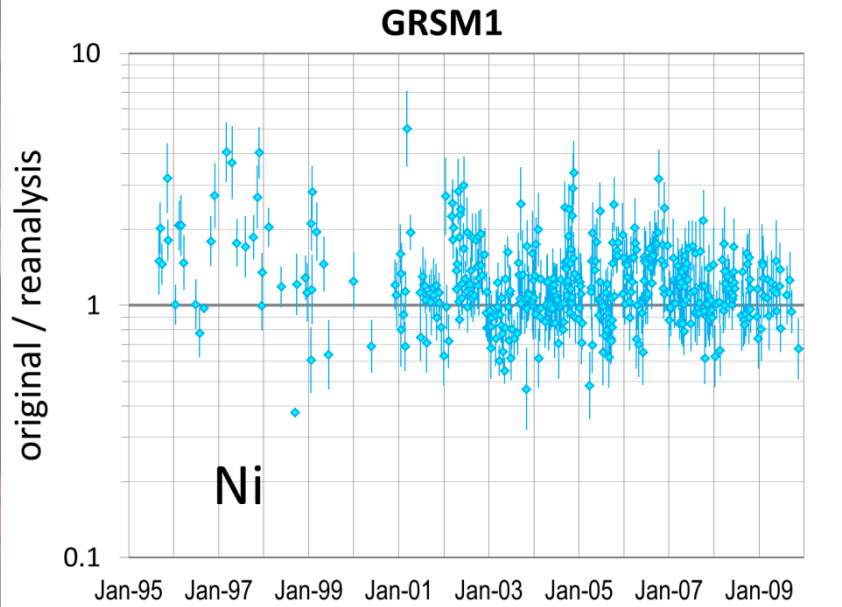
Reanalysis Results: Vanadium

Note change in y-axis scale



■ PIXE, vac ● Cu XRF, He ▲ Cu XRF, vac

Reanalysis Results: Nickel

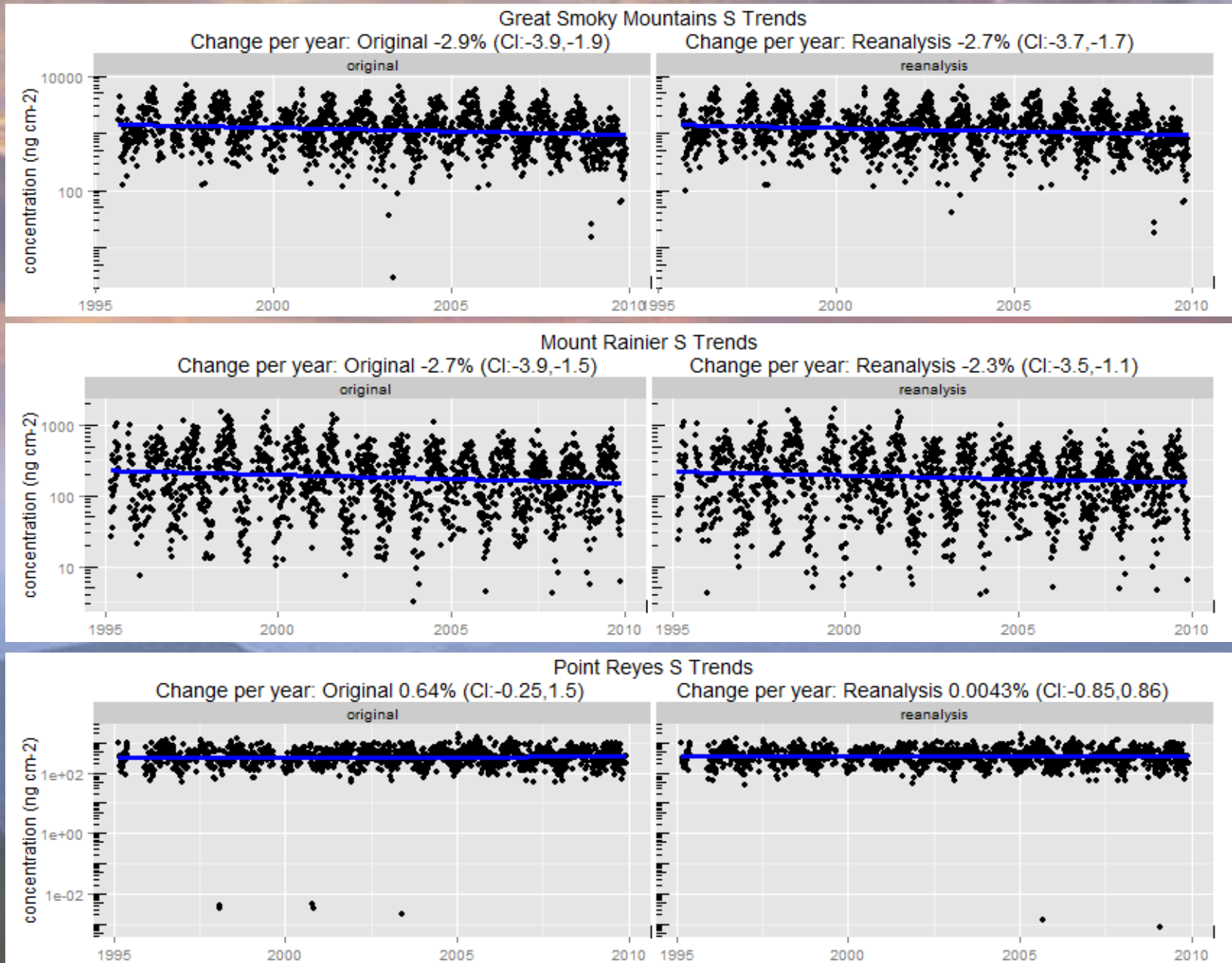


◆ Mo XRF, air

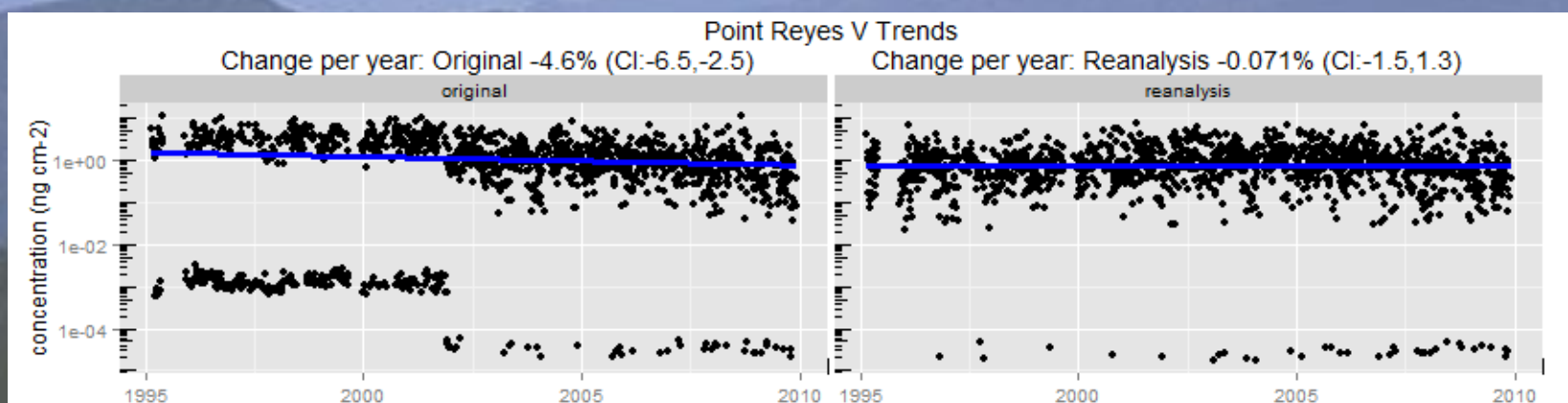
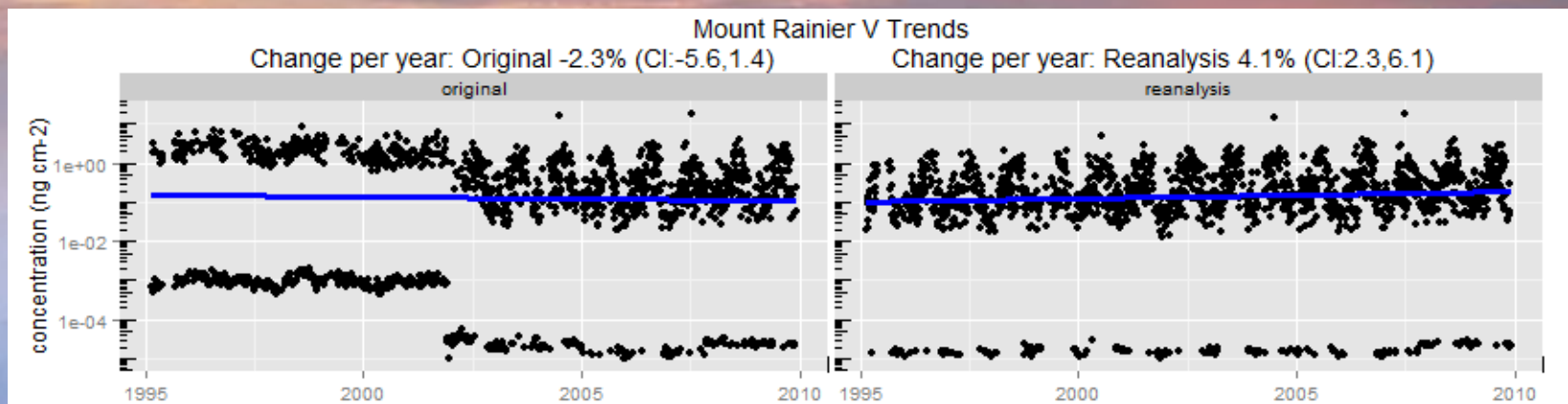
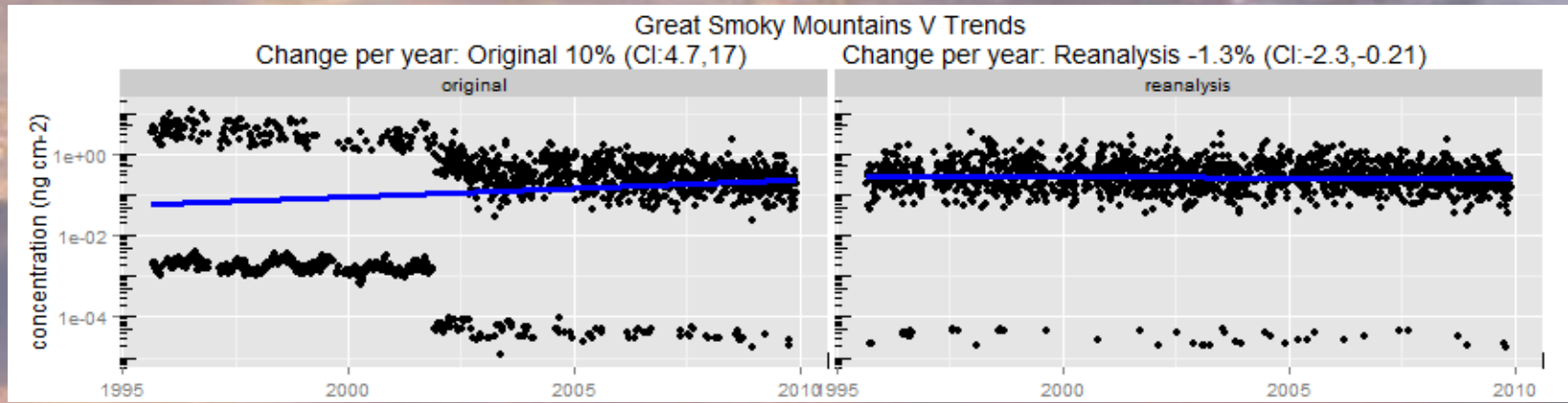
TRENDS ANALYSIS

Evaluate trends in original and reanalysis data

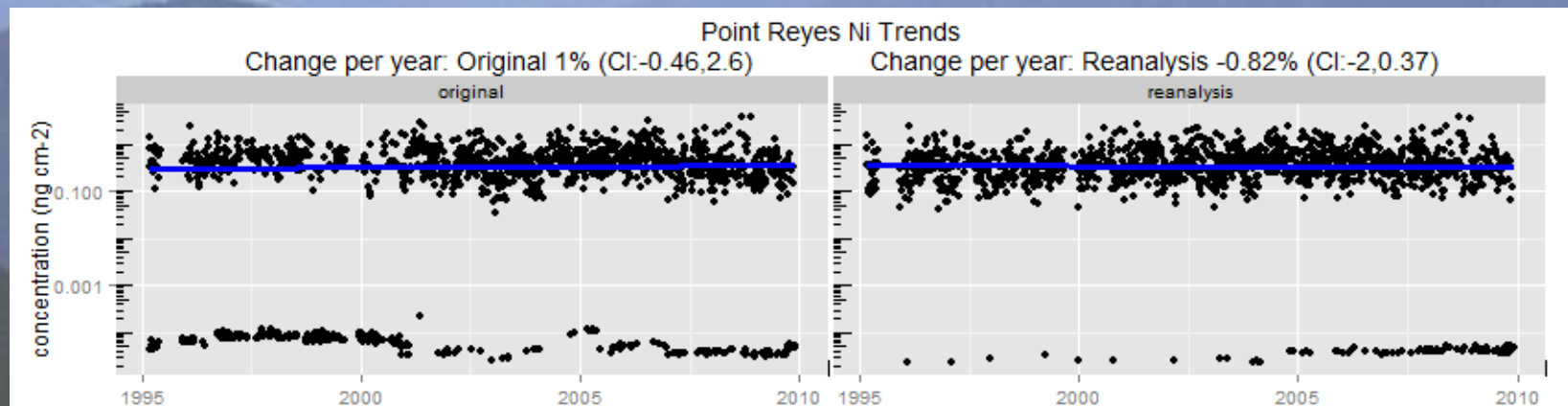
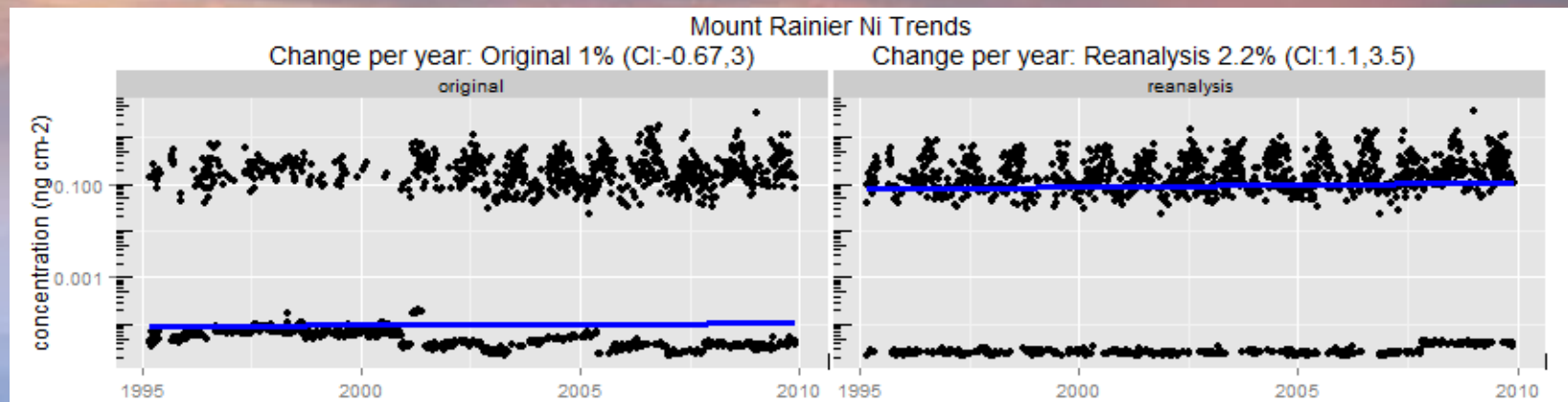
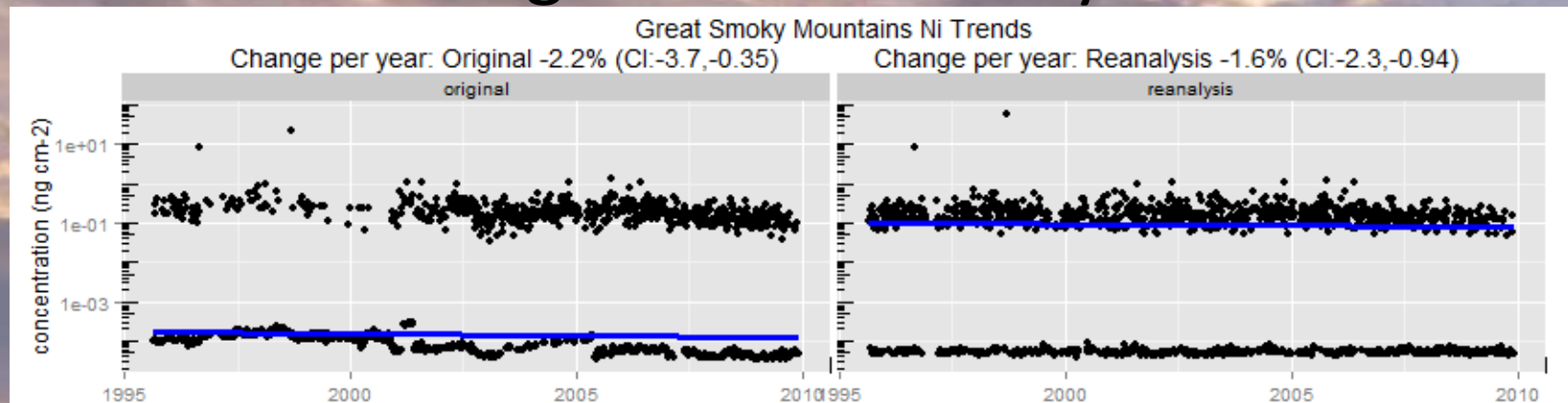
Sulfur: Original and Reanalysis Trends



Vanadium: Original and Reanalysis Trends



Nickel: Original and Reanalysis Trends



Advice for the analyst:

1. Elements measured close to the detection limits are the most sensitive to changes in analytical method
2. Expect shifts in concentrations over time even with consistent methods
3. Trend analyses are sensitive to analytical changes and treatment of data near or below detection limits

