

Observations of NH_3 in SLV



- Discrepancy between modeled and observed NH_3
- What are the sources of NH_3 in SLV?
- NH_3 measurements in SLV

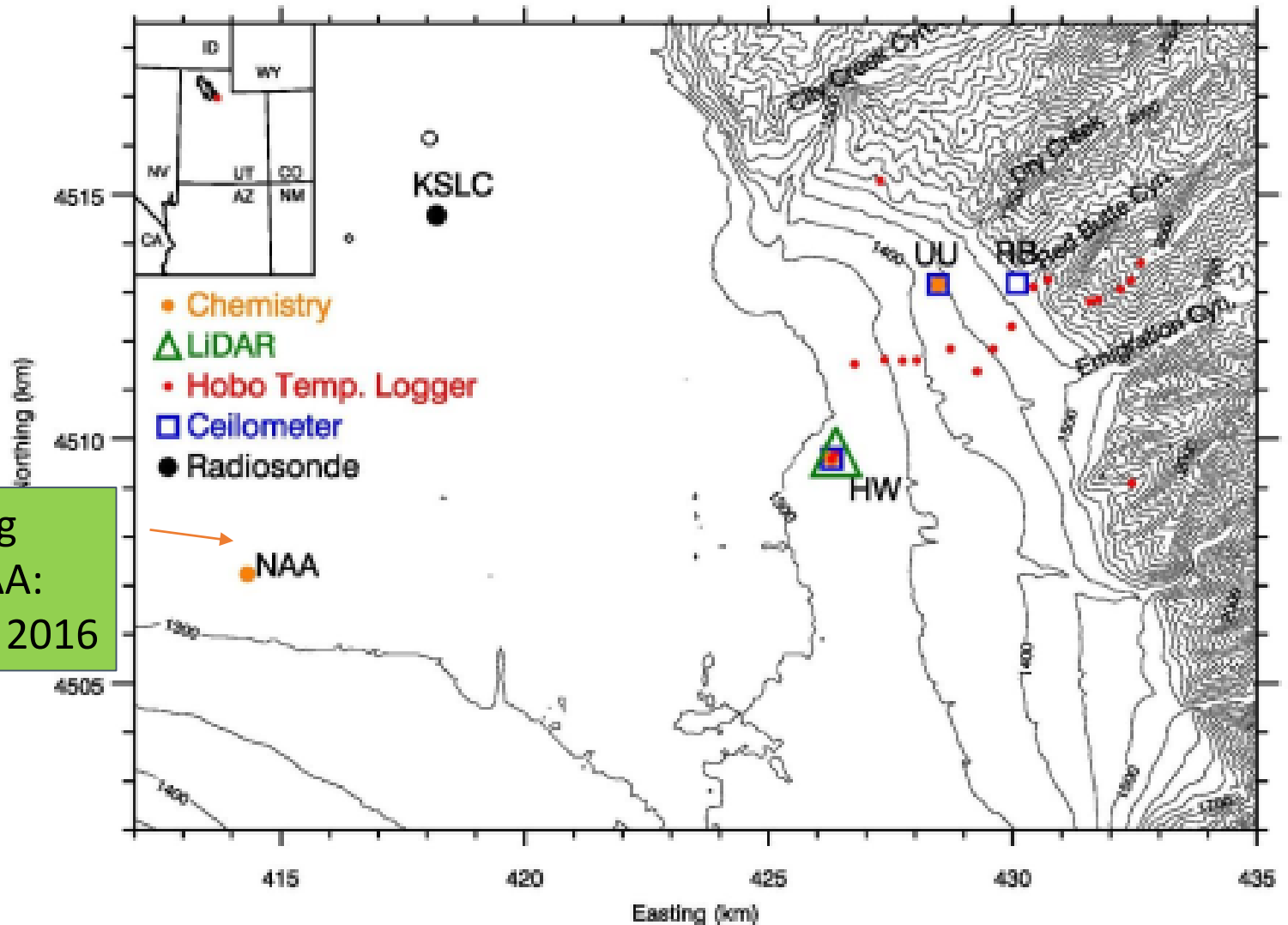
HW: Jan - Feb 2009 winter (Kuprov et al. 2014)

NAA: 2015 – 2016 winter as part of Air Toxics Campaign

UU, TO, passive: 2016 – 2017 winter as part of UWFPS

By M. Baasandorj

Measurement Sites



Winter sampling campaign at NAA: Dec 2015 – Feb 2016

NAA is a good site for monitoring valley-wide dispersion.

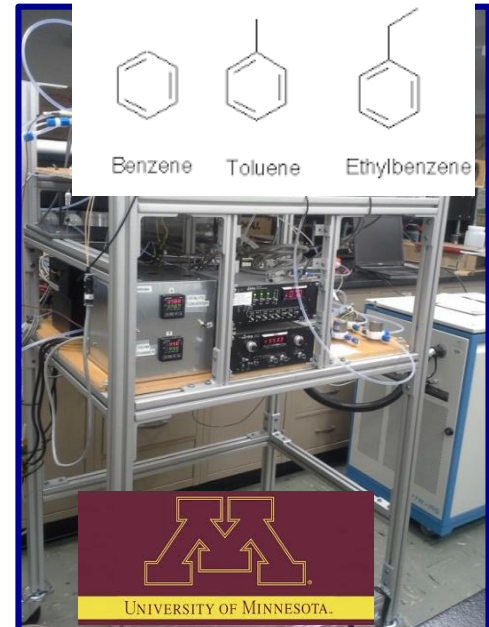
Baasandorj et al. 2017

Real-time monitoring of *HAPs in both gas and particle phase: chemical speciation*

- A wide suite of gaseous & particulate measurements
- Organic HAPs in gaseous and particulate phase & their tracers (I)



Trace gas analyzers: CO, O₃, NO_x



Gas phase VOC composition measurements by PTR-MS



Inorganic ions (ammonium, nitrate, sulfate etc.) by AIM



Organic / elemental carbon measurements



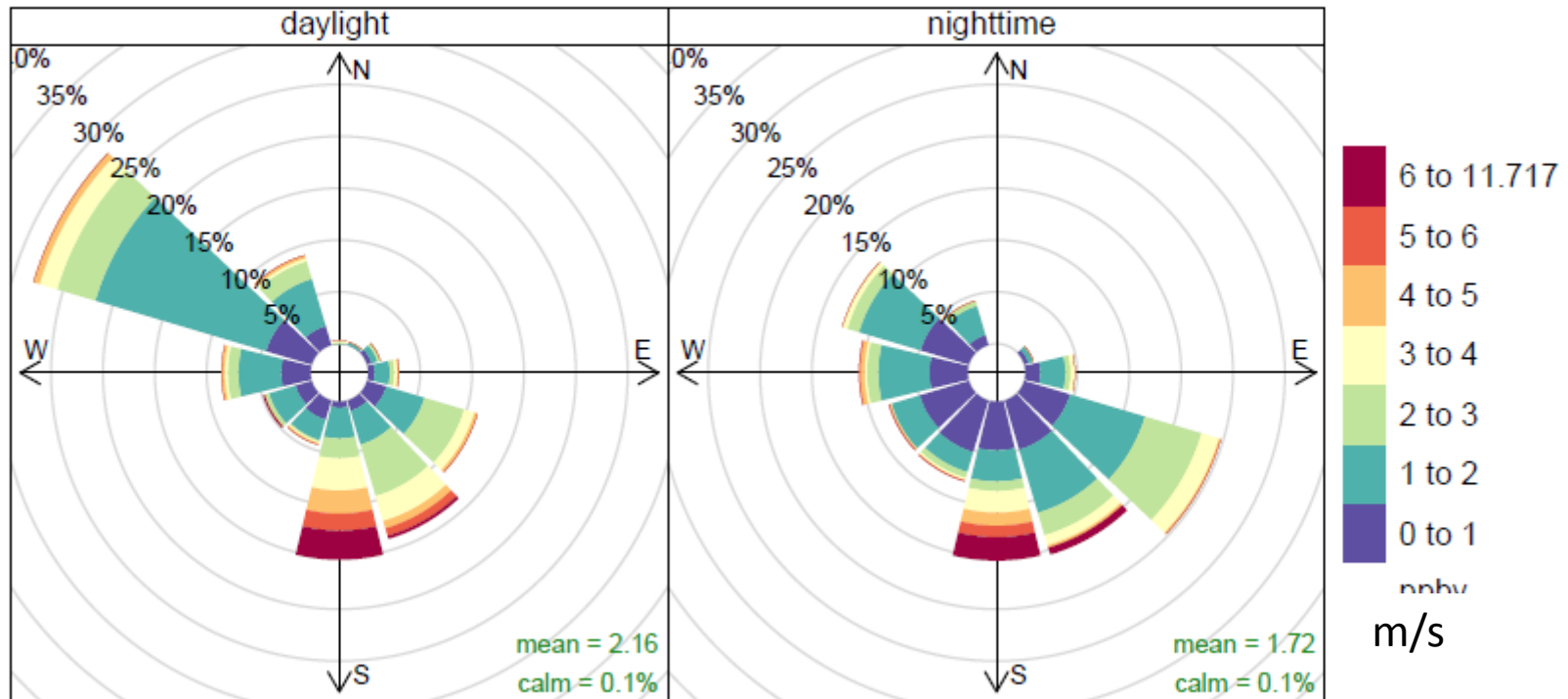
PM mass concentration by TEOM



Organic aerosol composition by Organic Aerosol Monitor (OAM)

Consistent Wind Pattern at NAA

wind spd.

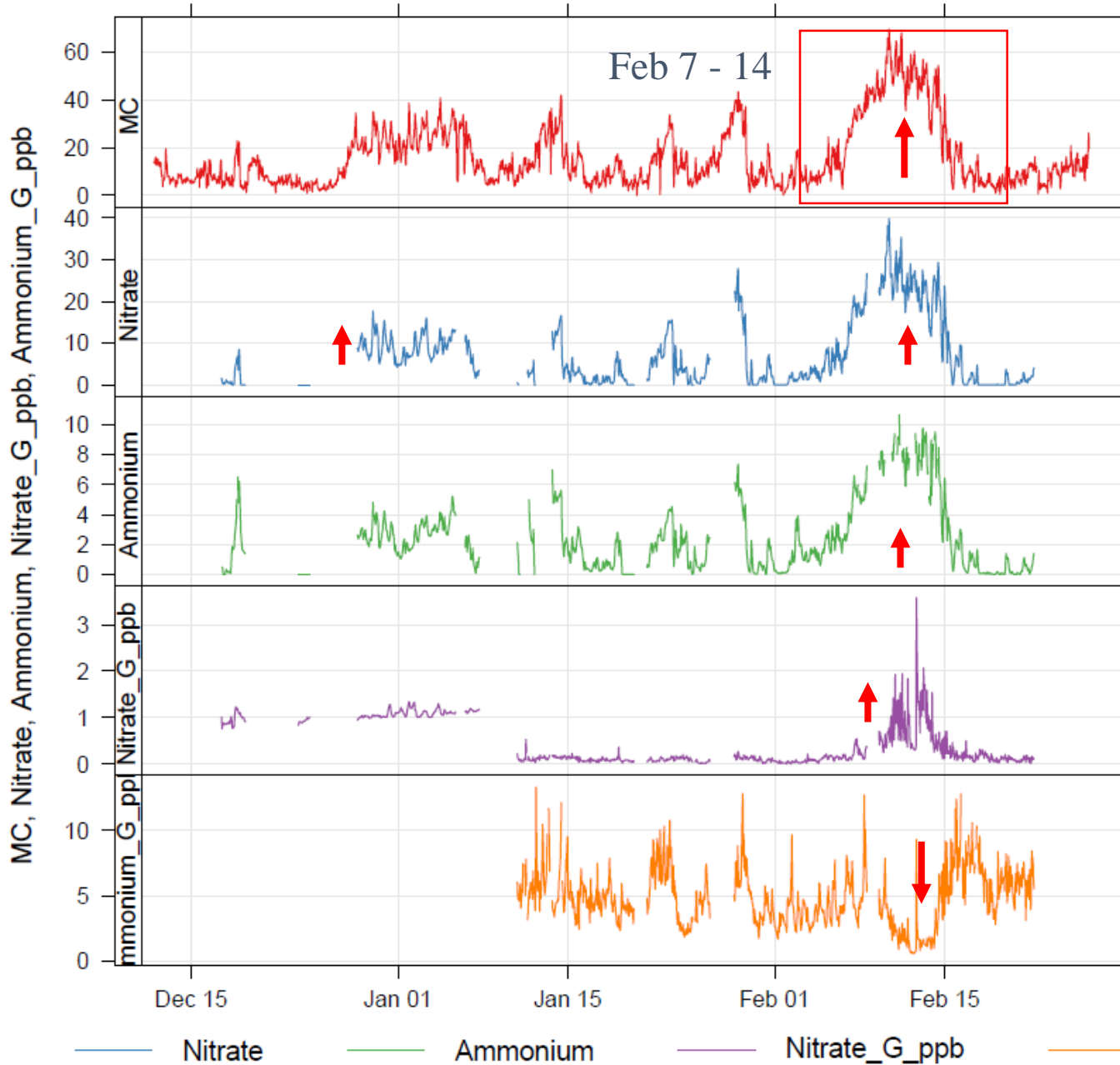


Frequency of counts by wind direction (%)

- Predominant winds are northwesterly during the day & southeasterly at night
- Often impacted by lake breeze during the day
- Persistent Southerly influence day and night.
- Negligible direct influence from the refineries

Time Series of PM and its ionic composition at NAA

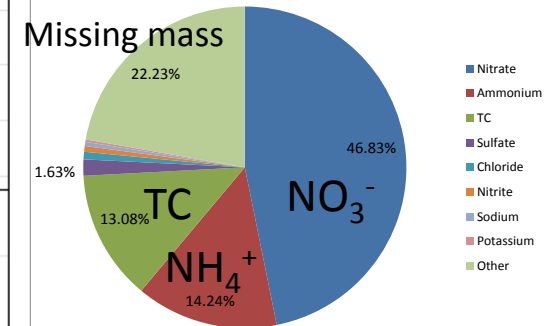
2015 – 2016 winter



PM_{2.5}

- Ammonium nitrate is enhanced.
- So is HNO₃
- NH₃ is depleted during pollution episodes.
- The ranges of NH₃ and HNO₃ are consistent with UWFPS observations.

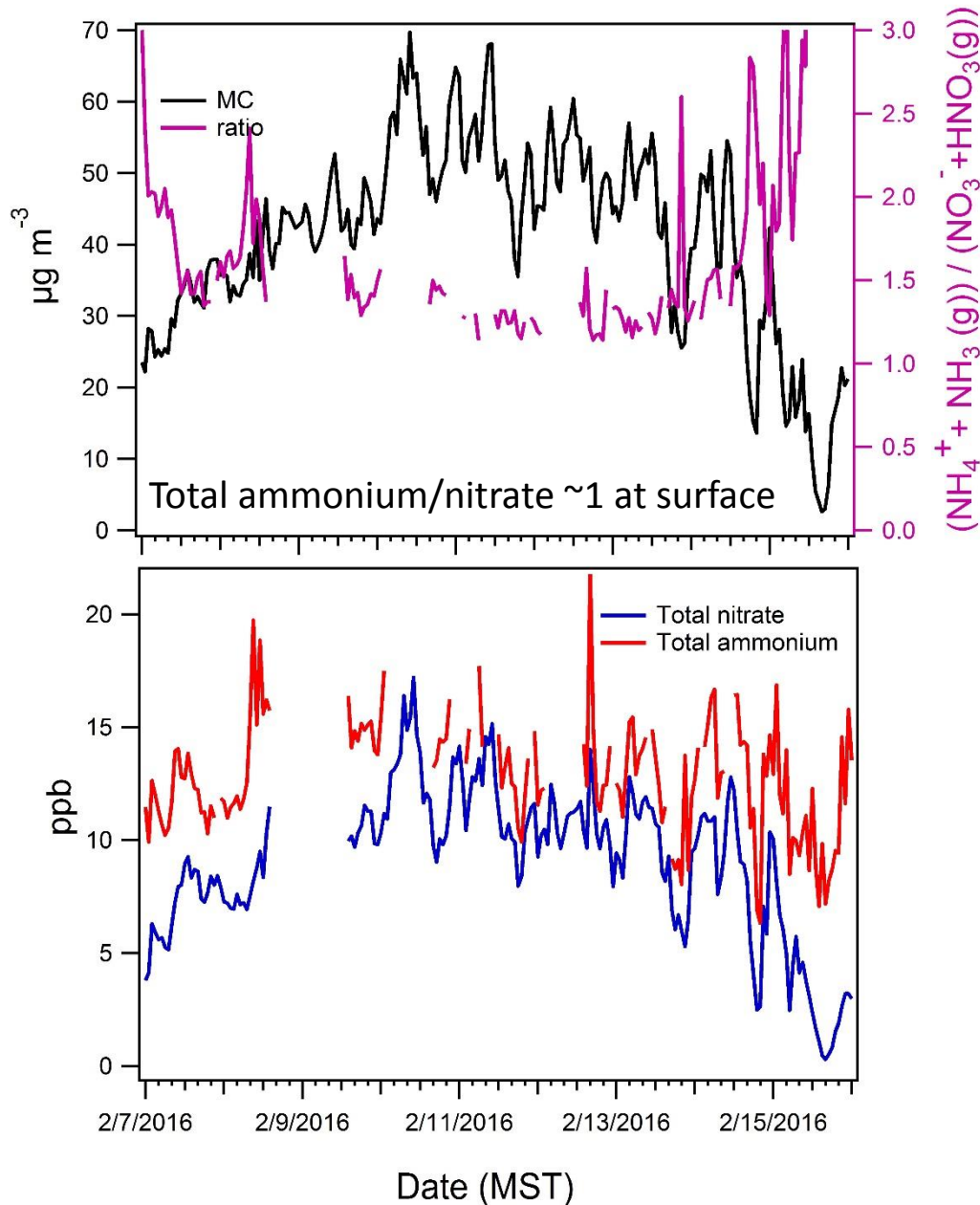
Chemical composition of PM_{2.5} during pollution episodes



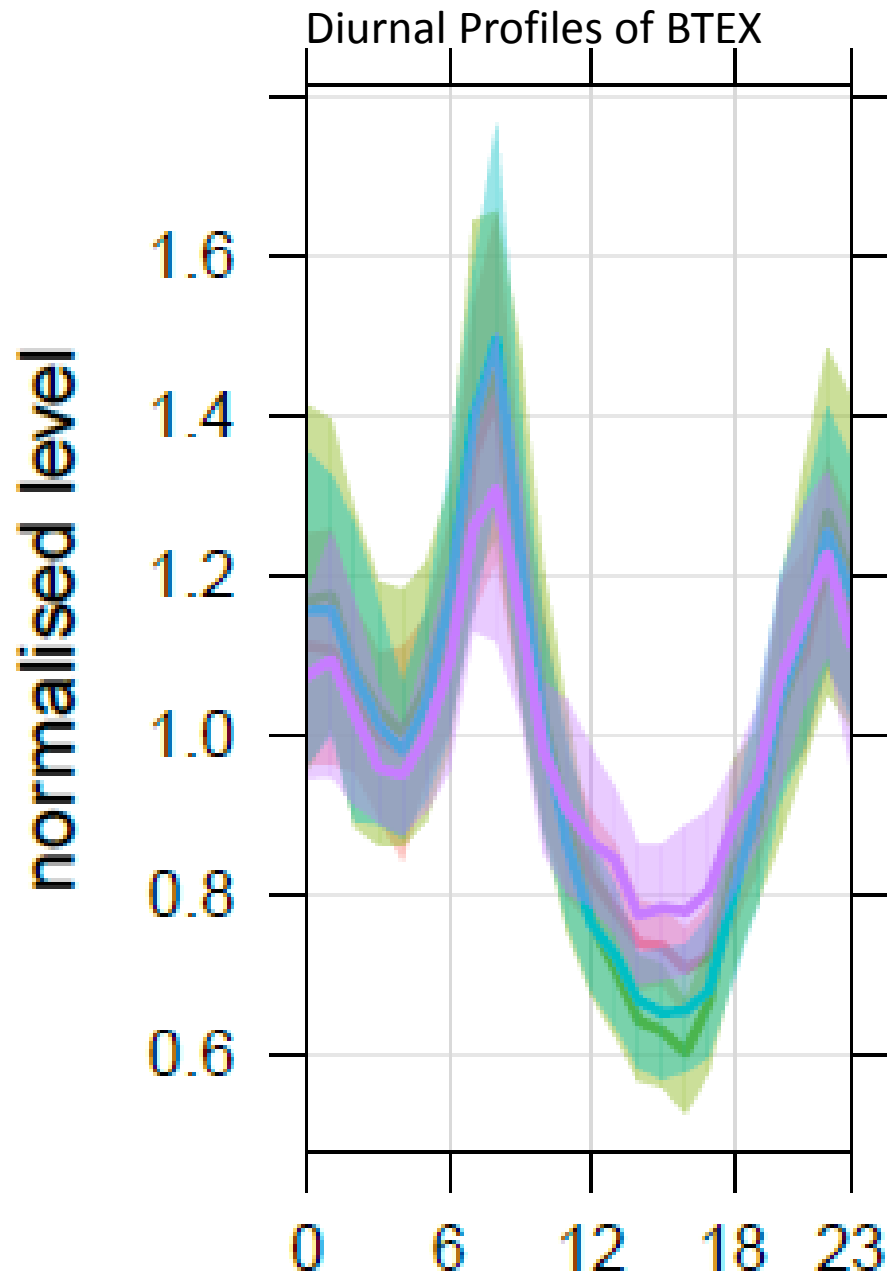
NH₄NO₃ is the predominant component (60 – 80%).

Total Nitrate and Ammonium Concentrations are Comparable at NAA

2015 – 2016
winter

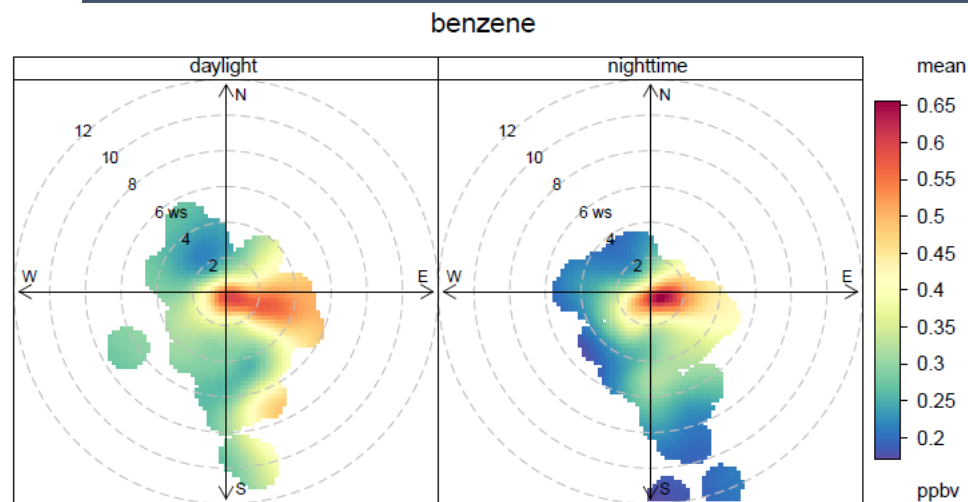


- Total NO_3^- and NH_3 are comparable at the surface.
- Ratio ~ 1
- Indication of NH_3 depletion near surface.



Aromatics:

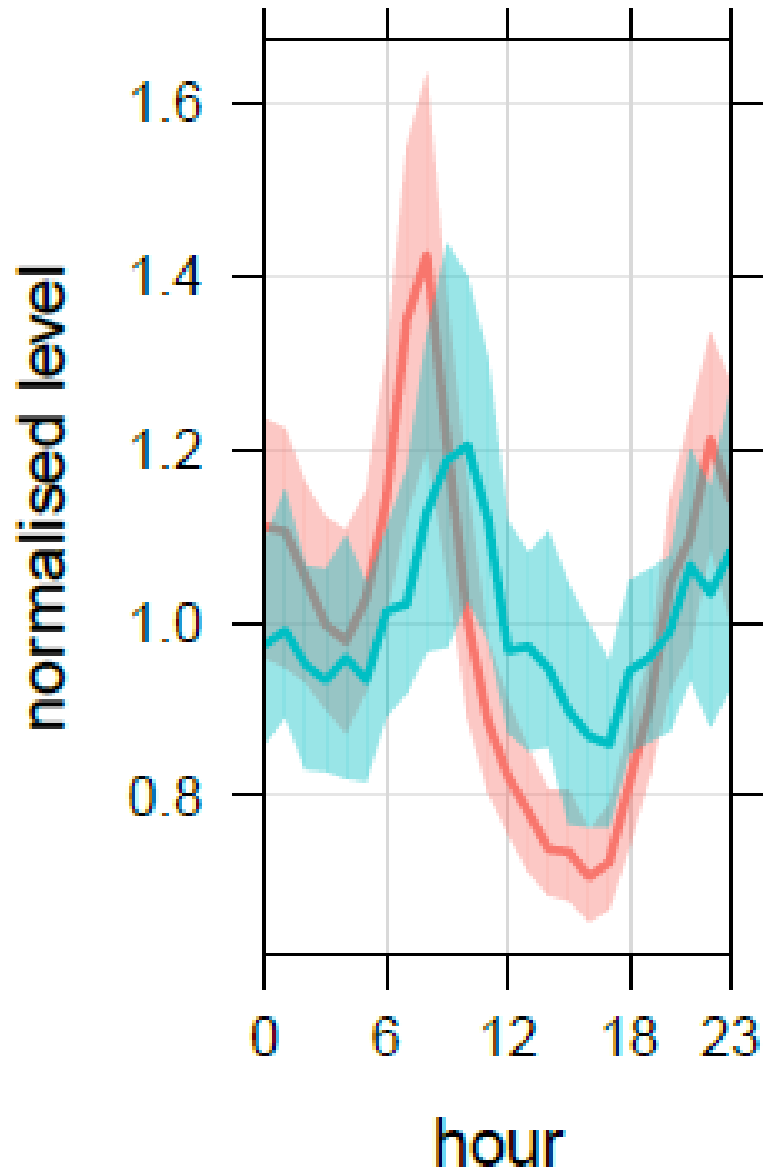
- <2 ppb on average
- Show typical signature associated with mobile sources
- Highest levels are associated with easterly winds.
- Consistent with CO, NO_x diurnal profiles.



Comparing Temporal Variation of Aromatics and NH₃ at NAA

Diurnal Profiles of Benzene and NH₃

2015 – 2016 winter



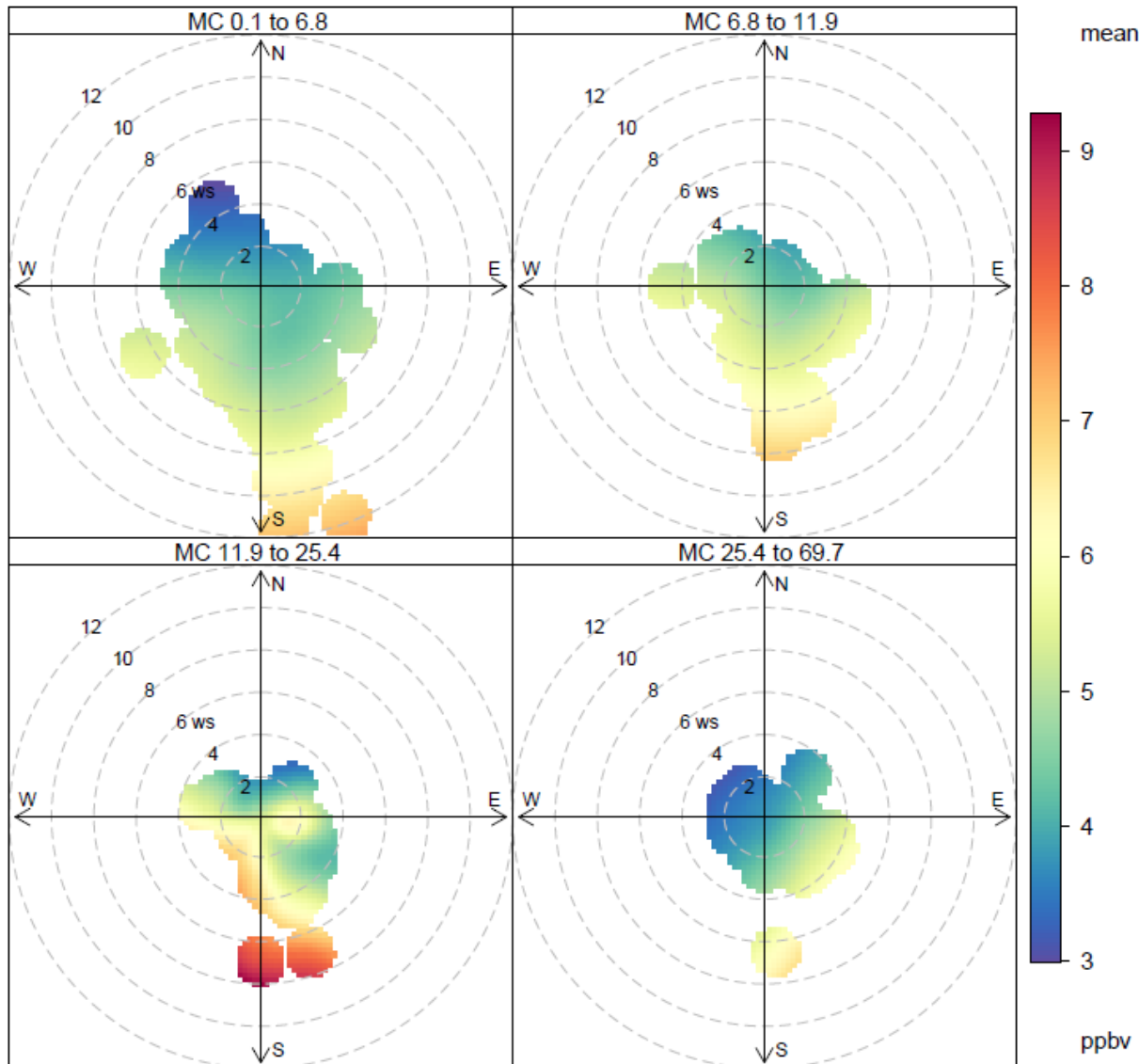
Diurnal profiles of benzene and NH₃ in SLV are

- similar but not the same
- Peak NH₃ lags by an hour
- Indicates transport of NH₃ and sources other than mobile sources.

Highest NH₃ at NAA are associated with Southerly

2015 – 2016 winter

Ammonium_G_ppbv

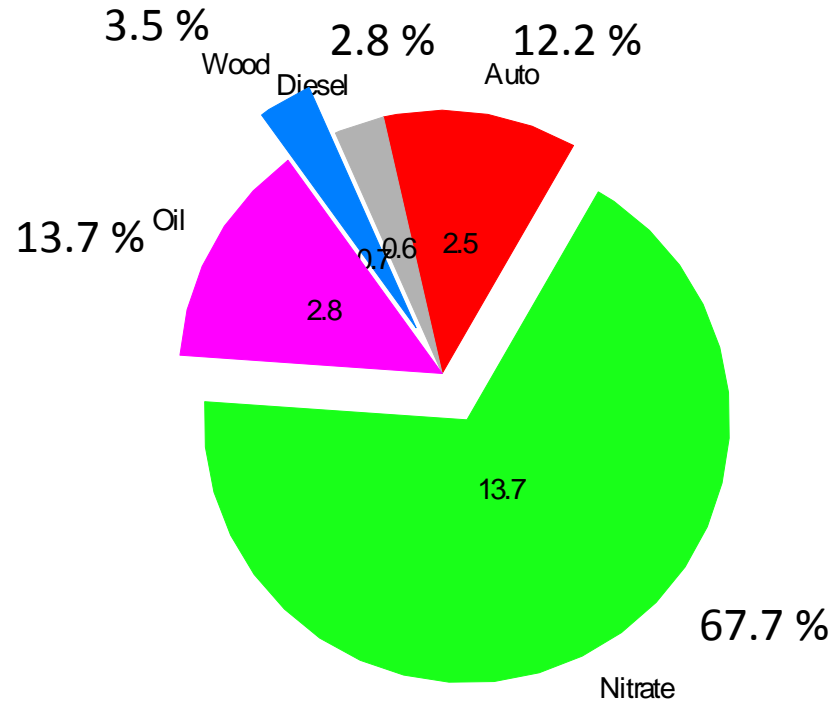
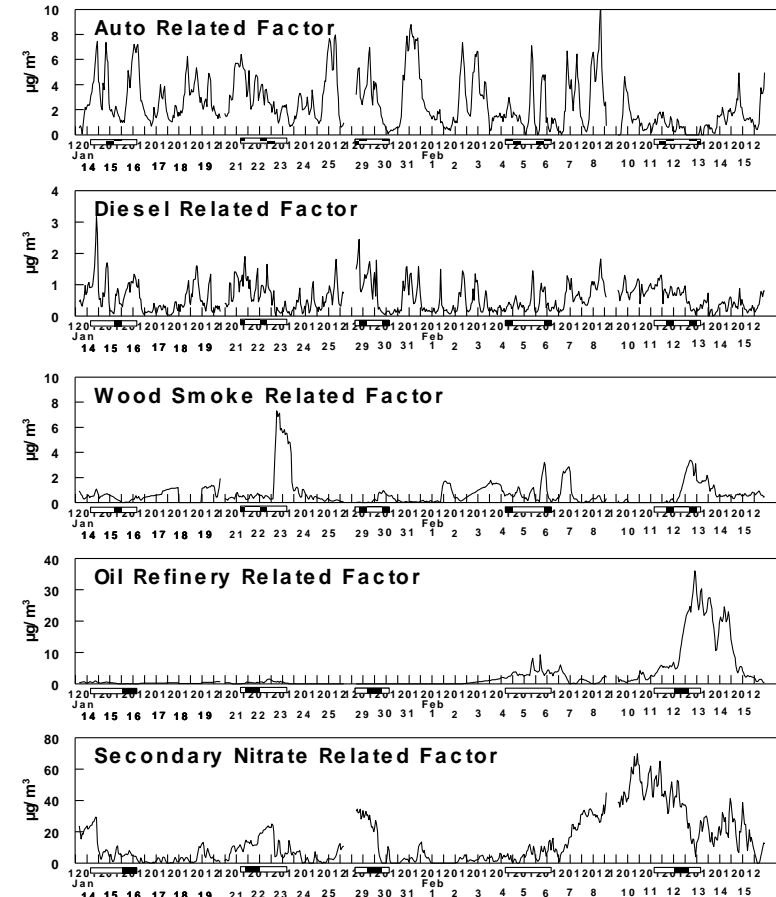


- Point source located south of NAA
- Transport of NH₃ from Utah Valley or Southern Utah??
- Is the formation NH₃ limited??

PMF Analyses of Combined Data at NAA: Significant contribution from NH_4NO_3 and minor contribution from wood-smoke.

5 factors used in the PMF analysis

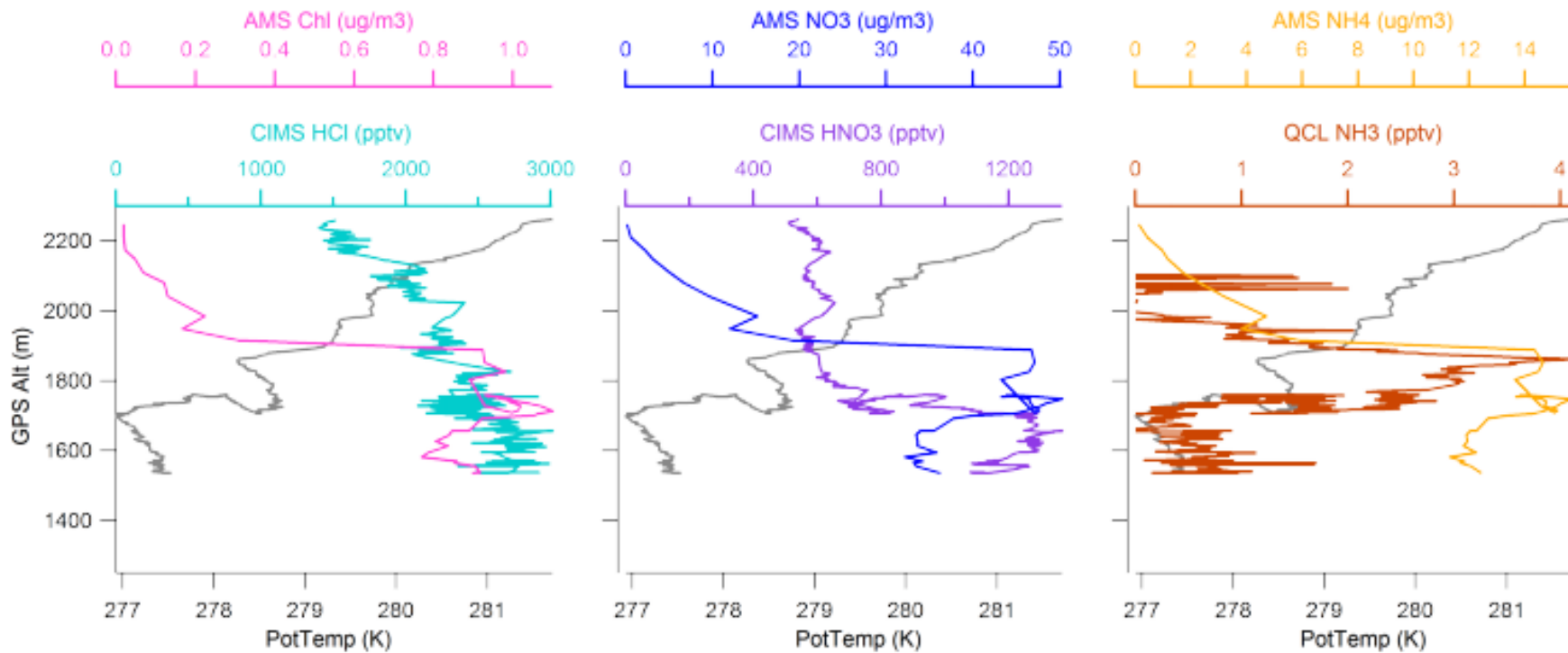
2015 – 2016 winter



Eatough et al.

- Robust analysis due to available data points (N=689)
- Provides more realistic estimation of source apportionment of PM_{2.5} on average.

Near Surface NH_3 Depletion During TO South Flights



RF05

Start Lat, Start Lon
40.716, -112.12

Stop Lat, Stop Lon
40.495, -112.03

Mean Lat, Mean Lon
40.594, -112.06

Start Pt, Stop Pt
1240, 1710

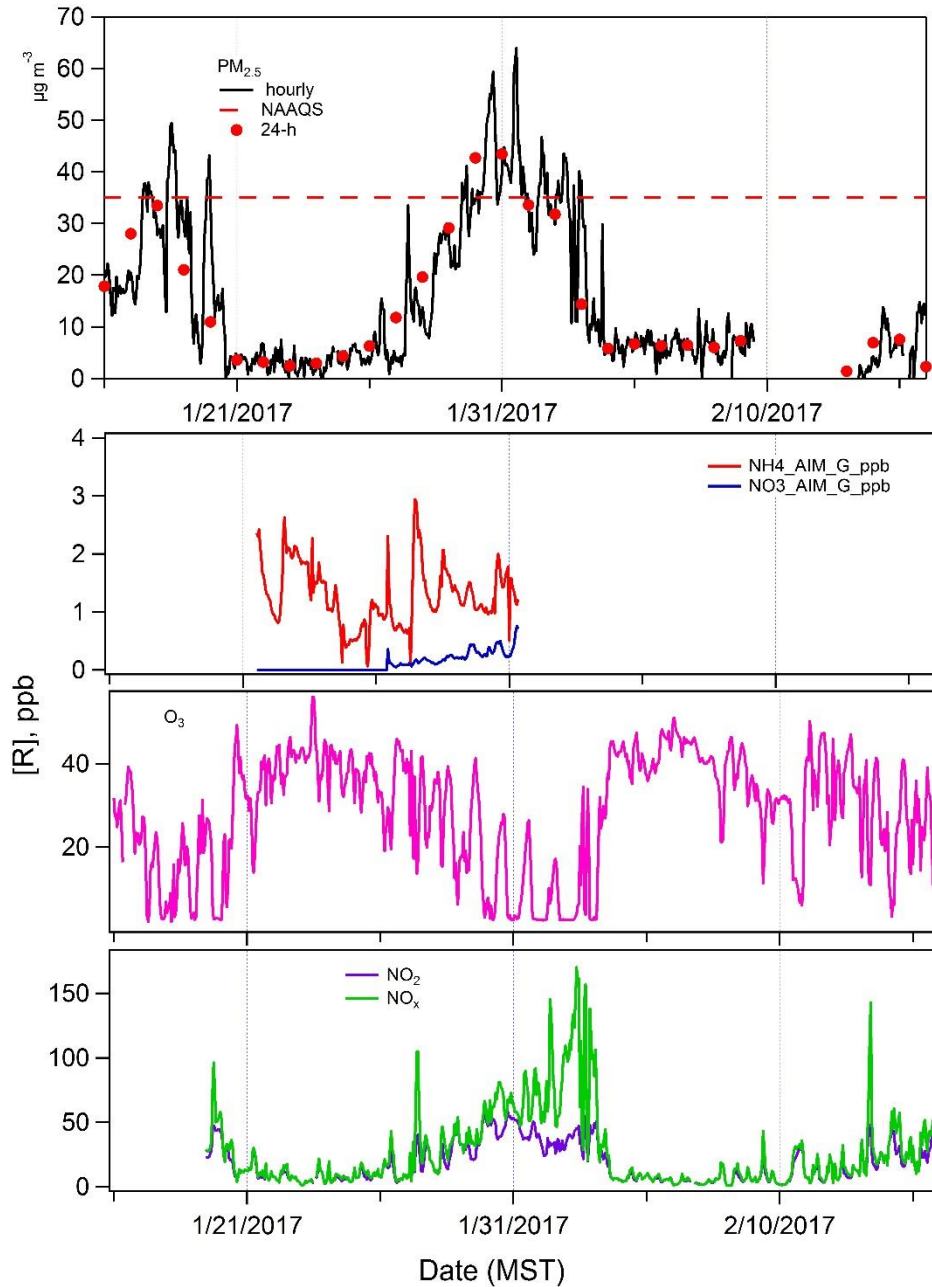
2017 winter

A. Franchin

Time Series of PM and Trace Gases at UU



2017 winter



- No obvious trend in NH₃ or HNO₃.
- In need of AIM data

What's Next?

- Back trajectory analysis of NH₃ at NAA
- Perform similar analyses of NH₃ measured in 2009 & during UWFPS