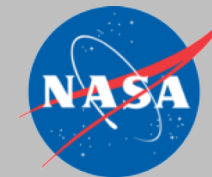


# Spatiotemporal variability of ammonia from satellite

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Dept. of Civil and Environmental Engineering



## Stakeholders:

Daniel Bon (Colorado Department of Public Health and the Environment)

Ying Kuang Hsu (California Air Resources Board)

John Walker (EPA Office of Research and Development)

Anthony Prenni, Barkley Sive (National Park Service – Denver office)

## Collaborators:

Lieven Clarisse, Martin van Damme, Simon Whitburn, Pierre-François Coheur (ULB) - IASI

Karen Cady-Pereira (Atmospheric and Environmental Research Inc.) - CrIS

Kang Sun (Harvard Smithsonian Center for Astrophysics) - oversampling algorithm

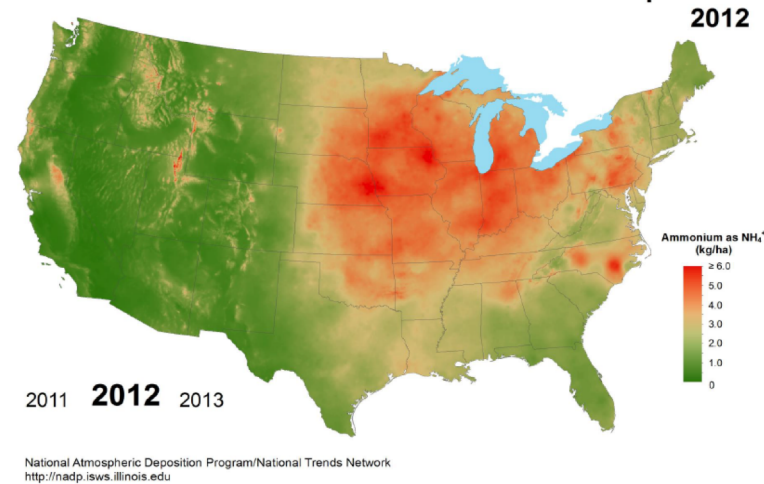
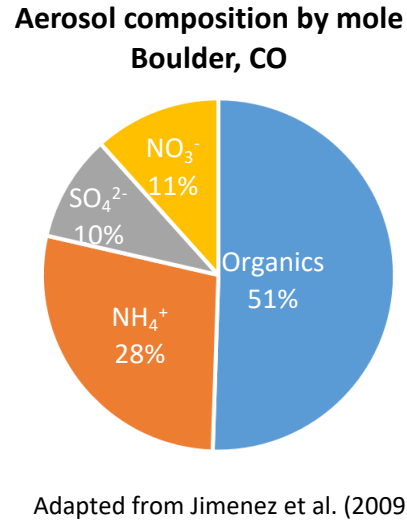
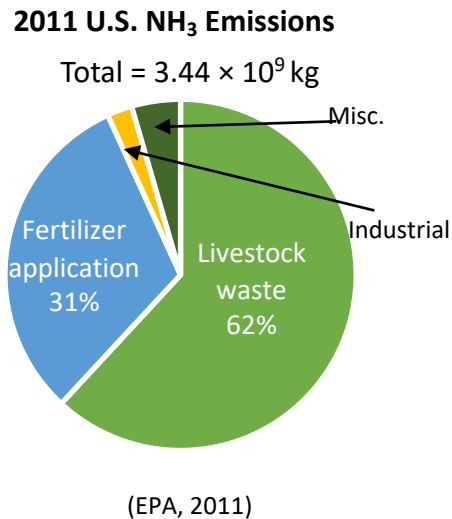
**NASA Health and Air Quality Applied Sciences Team**  
**Lamont-Doherty Earth Observatory, Columbia University**

November 28, 2017



# Motivation

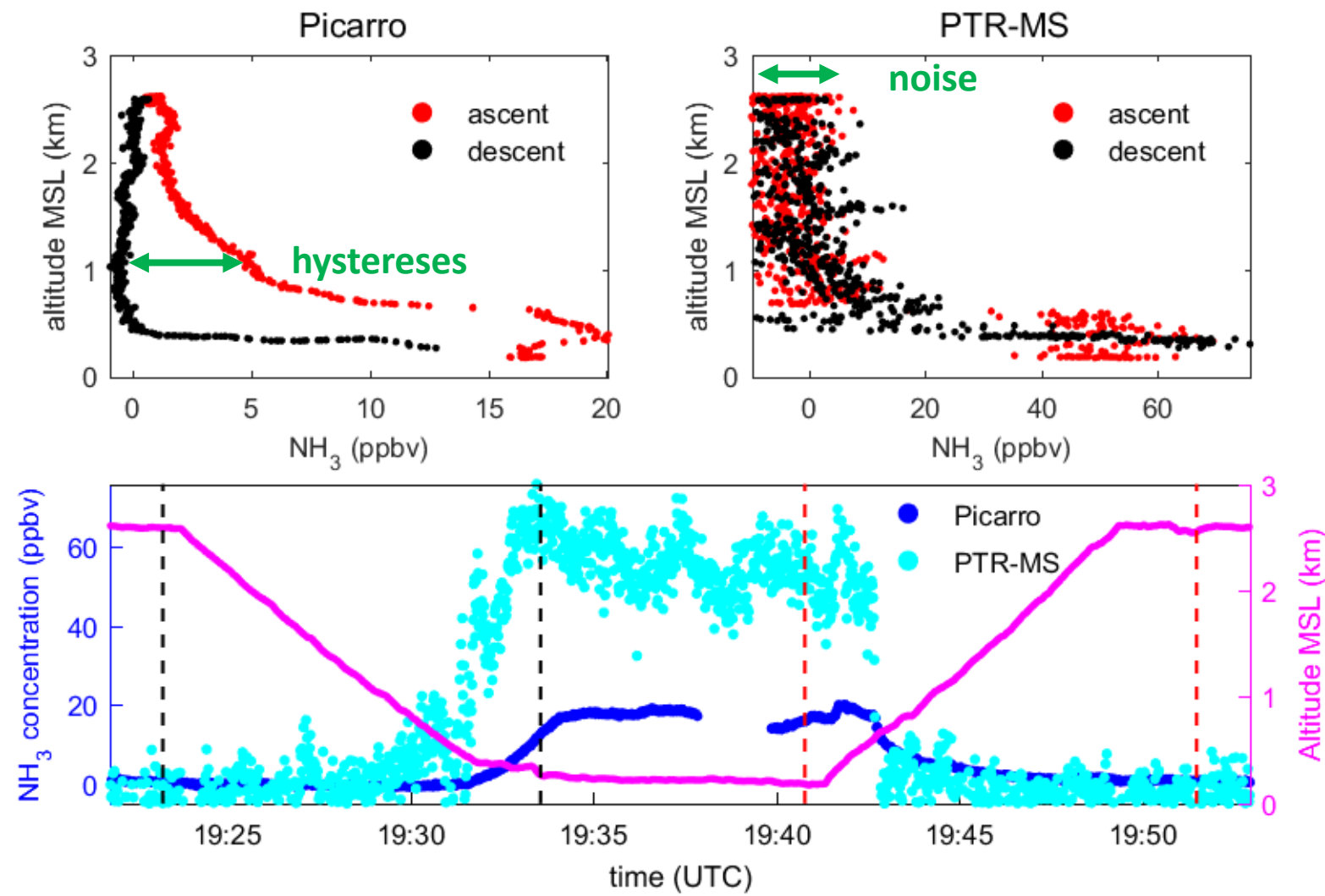
**Emissions poorly constrained: Key component of PM<sub>2.5</sub>: N-deposition in ecosystems:**



## Key questions for satellite NH<sub>3</sub>:

- What are the accuracy/precision of the satellite NH<sub>3</sub> products (IASI, CrIS)?  
e.g. inversions, thermal contrast, extent of pollution, sensitivity to boundary layer
- How representative are overpass times?  
e.g. synthesizing IASI and CrIS, daytime bias of NH<sub>3</sub> volatilization
- To what extent (duration) can satellite NH<sub>3</sub> be used for spatiotemporal mapping?  
What are weekly-seasonal-annual emissions inventories?

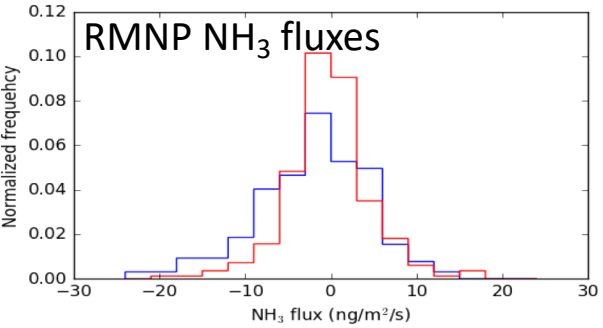
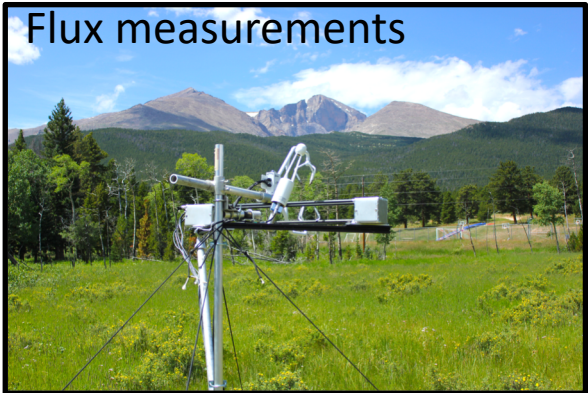
# Validation of IASI and CrIS NH<sub>3</sub>: progress and challenges



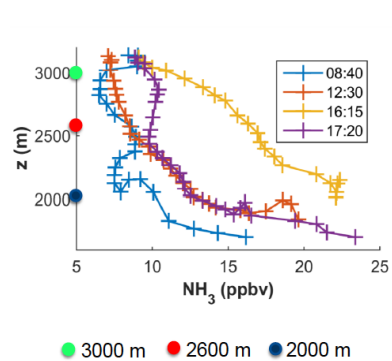
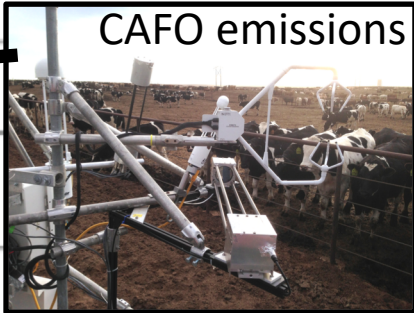
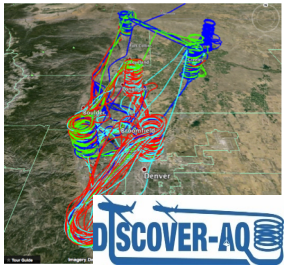
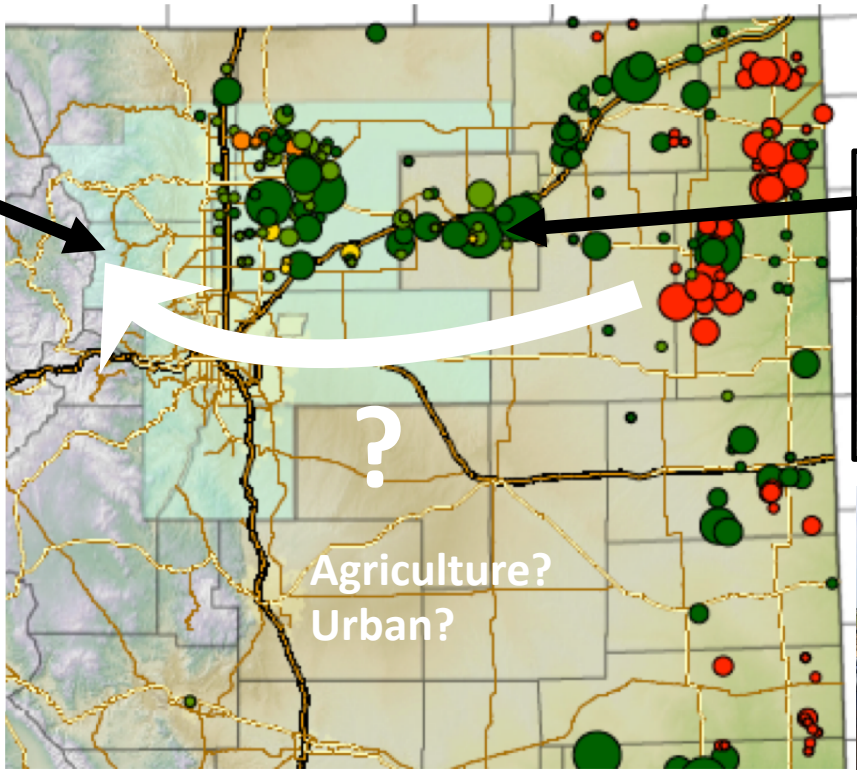
- (-) Unlike other tracers, NH<sub>3</sub> in-situ datasets limited, large uncertainties
- (+) IASI and CrIS clearly see moderate pollution at the single pixel level

# Ammonia emissions, deposition, and transport from agricultural regions

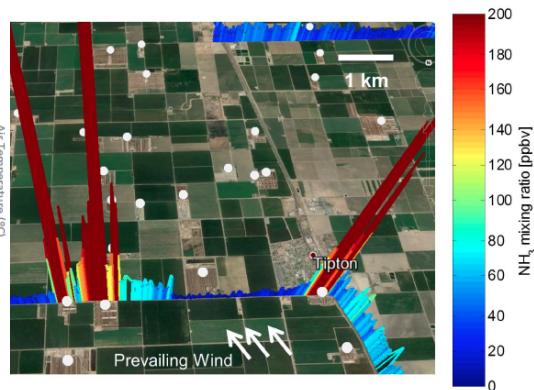
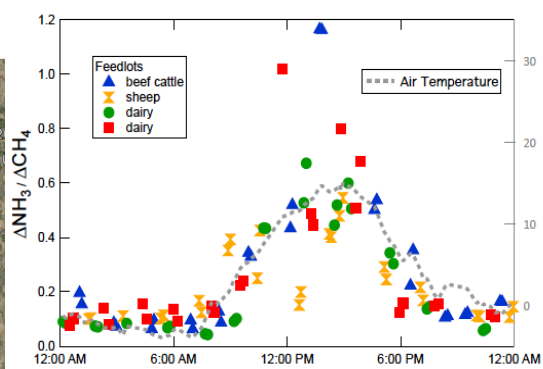
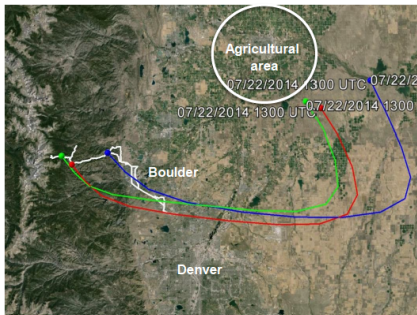
What are sources of N-deposition in Rocky Mtn. Natl. Park?



*Upslope Flux: -2.0 ng/m<sup>2</sup>/s*  
*Downslope Flux: -0.1 ng/m<sup>2</sup>/s*



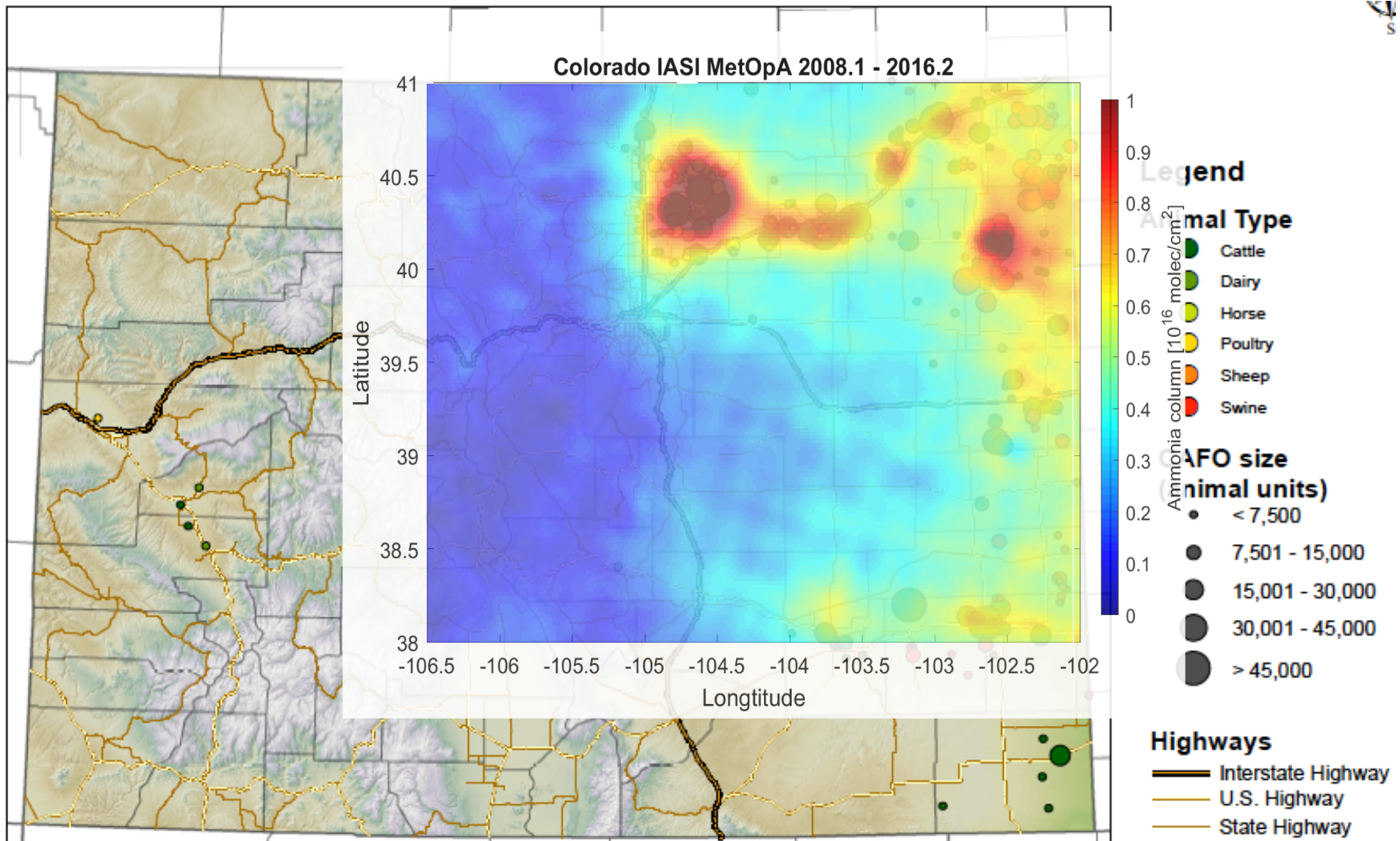
Backwards trajectories from HYSPLIT (12 hours)  
18:00 07/22/2014





# Ammonia measurements in northeast Colorado

IASI oversampling algorithm developed by Kang Sun – effective ~ 2 km resolution



Agriculture dominating  $\text{NH}_3$  deposition in mountain ecosystems along Front Range

*Future work: seasonal patterns,  $\text{NH}_3$  lifetime estimate, and CrIS  $\text{NH}_3$  maps*

**Future work**

- comparison of IASI and CrIS NH<sub>3</sub>
- seasonal and annual maps of NH<sub>3</sub> in other regions
- working with stakeholders on NH<sub>3</sub> emission inventories (CMAQ)
- large, episodic emissions with fertilizer application, PM2.5 increases

**Posters**

Da Pan:

*Intercomparison of Ammonia Observations from Policy Making Perspective*

Xuehui Guo:

*Feasibility of Using IASI Satellite NH<sub>3</sub> for Air Quality Monitoring*

Rui Wang:

*Validation of CrIS NH<sub>3</sub> Observations in the San Joaquin Valley during DISCOVER-AQ*