CrIS NH_3 and CO Retrievals: From Idea to Applications

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JPSS/GOES-R Proving Ground / Risk Reduction Summit
24-28 February 2020

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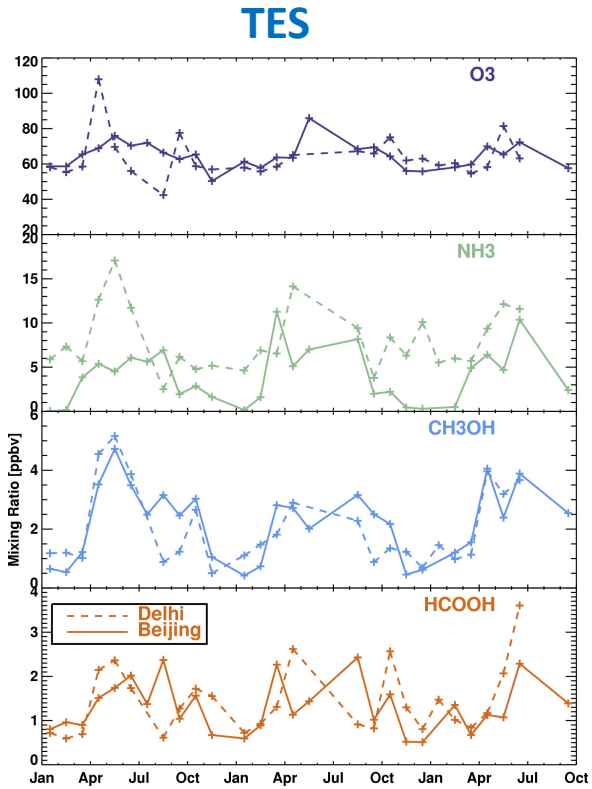
Using (TIR) Satellites to Study Atm. Composition



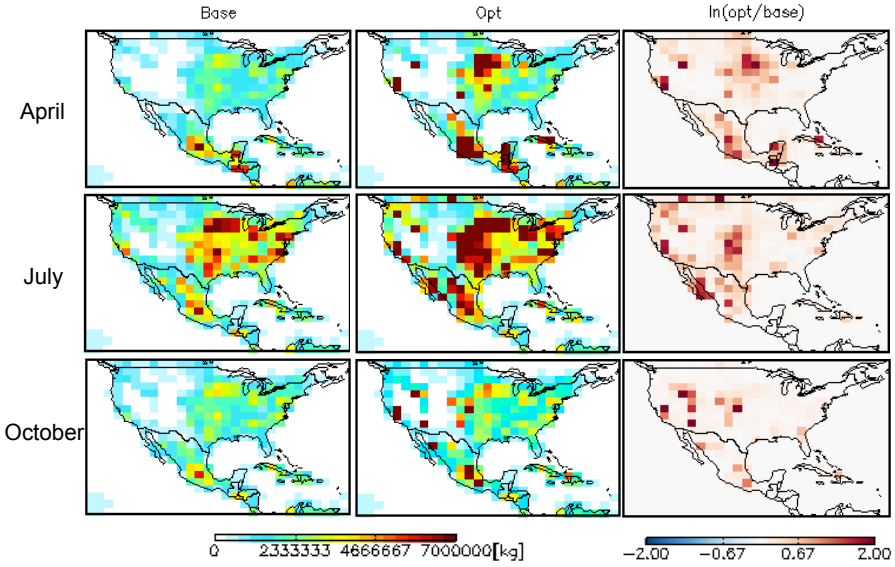
Beijing

Delhi

Cady-Pereira et al., 2017

Moving from TES to CrIS

Using TES to Optimize NH_3 Emissions



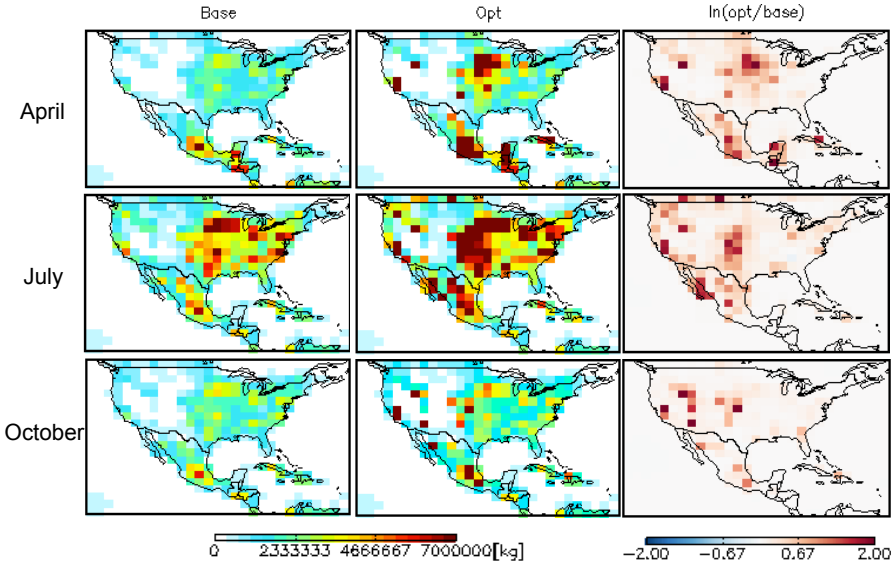
Zhu et al., 2013, JGR

TES and CrIS Comparison

	TES	CrIS
Satellite	AURA	S-NPP and JPSS-1
Dates	2004 - 2019	2011-present
Resolution	0.06 cm^{-1}	0.625 cm^{-1}
Repeat cycle	16 days	Daily
Noise in NH_3 window	0.09 – 0.12 K	0.03 – 0.06 K

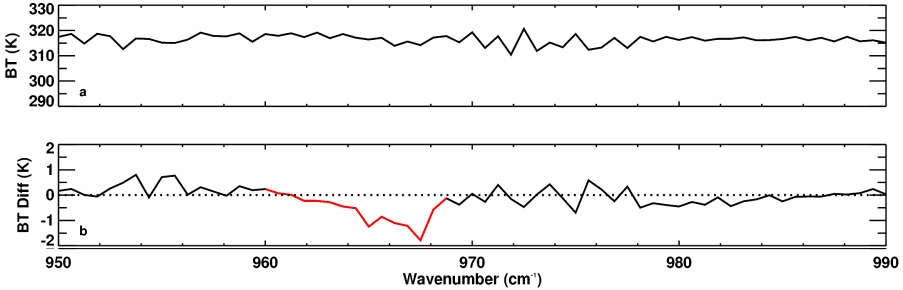
Moving from TES to CrIS

Using TES to Optimize NH_3 Emissions

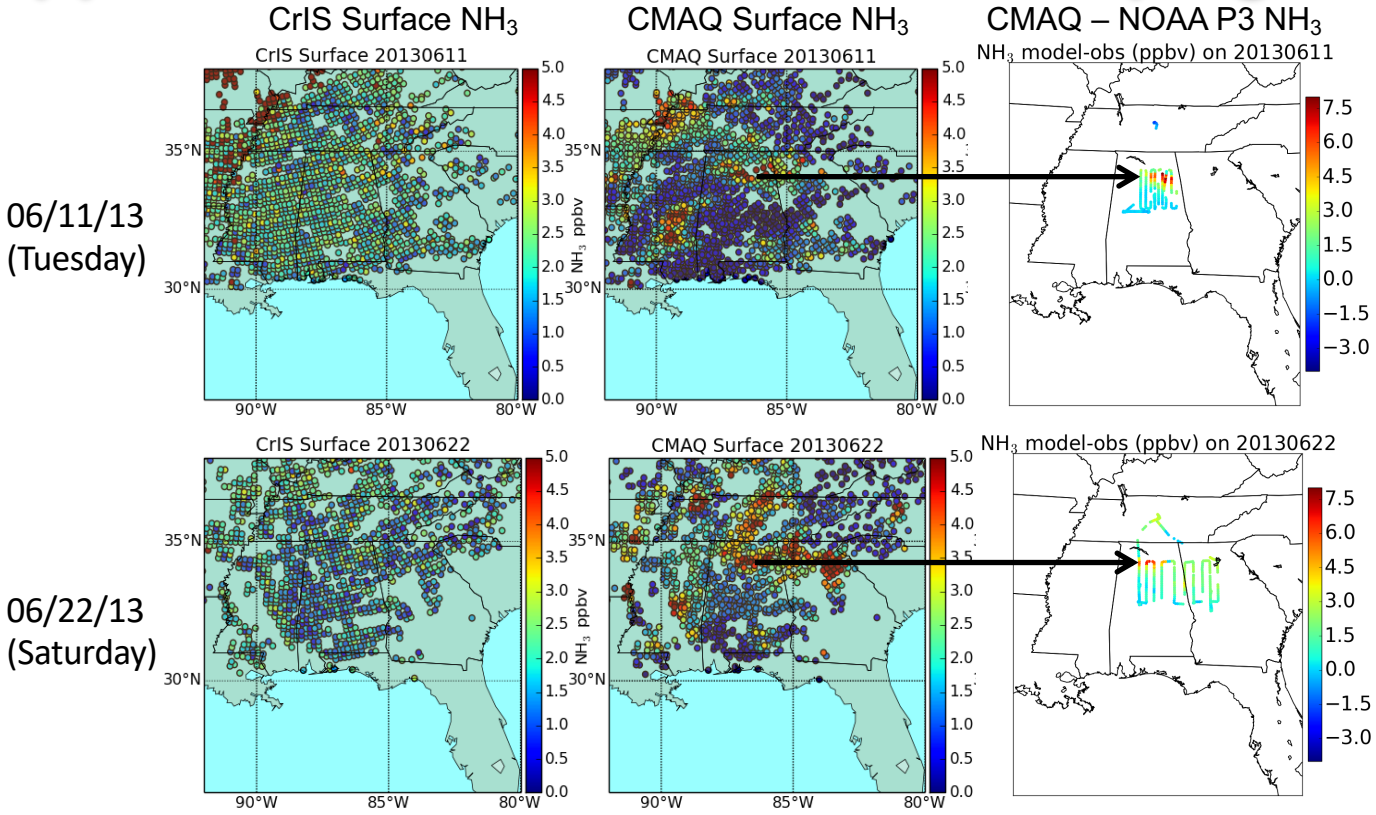


Zhu et al., 2013, JGR

Original Proof of Concept for CrIS NH_3 Retrieval from NOAA AC4 proposal

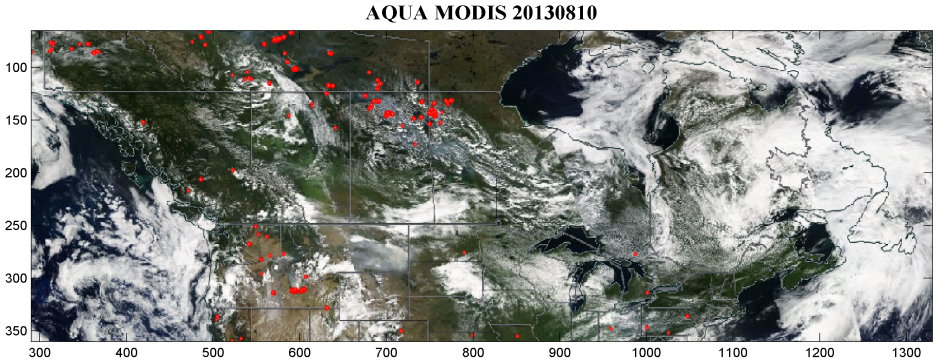


First Application in NOAA SENEX Campaign

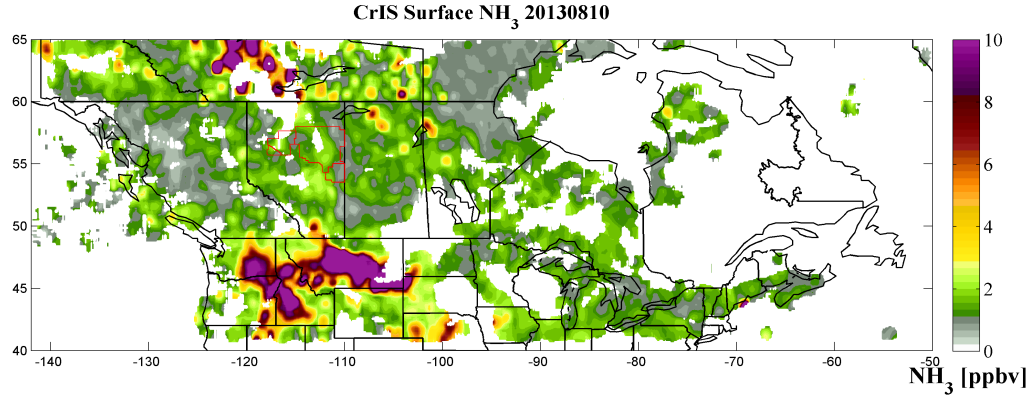


CrIS NH_3: Example of Fire Impacts

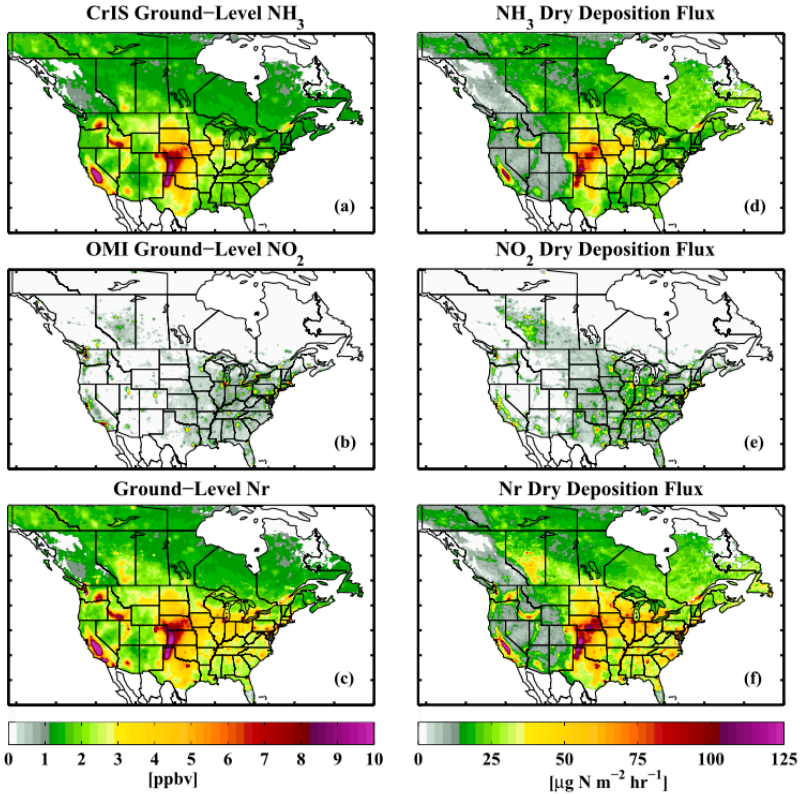
MODIS
Infrared:
Fire Detection (red)
Visible:
Cloud (White)
Smoke (blue/gray)



CrIS
Infrared:
NH_3



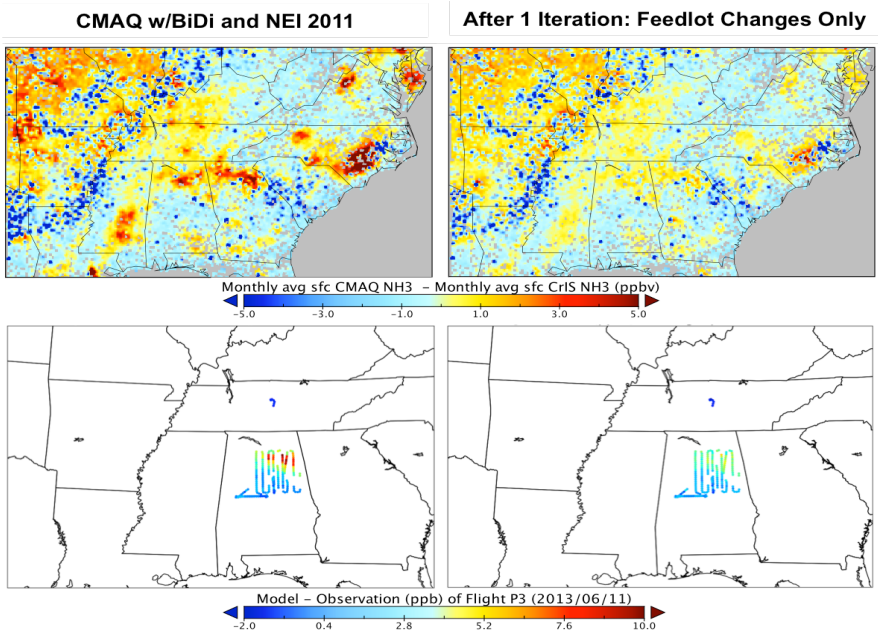
Using CrIS and OMI to Quantify Reactive N Deposition



- GEM-MACH model used to estimate diurnal cycles and deposition velocities
- NH_3 dry dep is lower in Intermountain West due to lower deposition velocities
- NO_2 dry dep hot spots are mainly located over urban and industrial regions (e.g., oil and gas development in Alberta).

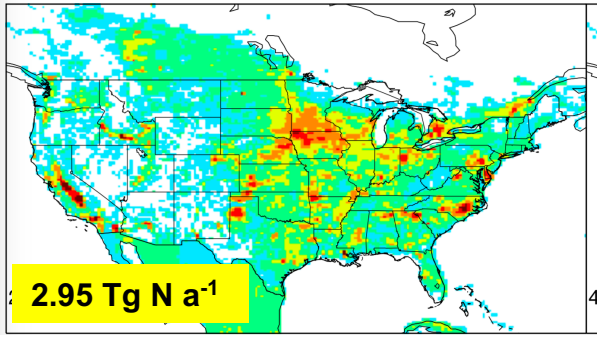
Kharol et al., GRL, 2018.

Optimizing Emissions with CrIS NH_3

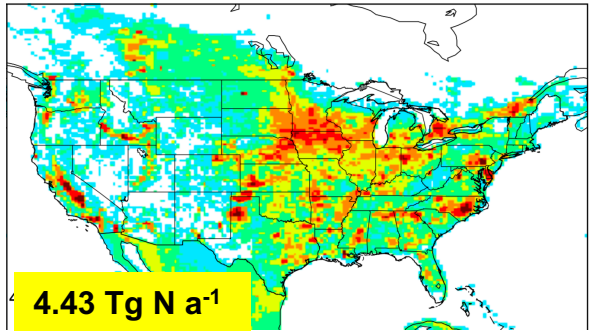


Lonsdale et al., in prep

Priori



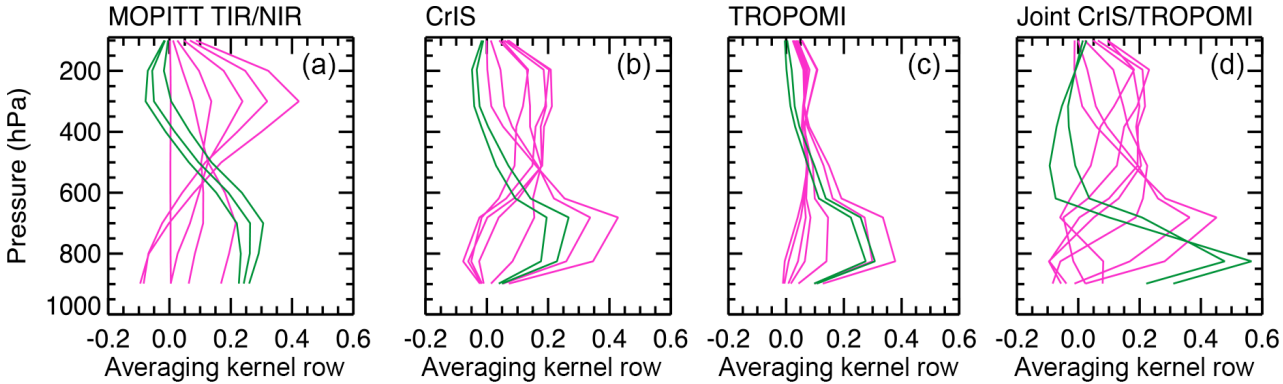
Posteriori



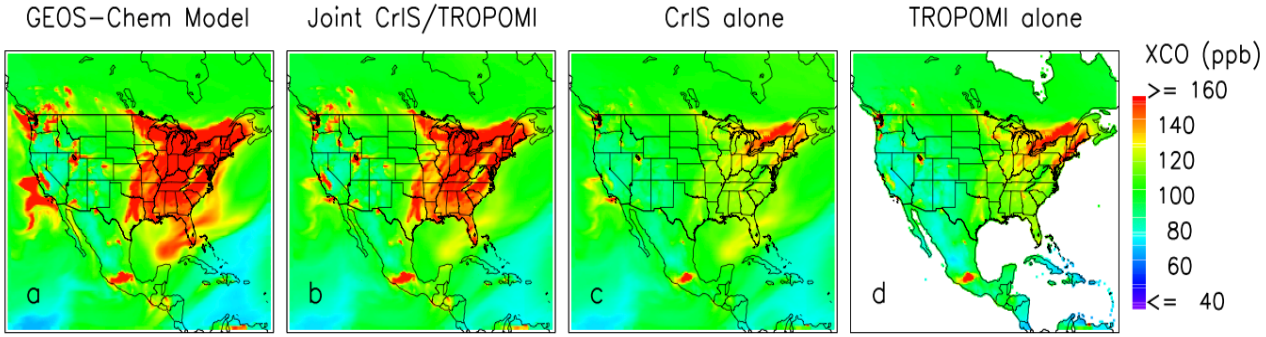
Cao et al., in prep

Extending the MOPITT CO record with CrIS and TROPOMI

Averaging Kernels
From Fu et al., AMT, 2016 – Using MUSES Algorithm for single pixel, OE retreivals



Simulated retrievals of surface layer CO (0-2km)



Where Should We Go From Here?

More Species More Often

- Get as complete spectral coverage as possible
- Geostationary TIR
- Seed funding before full product?

Nitrogen cycle studies

- NH_3, NO_x, PAN, and N_2O are all part of a larger N cycle that includes soil and ocean biology and chemistry
- *Use GOES/JPSS observations as part of a more comprehensive satellite picture of N cycle*