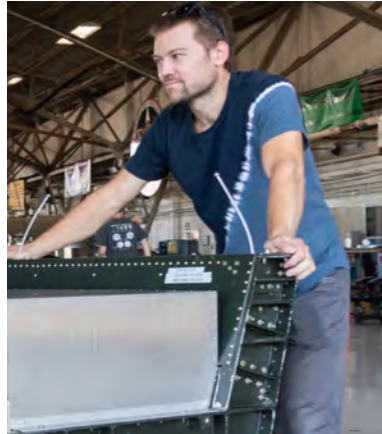


NO_x/NO_y and O₃ measurements on the DC-8 for AEROMMA



Kristen Zuraski



Drew Rollins



Eleanor Waxman



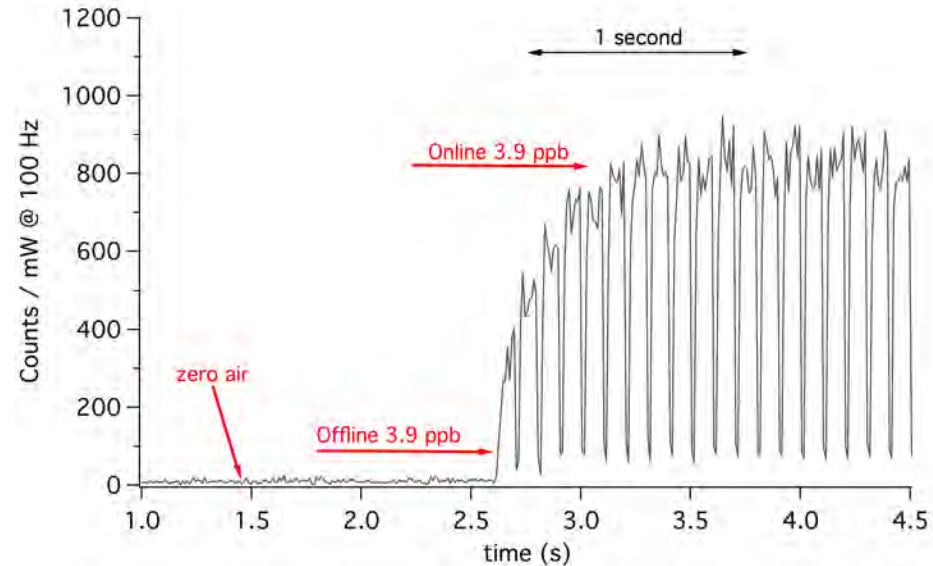
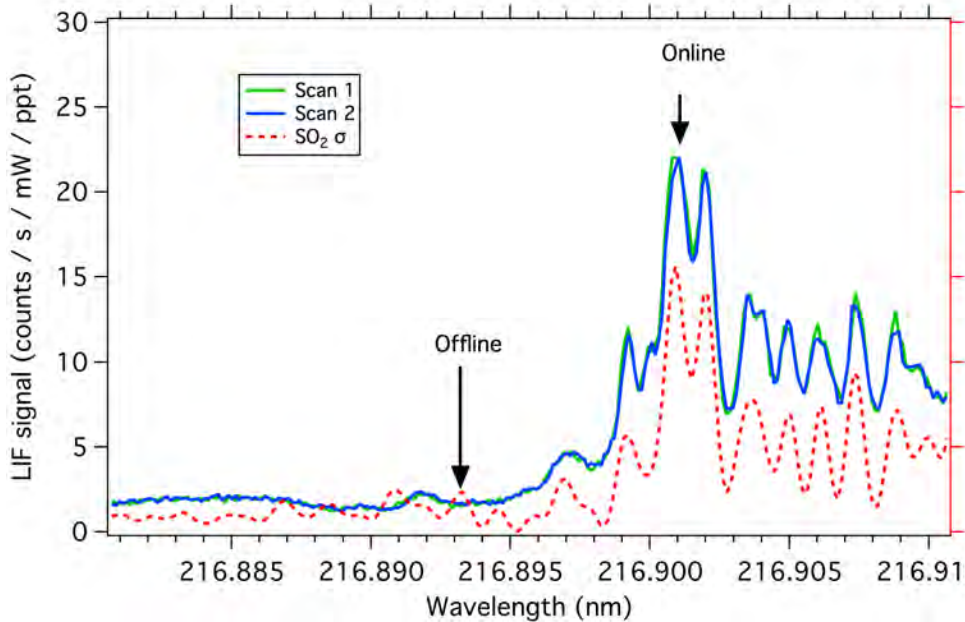
Jeff Peischl

SO₂ LIF Technique

- Laser excitation @ 216.9 nm
- Fluorescence collection ~300-400 nm
- 1 s detection limit: < 5 ppt

SO₂ - LIF Heritage

- VIRGAS 2015 (WB-57)
- POSIDON 2016 (WB-57)
- HOPE-EPOCH 2017 (Global Hawk)
- ATom-4 2018 (DC-8)
- FIREX-AQ 2019 (DC-8)



SO₂ Science Foci

Marine

- SO₂ deposition
- Marine sulfur budget closure
- Aerosol nucleation / growth

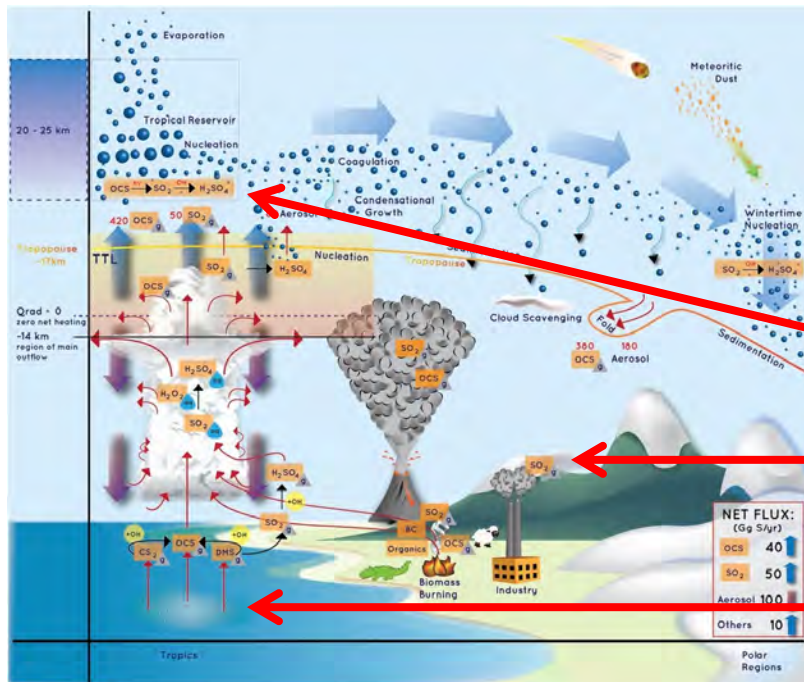
Continental

- Anthropogenic sulfur emissions
- Sulfur oxidation chemistry

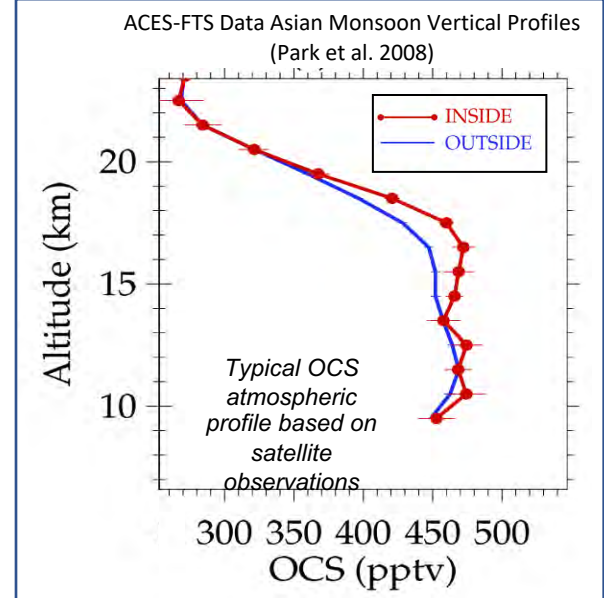
NOAA Airborne Carbonic Oxides and Sulfide Spectrometer (ACOS)

Airborne in-situ instrument designed to study Carbonyl Sulfide (OCS)

- Most abundant Sulfur species in atmosphere
- Lifetime ~1 year
- Low water solubility
- Assumed uniform tropospheric concentration (~500PPT)



Kremser, Stefania, et al. "Stratospheric aerosol—Observations, processes, and impact on climate." *Reviews of Geophysics* 54.2 (2016): 278-335.

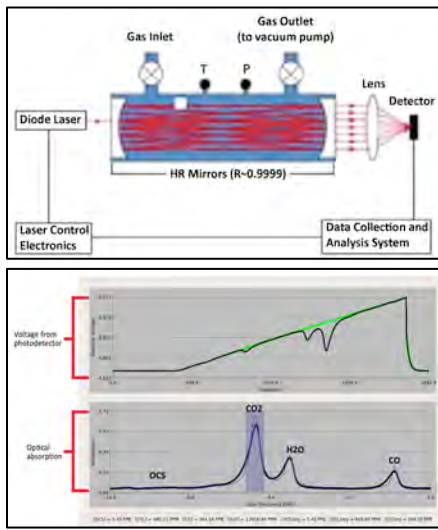


- Carbonyl Sulfide Stratospheric Photo Conversion

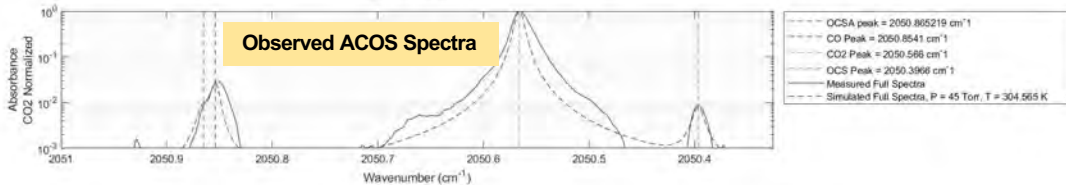
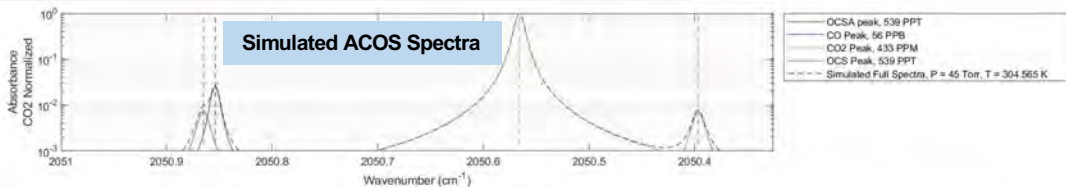
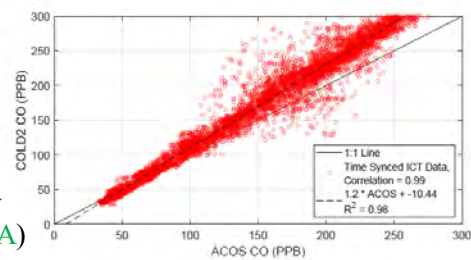
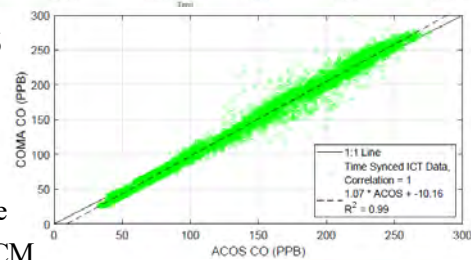
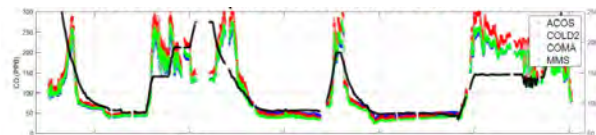
$$\text{OCS} \rightarrow \text{SO}_2 \rightarrow \text{H}_2\text{SO}_4$$
- Carbonyl Sulfide Anthropogenic Production from CS₂ Oxidation?
- Carbonyl Sulfide Ocean Production

NOAA Airborne Carbonic Oxides and Sulfide Spectrometer (ACOS)

- ICOS Based multi-pass spectrometer
- Derived from commercial LGR-OCS spectrometer
- Scan range 2050-2051 cm⁻¹
- Sampled Species:
OCS, CO, CO₂

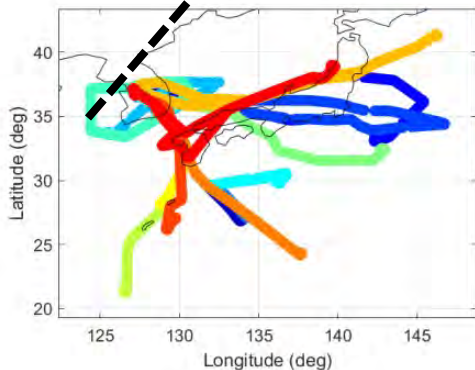
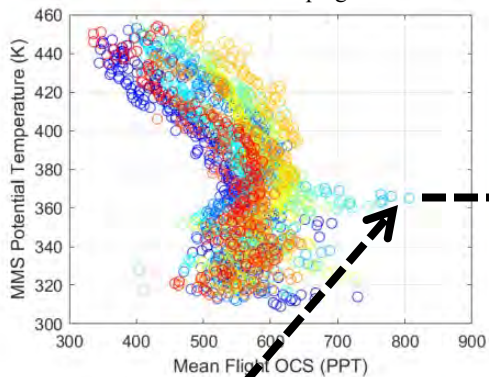


- Deployed for 26 flights during ACCLIP
- 1Hz real-time data with sample flow of 500 SCCM
- Excellent agreement with co-located CO measurements preliminary data (COLD2, COMA)

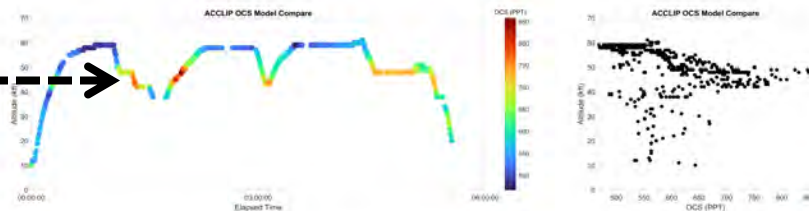


NOAA Airborne Carbonic Oxides and Sulfide Spectrometer (ACOS)

Preliminary Atmospheric OCS Profile from ACCLIP Campaign



- During ACCLIP, Consistent Atmospheric Profile for OCS.
- Some instances of high OCS concentrations observed during fresh pollution events from Asian Monsoon (high CO tracer concentration)



AEROMMA ACOS Objectives

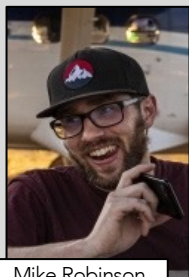
- Increase lower tropospheric OCS/CO observations for remote sensing validation
- Catalog vertical profiles of OCS in the presence of major sources:

- 1. Ocean Fluxes (Primary Production)**
- 2. Megacity Pollution**

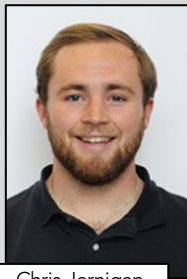


The NOAA Iodide CIMS Research Group

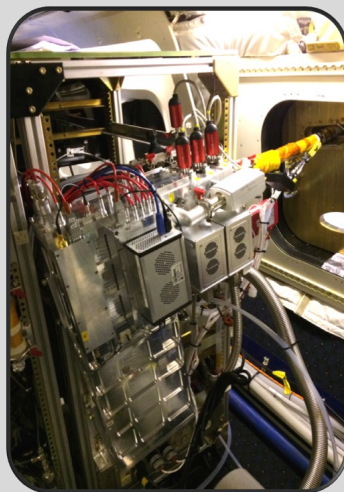
Patrick Veres, Mike Robinson, Chris Jernigan
 NOAA Chemical Sciences Laboratory (CSL) and Cooperative Institute for
 Research in Environmental Sciences (CIRES)



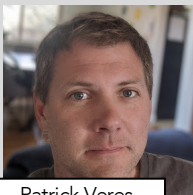
Mike Robinson



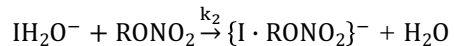
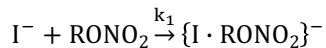
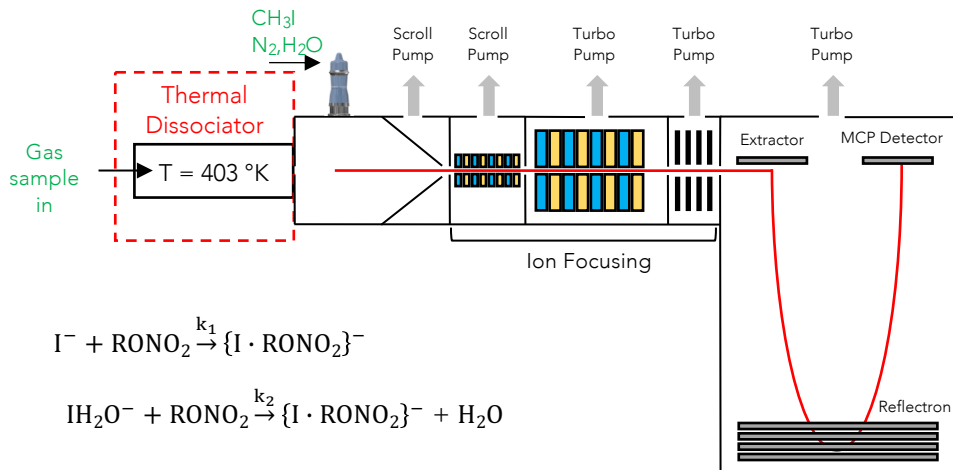
Chris Jernigan



Contact: patrick.veres@noaa.gov



Patrick Veres



AEROMMA Target Species

Reactive nitrogen species:
 HONO, HNCO

Halogen species:
 ClNO_2 , Cl_2 , BrO, BrCl, BrCN

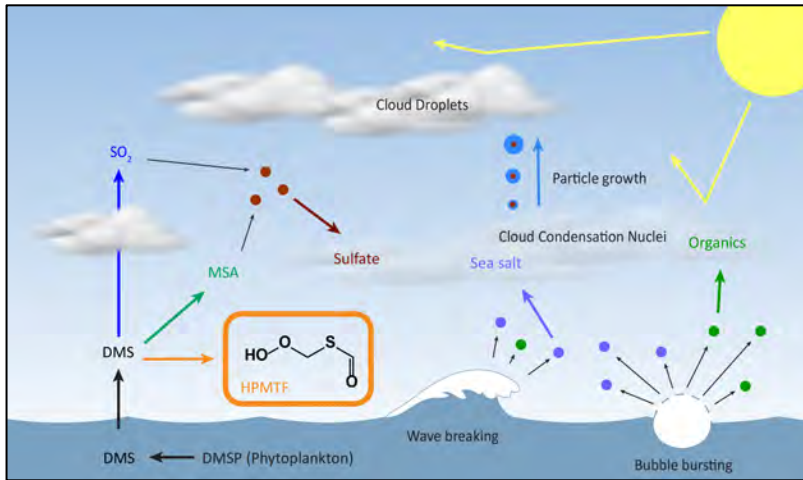
Organic Species:
 Low to intermediate volatility
 oxygenates

Organic nitrates:
 Isoprene hydroxy nitrate,
 MVK nitrate, α -pinene
 hydroxy nitrate...

Misc:
 HPMTF
 PANs (PAN, APAN, PPN)
 HCN

Iodide CIMS Group Science Foci

Marine sulfur cycle and new particle formation from DMS oxidation

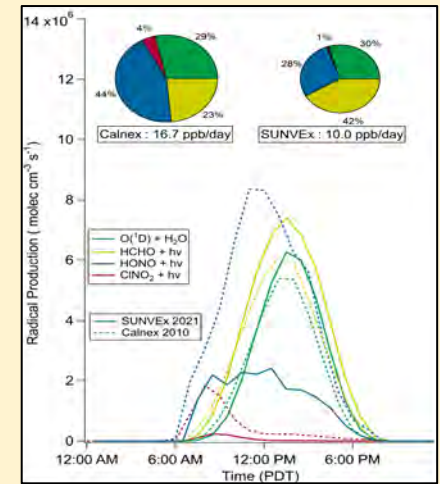


Utilize field observations to further constrain, evaluate, and improve modelling of the marine sulfur system

Constraining Radical Budgets in Urban Regions

Improve our understanding of radical budget sources in Urban areas, particularly atypical sources (ClNO₂, HONO).

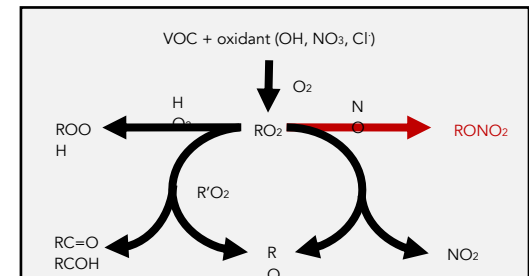
Observationally constrained radical budgets (Calnex 2021, SUNVex 2021)



Robinson et al. (in progress)

Impact of organic nitrates on NO_x removal and oxidant distributions

New RONO₂ calibration methods will provide fresh insight into the role of these species

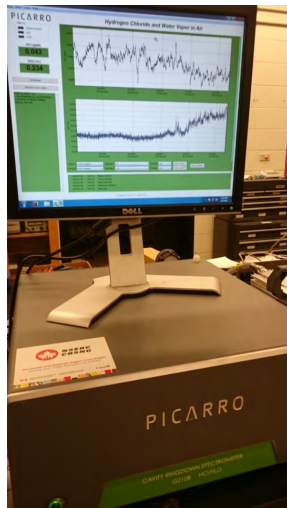


THE CIX Chlorine Measurements

1. Four HCl measurements

i. Picarro CRDS

- YorkU (Young)
- 0.5 Hz
- LOD: 18 pptv (30 s)



ii. Aerodyne TILDAS

- UYork (Edwards)
- 1 Hz
- LOD: 4 pptv (30 s)



iii. ToF-CIMS (acetate)

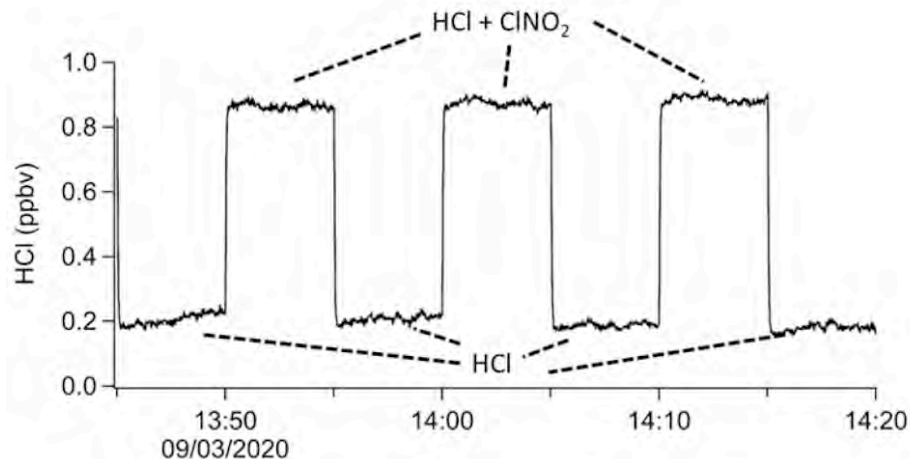
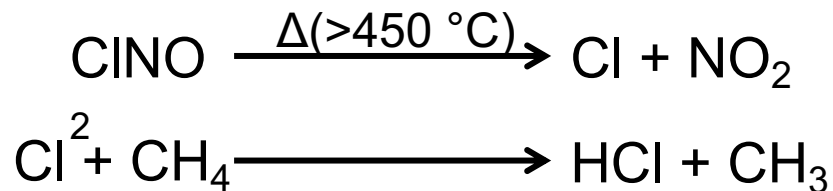
- YorkU (VandenBoer)
- ~1 Hz

iv. Ambient ion monitor-IC

- YorkU (Young)
- 1 hr
- Also measures particulate chloride

THE CIX Chlorine Measurements

2. Modified HCl TILDAS for ClNO₂



3. I-CIMS

- Likely quad CIMS (some chance of ToF CIMS)

THE CIX Chlorine Measurements

4. Modified HCl CRDS for total gaseous Cl

