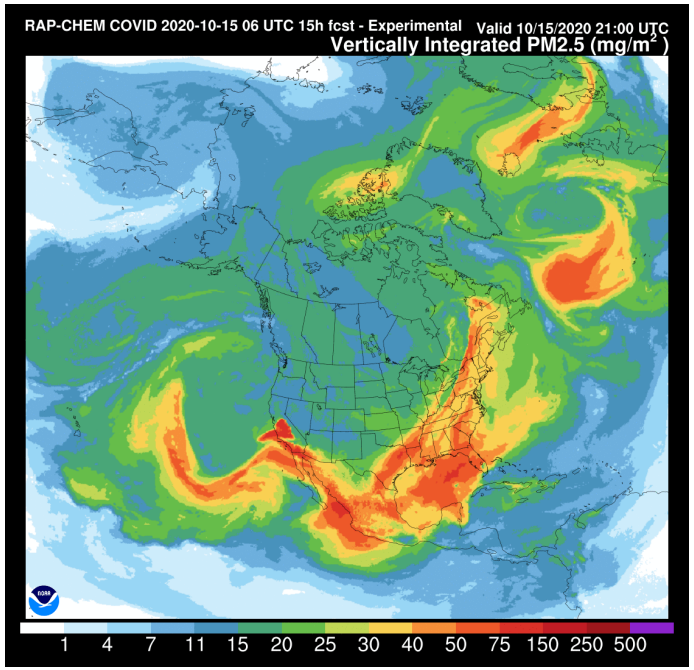
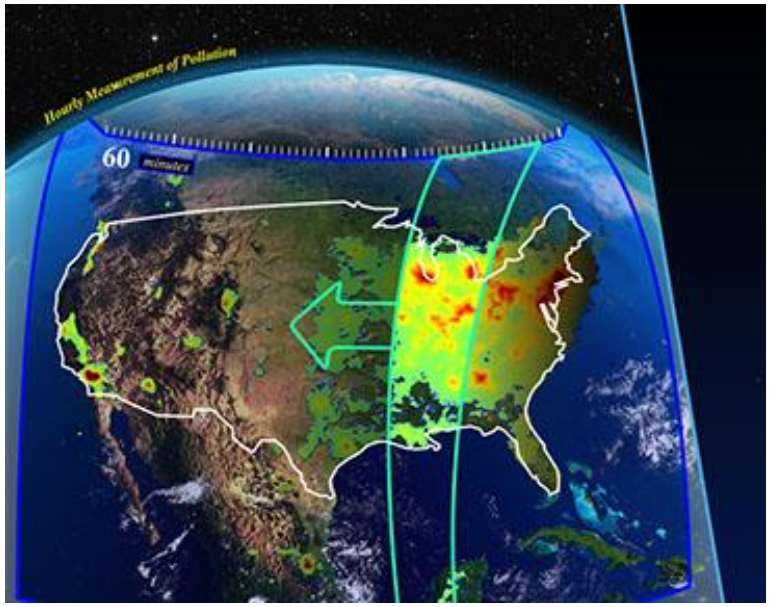
Comprehensive Airborne Sampling to Characterize GEO Satellite Observations and Data Products



TOAR tropospheric ozone assessment report Phase II



CSL NOAA CHEMICAL SCIENCES LABORATORY

Brian C. McDonald, Ph.D.

NOAA Chemical Sciences Laboratory, Boulder, CO

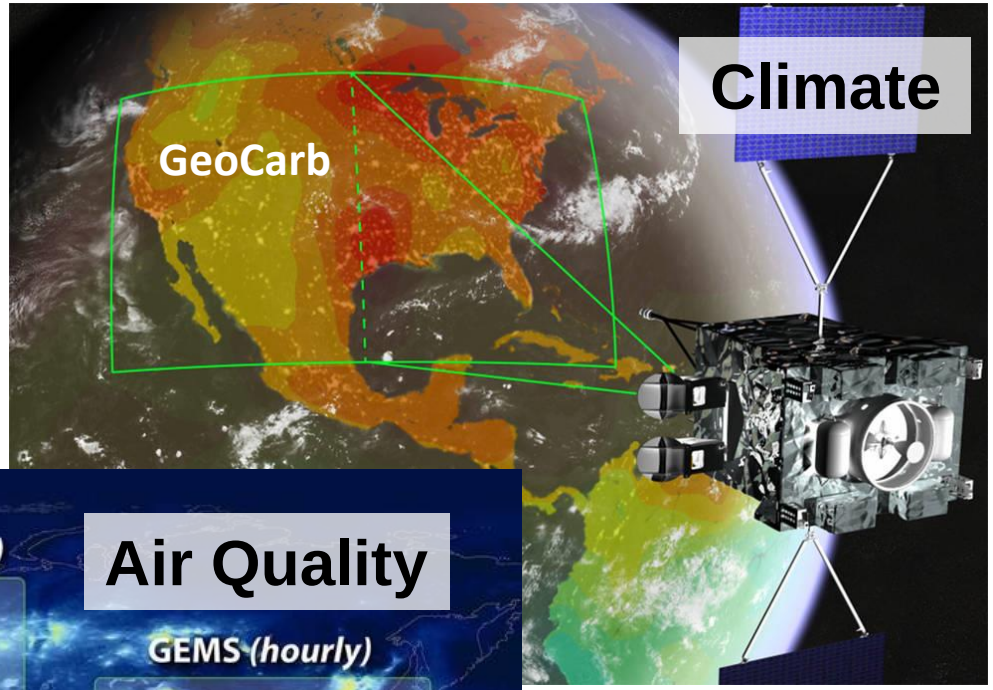
CIRES

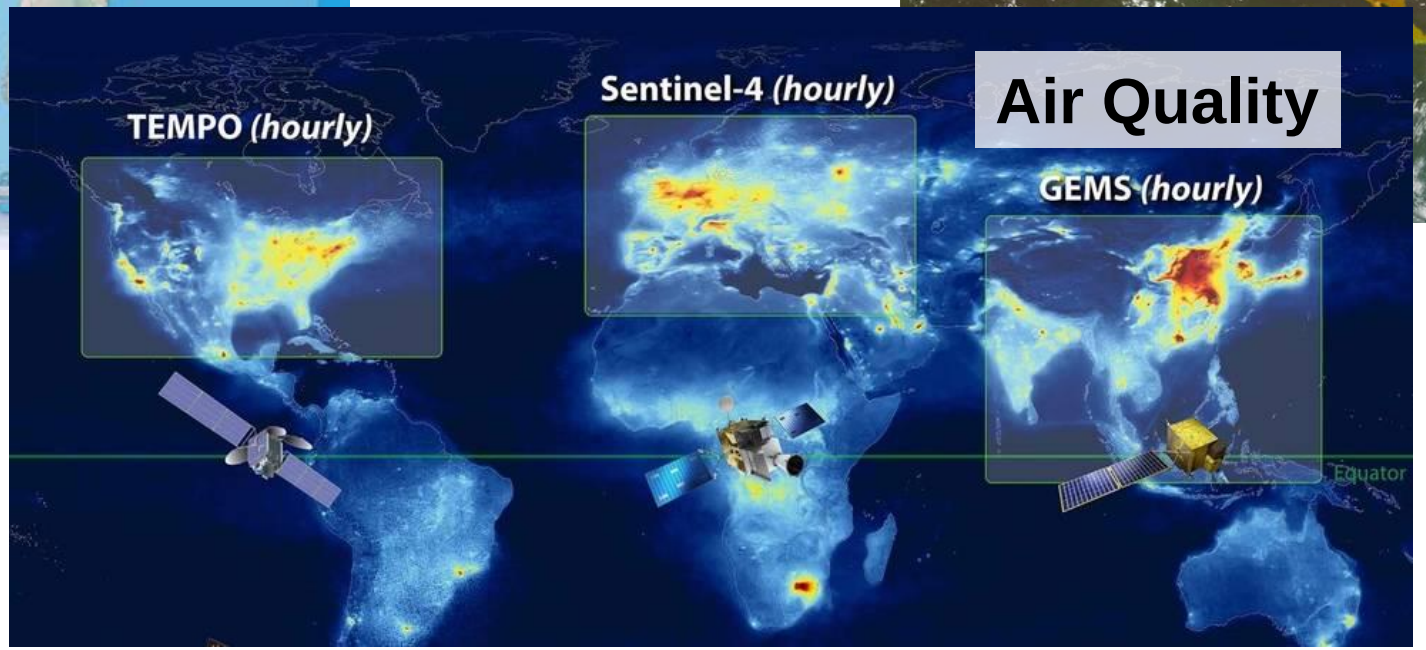
University of Colorado Boulder

NOAA

NOAA GEO-XO Atmospheric Composition Town Hall (April 29, 2021)

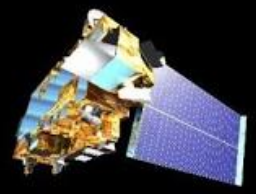
Near-Term Proving Ground of Geostationary Observations





Before GEO-XO launches in the early 2030's, opportunity to learn from existing and soon-to-be launched geostationary satellites, including for **air quality forecasting** and **emissions monitoring** capabilities.

Comprehensive Airborne Field Missions (e.g., FIREX-AQ)



Satellites: Remote Sensing

Laboratory studies in 2016
Field Intensives 2018 and 2019

NASA ER-2

NOAA/NASA FIREX-AQ

Aircraft: Intermediate to Continental

Chem. & Phys. Processes

CHEM Twin Otter

MET Twin Otter

Multiple other agencies, universities, and partners

Emissions

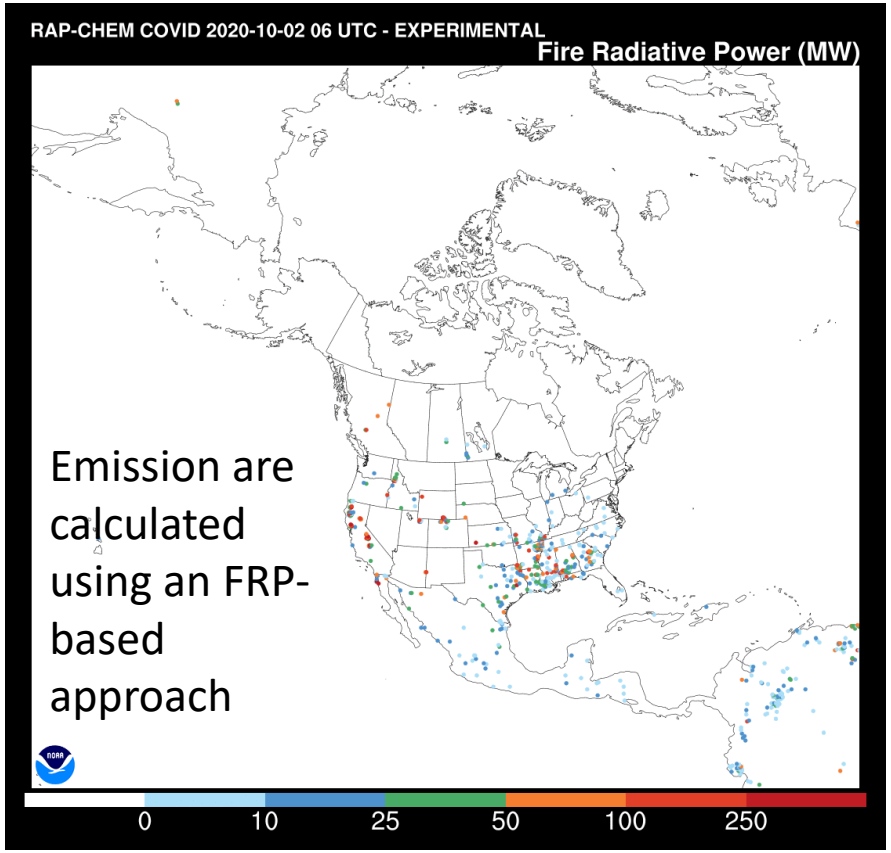
Impacts

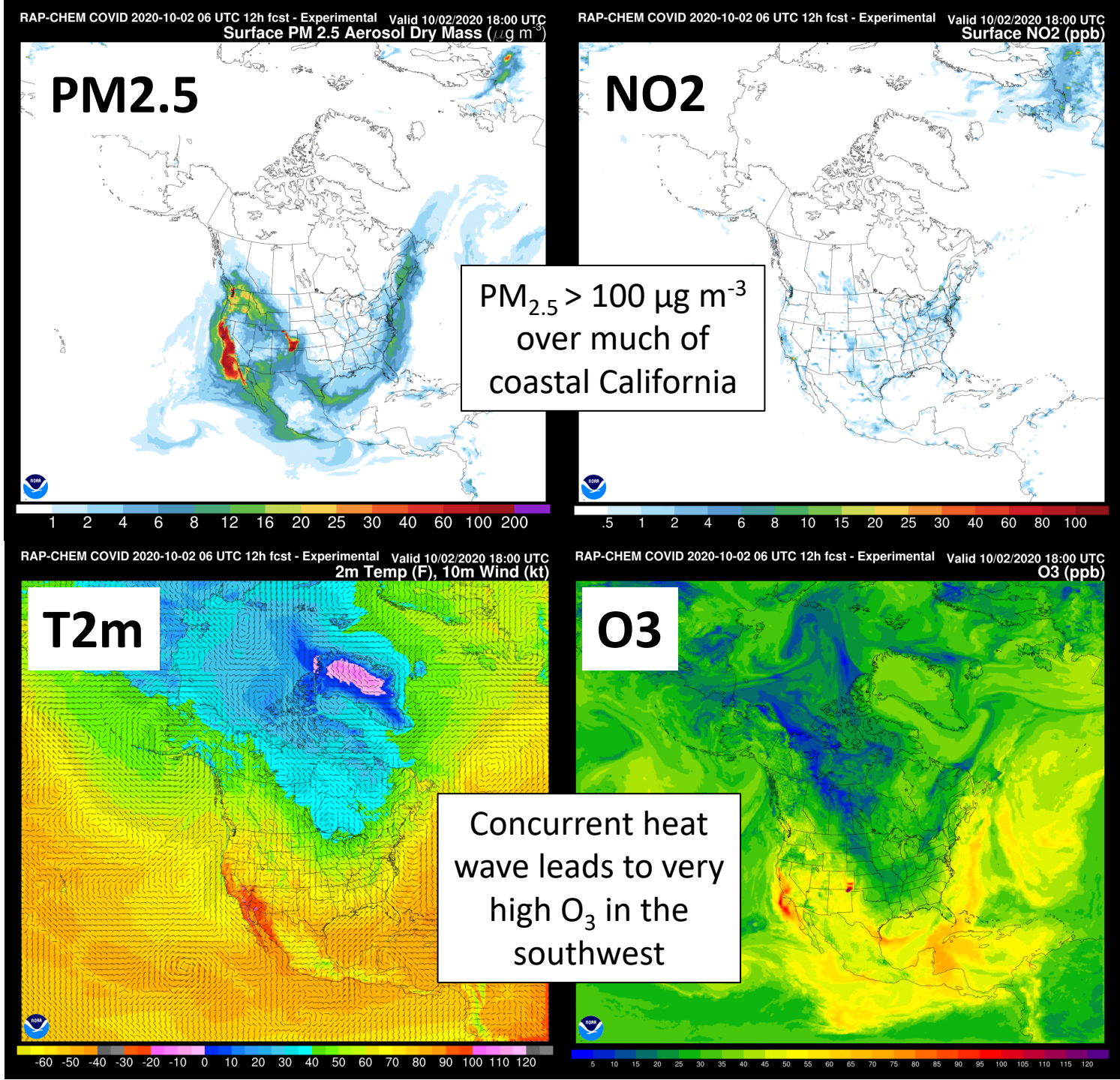
NSF WECAN
C130 aircraft study 2018

JFSP Western Wildfire Campaign
JFSP source fuel fire study 2019

Mobile Ground Sites: NASA LARGE GROUP, Aerodyne Mobile lab, NASA DRAGON, UNH/Brown Mobile Lab
Ground sites – Mt. Bachelor, U-M, Boise

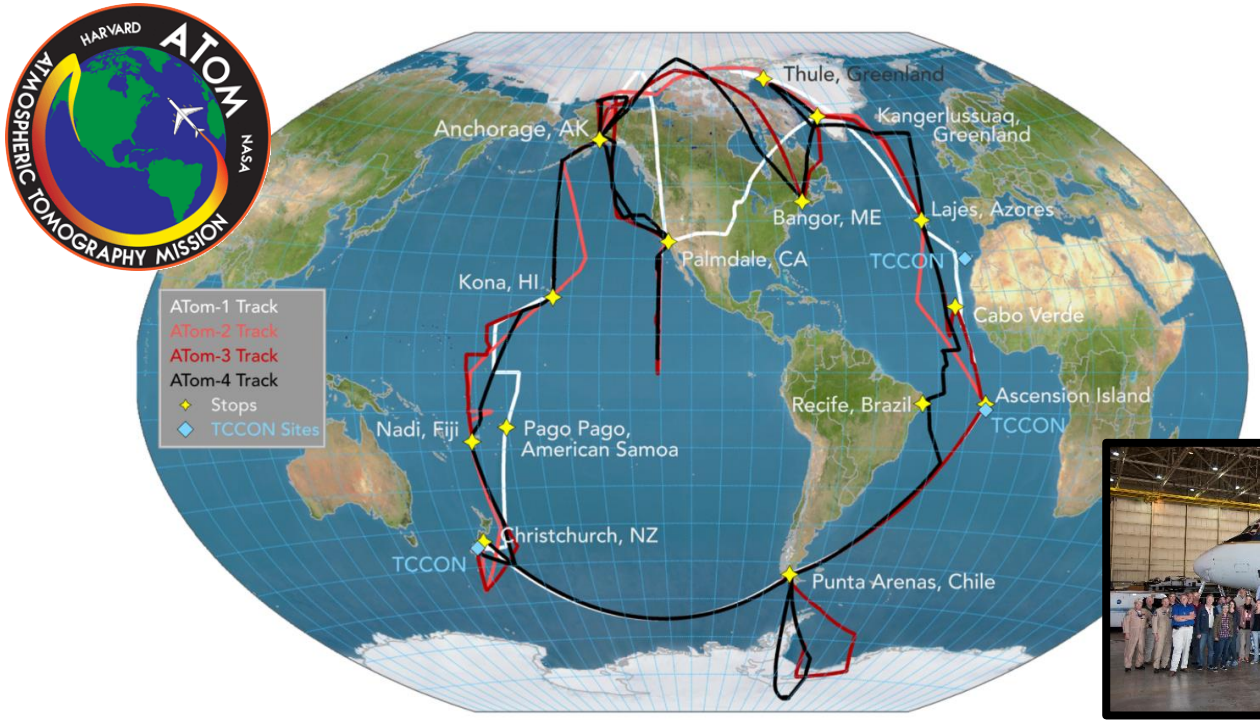
Improving wildfire emissions (NO_X, CO, VOCs, speciated PM) + plume-rise for AQ forecasting

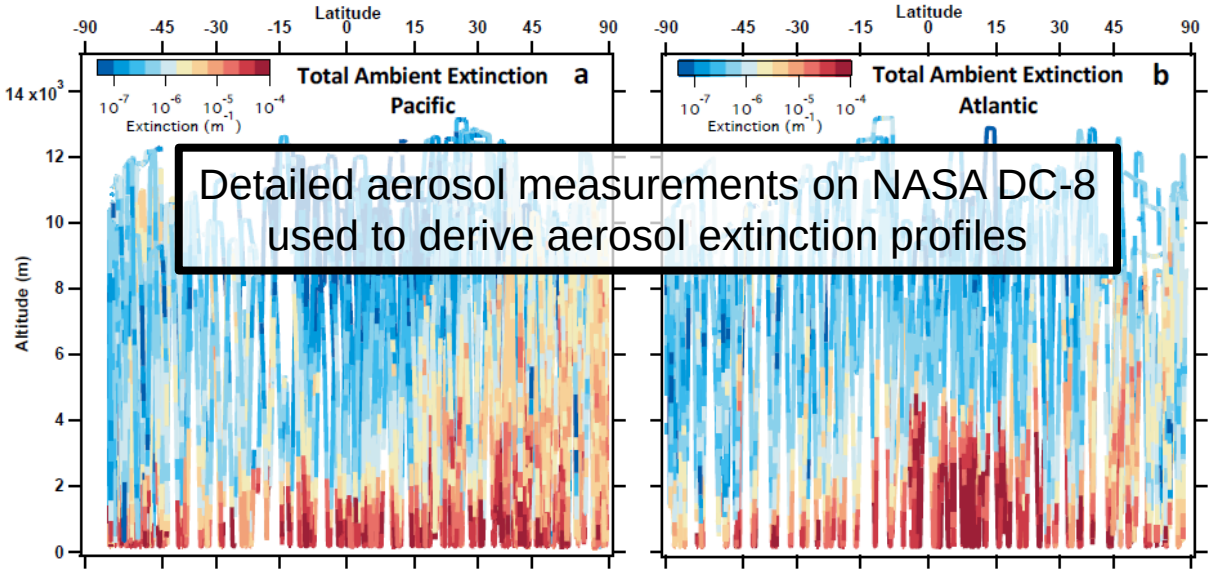




Point of Contact:
Ravan Ahmadov (ravan.ahmadov@noaa.gov)

Atmospheric Tomography Mission (ATom) 2016-18





Detailed aerosol measurements on NASA DC-8 used to derive aerosol extinction profiles

Brock et al. (in review)

Comparison of AOD from in-situ aircraft measurements with NOAA's VIIRS Satellite

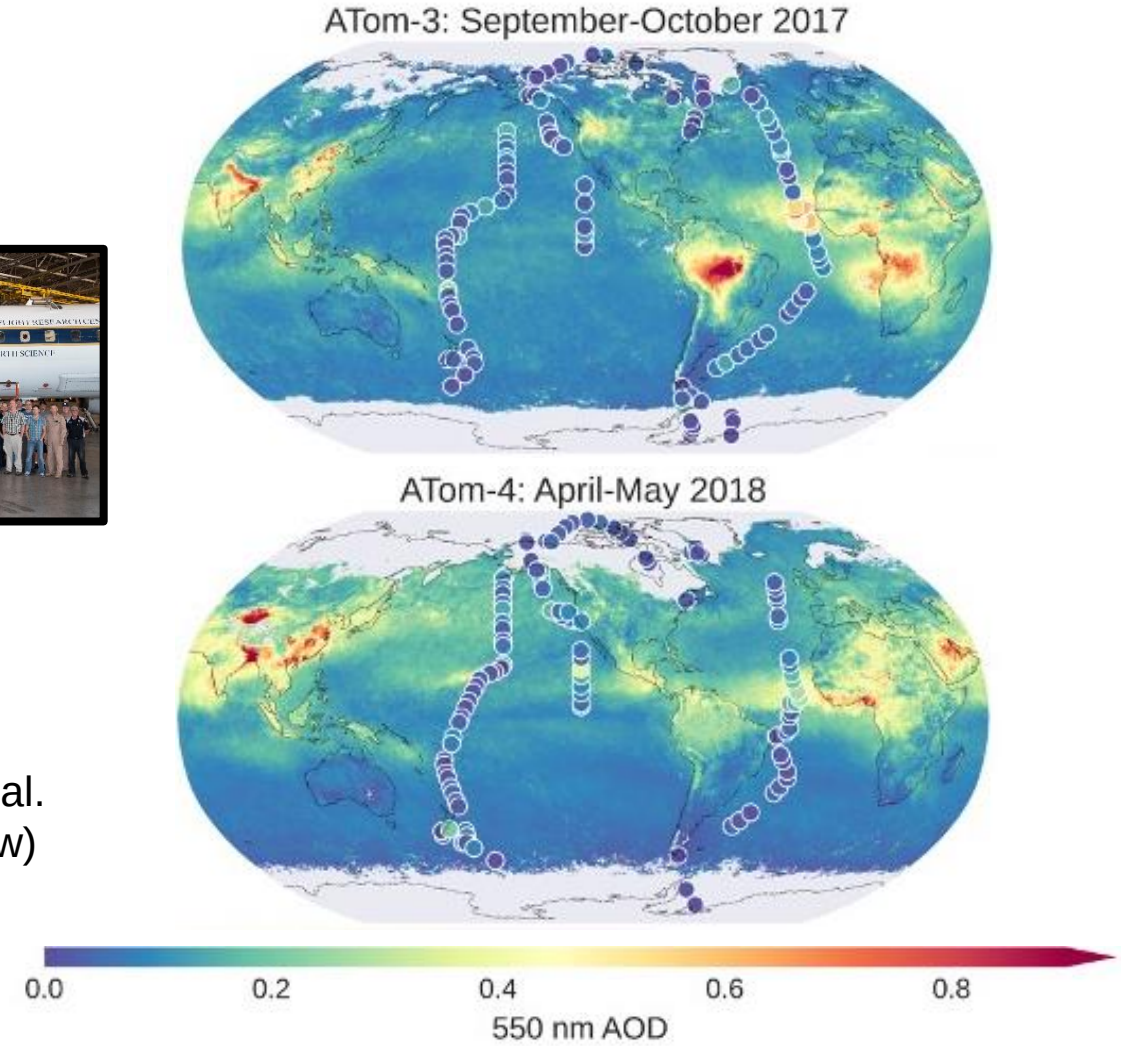
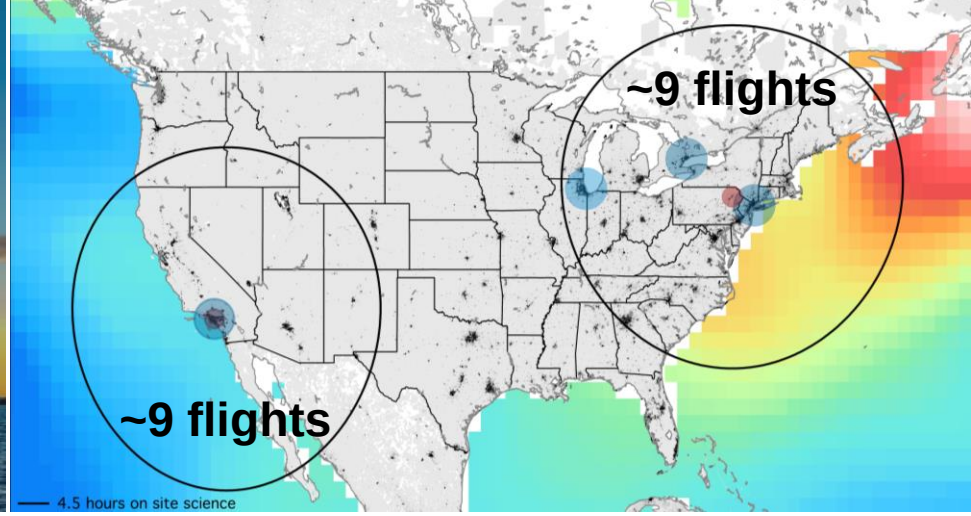
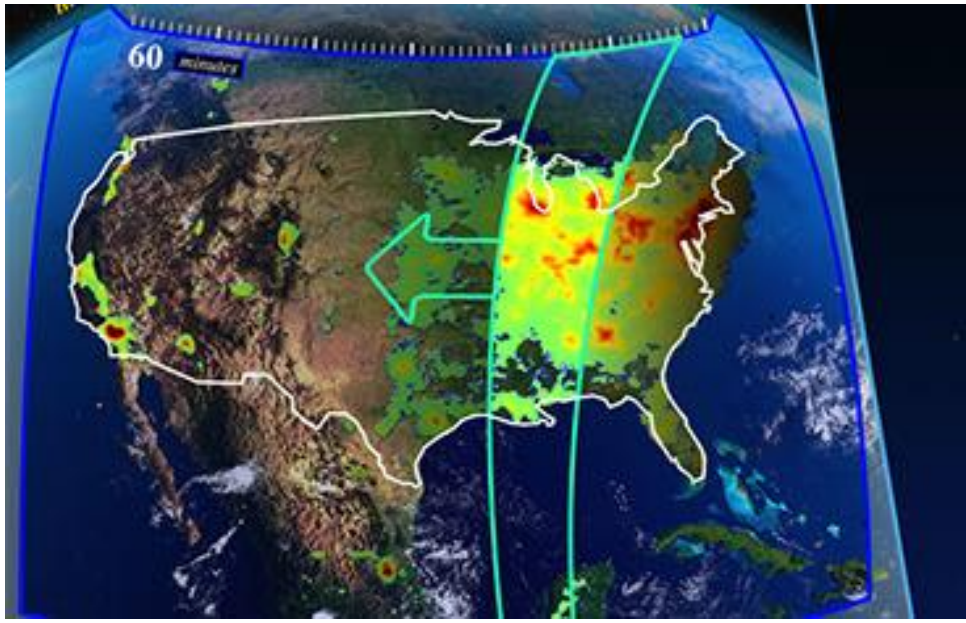


Figure provided by S. Wang (NOAA)



NOAA CSL airborne mission to investigate:

- **trace gases and particles** from U.S. megacities and in the marine atmosphere
- improve understanding of **urban air quality** and emission sources
- reduce uncertainty in **global climate models** from biogenic sulfur emissions



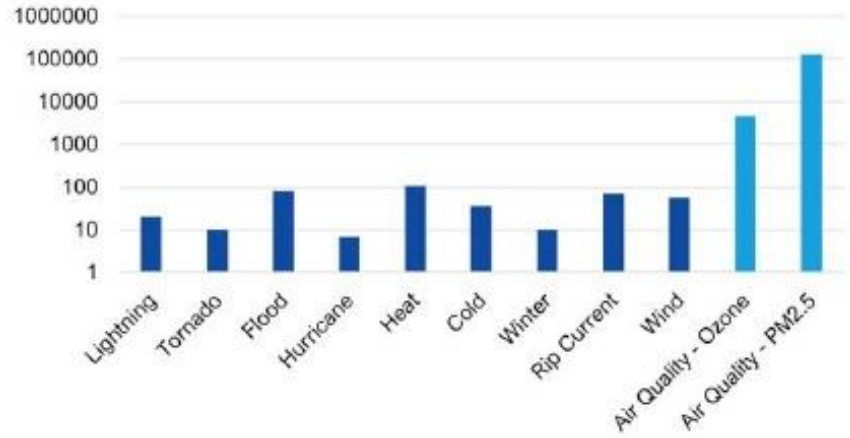
Points of Contact:
Carsten Warneke (carsten.warneke@noaa.gov)
Brian McDonald (brian.mcdonald@noaa.gov)
Patrick Veres (patrick.veres@noaa.gov)
Andrew Rollins (andrew.rollins@noaa.gov)

AEROMMA potentially coincides with launch of TEMPO in fall 2022

AQUARIUS - Air QUAlity Research In the western US

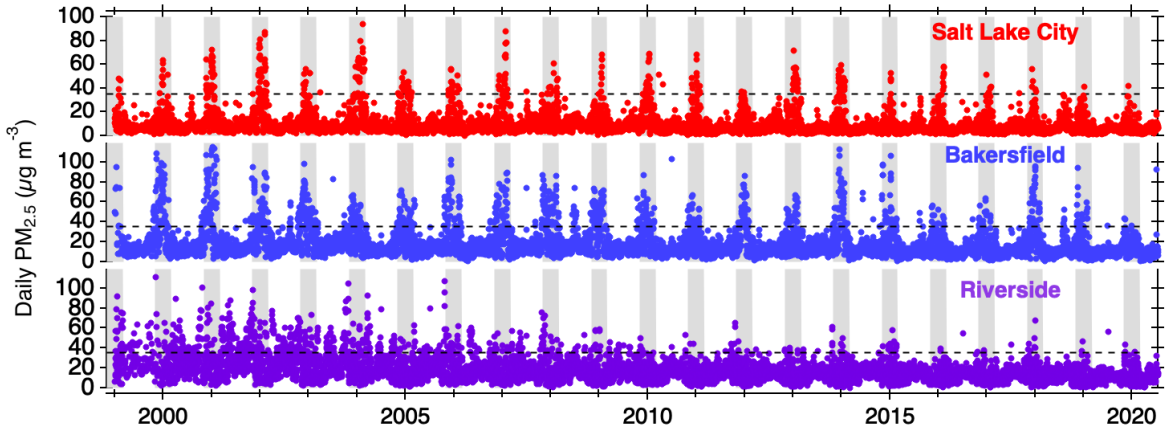
U.S. Annual Mortality due to Weather & Air Quality

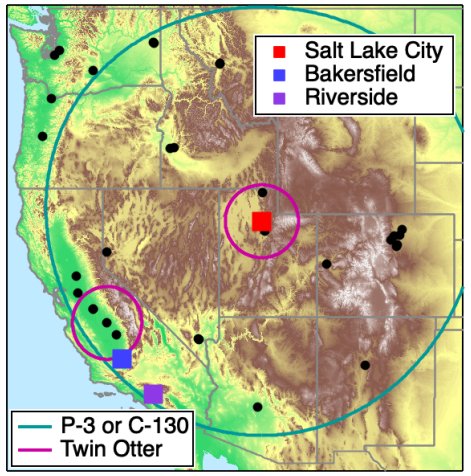
GEO-XO Report, 2020

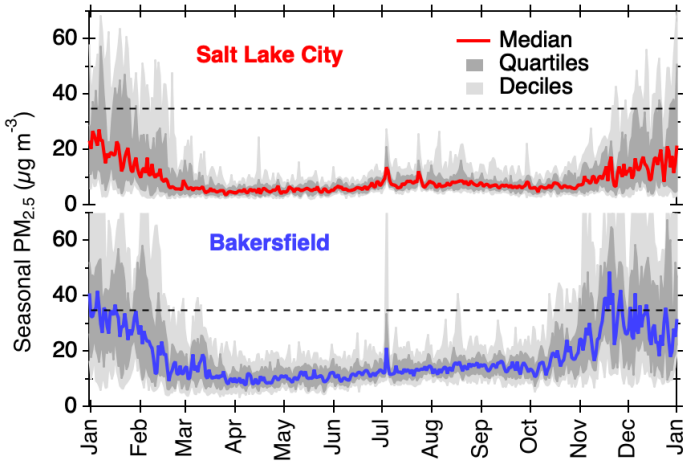


Non-attainment areas, 2006 $PM_{2.5}$ standard

October 2020







- Workshop: September 2019, Salt Lake City, 130 Participants
- White Paper: BAMS, submitted, August 2020
- Strategy: Aircraft & ground based, **2024-25**, western U.S. domain with focus on California Central Valley & Utah Great Salt Lake Basin

Point of Contacts:
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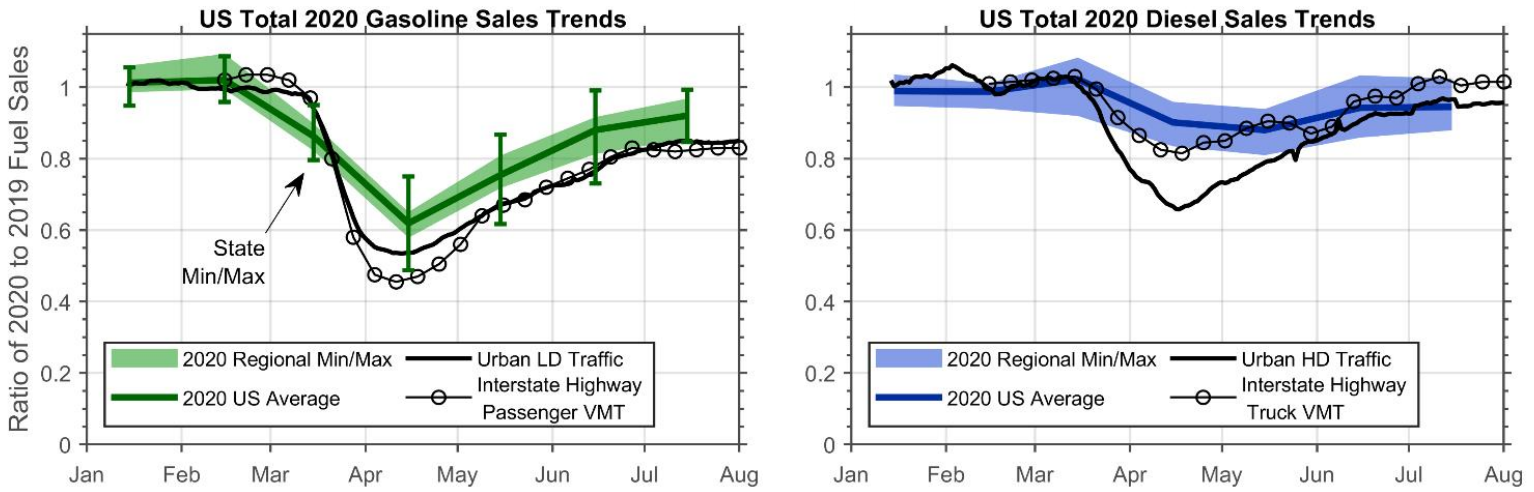
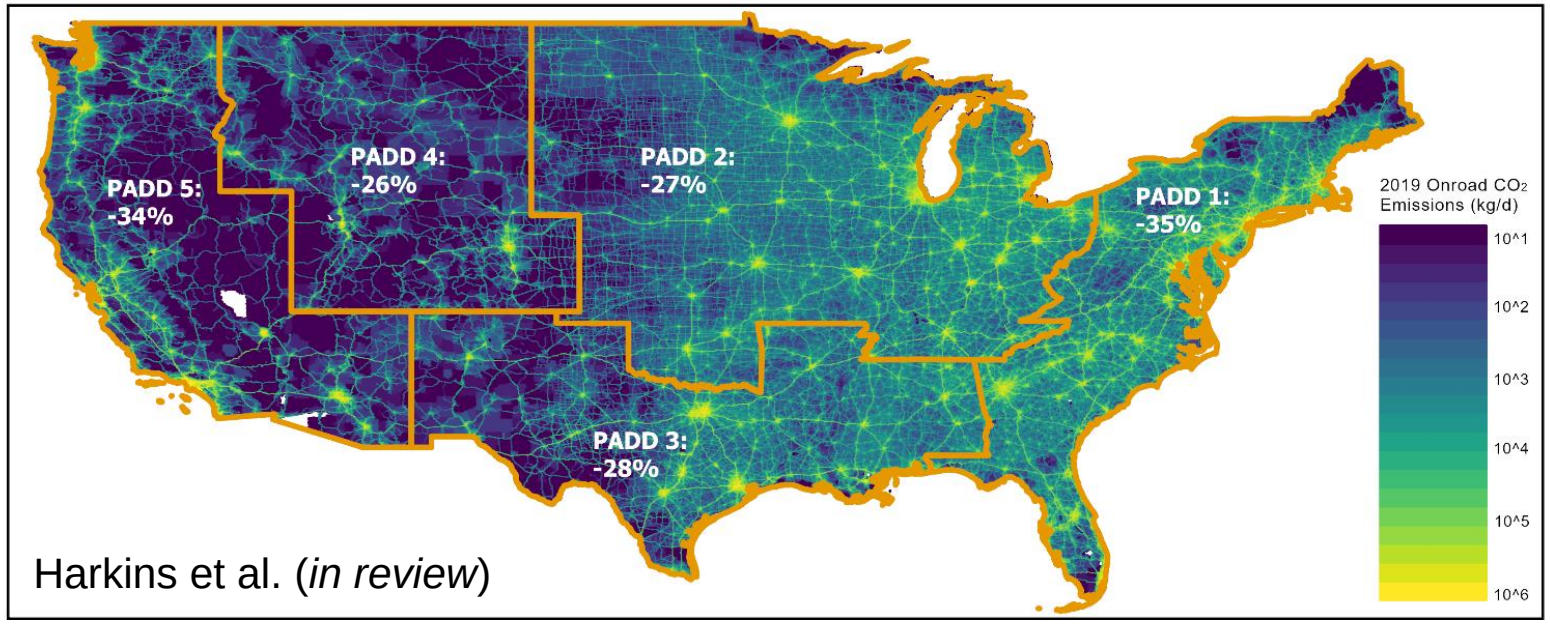
Ann Middlebrook (ann.m.middlebrook@noaa.gov),
Carrie Womack (caroline.womack@noaa.gov)

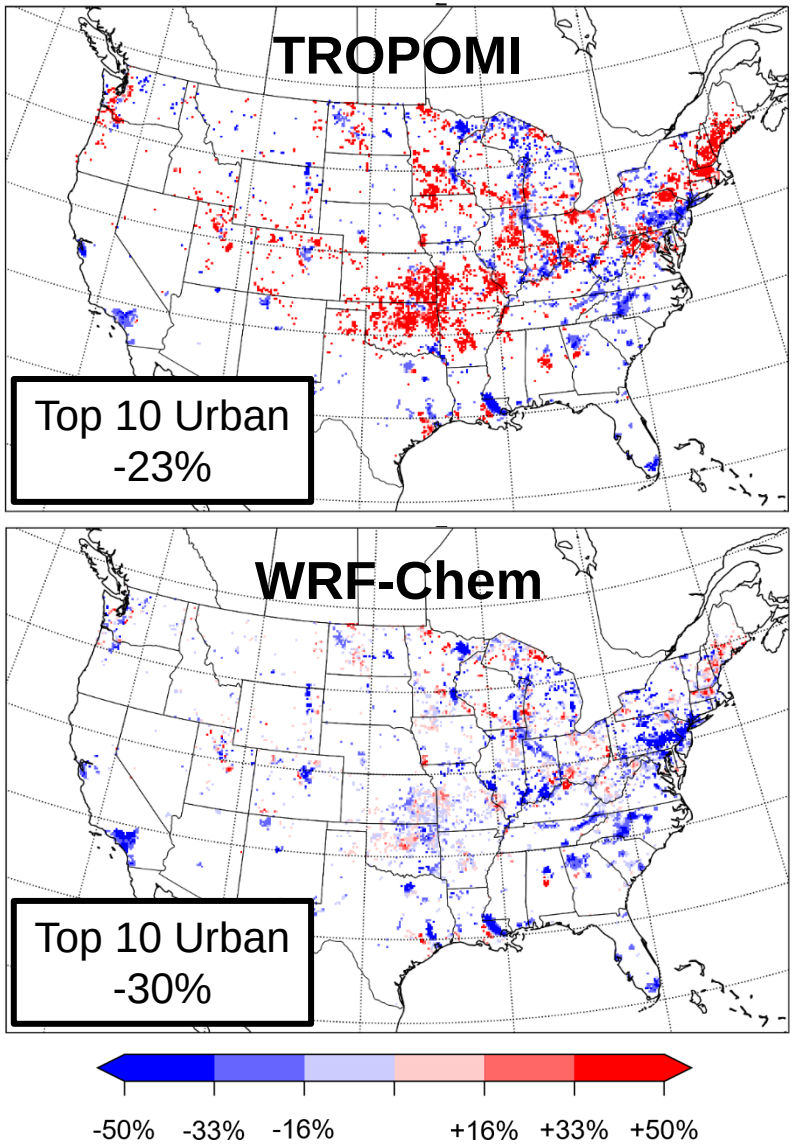
Near Real-Time Emission Updating for Air Quality Forecasting

US Transportation Changes due to COVID-19 Pandemic





ΔTrop. NO_2 Summer 2019 → 2020



Point of Contact: Brian McDonald (brian.mcdonald@noaa.gov)

Figure provided by M. Li (NOAA)

GHG and AQ Monitoring of US Energy Sector Emissions

NOAA P3 Aircraft Campaigns Provide Observational Constraint on Oil & Gas Emission Fluxes in 2013-15

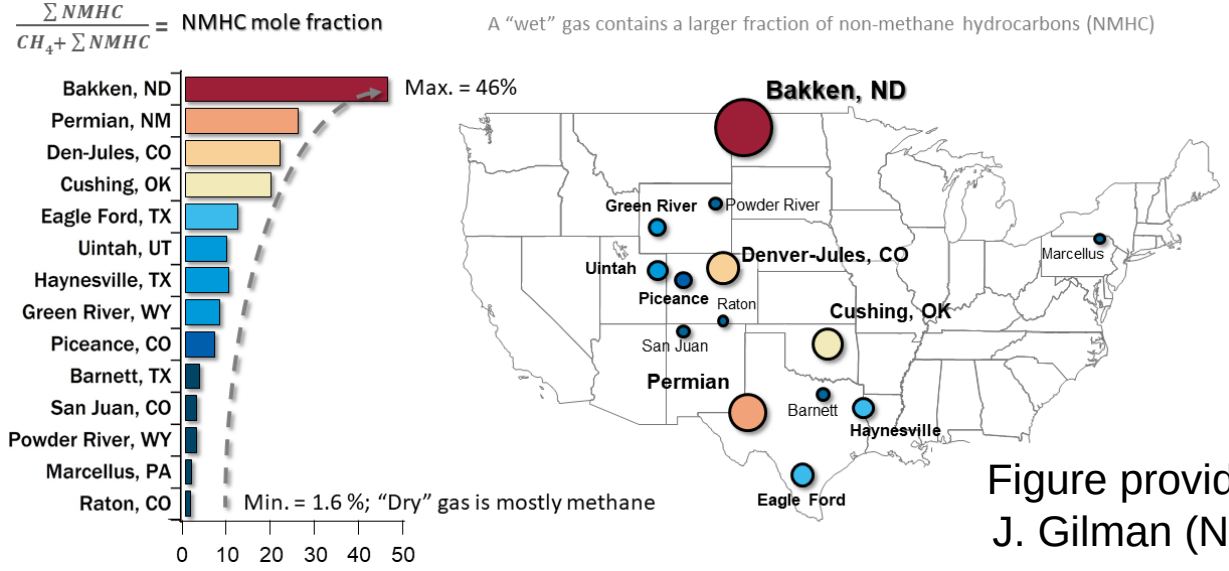
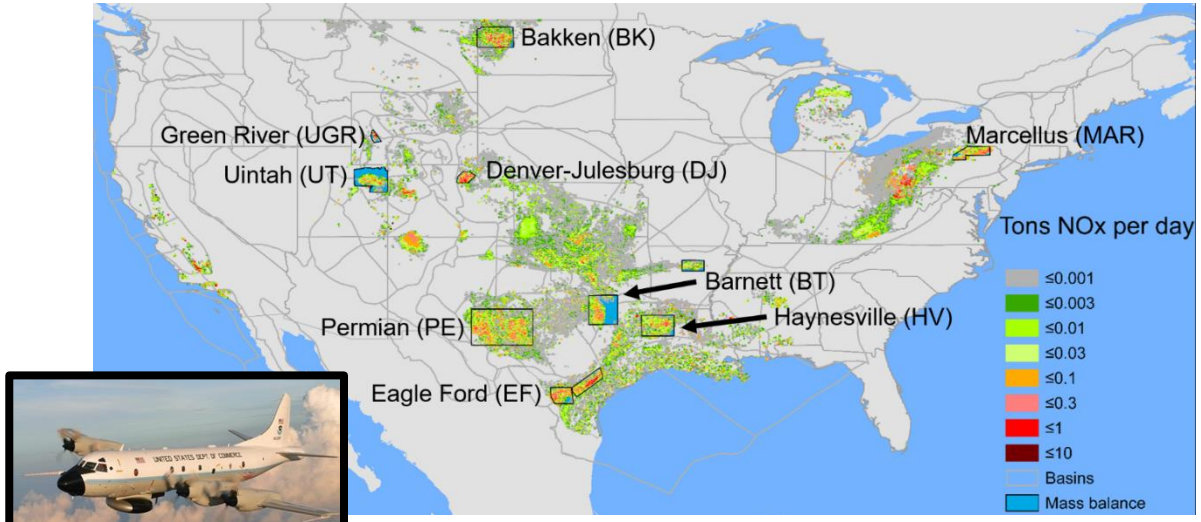
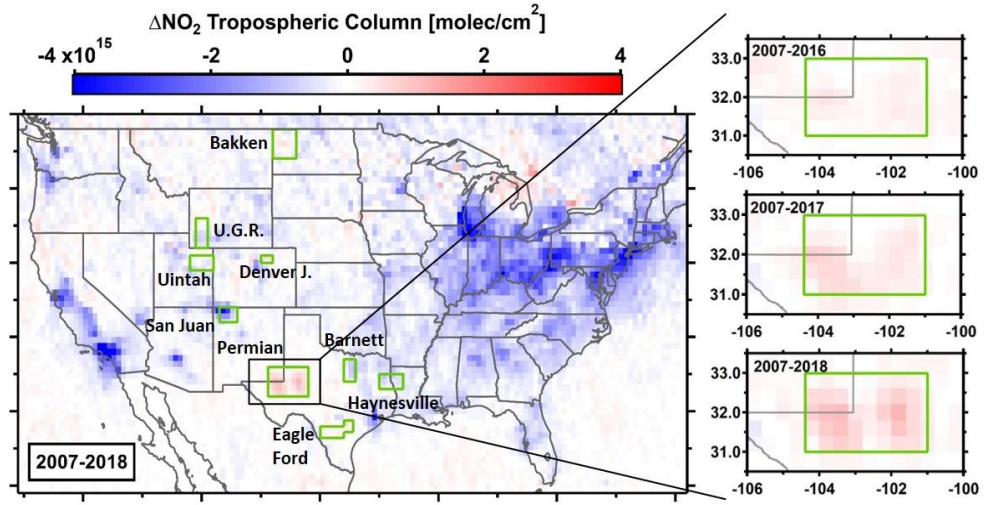


Figure provided by J. Gilman (NOAA)

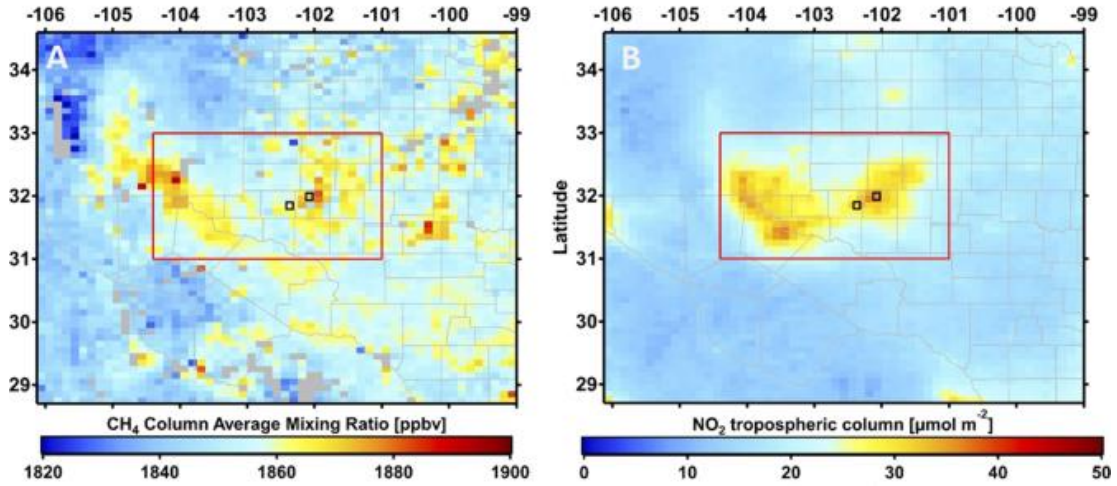


Francoeur et al. (*in review*)

Satellite Monitoring Capabilities Track Changes in Oil & Gas NO_2 and CH_4



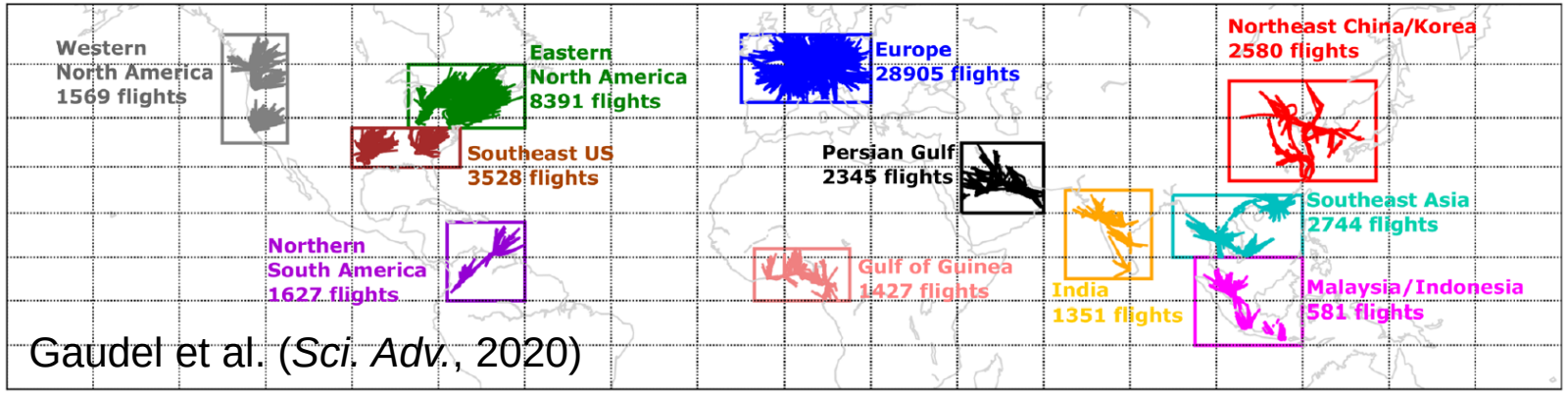
Dix et al. (*GRL* 2020)



de Gouw et al. (*Nat. Sci. Rep.* 2020)

Enhance Ozone Monitoring Capabilities for Health Assessments

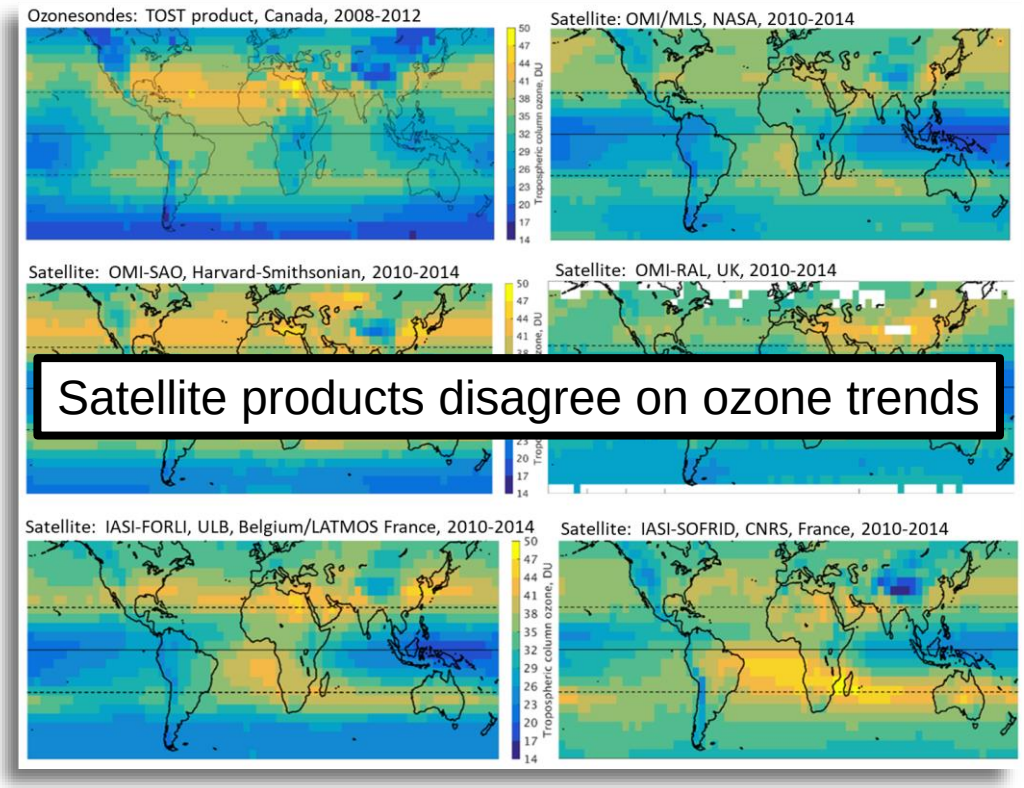
TOAR tropospheric ozone assessment report



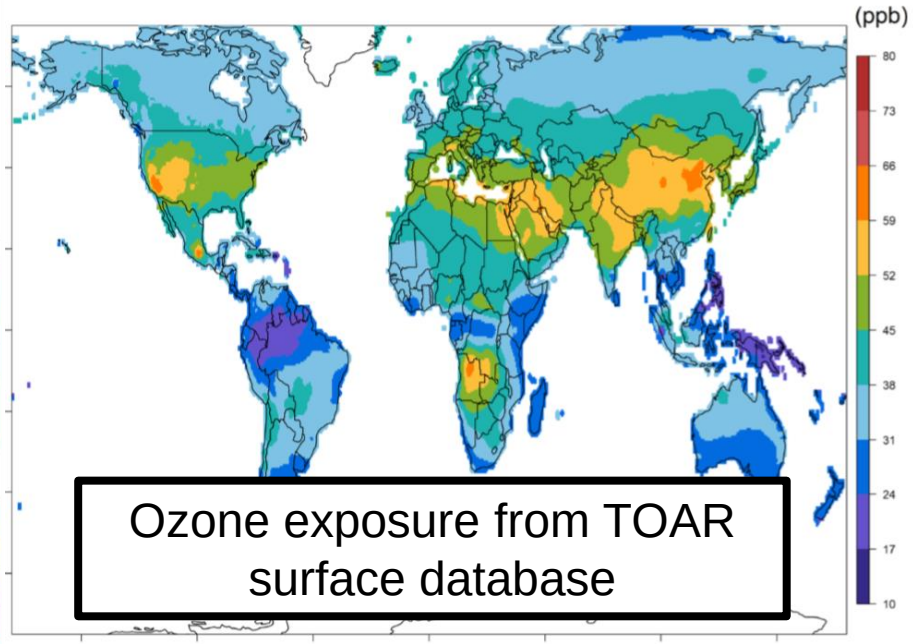
Gaudel et al. (*Sci. Adv.*, 2020)

Atmospheric composition observations from commercial airlines

IAGOS
IN-SERVICE AIRCRAFT FOR A GLOBAL OBSERVING SYSTEM



Satellite products disagree on ozone trends



Ozone exposure from TOAR surface database

Used in latest GBD study

Point of Contact: Owen Cooper (owen.r.cooper@noaa.gov)

Recommended GEO-XO Constellation

(Preliminary, pending program approval)

GEO-West
Vis/IR Imager
Lightning Mapper
Ocean Color
Space Wx Suite*

GEO-Central
Hyperspectral IR Sounder
Atmospheric Composition
Partner Payload

GEO-East
Vis/IR Imager
Lightning Mapper
Ocean Color
Space Wx Suite*

NOAA GEO-XO AC Value Assessment

1. Air Quality Forecasting
2. Weather and Climate Forecasting
3. Fire Weather Forecasting
4. Hazards Forecasting
5. Greenhouse Gas Monitoring
6. Stratospheric Ozone Monitoring
7. Air Quality Monitoring

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