

Aerosol Cloud, Convection, and Precipitation Panel

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Thanks to the OAQPS Satellite Forum group and others for contributions to the content!

Disclaimer: Although this work was reviewed by EPA and approved for publication, it may not necessarily reflect official Agency policy.

How do we use satellite data regularly?

Meteorological modeling

- Land use/Land Cover, Digital Elevation Maps
- GHR Sea Surface Temperatures
- Data assimilation (e.g, GEOS, CAMS, GDAS, indirectly WRF)

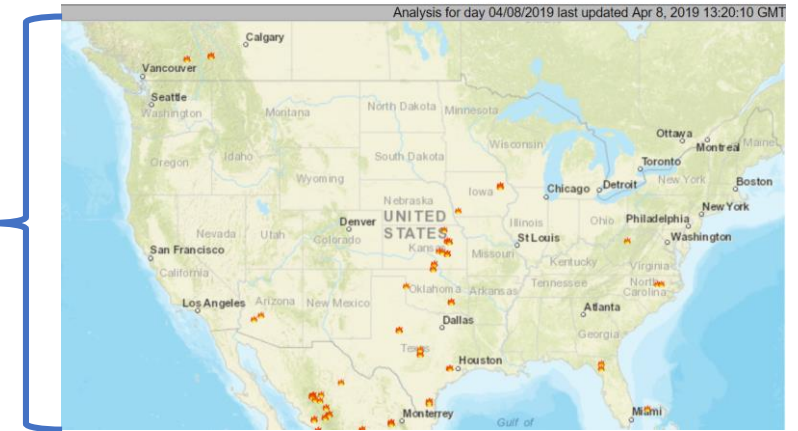
Emissions Inputs

- e.g., MEGAN, FINN, GFED, etc
- Fire detection, land area burned

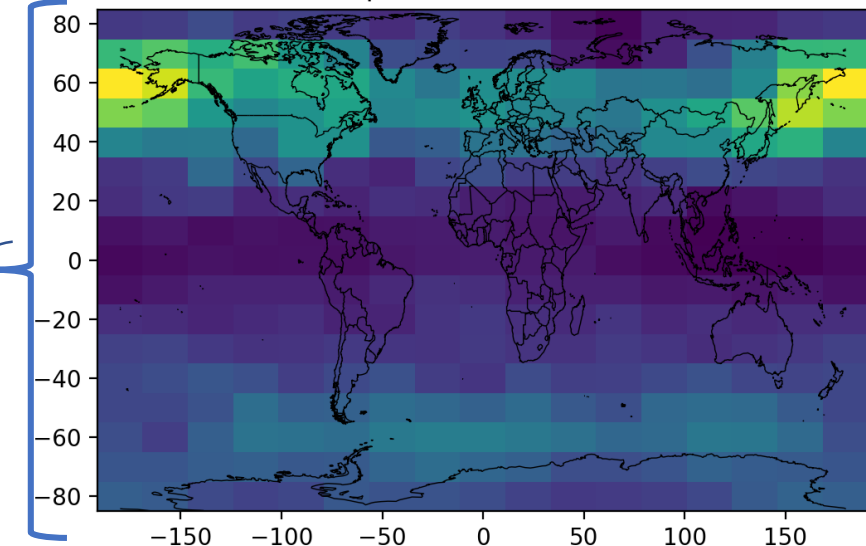
Air Quality Models

- Land use/Land Cover, Digital Elevation Maps
- TOMS/OMI Ozone columns to adjust photolysis

Fire detections from NOAA's Hazard Mapping System



CMAQ Input - TOMS-like OMI 2018



Evaluation for surface concentration estimates (current/future use)

Stratosphere and Wildfire Exceptional Events Demonstrations

- AQAD guidance uses applies satellites identify above ground or between monitor transport of pollutants
- States apply and submit

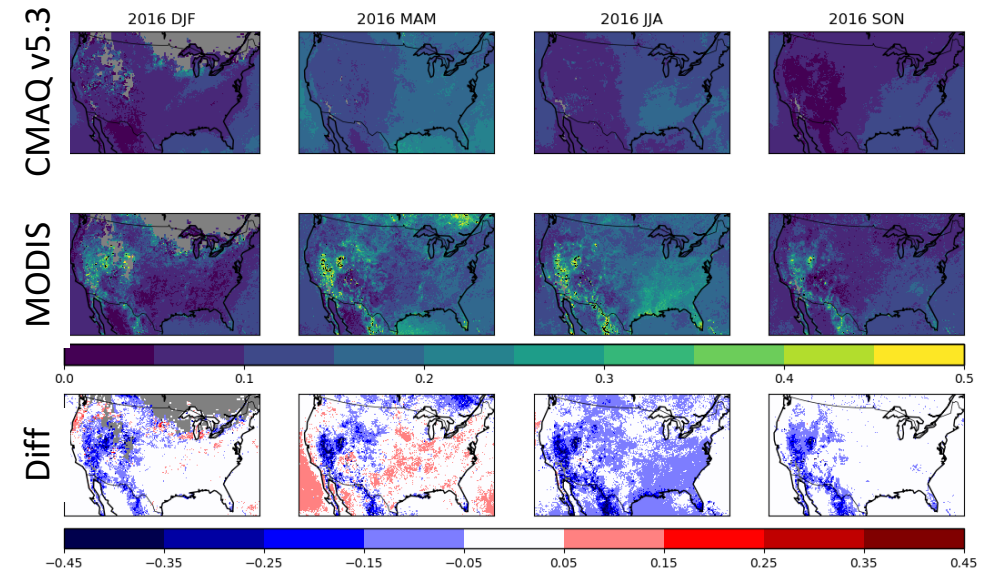
Model evaluation*

- Provide qualitative or quantitative constraints.
- Often indirect: total columns as surrogate for surface

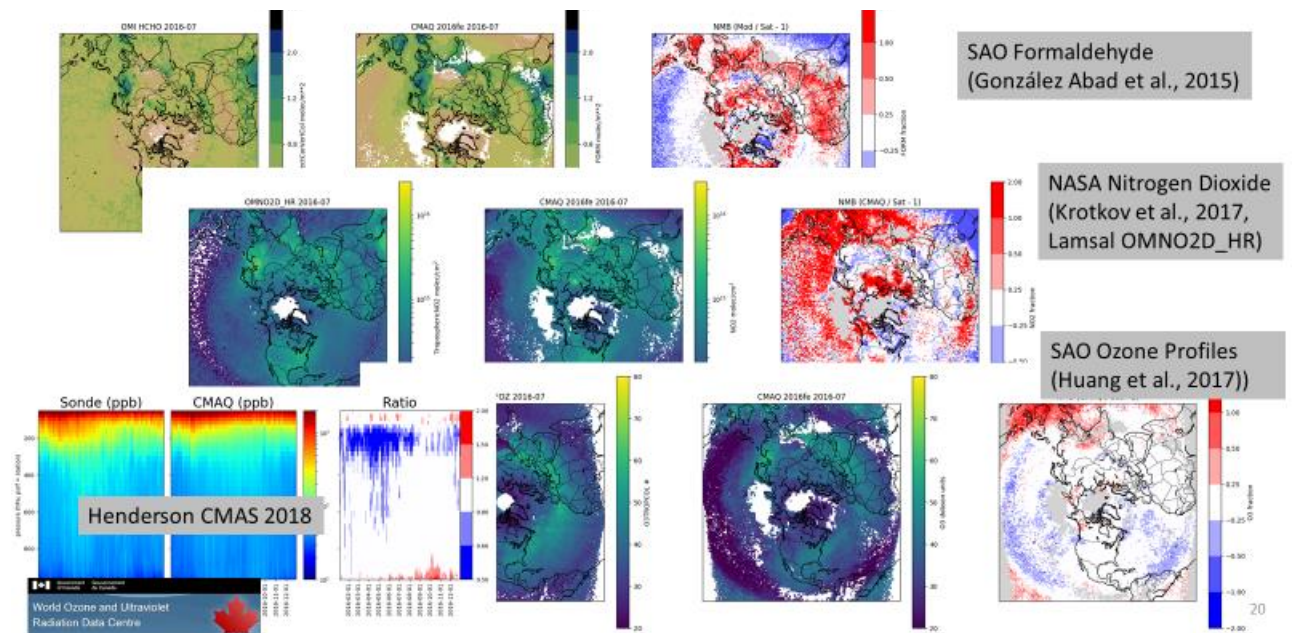
Emissions inferences

- NO2 and SO2 top-down constraint techniques are available
- Useful for evaluating current inventories even if not directly applied

*Aerosol Optical Depth



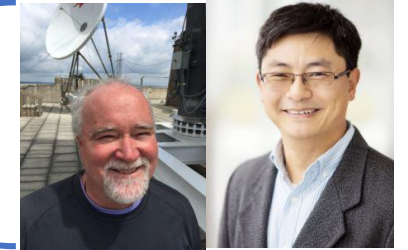
*Gases: NO2, O3, HCHO



Recent Webinar on Chemical Assimilation helping EPA toward routine application



- Motivated by Health and Air Quality Applied Science Team (HAQAST) project with Brad Pierce and Daniel Tong



- Assimilation experts from NASA and Academia advised on:
 - Numerical assimilation frameworks that can improve air quality predictions
 - Practical applications relevant to criteria pollutants and associated uncertainties
 - Ongoing research needs for satellite validation and retrieval improvements
- Huge success! Great panelists! Great attendance!

Chairs:

Barron H. Henderson
Bryan N. Duncan

Panelists:

Ron C. Cohen
R. Bradley Pierce
Kazuyuki Miyazaki
Zhen Qu

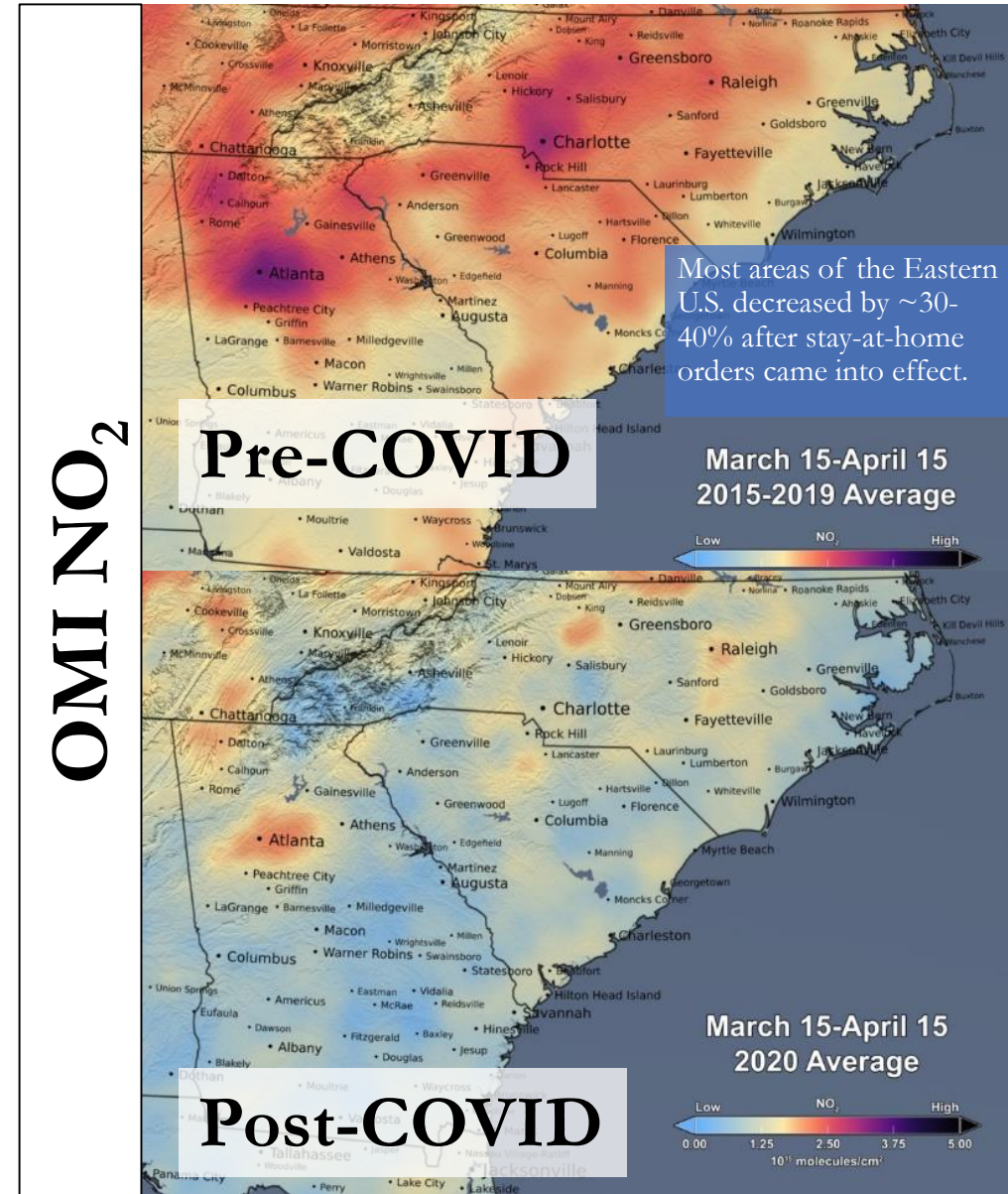
Attendees:

112 around the world

Policy-relevant modeling opportunities for satellite incorporation

NASA OMI Team

- Regional modeling is dependent on global “boundary conditions”
 - Inter-continental anthropogenic transport and natural emissions largely contribute to what enters our model and is not the focus of controls.
 - International inventories are often updated less frequently or are a challenge to integrate into our platform
- Emission Inventory Development
 - Quality assurance by evaluation and comparison
 - Temporal and spatial variation
 - Existence or absence of “hotspots” or Regional outliers
 - Constraints on uncertain sources (NO_x/VOC, but aerosol precursors)
 - Wildland fires, Soil NO_x
 - International Emissions, Area sources
- Rapid changes like COVID
 - What level of constraints can the satellite apply?
 - Urban vs rural areas?



Looking forward

- We see huge potential for NH₃ retrieval incorporation into the emission inventory.
- We do not currently assimilate AOD and there are challenges managing the vertical representation.
- Satellites offer an amazing spatial coverage and, looking forward, temporal frequency and spatial resolution.
- We need to figure out how to use that increased detail to better align with existing needs.
- Spatial resolution can help elucidate environmental justice issues that happen at fine-scales, and are not always measured.
- Spatial resolution can help identify sources of pollution that are geographically distinct.
- Temporal resolution can help differentiate sources whose activities are not aligned even though they spatially overlap.
- Some of these results will be direct inference, others will be through the lens of models.
- We need increased capability to couple the satellite data to the regulatory tools.