Aerosols and Clouds, Convection and Precipitation (ACCP) Instruments Virtual Air Quality Workshop

Jim Szykman, Rohit Mathur, George Pouliot, and Kristen Foley
U.S. EPA Office of Research and Development
Center for Environmental Measurements and Modeling

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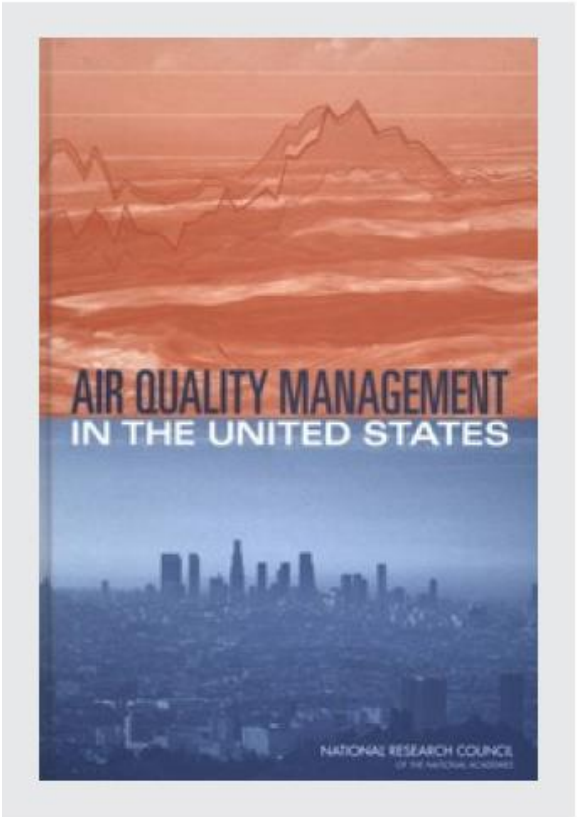
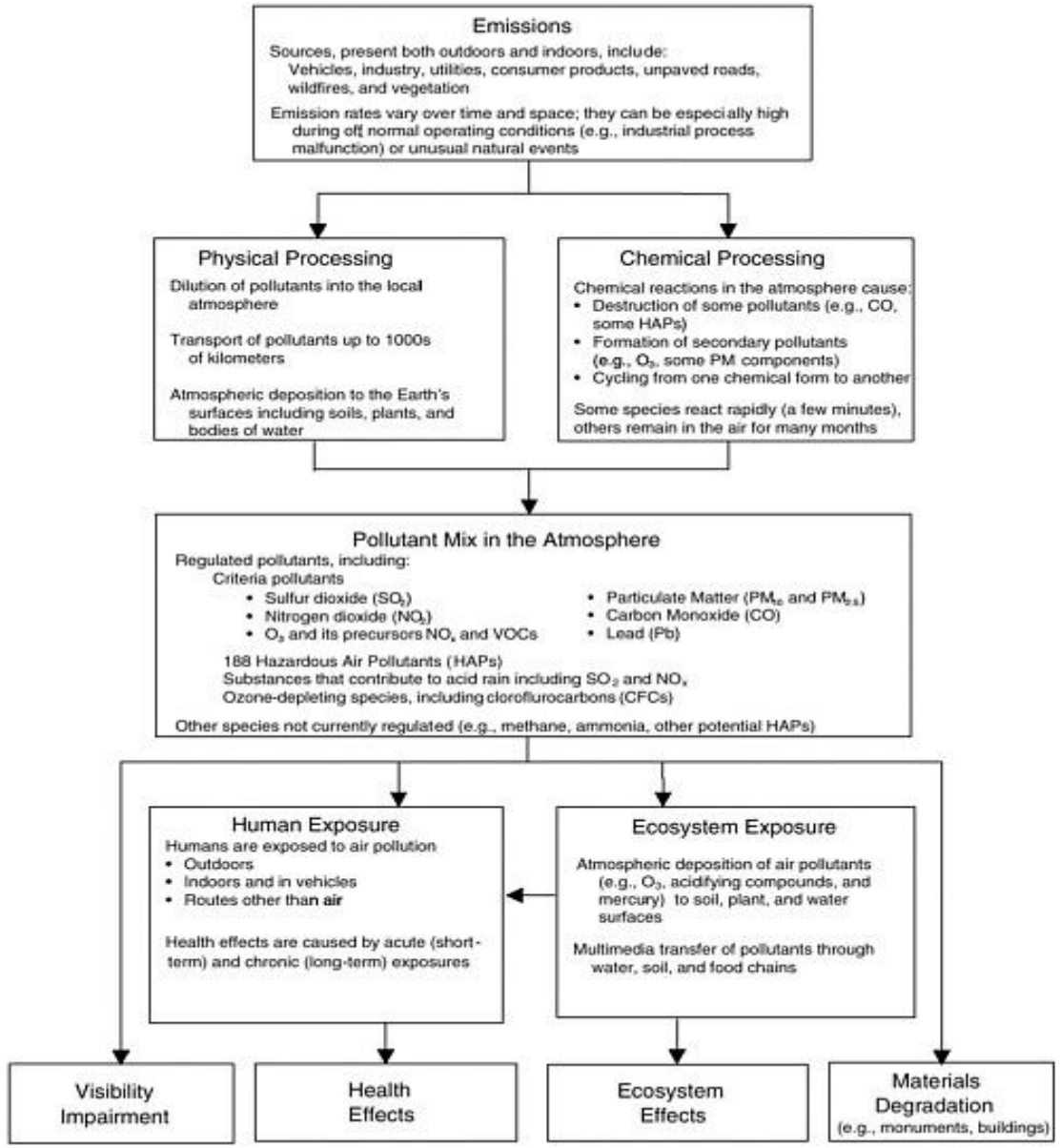
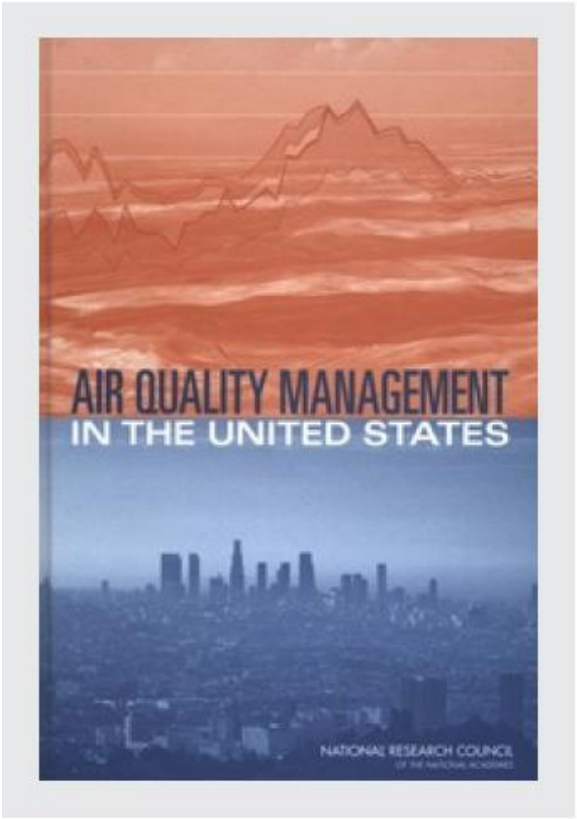


NRC 2004

The areas of air quality science and air quality management are closely coupled, because the tools developed by scientists and engineers to carry out the tasks shown in the figure are also widely used by the agencies tasked with controlling air pollution. Instrumentation and models developed and used by scientists are also used to support all aspects of AQM such as monitoring air pollution exposures, trends, compliance and design effective strategies for air pollution mitigation.



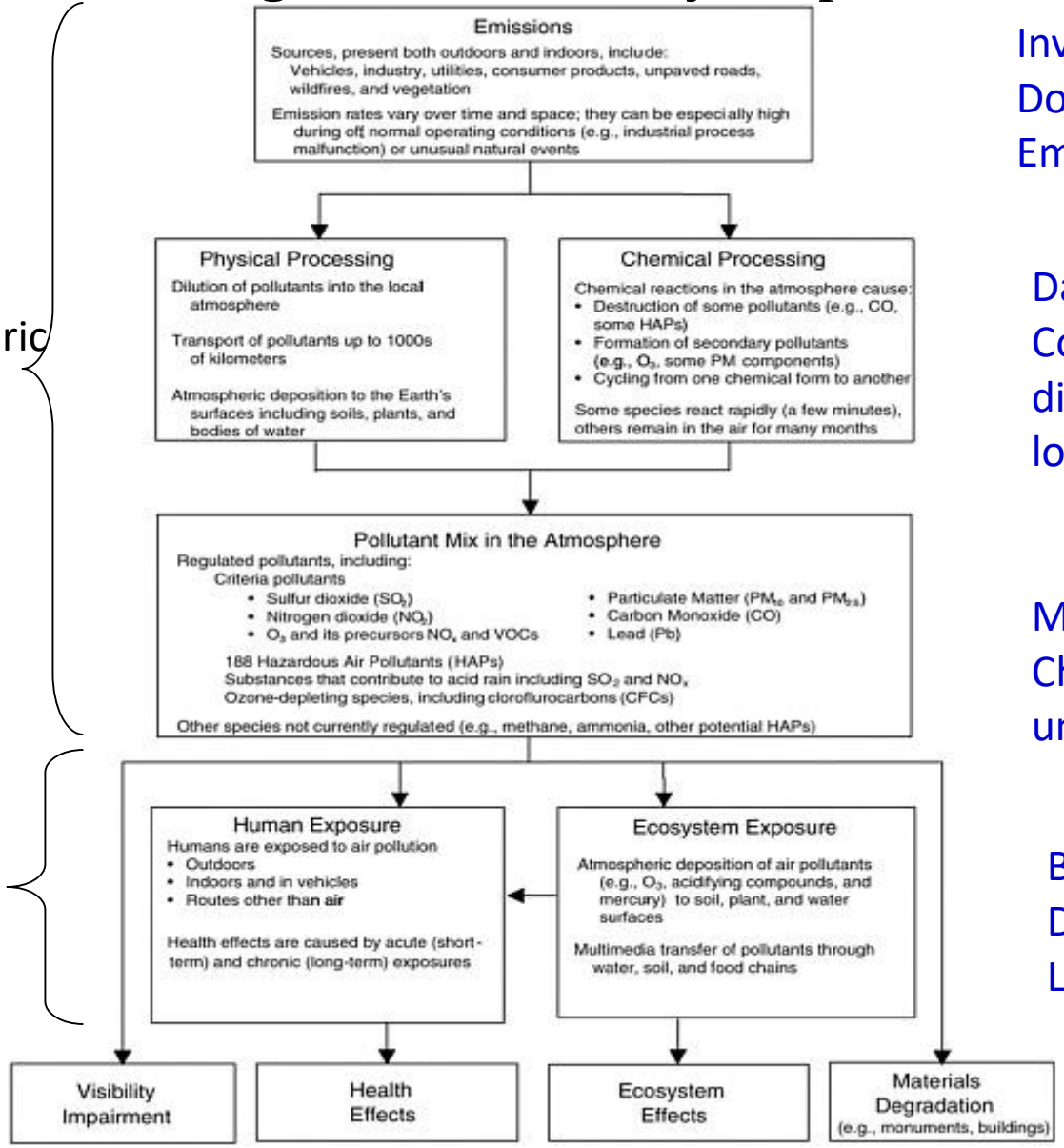


NRC 2004

Air quality science and management are closely coupled

Atmospheric Modeling

Exposure Modeling



Measurement Needs

Inverse Modeling – Top Down Constraints on Emission Sources

Data Assimilation - Constraints on vertical distribution, aerosol loading and composition

Model Verification – Characterize errors and uncertainties

Best Estimate of Spatial Distribution of Aerosol Loading and Composition

ACC-P General Questions

- How are you using or assimilating NASA datasets (particularly aerosol data) within your organization?
  - To understand systematic errors in model predictions and input parameters
- Where do you see some existing gaps in information your organization has that may be addressed with future satellite data?
  - Improve resolution and coverage relative to traditional surface based in-situ networks
- If you had a crystal ball looking 5-8 years in the future, what are your biggest data needs? Where do you see the biggest opportunities and challenges?
  - Quantitative characterization of aloft air pollution & transport(< above the PBL), especially nocturnally, with vertical resolution on the scale of regional CTMs (~100 to 300 m resolution)
- If you could have any data sets, what would you want most to aid your applications (e.g., spatio-temporal resolution, aerosol composition, ancillary data)?
  - Characterization of quantitative skill of the retrieval (true measurement uncertainty) to aid in quantitative comparisons with model
- What potential observations from ACCP most excite you or could be useful within your applications/operations? Do you see any data products that could help “raise the bar” for your applications/products?
  - Assessing long-term trends; aerosol-radiation interactions, including the effect of aerosols on photolysis rate calculation based on aerosol vertical profiles.

U.S. Group on Earth Observations (USGEO) Satellite Needs Working Group (SNWG)

- Formal interagency working group to help NASA and other satellite data providers (NOAA and USGS) gain a better understanding of federal agency satellite measurement and data product needs.

- Survey conducted every 2 years, with a focus on federal agencies identified high-priority needs for both sustained and unmet satellite Earth observation measurement or product needs.

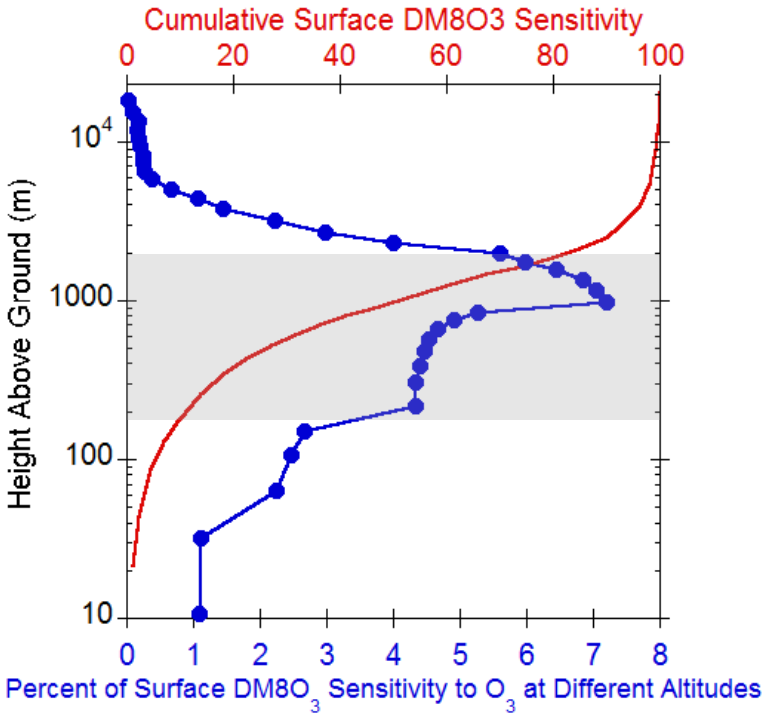
- For the 2020 survey EPA had 5 formal survey submissions signed off by Agency Senior Executive Official. 2020 surveys are currently under review by NASA Earth Science Division, with one directly relevant to A-CCP.

- SNWG # 208 focused on the need for an improved vertically resolved extinction measurement with low uncertainty. Direct extinction measurement in the 500 nm range was most important as this is most sensitive to aerosols with a diameter of 2.5 µm, or $PM_{2.5}$.
  - Help better characterize the long-range transport of airborne PM, smoke plume rise, and exceptional event analysis, and WFR-CMAQ model development and evaluation.
  - Provide increased knowledge on sources of particulate matter air pollutants to better help address both the design and implementation of the NAAQS for airborne particulate

- Low priority placed on new AOD measurements given current suite of measurements going forward, especially given VIIRS on JPSS, GOES ABI and GEO-XO.

- How can ACCP supplement surface-based AQ monitors

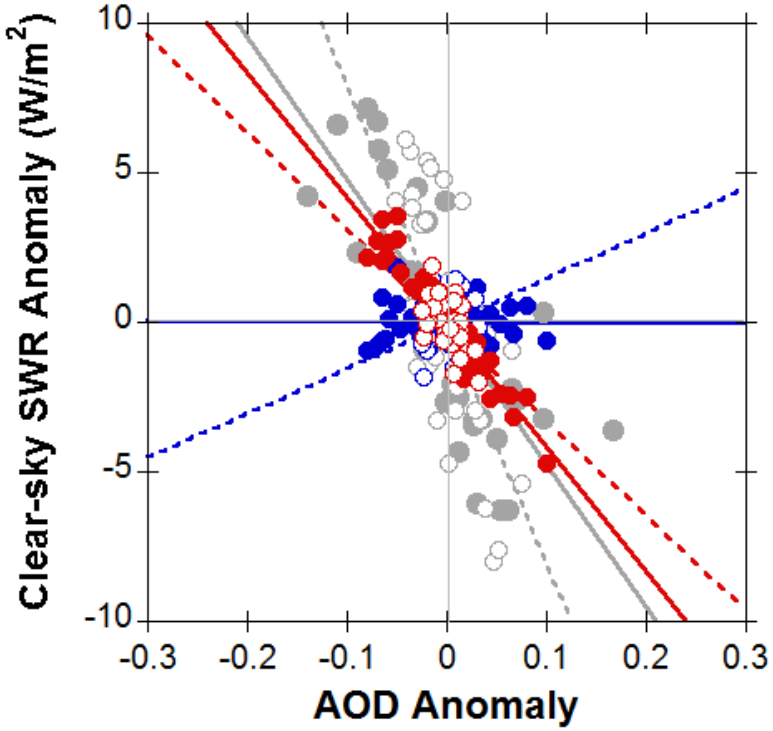
Sensitivity of surface pollution to aloft conditions



https://doi.org/10.1021/acs.est.8b02496

- O_3 example, but applicable to any pollutant transport including PM
- Capturing variations 200-2000m would help better characterization of LRT and impacts on surface pollution

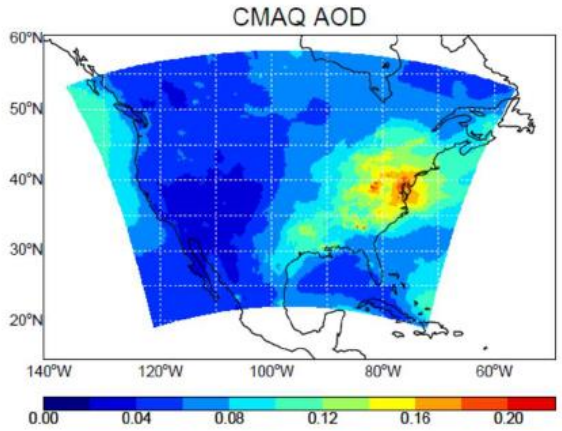
Improving representation of Aerosol-radiation interactions

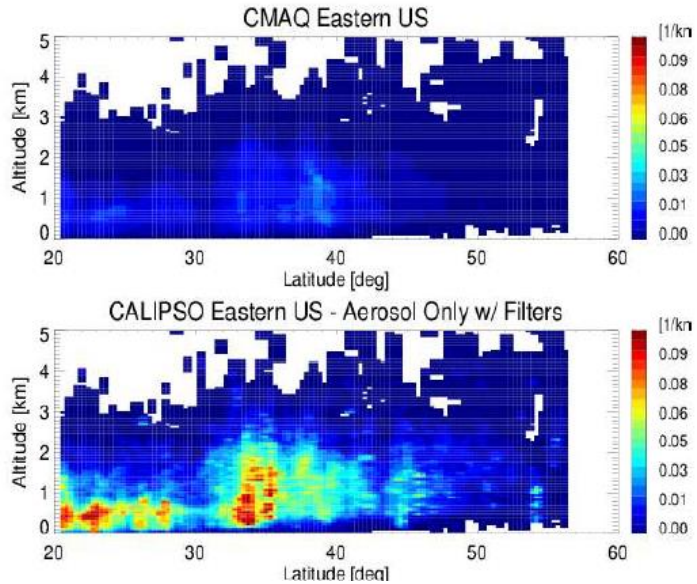


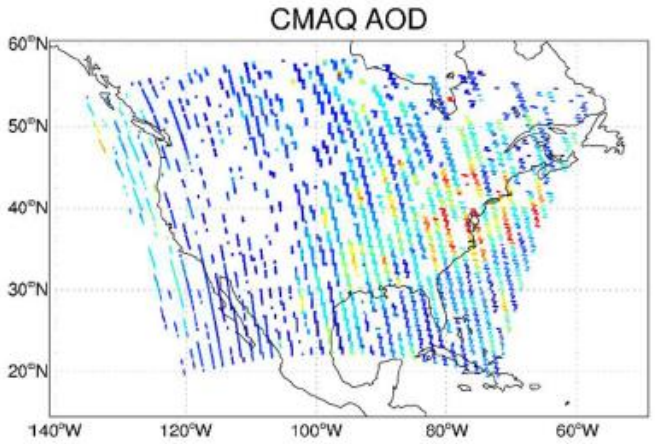
https://doi.org/10.5194/acp-17-12449-2017

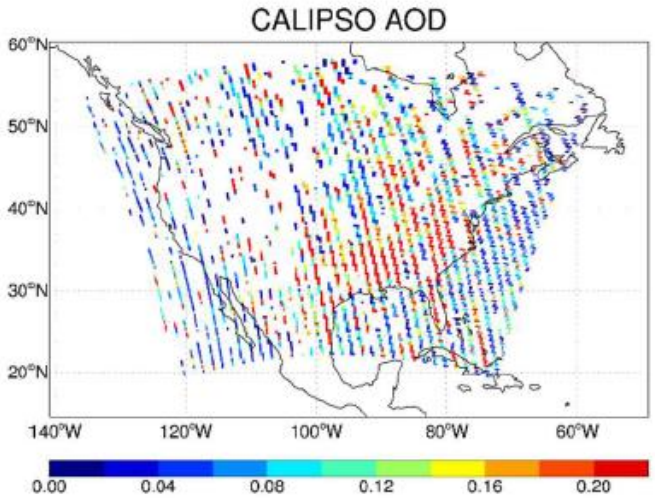
- Characterizing changes in aerosol burden on radiative budgets to improve representation of airquality-climate interactions

Use of CALIPSO for CMAQ Evaluation – Aug 2010









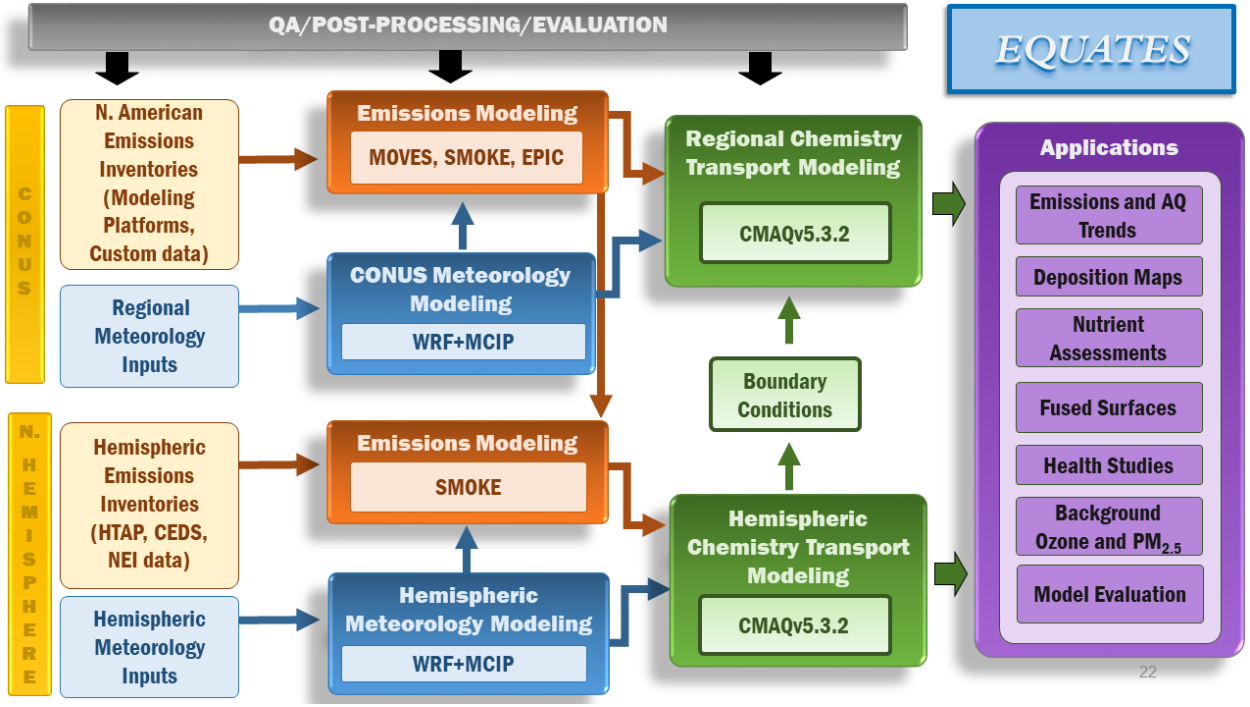
Extinction profiles provide much needed vertically resolved data to assess WRF-CMAQ performance

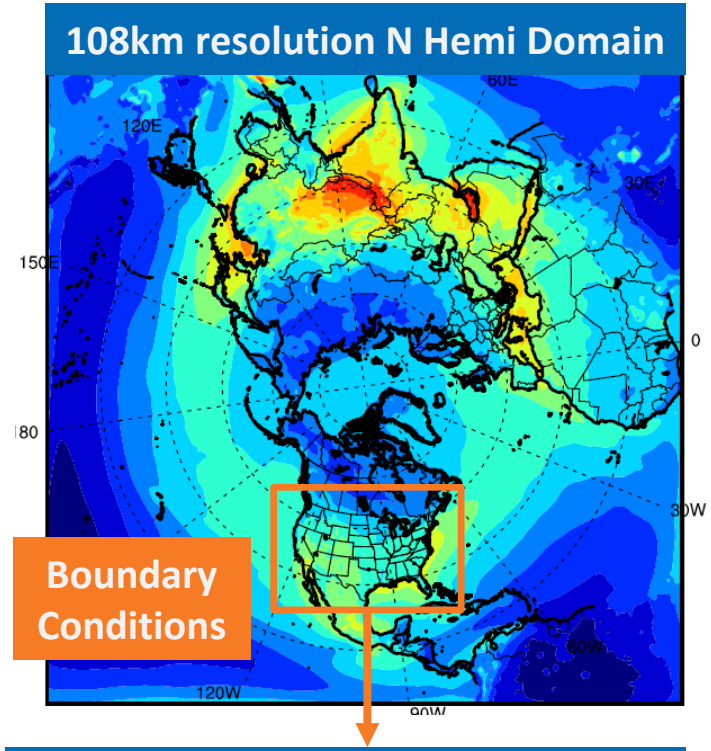
Past results showed CMAQ under predicted extinction.

EPA initiated review of extinction and AOD calculations, resulting in updated Mie extinction code developed and implemented.

EQUATES time series to be evaluated with multiple versions of CALIOP data v3 - v4.

EQUATES: EPA's Air QUAlity TimE Series Project





- 2002-2017 CMAQv5.3.2 simulation over the Northern Hemisphere (**N Hemi**) and the contiguous US (**CONUS**)
- N Hemi simulation will provide the boundary conditions for the CONUS simulations
- New meteorological and emissions inputs are being developed for N Hemi and CONUS simulations

Courtesy: Kristen Foley (foley.Kristen@epa.gov)

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