"NOAA/NESDIS Perspective on Air Quality Remote Sensing"

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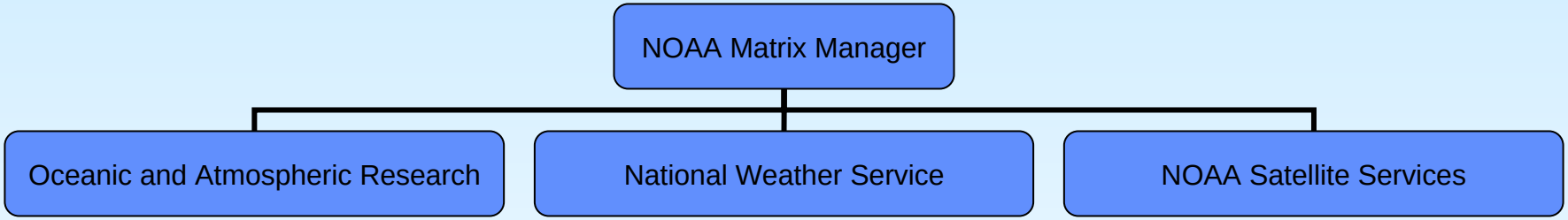
NASA Earth Science – Air Quality Team Meeting
June 18 - 20, 2007

NOAA Air Quality Program Structure



Research and Development:

- Air quality model development
- Air quality assessment using field campaigns and *in situ* data

Operational air quality forecasting guidance:

- Numerical models (met and chemistry and transport)
- Forecast verification

Observational support:

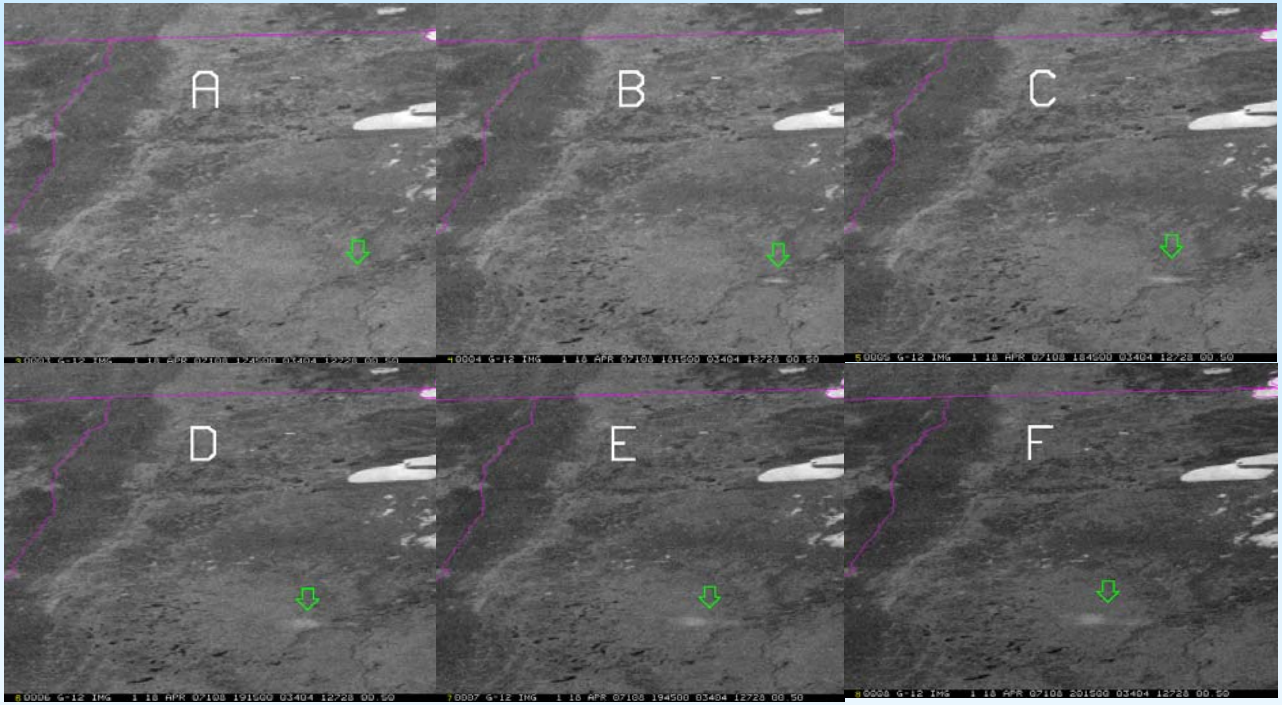
- Satellite based air quality monitoring
- Air quality forecast improvements via satellite data assimilation

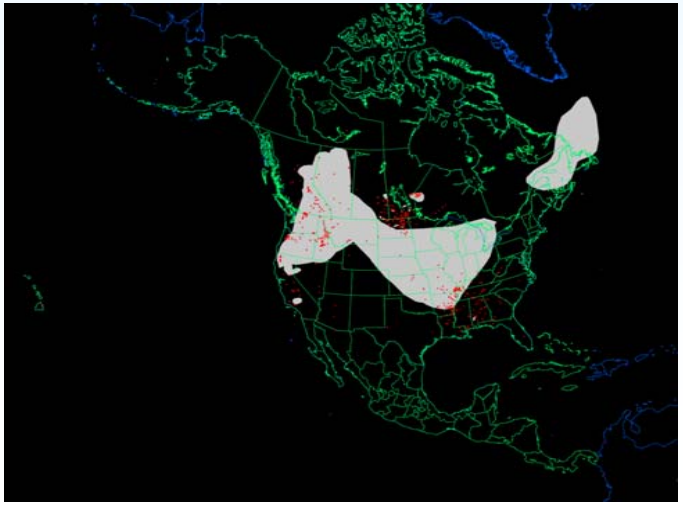
Funded by satellite services and research programs

Active collaboration with EPA for over 50 years

NESDIS Air Quality Program Objectives

- Support NOAA-EPA MOU and MOA which includes the development and deployment of operational air quality forecast guidance
  - » Development of algorithms to derive trace gas and aerosol products from NOAA operational satellite sensors
    - – Research (NASA) to Operations (NOAA)
  - » Conduct air quality application studies to demonstrate the usability of satellite data in air quality applications
    - – Data analysis and validation
    - – Modeling and assimilation studies
  - » Support NWS in air quality forecast verification and improvements
  - » Hazard mapping system
  - » Algorithm/product development from future satellite sensors
  - » Mission planning activities

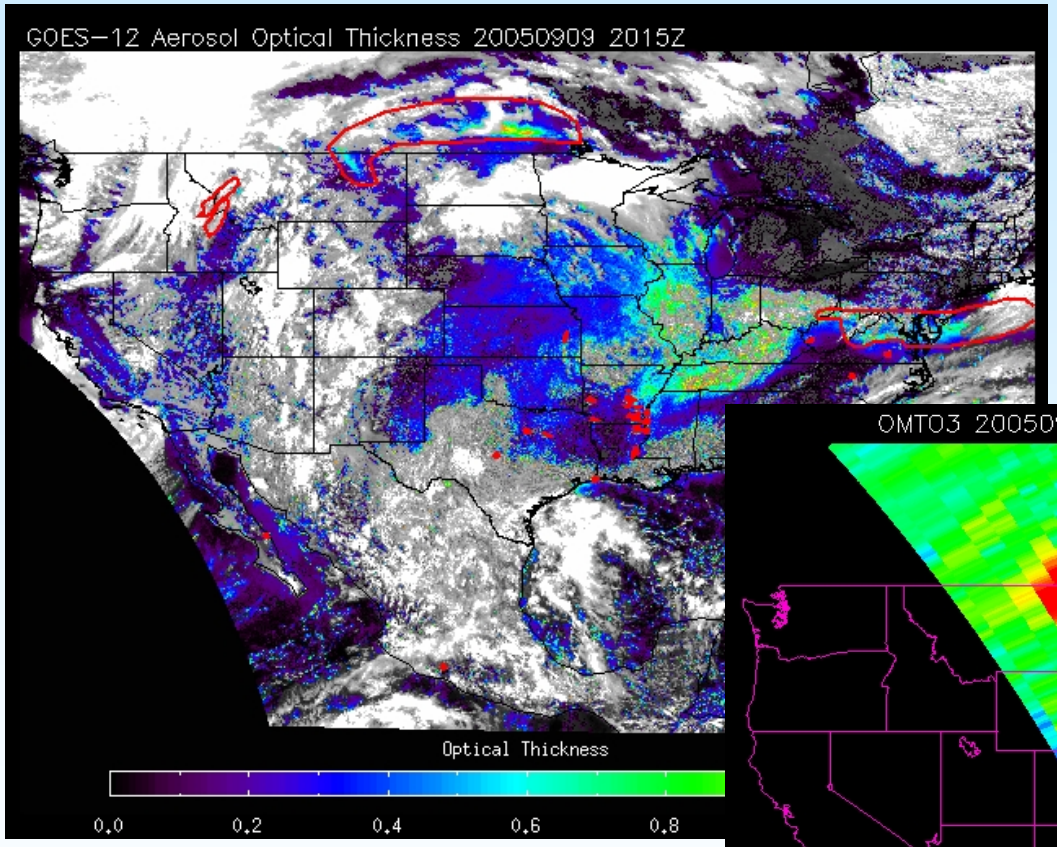


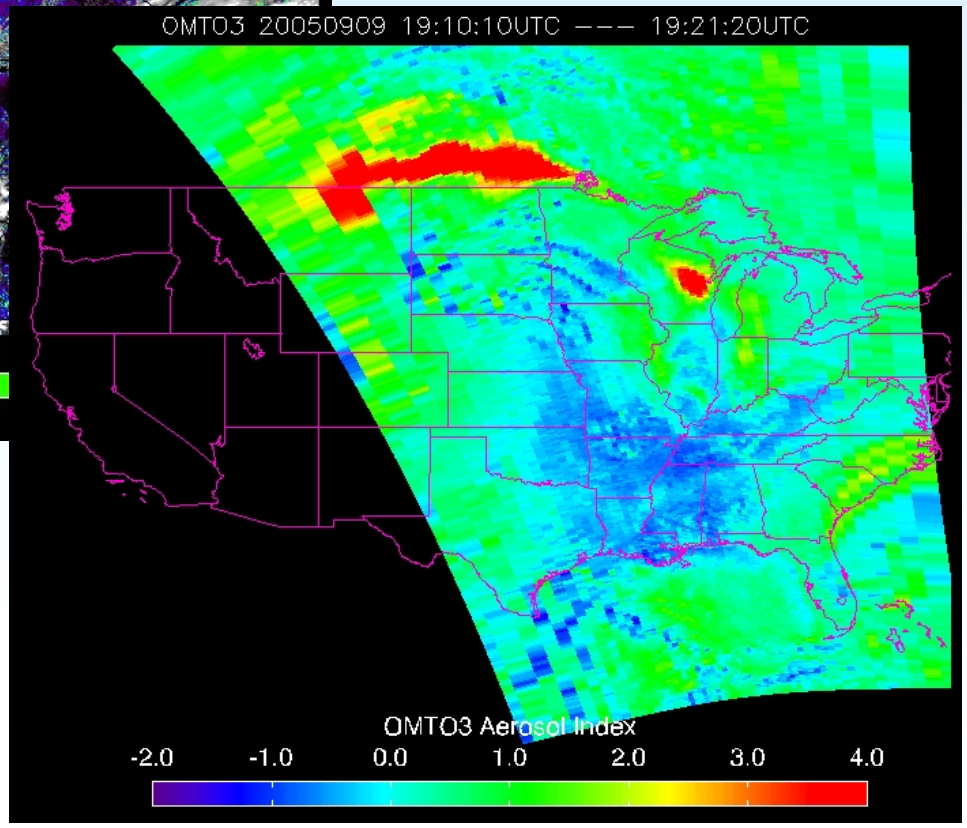


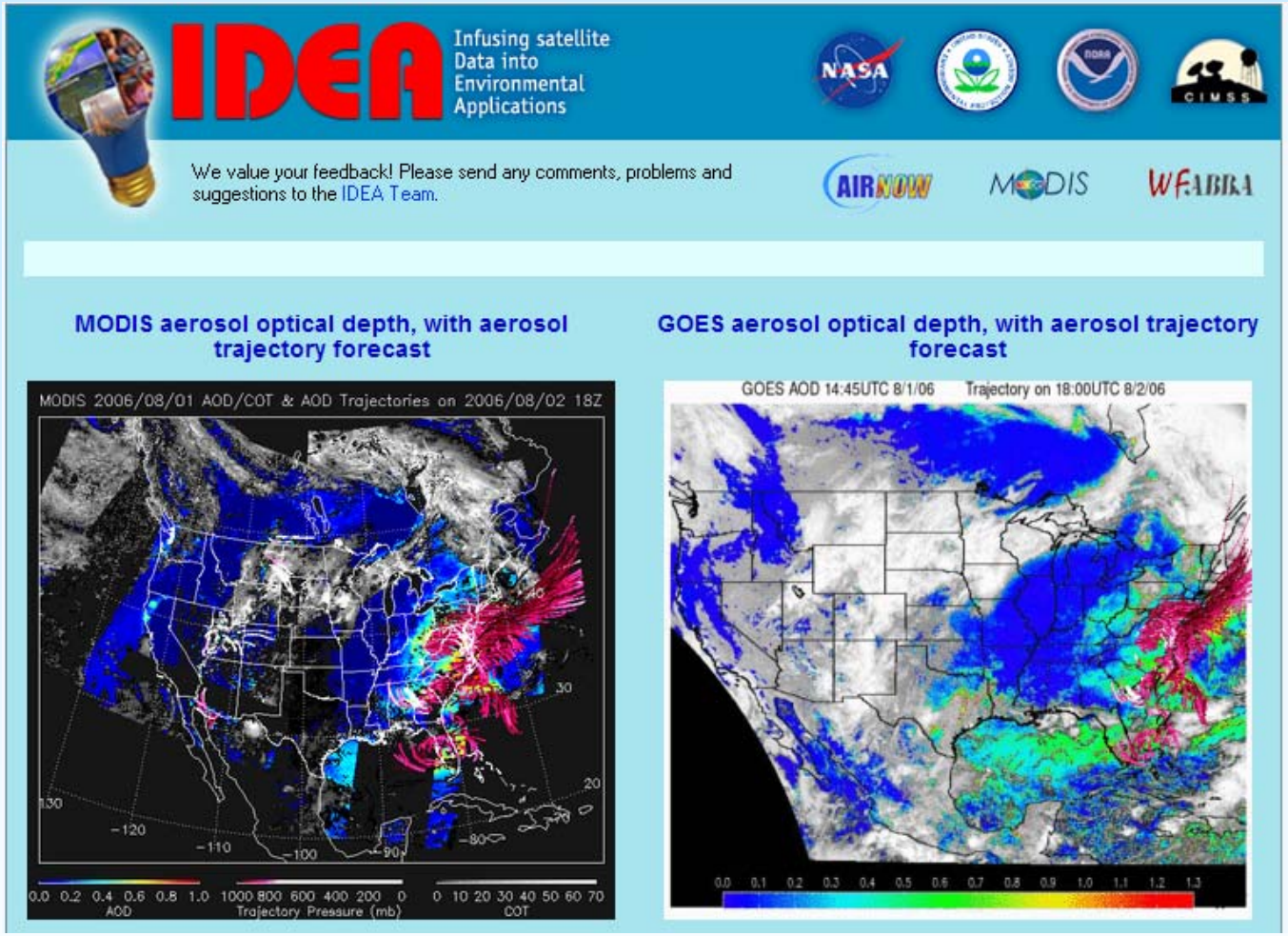
NESDIS Hazard Mapping System

- Analyst based GIS interactive tool that uses satellite visible imagery in conjunction with fire hot spots (manual and automated) to identify smoke plumes
- Difficulties: smoke mixed in or above/below clouds and smoke removed from fire source

OMI sees aerosols above clouds and NESDIS plans to bring OMI Aerosol Index/optical depth as a layer into HMS system

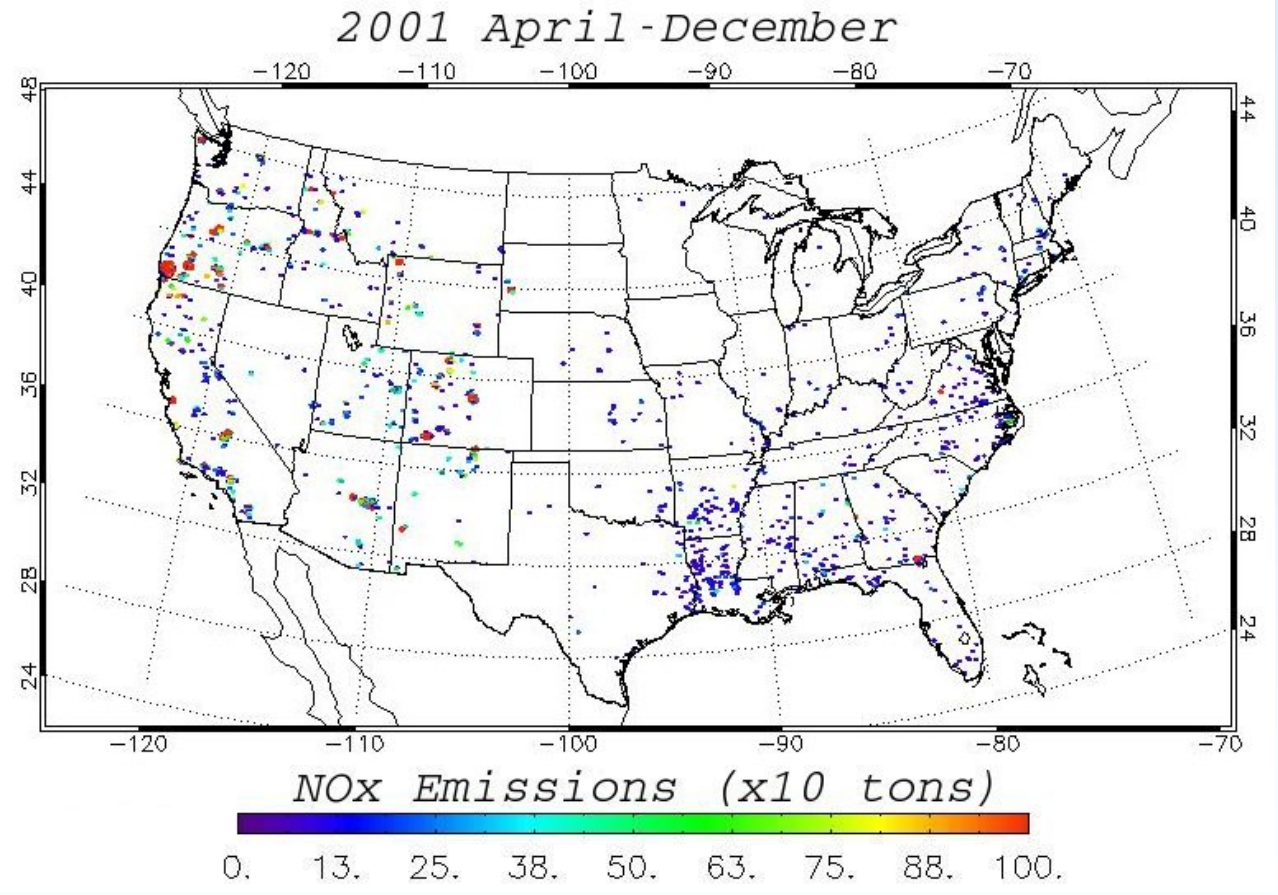






- NOAA cost sharing contribution to NASA funded 3D-AQS project led by UMBC
- Add other satellite datasets (e.g., OMI AI)
- Merge HMS and IDEA to create Air Quality Mapping System

Biomass Burning Emissions



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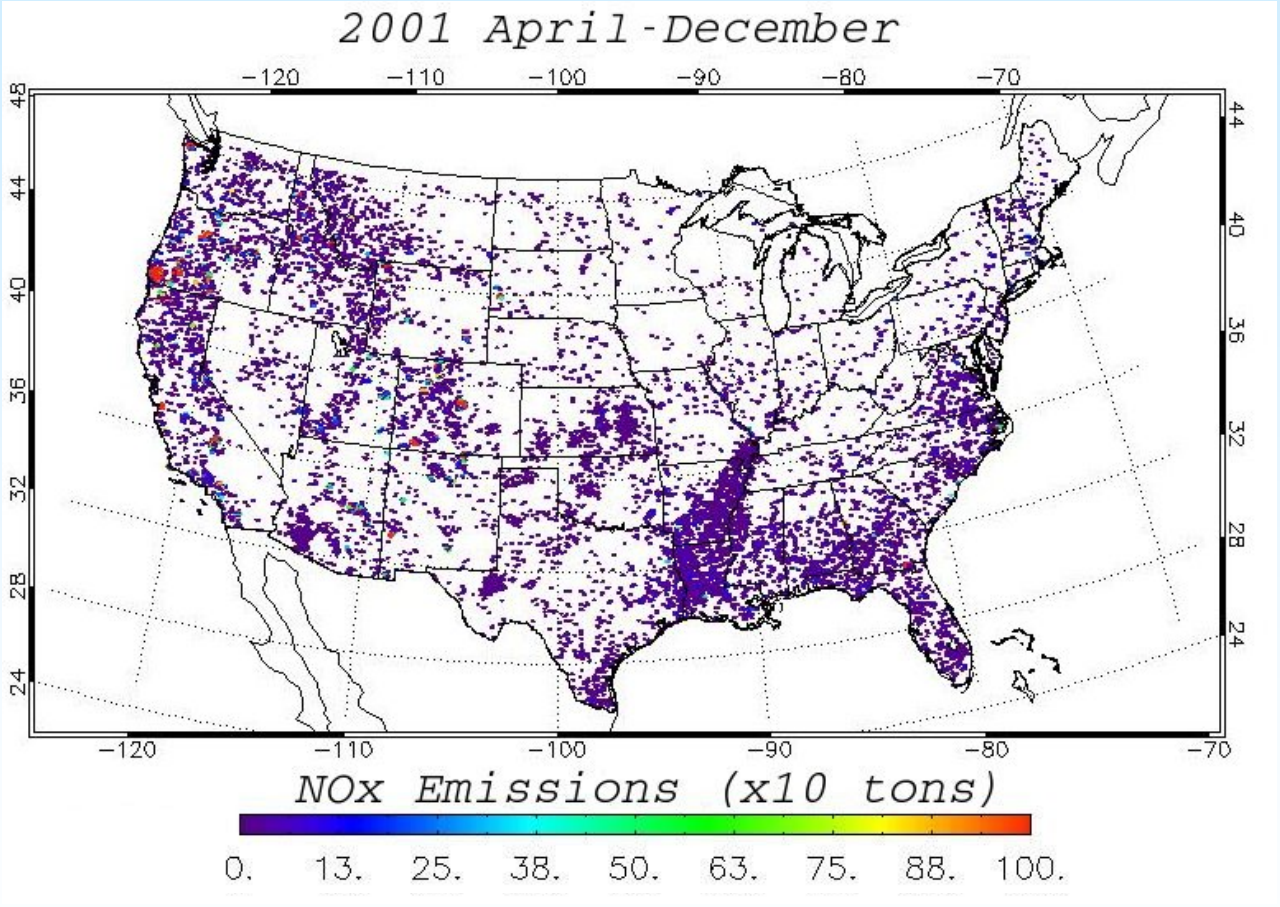
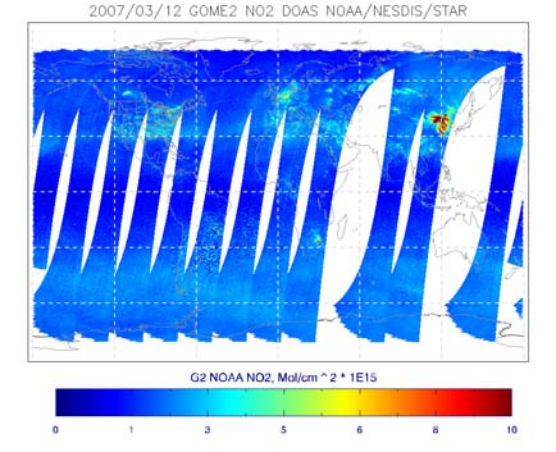
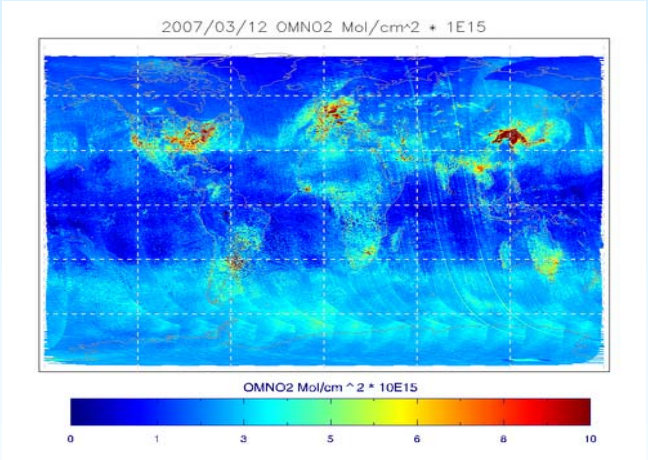
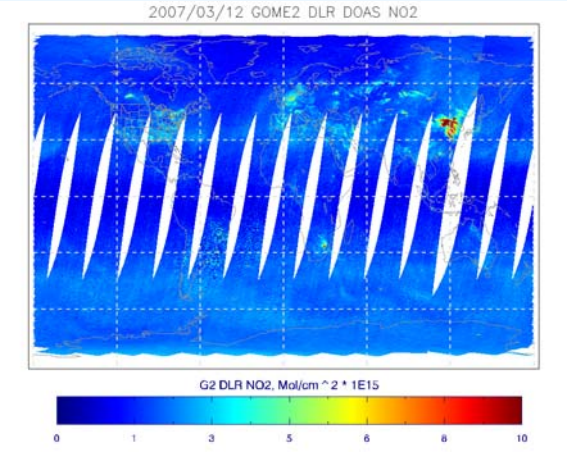


OMI NO2 product again can be very useful to constrain these random sources of emissions in an operational air quality forecast model

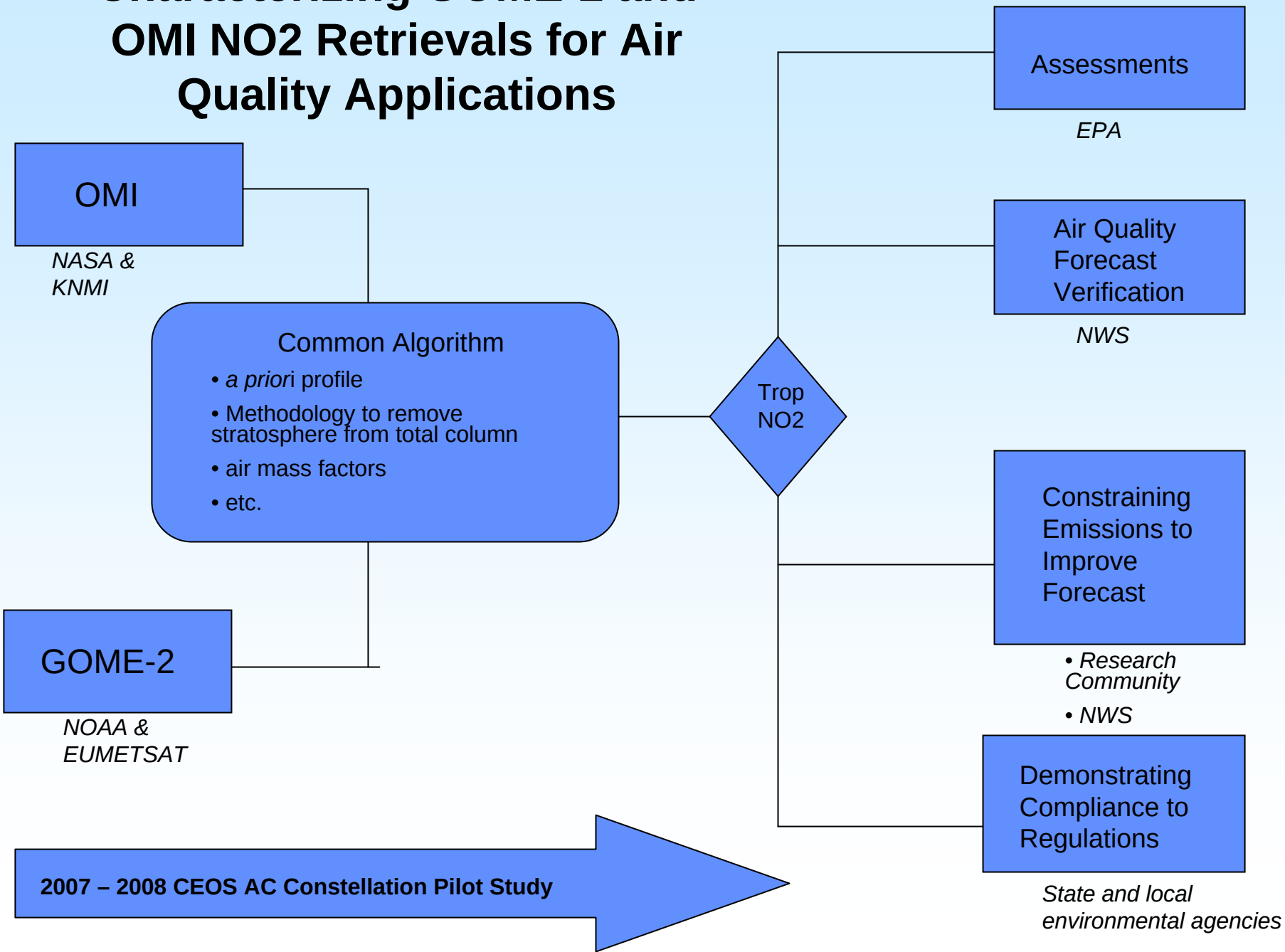
GOME-2 and OMI NO2







Characterizing GOME-2 and OMI NO2 Retrievals for Air Quality Applications



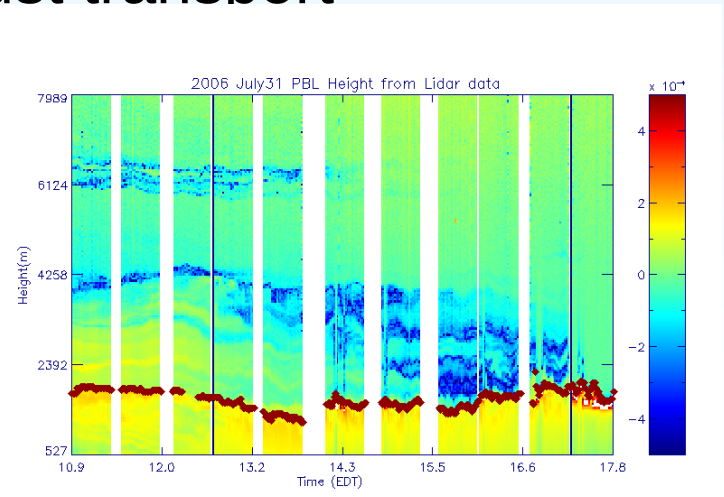
University Collaborations

- NESDIS support to LIDAR network
  - » UMBC
  - » CCNY

  } ⟸ Northeast Focus

  - » UAH ⟸ Southeast Focus
  - » Puerto Rico ⟸ Saharan dust transport

Help address air quality issues across the east and provide validation datasets for GFS and CMAQ

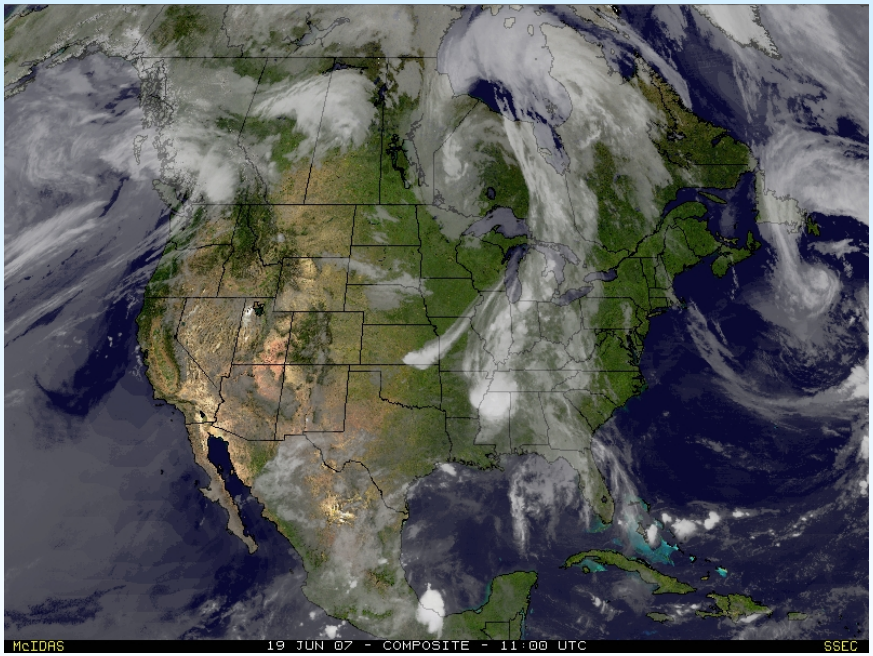


Resources

- NESDIS internal funding
- Joint Center for Satellite Data Assimilation (NASA/NOAA/DoD)
  - AO (open to outside research community)
  - NESDIS internal awards
- Office of Global Change Program
- NOAA Broad Area Announcement
  - Satellite related proposals come to NESDIS/STAR (Ingrid Guch)
- Integrated Program Office
  - Internal Government Study
- NESDIS Headquarters
  - Mostly international and GEOSS related activities

Where do we want to go?

- Observing clouds…



- Observing air quality from satellites as routinely as we do for clouds

Low Hanging Fruit

- Emissions from prescribed/wildfires are random and cannot be modeled *a priori*
- Satellites have unprecedented capability to observe fire locations
- EPA inventories are very expensive (~millions)
- Promote cost saving via leveraging satellite data in the creation of emissions inventory

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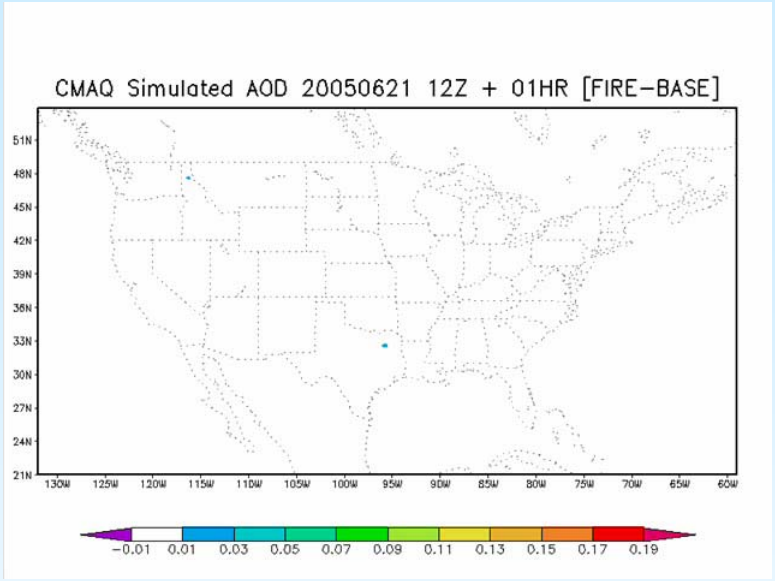

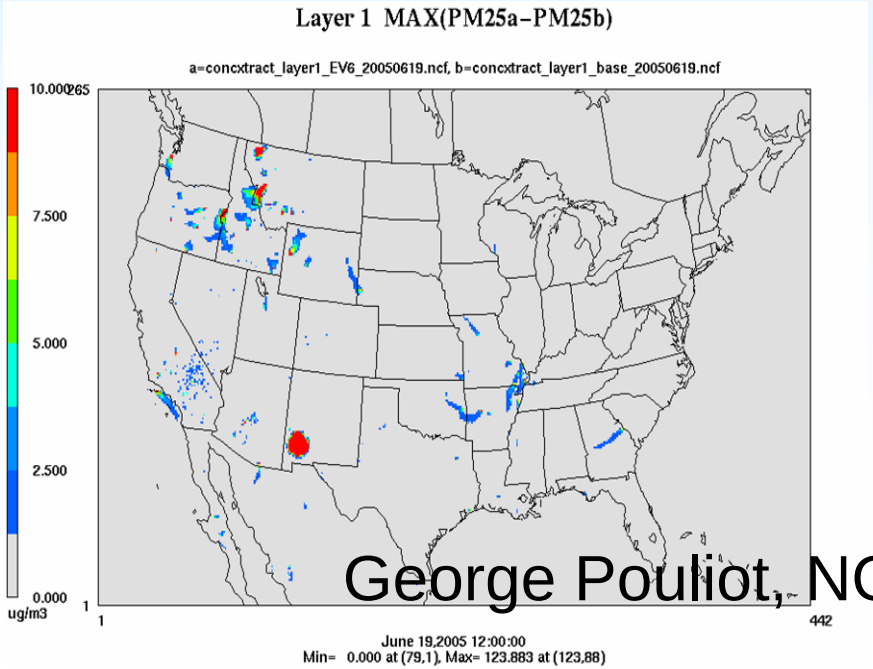

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George Pouliot, NOAA/OAR

Challenges

- Scales (local/regional/continental)
  - » Day to day monitoring vs spatial and temporal averaging
  - » Noisy data
- Chemical data assimilation
  - » Not equal to just ozone assimilation
  - » Ozone + other trace gases + aerosols
  - » Radiance assimilation or product assimilation
    - – Radiance assimilation requires fast radiative transfer model in the UV-VIS
  - » Assimilation into global models or regional models
    - – Global models do not have tropospheric chemistry
    - – Regional models need boundary conditions
- Future mission planning
  - » New species (e.g., ammonia)?
  - » Aerosol speciation?
  - » For aerosols, particle size?
  - » Vertical profile?
    - – Should we let satellites handle the total column and let *in situ* observations provide the verticality?

Closing Thoughts

- Suggestions
  - » Cost benefit analysis including estimates of balance between user requirements vs capabilities
- Gaps
  - » Sustainability
    - e.g., no US NO2 data beyond OMI
      - Lobby for modifying OMPS sensor for NPOESS flights 3 and beyond? Or invest in algorithm development to see if we can utilize available bands?
  - » Coordinate with JCSDA to leverage funds and conduct satellite chemical data assimilation (other than ozone).

NASA must take the initiative !!