Air Quality at NOAA

Research, applications and products

Dr. Monika Kopacz

Atmospheric Chemistry, Carbon Cycle and Climate (AC4) Program manager

NOAA co-chair **for Air Quality** and Community Health Research Subcommittee (ACRS), under OSTP

Advisor to GeoXO **Atmospheric Composition** instrument (ACX) Science Team

Air Quality Lead for NOAA One Health group

CPASW, March 26, 2024

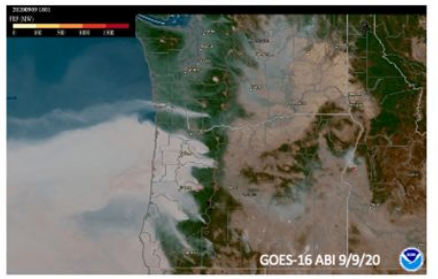
NOAA's mandates for atmospheric composition research, operations, and products

NOAA has numerous mandates to observe and predict Atmospheric Composition, e.g. **2021 EPA-NOAA MOA on Cooperation in Forecasting Air quality**

NOAA's **research** and operational Atmospheric Composition **products** address numerous applications as part of the agency's mission to protect **lives and property**

Air Quality

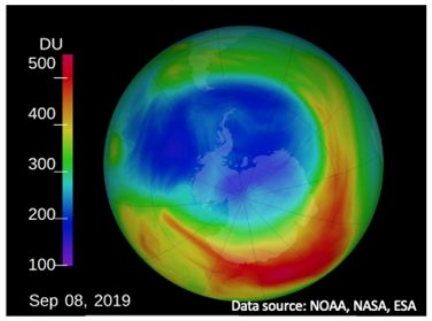
Wildfires



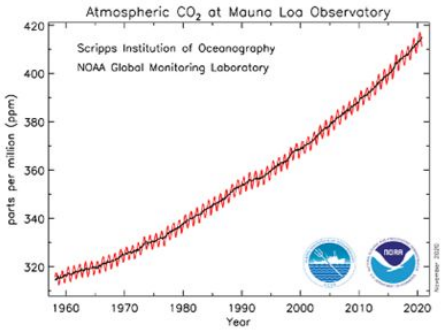
Hazards

Weather and Climate

Stratospheric Ozone



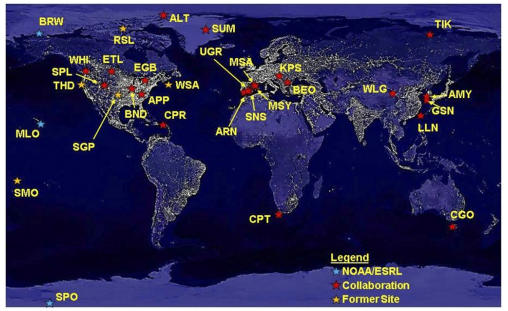
Greenhouse Gases

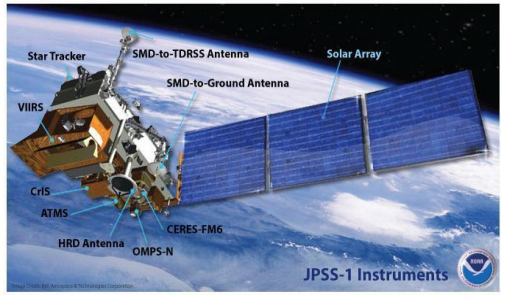


NOAA air quality capabilities

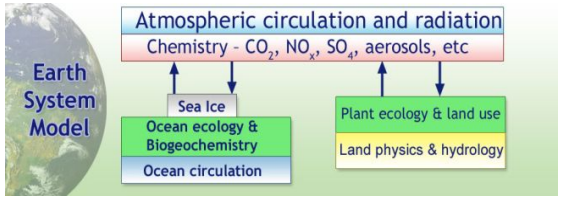
Measurements

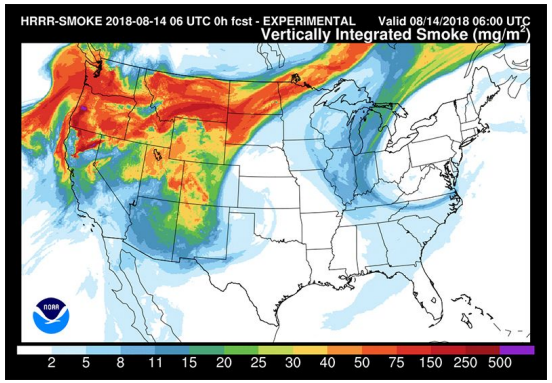
Monitoring





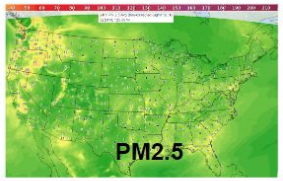
Models

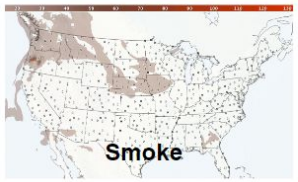


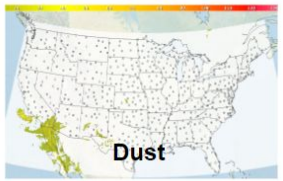


HYSPLIT

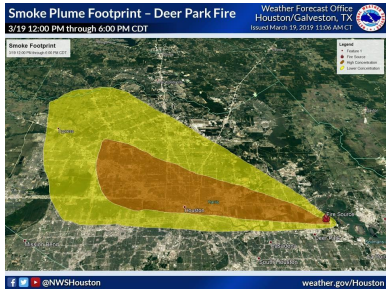
Services







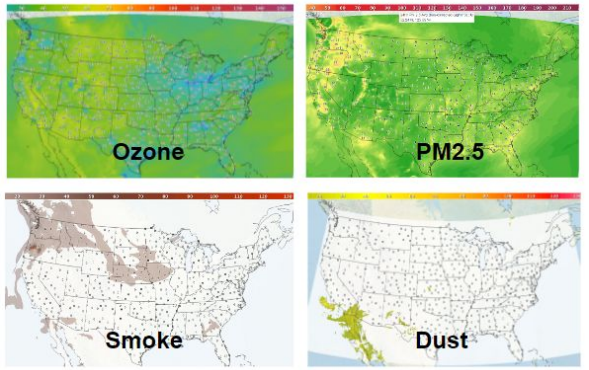
AerosolWatch
Every 10 minutes...



Focus: observe, understand, and predict atmospheric chemical composition and air quality

Highlights in this panel

Overview and listening session



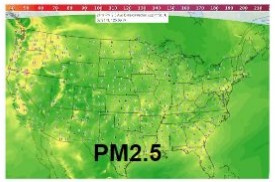
TRL 9

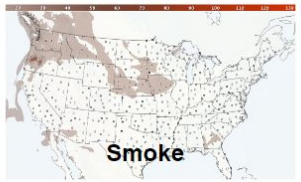
- Existing and experimental AQ forecasts (this presentation and Jordan Schnell) *NWS, OAR/GSL*
- Engagement with external scientists and stakeholders via competitive grants (this presentation) *OAR/CPO*
- Wildfire smoke information (Amy Huff) *NESDIS*
- Evolving urban atmosphere (Brian McDonald) *OAR/CSL*
- Potential future direction: AQ and health connections - dust research (Karin Ardon-Dryer) *Texas Tech U.*

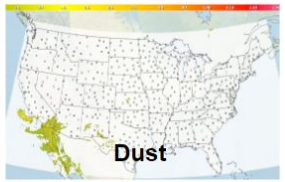
TRL "0"

NOAA Air Quality Forecasting

National Air Quality Forecast Guidance (NAQFC)



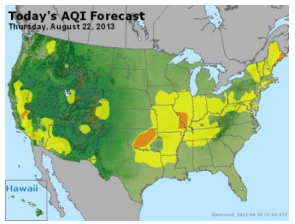




NOAA
Develop & evaluate models; provide operational AQ predictions

EPA
Maintain national emissions, monitoring data; disseminate/interprete AQ forecasts

State and local agencies
Provide emissions, monitoring data AQI forecasts



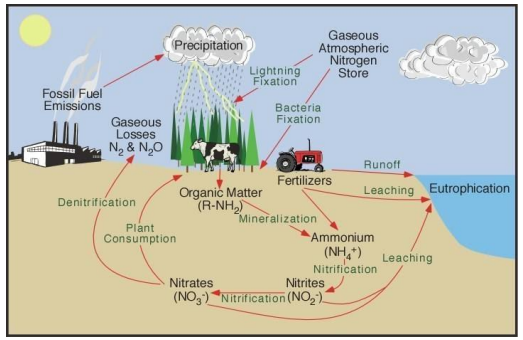
Air quality forecasting relies on a strategic partnership with EPA and state and local air quality agencies.

Engaging science community: AC4 program

(Program management: Monika Kopacz and Shiv Das)

Wildfire and smoke

Aerosols/PM



Urban atmosphere

Greenhouse gases

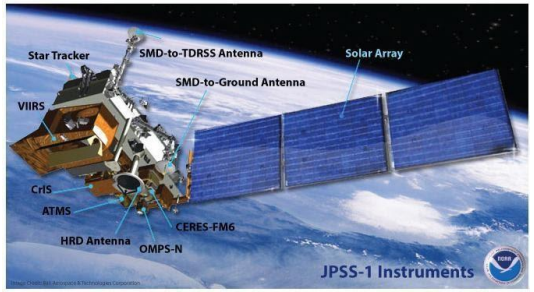
Field measurements

Ground based measurements and monitoring

Modeling

HYSPLIT

Satellite measurements

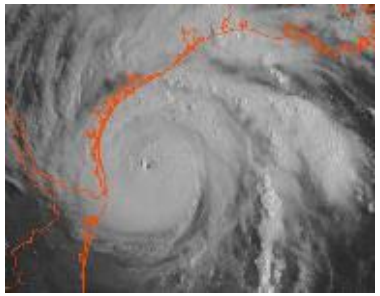


Future geostationary satellite observations: GeoXO: hourly AQ data from ACX!

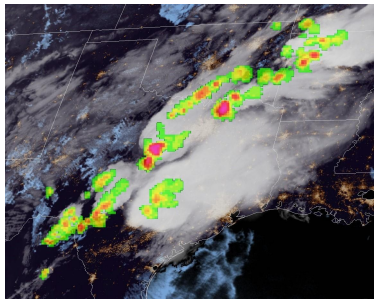
https://www.nesdis.noaa.gov/next-generation/geostationary-extended-observations-geoxo

GOES-R (current) + GeoXO (future)

Vis/Near-IR Imagery

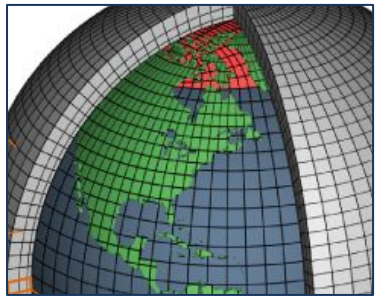


Lightning Mapping

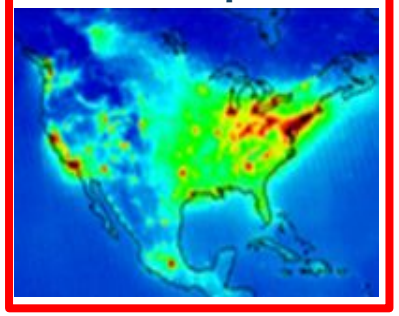


New to GeoXO

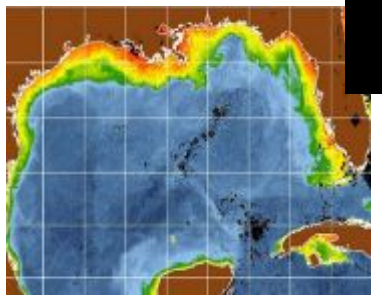
IR Sounding



Atmo. Composition



Ocean Color



GeoXO ACX product development lead:
Shobha Kondragunta (NESDIS)
GeoXO ACX user lead: Greg Frost (OAR)

First ACX Science Team meeting in College Park, MD on May 7-9, 2024. Registration is now open to all

See csl.noaa.gov/nacs for more

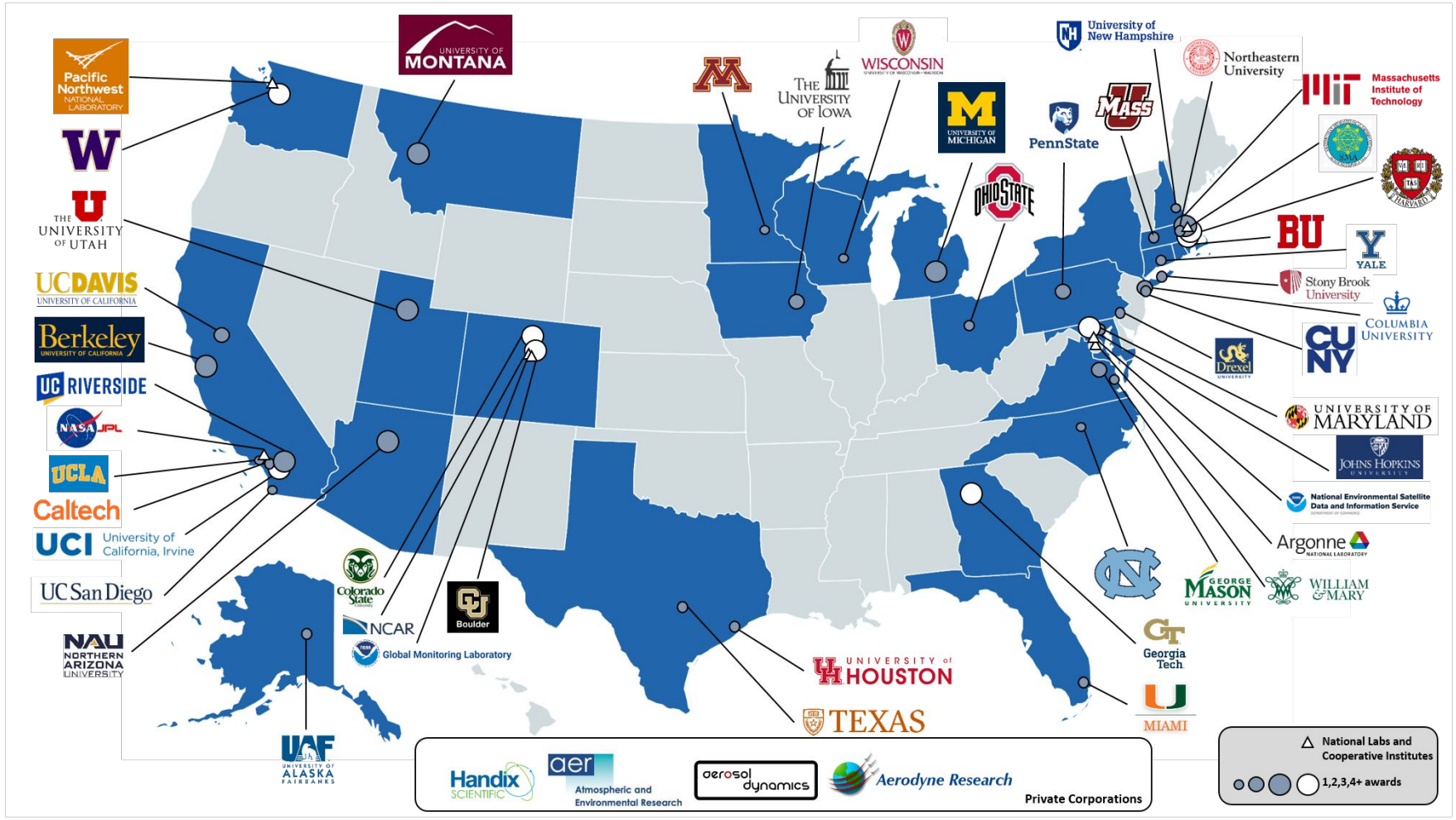
Interested in collaborating with AC4?

Monika Kopacz (AC4 Program manager):
monika.kopacz@noaa.gov

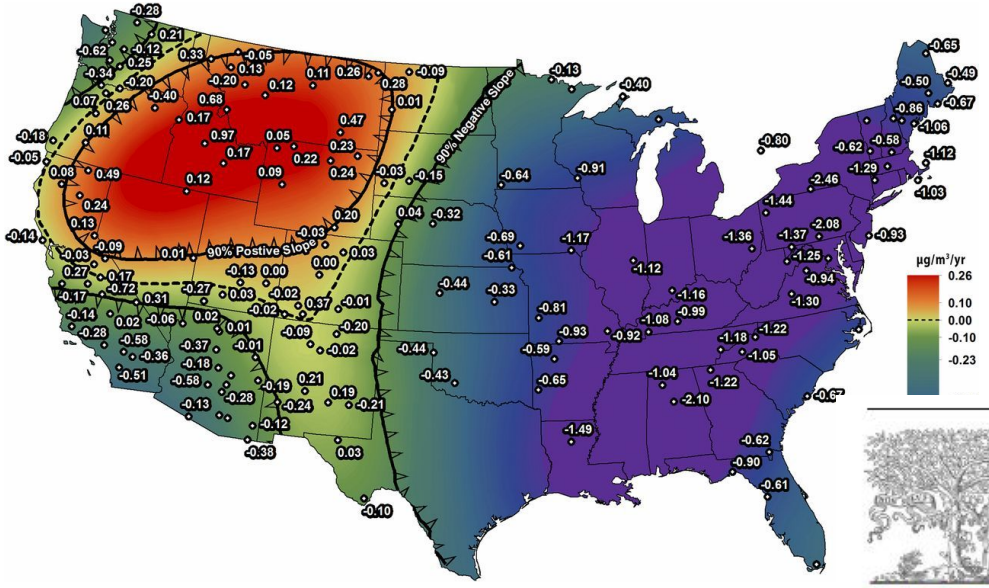
Shiv Das (AC4 Program Specialist):
shiv.das@noaa.gov

Website: cpo.noaa.gov/ac4

AC4 Funded institutions and private corporations



Fires: recent AC4 investments



McClure and Jaffe, PNAS 2018

Changes in PM2.5 from 1988 to 2016 - improvements in all but fire-prone areas in Northwest

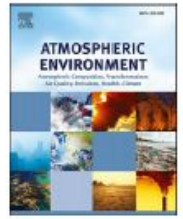
Fire Lab in Missoula, MT (2016)

Fied deployment (2019)

Contents lists available at ScienceDirect

Atmospheric Environment

journal homepage: www.elsevier.com/locate/atmosenv



The impact of wildfire smoke on ozone production in an urban area: Insights from field observations and photochemical box modeling

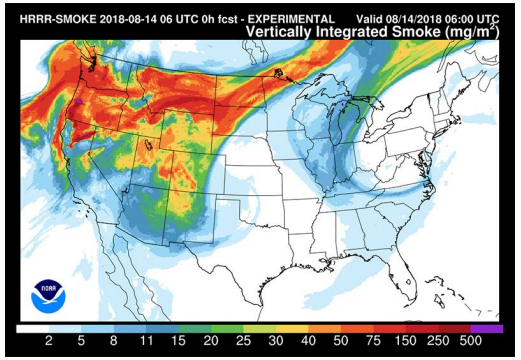
Matthew Ninneman *, Daniel A. Jaffe

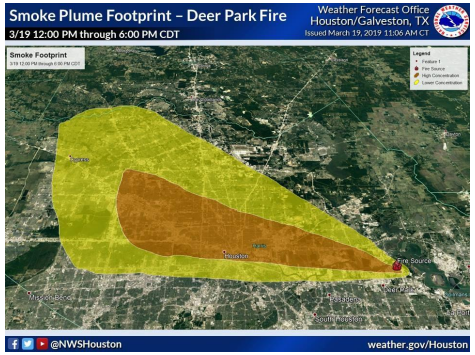
School of Science, Technology, Engineering and Mathematics, University of Washington Bothell, 18115 Campus Way NE, Bothell, WA, 98011, USA

Fire and smoke science and services

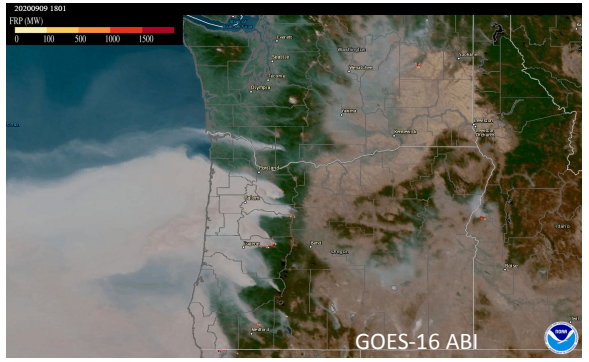
Process understanding

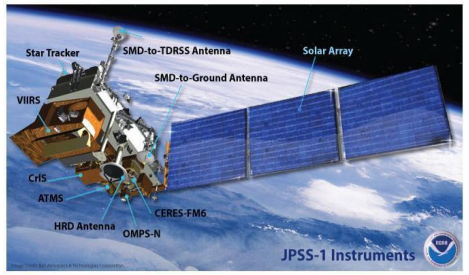
Models and forecasts





Data

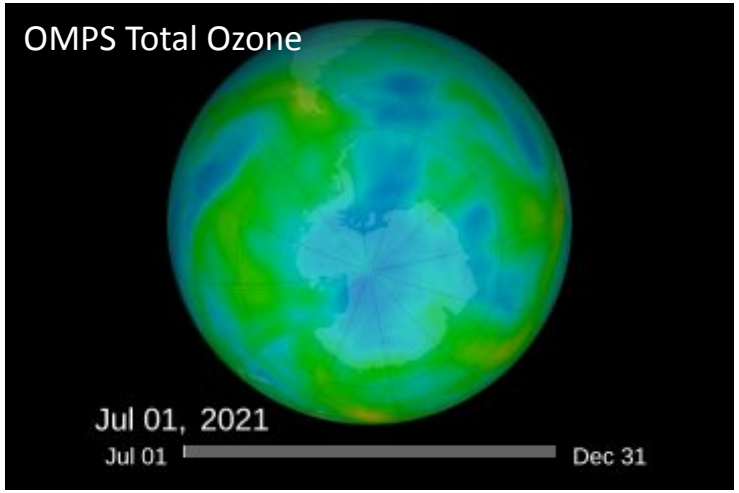




➡ Amy Huff's talk

Satellite observations: JPSS (polar-orbiting)

https://www.nesdis.noaa.gov/about/our-offices/joint-polar-satellite-system-jpss-program-office



Visible Infrared Imaging Radiometer Suite (VIIRS)

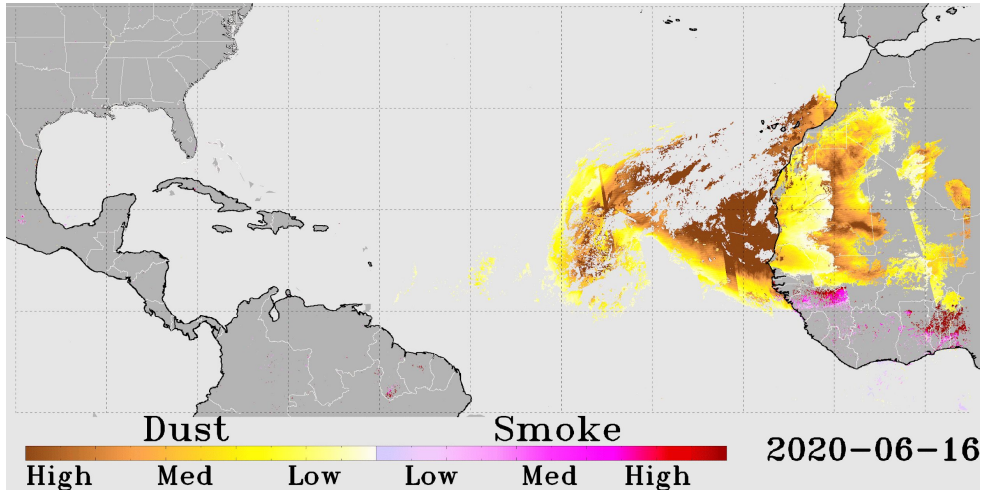
- Fire detection
- Fire radiative power
- Aerosol type
- Aerosol optical depth
- Aerosol concentration

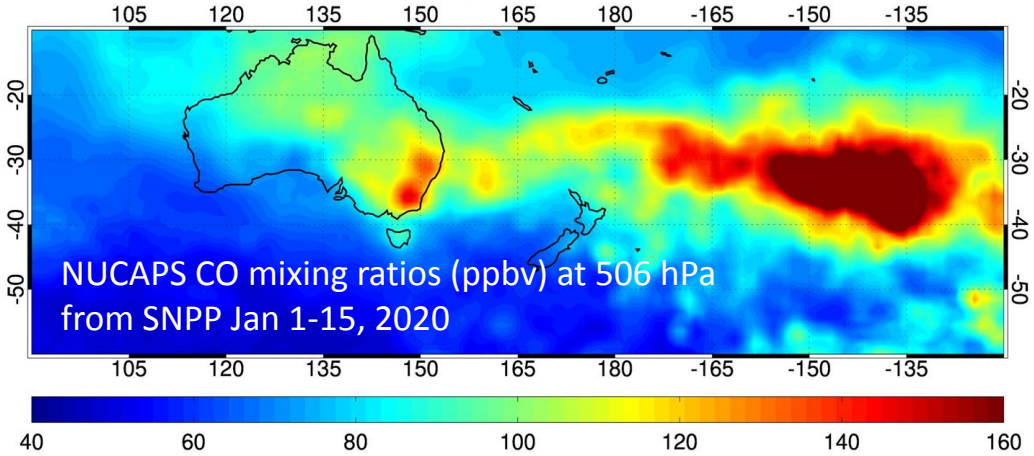
Cross-track Infrared Sounder (CrIS)

- Ozone
- Carbon monoxide
- Carbon dioxide
- Methane
- Ammonia

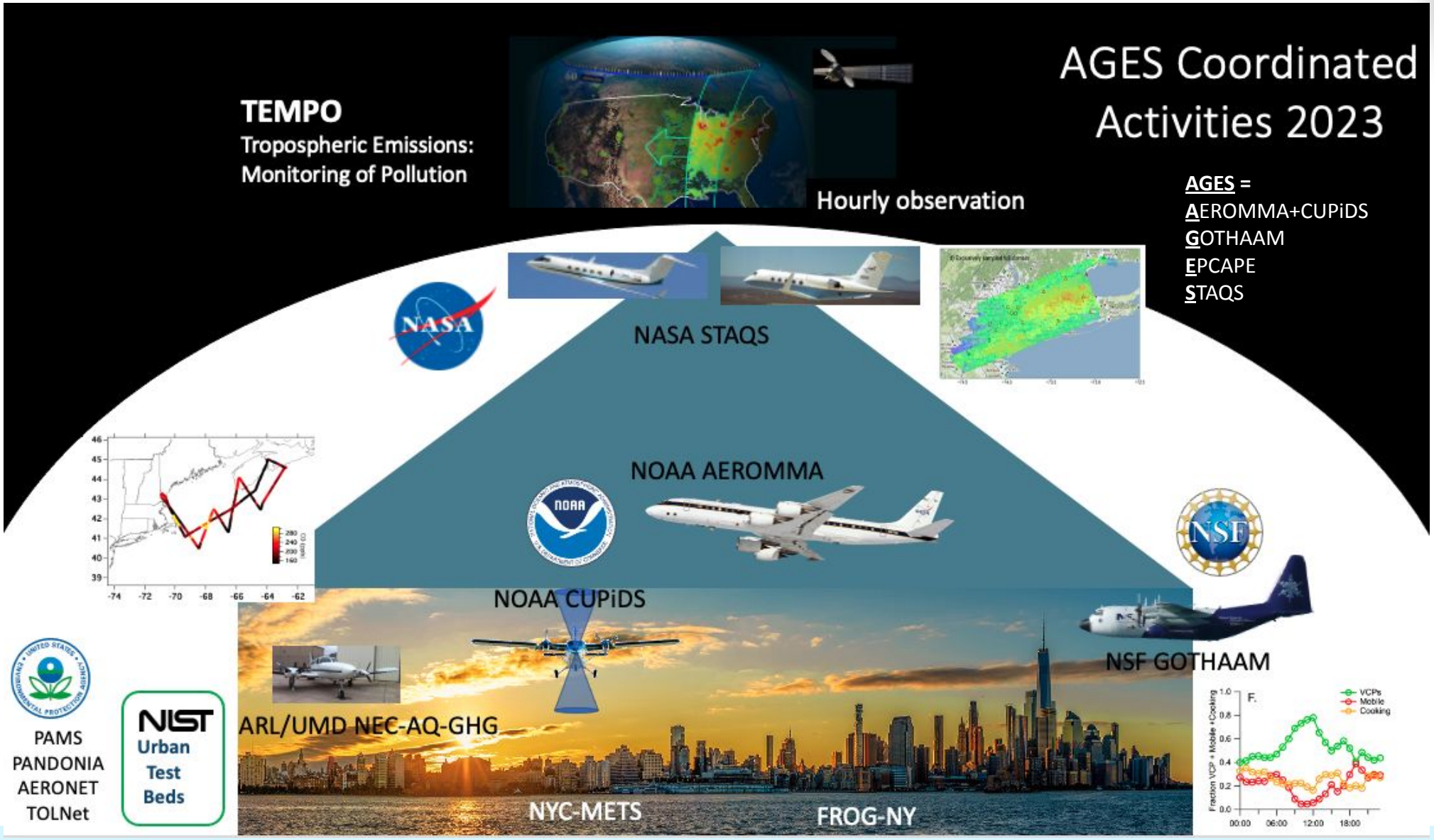
Ozone Mapping and Profiler Suite (OMPS)

- Ozone
- Nitrogen dioxide
- Sulfur dioxide
- Formaldehyde





Urban air quality: NOAA field campaigns



NOAA's One Health

This **NOAA-wide Group** advances NOAA's science and service to inform health decisions through:

- improved understanding of the linkages between environment conditions and health outcomes
- delivery of useful prediction products, data and tools

Thematic Areas:

Extreme Conditions
Heat, Drought, Severe Weather

The Arctic
Dramatic climate-driven changes to regional ecosystems impact local human health

Air Quality
Aero-allergens, pollution Weather patterns and atmospheric drivers

Vector-Borne Disease
Climate impacts on ranges and transmission

Benefits from the Sea
Marine products and nutrition

Water-Borne Disease
Harmful algal bloom and Vibrio forecasts; water quality

Marine Mammal Disease
Marine Mammal Health, Zoonotic transmission, Unusual Mortality Events

AQ-drought connections – focus on health too?

Drought □ unhealthy air quality

wildfires-smoke

Drought □ fire □ smoke

Dust

Dust Bowl 2.0? Rising Great Plains dust levels stir concerns *Science 2020*

Plant stress

Drought leads to increased ozone and PM2.5 production (via increased precursor emissions), decreased deposition, decreased scavenging of pollutants

Types of research, data, models and services

- Monitoring: network of in-situ, remote-sensing, tall tower, sondes, and aircraft sampling for trace gases, aerosols, radiation, boundary layer characterization, surface-atmosphere exchange, meteorology
- Satellite: polar-orbiting and geostationary measurements of trace gas, aerosol, and fire products
- Field campaigns: assessment of impacts of regulatory changes, identification of new air pollution sources, assistance with understanding exceedances, development of process understanding
- Models: developing algorithms and products for emissions, air pollution chemistry, atmospheric physics and dynamics
- Wildfires: advancing smoke forecasts and tracking
- Operational air quality forecast guidance
- Rapid response hazards nowcasting and tracking

In house NOAA capabilities (OAR, NESDIS, NWS) and externally supported research (OAR/WPO and OAR/CPO)

NOAA AQ-drought

Tools:

- Dust forecast
- AQ forecast guidance
- AirNow (airnow.gov) – AQI (Air Quality Index)
- Wildfire field measurements and modeling – understanding the spread and composition of smoke
- HRRR-smoke forecast
- Satellite monitoring – smoke transport monitoring, aerosol monitoring (fire and in general)

Unknowns:

- Dust sources, chemical/biological composition and impacts
- Drought impacts on plant emissions

Types of research, data, models and services

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Stakeholders for NOAA air quality products and services

Who are our stakeholders?

- Research community
- Operational forecasters
- Environmental regulators
- Assessment bodies
- Public health officials
- Diplomats
- Press
- General public

How are we connecting with them?

- 1-on-1 engagement
- Conferences
- Websites
- Social media
- Trainings
- Assessments
- Public media