AGES Workshop Sep 27-29 Boulder, CO

Goals and potential outcomes Overarching science questions

Workshop Goal: Bring Projects and People Together in 2023

TEMPO

PAMS

AGES

AERONET

NEC-AQ-GHG

NYC-METS

Pandonia

NIST

EPA monitoring

Atlanta+ASCENT

AEROMMA+CUPiDS
GOTHAAM
EPCAPE
STAQS

NIST urban test bed

FROG-NY

THE CIX

SARP

TOLNet

North American Urban AQ and GHG – Emissions & Trends

Mortality & Non-Attainment

U.S. Annual Mortality

NOAA Geo-XO report 2021
Fann Risk Anal. 2012
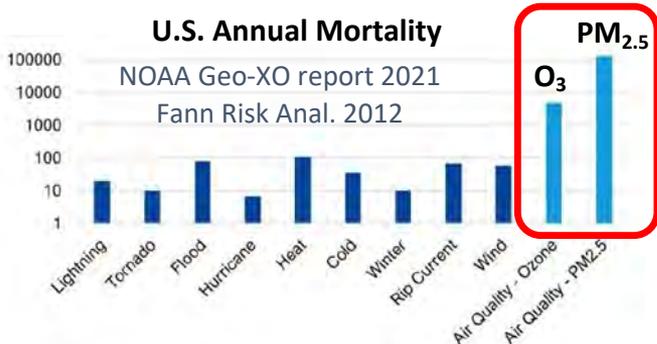
U.S. Air Quality Non-Attainment Areas
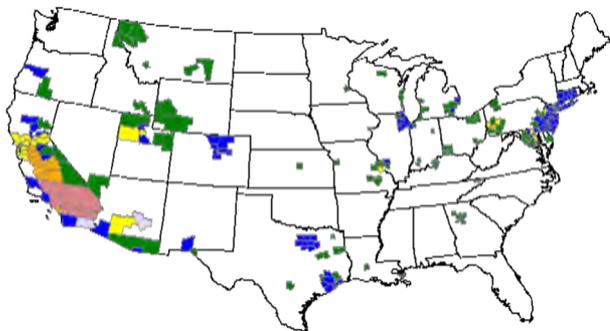
130 million residents; >100,000 deaths;
~$900 billion in annual damages;
significant impacts during extreme heat

Emissions Reductions
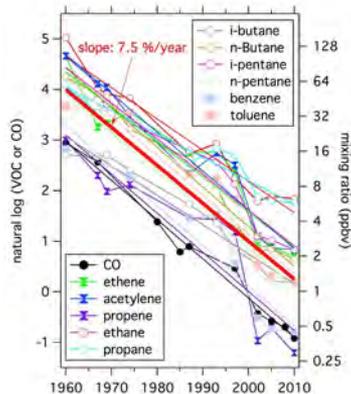
Substantial reductions in urban pollutants, especially VOCs

Warneke et al. (*2012*), Pollack et al. (2013)

VCP importance

McDonald et al. (*2018*)
Coggon et al (2021)

VOC Emissions = 350 ± 50 Gg
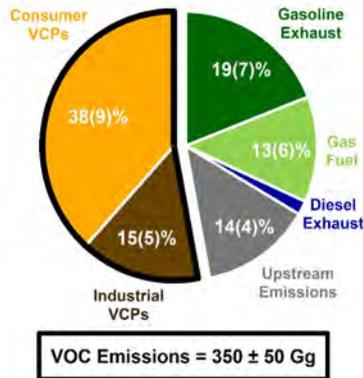
Recent Trends

Historical improvement in O_3
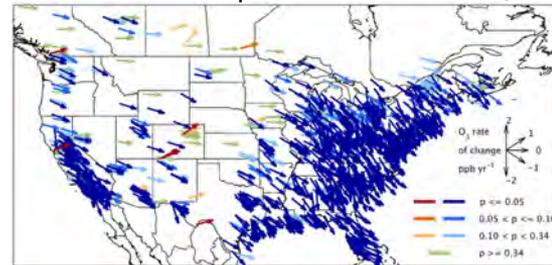
Fleming et al. (*2018*)
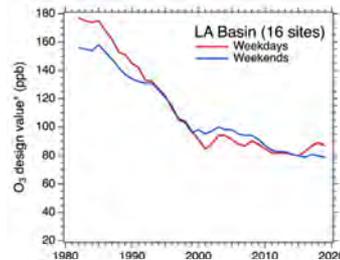
Recent slowdown in O_3 trends
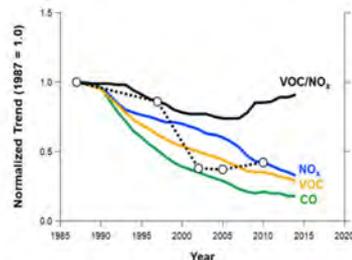
Kim et al. (*2022*)

Geostationary Atmospheric Composition Measurements

- The NASA Tropospheric Emissions: Monitoring of Pollution (TEMPO) instrument launches in December 2022
- Opportunity for new science in emissions, air quality, climate with high spatial resolution, hourly satellite data
- Validation mission for NOAA in preparation for the 2030's GeoXO atmospheric composition instruments

NASA TEMPO: 2023 – 20xx

NOAA GeoXO: 2030 – 20xx
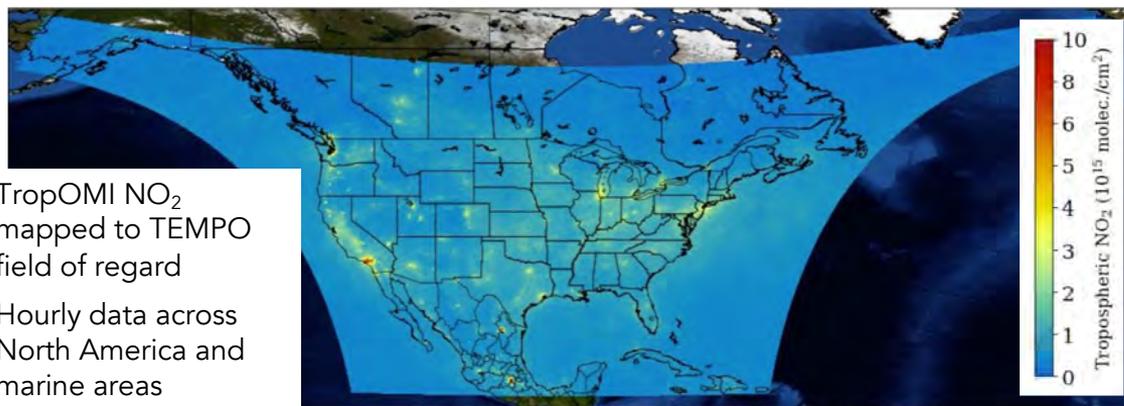
TropOMI NO_2 mapped to TEMPO field of regard

Hourly data across North America and marine areas

Standard Products
Nitrogen dioxide NO_2
Formaldehyde CH_2O
Total ozone
Boundary layer ozone

Enhanced Products
Aerosol optical depth AOD
Glyoxal $C_2H_2O_2$
Bromine monoxide BrO
Sulfur dioxide SO_2
Nitrate radical NO_3

All TEMPO products included in AEROMMA/STAQS in-situ airborne observations

GeoXO Constellation
(Preliminary, pending program approval)

GEO-West
Visible/Infrared Imager
Lightning Mapper
Ocean Color

GEO-Central
Hyperspectral Infrared Sounder
Atmospheric Composition
Partner Payload

GEO-East
Visible/Infrared Imager
Lightning Mapper
Ocean Color

Product Lead:
Shobha Kondragunta
User Lead:
Greg Frost

GeoXO atmospheric composition may also include an IR sounder for a suite of other species (e.g., GHG, NH_3, etc.) currently measured in LEO but validated by AEROMMA

The Marine Atmosphere, Urban Interface, and Climate Impacts

Adapted from Thompson et al. 2022

Remote Marine Chemistry

- Air/Sea exchange
- Aerosol nucleation and growth
- Coupling chemistry and cloud processes

- Emissions and chemistry
- Reactive nitrogen

Urban Marine Interface

- Urban impact on cloud properties
- Marine impact on coastal urban AQ

- Impact of urban NO_x

Climate

- Impact on key climate gases, e.g. CH_4, O_3
- Marine/urban aerosols cloud interactions

- Aerosol radiative properties

Change in global sulfate burden with updated DMS oxidation scheme
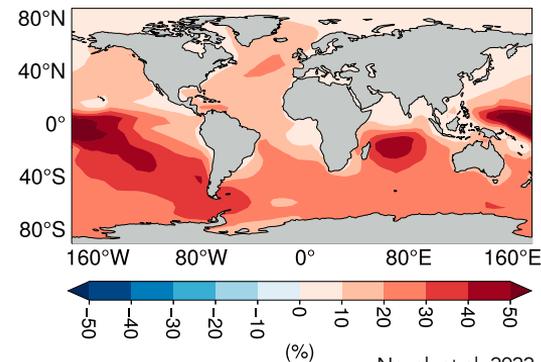
Novak et al. 2022

AGES 2023: Sampling Strategy

DC-8: Marine and urban in West Coast, Mid/East Coast

Twin Otter (NOAA Aircraft): **CUPiDS** - Remote sensing & dynamics, regional focus

G-V and G-III (NASA Aircraft): NASA **STAQS** - Remote sensing package coordinated with DC-8

C-130 (NSF Aircraft): **GOTHAAM** - In-situ, mostly regional focus

ARL/UMD Cessna: NYC flights+mobile

NPS Twin Otter: regional marine flights

Albany mobile lab: regional NYC

Ground sites (NYC x 3, Toronto, Atlanta, Scripps)
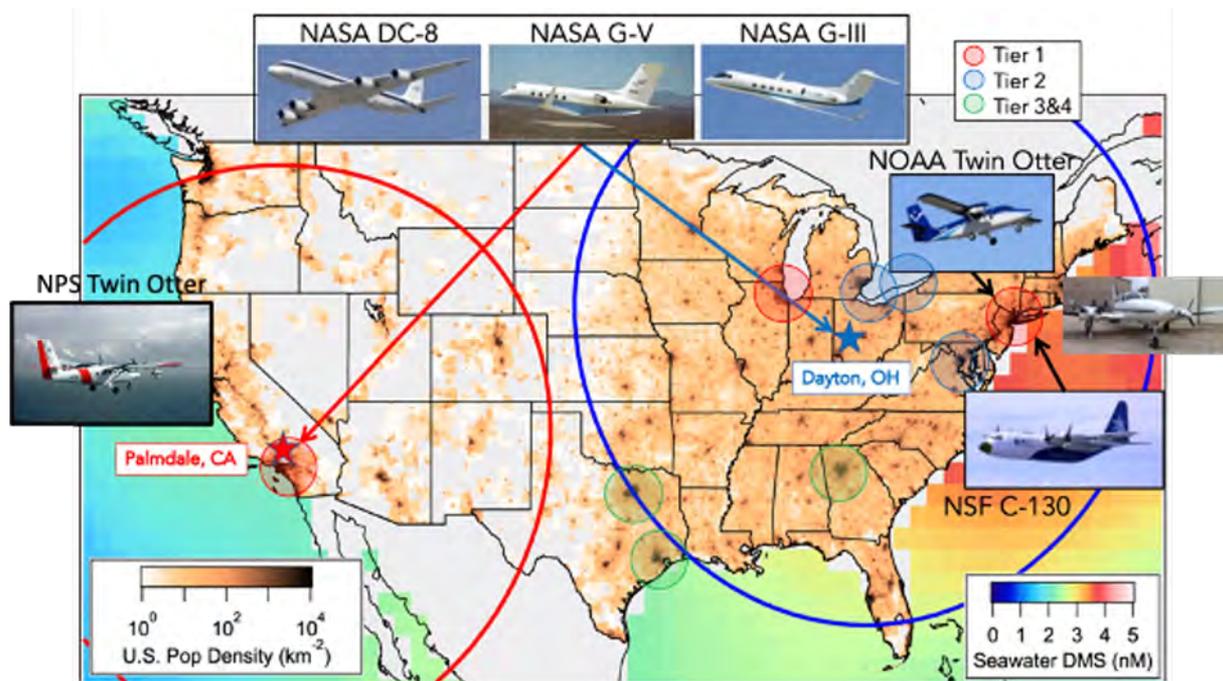
Platform/Location	Experiment name	PIs	Affiliation	Sponsor	Web resource
	Aircraft				
NASA DC-8	AEROMMA (Atmospheric Emissions and Reactions Observed from Megacities to Marine Areas)	Urban: Carsten Warneke, Rebecca Schwantes Marine: Patrick Veres, Drew Rollins	NOAA CSL	NOAA, NOAA NESDIS, NOAA GeoXO	https://csl.noaa.gov/projects/aeromma/
NOAA Twin Otter	CUPiDS (Coastal Urban Plume Dynamics Study)	Alan Brewer	NOAA CSL	NOAA	https://csl.noaa.gov/projects/aeromma/cupids/
NASA GV/G-III	STAQS (Synergistic TEMPO Air Quality Science)	Laura Judd	NASA Langley	NASA	https://www-air.larc.nasa.gov/missions/staqs/index.html
NCAR/NSF C-130	GOTHAAM (Greater New York Oxidant, Trace gas, Halogen, and Aerosol Airborne Mission)	John Mak	Stony Brook	NSF	https://www.nsf.gov/awardsearch/showAward?AWD_ID=2023574&HistoricalAwards=false
ARL/UMD Cessna	NEC-AQ-GHG (NEC Air Quality and Greenhouse Gas Study)	Xinrong Ren Russ Dickerson	NOAA ARL U. Maryland	NOAA ARL	
NPS Twin Otter	SCILLA (Southern California Interactions of Low cloud and Land Aerosol)	Mikael Witte	Naval Postgraduate School	ONR, DOE	
	Ground sites				
NYC CUNY	NYC-METS (New York City metropolitan Measurements of Emissions and TransformationS)	Drew Gentner, Andy Lambe	Yale, Aerodyne	NOAA AC4	https://csl.noaa.gov/projects/aeromma/partners/NYC-METS_ProjectSummary&MeasurementLocations.pdf
NYC Yale Coastal Site	NYC-METS	Drew Gentner, Andy Lambe	Yale, Aerodyne	NOAA AC4	
NYC Minneola	FROG-NY (Fluxes of Reactive Organic Gasses in New York)	Delphine Farmer, Dylan Millet	CSU, U. Minnesota	NOAA AC4	
Atlanta	Atlanta	Nga Lee (Sally) Ng, Jennifer Kaiser	Georgia Tech.	NSF, NOAA AC4	
Toronto	THE CIX (Toronto Halogen, Emissions, Contaminants, and Inorganics eXperiment)	Cora Young	York U.	NSERC, TBD	
Scripps Pier La Jolla, Mt. Soledad	EPCAPE (Eastern Pacific Cloud Aerosol Precipitation Experiment)	Lynn Russell	Scripps	DOE ARM	https://www.arm.gov/research/campaigns/amf2023epcape
	Long term monitoring				
7 cities and mobile units	TOLNet (Tropospheric Ozone Lidar Network)	John Sullivan	NASA Goddard	NASA	https://www-air.larc.nasa.gov/missions/TOLNet/
multiple locations	Pandonia Global Network	Thomas Hanisco	NASA GSFC	NASA	https://pandora.gsfc.nasa.gov/
43 cities	PAMS (Photochemical Assessment Monitoring Stations)	Luke Valin	EPA	EPA	https://www.epa.gov/amtic/photochemical-assessment-monitoring-stations-pams
Indianapolis, LA, North East Corridor	Urban Test Bed Measurements: greenhouse gas fluxes	Kimberley Mueller, Anna Karion	NIST	NIST	https://www.nist.gov/topics/greenhouse-gas-measurements/urban-test-beds
12 cities	ASCENT (Atmospheric Science and mEasurement NeTwork)	Nga Lee (Sally) Ng	Georgia Tech.	NSF	https://chbe.gatech.edu/news/2021/10/

2023

	April	May	June	July	August
AEROMMA DC-8			9 · 20 · 30	22	18
STAQS GV & GIII					18
CUPiDS TO			24		8
GOTHAAM C-130			25		5
NEC-AQ-GHG Cessna				1	15
NYC CUNY				1	31
NYC Yale Coastal				1	31
NYC Mineola			25		20
Atlanta			25		20
Toronto			25		20
EPCAPE					
SCILLA TO					

AGES Coordinated Activities 2023

TEMPO
Tropospheric Emissions:
Monitoring of Pollution
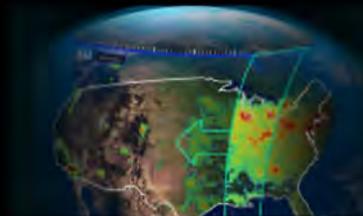
Hourly observation

NASA STAQS

NOAA AEROMMA

NOAA CUPiDS

NSF GOTHAAM

ARL/UMD NEC-AQ-GHG

PAMS
PANDONIA
AERONET
TOLNet

NIST
Urban
Test
Beds

NYC-METS   FROG-NY

AGES Coordinated Activities 2023

TEMPO
Tropospheric Emissions:
Monitoring of Pollution

Hourly observation

NASA STAQS

3D-Modeling

NOAA AEROMMA

NOAA CUPiDS

NSF GOTHAAM

ARL/UMD NEC-AQ-GHG

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