



## GeoXO ACX Update

Presented by  
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GeoXO ACX Product Scientist

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NOAA  
National Satellite and  
Information Service  
*Center for Satellite Applications and Research*

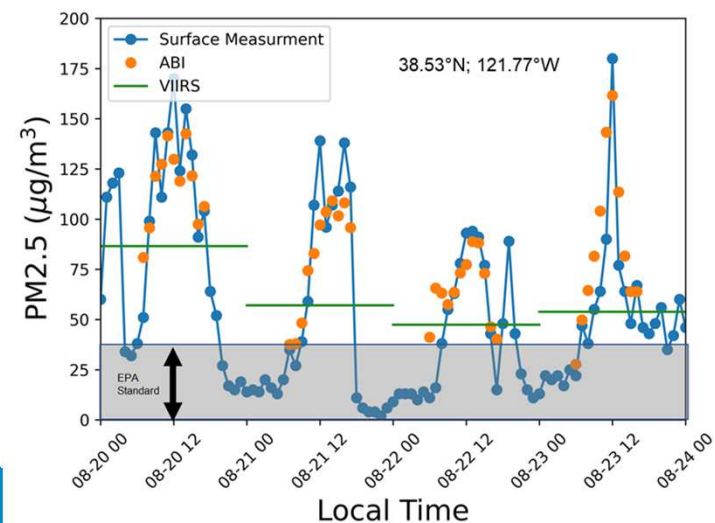
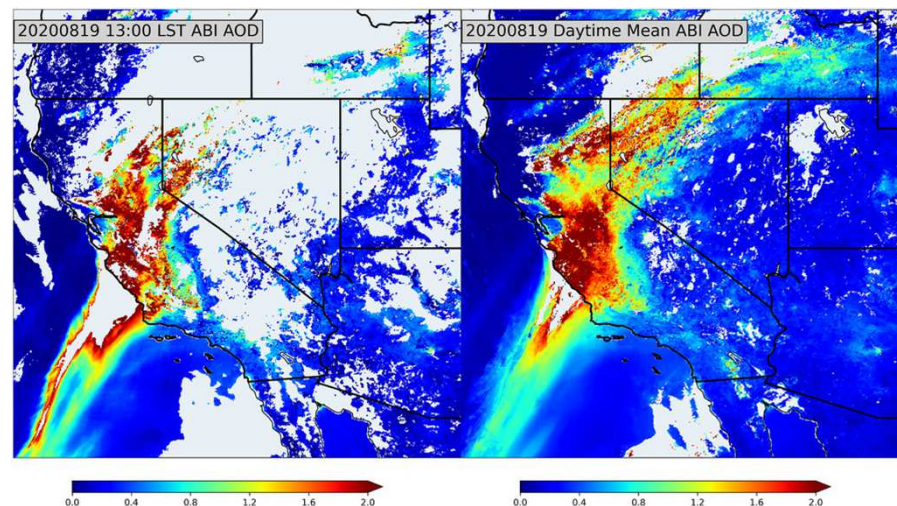
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October 25, 2023  
CEOA AC-VC#19 Brussels, Belgium

# GeoXO ACX Instrument



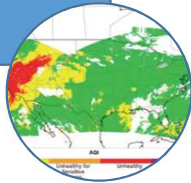
Attribute	What	Why
Coverage	CONUS, southern Canada, northern Mexico, Caribbean	Hourly inputs to national air quality, hazard and fire forecasting capabilities and warnings.
Spatial Resolution	8x3 km <sup>2</sup> @ nadir	Resolve sources, including cities, highway corridors, airports, oil/gas fields, large point sources like fires and power plants.
Temporal Resolution	60 min	<p>Capture diurnal variations in pollution emissions, photochemistry, and exposure. Detect episodic events like wildfires and volcanoes.</p> <p>Select for cloud-free conditions.</p> <p>Increase geographic coverage compared with LEO or surface observations.</p>
Spectral Coverage / Resolution	UV: 300-500 nm Vis: 540-740 nm Both @ 0.6 nm	UV: ozone, nitrogen dioxide, formaldehyde, sulfur dioxide, absorption aerosol optical depth. Vis: cloud/aerosol layer height, PBL ozone, vegetation.



# GeoXO atmospheric composition will be a multi-instrument strategy for various NOAA applications

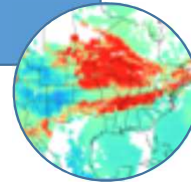
- Fire detection
- Fire radiative power
- Aerosol type
- Aerosol optical depth
- Aerosol concentration

## IMAGER



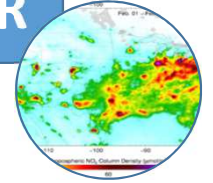
- Ozone
- Carbon monoxide
- Carbon dioxide
- Ammonia
- Isoprene

## SOUNDER



- Ozone
- Nitrogen dioxide
- Sulfur dioxide
- Formaldehyde
- Aerosol layer height
- UV AI
- UV aerosol optical depth

## SPECTROMETER



### Applications

Near real time emissions | Air quality forecasting

Air quality monitoring | Fire weather forecasting

Fire emissions monitoring | Ozone monitoring

Hazards forecasting | Greenhouse gas monitoring

Climate modeling and earth system science research

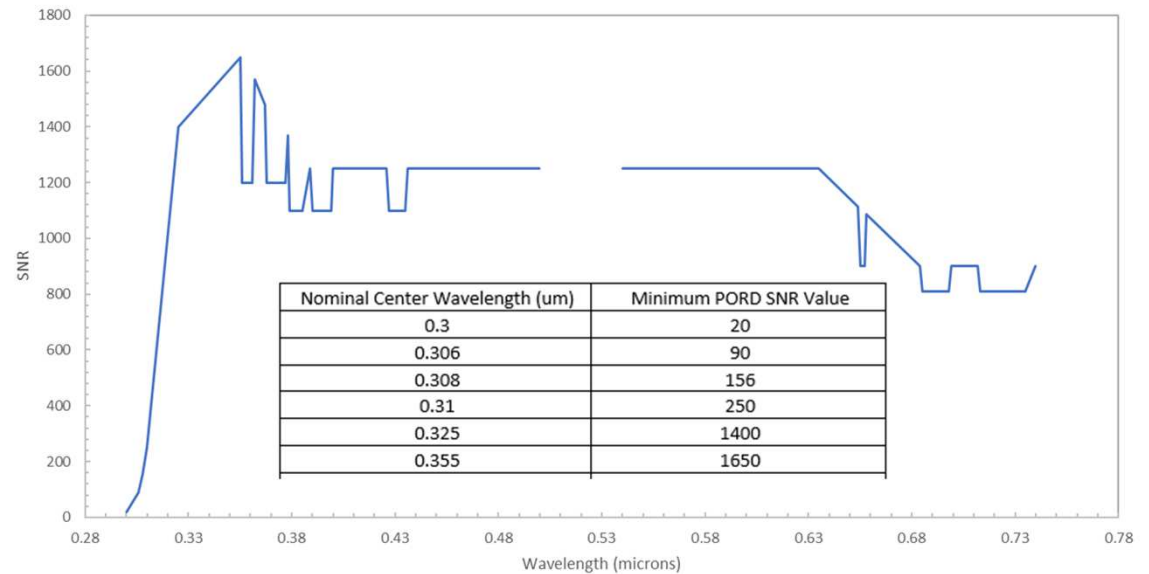
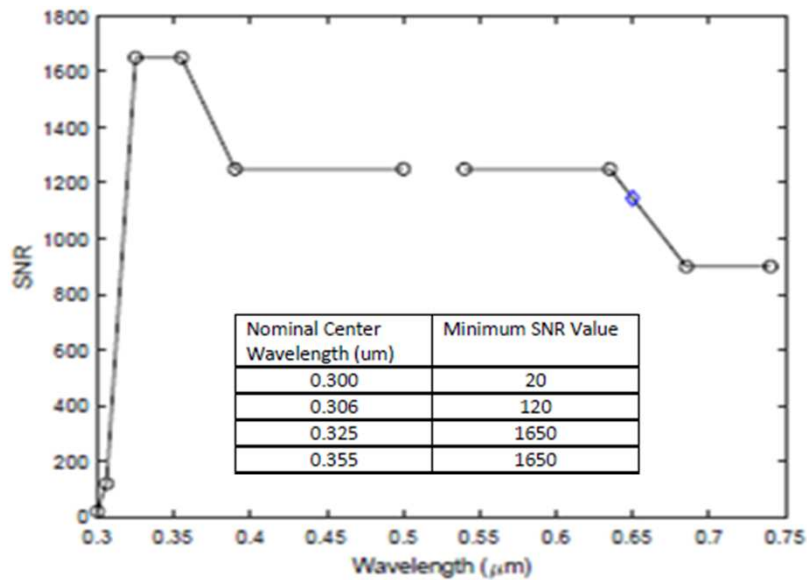
# ACX Phase A Trade/Studies

- Revisit Time and SNR Trade Study
  - Evaluate increased temporal repeat and system cost and design impacts while meeting required SNR and spectral sampling and resolution. Can the instrument be commanded for repeated observations of smaller targeted regions?
  - Relaxation of ACX SNR requirement would result in increased revisit time
  - Repeated observations of small, targeted regions can be commanded
- Polarization Trade Study
  - Examine levels of polarization performance, reporting of optical design and test campaign impacts
  - ACX concepts expected to meet polarization requirement of less than 5%
- Field of Regard Trade Study
  - Evaluate maintaining CONUS coverage within the instrument field-of-regard (FOR) with a yaw flip (north-south inversion) nominally at 105°W
  - Subsystem modification needed in some cases

ACX instrument RFP draft is ready but not out yet

*Slide content from Monica  
Todorita (GeoXO program office)*

# Changes to ACX Requirements



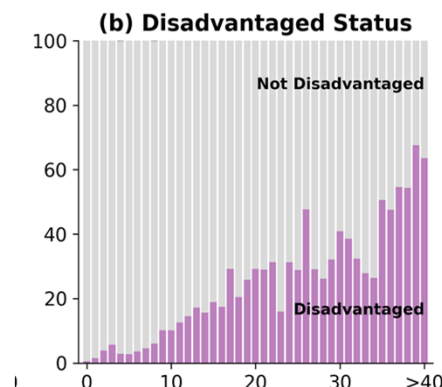
- Relief in the UV range and for deep features at absorption lines throughout
- ACX science team analysis fed into UV relaxation

*From Joanna Joiner (NASA)*

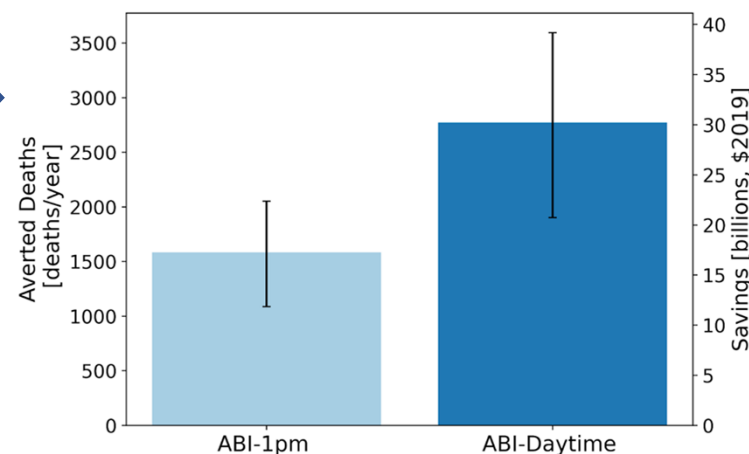
# Science Updates



- Aerosol algorithms ready and tested on GEMS. Awaiting for TEMPO L1B data to become available. NOAA will access the L1B and L2 standard products from NASA via AWS cloud-to-cloud transfer.
  - All algorithm work will be run on AWS, including NOAA research air quality models that will do some pilot studies.
    - First pilot will be to use TEMPO tropNO2 product for NOx emissions updates
    - Near real time GOES ABI + TEMPO merged surface PM2.5 for EPA. This follows our very successful joint NASA-NOAA-EPA project (see *Barron Henderson and Phil Dickerson talk this afternoon*)
    - Etc.
- Published our first atmospheric composition value study
  - 1200 premature deaths averted
  - \$13B health care costs and lost economic productivity
- Formed our science team and had our first meeting in May 2023
- The program is in the process of hiring a GeoXO user engagement lead
- NASA-NOAA joint field campaign AGES+ completed



**Katelyn O'Dell**, Shobha Kondragunta, Hai Zhang, Daniel Goldberg, Gaige H. Kerr, Zigang Wei, Barron Henderson, and Susan C. Anenberg, Public Health Benefits from Improved Identification of Severe Air Pollution Events with Geostationary Satellite Data, *GeoHealth*, in press, 2023



## ACX Science Team Members Update

Susan <b>Anenberg</b>	<b>Shobha Kondragunta</b>
Jerome <b>Barre</b>	Xiong <b>Liu</b>
Trevor <b>Beck</b>	Istvan <b>Laszlo</b>
Patricia <b>Castellanos</b>	Randall <b>Martin</b>
David <b>Edwards</b>	Brian <b>McDonald</b>
Lawrence <b>Flynn</b>	R. Bradley <b>Pierce</b>
<b>Gregory Frost</b> <sup>3</sup>	Ivanka <b>Stajner</b>
→ Mitch <b>Goldberg</b>	James <b>Szykman</b>
Gonzalo Gonzalez <b>Abad</b>	Omar <b>Torres</b>
Katherine <b>Hawley</b>	Luke <b>Valin</b>
Barron <b>Henderson</b>	Jun <b>Wang</b> <sup>*</sup>
Daven <b>Henze</b>	Kai <b>Yang</b>
<b>Joanna Joiner</b> <sup>1</sup>	
Laura <b>Judd</b>	<sup>*</sup> Starting May 2024

*Advisors:*  
 Andrew Heidinger  
 Dan Lindsey  
 Mitch Goldberg  
 Walter Wolf  
 Monika Kopacz  
 Kathryn Mozer  
 Barry Lefer

*Support:*  
 Victoria Breeze  
 Shiv Das

<sup>1</sup>ACX Instrument Scientist <sup>2</sup>ACX Product Scientist <sup>3</sup>ACX User Scientist



# Hyper Local Air Quality Monitoring In Baltimore in partnership with Maryland Department of Environment to track airborne coal dust

Piles of coal sit at a coal export terminal in the Curtis Bay neighborhood of Baltimore. The area is one of the most polluted in the state and is one of hundreds of communities in the U.S. that grapple with disproportionate air pollution.  
*Ryan Kellman/NPR*

