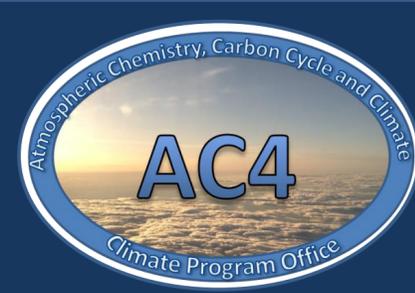




# Atmospheric Chemistry, Carbon Cycle And Climate Program

## ATMOSPHERIC COMPOSITION FROM SPACE



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### WHAT IS THE AC4 PROGRAM?

AC4 is a competitive research program that focuses on atmospheric composition. The program aims to provide a process-level understanding of the climate system through observation, modeling, analysis, and field studies to support the development and improvement of models and ultimately predictions.

AC4 is part of OAR, under the Climate Program Office (CPO). On atmospheric composition from space, AC4 collaborates with **NESDIS** directly through product development and validation, but also with users across OAR, namely with **ESRL's** Chemical Sciences Division and Global Monitoring Division, **ARL** and **GFDL**.



### PROGRAM GOAL

*Determine the processes governing atmospheric composition in the context of the Earth system and climate.*

### RESEARCH AREAS

- In collaboration with NOAA labs and line offices, as well as the academic community, AC4 has supported research on:
- trace gases,
  - aerosols – their emissions,
  - chemistry and transport,
  - aerosol-cloud interactions in connection, and
  - research on atmospheric and oceanic components of carbon cycle.

### SCIENTIFIC CAPABILITIES



AC4 supported research spans several platforms. Primarily, it focuses on in situ field measurements, but also includes laboratory experiments, analysis of field and monitoring observations, as well as process, regional, global and Earth system modeling. In situ measurements allow for satellite data validation, while satellite data are a data source for all types of atmospheric composition studies.

### NOAA Satellite Products

AC4 program science can benefit from all trace gas, aerosol and related products retrievable from JPSS and GOES-R instruments, including:

- CrIS: carbon monoxide, CO<sub>2</sub>, ozone, methane, ammonia, SO<sub>2</sub>, N<sub>2</sub>O, PAN, isoprene
- OMPS: ozone, NO<sub>2</sub>, HCHO
- VIIRS: burned area, AOD, other fire products



### SATELLITE PRODUCT VALIDATION



**FIELD CAMPAIGNS**  
During field campaigns, coordinated vertical profiles of measurements from an aircraft are a good source of validation data for all types of chemical species. FIREX-AQ field campaign in 2019 featured several aircrafts measuring chemical species such as CO, ozone, CH<sub>4</sub>, NH<sub>3</sub> and may others.



**IN SITU MEASUREMENTS**  
Validation of satellite data using vertical profiles of atmospheric composition has most recently been enhanced by AirCore, developed and deployed by ESRL's Global Monitoring Laboratory. AirCore measures CO<sub>2</sub>.



**ROUTINE MONITORING**  
Ozone profiles at the South Pole provide vertical profiles for validation of satellite products.

### PROJECT HIGHLIGHTS

Between FY13 and FY19, AC4 has supported 10 projects that specifically focus on development and application of JPSS data in atmospheric composition research. Several more include other relevant satellite data products. Below are just a few examples.



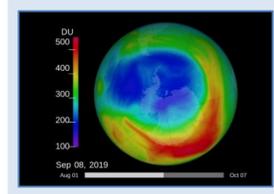
Biosphere emits chemical compounds that can form aerosols. Formaldehyde (HCHO) is a chemical product of the most abundant biogenic volatile organic compound (BVOC), which is observable from space by OMPS instrument.



Ammonia (NH<sub>3</sub>) emissions. NH<sub>3</sub> is an important trace gas, emitted from various sources such as agriculture and wildfires. It can be retrieved from CrIS instrument.



Carbon monoxide and ozone are good tracers of biomass burning. Both species were retrieved from CrIS and tested during FIREX-AQ field campaign.



Status of stratospheric ozone recovery can be monitored through ozone measurements retrieved from OMPS instrument, thus continuing a long term satellite record.

### FUTURE APPLICATIONS

- Improved understanding of atmospheric composition
- NOAA Climate/Earth System Model (GFDL) development and validation
- Air quality forecasting
- NGGPS
- Monitoring of air pollution and greenhouse gases

### LEARN MORE

AC4 program website:  
[www.climate.noaa.gov/ac4](http://www.climate.noaa.gov/ac4)  
Climate Program Office website:  
[www.climate.noaa.gov](http://www.climate.noaa.gov)  
CrIS Atmospheric Chemistry Data Users' Workshop report:  
<https://repository.library.noaa.gov/view/noaa/11187>