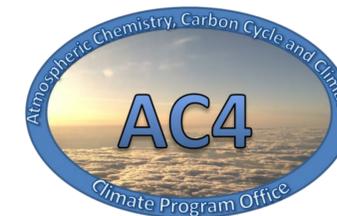




# Atmospheric Chemistry, Carbon Cycle and Climate (AC4) Program

Program manager: Monika Kopacz, Program Specialist: Shiv Das

NOAA/OAR Climate Program Office



## INTRODUCTION

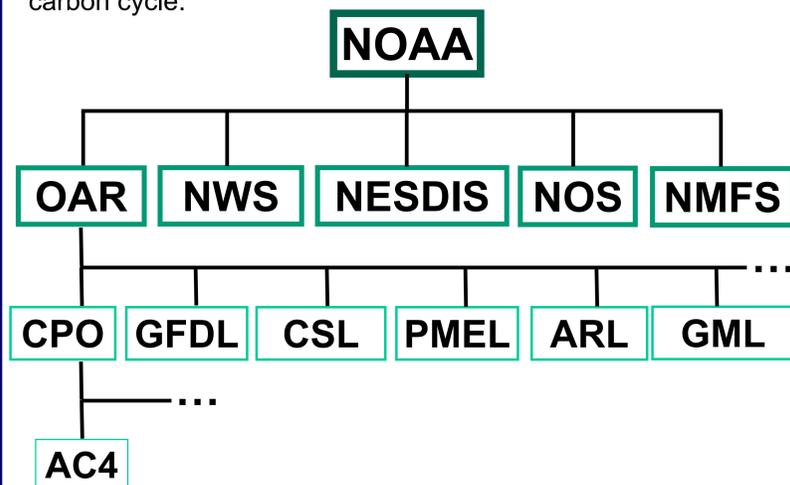
**Program goal: Determine the processes governing atmospheric concentrations of trace gases and aerosols in the context of the Earth System and Climate.**

AC4 is a competitive research program that supports research on atmospheric chemistry and carbon cycle. The program aims to provide a process-level understanding of the climate system through observation, modeling, analysis, and field studies to improve models and to provide of Atmospheric Composition science for decision making.

Working towards fulfilling NOAA's mission, AC4 program partners with NOAA Laboratories, Academia and private sector to work on field campaigns, joint solicitations, research projects, conferences and workshops. AC4 program is also involved with NOAA NESDIS on several aspects of NOAA satellite planning (both from geostationary and low Earth orbit).

## ORGANIZATIONAL STRUCTURE

NOAA is organized into five Line Offices, most of them of operational nature such as the Weather Service (NWS). **Research at NOAA is carried out in the Office of Oceanic and Atmospheric Research (OAR). AC4 program is part of OAR, under Climate Program Office (CPO).** Also in OAR there are several NOAA Laboratories that conduct atmospheric chemistry and carbon cycle research. These laboratories are Geophysical Fluid Dynamics Laboratory (GFDL), Chemical Sciences Laboratory (CSL), Global Monitoring Laboratory (GML), Pacific Marine Environmental Laboratory (PMEL), Air Resources Laboratory (ARL). Below is an abbreviated organizational chart as it relates to atmospheric chemistry and carbon cycle.



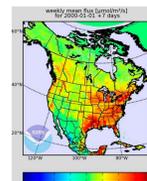
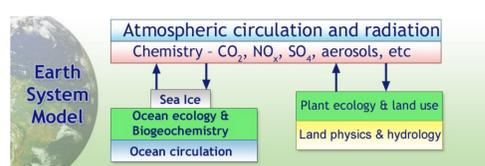
**NWS:** National Weather Service  
**NESDIS:** National Environmental Satellite, Data, and Information Service  
**NOS:** National Ocean Service  
**NMFS:** National Marine Fisheries Service

## SCIENCE PRIORITIES



Aircraft, satellite and tall tower: three of NOAA's research platforms

- Improve understanding of emissions and chemical reactions that affect **urban air quality** and **climate**, through **aircraft and ground based field campaigns** (e.g., AEROMMA, ALPACA) and collect new observations from megacities to marine environments.
- Understanding the composition of **wildfire smoke** in both temporal and spatial scales, and its impact on air quality, weather and climate and leveraging data from previous field campaigns (e.g., FIREX-AQ).



Schematic of NOAA/GFDL Earth System Model; a map of fluxes provided by CarbonTracker

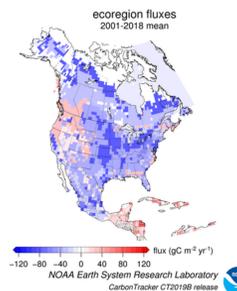
- Improve the diagnosis and attribution of sources and sinks of **aerosols** and **greenhouse gases** through increased efforts in **synthesis of data**, especially focusing on areas revisited in **NOAA field campaigns** (e.g. West Coast US, South-East US, Arctic).
- Through national and regional **field measurements** and **modeling**, quantify the interaction between anthropogenic and biogenic emissions, determine the pathways for aerosol production and ageing (including aerosol-cloud interactions), and quantify aerosol radiative properties.
- Reduce uncertainty on North American CO<sub>2</sub> flux estimates in **CarbonTracker** through improved techniques in data assimilation to better quantify the North American CO<sub>2</sub> budget.
- Quantify **methane** and other greenhouse gas fluxes in areas of increasing emissions (**urban environments**, and **oil and gas fields**) by conducting targeted observations and modeling.

## SCIENCE HIGHLIGHTS



**The Fire Influence on Regional to Global Environments and Air Quality (FIREX-AQ)** is a field campaign that took place in the summer of 2019. In collaboration with NASA, NOAA scientists and academic partners made atmospheric chemistry relevant measurements via aircraft that will help understand and predict the impact of North American fires on the atmosphere and to support better land management to help prevent them from occurring.

**CarbonTracker** is an assimilation system that produces quantitative estimates of atmospheric carbon uptake and release for North America and the rest of the world that are consistent with observed patterns of CO<sub>2</sub> in the atmosphere. The newest release of CarbonTracker ("CT2019b") provides global estimates of surface-atmosphere fluxes of CO<sub>2</sub> from January 2000 through December 2018. CarbonTracker is intended to be a tool for the community, and feedback and collaboration from anyone interested are welcome.



## SCIENCE PLANNING



### GeoXO

NOAA's **Geostationary Extended Observations (GeoXO)** satellite system is the ground-breaking mission that will advance Earth observations from geostationary orbit. GeoXO will supply vital information to address major environmental challenges of the future in support of U.S. weather, ocean, and climate operations. AC4 has contributed to the development of GeoXO constellation with a first ever dedicated operational instrument for Atmospheric Composition (**ACX**).

**AQUARIUS (Air Quality in the Western US)** is an aircraft and ground based field campaign to be conducted in the winter of 2022/2023 to investigate wintertime PM in mountain basins of the western U.S. The research priorities of the campaign includes atmospheric chemistry, the meteorology of inversions, and the measurements needed to understand emissions sources across urban and rural areas.



## SUBMITTING AND REVIEWING PROPOSALS

**Program announcement:** AC4 typically issues a program announcement on an annual basis; research priorities are announced in the summer, with Letters of Intent due several weeks later and full proposals due in the fall.

**Proposal review:** AC4 conducts both mail and panel reviews. Many community members are involved in the review process, and relevant volunteer reviewers are always welcome.

**Contact:** Please contact Monika Kopacz or Shiv Das to be included on the AC4 email list to hear about upcoming solicitations or to volunteer to review proposals.

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## REFERENCES

AC4 program website: <https://cpo.noaa.gov/Meet-the-Divisions/Earth-System-Science-and-Modeling/AC4>

Climate Program Office (CPO) [www.climate.noaa.gov](http://www.climate.noaa.gov)

2<sup>nd</sup> state of the Carbon Cycle Report (SOCCR2) <https://www.globalchange.gov/content/about-soccr-2>

Carbon Cycle Science Plan: <https://www.carboncyclescience.us/carbon-planning>

NOAA AEROMMA Field campaign <https://csl.noaa.gov/projects/firex-aq>

NOAA-NASA FIREX-AQ Field campaign <https://csl.noaa.gov/projects/firex-aq>

CarbonTracker: <https://gml.noaa.gov/ccgg/carbontracker/>

US Global Change Research Program <http://www.globalchange.gov/>

NOAA's Next Generation Strategic Plan <https://oceanexplorer.noaa.gov/about/what-we-do/program-review/next-gen-str-plan.pdf>



AC4 Website



SCAN ME