National Science Foundation
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SCIENTISTS UNDERTAKE EXTENSIVE FIELD CAMPAIGN TO STUDY U.S. SOUTHEAST ATMOSPHERIC CHEMISTRY

Research examines chemical reactions between human-related pollution and volatile organic compounds (VOCs) emitted by vegetation such as trees

Southeast Atmosphere Study (SAS) tower in the Talladega National Forest in Alabama.
Credit and Larger Version

Top-of-tree-canopy view of the SAS instrument tower in the Alabama forest.
Credit and Larger Version

Close-up of the instrument tower being used by SAS atmospheric chemists.
Credit and Larger Version

SAS scientists are conducting research aboard the NSF/NCAR C-130 aircraft.
Credit and Larger Version

Scientists get ready to fly across the U.S. Southeast in search of air quality discoveries.
Credit and Larger Version

June 19, 2013

In the largest U.S. atmospheric chemistry field project in decades, researchers sponsored by the National Science Foundation (NSF) and other organizations are working to study tiny particles and gases in the air over the southeastern United States.

The study looks at the chemical reactions between human-related pollution and volatile organic compounds (VOCs) emitted by vegetation such as trees in forests.

The project, called the Southeast Atmosphere Study, or SAS, runs through July 15, 2013. It's part of an unprecedented campaign, say the scientists, to investigate the relationship between air chemistry and climate change.

SAS is supported by NSF, the U.S. Environmental Protection Agency and the U.S. National Oceanic and Atmospheric Administration, along with the

the U.S. National Oceanic and Atmospheric Administration, along with the Electric Power Research Institute. Participants are from some 30 U.S. and international research institutions.

Researchers prepare to sample air chemistry from the skies rather than the ground.
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Atmospheric chemists have long known that human-made pollutants have the potential to interact with plant-emitted VOCs, turning them into airborne particles, or aerosols, that may then affect air quality and human health.

In the Southeast, the aerosols also affect the region's climate. The southeastern United States is one of the few places on Earth displaying an overall cooling trend over the last century.

"The Southeast Atmosphere Study will illuminate the role of the surface biosphere in producing volatile organic gases that can then form new particles, known as secondary organic aerosols (SOAs)," says Michael Morgan, NSF division director for Atmospheric and Geospace Sciences.

"The formation of SOAs has been observed over many forested regions of the world. Emission of these gases may have an important influence on our changing climate."

Some scientists believe that enhanced SOA formation may be responsible for an "aerosol cooling effect" that would explain the divergence of southeastern U.S. temperature trends from global average temperature trends over the last century.

Black aerosols produced by industry, home heating and other means absorb incoming solar radiation, increasing global temperatures, say scientists such as Ann Marie Carlton of Rutgers University in New Brunswick, N.J., lead NSF-funded SAS investigator.

However, many lighter-colored aerosols, such as those composed of sulfates or organics from vegetation typical of the Southeast, have a cooling effect because they reflect some amount of incoming light back to space, says Alex Guenther of the National Center for Atmospheric Research (NCAR) in Boulder, Colo., also a scientist on the project.

Some of these aerosols get carried high into the atmosphere, affecting temperatures over a large area. But many linger in the region where they were emitted, resulting in more localized effects.

High concentrations of light-colored aerosols such as those expected in the Southeast can reduce the average temperature in the region, offsetting the warming caused by greenhouse gases circulating around

the globe.

But those same aerosols can trigger chemical reactions that worsen air pollution such as ground-level ozone.

Certain types of aerosols affect cloud formation and cloud opacity; both can affect the amount of energy trapped in Earth's atmosphere.

Computer simulations can replicate some of the influences of aerosols. But they can't yet produce the level of detail required for a complete

But they can't yet produce the level of detail required for a complete understanding of these complex chemical and atmospheric dynamics, which would lead to more accurate predictions of future air quality and regional climate.

To address these questions and improve observations that may be used to expand the capabilities of climate and chemistry models, SAS investigators are bringing a suite of air sampling equipment and sensors to the Southeast.

Project scientists are using two aircraft, the NSF/NCAR C-130 and the NOAA P-3, to sample air chemistry from the Mississippi River to the Atlantic Ocean, and from the Ohio River Valley to the Gulf of Mexico.

Researchers are also using ground instruments to measure low-level winds, moisture, temperature and chemistry.

Instrumented towers reaching some 150 feet high are taking measurements within and above forest canopies.

Additional aircraft and ground sensors deployed by companion programs will help paint an accurate atmospheric chemistry picture of this unique region.

NSF Southeast Atmosphere Study (SAS) Principal Investigators

Ann Marie Carlton, Rutgers University, New Brunswick:
Collaborative Research: Atmospheric mixed phase chemistry for improved climate predictions: field measurements and modeling of the Southern Oxidant and Aerosol Study

William Brune, Pennsylvania State Univ., University Park:
Resolving issues of OH measurements and oxidation chemistry in forest environments

Rodney Weber, Georgia Tech Research Corporation:
Collaborative Research: Atmospheric mixed phase chemistry for improved climate predictions: field measurements and modeling of the Southern Oxidant and Aerosol Study

Donald Collins, Texas A&M University Main Campus:
Collaborative Research: Sensitivity of gas and aqueous phase production of secondary organic aerosol to chemical and environmental perturbations

Robert Griffin, William Marsh Rice University:
Collaborative Research: Sensitivity of gas and aqueous phase production of secondary organic aerosol to chemical and environmental perturbations

Delphine Farmer, Colorado State University:
Organic acid concentrations and fluxes over a Southeastern forest during the Southern Oxidant and Aerosol Study

Allen Goldstein, University of California-Berkeley:
Contribution of Biogenic Volatile Organic Compounds to Organic Aerosol Formation in the Presence and Absence of Anthropogenic Pollution

Jose Jimenez, University of Colorado at Boulder:
Collaborative Research: Investigation of the Effects of Anthropogenic-Biogenic Interactions on Secondary Organic Aerosol Formation

Douglas Worsnop, Aerodyne Research, Inc.:
Collaborative Research: Investigation of the Effects of Anthropogenic-Biogenic Interactions on Secondary Organic Aerosol Formation

Frank Keutsch, University of Wisconsin-Madison:
Field and laboratory study of rural VOC oxidation and SOA formation utilizing measurements of formaldehyde and glyoxal

Jesse Kroll, Massachusetts Institute of Technology:
Measurement of Low-Volatility Gas-Phase Organic Compounds during the Southern Oxidant and Aerosol Study

Shan-Hu Lee, Kent State University:
Measurements of Amines During the SOAS (SAS) Field Campaign

Paul Wennberg, California Institute of Technology:
Hydroperoxide, Nitrate, and Epoxide Chemistry of Biogenically produced Alkenes

Xianliang Zhou, Health Research Inc/New York State Health Department:
Collaborative Research: Photolysis of Particulate Nitrate as a Daytime HONO Source and a Re-NOx-ification Pathway in the Troposphere

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Collaborative Research: Photolysis of Particulate Nitrate as a Daytime HONO Source and a Re-NOx-ification Pathway in the Troposphere

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Collaborative Research: The North American Airborne Mercury Experiment

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Collaborative Research: The North American Airborne Mercury Experiment

Christopher Cantrell, University of Colorado at Boulder:
Collaborative Research: The North American Airborne Mercury Experiment

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Related Websites
Southeast Atmosphere Study: **http://www.eol.ucar.edu/projects/sas/**

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