Indirect and Semi-Direct Aerosol Campaign

For the month of April, researchers are descending on and above Barrow, Alaska, to obtain data from the atmosphere that will help them understand the impacts that aerosols have on Arctic clouds and climate. Scientists sponsored by the U.S. Department of Energy's Atmospheric Radiation Measurement (ARM) Climate Research Facility are using a heavily instrumented aircraft to collect data from the sky, while instruments based at surface sites in Barrow and Atqasuk, Alaska, are obtaining measurements from the ground. Information obtained during the Indirect and Semi-Direct Aerosol Campaign, or ISDAC, will help scientists analyze the role of aerosols in climate, and represents a key contribution to Arctic climate research during International Polar Year.

Science Objective

Aerosols – tiny airborne particles from both natural and manmade sources – can affect Earth's climate in two ways: directly, through scattering and absorption of solar and infrared radiation; and indirectly, by influencing the creation (or nucleation) of cloud droplets and ice crystals, leading to increased surface area and reflectivity of clouds. Because clouds are such an important modulator of climate yet remain one of the key uncertainties in climate models, the main question is—what role do aerosols play in the cloud/climate picture? This field campaign will result in a comprehensive data set that scientists will use to examine the effects of aerosols on clouds, and improve the way those processes are represented in climate models.

Research Instrumentation

Ground-based – The ARM Climate Research Facility site in Barrow is equipped with a full suite of sophisticated instruments and radars for measuring cloud, aerosol, and other atmospheric properties. A subset of these instruments also operates at the Facility's research site in Atqasuk. Measurements from these sites provide a long-term record of continuous observational data from the North Slope of Alaska. During the ISDAC field campaign, the permanent measurement suite in Barrow is enhanced with key instruments for measuring specific cloud and aerosol properties.

Airborne – The National Research Council of Canada's Convair-580 contains more than 40 instruments to obtain measurements of the following atmospheric properties:

- Atmospheric State – temperature, humidity, water vapor, and vertical velocity
- Cloud Microphysics – water and ice concentration, cloud particle shape and size distribution, and solar scattering
- Aerosol Properties – particle concentration, size distribution, soot, solar scattering and absorption, composition, and cloud droplet and ice nuclei concentration
- Visible and Infrared Radiation – cloud extinction and radiation flux.

Photo courtesy: National Research Council of Canada

Related aircraft studies by the National Aeronautics and Aerospace Administration and the National Oceanic and Atmospheric Administration are occurring at the same time in the same study area. Research flights by the Convair-580 will be coordinated with three NASA and one NOAA aircraft when possible, as well as with satellite overpasses. A variety of flight plans will be used to carry out the campaign's scientific missions, with daily weather forecasting provided by the Pennsylvania State University and the University of Alaska.

Sponsor and Participants

The U.S. Department of Energy is the primary sponsor for ISDAC, which involves more than 80 researchers from a variety of national laboratories, agencies, universities, and private organizations in the United States and Canada. For more information, see the ISDAC website.

http://acrf-campaign.arm.gov/isdac/

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