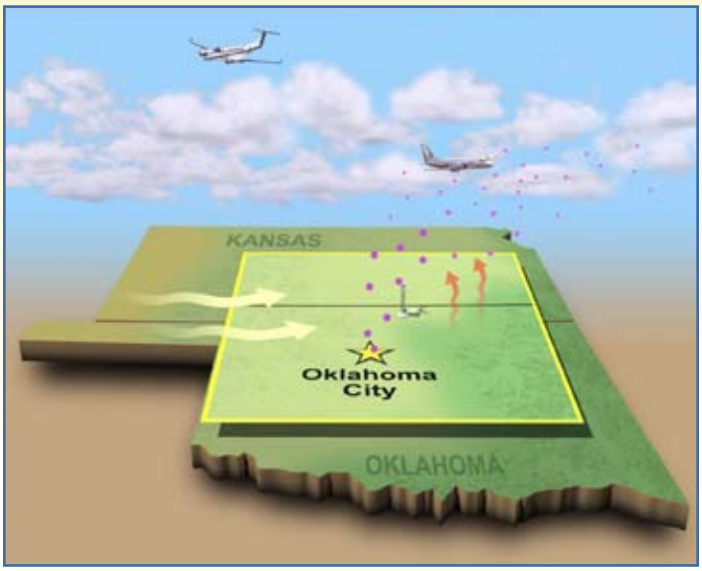
Atmospheric Science Program

Cumulus Humilis Aerosol Processing Study (CHAPS)

General Description

'Cumulus humilis' is the scientific term used to describe the small fair weather clouds that dot the summer skies over Oklahoma. During the month of June, scientists sponsored by the U.S. Department of Energy's Atmospheric Science Program will use aircraft and ground based instruments to obtain information about the physical and chemical properties of these clouds and the small airborne particles – called aerosols – within and around them. Aerosols – particularly those associated with human activity – are thought to be changing the brightness, the lifetime, the amount of precipitation, and other properties of clouds.



Measurements from two instrumented aircraft and a ground site near Oklahoma City will allows scientists to study the effects of aerosols on clouds, and vice versa – the effects of clouds on aerosols.

Science Objective

The primary objective of CHAPS is to examine the influence of manmade aerosols on clouds and the effects that clouds have on these small particles. While many of the issues surrounding climate change are linked to the trapping of heat by greenhouse gases such as carbon dioxide, climate change is also dependent on the amount of solar energy reflected back to space by clouds. The magnitude of these changes is a major concern to scientists trying to improve the capability to simulate climate change.

Participants

- Pacific Northwest National Laboratory
- Brookhaven National Laboratory
- National Oceanic and Atmospheric Administration
- The Cooperative Institute for Environmental Research
- Harvard University
- Argonne National Laboratory
- Los Alamos National Laboratory
- NASA Langley Research Center
- Aerodyne Corporation.

Measurement Platforms

Gulfstream-1

The G-1 operates at speeds enabling both relatively slow sampling, but also fast enough to make it easily deployed to field sites around the world.

Battelle's Gulfstream-1 (G-1) is a large, twin turboprop plane capable of making measurements at altitudes approaching 30,000 feet over ranges of 1500 nautical miles. The aircraft is equipped with highly specialized instrumentation for characterizing the properties of the atmosphere, the intensity of solar radiation, and the amount and properties of trace atmospheric constituents

During CHAPS, the G-1 will carry two broad categories of instruments to measure climate-relevant properties of aerosols. One set of instruments will measure the properties of aerosols found within individual cloud droplets. The other set of instruments will measure these same properties both for aerosols not incorporated into cloud droplets as well as aerosols found outside of the larger cloudy environment.

Aerosol properties to be measured include:

- The number and size of aerosols both within and outside the cloud
- How much solar radiation these particles can absorb and reflect
- The propensity of these aerosols to attract water vapor
- The chemical composition of these aerosols.

King Air B200

This twin engine turboprop aircraft will fly at altitudes of around 28,000 feet, conducting 'scouting' missions to identify the Oklahoma City plume. It will then fly above the G-1 to make remote observations of these fields of clouds and aerosols. Its instrument payload will provide profiles of aerosol backscatter and extinction in the vicinity of clouds.

NASA's Beechcraft King Air B200. Photo courtesy: NASA Dryden Flight Research Center Photo Collection.

For more information, see the fact sheet provided by the National Aeronautics and Space Administration (NASA).

Ground Site

Just outside of Oklahoma City, CHAPS scientists will launch daily weather balloons to monitor the temperature and moisture conditions of the lower atmosphere. Other ground-based instrumentation will make continuous measurements of climate-related properties of the aerosols coming from Oklahoma City. These properties include measuring how much solar energy aerosols absorb and reflect, and also the aerosols' ability to serve as surfaces on which moisture condenses to form clouds.

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