Cloud and Land Surface Interaction Campaign

General Description

The formation of clouds over land—called "continental" cumulus convection—is strongly modulated by land surface conditions. For 3 weeks in June 2007, the Atmospheric Radiation Measurement Climate Research Facility's Southern Great Plains (SGP) site was the focal point for an intensive field study called the Cloud and Land Surface Interaction Campaign, or CLASIC.

This cross-disciplinary, interagency field study focused on the influence of land surface processes on the evolution of cumulus convection, especially the stages leading from cumulus humilis (fair weather clouds) to cumulus congestus (storm clouds). Researchers used aircraft, satellite, and enhanced surface-based instrument platforms to obtain simultaneous ground and airborne measurements that will allow them to evaluate changes in clouds and atmospheric structure—key elements of regional climate systems.

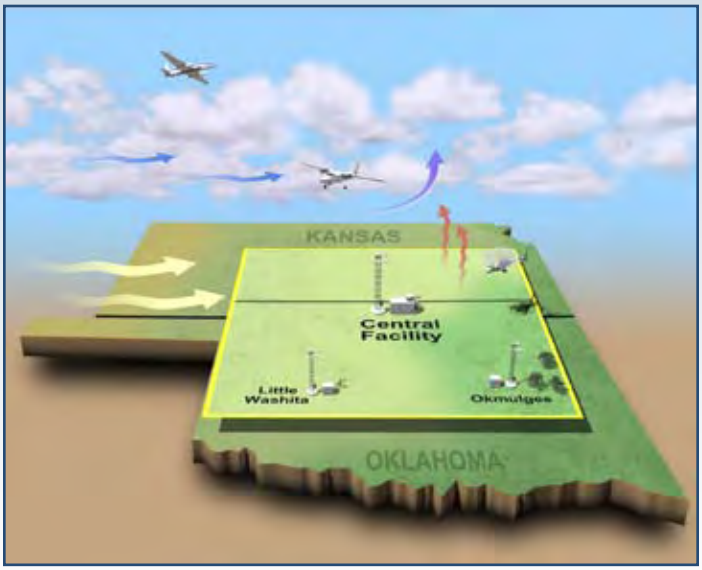
Science Objective

Because of the wide range of processes that occur during the formation of continental cumulus convection, it is difficult to simulate these cloud conditions in climate models. The goal of CLASIC was to obtain data about regional land surface changes that impact surface reflectivity, temperature, evapotranspiration, and the energy balance. Scientists will use these data to better understand how changes in land use affect clouds through changes to surface heating and associated dynamics. Because of its interdisciplinary nature, the U.S. Climate Change Science Program designated CLASIC as a core component of its Interagency Water Cycle Working Group.

Measurement Platforms

Ground Sites

Three primary "supersites" in the experiment domain were heavily instrumented to obtain ground-based measurements to link observed heat, moisture, and carbon fluxes to atmospheric structure. Data from these sites were supplemented with data from an existing network of soil moisture instruments and additional towers for flux measurements.



During CLASIC, a fleet of seven research aircraft and enhanced surface instrumentation were used to obtain cloud and atmospheric properties measurements throughout the SPG site, which covers 55,000 square miles in Oklahoma and Kansas.

- **SGP Central Facility** – surrounded by wheat fields, the heavily instrumented Central Facility served as the primary source of information about cloud and carbon feedbacks.
- **Little Washita Watershed** – located in a mix of pasture land and winter wheat, three carbon flux towers and associated instruments were added at this site. Two additional flux towers were located at Fort Cobb, in nearby croplands, to supplement the data set from this area.
- **Okmulgee** – amid oak forests, the existing flux tower at this site was supplemented with two more, plus additional instruments, to help identify carbon dioxide sources and sinks.

Aircraft

Seven aircraft were used in coordinated flights over the experiment domain to obtain measurements below, within, and above the clouds.

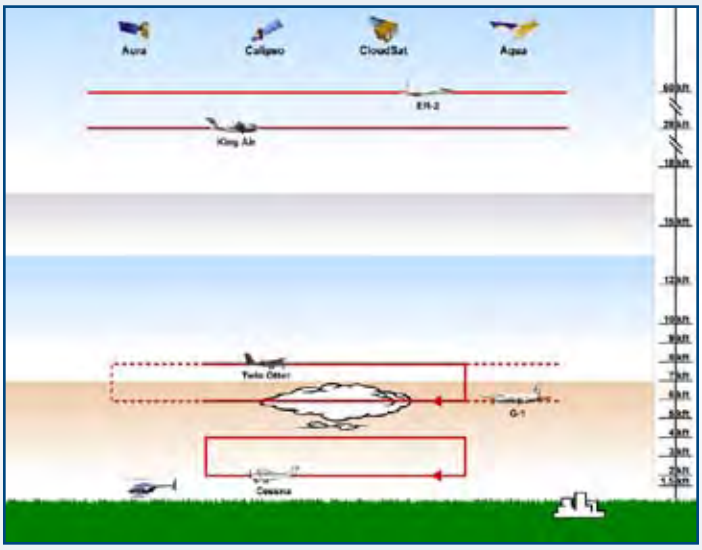
- ER-2
- P-3
- Twin Otter (CIRPAS)
- Cessna 206

- Helicopter
- Twin Otter (International)
- Jetstream-31

Several of the science missions were coordinated with two additional aircraft— a Gulfstream-1 and King Air B200— from a related field campaign which occurred at the same time. All aircraft were coordinated through the ARM Aerial Vehicles Program. Flights were timed with routine "A Train" satellite overpasses on selected days.

Satellites

Satellites carrying active and passive sensors obtained space-borne measurements to provide spatial context and connection to long-term data sets obtained from the SGP site.



This illustration demonstrates one of many flight plans that were used during CLASIC.

Sponsors and Primary Resources

ARM Climate Research Facility
- 3 Supersites (flux towers and other land and atmospheric characterization instrumentation)
- Phased array radar
- Radiosondes
- Twin Otter aircraft
- ER-2 aircraft
- Cessna 206 aircraft

National Aeronautics and Space Administration
- Twin Otter aircraft
- Duke University helicopter
- Jetstream-31 aircraft
- P-3 aircraft
- Soil moisture site
- Satellites and data products
- Tethersondes

National Oceanic and Atmospheric Administration
- Carbon cycle gases sampling flasks
- Forecasting support
- Aerosol optical properties instrumentation

U.S. Department of Agriculture
- Soil moisture instrumentation

Los Alamos National Laboratory
- Flux towers

State of Oklahoma
- Environmental monitoring network

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