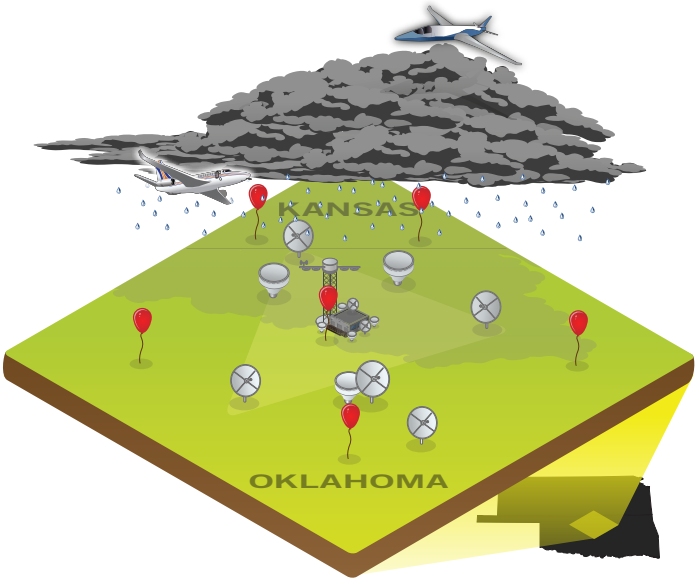
ARM
CLIMATE RESEARCH FACILITY

Midlatitude Continental Convective Clouds Experiment

Large storm clouds greatly influence Earth's climate system by redistributing heat and moisture in the atmosphere and sending rain to the surface. During April and May of 2011, scientists involved in the **Midlatitude Continental Convective Clouds Experiment (MC3E)** will use a comprehensive array of ground-based instruments in the central Oklahoma region and two instrumented aircraft to gather the most complete data set ever obtained for studying convective cloud systems. These data will provide details about clouds processes that have never before been available for computer models that simulate Earth's climate.

This effort is a collaboration between the U.S. Department of Energy's Atmospheric Radiation Measurement (ARM) Climate Research Facility and the National Aeronautics and Space Administration's (NASA) Global Precipitation Measurement mission Ground Validation program. It is the first major field campaign to take advantage of numerous new radars and other instrumentation purchased through the American Recovery and Reinvestment Act of 2009 and installed throughout ARM's Southern Great Plains (SGP) site.



Science Objective

Despite improvements in computing power, current weather and climate models are unable to accurately reproduce the formation, growth, and decay of clouds and precipitation associated with storm systems. Not only is this due to a lack of data about precipitation, but also about the 3-dimensional environment of the surrounding clouds, winds, and moisture, and how that affects the transfer of energy between the sun and Earth.

To obtain this type of holistic data, MC3E is enhancing the existing array of ground-based instruments at the SGP site with additional precipitation sensors, radars, weather balloon launches, and flights by research aircraft. Ideally, the goal is to encounter several storms and obtain 3D measurements of the storm life cycle from growth to decay, as well as a detailed description of the environment in which the storm occurs.

The MC3E "ideal scenario" will capture the life cycle of a storm system. Centered at the SGP Central Facility, research aircraft will fly above and within the clouds while radar systems scan through the storm from multiple locations. At the same time, additional ground-based instruments will measure surface precipitation and wind speed.

Research Instrumentation

DOE Atmospheric Radiation Measurement (ARM) Climate Research Facility

Southern Great Plains site. Approximately 50 different instruments throughout the site operate 24/7 to obtain measurements of clouds, aerosol, precipitation, and solar and thermal energy. Many of these instruments are new and purchased through the Recovery Act, and will greatly enhance the data collection that began in 1994. During MC3E, key instruments in this permanent observational infrastructure include:

- Radars – four scanning precipitation radars, one scanning cloud radar, and one vertically pointing cloud radar to provide high-resolution information about cloud properties and evolution.
- Wind profilers – three wind profilers to measure precipitation and vertical air motion.
- Radiosondes – routine weather balloon (radiosonde) launches from the SGP Central Facility, supplemented with five additional radiosonde stations to add approximately 1500 more launches during the course of the 6-week campaign.

Both vertical pointing (left) and scanning (right) radars are key elements of MC3E.

NASA Global Precipitation Measurement Mission

Ground Validation Program. To provide additional measurements, NASA is deploying:

- Radars – two scanning radars for measuring precipitation in liquid, mixed, and ice phases.
- Disdrometers and rain gauges – a dense network of rain gauges and disdrometers will provide comprehensive measurements of rainfall at the surface.
- Aircraft – the NASA ER-2 and University of North Dakota Citation research aircraft will fly above and within the clouds, respectively. Onboard instruments and sensors will obtain measurements of precipitation, ice and cloud structure, and environmental conditions.

National Oceanic and Atmospheric Administration

Contributions from NOAA include an additional wind profiler, a vertically pointing radar, and a sophisticated instrument called an interferometer that obtains measurements of infrared energy. In addition, forecasters and modelers from NOAA's National Weather Service Forecast Office and the Severe Storms Laboratory will provide important guidance and local expertise for MC3E forecast operations.

http://campaign.arm.gov/mc3e/

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