ARM

CLIMATE RESEARCH FACILITY

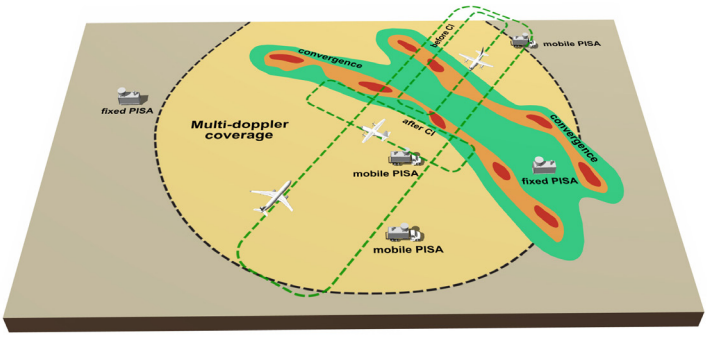
ARM Support for the Plains Elevated Convection at Night Experiment

In the Great Plains of the United States, most of the rain happens at night. Better understanding the various atmospheric processes that cause this weather phenomenon would significantly improve climate and weather models. During June and July of 2015, the Atmospheric Radiation Measurement (ARM) Climate Research Facility will provide an array of instrumentation and its largest research site to support a multi-agency effort, known as the Plains Elevated Convection at Night (PECAN), to collect data that will be used in climate prediction studies worldwide.

During the PECAN experiment, scientists will use mobile and fixed instrumentation to take detailed measurements of what triggers clouds and precipitation when most people are asleep. This set of resources has never been put in the field before and is only possible because of interagency cooperation. Using three research aircraft, dozens of research-grade instruments, and a fleet of mobile facilities, 25 missions will be conducted between sunset and 6 a.m. in a 45-day period, weather permitting.

A second field campaign will run concurrently at the ARM Facility's Southern Great Plains (SGP) site in Oklahoma. The Enhanced Soundings for Local Coupling Studies will take measurements to improve the understanding of how the lowest levels of the atmosphere are affected by the properties of the land surface below, another important factor in accurately simulating cloud and precipitation processes. There is evidence that the initial development of the nocturnal boundary layer strongly depends on the characteristics of the daytime boundary layer, and both the Local Coupling Studies campaign and 24/7 operations of the Atmospheric Emitted Radiance Interferometers (AERIs) during PECAN will provide data to investigate this hypothesis. These two data sets will provide scientists with a rich description of the atmosphere to study for many years to come.

Radar row, located on the SGP site, is a series of radars used to measure a variety of atmosphere ice properties. Due to the narrow antenna beamwidth, ARM's scanning cloud radars utilize scanning strategies that are unlike typical weather radars.



The PECAN ideal scenario will capture the life cycle of a storm system. Research aircraft will fly above and within the clouds while ground-based mobile and fixed radar systems scan through the storm from multiple locations. At the same time, PISA stations will measure profiles of temperature, humidity, and wind speed. Radars and PISAs remain in a fixed deployment, while the other mobile platforms adjust for system motion.

Science Objective

Simulating the nighttime development of the atmosphere is a fundamental, yet extremely complex, task for global atmospheric models. This field campaign is working to improve the knowledge of the processes at work that lead to the initiation, growth, and evolution of nighttime convective events over the SGP.

Measurement Platforms

Ground Sites

Unique to this campaign, there will be six fixed PECAN Integrated Sounding Array (PISA) sites and four mobile PISAs that will be moved nightly to find the best opportunity for rain activity. The ARM Facility is providing five AERIs, which will be deployed at the fixed PISAs. This set of instruments will provide a uniform and consistent thermodynamic data set, greatly improving the ability of

data assimilation schemes and other analysis techniques to characterize the thermodynamic environment and its evolution before and during these nighttime events. The full PISA data set will become public domain, serving as a leading mesoscale profiling network data set for data assimilation and prediction studies by weather and climate scientists.

PECAN Integrated Sounding Array (PISA) – Each PISA will have remote sensing instruments that are able to profile temperature, humidity, and winds throughout the boundary layer and lower troposphere at a high time resolution of 5-minute intervals.

Southern Great Plains Central Facility – Approximately 50 different instruments throughout the site operate 24/7 to obtain measurements of clouds, aerosol, precipitation, and solar and thermal energy. During PECAN, the SGP Central Facility will serve as a fixed PISA in the southeastern cornerstone of the PECAN domain. Key instruments in this long-term observational infrastructure include:

- **Radars** – includes scanning precipitation radars, scanning cloud radar, and a vertically pointing cloud radar to provide high-resolution information about cloud properties and evolution.
- **Wind profilers** – used to measure precipitation along with horizontal and vertical air motion.
- **Radiosondes** – include routine weather balloon (radiosonde) launches.

Aircraft

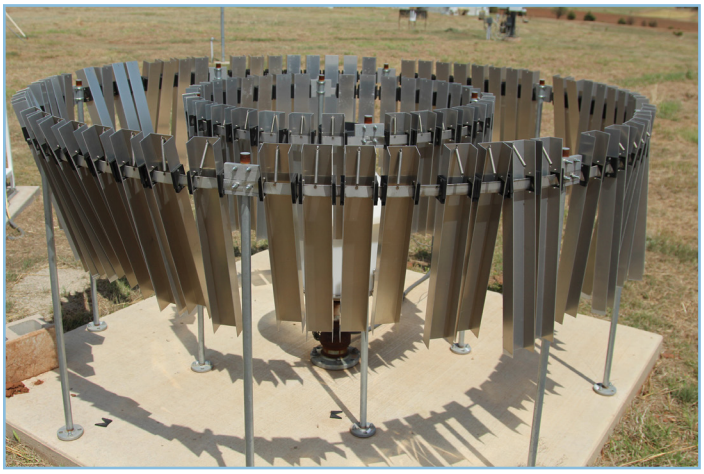
To provide airborne measurements, three aircraft will take flight during the experiment:

- NSF University of Wyoming King Air
- NASA DC-8
- NOAA P-3.

Collaboration

The PECAN experiment is a collaboration between the National Science Foundation (NSF), National Oceanic and Atmospheric Administration (NOAA), National Aeronautics and Space Administration (NASA), and the U.S. Department of Energy's Office of Science. Through its support of ARM and other national user facilities, DOE's Office of Science is the single largest supporter of basic research in the physical sciences in the United States and is working to address some of the most pressing challenges of our time.

The Atmospheric Emitted Radiance Interferometer, developed specifically for ARM, is a sensitive infrared spectrometer covering the wavelength range from 3.3 to 18 microns to measure downwelling radiance at high spectral resolution. High temporal resolution profile of temperature and humidity are retrieved from these infrared spectra.



The tipping bucket rain gauge measures the cumulative rainfall over a period of time.

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Additional information is available on the ARM website at www.arm.gov.