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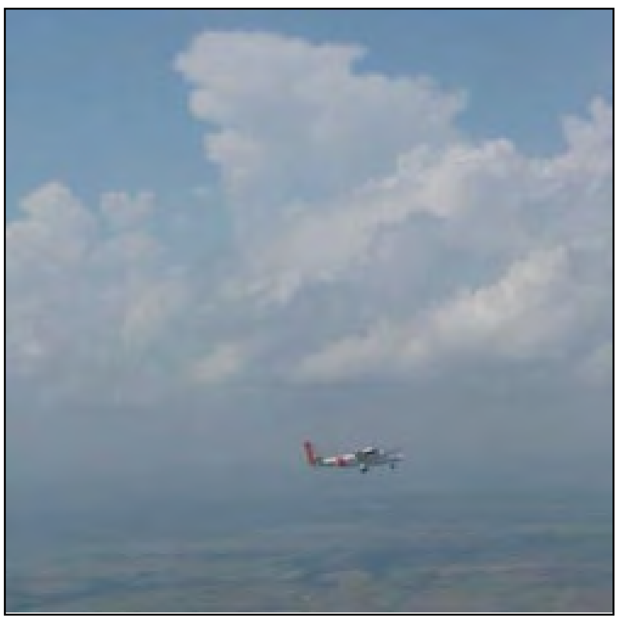
Routine AVP Clouds with Low Optical Water Depths (CLOWD) Optical Radiative Observations (RACORO) Field Campaign Scheduled at SGP

Clouds with low-optical water depths (CLOWD) refer to "thin" clouds that contain a limited amount of water, which are often below 100 g/m2. This cloud type is very common—occurring in the earth's boundary-layer (from the earths' surface up to about 2.5 km) throughout the globe. However, because these clouds are thin and often broken, even the best ground-based instruments have trouble accurately measuring their cloud properties. Attempts to retrieve these properties by different methods produces varying results, and such discrepancies prevent resolving uncertainties within climate models. To resolve this dilemma, a better understanding of this cloud type is needed that can only be achieved by acquiring the critical in-situ data needed to evaluate and refine existing retrieval algorithms from ground-based instruments.

Between January and June 2009, the RACORO field campaign will conduct routine flights below, within, and above these boundary layer liquid-water clouds in the vicinity of the ACRF Southern Great Plains site. Coordinated by the ARM Aerial Vehicles Program, a Twin Otter aircraft equipped with a full payload of research instrumentation will obtain representative statistics of cloud microphysical, aerosol, and radiative properties of the atmosphere. The data will be used to validate retrieval algorithms and support process studies and model simulations of boundary layer clouds and, in particular, CLOWD-type clouds.



Left: As in other mid-latitude regions, low-level boundary-layer clouds occur frequently at the ACRF Southern Great Plains site (ARM Photo).

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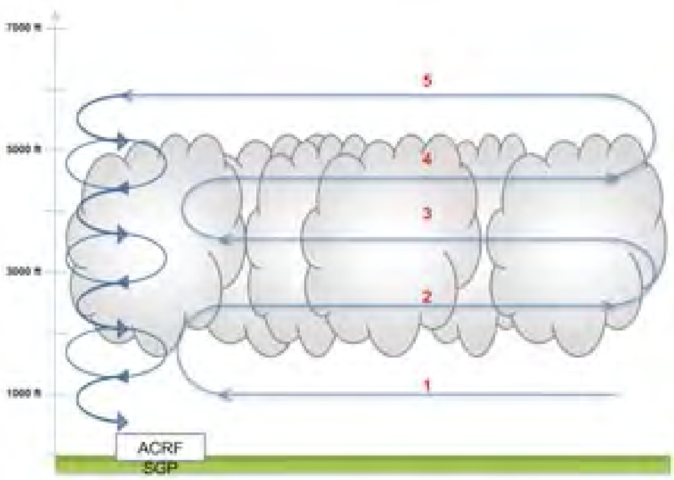
Researchers from the U.S. Department of Energy's Atmospheric Radiation Measurement (ARM) Program discovered surprisingly large differences in the results from various techniques used to measure the properties of low-lying clouds. To increase confidence in future measurements, they decided to learn more about these clouds first-hand—from the sky.



This figure shows a potential flight configuration during RACORO. The Twin Otter aircraft will take measurements at five different altitudes, up to 12,000 ft (about 3600 m), then spiral down in close proximity to the SGP site. Flights will occur at different times throughout the day to sample variations in cloud properties (ARM Graphic).

After a year of planning and coordination by the ARM Climate Research Facility team, the Routine AVP CLOWD Optical Radiative Observations (RACORO) field campaign will obtain representative statistics of cloud properties from the Earth's surface up to an altitude of about 3.6 kilometers (12,000 feet). Using a Twin Otter aircraft, several science flights per week are planned for the duration of the campaign, ending on June 30.

Equipped with a comprehensive set of probes and sensors to measure solar and thermal radiation, cloud microphysics, aerosol properties and atmospheric state, the Twin Otter will fly over the ARM Climate Research Facility site centered near Lamont, Oklahoma. Established in 1994, this heavily-instrumented research site operates 24/7 to obtain continuous ground-based atmospheric measurements ideally suited to climate studies. Data obtained during the RACORO field campaign will be used to validate ground-based measurements and support model simulations and studies of cloud processes.

"This is the first time that a long-term aircraft campaign has been undertaken for systematic in-cloud sampling of cloud field properties and will go a long way toward validating and improving the retrieval algorithms for ground-based measurements of these cloud types," said Dr. Andrew Vogelmann, a scientist from Brookhaven National Laboratory and the principal investigator for the campaign.

Clouds contain different amounts of water and ice, which affect their opacity and make them appear either thick or thin. These characteristics directly affect how much sunlight the cloud transmits to Earth or reflects back into space. This energy feedback process is a key component of climate.

In addition, low-level "thin" clouds are often tenuous and scattered, which makes their properties—such as water content and water droplet size—hard to measure accurately with ground-based or satellite instruments. Scientists rely on these measurements as input to climate models, and because these cloud types occur all over the globe, it's important that the models have accurate data.