February 2000

ARM Facilities Newsletter

ANL/ER/NL-00-02

Atmospheric Radiation Measurement Program

ARM

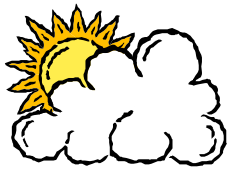
Spring 2000 Cloud Intensive Observation Period, March 1-21, 2000

The month of March brings researchers to the SGP CART site to participate in the Spring 2000 Cloud IOP. The purpose is to gather data about the three-dimensional structure and distribution of clouds over the CART site. This effort will help to produce a more accurate representation of the clouds and their influence on our weather and climate for use in computer modeling.

Although we know that clouds play a vital role in Earth's radiation budget by limiting radiation transfer through the atmosphere, the incorporation of cloud effects into computer models used to mimic climate is far from satisfactory. Understanding just how clouds attenuate sunlight is a difficult challenge, because the characteristics of individual clouds differ greatly, depending on the atmospheric conditions in which the clouds occur.

Currently, the SGP CART site operates several cloud sensing instruments. Most of these are located at the central facility near Lamont, Oklahoma. In addition, the boundary facilities at Hillsboro, Kansas, and at Vici, Morris, and Purcell, Oklahoma, each have two cloud sensing instruments.

These permanent instruments measure sky conditions and cloud cover, water vapor, liquid water content, cloud bottom and top locations, and the presence of cloud layers. Important though these measurements are, their value is limited because each instrument can collect data from only a single point directly above its location. In essence, this gives researchers only a one-dimensional view of the cloud field.



ARM Facilities Newsletter is published by Argonne National Laboratory, a multiprogram laboratory operated by The University of Chicago under contract W-31-109-Eng-38 with the U.S. Department of Energy.

Technical Contact: Douglas L. Sisterson *Editor*: Donna J. Holdridge

During March, researchers involved with the Cloud IOP will be deploying many specialized cloud-measuring instruments at three temporary sites. The additional

Figure 1. The Microwave Water Radiometer (MWR) provides time-series measurements of column-integrated amounts of water vapor and liquid water present in the atmosphere.

instruments will supplement measurements at the SGP central facility and provide enough data to construct three-dimensional views of the clouds and the overall cloud field over a triangular study area with sides roughly six miles long.

The southwest corner of the triangular experiment area will be at the central facility. The Blackwell Tonkawa Airport will anchor the northeast corner. A third site, at the southeast corner of the area, will lie directly east of the central facility and directly south of the airport. The fourth site will be set up on one leg of the triangle, halfway between the central facility and the airport.

The instruments at each of the four sites will make cloud and solar radiation measurements. In addition, three research aircraft will be in flight, measuring microphysical properties within the clouds themselves. The goal is to obtain a data set describing clouds in three dimensions in terms of properties like water content and temperature. The way the physical composition of a cloud limits the amount of solar radiation that can penetrate it and reach the surface is a crucial question for researchers. Once understood, the relationship between clouds and solar radiation can be incorporated into global climate models and even the models used to predict our daily weather.

Researchers hope to be able to fine-tune weather models by using results from this IOP. By gathering detailed information about various cloud types and their interactions with solar radiation, scientists hope to define generalized cloud parameters for various conditions. Information on a cloud's influence on solar radiation transport, keyed to current weather conditions, specific cloud and microphysical characteristics, and the season, can be fed into a weather or climate model. The ultimate result will be more accurate weather predictions and improved climate modeling results.

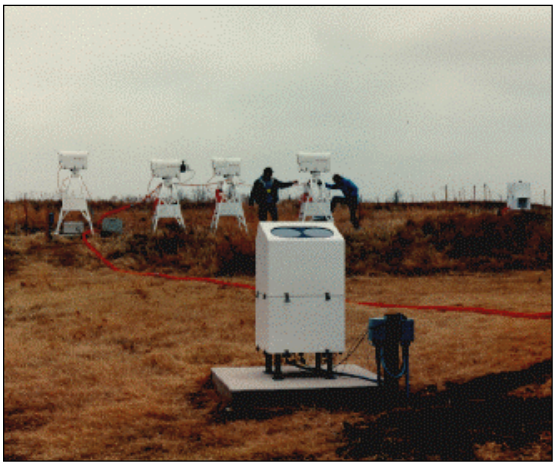


Figure 2. The Laser ceilometer measures cloud height, optical parameters, and cloud layers.