

Marine ARM GPCI Investigation of Clouds (MAGIC)

In October 2012, the U.S. Department of Energy's Atmospheric Radiation Measurement (ARM) Climate Research Facility embarks on the first marine deployment of its portable climate observatory. In a joint venture with Horizon Lines shipping company, the second ARM Mobile Facility, or AMF2, is operating through September 2013 on the *Horizon Spirit* container ship as it routinely transits the Pacific Ocean between Los Angeles and Honolulu every two weeks. Data obtained during the 20 round trips will be used by scientists for the **Marine ARM GPCI Investigation of Clouds, or MAGIC**, field campaign. The GPCI acronym refers to a study comparing how different computer models simulate the transition from cumulus to stratocumulus clouds in a specific region of the Pacific Ocean.

The AMF2 instruments will obtain continuous measurements of cloud and precipitation, aerosols, and atmospheric radiation; surface meteorological and oceanographic variables; and atmospheric profiles from weather balloons launched every six hours. During two two-week intensive observational periods in January and July 2013, additional instruments will be deployed and balloon soundings will be increased to every three hours. These additional data will provide a more detailed characterization of the state of the atmosphere and its daily cycle during two distinctly different seasons.



Science Objectives and Significance

Every cloud in the sky begins as a tiny droplet, which forms around an even smaller particle called an aerosol particle. Some clouds produce precipitation, and some don't. The relationship between clouds, precipitation, and aerosols is very complex and very important. Scientists use data about clouds, precipitation, and aerosols to develop computer codes, or models, that simulate what's happening in the atmosphere and how that affects Earth's climate. For accurate models, real observations are needed.

For the MAGIC study, the route between Los Angeles and Honolulu is ideal because of the types of clouds encountered along the way. Near the coast of California, the dominant cloud type is shallow stratocumulus—low-level cloud layers that tend to produce light drizzle. Toward Hawaii, the dominant cloud type is cumulus—puffy vertical clouds that tend to produce rain showers. Scientists don't have enough data about the east-to-west transition between these cloud systems to be confident in how their models simulate them. Measurements obtained during MAGIC will give them these data.



ARM Mobile Facility

Each Mobile Facility consists of numerous scientific instruments, cargo containers that serve as operations shelters, and data communications systems. They operate 24/7 to obtain continuous measurements of clouds, aerosol, precipitation, and solar and thermal energy. These measurements are collected by computers inside the operations shelters. Two technicians maintain the facility and launch weather balloons four times per day.

Measurement Capabilities. Measurement capabilities include the standard meteorological instrumentation, broadband and spectral radiometer suite, and remote sensing instruments.

- W-Band Scanning ARM Cloud Radar
- High Spectral Resolution Lidar
- Micropulse Lidar and Laser Ceilometer
- X- and Ka-Band Scanning ARM Cloud Radar
- Microwave Radiometer
- Atmospheric Emitted Radiance Interferometer
- Multifilter Rotating Shadowband Radiometer
- Sky Radiation System – a collection of radiometers to measure visible diffuse, global, and direct visible and infrared solar radiation
- Ground Radiation System – a collection of radiometers to measure visible and infrared radiation coming from the ground
- Balloon-Borne Sounding System – sondes launched each day at regular intervals
- Radar Wind Profiler
- Total Sky Imager
- Aerosol Observing System
- Surface Meteorology Station



Data and Communication System. Continuous measurements obtained by the sensors and instruments are collected by integrated data systems. These data are routinely checked for quality and transmitted to the ARM Data Archive for storage and availability to the scientific community.

Using an ARM Mobile Facility. The AMFs are available to collaborate with experiments (especially those involving aircraft) from other agencies. They can accommodate instruments in addition to, or in place of, the baseline collection. Scientific organizations interested in using an AMF are encouraged to submit proposals at the following web page: www.arm.gov/campaigns/propose.

Sponsor

The DOE Office of Science, Office of Biological and Environmental Research, funded the development of ARM's three mobile facilities. Numerous national laboratories are responsible for the science, engineering, and operation of the AMFs, which are managed by the ARM Climate Research Facility.

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