

Two New ARM Sites: Oliktok, Alaska, and the Azores

In 2012, the Atmospheric Radiation Measurement (ARM) Climate Research Facility began developing two new observation sites: a new ARM Mobile Facility for an extended deployment at Oliktok, Alaska, and a new fixed site on Graciosa Island in the Azores. The new sites are scheduled to be operational by the end of 2013, and they will join ARM's existing suite of permanent climate observation facilities around the world—in Barrow, Alaska; Oklahoma; Darwin, Australia; and Manus Island, Papua New Guinea—as well as its mobile and aerial research facilities. Each facility includes nearly two dozen different instruments that monitor various elements of the climate, such as clouds, aerosols, precipitation, solar and thermal energy, and basic weather components. Proposed instrumentation for the two sites includes:

- **Radars:** zenith cloud radar, scanning cloud radar, scanning precipitation radar, and radar wind profiler
- **Lidars:** micropulse lidar, Doppler lidar, and high spectral resolution lidar
- **Atmospheric and boundary state:** surface meteorological instrumentation, boundary layer cloud system, total sky imager, weighing bucket rain gauge, total precipitation sensor, eddy correlation flux measurement system, disdrometer, sun photometry, and balloon-borne radiosondes
- **Aerosol observation system:** more than a dozen instruments for measuring aerosol size, composition, and trace gases
- **Radiometry:** atmospheric emitted radiance interferometer, microwave radiometer, 3-channel microwave radiometer, multifilter rotating shadowband radiometer, broadband shortwave and longwave measurements, and spectral albedo measurements

Oliktok

The Oliktok site, an extended mobile facility deployment, is located approximately 300 kilometers southeast of the fixed ARM site in Barrow. Measurements in the Arctic are vital because dramatic changes are occurring at rates greater than predicted by any model. One of the most pressing remaining questions is why the Arctic sea ice is melting so much faster than the models predict. Answering that question requires data acquired from over the Arctic sea ice.

As part of the 2004 Mixed-Phase Arctic Cloud Experiment (M-PACE), the Federal Aviation Authority (FAA) granted an area of "restricted airspace," allowing tethered balloon operations to be conducted at Oliktok. The Department of Energy currently has a request pending with the FAA to declare a strip of airspace as a "warning area," beginning offshore of



The Oliktok Point site provides an opportunity to link coastal conditions from the standard ARM measurement suite with near-coast conditions using an Unmanned Aerial System over the Arctic Ocean and sea ice.

Oliktok and heading several hundred miles towards the North Pole. Warning areas over international waters are the rough equivalent of restricted airspace over U.S. territory.

The combination of restricted airspace and warning area provides the potential for different types of operations from Oliktok, including manned and unmanned aircraft operations out over the sea ice, dropping instrument probes, and operating instrumented tethered balloons out over the sea ice. This provides a unique opportunity to couple atmospheric observations with ground-based measurements and measurements from over the Arctic Ocean. This site will be operated for the ARM Facility through Sandia National Laboratories.

Azores

The Azores is an island group located in the northeastern Atlantic Ocean, a region characterized by marine stratocumulus clouds. The response of these low clouds to changes in atmospheric greenhouse gases and aerosols is a major source of uncertainty in global climate models.

The Clouds, Aerosol, and Precipitation in the Marine Boundary Layer (CAP-MBL) field campaign, a deployment of the ARM Mobile Facility, took place on Graciosa Island in the Azores during 2009–2010. Results from this campaign confirmed that the Azores have the right mix of conditions to study how clouds, aerosols, and precipitation interact. The Azores typically experiences relatively clean conditions with northerly wind flow, but with periodic episodes of continentally influenced polluted air masses. Its location is therefore ideal for capturing a wide range of aerosol conditions.

Significant enhancements to instruments previously deployed to the Azores include Ka-/W-band scanning cloud radars, precipitation radars, high spectral resolution lidar, and Doppler lidars.



Graciosa Island is small enough (4 x 8 kilometers) and low enough (elevation less than 400 meters) that clouds are not expected to be strongly influenced by the island's presence.

The new fixed site in the Azores will be identified as the Eastern North Atlantic (ENA) site, and it has the full support of the Azorean government and collaborators at the University of the Azores. It will be operated for the ARM Facility through Los Alamos National Laboratory.



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