

# State of the Tropics: 1998

*W. E. Clements and F. J. Barnes  
Los Alamos National Laboratory  
Los Alamos, New Mexico*

## Introduction

The U.S. Department of Energy's (DOE's) Atmospheric Radiation Measurement (ARM) Program was created in 1989 as part of the U.S. Global Change Research Program to improve the treatment of atmospheric radiative and cloud processes in computer models used to predict climate change. The overall goal of the ARM Program is to develop and test parameterizations of important atmospheric processes, particularly cloud and radiative processes, for use in atmospheric models. This goal is being achieved through a combination of field measurements and modeling studies. Three primary locales were chosen for extensive field measurement facilities. These include the Southern Great Plains (SGP) of the United States, the Tropical Western Pacific (TWP), and the North Slope of Alaska and Adjacent Arctic Ocean (NSA/AAO). This paper describes the status of the ARM Program in the TWP locale.

## Siting Strategy

An important property of the climate in the TWP is a strong east to west gradient in various climate parameters including sea surface temperature, water vapor column, and frequency of convection. The TWP is characterized by high sea surface temperatures and frequent, deep convection. Toward the eastern Pacific, there is a steady decline in sea surface temperature and a corresponding decrease in the frequency of convection. Because of this longitudinal structure and its variability, it would be difficult to characterize the climate of the TWP with a single site. The plan for ARM in the TWP is to deploy an Atmospheric Radiation and Cloud Station (ARCS) at several sites to sample the structure in this region.

An ARCS consists of an integrated instrument set that can measure the surface radiation balance, surface meteorology, cloud properties, and some limited atmospheric quantities. A complete list of ARCS measurements and instruments is given in Table 1. In addition to the suite of scientific instruments, an ARCS contains data acquisition systems,

monitoring and control systems, satellite communications, a backup electrical generator, and other support equipment. The ARCS is housed in five specially modified 20-ft sea containers. The ARCS system is self-contained and designed to operate semi-autonomously with a minimum of on-site support.

Three sites (Figure 1) have been identified for implementation in the TWP locale. The first site in Papua New Guinea (PNG) is operational, the second site on Nauru is scheduled to be operational this year, and plans for the third site are under way. The status of each of these sites is given below.

### Manus

The Manus site is located at the National Weather Service (NWS) station at the Momote airport on Los Negros Island in Manus Province, PNG at 2.060°S, 147.425°E, 6 m mean sea level (MSL). All equipment is located within the NWS compound at Momote. The site is operated in collaboration with the PNG NWS. Routine operations began on October 8, 1996. A new Global Positioning System (GPS) rawinsonde system was installed in August 1997. The whole sky imager and the cloud radar will be added within the next year. Health and status data are received hourly by TWP operations via satellite. Higher resolution data is delivered to the ARM Experiment Center monthly.

### Nauru

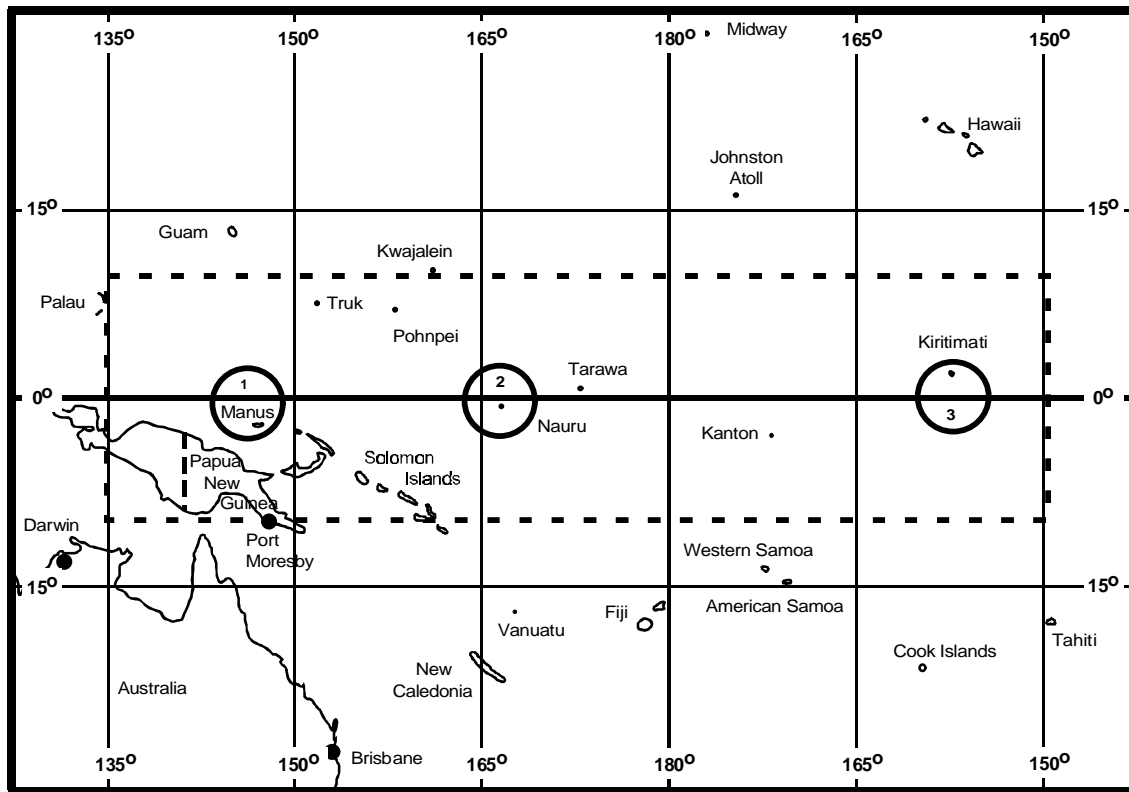
The second site to be implemented in the TWP will be on Nauru Island at 0.53°S, 166.92°W in the central Pacific. ARCS-2 will be installed at a site on the west side of the island. Operations are expected to begin in October 1998. The operation of the site is a collaborative effort with the Nauruan Government's Department of Island Development and Industry. The site will have the standard ARCS complement of instruments and an atmospheric emitted radiance interferometer (AERI).

## Kiritimati

The proposed location for the third site is on Kiritimati (Christmas) Island at 1.87°N, 157.33°W. Discussions have begun with the Kiribati government concerning this possibility. Two potential sites have been identified on the island. One is located at the northeast end near the town of

Banana and another at the southwest end near Aeon Field. The operation of the site most likely would be a collaborative effort with the Kiribati Meteorological Services. There is also a possibility of collaboration with the Japanese National Space Development Agency (NASDA) that has activities on the island. Operations of the Kiritimati Island site could begin in 2000.

<b>Measurement</b>	<b>Instruments</b>
Surface radiation balance	<ul style="list-style-type: none"> <li>• Up- and down-looking pyranometers and pyrgeometers</li> <li>• Sun-shaded pyranometer and pyrgeometer</li> <li>• Normal incidence pyrhelometer</li> <li>• Up- and down-looking 9 <math>\mu\text{m}</math> to 11 <math>\mu\text{m}</math> narrow field-of-view radiometers</li> <li>• UV-B hemispheric radiometer</li> <li>• Broad band (solar and infrared) net radiometer</li> </ul>
Surface meteorology	<ul style="list-style-type: none"> <li>• Temperature and relative humidity sensor</li> <li>• Barometer</li> <li>• Optical rain gauge</li> <li>• Propeller vane anemometer</li> </ul>
Cloud properties	<ul style="list-style-type: none"> <li>• Cloud lidar (523 nm)</li> <li>• Ceilometer (7.5 km maximum range)</li> <li>• 35-GHz radar</li> <li>• Whole sky imager</li> </ul>
Aerosol optical depth	<ul style="list-style-type: none"> <li>• Multifilter rotating shadow band radiometer (total, direct, and diffuse irradiance in six 10-nm channels)</li> </ul>
Column water	<ul style="list-style-type: none"> <li>• Dual channel (23.8 GHz and 31.4 GHz) microwave radiometer</li> </ul>
Vertical structure of the atmosphere	<ul style="list-style-type: none"> <li>• Rawinsonde</li> <li>• 915-MHz wind profiler with Radio Acoustic Sounding System (RASS)<sup>(a)</sup></li> </ul>
(a) Operated in cooperation with the National Oceanic and Atmospheric Administration's (NOAA's) Aeronomy Laboratory	



**Figure 2.** Equatorial western Pacific region showing the TWP locale (dashed area) and proposed ARCS sites (circles).