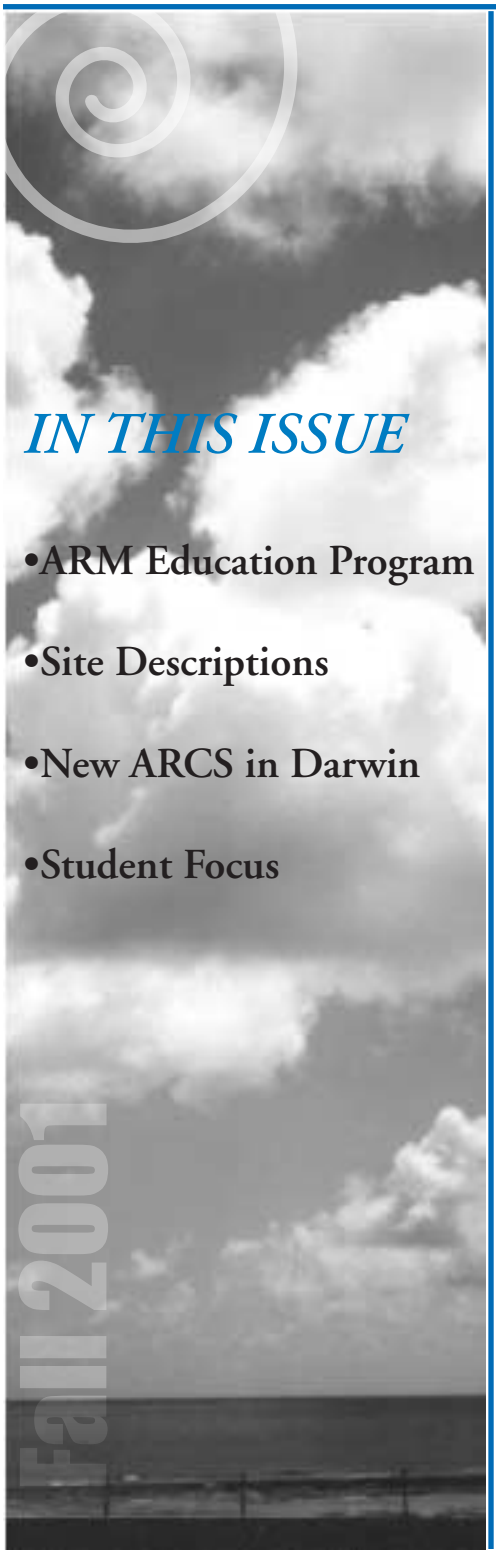
ARM Education Update

News from the ARM Program ☐ for students and teachers about ☐ climate-change studies



IN THIS ISSUE

The ARM Education Program

The Atmospheric Radiation Measurement (ARM) Education and Outreach program supports ARM operations at all three Cloud and Radiation Testbed (CART) sites in ways that are relevant to the needs of the communities and regions that host the ARM program sites. The goal of the education and outreach program is to develop basic science awareness, critical thinking skills, and improve environmental-science capacity building for communities, teachers, and students in ARM host communities and regions. This year, the primary goal is to extend the existing program to cover all three sites and to coordinate activities among the sites.

In order to achieve this goal, we do the following:

- Bring awareness of the ARM program to host communities through public education relevant to the culture of the region;
- Provide opportunities for educators and students close to the ARM sites to understand the goals of the ARM project and have access and use ARM data for educational programs as technical resources permit;
- Increase the knowledge base for basic science and critical thinking skills using curriculum enrichment activities in climate, climate change, and climate change effects relevant to each region;
- Develop and use tools (curriculum, teacher enrichment, workshops, science fair support, high school research projects, school interactions between the sites) and teacher internships to promote learning and understanding of climate science and environmental effects.

Activities for the program include teacher in-service days, community and teacher workshops, Internet projects, educational kiosks, curriculum development, site tours, and support for teacher enrichment activities.

The ARM Education program director is Dr. Fairley Barnes at Los Alamos National Laboratory in Los Alamos, New Mexico. Dr. Barnes was instrumental in developing the teacher workshops in the Tropical West Pacific and conducted a number of workshops on the islands of Manus and Nauru. She worked with local staff from Flinders University in Australia to develop the two science curriculum volumes that exist for the education program.

The ARM education program complements the ARM program scientific efforts because the education program staff uses ARM program objectives and data to enrich students' science programs. Each site is different, and the education program staff is committed to incorporate the regional culture into the education program materials that will be developed. Last year the ARM education program was consolidated, and education efforts across sites will be more integrated as a result. We are looking forward to working with all of you as we move forward in this exciting effort. Please visit the ARM education website at ***www.arm.gov/docs/education.html***.

What is.....

ARM?

The United States Department of Energy (DOE) created the ARM Program in 1989. The ARM Program is part of DOE's effort to resolve scientific uncertainties about global climate change with a specific focus on improving the established computer models called general circulation models (GCMs) used for climate research and prediction. These improved models will help scientists better understand the influences of human activities on the earth's climate.

The ARM Program established and operates several field research sites, called CARTs, in climatically significant [and VERY different locations: the Southern Great Plains (SGP) states in the United States, the Tropical Western Pacific, and the North Slope of Alaska]. These sites were identified as representing the range of climate conditions that should be studied. Each CART site has lots of different instruments to gather massive amounts of climate data. Using these data, scientists hope to better understand the effects and interactions of sunlight, radiant energy, and clouds on temperatures, weather, and climate.

Education is an important part of the ARM program. Another article in this newsletter talks about what the program's goals are.

The Tropical Western Pacific

One of ARM TWP's data collection sites is on Nauru Island in the central Pacific.

The Tropical Western Pacific (TWP) locale is the second Cloud and Radiation Test bed (CART) established by DOE's ARM Program. The TWP site spans an area roughly between 10°S and 10°N latitude and 135°E and 150°W longitude (east to west from approximately Easter Island to Indonesia). Using Atmospheric Radiation and Cloud Stations (ARCS), ARM has been collecting data on Manus Island in Papua New Guinea since 1996 and from the Republic of Nauru since 1998. A third ARCS is currently being installed in Darwin, Australia (see article in this newsletter).

The TWP is a very important climatic region. The sea surface temperatures in the TWP are exceptionally high over a large area, and therefore the area is referred to as the "warm pool." The warm sea surface introduces lots of moisture and heat to the overlying atmosphere, which results in deep convective cloud patterns and high rainfall. This area also experiences substantial climate variations associated with El Niño.

An extensive education outreach program is in progress in the region. Two curriculum modules for Pacific schools have been written and presented in Teacher Workshops in Port Moresby and Manus Island, Papua New Guinea, and the Republic of Nauru. The curriculum modules, Climate Change and Sea Level, Part One: Physical Science, and Part Two: Social Science, address issues surrounding climate and sea level change and their effects in the region through descriptions, charts, graphs, maps, and student activities. A third module on Ecology is currently in the process of being written. A second round of teacher workshops is now tentatively scheduled for the summer of 2002.

Third TWP Atmospheric Radiation and Cloud Station (ARCS) to be operated in Darwin, Australia.

In September 2001, site preparation began in Darwin, Australia, for the third ARCS in the TWP. Currently, ARM TWP operates sites on Manus Island in Papua New Guinea and on Nauru Island in the central Pacific. Through a collaborative agreement between the ARM TWP Office at Los Alamos National Laboratory and the Australian Bureau of Meteorology, an ARCS will be installed and operated near the airport in Darwin. During October and November, the site infrastructure will be put in place. The final phase of the site installation will take place January through March 2002 when the instruments and data system will be installed and tested. It is expected that the Darwin facility will be fully operational by April 2002. A commissioning ceremony is being planned and will be held when the site is operational. Additional information on the Darwin site and installation progress can be found at *http://www.twppo.lanl.gov/docs/siteinfo3.html*.

The Southern Great Plains

Southern Great Plains Site.

The SGP site was the first field measurement site established by DOE's ARM Program. The SGP site consists of different instrumentation spread across approximately 55,000 square miles in north-central Oklahoma and south-central Kansas. In the spring of 1992, the first instrumentation to the SGP site was installed, and in November 1992, the site was dedicated. Since that time, additional instrumentation and data-processing capabilities have been added. The SGP site was chosen for several reasons. The area has a wide variety of cloud types as well as large seasonal variations in temperature and specific humidity. The 55,000 square mile site also has relatively homogeneous geography. There existed already a large network of weather and climate research instrumentation at or near the site, and this area provided a good opportunity for cooperative activity with many other federal and state climate research programs.

This site is the largest and most extensive climate research field site in the world and can be viewed as a "Laboratory without walls." The Central Facility, located on 160 acres of land southeast of Lamont, Oklahoma, is staffed by 30 scientists and technicians collecting and monitoring data from the numerous instruments in the Central Facility and from smaller, unmanned facilities throughout the site.

The North Slope of Alaska

The "Great White" in Barrow, Alaska.

The North Slope of Alaska (NSA) is the third ARM Cloud and Radiation Test bed (CART) site. This site, which began operation in the fall of 1997 is centered near Barrow, Alaska, and extends south to the vicinity of Atqasuk and east as far as Oliktok Point.

The CART site on the North Slope of Alaska is important to the ARM program because extremely different climate processes occur at high latitudes. In the NSA region, ice and snow are the predominant forms of condensed water most of the year, both in the air and on the surface. Ice and snow scatter, transmit, and absorb sunlight and radiant heat very differently than liquid water. Additionally, ice clouds form, evolve, and evaporate differently than water clouds. In this region there is also very little water vapor in the atmosphere. This changes the impact of the atmosphere on the propagation of radiant energy from the sun—especially the radiation upward from the Earth's surface. Another important reason that the Arctic is ideal for climate study stations is that the atmosphere at the Arctic ground level is very similar to that of the upper atmosphere year-round and worldwide. It is easier to study the Artic ground atmosphere in detail rather than the upper atmosphere.

In working on the North Slope of Alaska, ARM scientists have had the opportunity to work in collaboration with many other research groups from around the world. The ARM program works with scientists from the National Science Foundation and the Office of Naval Research, the National Weather Service, and the National Oceanic and Atmospheric Administration (NOAA) Climate Monitoring and Diagnostics Laboratory. The NSA region has become a central location for climate-related research.

Student Focus

The ARM program offers a number of opportunities for students to learn about the Program. One of our students this summer was Johnny Finn, who worked with the ARM Education Program at Los Alamos National Laboratory. Johnny agreed to share some of his experiences as an ARM intern.

Q: What University do you attend, and what is your major?

A: I attend the University of Missouri, Columbia, Missouri and major in international studies, Spanish, and music.

Q: Why did you want to work at Los Alamos National Laboratory?

A: I have an interest in the environmental part of the Laboratory. Often you only hear about the weapons-related work at Los Alamos, but I wanted to experience what they are doing to address problems in the environment. I also wanted to learn new skills. This job has exposed me to a lot of different areas, fieldwork, and working for the ARM education program.

Q: Tell me what you liked about the ARM Education Program.

A: I liked the fact that it was international in scope and was intended to improve levels of education. It is a very interesting program of great magnitude, and it is so great that there is money set aside for education. It is much more than just public relations. It is yet another way of working with developing countries. It gave me a chance to design materials that would be useful to teachers in the Tropical West Pacific. The design had to be appealing to teachers and easy to use for them and for students.

Q: What did you accomplish this summer?

A: I did a lot of research projects. Because we were on a deadline for the TWP workshops, we had to get a lot of materials produced and shipped out. Preparation and coordination for the workshops took a lot of time. We designed evaluations for the workshop that were designed to get the information needed by the program. Even though the workshops were cancelled at the last minute, we prepared materials and evaluations to be shipped to the teachers to use in their classes. I also updated all the briefing books for the North Slope of Alaska and TWP sites.

Q: What did you like best about your work environment?

A: There was a real team effort to get things done within a short time frame. I liked the fact that everyone was so friendly, supportive, and created a relaxed atmosphere that allowed me to learn about the program.

Q: Did working for the ARM Education Program help you in future career choices?

A: I identified lots of possibilities that I never might have thought about if I hadn't worked for the program. I definitely want to work on projects that reach beyond the U.S. border. I also want to go on to graduate school. There are so many highly educated people at the Laboratory that I realize I need to expand my education even further.

Los Alamos NATIONAL LABORATORY

Tropical Winds is published three times a year to highlight recent activities of theTropical Western Pacific Program.

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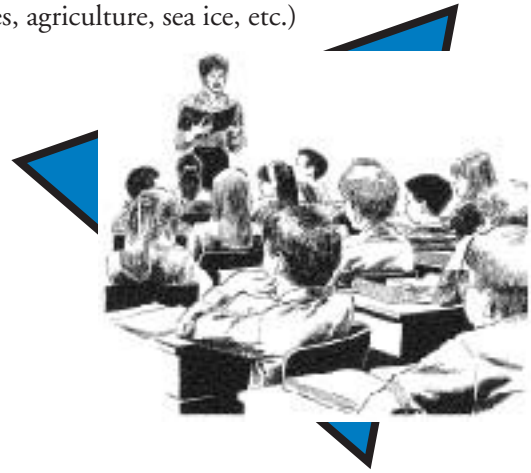
MATERIALS

- PAPER AND PEN
- COLORED PENCILS
- TAPE OR GLUE

Objective

Develop a timeline to illustrate the changes in the environment and to study relationships between different sectors, such as natural changes in the environment, (shorelines, agriculture, sea ice, etc.)



Procedure

(1) Begin by having students connect several pieces of paper together end to end to make a long continuous sheet roughly 3 m or 9 feet long.

(2) Have students then draw a timeline on the paper. They should begin the timeline with the earliest recorded date of the site history and end at the present day. It may be most effective if the students mark the timeline with equal intervals.

(3) Use the following code to mark events on the timeline:

Green–environmental changes

Grey–human or industrial development

Violet–economic development or benchmarks

Blue–natural events

Orange–social impact or interaction

(4) Mark the dates or approximate times of major and minor events that happened in each of the categories. These include such things as weather changes, introduction of currency, expansion of towns and populations, etc. Think of as many things as possible and be specific. Consult site records or at least the elders in the community.

(5) Have students review the timeline. Are there times that had a great number of changes? Are there times that had nearly no change? Are there events that seem to be related to each other? When have most of the changes occurred? Why is that? How has the site or area changed from the beginning of the timeline until the end? Pay particular attention to the coastline erosion, other environmental changes, climate changes, and communications.

(6) Have students think about things that are happening now. How will future students record these changes? What will they see as a result?

NOTES

We want to hear from you!

We are committed to staying in touch with you. Please send us any comments about the contents and let us know how we can serve you and your school. If you have access to the Internet, you can send us e-mails. If you live in Manus or Nauru, you can bring your comments or questions to our observers at the ARCS research site. Of course, you can send us a letter, too. Here is the contact information.

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