



# Tropical Winds

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

## WELCOME TO TW

by Fairley Barnes, TWP Deputy Program Manager/Education Director

### IN THIS ISSUE



TWP deputy program manager Fairley Barnes talks to educators in Papua New Guinea.

### Welcome

to the first issue of Tropical Winds, an educational newsletter from the Tropical Western Pacific (TWP) Program Office in the United States. This quarterly newsletter will complement our education program with information, news, and articles for teachers and students in schools close to the U.S. Department of Energy's (DOE) Atmospheric Radiation Measurement (ARM) program research sites in the Pacific region. The information will include regional climate meteorology, climate change, the effects of climate change on the region, and news from the current ARM sites: Manus in Papua New Guinea and the Republic of Nauru. We plan to establish a third site in Kiribati in the year 2000.

The ARM education program started in 1993, when TWP program manager Bill Clements and I gave our first classroom talk on the ARM program

at Utu High School in Kavieng, Papua New Guinea. We learned a great deal about local needs and priorities from a few short sessions with teachers and students. These sessions helped us realize that our education program must be relevant to the needs of educators in each country.

Because of the experience in Kavieng, we started our education program in each country by sitting down and discussing needs and possibilities with teachers and school administrators. Those discussions with local educators helped us plan how to use our resources in the most effective ways for the communities close to our research sites. As a result, we have established three goals for the program: 1) To inform and enrich primary, secondary, and college programs in the Tropical Western Pacific region; 2) To focus on basic science concepts, through activities and study of climate, climate change, and the effects of climate change relevant to the region; and 3) to foster career goals in science for students in the region.

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Welcome to Tropical Winds

Curriculum Modules

Test Your Knowledge

## Curriculum Modules for the Pacific Schools

by Fairley Barnes, TWP Deputy Program Manager/Education Director

In 1995, TWP program manager Bill Clements and I met with the education department of Nauru to find out how the ARM program could help the country's students and teachers. The greatest need was for a science enrichment curriculum to enliven the classroom work. We returned home quite puzzled about how we can use our resources to do this really big job. However, our colleagues in the South Pacific Regional Environment Programme (SPREP) in Samoa suggested that we contact Dr. Than Aung at the National Tidal Facility (NTF), Flinders University, Australia. It was the beginning of a wonderful partnership. Dr. Aung and colleagues at such institutions as NTF, SPREP, SPaRCE and ARM, started working with us to scope out a curriculum for schools in the Pacific.

About two years later, in January 1998, the NTF published the first set of curriculum modules: *Climate and Sea Level Rise, Part 1: Physical Science* and *Part 2: Social Science*, both authored by T. H. Aung, C. Kaluwin, and G. W. Lennon.

In July 1998, Australian Ambassador for the Environment, Ms. Meg McDonald, officially launched the curriculum modules in Fiji. The books were well received by more than 150 educators from the SPREP countries. Following the successful launch of the first modules, in November 1998

we held the first implementation workshop in Nauru. It was fitting to host such a workshop for the curriculum in Nauru because it was where the whole idea started for us.

Dr. Than Aung helped us conduct the Nauru workshop over a 5-day period. Thirty-six enthusiastic teachers and principals from two high schools and several primary schools attended the workshop and earned certificates of completion. During the workshop, teachers learned how to conduct over half of the scientific activities in the modules, and they practiced presenting the ideas and activities using all of us as a class. We learned more about how to present the activities in this workshop than in any previous occasions, and it was a true

**"...it was a true collaboration with the Nauru educators."**

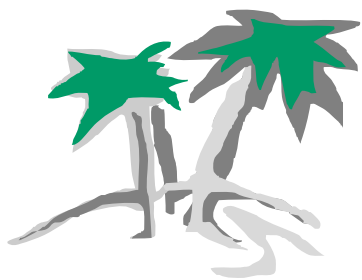
collaboration with the Nauru educators. At the end of the workshop, all the participating teachers expressed their enthusiasm for our education program.

Teachers received booklets to help them explain the ARM research site to their students. We also took a field trip to the ARM site and the NTF tidal facility in Nauru to see the state-of-the-art equipment in use. In the following week, we had follow-up meetings for the workshop, and one teacher, Mr. Stephen White, had already had great success in two classes using an activity on microclimates. The Nauru workshop was a good beginning for our implementation effort.

We will be conducting the second implementation workshop in Papua New Guinea, in May 1999, and more workshops will follow in several other Pacific nations this year. As we carry on the workshops, we will also develop new activities to better explain basic concepts to students, and we will use this newsletter and other mailings to pass on those activities. We are also starting to write a third volume, *Part 3: Environmental Science* to complete the series for science enrichment in the Pacific schools. If you have already started to use the curriculum, we would greatly appreciate your feedback and suggestions on how to present the ideas to classes at different levels.



36 educators attended the 5-day education workshop in Nauru.



## That "R" in ARM

by Bill Clements, TWP Program Manager

The acronym ARM stands for Atmospheric Radiation Measurement, the name of our program. The term "radiation," however, means something a bit different from what you may think. It refers to two kinds of radiation, solar and terrestrial radiation, and has nothing to do with nuclear radiation.

Solar radiation, or sunshine, is the source of all the energy available for supporting life on our planet. The atmosphere and the ground absorb some of the solar energy reaching the Earth, while some is reflected back to space by the surface and clouds. By absorbing the energy the ground heats up, and the warm ground radiates energy itself. If you hold your hand palm-down over a paved road on a hot clear day, the heat you feel on the back of your hand is solar radiation, but the heat you feel on your palm is terrestrial radiation.

If more energy is absorbed by the earth and the atmosphere than is reflected or radiated back to space, then the planet will tend to warm. Conversely, if the opposite is true, then cooling will take place. Right now there is a concern that human activities may be causing the Earth's temperatures to rise: the phenomenon also known as "global warming."

Scientists have found that global warming is mainly caused by "greenhouse gases." Those gases include naturally occurring gases as well as gases introduced into the atmosphere by human activities. Activities

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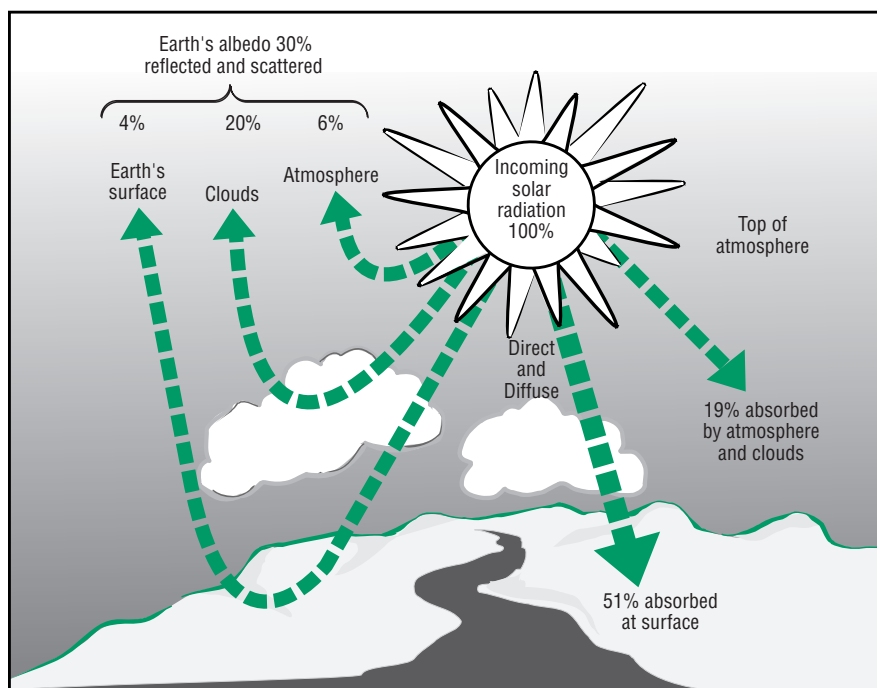
### So, what do you know?



- Test your global
- climate knowledge

- 1 What is the average global temperature?**
  - a. 49 degrees F (9.4 degrees C)
  - b. 57 degrees F (13.9 degrees C)
- 2 Scientists think that there will be significant warming in which polar zone?**
  - a. northern polar zone only
  - b. northern and the southern polar zones
- 3 When could global warming occur?**
  - a. When the energy leaving the earth is greater than the energy arriving
  - b. When the energy arriving at the earth is greater than the energy leaving
- 4 What is the biggest source of carbon dioxide?**
  - a. Burning wood
  - b. Burning coal
- 5 Which gas is NOT a greenhouse gas?**
  - a. Oxygen
  - b. Ozone
- 6 Which greenhouse gas would cause over half of global warming?**
  - a. CO<sub>2</sub>
  - b. Methane gas
- 7 What are the two main contributors to producing acid rain?**
  - a. Sulfur and nitrous oxide
  - b. Rain and acetic acid

Answers:  
1. b), 2. a), 3. b), 4. b), 5. a), 6. a), 7. a)



## Welcome

*continued from page 1*

We plan to achieve those goals by: 1) Using the ARM research sites as a resource for teachers and students to learn about climate research and advanced technology; 2) Making the ARM data available to teachers and students for a wide variety of activities in science, mathematics, social sciences, and humanities; 3) Developing a regional science enrichment curriculum for upper primary and secondary schools; 4) Helping implement the curriculum and ensuring its relevance in each country; 5) Collaborating with schools of the Pacific Rainfall Climate Experiment (SPaRCE); and 6) Interacting with education departments, teachers, and students through visits, letters, workshops, and the newsletter.

By now, we have already had some great successes, some failures, and a lot of enthusiasm for what we are trying to accomplish in the education program. This newsletter is our next big step in ensuring the success of our education program in the Tropical Western Pacific. We are eager to answer your questions and to stay in touch. So, let us know how we can serve you and your school!

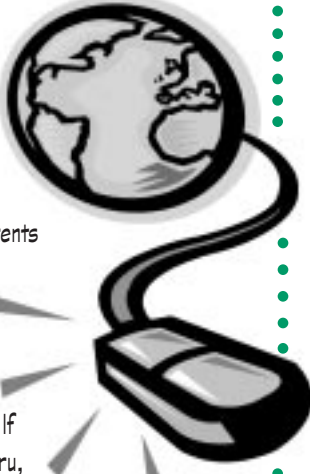
## "R" in ARM

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such as burning fossil fuels create those gases that can trap energy in the Earth's atmosphere, causing average global temperatures to rise. Clouds can be another factor in global warming; depending on the type, clouds can cause either heating or cooling of the planet.

The ARM program's goal is to study the relationships between solar and terrestrial radiation, clouds, greenhouse gases, and other atmospheric properties. The results of our study will help scientists better understand how those relationships affect Earth's climate and make better predictions about climate change.

## We want to hear from you!



We are committed to stay 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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