ARM

Climate Education Update

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

WINTER 2002

Talking About Climate at Schools in the Tropical Western Pacific

Dr. Bill Porch, ARM Science Programs Specialist

When I visit the ARM sites at Manus Island, Papua New Guinea and the Island Nation of Nauru, I am often asked to give a presentation about climate at the local high schools. These class presentations often begin with short demonstrations displaying the following:

1. Atmospheric pressure can hold up the water in a glass if it is turned upside down with a card underneath to trap the air inside the glass;
2. When air is heated in a bottle, it can blow up a balloon;
3. And, when that bottle is cooled, the balloon will deflate.

Afterwards, it is important to explain what climate questions ARM and other programs are trying to address. Because research is being done practically in the backyards of these students, ARM assists them in utilizing the data to better understand climate.

Bill Kornke and Dennis Morrison showing pressure and temperature effects.

There are hundreds of other questions about climate that ARM tries to explain. For instance, if water vapor increases as CO_2 warms the air, do we see this increase and is it the same as the models predict? Water vapor is different than CO_2 because it changes from a gas to a liquid

Students in Nauru listening to ARM presenters.

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Merging Indigenous Knowledge and Culture into Climate Education

Since Western culture and worldview were introduced to Iñupiat Eskimo communities on the North Slope of Alaska (NSA), there has been a steady loss of Iñupiat language and traditional knowledge in the following generations. Native Alaskan students have shown a lack of enthusiasm for the western school system, and this has in part been attributed to the fact that the curricula, the teaching methods, and the teacher training are all based on the western worldview. Because of this loss of traditional Iñupiat knowledge and because of the failure of the present school system to meet the needs of indigenous students, many people are working to put Iñupiat ways of teaching and traditional knowledge back into the classroom.

Jeff Berger and John Nusunginya interviewing Barrow elder, Sadie Neakok on climate change.

The ARM Education Program is working toward incorporating the Iñupiat worldview and traditional knowledge into educational outreach work they do for NSA communities. For example, ARM Education is creating a touch screen museum kiosk for the Iñupiat Heritage Center in Barrow. The purpose of this kiosk is to tell about climate change and how the local environment is affected. ARM has been interviewing and videotaping not only climate change scientists that do research on the North Slope, but also elders and the community on what climate change affects they have seen throughout their lives and how it has affected traditional subsistence practices.

Last year, ARM Education hired student Carrie Talus from Fairbanks, Alaska. Carrie is enrolled in a M.A. degree program in Cross-Cultural Studies from the University of Alaska Fairbanks in order to learn more about Native Alaskan culture and how to incorporate it into climate education. Carrie is creating classroom activities and lessons that teach climate change related science, but also tie in traditional Iñupiat culture and language. The goal of these lessons is to make them revolve around something familiar and a part of every day life for Native Alaskan students, hopefully making the lessons interesting and relative to the students.

ARM graduate student, Carrie Talus.

Carrie is also working on getting an "Elders and Climate in the Classroom" project started in North Slope schools. While this is in no way a new concept, this project is a way to encourage more teachers to invite elders into their classroom to talk about weather and climate related subjects such as survival,

Bowhead skull from Inupiat tradition of whale hunting.

navigation, climate change, and predicting the weather. ARM Education is setting up a system to give interested teachers small grants to pay for an elder and translator if needed. Carrie is creating classroom lessons that revolve around Iñupiat culture, and a part of each lesson will be having the students document local elder knowledge to share with other students.

We all need to recognize that there are multiple worldviews, ways of learning, and knowledge systems. In order to give curriculum a meaning for Native Alaskan students, it is important to merge Native Alaskan traditional knowledge, language, and culture into each school day. In this way, we help to provide students with education within their own culture. It is this diversity that strengthens humankind.

Martha Hopson and her grandson, Michael, taking a walk on the tundra.

Conservation through Education in Papua New Guinea

Janine Watson and Debra Wright

The Research and Conservation Foundation (RCF) of Papua New Guinea (PNG) and the Wildlife Conservation Society (WCS) have come together to create the RCF/WCS Conservation Education Teacher Training Program. This program teaches environmental science to PNG teachers and focuses on the importance of protecting natural resources. ARM is collaborating with RCF/WCS to enhance climate change education throughout the region.

WCS has designed curriculum materials that teach about PNG ecology and wildlife. By highlighting the unique wildlife in this region, RCF/WCS hopes to foster pride in PNGs natural environment. Also, the RCF/WCS Program is collaborating with the ARM Program by adding climate change to their curriculum. WCS curricula is taught at Conservation Education Teacher Training workshops. The curricula provides teachers with a broad introduction to basic ecological concepts and covers topics such as climate, habitat characteristics and human impacts on natural habitats. During the workshops, teachers carry out a number of student activities themselves such as designing a rain forest mural so that they are confident when using the activities with their students.

Teacher workshops aim to develop teacher skills in using nature to conduct education.

RCF/WCS has also established the Conservation Education Resource Centre (CERC), which provides educational materials such as books, videos, magazines, and student activity books to teachers. Teachers are encouraged to bring their student groups to the CERC to watch videos, hear from guest speakers, and to take part in various activities from the WCS curricula. There are plans to open similar but smaller 'satellite' CERCs in other provinces in PNG.

School children taking part in a lesson on different habitats at the CERC.

RCF/WCS, working with the University of Goroka, has a Conservation Education Teacher Training program that conducts a semester-long course for fourth year Social Science student teachers. Currently, the University of Goroka is the only institution in the country training teachers for secondary schools so this is a very important achievement.

The RCF/WCS Program is now collaborating closely with participating Provincial Education Offices and the National Curriculum Development Division to integrate their curricula into the official PNG curriculum.

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as it collects on small particles in the air and then drops out of the air (rain). CO_2 is more or less inert and leaves the air only when plants use it to make food (a not very fancy description of photosynthesis). Water vapor changes a lot from day to day, place to place, and at different altitudes. CO_2 changes with season and as biological activity increases and decreases on the land and in the oceans, but therse changes are slower and more uniform than changes in water vapor. The ARM program is attempting to improve the accuracy and representation of water vapor measurements, and connect these measurements at locales like the Tropics and the North Slope of Alaska to satellite remote sensing measurements related to water vapor on a global scale.

The ARM Program and its scientists are committed to using their knowledge to teach these students about the effects of climate. After all, these students have the potential to be the scientists of the future.

Activity ~ Air Pressure

For other classroom activities, check out the ARM webpage at http://www.arm.gov/docs/education/tlessons.html

Objective: The object of this activity is to investigate the effects of atmospheric pressure.

Materials:

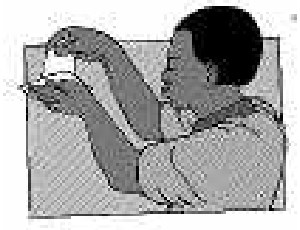
Sturdy paper cup	Water
2 index cards	Sink or catch tray
Straight pin	

Important Points to Understand:

- Air has weight and exerts pressure on everything with which it comes in contact.
- The force exerted on a surface by air is equal to the weight of a column of air above the surface extending to the top of the atmosphere.
- Air pressure is exerted equally in all directions.

Preparation:

Teachers may need to assist students who have trouble getting the activity to work. It is important that students work carefully and slowly. A break in the seal between the cup and card allows air into the cup, causing the water to fall. (Note: If students have trouble getting a seal between the cup and the index card, have them fill the cup completely with water and moisten the card slightly before placing it on the cup.)



Procedure:

Trial I

1. Working over a sink or a catch basin, fill a cup to the rim with water. In the box marked "Trial I Prediction," suggest what will happen when you turn the cup over. Explain your prediction.
2. Turn the cup over. What happened? Record your observations.

Trial 2

1. Fill the cup again. Cover it with the index card, and make sure that you have created a water seal around the rim of the cup, so no air can seep in. Try to predict what will happen when you turn the cup over with the index card covering it. Explain your prediction.
2. While holding the index card on top of the cup, carefully turn the cup over. Hold the cup around the rim at the bottom so that the cup is not deformed (bent) and remove the hand holding the card. What happened?

Trial 3

1. Use a pin to carefully make a hole in the bottom of the cup. What do you predict will happen when you now repeat the experiment? Write down your prediction first before you try.
2. Cover the water filled cup with a new index card. Repeat the experiment, turning the cup over carefully. What happened? Record your observations.

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Questions:

1. In Trial 1, what caused the water to fall out of the cup?
2. In Trial 2, what held the index card to the cup? What prevented the water from falling out of the cup, as it had done in Trial I?
3. Explain why the water and the index card fell from the cup in Trial 3 of the activity.
4. Based on your observations, in which direction(s) is air pressure being exerted? Draw a picture representing your explanation and explain the phenomenon of air pressure in your own words.
5. Try to explain why we usually do not feel the pressure of the atmosphere around us. When do we feel air pressures?

Explanation:

In trial 1 the water falls out because of the pull of gravity. In trial 2, the index card remains in place due to the outside air pressure being greater than the air pressure inside the cup. When the cup of water is first inverted air pressure inside and outside the cup is equal. Therefore, due to the pull of gravity water begins to leave the cup, which causes the volume of air, or space above the water, to increase. Though the quantity of air above the water remains the same, the volume occupied by the air is now greater so the air pressure decreases. This results in more air pressure outside the cup than inside the cup. In trial 3, the hole poked in the top of the cup suddenly causes the air pressure in the cup to be the same as air pressure outside of the cup.

Critical Thinking Question

How many days would the sun have to shine on a 10 km square area (about the size of Nauru Island) to put in as much energy as the biggest nuclear bomb releases?

It would take less than 1 day! Small changes in the energy that gets to Earth from the sun dominate climate change and make direct climate change by humans very difficult. However, while 10 kilometers seems like a small distance on the ground, almost all the atmosphere above us is below 10 kilometers. Thus, when we put gases like CO_2 into the air, they are kept in a relatively thin shell of air above the earth and begin to accumulate. In fact, CO_2 from fossil fuel burning is growing in the atmosphere.

We want to hear from you!

Please contact us to send any comments or let us know how we can serve you and your school. If you live in Manus or Nauru, you can also bring your comments to our observers at the ARCS research site. We are happy to hear from you anytime!

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A Teacher's Experience Working for the ARM Program

David Galliher began working for ARM at Pacific Northwest National Laboratory in the spring of 1998, where he developed the ARM Education website, the interactive teaching and learning site for teachers and students. Currently, he is involved in managing the website, and one of his primary tasks is managing the popular "Ask An ARM Scientist" program.

The ARM Education website receives a good amount of use, and David is always impressed with the quality of questions submitted to "Ask An ARM Scientist." More than 20 ARM Scientists are on hand to help answer the questions submitted, such as Chief Scientist Tom Ackerman who David likes to use as a resource for the tough questions. The ARM scientists are careful to stay away from opinion-based questions and stick only to those dealing with the facts.

Dave Galliher, teacher and ARM website developer.

David continues to spend much of his time improving the ARM Education site. He also posts current articles dealing with climate change and updates the FYI and quiz questions.

When David is not working for ARM, he is teaching Web Design and Broadcast at Carmichael Middle School in Richland, WA. He taught science for ten years before switching to his current assignment, teaching technology. David has a MA in Computer Education and is responsible for managing all of the technology at his middle school, and is also the athletic director at his school. David is a past recipient of the Southeastern Washington Science Teacher of the Year.

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