

**Strategies for Engaging Students, Teachers, and the General Public
in Climate Change and Health Education**

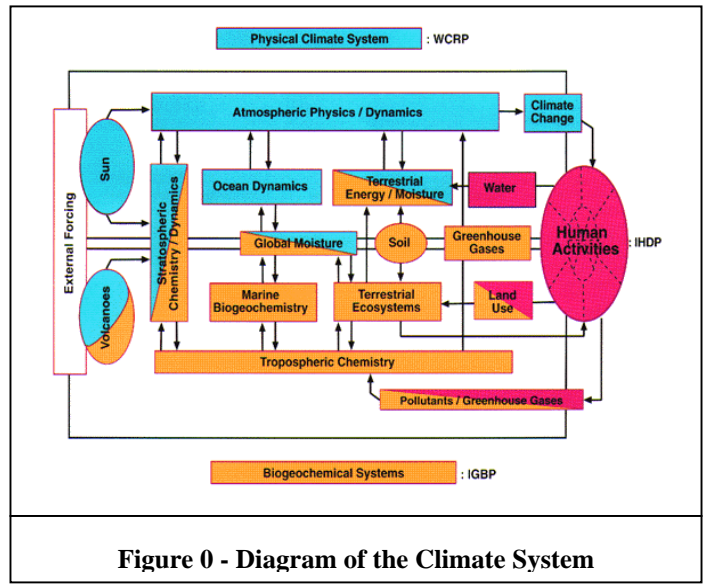
Reports about climate and global change and their impacts on our environment and our lives are almost daily features in the news media in print, on the radio, and now in film. The debate about climate change – if it is happening or not, what to do about it, and the motivations of the people involved in this research - has increased its profile on the national scene to the point that students, teachers and the general public are regularly faced with reports which, in many cases, they are ill-prepared to interpret and assess critically. Because of the critical importance of climate and global change research for our future on this planet, the National Center for Atmospheric Research has placed an emphasis on contributing to increased science literacy for the general public, students, and teachers in this subject area. The objective of this presentation is to share our strategies for engaging students, teachers, and the general public in climate and global change education, including potential impacts on human health.

But what is the relevance of climate change, global change, and related health impacts to education? When we consider the status of education, in both formal and informal settings across the country, we see an enormous range in the degree to which these topics are addressed and in the quality of the treatment the topics receive. A significant reason for this disparity is the state- and district-based emphasis for what is actually taught in the classroom and expectations for success, as well as differing requirements for preparation of classroom educators. Although there are some excellent educators in the K-12 setting who successfully provide effective instruction on these subjects to their students, in general educators have limited if any scientific background in the fields relevant to climate and global change and are therefore ill prepared to provide effective educational opportunities to their students.

Motivated by a desire to help increase our success in educating youth in science, the National Research Council, the National Academy of Sciences, and the American Association for the Advancement of Science have been involved for over a decade in developing frameworks to guide science education in the United States. The documents developed through their efforts have been used in many educational systems across the country to provide guidance for revisions to their state and district education standards, resulting in increased consistency in expectations across the country.

The National Science Education Standards [NRC, 1996] include guidance for educators on the process skills and content understandings to be expected of students at various stages in their educational preparation, in addition to pedagogy standards. The science content standards are subdivided into a number of different categories including Unifying Concepts and Processes in Science, Science as Inquiry, Physical Science, Life Science, Earth and Space Science, Science and Technology, Science in Personal and Social Perspectives, and the History and Nature of Science. Within each category, key understandings and abilities that should be achieved within each level (K-4, 5-8, and 9-12) are identified.

Within the Unifying Concepts and Processes Standard, the importance of conceptual, procedural, and integrative schemes that help students build their understanding within multiple topics in science are stressed, including Systems, Order, and Organization, Evidence, Models, and Explanation, Change, Constancy, and Measurement, Evolution and Equilibrium, and Form and Function. Similarly, guidance for the Science as Inquiry Standard stresses the importance of students developing an understanding of the process of science, the skills required for observation, inference, and experimentation, and the use of scientific reasoning and critical thinking to develop understanding in science.



When we consider the topic of Climate and Global Change and Health Impacts, we see that it is exceptionally well suited for providing an interdisciplinary educational context for developing an understanding of the Earth system as well as the broader themes mentioned above. We use systems, models, evidence, and measurement to understand the behavior of the climate system, and study the evolution and equilibrium states of the system. We use observation, inference, and experiments to develop our understanding. We could not make

significant progress without technology, and the impacts of climate and global change on life – both our own as well as the lives of others around the world, human and otherwise – are a central focus of our research.

For these reasons, we have identified Climate and Global Change education as a valuable central focus of our formal education program. Through our Climate and Global Change Workshop (http://www.ucar.edu/educ_outreach/gew/) we provide middle- and high-school geoscience educators with an opportunity to learn about state-of-the-art research from leading scientists, instruction in hands-on and computer-based classroom activities, field trips, project work, in addition to discussions and instruction relating to pedagogy, educational standards, classroom implementation, and student assessment. Our experience over the past three years with geoscience educators has shown us that they, along with their students, find climate and global change to be a very engaging topic. They are committed to finding the best approaches to presenting the scientific research and future scenarios to their students. During the Climate and Global Change Workshop, we have found teachers are keenly interested in topics with social impact – policies, mitigation or adaptation, the relationship of population growth, and impacts on health. After participating in the workshop, the educators are expected to provide additional outreach and instruction on topics from the workshop to a minimum of 40 teachers in their regions, resulting in broader dissemination of the instruction we provide on site at NCAR. As our emphasis in this area continues to

evolve in the coming year, we intend to extend this effort to include a distance-learning opportunity for educators around the world, so that those that are not able to participate in workshops here in Boulder can also benefit from the instruction and resources we provide.

In the informal education setting, we have developed a new exhibit on Climate and Global Change – “Climate Discovery” – that was installed in the Mesa Lab in June 2003. This exhibit, which will soon be extended to include a “Climate Futures” component, has been an outstanding success for our exhibits program. The quality of the visitors experience in the exhibits has changed significantly, with visitors spending much more time than in the past interacting with the exhibit. With our emphasis on multi-purposing resources, we use the exhibit in support of our educational workshops, in addition to our teacher-student visitor groups to the lab, and also are multi-purposing graphics from the exhibit in our new “Climate and Global Change” sections of our websites (<http://www.eo.ucar.edu/> and <http://www.windows.ucar.edu/tour/link=/earth/climate/climate.html>). We also use our exhibit as a launching point for curriculum activities that support educators that visit the exhibit. We are currently finishing development of a unit on the Little Ice Age, and plan to develop a full Teacher’s Guide to the exhibit that will support further exploration of many of the topics discussed in the exhibit, such as relevant Earth system cycles, Coral Reef, Health Impacts, Population Dynamics, and concepts of uncertainty and modeling.