CLIMATE CHANGE SCIENCE UNIT

Partners with James J. McCarthy's Lecture, *The Science of Climate Change*

Lecture Given at Harvard Medical School on February 21, 2007

Link to Lecture Video and Background Reading

http://chge.med.harvard.edu/programs/education/course_2007/topics/02_21/

Lecture Summary

Within the last four decades evidence that Earth's climate is changing at an unusual rate has drawn the attention of scientists who endeavor to understand how the physical, chemical, and biological aspects of climate are linked. Our species, Homo sapiens, has altered many fundamental aspects of the climate system, most notably the composition of Earth's atmosphere. Over the last several million years, climate fluctuations were driven by basic properties of Earth - Sun orbital geometry, and over shorter periods, by lags in the response of atmospheric and ocean circulation, solar variability, volcanic activity and by the functioning of the biosphere. Changes in the atmospheric concentration of greenhouse gases resulting from human activities now have the potential to swamp these natural changes. The fundamental physical and chemical aspects of these processes are known, but important details, especially the moderating and enhancing properties of biological processes, are still only poorly quantified.

Greenhouse gases are now at higher concentration in the atmosphere than at any time in the last million or more years. Should we be concerned? This enhanced "insulation" in the lower atmosphere will continue to warm the surface of Earth, evaporate more water, and energize the atmosphere. How much difference will this make in Earth's climate, and how much of this change might we be prepared to live with?

Certain recent climate trends are difficult to ignore. The 1980s and then the 1990s were the warmest decades in the last century. Is it particularly surprising that precipitation anomalies of unprecedented magnitude occurred on the Indian subcontinent (Bangladesh) in 1998, Central America (Honduras) in 1998, and South America (Venezuela) in 1999? What about changes in the Arctic with widespread melting of permafrost and Arctic Ocean sea ice (40 % has been lost in the last forty years)?

Inertia in both the Earth's climate system and human socioeconomic systems preclude an immediate cessation to this warming in any plausible future. Hence, climate is likely to continue to change for the next several human generations, resulting in some positive and some negative effects for different human and natural systems. However, the rate of future climate change can be minimized, and this will reduce harm to the most vulnerable individuals and communities.

Whether we are discussing past, present or future climate regimes, many unknowns remain relating to the intricacies of interactions within the climate system, However, the greatest uncertainty as to how climate will behave in the future depends on how humans will actually behave. How many of us will there be? What will be our standard of living in the developed and in the developing world? And, very importantly, how fossil fuel intensive will these development activities be?

Key Vocabulary Words for the Climate Change Science Lecture

1. albedo effect
2. anthropogenic
3. Arctic Climate Impact Assessment
4. climate change modeling
5. continental ice
6. drivers
7. emission scenarios
8. global atmospheric concentration
9. IPCC
10. sea level rise

Questions to Address During the Climate Change Science Lecture

1. How is climate change in the Arctic regions connected to your daily life?
2. Why is climate change in the Arctic more pronounced than in other areas of the world?
3. How can a changing climate affect the frequency and severity of droughts?

Activity: Observing Climatic Changes in Your Hometown

In James McCarthy's lecture, *The Science of Climate Change*, he notes that indigenous communities in the Arctic have given us much of the information available about how climate change has impacted the Arctic through their observations of changing sea ice coverage, snow levels, treeline, and weather patterns. Has a changing climate impacted your hometown? Ask students to find an older adult that has lived in the area since s/he was a child. Students should ask the adults the following questions, and rate each answer on a scale of 1 to 10:

1. What was the weather usually like for you on your first day of school each year? Is it the same now?
2. Are snow and storm patterns similar to how they were when you were a child?
3. Are there bird, plant, or animal species that are more/less present in our town than they were in the past?

Add additional questions that apply to your specific region. When students return with answers, have students combine answer totals and plot each answer on a graph to determine the average answer for each question.

Background Reading

IPCC. "Summary for Policy-Makers." *Climate Change 2007: The Physical Science Basis: Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. ed. S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Avery, M. Tignor, and H.L. Miller. Cambridge, UK and New York, NY: Cambridge University Press, 2007.

This reading may be found free-of-charge on the Center for Health and the Global Environment's website at:
http://chge.med.harvard.edu/programs/education/secondary/hhgec/documents/ippc_spm_feb_07.pdf

This lesson plan was created by the Center for Health and the Global Environment at Harvard Medical School. Should you have any questions about its content, please feel free to contact Margaret Thomsen, Program Coordinator. She may be reached by telephone at 617-384-8533, or by email at margaret_thomsen@hms.harvard.edu.