



## Reconciling Facts with Behavior



### Active Listening Questions:

- What is the fundamental question Dr. Kiehl poses to himself?
- What is the dissonance Dr. Kiehl describes?

**WHAT:** Dr. Kiehl opens his introductory talk, "Nature Visible and Invisible," at a 2006 workshop he helped to organize on "Exploring the Boundaries of Nature." He outlines his career in physical science and chemistry, which spans over 25 years of work on understanding past, current, and future climate systems. Dr. Kiehl then describes how all of his training in natural science was inadequate to address the fundamental question of why humankind has yet to respond to its awareness of its own role in affecting climate change in a way that protects the Earth and the habitability of the planet.

**HOW:** Dr. Kiehl's concerns are based on climate projections drawn from models. Scientists use models to help predict future circumstances. These models are created using known information about the factors involved and past records. Using this information, scientists can make educated guesses about how a system, such as Earth's climate, may behave in the future. Models can be checked for accuracy by running them for a period of time that has already passed and then comparing them to actual observed conditions. If it is a reliable model, the observed conditions should match well with the model's output.

"WHY ARE WE DOING THIS  
TO THE EARTH? WHY ARE  
WE TREATING OUR HOME IN  
THIS WAY?"

**WHY:** Scientists such as Dr. Kiehl are able to use models to make reasonable predictions about the future because there are certain physical relationships and properties that hold true. For example, carbon dioxide is known to be a greenhouse gas—one that holds heat in the Earth's atmosphere. Therefore, there is a potential relationship between carbon dioxide concentration and global temperature. These relationships can be used to create formulas that are plugged in to the models.

**SO WHAT:** Acknowledging future changes is an important step toward reducing consequences of those changes. But knowledge about the future is only useful if coupled with actions that reduce the rate and scale of change. Dr. Kiehl's knowledge of Earth systems tells him that a lack of corrective action in reducing greenhouse gases will lead to radical changes in life as we know it. In order to address those changes scientists need to consider ways to improve their ability to communicate their concerns to the public so that the public can make informed decisions about potential action.



**BIO:** Jeffrey Kiehl is a senior scientist for the Climate Change Research Section at NCAR who has also served on a number of National Research Council panels. He is currently investigating connections between psychology and environmental issues.



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### TAKING THE REINS

#### **DISCUSSION QUESTIONS:**

Discuss with a friend or record your thoughts in a journal.

- Why does Dr. Kiehl say that questions about climate change “transcend the physical sciences”?
- Dr. Kiehl asks three questions about values: “How do we value? What determines our valuing? How do our values translate into actions?” Consider your own answers to these questions. What types of things do you value in your own life? Why? How do these values shape your actions on a day to day basis?
- Dr. Kiehl cites challenges in science communication as a barrier to community awareness. What do you think scientists could do or do differently to become more effective at communicating their research and discoveries to the rest of the public?
- What do you think is the role for education and the media in furthering our understanding or misunderstanding of climate change and its impacts?

#### **QUIZ QUESTIONS:**

**Quiz 1.** Dr. Kiehl works on the science of simulating Earth’s climate using what primary approach?

- a) computer models
- b) weather forecasts
- c) field observations
- d) psychological studies

**Quiz 2.** The climate change projections Dr. Kiehl refers to are...

- a) moderate compared to the 18<sup>th</sup> century
- b) the greatest change in human history
- c) relatively easy to adapt to
- d) similar to the last Ice Age

#### **GLOSSARY TERM: FOSSIL FUELS**

Fossil fuels are carbon-based compounds that can be combusted to release energy. Examples are coal, oil, and natural gas. They are called *fossil* fuels because they are formed by carbon deposits from dead organic matter that was decomposed in anaerobic conditions over hundreds of thousands of years.



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### Go Beyond: Science Journal

Materials: *Notebook, paper and pencil or dedicated computer file where you can keep your work.*

Using the following science journal template (a 7 part process) answer the questions that follow?

- a) If climate scientists know that human activity --- primarily burning of fossil fuels ---- is changing the Earth's climate, why is it so difficult to utilize this knowledge in changing human behavior?
- b) How is it that values become important in a scientific issue such as climate model projections?
- c) If the average temperature of the Earth were 5 degrees C warmer than it is today, how would that matter?



Coast View. Image Credit: ECO

1. Select one or more of the questions above.
2. Write down or sketch what you think answers the question based on your own understanding without looking anything up.
3. Ask a family member, friend, or teacher the same question(s) and write down or sketch their answers.
4. What are the common ideas in the answers you've collected? Write or sketch the common themes/ideas.
5. Devise your own strategy for digging deeper (ask a scientist, check out university or government agency websites like NASA and NOAA, go to the library, design and conduct an experiment, etc.) until you're satisfied the answer makes sense to you.
6. Summarize what is known and unknown about the subject of the question(s). Also note what evidence there is in supporting what is known and how the evidence was obtained.
7. Rate the answer you've come up with on a scale of 1 to 10, 1 being weak with lots of uncertainty, 10 being perfect.

### FURTHER READING:

The complete PowerPoint of this presentation is available on AGCI's website:  
[http://www.agci.org/dB/PPTs/06S2\\_JKiehl\\_0814.pdf](http://www.agci.org/dB/PPTs/06S2_JKiehl_0814.pdf)

Kiehl, J. (2011). Lessons from Earth's Past. *Science*. 331: 158-159. *Access to this article requires a subscription; however, there is a free summary available at in Science Daily.*