

**Using Scientific Data for Multi-disciplinary Science Instruction**  
**2012 SEIS/EPSCoR Course**  
**Ellwein and Nyman**

**Activity: The Physical Science Behind Climate Change, Scientific American, August 2007**

**Directions:** To help understand the science behind climate change, you will read the article, start answering your group's questions, and report out in groups tomorrow morning. Read the entire article and answer your group's questions before the beginning of tomorrow's class. Your group will work together in the morning to fact check answers to your questions and prepare your group presentations, which will happen after this review.

For your presentation, all figures from the article have been uploaded to a PowerPoint presentation. During the other group presentations, take notes to help you answer the remaining questions

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**First, ALL groups/individuals should be able to answer the following:**

1. What is the IPCC and what does it do? (See page 71 of the reading).

**Group 1: Drivers of Climate Change (pg. 65-66) and "Influences on Climate" figure on page 67.**

2. How do greenhouse gases work?
3. How have the concentrations of greenhouse gases changed?
4. How can we be sure that humans are responsible for these increases?

**Explain the data:** Figure 1 "influences on climate" on page 67.

- a. Define radiative forcing.
- b. Where do the greenhouse gases (carbon dioxide, methane, nitrous oxide, and halocarbons) come from?
- c. What is surface albedo and how/why does it change?
- d. What do the black bars on this figure represent?
- e. Which radiative forcing mechanisms are scientists most certain of?

**Group 2: Observed Climate Changes (pg. 66-68) and "Observed Evidence" figure on pg. 68.**

5. What is meant by the term "observational data"?
6. Do observations support global climate change? Explain.
7. How has the hydrologic (water) cycle been affected by global climate change?
8. What do paleoclimate "observations" tell us about current observational trends?

**Explain the data:** Figure 2 "observed evidence" on page 68.

- a. Explain the y-axis (this type of data representation can be very difficult to understand).
- b. Why do the data sets start at different times?
- c. Why does the blue shading on the middle graph (changes in global sea level) get narrower with time?



**Group 3: Attribution of Observed Changes (pg. 68-70) and “Human-Induced Temperature Change” figure on pg. 69**

9. Are human activities primarily responsible for observed climate changes, or is it possible they result from some other cause, such as some natural forcing or simply spontaneous variability within the climate system?
  - a. How and why have IPCC estimates changed?
10. Describe the “two important advances” to climate models since the last IPCC assessment.
11. What are the two patterns that “provide a fingerprint of human influence” on the climate? (Be sure to describe what *thermal inertia* is.)

**Explain the data:** Figure 3 “human-induced temperature change” on page 69.

- a. What do the blue shaded regions represent?
- b. What do the orange shaded regions represent?
- c. How do the blue and orange shaded regions correspond to observations of temperature? What does this mean?
- d. Where do we see the largest observed change – over the land or oceans? Why?
- e. Can you explain why the observed changes in temperature are larger over northern hemisphere continents than southern hemisphere continents?

**Group 4: Projections of Future Changes (pg. 70-71) and “projected temperature changes” figure on pg. 70.**

12. How will climate change over the 21<sup>st</sup> century according to model simulations?
13. Explain what is meant by “inertia in the climate”.
14. How does the ocean remove carbon dioxide from the atmosphere? Why will this removal become less efficient as the planet warms? As the ocean absorbs more carbon dioxide, it becomes more acidic. What does this do to marine ecosystems and/or marine organisms?
15. Describe some of the changes predicted for polar regions and lower latitudes.

**Explain the data:** Figure 4 “projected temperature changes” on page 70.

- a. How are these three scenarios generated?
- b. What are the temperature changes relative to?
- c. What do the dates mean for the two images in each scenario?
- d. What does it mean that these are “not mitigation scenarios”?