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Module 03: Energy & Climate Change

Urban EcoLab

April 2021

Student Pages - Answer Key

Center for Urban Resilience

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This Lesson 1: Is the Earth's Climate Changing? is brought to you for free and open access by the Urban EcoLab at Digital Commons @ Loyola Marymount University and Loyola Law School. It has been accepted for inclusion in Module 03: Energy & Climate Change by an authorized administrator of Digital Commons@Loyola Marymount University and Loyola Law School. For more information, please contact digitalcommons@lmu.edu.

Name: _____ Teacher _____ Date: _____ Class/Period: _____

Lesson 1.1: Is the earth's climate changing?

1. Write an argument for whether or not the earth's climate is changing. Is global warming occurring? Provide evidence for your claim and provide your reasoning for why that evidence supports the claim. Your argument should contain three elements:

- **Claim**
(State whether you believe climate change is or is not occurring.)
- **Evidence**
(State the data or observations that you are supporting your claim.)
- **Reasoning**
(Explain why your evidence supports your claim. Describe how those data or observations convince you that your claim is correct.)

Student Examples:

Based on the data presented in the two videos, below are examples of two different arguments that students could write:

Argument #1 – For Global Warming

Global warming is occurring. There are multiple pieces of scientific evidence that support this. The 10 hottest years on record have all been within the last 25 years. Throughout the world, glaciers are melting and there is less ice than there was 50 or 100 years ago (e.g. Switzerland, U.S., Italy, Africa, Argentina). Artic ice has diminished by 40% in 40 years. The temperature increase and the other changes to the environment prove that the climate is changing.

Argument #2 – Against Global Warming

Global warming is not occurring. The climate is not changing. Greenland's glaciers are growing. The Antarctic ice sheet is getting thicker. Carbon dioxide is a natural gas that is important for life. Since carbon dioxide is natural and the ice is not melting, that provides evidence that global warming is not occurring.

Discussion Points

You may want to talk to your class about how the evidence presented in the videos is different. The “for global warming” video provides both direct (e.g. 10 hottest years) and indirect evidence (e.g. glaciers melting, artic ice melting) for their claim. The video against global warming focuses more on providing rebuttals for why the indirect evidence for global warming is invalid and how carbon dioxide is natural (e.g. we breathe it out) suggesting that it then does not have a negative impact on the environment.

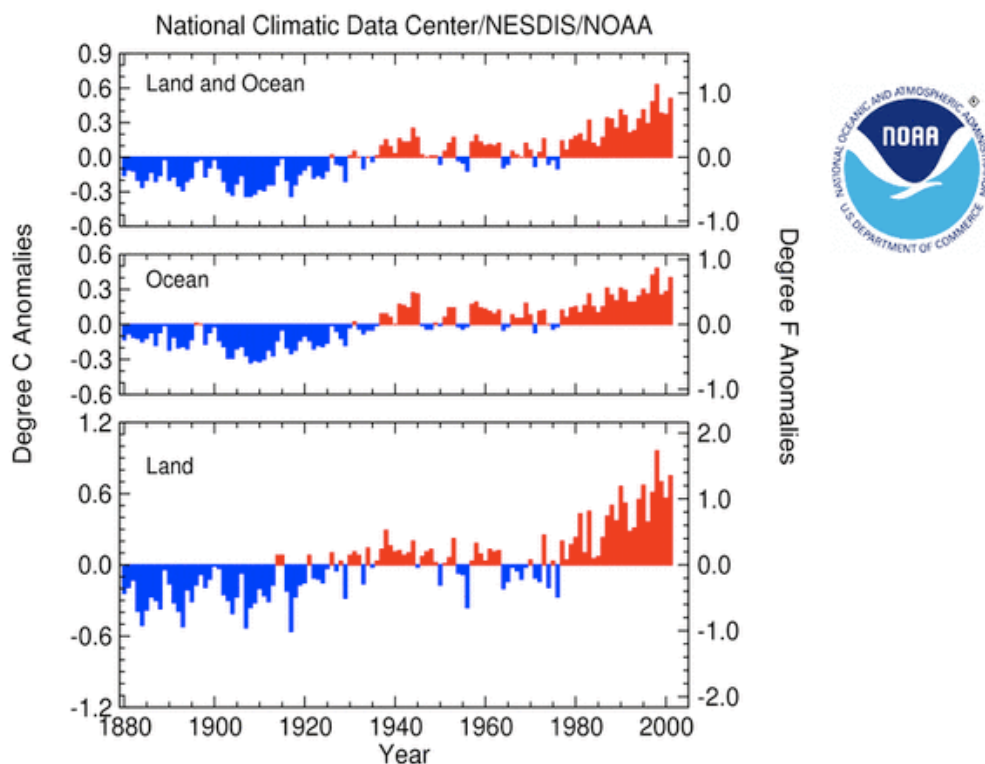
Name: _____ Period/Class: _____ Date: _____

Lesson 1.3: Is the earth's climate changing?

Purpose

In this activity you will analyze data from the National Oceanic and Atmospheric Administration (NOAA), to determine whether or not global warming is occurring.

Figure 1: Variation from Mean Temperature, 1880-2001

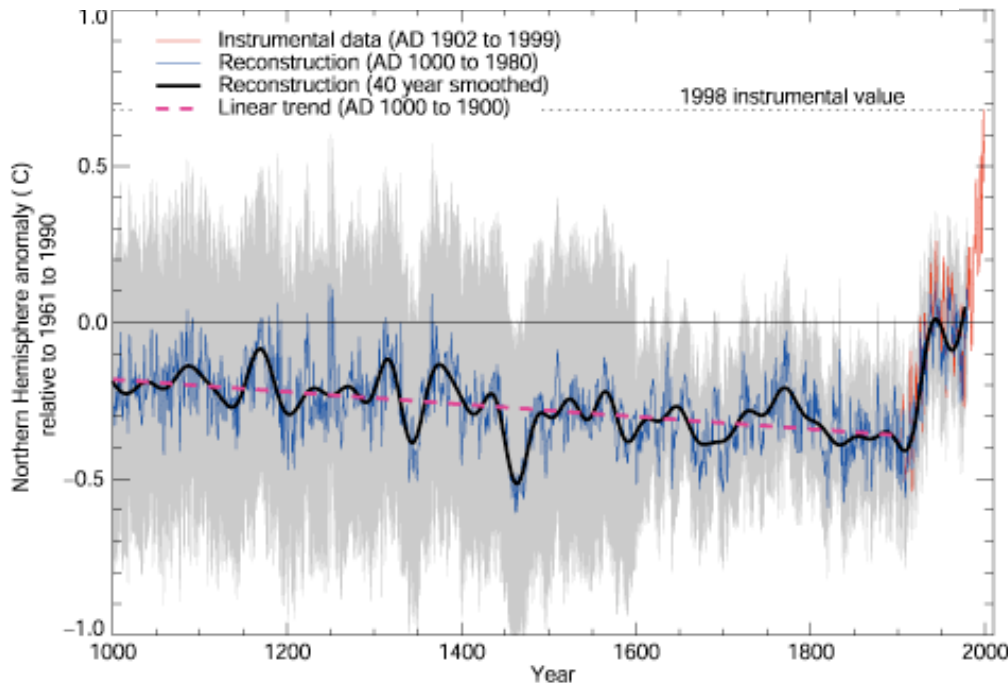


<http://www.ncdc.noaa.gov/oa/climate/globtemp.html>

1. The zero line in Figure 1 above represents the long term mean temperature from 1880-2001. The bars show annual departures from the mean.
 - What is the overall trend for temperature over time for land and ocean?
 - Do you think this provides convincing evidence of global warming?
 - Why or why not?

The temperature over land and water has increased over the last 120 years. The hottest temperatures have all been in the last 25 years. This does provide evidence of global warming. While the temperature change is not large (about two degrees), the trend is clearly increasing.

Figure 2: Variation from Mean Temperature, 1000-1999



<http://www.ncdc.noaa.gov/img/climate/globalwarming/ipcc20.gif>

2. Modern instrumentation has only been used to collect data since 1902. Many natural phenomena are influenced by the climate. By collecting data from glaciers, lake bottom sediments, tree rings and other phenomena, scientists can estimate the temperature of the earth. Examine Figure 2.

- What is the overall trend for temperature over time?
- Do you think this provides convincing evidence of global warming? Why or why not?
- Are there any other possible scientific explanations for this data?

Over the past 1,000 years the temperature was relatively the same with a slight negative slope (Colder) until about 100 years ago. In the past 100 years, the temperature has been increasing. I do think this is convincing evidence, though there is some variation over time, the overall trend is that the temperature has increased in the last 100 years.

For other possible explanations, this question can be used to address common misconceptions about the earth receiving more solar energy, seasonal fluctuations affecting overall temperature patterns, the ozone hole letting in more solar energy, or changes in the earth's orbit.

3. Do you think these two graphs are convincing data that global warming is occurring? Is there other data that you think would be important to prove whether or not global warming is occurring? If yes, describe that data.

Answers may vary.

Example:

I do think these are convincing data. Having more data into the future would also be important to continue to watch what happens to the trend.

4. Many ecologists would consider global warming or climate change to be major drivers or forces that influence ecosystems. What relationship do you think climate change has to presses and pulses? Explain your answer.

Students should refer back to the definitions of presses and pulses.

A press is a long term force that influences ecosystems. Because climate change is occurring over many years, it can be viewed as a press if one considers that higher temperatures are being experienced by many ecosystems around the world.

A pulse is a short term force that influences ecosystems. Because climate change is associated with more hurricanes and more droughts, it can also be seen within the context of pulses indirectly. The droughts and hurricanes last for a relatively short amount of time, however they can leave lasting consequences.