



## Using Real-Life Data to Understand Climate Change

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### INTRODUCTION

This lesson is aimed at increasing students' general knowledge of climate change on local, national, and global scales, and how such changes in climate will affect humans. This lesson provides data detailing the average annual temperature over time recorded at a climate station in Greenland. Students will use this information to practice their math and analytical skills and relate to average temperature change over time. A follow-up discussion is provided to help focus students' comprehension of the material as related to global climate change.

### LESSON OVERVIEW

**Grade Level & Subject:** 7-12: Math, Social Studies, Environmental Science

**Length:** One class period

**Objectives:** After completing this lesson, students will be able to:

- Practice math and critical thinking skills using practical, real-life numbers
- Recognize trends in data and use them to predict future changes
- Understand the connection between human activity and global climate change

#### National Standards Addressed:

This lesson addresses the following National Education Standards.

- **Content Standard: NCTM - Data Analysis and Probability Standard<sup>1</sup>**  
Instructional programs from prekindergarten through grade 12 should enable all students to
  - Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.
  - Select and use appropriate statistical methods to analyze data.
  - Develop and evaluate inferences and predictions that are based on data.
- **Content Standard: [NS.9-12.6 PERSONAL AND SOCIAL PERSPECTIVES](#)<sup>2</sup>**  
As a result of their activities in grades 7-12, all students should develop an understanding of:
  - Personal and community health
  - Environmental quality
  - Natural and human-induced hazards

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<sup>1</sup> <http://standards.nctm.org/document/appendix/data.htm>.

<sup>3</sup> <http://www.education-world.com/standards/national/index.shtml>.

- Science and technology in local, national, and global challenges
  - **Content Standard:** [NSS-G.K-12.4 HUMAN SYSTEMS](#)<sup>3</sup>
- As a result of their activities in grades 7-12, all students should:
- Understand how human actions modify the physical environment
  - Understand how physical systems affect human systems
  - Understand the changes that occur in the meaning, use, distribution, and importance of resources

**Materials Needed:**

- Graph paper
- Calculators
- Computer with internet access and projector
- **Reproducible: Average Temperature Data** (as projection for class or provided for each student.)

**Assessment:** Students will be assessed on the following:

- Accuracy of their math
- Thoroughness of their homework
- Ability to analyze the data and make connections between the data and current climate trends
- Ability to state potential future risks of climate change

## LESSON BACKGROUND

**Relevant Vocabulary:**

- **Climate Change:** Any long-term significant change in the weather patterns of an area.
- **Global Warming:** An increase in the earth's average atmospheric temperature that causes corresponding changes in climate that may result from the greenhouse effect.
- **Greenhouse Effect:** Natural process of trapping solar radiation by atmospheric gases to increase the surface temperature on Earth. Recent increases in certain greenhouse gases, such as carbon dioxide, methane, nitrous oxide, chlorofluorocarbons, and ozone have increased this process, leading to rising temperatures on Earth.
- **Mean:** The “average” of a group of numbers – add them up and divide by the number in the group.
- **Median:** The "middle" value in a list of numbers – list the group in numerical order and find the number in the center.
- **Mode:** The most occurring value in a group of numbers.

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<sup>4</sup><http://www.education-world.com/standards/national/index.shtml>

**Information:**

Because climate change is of great concern to politicians and the everyday citizenry alike, it has been at the forefront of media coverage and a topic of discussion among many. It is important to educate students, at every grade level, of the imminent problems related to changes in our globe's climate and temperature, as it is currently such an important topic.

As climate change increases, our planet's overall temperature will increase, fresh water supplies will dry up, sea levels will rise, crops will be altered, plant and animals species will continue to become extinct, and degraded environmental conditions will be harmful to human health. Because there are so many negative impacts associated with global warming, it is imperative to teach students why it is occurring, how it will affect life on earth, and what each person can do to curb the destruction of the environment. The following lesson will ask students to analyze decades of changing global temperatures, and then have them correlate the changes in temperature they find to current environmental trends.

**Resources:**

NASA Goddard Institute for Space Studies, <http://data.giss.nasa.gov/csci/stations/>

**LESSON STEPS****Warm-up: *Using a Data Table***

1. Ask students to look over the table provided (as projection for entire class or provide **Reproducible: Average Temperature Data** to each student). Ask them to write down and compare their immediate observations.

Year	Average Temperature (Celsius)	Decade Average
1970	-19.93	1970-1979:
1971	-19.8	1980-1989:
1972	-21.56	1990-1999:
1973	-21.1	2000-2004:
1974	-20.94	
1975	-20.53	
1976	-20.69	
1977	-19.38	
1978	-20.16	
1979	-20.83	
1980	-20.22	
1981	-17.88	
1982	-19.74	
1983	-19.63	
1984	-20.83	
1985	-20.31	
1986	-20.57	

1987	-21.02
1988	-17.61
1989	-20.53
1990	-19.51
1991	-18.48
1992	-20.74
1993	-18.78
1994	-18.06
1995	-19.24
1997	-18.92
1998	-17.38
1999	-18.67
2000	-19.9
2001	-18.61
2002	-17.92
2003	-17.51
2004	-18.72

### **Activity One: *Analyzing the Data***

1. Ask the students to answer the following questions while looking at the table:
  - a) Find the average temperature for each of the past four decades. What trend do you notice?
  - b) Find the mean, median, and mode of temperatures between 1970 and 2009. Do the data give evidence of global warming trends?
  - c) Plot a graph of the temperatures. Use this data to extend your graph out to the next ten years. What does your prediction show?

### **Activity Two: *Finding Your Town on the Climate Index***

1. As a class, use a computer hooked up to a projector to access NASA's climate index website. <http://data.giss.nasa.gov/csci/stations/> On the world map or the map of the US, click on the station closest to your hometown.
  - a) Compile the data from the last 25 years. You may download the data as text and/or view a GISTEMP [graph of station temperature data](#).
  - b) Is it similar to or different from the data above?

### **Activity Three: *Homework (optional)***

1. Have students find additional data set(s) from another NASA station or different source. You may have them calculate mean, median and mode or practice graphing skills by plotting data on a graph.

### **Wrap-Up: *Putting It Together***

1. As a follow-up discussion, pose the following questions to the students:

- a) What are some possible causes of this recent increase in temperatures? *Increases in greenhouse gases such as carbon dioxide and methane, which trap more solar radiation in Earth's atmosphere. Although climate variation has occurred throughout history, this recent sudden increase is likely linked to human actions and behaviors such as burning of fossil fuels, increased emissions, agriculture, reduced tree cover, etc.*
- b) What are some possible effects of climate change in the long run? *Increased global temperatures will lead to new weather patterns, ice caps and glaciers will melt, ocean currents will alter, furthering climate changes; sea levels will rise, fresh water supplies will dry up, crops will be altered, plant and animals species will continue to become extinct, and degraded environmental conditions will be harmful to human health.*
- c) Why is it considered such a risk? *This will change life on Earth as we know it and may cause it to be uninhabitable for humans and many other species. In addition to the changes above, other consequences could include: famine, spread of disease, greater competition for resources, harsher weather incidents, etc.*
- d) What can we do to combat global warming? *Reduce fossil fuel and energy use, reduce emissions, plant trees, consume less, alternative transportation, etc.*

## CONCLUSION

At the end of this lesson, students should have strengthened their math and analysis skills and gained an understanding of how their work in math class can be applied to real life data and situations. In addition, they should understand the hazards posed by global climate change and some of the ways we are working to fight it.

**Average Temperature Over Time**  
(Data recorded at a climate station in Greenland)

<b>Year</b>	<b>Average Temperature (Celsius)</b>	<b>Decade Average</b>
1970	-19.93	1970-1979:
1971	-19.8	1980-1989:
1972	-21.56	1990-1999:
1973	-21.1	2000-2004:
1974	-20.94	
1975	-20.53	
1976	-20.69	
1977	-19.38	
1978	-20.16	
1979	-20.83	
1980	-20.22	
1981	-17.88	
1982	-19.74	
1983	-19.63	
1984	-20.83	
1985	-20.31	
1986	-20.57	
1987	-21.02	
1988	-17.61	
1989	-20.53	
1990	-19.51	
1991	-18.48	
1992	-20.74	
1993	-18.78	
1994	-18.06	
1995	-19.24	
1997	-18.92	
1998	-17.38	
1999	-18.67	
2000	-19.9	
2001	-18.61	
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