5 E's for Everitt Middle School
8th grade Math
GK12 Fellow: Debbie Batista

Lesson 1: Studying Nature's Recorders of Climate Change. (This activity will run over a course of 2-3 days)

Engage: Show students a plot of 2000 years of the average global temperature (time series). Have the students describe what they see. Does the plot show that the average global temperature is increasing? Does the series look very noisy? Does the series change drastically year to year?

Explore: What is meant by average global temperature? How far back do we have written temperature readings in the US? in the world? Then how did the scientists produce this time series?

Explain: When written temperature readings are not available, scientists use "proxy" data. Reconstruction of the climate utilizes indirect measures such as tree rings, coral reefs, ice cores, and ocean and lake sediments. Show photos of the different types of proxy data. Explain what scientists actually measure and what it tells us about the climate. (Use online resources and photos).

Elaborate: Students are given "tree cross section" samples. [Another possibility is to create a "simulated ice core" for students to analyze.] (Tree cross sections can be ordered online-- packs of 5 at a cost of $7.75). Have student describe the rings. Note the ring colors. Is there a pattern to the light and dark rings?

- Study the age of the tree based on cross-sections. Light and dark ring represent one growing season. Assume the cross-section of the tree was cut this year. Have students estimate the age of their cross-section by counting couplets of light and dark rings. Which rings are oldest? Youngest?

- Are all tree rings the same thickness? What do thick rings indicate? Narrow rings? Have students find the years with the best growing season.

Evaluate: Give students simulated tree rings core from period 1400-1960. Explain that this simulated core is from northern latitudes where length of growing season controls the thickness. Here students will develop a hypothesis whether there has been a climate change. Then they will measure rings for each time period in mm, and record thickness in data table. The students will determine average ring thickness for each time interval and determine whether they can support or reject their hypothesis.

Lesson 2 Analyzing Temperature Time Series… Is it evidence of climate change?

Engage: Show a video from Hollywood movie. For example, show snippets of "The Day after tomorrow" or "An Inconvenient Truth". Form a discussion of global warming and climate change. What factors contribute to climate change?

Explore: Return to the temperature series shown in lesson 1. We want to determine if this time series provides evidence of climate change. What would one expect to see if there is climate change? How can we measure the change? Hopefully, we will lead students to idea of computing slope and finding a line of best fit.

Explain: Each student will be given a calculator containing the data. Review slope, finding the line of best fit using the calculator.

Elaborate: Have each student compute the line of best fit with the data provided (this will be dependent on the amount of data the calculators can hold. What is the slope of the line? Does this factor support global warming? Why or why not? Implement discussion of possible cyclic nature of the Earth. Scientists need to better understand what the natural cycle of the Earth is.

Evaluate: Have students work on answering the following questions in groups. Does the "trend" look linear? How certain are you of the interpretations? Would you like to see more evidence and from what time periods? Assume that the linear trend holds. What is the average temperature presently? 5 years ago? What will the temperature be in 2020? 2050? 2100

Lesson 3: Understanding Volcanic Contribution to Climate Change:

Engage: Show a clip of 1991 Mt. Pinatubo eruption. Read a quote describing what it was like to be in Olongapo City, relatively close to Mt. Pinatubo when it erupted in 1991.

Explore: Ask students if this process natural? What occurs during a volcanic eruption? What materials are forced out of the volcano? What is the impact on the landscapes? What is the impact on the atmosphere?

Explain: Show photos of the atmosphere, before eruption, and various time intervals after the eruption. Explain how volcanic debris in the atmosphere reduces the amount of sunlight reaching the surface of the Earth and will lower the temperature near the Earth's surface. Explain the different sizes of volcanic eruptions. From a climatologist perspective, super volcanoes are volcanic events that impact climate. So for example eruption Mount St. Helens is not considered a super volcano.

Elaborate: Activity involving modeling reduction of light. Another possible activity involves having the students look at the time series of climate temperatures alongside time series of volcanic eruptions as determined in ice cores to identify the inverse relationship..

Evaluate: Have students draw a graph of the relative amount of ash in the atmosphere based on some photos of the Sun and ask students to predict how this would impact the temperature on the Earth's surface. Students should see the inverse relationship between amount of debris in atmosphere and temperature.

Lesson 4: Impact of Melting of Ice Caps on Geographical Landscape: A lesson in Area and Volume

Engage: Show a video of the melting ice caps and polar bears.

Explore: If the temperature increases by x number of degrees, how much ice would melt? This will involve performing conversions.

Explain: Here we review some of the properties of ice, and water. Review volume and the relationship to area.

Elaborate: Working in groups, the students would calculate the volume of the ocean if the temperature increased x degrees under the assumption of the surface area of the ocean would remain constant. Have students look at various coastal cities and find the elevation of the cities of interest to them.

Evaluate: Would the cities be underwater based on their calculations? Look at cities below sea level and the use of canals.