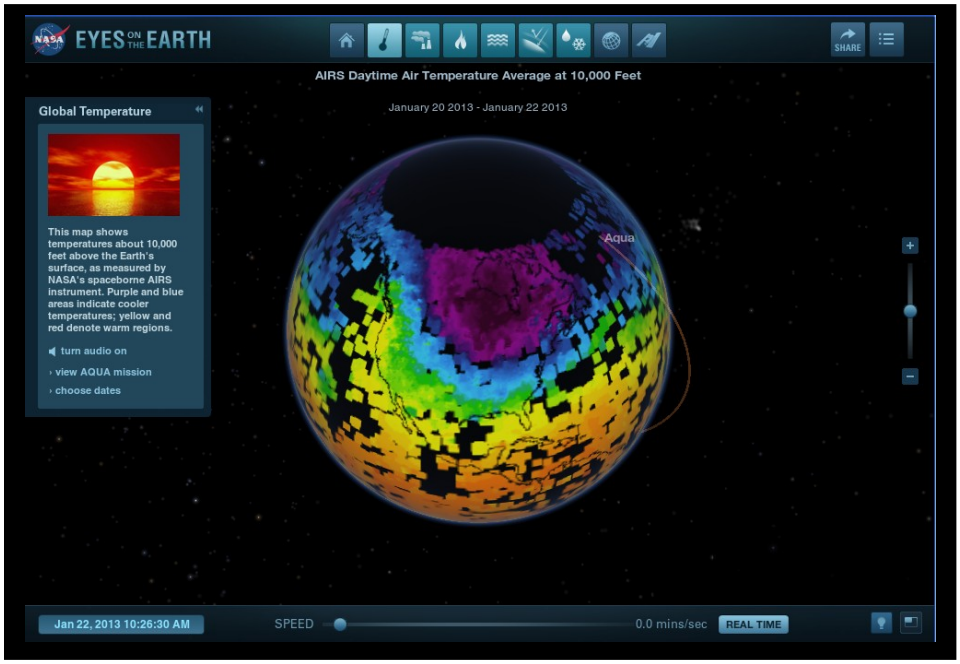
Eye Spy – Estimating the Average Temperature of Earth



Get the Data

Visit Eyes on Earth **http://eyes.nasa.gov/earth/** and click on **Start.** Recommended operating system: MS Vista or later; Browser: MS Internet Explorer 8 or later.

Step 1 – Click on the Temperature icon to display the temperature map of Earth for the current time. The display should be similar to the above image.

Step 2 – Select the area over the United States in North America. Use the color bar in the lower right corner to read the map in degrees Fahrenheit. If ¼ of the area of the United States has a temperature of 65^{O} F and ¾ of the area has a temperature of 40^{O} F, the average weighted temperature is T = ¼(40)+3/4(60) = 55^{O} F.

Answering Questions

Problem 1 – At the time of the display, what would you estimate as the average weighted temperature of South America?

Problem 2 – At the time of the display, what is your estimate for the average weighted temperature of Africa?

Problem 3 – About where was the hottest place on the Earth and the coldest place on Earth at the time of the display?

Math Challenge

Challenge Problem: In 1975, the average global temperature was 57.1^{O} F, and in 2005 it was 58.1^{O} F. During the same time, the amount of carbon dioxide in the atmosphere changed from 330 to 380 parts per million. What are the rates of change of each quantity over this time period? How much of a temperature change would you expect for a 100 ppm change in carbon dioxide?

Answer Key

Problem 1 – At the time of the display, what would you estimate as the average weighted temperature of South America?

Answer: If the color scale shows 1/3 is about 80 F and ¾ is about 60 F then the weighted average is T = 1/3(80) + ¾(60) = 71.6 F. This is only an example and student's data and area estimates will vary.

Problem 2 – At the time of the display, what is your estimate for the average weighted temperature of Africa?

Answer: Same as for Problem 1.

Problem 3 – About where was the hottest place on the Earth and the coldest place on Earth at the time of the display?

Answer: Students answers will vary, but coldest place is often in the Antarctic!

Challenge Problem: In 1975, the average global temperature was 57.1 F, and in 2005 it was 58.1 F. During the same time, the amount of carbon dioxide in the atmosphere changed from 330 to 380 parts per million. What are the rates of change of each quantity over this time period? How much of a temperature change would you expect for a 100 ppm change in carbon dioxide?

Answer: Temperature change = (58.1-57.1)/30 years = +**0.033 F/year**. CO2 change = (380-330)/30 years = +**1.66 ppm/year**.

Students should realize that the two changes occur over the same number of years, so they can determine the temperature change relative to the CO2 change as 1.0 F / 50ppm = 0.02 F/ppm

So, 1 ppm change in CO2 raises the temperature by 0.02 F. Then, a 100 ppm change in CO2 will cause a 0.02 x 100 = **2.0 F change in temperature**.