GLOBE VISUALIZATIONS
## SAMPLE STUDENT ASSESSMENT TOOL - HIGH SCHOOL

(Given visualizations from the GLOBE data archives)
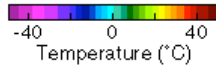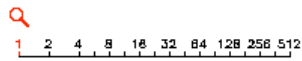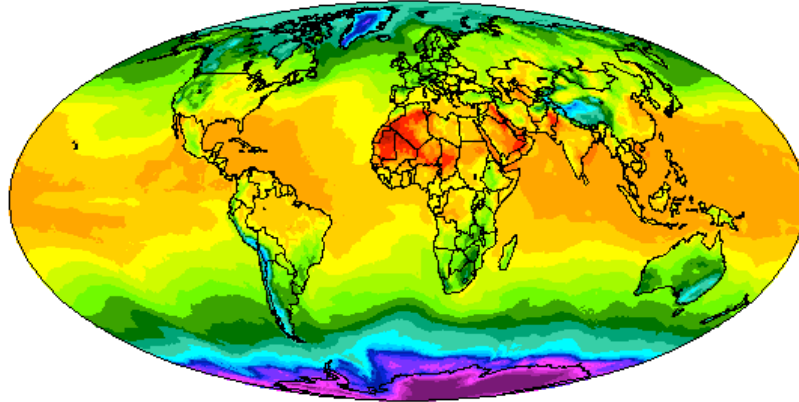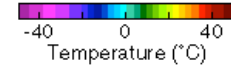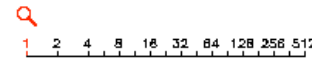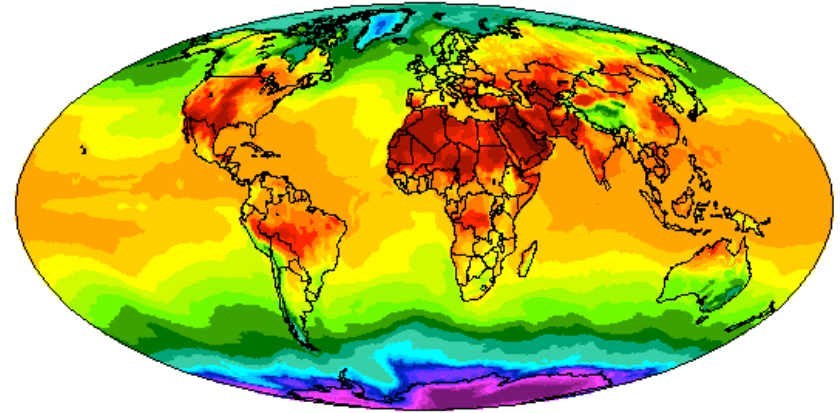
(Present problem requiring use of GLOBE visualizations)

During a recent web chat with other GLOBE schools, a student was confused as to why you have to take minimum and maximum temperature measurements each day. "Why not just take the temperature a few times on a given day and average them together?", the student asked. One of the GLOBE scientists who was part of the chat thought it was an excellent question. "We should make an activity about this!", she exclaimed.

In this activity your goal is to analyze several GLOBE visualizations and to report your findings on why maximum and minimum temperature are part of the GLOBE database.

The GLOBE visualizations contain many sub-elements that together form a useful tool for uncovering patterns in GLOBE data. Above are two visualizations generated for the same day. One is for the minimum temperature and the other is for the maximum temperature.

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1) **(Plan Investigations: Pose relevant questions)** Pick one of the GLOBE visualizations shown on the previous page. Think of two questions you might ask regarding the visualization. A sample question might be "What regions of the world have the highest temperatures?"

Although questions will vary, both questions should be related to the same visualization. Examples include but are not limited to:

How much do the regional patterns of temperature vary from day to day?
What would the visualization look like if the regional landforms (mountains, rivers, valleys, deserts, volcanic activity, ocean currents etc.) were also shown?
What would the visualization look like if land cover patterns (vegetation, fires, biomes etc.) were also shown?
What would the visualization look like if human-related activities & patterns (cities, population, manufacturing, clear-cutting, fires etc.) were also shown?
Do the ocean temperatures have any relationship to the ocean depths?
Is it possible to see El Nino effects on this type of visualization?
Why is it colder at the South Pole than at the North Pole?
How many data points were used to make these visualizations?
Why do the temperature variations show such an uneven pattern (non-straight line)?

2) **(Plan Investigations: Pose relevant questions)** From previous visualizations you have studied in your class, you've noticed that the colors change as you go from one location on the visualization to the other. Choosing one of the visualizations given and starting at the bottom of it, what trend(s) do you see regarding temperature as you move to the top of the visualization?

3) **(Take GLOBE Measurements: Use quality assurance procedures)** A student in your science class, Tim, has collected GLOBE data before and has always been very careful when taking measurements. Are there any data in the images that you suspect might be due to measurement errors? How can you tell? What are some possible errors that might occur in creating a visualization?

Possible errors that can occur when visualizations are created include but are not limited to: too few data points used to calculate average temperature; not all data points collected at same time; measurement inaccuracies due to operator or instrument errors.

4) **(Interpret GLOBE Data: Explain data & relationships)** In what unit is the temperature given? Do you think the color attribute that is used in the visualizations is appropriate for representing temperature? Why or why not? Pick one of the visualizations. What is the temperature range for the Southern hemisphere?

Temperature is shown in degrees C.

Answers about the preferred color scheme will vary. The key feature to the answer is the explanation given for the color scheme. Two examples are shown below:

The colors are okay. Purples "feel" very cold and reds "feel" hot. OR Purple is at one extreme of the color spectrum and red is at the other extreme.

Personally, I'd omit the purple tones and begin with dark blue for the coldest. I'd also omit the green shades and go to more yellows. In other words I'd use dark blue*,* blue*,* sky blue, light blue, pale yellow, yellow, golden yellow, light orange*,* orange*,* red orange, red*,* brown-red*. I chose these colors because when you get very very cold, your skin can turn bluish color. When you get too much sun your skin can get sunburned and turn red or you can get "tanned" which is like the brown-red color that I chose.*

The temperature range for the Southern hemisphere in the "minimum temperature" visualization is: approximately 25 degrees C - less than –40 degrees C. (note: It is important that the student does not attempt to identify as specific temperature value at the lower end of the temperature range because no indication is given that the color variation at the extremes continues to be linear.)

The temperature range for the Southern hemisphere in the "maximum temperature" visualization is: above 40 degrees C - less than –40 degrees C. (note: It is important that the student does not attempt to identify as specific temperature value at either end of the temperature range because no indication is given that the color variation at the extremes continues to be linear.)

5) **(Interpret GLOBE Data: Explain data & relationships)** Pick three countries on the visualizations that are on different continents. What is the range in temperature for each of these countries? Are the temperature ranges for the countries you chose similar (within about15 degrees of each other) or are they different? Explain you answer.

Answers will vary depending on the countries chosen.

6) **(Interpret GLOBE Data: Explain data & relationships)**
Using your answer to the question above, how do you think the temperature range is related to its location on the planet? For example, what could you say about a country in the northern hemisphere when compared to a country in the southern hemisphere or on the equator? If you were given a visualization that had only average temperature for the same day, would it provide more or less information than having the minimum and maximum visualizations? Explain you answer.

Answers will vary depending on the countries chosen, but should include information related to landforms, proximity to oceans, etc. Generally, countries in the Northern Hemisphere have higher minimum and higher maximum temperatures compared to countries in the Southern Hemisphere.

A visualization with only average temperature might provide the same amount of information since the question asks for information that compares the temperature ranges for two different countries which can cover a large area. If small countries were being compared and the visualization included greater detail than is shown on the global map then the max & min temperature visualizations would provide more comparison information.

7) **(Plan Investigations: Set up another problem)** Using the GLOBE database, choose minimum and maximum temperature visualizations for another date in 1998. Repeat questions #5 and #6 above for these new visualizations, using the same countries. How does help you support the argument that it is important to study both maximum and minimum temperature measurements?

Answers will vary depending on the visualizations created from the database.

8) **(Communicate: Compose reports to explain or persuade)** Create a 10 minute presentation that supports the collection and use of maximum and minimum temperature data. Be sure to include what a visualization is, how you read a visualization, and how you might find patterns in the data. Use specific examples that you have from this investigation to support you argument.

Answers will vary but should include the specifics asked for within the question, for example:

> *definitions of maximum temperature, minimum temperature, visualization;*
> *explanations of using/reading a visualization, how to find patterns in data;*
> *a clearly stated argument for or against use of average vs. max/min temperature data;*
> *use of specific examples to support the chosen argument*