

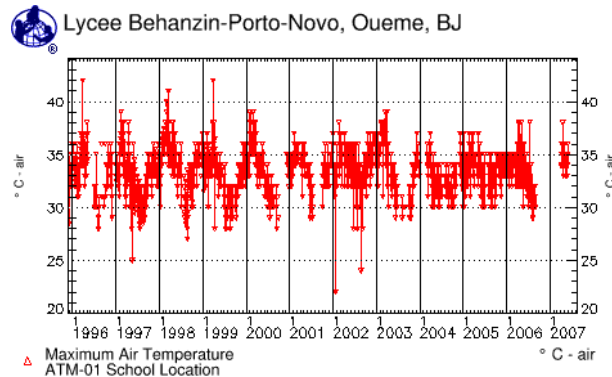


In Search of GLOBE Data – Teacher Answer Sheet

These answer sheets provide a number of possible answers for the open questions within the “*In Search of GLOBE Data – Student Worksheets*”. These answers are by no means the only possible answers but rather some possible answers. If the student does not provide answers to these questions, the teacher can use the answers provided here to help the student begin to see what story the data can tell.

Project #1, Part 1: Creating graphs using GLOBE data

Graph 1: Lycee Behanzin, in Porto-Novo, Benin.

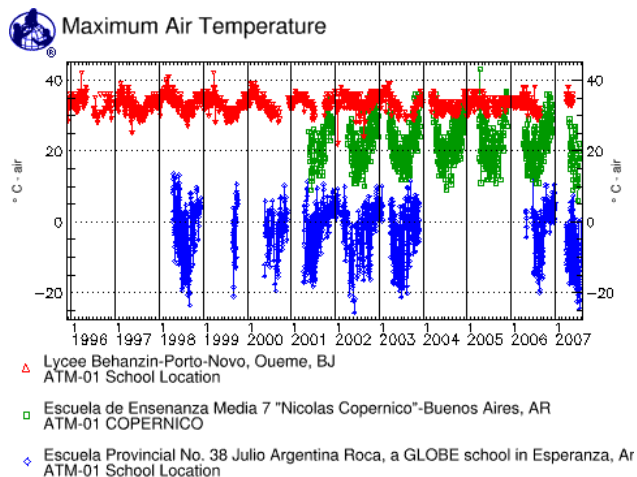


What do you notice about this graph? _____

Students may notice any of the following:

- 1) The temperature varies from (most often) 28 to 38° Celsius;
- 2) The temperature throughout the year does not vary much for this school;
- 3) The warmest months for this school are usually between February and April;
- 4) On several occasions, the temperature rises above 40° Celsius;
- 5) The coldest months for this school are usually between July and October;
- 6) On several occasions, the temperature falls below 25° Celsius.

Graph 2: Lycee Behanzin, in Porto-Novo, combined with Escuela Provincial No. 38 Julio Argentina Roca, in Esperanza, and Escuela de Ensenanza Media 7 "Nicolas Copernico", in Buenos Aires.



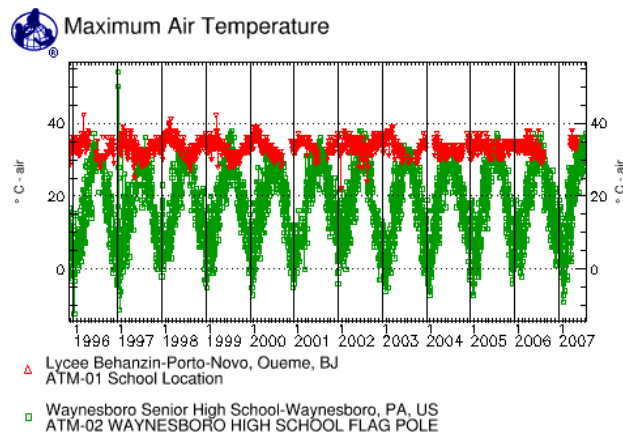
What do you notice about this graph? (Note: Latitudes and Longitudes of the schools can be found below the Other Options box.) _____

Students may notice any of the following:

- 1) The temperature graph for Benin (red line) doesn't change as much as the two from Argentina (blue and green lines);
- 2) Both Argentine schools report most of their data between March and December, while the Benin school reports almost every day;
- 3) The Argentine school, "Escuela Provincial No. 38," didn't enter data for 2004 or 2005;
- 4) Both Argentine schools have colder temperatures between June and August;
- 5) Both Argentine schools experience warmer temperature twice per year, between March and May and between October and December (note that peak temperatures for these 2 schools are at the points where they stop collecting data);
- 6) One Argentine school, Escuela Provincial No. 38, experiences much colder temperatures (barely over 0° Celsius) than the school from Buenos Aires;
- 7) Escuela Provincial No. 38 is much farther south than Escuela de Enseñanza Media 7 "Nicolas Copernico" (Latitude 63.4° S compared to 34.5° S);
- 8) Escuela Provincial No. 38 is an Argentine school located in Antarctica (by scrolling down to view Latitudes and Longitudes students may notice the long school name: "Escuela Provincial No. 38 Julio Argentina Roca, a GLOBE school in Esperanza, Antarctica, hosted by Argentina, AR").

Project #1, Part 2: Creating graphs using GLOBE data

Graph 1: Lycee Behanzin, in Porto-Novo, Benin combined with Waynesboro Senior High School, Waynesboro, Pennsylvania, U.S.A.



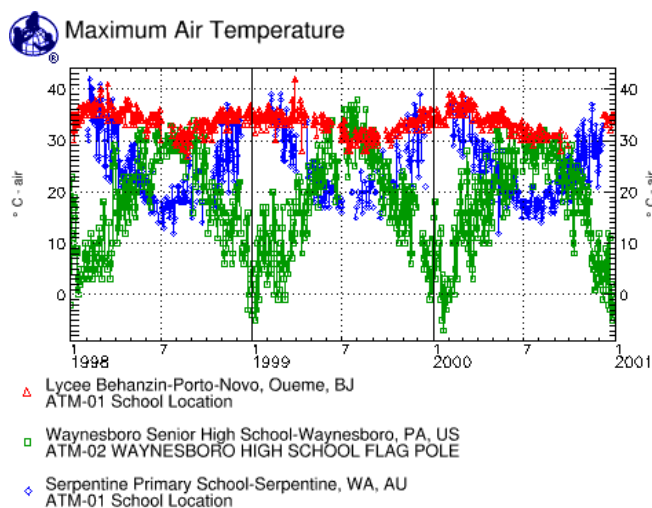
What do you notice about this graph? _____

Students may notice any of the following:

- 1) Temperature at the U.S. school rarely rises above those at the Benin school;
- 2) The temperature varies greatly at the U.S. school, from below 0° Celsius to most often about 35° Celsius;
- 3) The warmest months for the U.S. school are usually between July and August;
- 4) The coldest months for the U.S. school are usually between December and February;

- a. On several occasions, the temperature falls to nearly, or below, -10° Celsius;
- 5) The warmest months for the Benin school are usually between February and April;
 - a. On several occasions, the temperature rises above 40° Celsius;
- 6) The coldest months for the Benin school are usually between July and October;
 - a. On several occasions, the temperature falls below 25° Celsius;
- 7) When the U.S. school experiences the warmest temperatures, the Benin school is often experiencing the coldest temperatures.

Graph 2: Lycee Behanzin, in Porto-Novo, Benin, and Waynesboro Senior High School, Waynesboro, Pennsylvania, U.S., combined with Serpentine Primary School, in Serpentine, Australia.



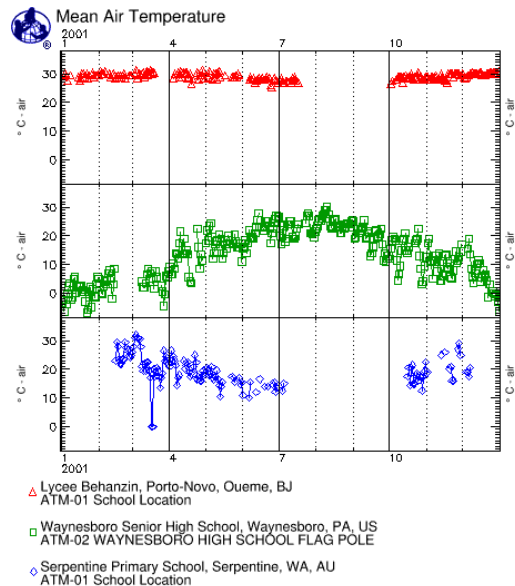
What do you notice about this graph? _____

Students may notice any of the following:

- 1) Temperature at the Australian school ranges from 15 to about 40° Celsius;
- 2) Temperature at the Australian school varies more than at the Benin school but not as much as at the Pennsylvania school;
- 3) The warmest months for the Australian school are usually February and December;
 - a. Data are not available during late December through January;
- 4) The coldest months for the Australian school are usually between July and August;
 - a. On several occasions, the temperature falls to nearly 10° Celsius;
- 5) The warmest months for the U.S. school are usually between July and August;
 - a. On several occasions, the temperature rises to nearly 40° Celsius;
- 6) The coldest months for the U.S. school are usually between December and February;
 - a. On several occasions, the temperature falls to nearly, or below, -10° Celsius;
- 7) The warmest months for the Benin school are usually between February and April;
 - a. On several occasions, the temperature rises above 40° Celsius;
- 8) The coldest months for the Benin school are usually between July and October;
 - a. On several occasions, the temperature falls below 25° Celsius;
- 9) When the Australian school experiences the warmest temperature, the U.S. school is often experiencing the coldest temperature;
- 10) The schools in Benin and Australia experience the coldest and warmest temperatures during (nearly) the same months.

Project #1, Part 3: Creating graphs using GLOBE data

Graph 1: Lycee Behanzin, in Porto-Novo, Benin; Waynesboro Senior High School, Waynesboro, Pennsylvania, U.S.; and Serpentine Primary School, in Serpentine, Australia (stacked graph).



What is Mean Temperature? How is this temperature determined? _____

Mean temperature is defined as the average of a series of temperatures taken over a period of time, such as a day or a month; within GLOBE that period of time is one 24-hour period (Solar Noon to Solar Noon).

Mean temperature is calculated by averaging the Maximum and Minimum daily temperatures, which is dividing the sum of these by 2 [(maximum daily temperature + minimum daily temperature)/2].

What do you notice about the three graphs? Why are these three graphs of Mean Temperature different? Note: Latitudes and Longitudes of the schools can be found below the graph in the list of Selected Schools under the "Other Options" box. _____

Students may notice any of the observations noted under Project #1, Graph 2.

They may also notice:

- 1) A datum (or several data) in the Australian graph seem to approach zero, not conforming to the pattern of the graph.
- 2) The Australian and Benin schools did not collect temperature data during the entire year. Both schools have a gap in their data from sometime in July until sometime in October.

Do the data in the three graphs seem reasonable? Why or why not? _____

Students should question the reliability of the data associated with the strange line coming down out of the graph of the Australian school's data, not conforming to the pattern. This day (or these days), the school reported 0° Celsius (or nearly 0°) which does not fit the pattern of the data at all. This datum (or these data if there are more than 1 day associated with this anomaly) should be considered suspect.

The table of data is located below the graph and graphing tools. Scroll through the data. Students should notice that Serpentine Primary School reported 0° Celsius on March 17 and 18 (see data and arrow below). Does that seem reasonable? If not, what might have happened? _____

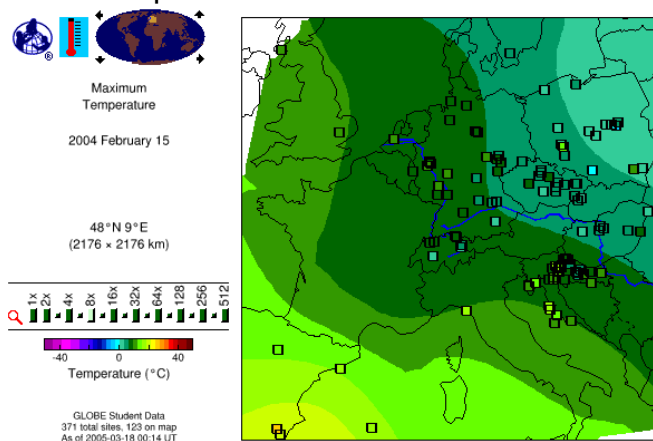
31 dates in this time series

Date[+]	Porto- AvTmp ATM-01	Porto- ATYP ATM-01	Waynes AvTmp ATM-02	Waynes ATYP ATM-02	Serpen AvTmp ATM-01	Serpen ATYP ATM-01
20010301	--	--	--	--	26.0	4
20010302	--	--	--	--	28.0	4
20010303	30.5	4	--	--	31.0	4
20010304	31.5	4	--	--	32.0	4
20010305	28.5	4	--	--	31.0	4
20010306	29.5	4	--	--	30.5	4
20010307	30.0	4	--	--	28.0	4
20010308	29.5	4	--	--	21.0	4
20010309	30.0	4	4.0	4	19.5	4
20010310	30.5	4	2.0	4	22.0	4
20010311	29.0	4	3.5	4	19.5	4
20010312	30.8	4	6.5	4	22.5	4
20010313	29.5	4	8.5	4	22.5	4
20010314	30.0	4	5.0	4	19.5	4
20010315	31.5	4	7.0	4	17.0	4
20010316	30.0	4	7.5	4	0.0	4
20010317	30.8	4	5.0	4	0.0	4
20010318	30.5	4	1.5	4	20.0	4
20010319	--	--	7.5	4	17.5	4
20010320	--	--	5.5	4	20.5	4
20010321	--	--	--	--	19.5	4
20010322	--	--	--	--	17.5	4
20010323	--	--	--	--	13.5	4
20010324	--	--	2.5	4	17.0	4
20010325	--	--	0.5	4	18.5	4
20010326	--	--	-4.5	4	26.5	4
20010327	--	--	-0.5	4	23.0	4
20010328	--	--	6.0	4	24.5	4
20010329	--	--	5.5	4	24.0	4
20010330	--	--	7.5	4	22.0	4
20010331	--	--	--	--	--	--

When looking at the table of data (shown above), students should clearly see that the Australian school entered 0° Celsius for two days during March 2001. Days prior and following these two measurements the school reported temperatures in the upper teens and low 20s. The temperatures do not seem reasonable when comparing them to all the data entered by this school. It is entirely possible that the students entered 0, not as a temperature value but rather meaning the absence of data or no data. However, this could cause confusion in data interpretation since zero is a number on thermometers and in many parts of the world is a very reasonable temperature reading.

Project #2: Creating maps using GLOBE data

Map 1: Europe, Maximum Temperature



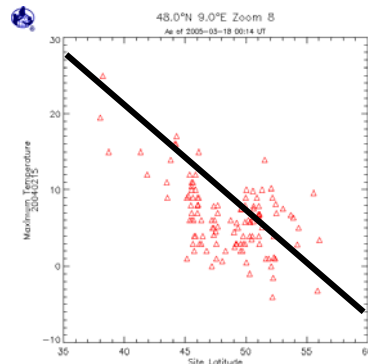
Looking at the map your queries produced, do the data look reasonable? Why or why not? _____

How might the Contours help answer this question? _____

Students may not know how to interpret map data at first. Provide hints such as describing how temperature contours, or Isotherms (lines connecting points of equal temperature, commonly seen on weather maps to show large-scale temperature distributions), connect points of equal temperature within an area. Data within close proximity to each other should be the same or similar color as well as that of the surrounding isotherm. Individual data points that are not the same or of similar color as those points near it or to the surrounding isotherm may show this difference due to a change in elevation, proximity to a large water body, or other geological or geographical differences. Students should look for those points that are not similar and ask “why” and/or “how do they differ?” If temperatures are greater than or less than 10° Celsius from surrounding points they may be worth investigating.

Step 7 will generate an X, Y plot (or Horizontal, Vertical plot) of the data visible on the map. On the Horizontal, or X, axis is Latitude and on the Vertical, or Y, axis is Maximum Temperature. Do the data graphed in this manner help determine whether one or more data represent possible errors? Explain: _____

Graph 1: Scatter Plot



When looking at scatter plots students should look for “outliers.” Outliers are those data that do not fit the shape of the graph or the flow of the data. If the data are expected to have a linear relationship then placing an imaginary line or a pencil on the scatter plot through the data as they seem to flow may help students visualize possible outliers.

Graph 2 shows a scatter plot containing two outliers. Why do outliers occur? Often incorrect dates are recorded but most often digits are transposed (entering 32 instead of 23) or using an incorrect measurement (for example, recording Fahrenheit instead of Celsius) or using a non-calibrated instrument. Calibration is the process of comparing an instrument's measuring accuracy to a known standard (for example, ensuring that a thermometer reads 0° Celsius in an ice water bath).

Graph 2: Scatter Plot Showing outliers

