



In Search of GLOBE Data Lesson Plan



Purpose:

1. Encourage the use of GLOBE data through on-line visualization tools.
2. Understand the value of GLOBE data in science and technology instruction.

Overview:

Students use on-line GLOBE visualization tools to locate and display data from schools and use the data to answer questions regarding weather and climate.

Science Objectives:

This activity addresses or touches on the following Next Generation Science Standards:

- **3-ESS2-1.** Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.
- **4-ESS2-2.** Analyze and interpret data from maps to describe patterns of Earth's features.
- **MS-ESS2-6.** Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

(Additional information on NGSS can be found at www.nextgenscience.org)

This activity addresses the following content science standards according to the (U.S.) National Science Education Standards:

Science as inquiry

- An appreciation of "how we know" what we know in science,
- Skills necessary to become independent inquirers about the natural world.

Earth and space science (Content Standard D)

- Changes in the earth and sky (Grades K-4)
- Structure of the earth system (Grades 5-8)
- Energy in the earth system (Grades 9-12)

This activity addresses the following content and cognitive domains according to the Trends in International Mathematics and Science Study (TIMSS), 2007:

Fourth-Grade Content Domains

- Earth Science
 - Earth's Processes, Cycles, and History

Eighth-Grade Content Domains

- Earth Science
 - Earth's Processes, Cycles, and History

Cognitive Domains

- Knowing
 - Illustrate with Examples
- Applying
 - Compare/Contrast/Classify
 - Relate
 - Interpret Information
 - Explain
- Reasoning
 - Analyze/Solve Problems
 - Hypothesize/Predict
 - Draw Conclusions
 - Generalize
 - Justify

Level:

This activity is suitable for students who possess a beginning understanding of cause-and-effect relationships; the ability to read simple graphs and tables and are able to make simple data comparisons; know basic weather-related phenomena; and are able to create, interpret, and make predictions from charts, diagrams, and graphs based on information provided; principally grades 6 to 12. For younger students, or students who do not possess these skills, teachers may need to provide more input at various steps, while for students with more experience at looking at graphs of data, less teacher input would be necessary.

Time:

One to two class periods

Materials included:

1. In Search of GLOBE Data – Student Worksheets for two projects:
Project 1 (Parts 1 and 2, Exploring Data Layers Tools and Testing Student Understanding, respectively)
Project 2 (Parts 1 and 2, Creating a Time Series Plot of Data and Searching for GLOBE Data, respectively)
2. In Search of GLOBE Data – Teacher Answer Guide

Materials needed:

1. Computers with Internet connection.
2. One large world map to display on the wall (optional).

Lesson Preparation:

1. Review Lesson Plan; make copies of appropriate student worksheets.
2. Assure that GLOBE website is accessible through firewall (if applicable).

Procedures:

1. Present the activity to the students – they will be following two self-paced projects on creating maps of data layers and time series plots (graphs) using on line tools available on the GLOBE website <www.globe.gov>. Both projects contains two parts.
2. Student worksheets include questions investigating what the students see or think about the data presented.

Assessment:

1. Teachers can ask students to use their skills in searching for GLOBE data to locate schools in with other GLOBE data available in the dropdown list for a certain time period.
2. Good follow-up activities are “Using GLOBE Water Temperature and Dissolved Oxygen Data in the Classroom”, “Where in the World” and “What is the Temperature in” (from the Understanding GLOBE Student Data collection), and the Earth System Poster activities available on the GLOBE website.

A Note About GLOBE Data:

The GLOBE Database, as of August 2015, houses over 130 million student data from over 8,500 schools in 93 countries! As the GLOBE Program has recently celebrated 15 years from its announcement on April 22, 1994, it seems appropriate to ask, “What can these data tell us? What can we do with these data?” The purpose of these activities is two-fold: first, to help guide the user through these millions of data, and second, to inspire teachers and students to collect, report and use GLOBE data in their own research.

Looking at and understanding data may at first seem difficult, confusing or uninteresting; however, data exploration can be exciting and a little addicting. Data activities can also fit into various parts of the curriculum: science (since they are environmental data), mathematics (since the data are mostly comprised of numbers), social studies (since data have a geographical location attached to them), art (since graphs and maps can take the form of shapes and colors), language arts (since written and/or oral reports about data can be generated by students), foreign, or second, language literacy (since students communicate their findings to their peers around the world),....

Data are everywhere, no matter where we look someone or some thing has collected data about it, whether it consists of remotely sensed data from a satellite instrument or a student researcher collecting *in situ* (or on site) data. However, just because data exist doesn't necessarily mean the data are useful to anyone other than those who collected them. One of the keys to determining the usefulness of any dataset is to understand how the data were collected and how accurate and/or precise they are.

Accuracy and precision, while related, can have very different meanings when dealing with data collection. Imagine using two thermometers to determine the temperature of three samples of ice water. The first thermometer reads 0.3 °C, 0.1 °C, and 0.2 °C (an average measurement of 0.2 °C). The second thermometer reads 3.251 °C, 3.254 °C, and 3.252 °C (an average measurement of 3.252 °C). Ice water should read approximately 0.0 °C (+/- 0.5 °C). The first thermometer measured all the three ice water baths accurately, within the margin of error. The second thermometer measured very precisely but not accurately (all data are grouped together very closely and the instrument has a greater precision than the first thermometer).

Most scientific instruments used by GLOBE students can be calibrated, compared and adjusted to a standard measurement. Additionally, each instrument has a specification agreed to by scientists that makes GLOBE data useable scientifically. To help further, the GLOBE data entry tools have associated range checks, preventing data from outside those ranges to be accepted. Each measurement also have a set of protocols (or procedures) that also identify the timeframe for proper data collection. A hands-on training program that has been in place since the inception of the Program can also help to assure of the data's accuracy. In this way, students and scientists know that data collected from all over the world have been collected using the same steps, at approximately the same time of day and using the same or similar instruments.



In Search of GLOBE Data Student Worksheet



Project 1

Part 1: Exploring Data Layers Tools

Step 1: From the GLOBE Home page (www.globe.gov), click on the [Visualize Data](#) button. The GLOBE visualization tools can also be launched from the Visualize and Retrieve Data page, found under the GLOBE Data tab.

Step 2: Close the Welcome box and click on **Add+** next to Data Layers (Image 1) on the Layers tab; this will open the Measurement pop out box (Image 2). Note that the Measurements available are on a drop-down list; there are various datasets to choose from depending on the measurement selected. The default is Air Temperature Dailies; if you changed the data layer during your exploration of the drop-down list change it back to Air Temperature Dailies for this exercise.

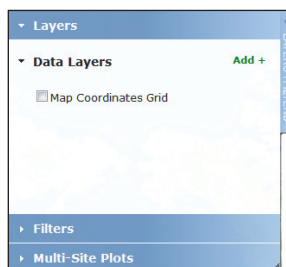


Image 1. Data Layers on the Layers tab

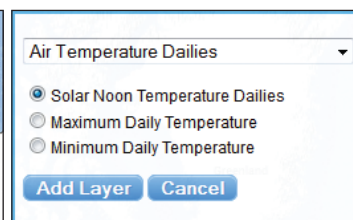


Image 2. The Measurement layer selection tool

Step 3: Select Maximum Daily Temperature and click on “Add Layer”. Several data will populate the map and **Maximum Daily Temperature** and **Contours** appear under Data Layers on the Layers/Filters tab. Notice that a small thermometer icon is to the left of the data layer (Image 3).

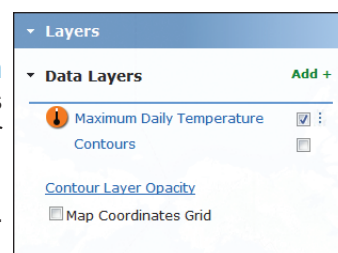


Image 3. The Data Layers tab listing the selected data layer

Step 4: Click on **Add+** again (on the Layers tab), click on the drop-down arrow and select Precipitation. Click on Total Liquid Equivalent from the list and then click on the Add Layer button. Notice that two data layers are listed under Data Layers (Total Liquid Equivalent, showing a rain drop with two lines under it, and Maximum Daily Temperature). Total Liquid Equivalent is listed on top and chances are that several of the new data now cover the temperature data that were originally on the map. Click and hold down the cursor on the Maximum Daily Temperature icon (thermometer) under Data Layers and drag it on top of the Total Liquid Equivalent layer. This function will allow you to determine which data layer appears on the top level of the map.

Step 5: A Legend tab is along the bottom right of the map (Image 4); click on the tab to open it. There are two measurements on the legend for the two data layers displayed on the map. The color bars can provide you with a quick way to determine the values represented by the different data icons on the map. Clicking the Legend tab again will close it. This function is also available for the Layers/Filters tab.

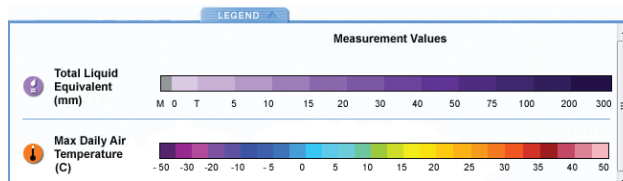






Image 4. Measurement Values Legend tab

Step 6: Zoom and Pan tools are located on the right of the map (Image 5).  Click the  on the Zoom two times (Note: double clicking on the map will also zoom). Now click on the four directional pan arrows to move around the map. You can also grab the map with your mouse cursor and move  it. Now click on the  two times to return to the full global view.

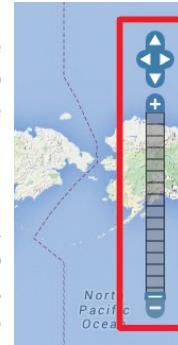


Image 5. Zoom and Pan tools

Step 7: A Map Date tool is located above the Layers/Filters tab (Image 6a). Click and drag the small blue square below the date, changing the date to sometime in 2010. Then click in the date field and click on the arrows to display April 2010. Finally, click on the 22nd within April 2010. Notice that the small dark blue square has shifted on the light blue line directly below the Map Date (Image 6b). You can also change the date manually within the date field by highlighting the year, month or day and typing the desired dates.

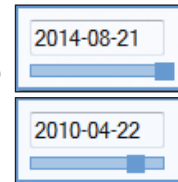


Image 6a and 6b. Map Dates and Blue timelines

Step 8: Click on the text “Total Liquid Equivalent” on the Layers tab. A small pop out box will appear with several options: View Layer Table; Download Layer .kmz; Delete Layer; and Cancel. Click on Delete Layer; this will remove the layer from the map leaving only Maximum Daily Temperature for 22 April 2010.



In Search of GLOBE Data Student Worksheet



Project 1

Part 2: Testing Student Understanding

If continuing from Project 1, Part 1, the world map should display Maximum Daily Temperature icons for 22 April 2010.

If you are beginning the activity and not continuing from Project 1, Part 1, go to the GLOBE home page <www.globe.gov>, click on the “Visualize Data” button to launch the GLOBE visualization tools in another browser tab. Close the Welcome box and add the Maximum Daily Temperature Data Layer to the map.

Step 1: Change the date on the map to 10 February 2011. Zoom into central Europe by double-clicking on the map four times (avoid clicking on any of the data icons), positioning the Czech Republic near the center of the map. The area of central Europe displayed should be populated by a scattering of data.

Question 1: Do the data look reasonable on the map generated? ____ Why or why not?

Step 2: Click in the small box to the right of “Contours” under Maximum Daily Temperature on the Layers/Filters tab.

Question 2: How might the contours help answer this question? _____

Step 3: Change the date on the map to 10 May 2011. Contours should still be selected.

Question 3: Do the data look reasonable on the map generated? ____ Why or why not?

Question 4: How can the Measurement Values Legend help in determining if the data are reasonable? _____

Step 4: Click the small box to the left of “Map Coordinates Grid” on the Layers tab. Click on the blue temperature icon in eastern Czech Republic located on the 18 degree Longitudinal line and just south of the 50 degree latitudinal line (zoom in more if necessary). A pop-up box will appear after clicking on the temperature icon. Review the information provided near the bottom left of the pop-up box.

Question 5: Does the listing of the Solar Noon, Minimum Daily and Maximum Daily Temperatures seem reasonable? ____ Why or why not? _____

Step 5: Click the X at the top right of the pop-up box to close it.

Step 6: Open the Layers/Filters tab and select Filters. Click on Location/Site. This will open up a *Select by* drop-down (schools will be the listed selection by default).

Step 7: Click on the Select by drop down and choose “Drawing on Map”. Two icons show the tools that are available: a polygon selection tool and a map movement tool, on the left and right respectively (Image 7). Click on the polygon tool icon. Click on the map to draw a square or other polygon around the blue temperature icon and several other icons around it, clicking on the map to create each corner. Finish the polygon, with a double click. This will display only the data within the polygon.



Image 7. Drawing on Map tools.

Step 8: Click on the Layers tab and then click on the Maximum Daily Temperature *text*. Select “View Layer Table” from the selection in the pop out box. This will generate a table of data from all schools and data within the box created in Step 7.

Step 9: Click on *Export to .csv* (at the bottom right of the table). Open the .csv file with a spreadsheet tool and create a scatterplot (or x, y chart) with air temperature on the y axis and latitude on the x axis. If a spreadsheet tool is not available sketch a graph of these data in the available space below.

Question 6: What do you notice about these air temperature data and their relationship to one another? _____

Question 7: Do the data graphed in this manner help determine whether any data represent possible errors? Explain: _____

Step 10: Click on the small x on the top right of the maximum air temperature table to close it. Click on the Filters tab and click on Reset Custom Polygon. Click on the Layers tab and then on the Maximum Daily Temperature text to open the pop out box. Click on Delete Layer to remove it from the selection.

You are now ready to proceed to Project #2.



In Search of GLOBE Data Student Worksheet



Project 2

Part 1: Creating a Time Series Plot of Data

If continuing from Project 1, Part 2, the visualization map is open with the map coordinates grid displayed.

If you are beginning the activity and not continuing from Project 1, Part 2, go to the GLOBE home page <www.globe.gov>, click on the “Visualize Data” button to launch the GLOBE visualization tools in another browser tab. Click the small box to the left of Map Coordinates Grid.

Step 1: Click on the Filters tab (See Project 1, parts 1 and 2: Exploring Data Layers Tools for activities using Layers). Click on Location/ Site. Click on Schools in the drop-down list. A School Name text field box will open up below the selection. Type “Mamadou” in the school name field; click on Lycee Mamadou M'Bodj de Sebenikuo (LMBS) from any school name options that are provided. A site drop-down list will appear once the school is selected. Make sure that “1ATM a l'interieur du lycee pres de la direction(a son sud-Est):ATM-01” is selected as the site (Image 1). Click on Go.

Image 1. The Filters tab with the school and site selected

Step 2: A school measurements information box will appear on the map for this school (Image 2) listing the school and site. Four tabs are along the top of the box under the school and site information: Measurements; Data Counts; School Info; and Site Info. The Measurements tab is automatically selected, listing Atmosphere datasets; Air Temperature Dailies is the default selection on the drop-down. Three radio buttons below the drop-down list the options for air temperature. The data date range is listed under these radio buttons. To the right of the drop-down and radio buttons is a small plot of recent data (if any have been submitted). To the right of this plot are two icons: the top icon is to view data in a table; the bottom icon is to view data in a time series plot.

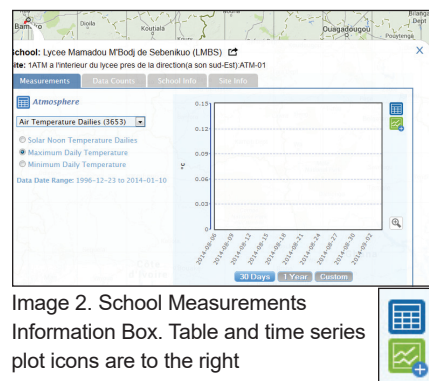


Image 2. School Measurements Information Box. Table and time series plot icons are to the right

Step 3: Click on the Maximum Daily Temperature radio button and click on the Time Series icon. The dataset has been added to the Multi-Site Plots tab (Image 3).

Step 4: Scroll down the Multi-Site Plots tab until you are able to see both the Plot Date Range fields and the Plot All button. Change the “Plot Range Dates” manually by clicking the date and changing the year, month and day to: 2010-01-01 to 2013-12-31 (Image 4). Click on the “Plot All” button.

Image 3. The Multi-Site Plots tab showing added site

Image 4. The Multi-Site Plots tab showing new dates and Plot All button

Question 1: What do you notice about the resulting time series plot?

Project 2

Part 2: Searching for GLOBE Data

Step 5: Close the Time Series Plot by clicking on the small x at the top right. Click on the Filters tab. Click on the small x on the right side of the School Name field to remove the school and the school measurement information box. Click on the “-” on the zoom tool until the full global map is visible.

Step 6: Click on the Layers tab and click the **Add +** to the right of Data Layers. Click on Air Temperature Dailies (unless it is already displayed). Click the radio button next to Maximum Daily Temperature and then on the Add Layer button. Several data icons will load on the map. These are data that have been submitted for the date shown above the Layers/Filters tab.

Step 7: Click on the Data Counts button next to the Measurements button above the date field. This will open a second date field with time sliders on both ends (Image 5). The map will also be populated by dots of the same color and of various sizes. These represent all schools which have submitted the selected data between the two dates, in this case Maximum Daily Temperature between 1 January 1995 and 4 September 2014.

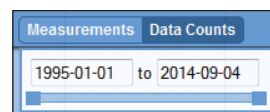


Image 5. The Measurements and Data Counts buttons and timeline slider.

Step 8: Click the date field on the left and change the date to 2010-01-01. Click the date field on the right and change the date to 2013-12-31. The number of dots on the map will be reduced based on this selection. This date selection corresponds to the dates of the Lycee Mamadou time series plot created in step 4 of Project 2, Part 1.

Step 9: Click on the Filters tab, then on the Data Range text. Two data range fields will open up as well as a slider with dark blue squares on both ends. Move the slider on the left until the data range on the left reaches approximately 1000. This will reduce the sample size of datasets again. The dots on the map indicate datasets of at least 1000 maximum daily temperature data between 1 January 2010 and 31 December 2013.

Step 10: Click on a dot in South America to open up the school measurements information box. The Data Counts tab will be highlighted. Click on the Measurements tab. The Maximum Daily Temperature radio button should be selected; click on the Time Series icon. This will add this school's dataset to the Multi-Site Plots tab.

Step 11: Click on Multi-Site Plots, scroll down until you are able to see both the Plot Date Range fields and the Plot All button. Change the “Plot Range Dates” manually by clicking the date and changing the year, month and day to: 2010-01-01 to 2013-12-31 (Image 4 from Step 4 earlier). Then click on the “Plot All” button.

Question 2: What do you notice about the resulting time series plot? _____

Step 12: Close the time series plot and the school measurement information box. Click on a dot in New Zealand. Click on the Measurements tab. The Maximum Daily Temperature radio button should be selected; click on the Time Series icon. This will add this school's dataset to the Multi-Site Plots. Change the “Plot Range Dates” manually to: 2010-01-01 to 2013-12-31. Then click on the “Plot All” button.

Step 13: Click on the Lycee Mamadou school name within the legend of the time series plot. This will remove the dataset from the plot but keep it listed within the legend.

Question 3: What do you notice about the two datasets remaining on the time series plot? _____

Step 14: Click on the school name again to have the dataset restored to the time series plot. Any or all of the datasets can be removed from and restored to the time series plot by clicking the school name within the time series plot legend.

Step 15: Close the time series plot. Click on the Multi-Site Plots and scroll up until you can see the school names and datasets. Click on the X to the right of the school in South America (Image 6). This will remove it from the Multi-Site Plots.

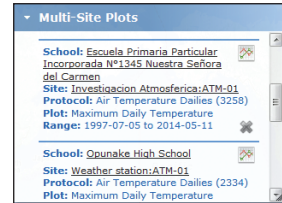


Image 6. The Multi-Site Plots tab showing the X to remove the dataset from the tab.

Step 16: Close the school measurement information box for the school in New Zealand. Double-click on the map to zoom into the area of Scandinavia. Click on the northern-most dot and add the maximum daily temperature dataset to the multi-site plots. Ensure that the "Plot Range Dates" read 2010-01-01 to 2013-12-31. Click on the "Plot All" button.

Question 4: What do you notice about the datasets on the time series plot? Explain the patterns of the data. _____

Question 5: Explain why these three schools have different temperatures patterns. _____

Step 17: Close the time series plot and the school measurements information box. Click on the Multi-Site Plots and click on the Clear List button to remove the three school's datasets from the list. Click on the Filters tab and the Location/Site text. Remove any school information listed in the School Name field.

Step 18: Type the school name *Al-Farouq* in the School Name field. Select the school "Al-Farouq Intermediate School at Jeddah" from the list of schools. Select the "ikea: ATM-01" from the Site drop-down list and click on Go.

Step 19: When the school measurements information box is displayed click on the radio button for Maximum Daily Temperature and add this dataset to the Multi-Site Plots. Click on the drop-down list of measurements and select Precipitation. Click on the radio button next to Total Liquid Equivalent and add this dataset to the Multi-Site Plots. Ensure that the "Plot Range Dates" read 2010-01-01 to 2013-12-31. Click on the small box to the left of "Use Auto Y-axis". This will utilize only the portion of the temperature time series plot containing data from these two datasets, eliminating the portion of the plot area below zero degrees Celsius. Click on the "Plot All" button.

Question 6: What do you notice about the data in the time series plot? Do these data seem reasonable? Hold the mouse cursor over the spike in precipitation in January of 2011 to discover the values entered into the database. Explain. _____

Step 19: Click on the following url: www.ncdc.noaa.gov/sotc/hazards/2011/1 (or type it into an Internet browser). Read the last paragraph of the Flooding section.

Question 7: Does this information help explain the precipitation dataset? Explain. _____

You are now ready to search for data from other GLOBE schools in other countries and in other investigation areas.



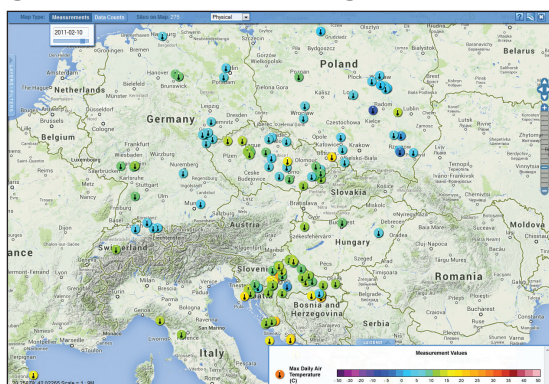
In Search of GLOBE Data Teacher Answer Guide Project 1



This answer guide provides 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 possible answers. If the student does not provide answers to these questions, the teacher can use the answers provided in this guide to help the student begin to see what story the data can tell.

Project 1, Part 1: Exploring Data Layers Tools is a guided step-by-step activity to help students understand the navigation. There are no questions associated with this part of the activity. Therefore, this answer guide begins with Project 1, Part 2: Testing Student Understanding.

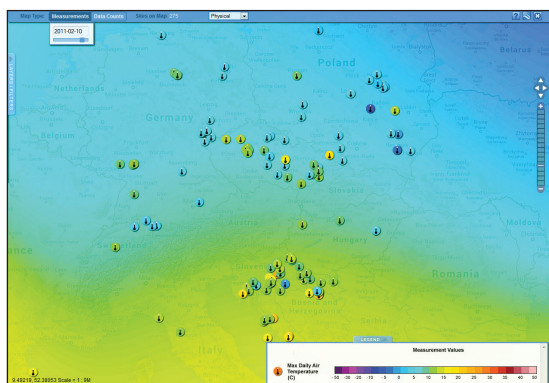
Project 1, Part 2: Testing Student Understanding



Map, question 1. Maximum Daily Temperature map in central Europe, 2 February 2011, showing placement of data.

Question 1: Looking at the map generated, do the data look reasonable? Why or why not?

Answer: Students should note that yes, the data look reasonable, referencing the colors of icons, as identified in the Legend, and geographic areas. While there are icons of different colors next to each other, those colors are next to each other on the Legend. Data collection sites that appear to be close to each other can experience slightly different temperatures due to elevation, cloud cover, rainfall, proximity to large bodies of water, as well as whether the school is urban or rural.

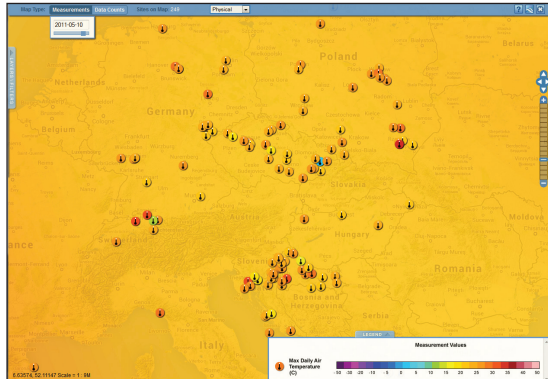


Map, question 2. Maximum Daily Temperature in central Europe, 2 February 2011, showing data with contours.

Question 2: How might the Contours help answer this question?

Answer: Students may not know how to interpret map data and contours at first. Provide hints such as describing how temperature contours, or isotherms, connect points of equal temperature within an area (Isotherms are lines connecting points of equal temperature, commonly seen

on weather maps to show large-scale temperature distributions). 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 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 °C from surrounding points they may be worth investigating.



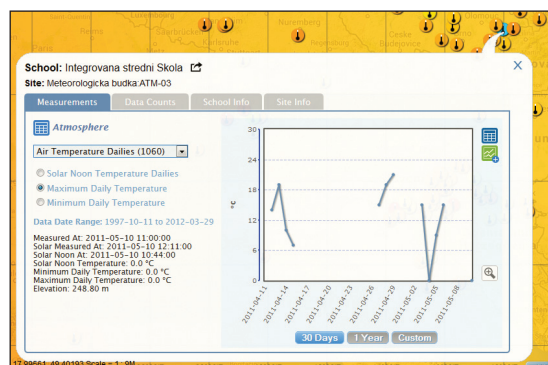
Map, question 3. Maximum Daily Temperature in central Europe, 10 May 2011, displaying data in contours.

Question 3: Looking at the map generated, do the data look reasonable? Why or why not?

Answer: Students should notice a blue temperature icon, surrounded by orange and orange-yellow temperature icons, in eastern Czech Republic. A red icon in southeast Poland might also be worth investigating, as the surrounding icons tend to be yellow and yellow-orange.

Question 4: How can the Measurement Values Legend help in determining if the data are reasonable?

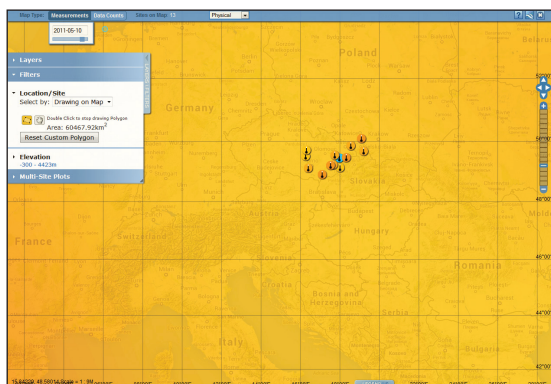
Answer: Students should have opened the Measurement Values Legend in order to estimate the temperatures represented by the various colors. The orange and orange-yellow icons appear to range from 20 to 25 °C, while the blue icon seems to be near 0 °C. If they have also identified the red icon in southeast Poland they will have noticed that the surrounding icons tend to be 10 or more degrees cooler. This activity will focus on the blue icon; however, encourage students to write down additional questions that they would like to explore later.



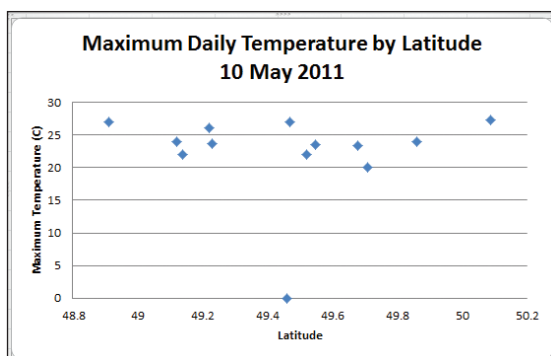
Map, question 5. School Measurements Information Box showing data for selected school.

Question 5: Does the listing of the Solar Noon, Minimum Daily and Maximum Daily Temperatures seem reasonable? Why or why not?

Answer: Students should notice that Solar Noon, Minimum Daily and Maximum Daily temperatures are all listed as 0.0 °C. While 0 °C in central Europe in May is not an expected temperature, it is not reasonable for all three temperatures to be the same. Air temperature fluctuates throughout a day due to incoming solar radiation (insolation).



Map, question 6a. Subset of maximum Daily Temperature in central Europe from Drawing on Map tool.



Map, question 6b. Scatter (XY) plot of Maximum Daily Temperature by Latitude.

Question 6: What do you notice about these air temperature data and their relationship to one another?

Answer: Students will have slightly different selections of data; however in general they should have selected a grouping of temperature icons along with the blue temperature icon (See image Map, question 6a). When placed in a scatter plot (Image Map, question 6b), the data point representing the blue temperature icon lies along the 0 °C horizontal line whereas all other data are from 20 to 30 °C. The data point at 0 °C stands out as an outlier.

Question 7: Do the data graphed in this manner help determine whether one or more data represent possible errors? Explain.

Answer: Students should understand the value of graphing temperature data in a scatter plot. Outliers are easier to identify using this tool. For students with more advanced mathematics experience, teachers can include additional questions on the use of trend lines and an r-squared coefficient for estimating “fit”.



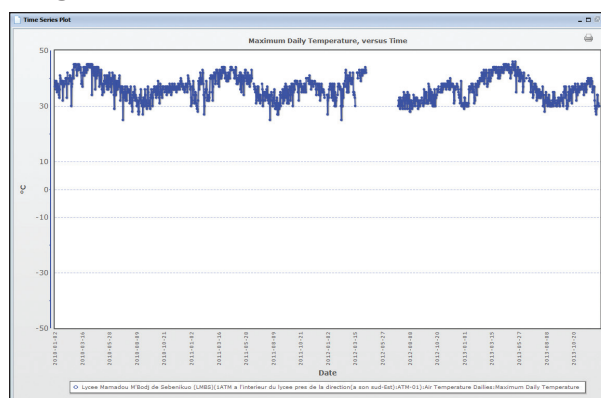
In Search of GLOBE Data Teacher Answer Guide Project 2



This answer guide provides 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 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, Parts 1 and 2 (Exploring Data Layers Tools and Testing Student Understanding, respectively) provide both a step-by-step guide to understanding the navigation of the visualization tools and a series of questions to test student comprehension of map interpretation and identifying outliers. Project 2 moves from mapping data to graphing data.

Project 2, Part 1: Creating a Time Series Plot of Data



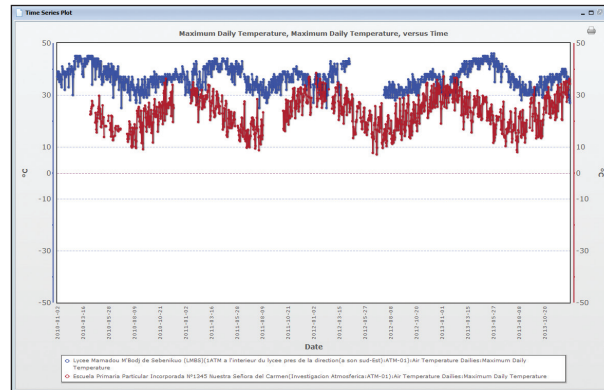
Time series plot, question 1. Maximum Daily Temperature time series plot for Lycee Mamadou M'Bodj de Sebenikuo (LMBS).

Question 1: What do you notice about the resulting time series plot?

Answer: Students may notice any of the following:

- 1) The maximum daily temperature varies from (typically) about 30 °C to about 45 °C, with lows reaching 25 °C;
- 2) The coolest months appear to be during July and August and then again during part of December and January;
- 3) The warmest months appear to be during February through April;
- 4) During 2013, the warmest month appears to be in May.
- 5) The temperature throughout the year doesn't vary much for this location;
- 6) The time series plot is not a smooth line, but rather appears very jagged as the temperature fluctuates from one day to the next.
- 7) There is a gap in the data (several months in length) during April, May and June of 2012.

Project 2, Part 2: Searching for GLOBE Data

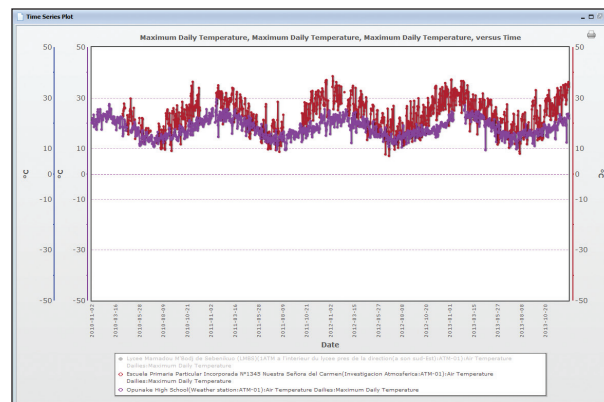


Time series plot, question 2. Maximum Daily Temperature time series plots for Lycee Mamadou M'Bodj de Sebenikuo and Escuela Primaria Particular Incorporada N1345 Nuestra Señora del Carmen.

Question 2: What do you notice about the resulting time series plot?

Answer: Students may notice any of the following (including answers to question 1):

- 1) The maximum daily temperature of the Escuela Primaria (Argentine) school varies from (typically) about 10 °C to about 35 °C;
- 2) The coolest months for the Argentine school appear to be during July and August;
- 3) The warmest months for the Argentine school appear to be during January and February;
- 4) The temperature throughout the year for the Argentine school varies much more than the Lycee Mamadou (Mali) school;
- 5) The day-to-day fluctuations are greater for the Argentine school, however a more pronounced annual (seasonal) cycle seems to be visible.

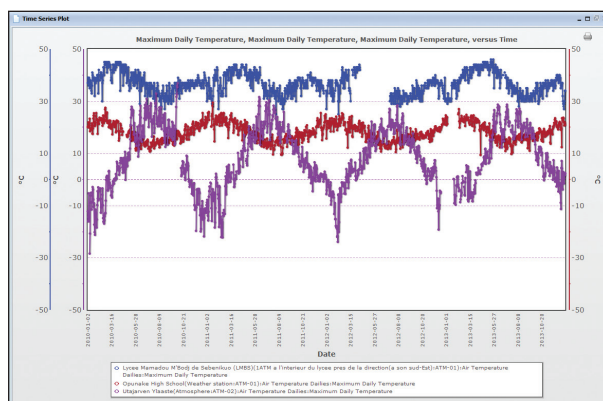


Time series plot, question 3. Maximum Daily Temperature time series plots for Escuela Primaria Particular Incorporada N1345 Nuestra Señora del Carmen and Opunake High School.

Question 3: What do you notice about the two datasets remaining on the time series plot?

Answer: Students may notice any of the following (including answers to question 2):

- 1) The maximum daily temperature of Opunake High School (New Zealand school) varies from about 10 °C to about 25 °C;
- 2) The coolest months for the New Zealand school appear to be during July and August;
- 3) The warmest months for the New Zealand school appear to be during January and February;
- 4) The annual (seasonal) cycle of the New Zealand school is similar to that of the Argentine school, however there is much less fluctuation from day to day, making for a tighter line.



Time series plot, question 2. Maximum Daily Temperature time series plots for Lycee Mamadou M'Bodj de Sebenikuo, Escuela Primaria Particular Incorporada N1345 Nuestra Señora del Carmen and Utajarven Ylaaste.

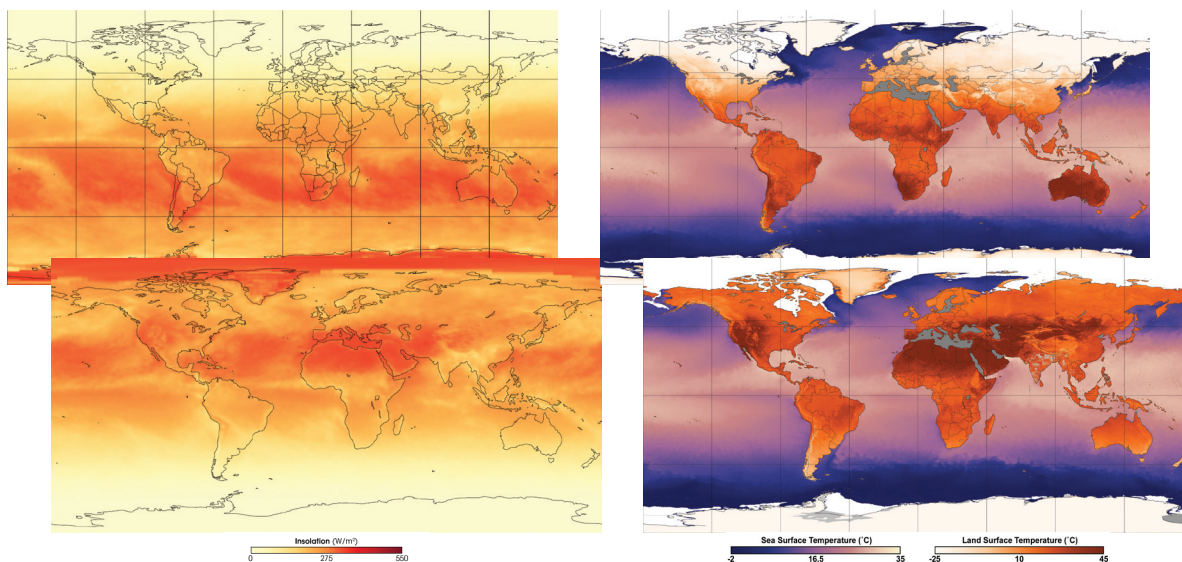
Question 4: What do you notice about the datasets on the time series plot? Explain the patterns of the data.

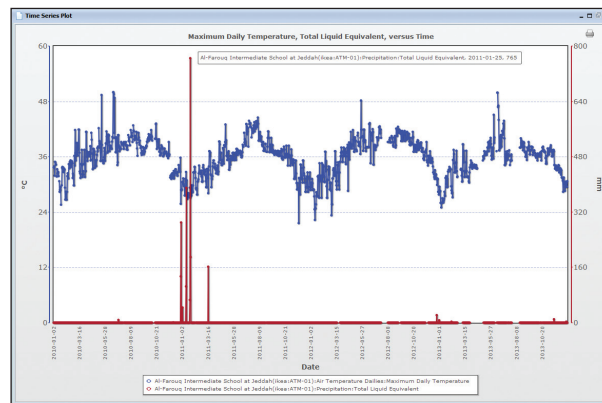
Answer: Students may notice any of the following (including answers to question 1 and 3):

- 1) The maximum daily temperature of the Utajarven Ylaaste (Finnish) school varies from (typically) about -20°C to about 30°C ;
- 2) The coolest months for the Finnish school appear to be during November through February;
- 3) The warmest months for the Finnish school appear to be during June and July;
- 4) The annual temperature for the Finnish school follows, in general, an opposite pattern from the New Zealand school;
- 5) When the New Zealand school experiences the warmest temperature, the Finnish school is experiencing the coldest temperature.

Question 5: Explain why these three schools have different temperatures patterns.

Answer: Students should connect the three temperature variations to time of year (season) and the location of the schools (latitude) and the resulting amount of solar energy Earth receives (measured in Watts per square meter). Incorporating the Insolation and Surface Temperature images (below) from the Earth System Poster activities (<http://www.globe.gov/do-globe/for-teachers/resources/additional-teaching-resources/earth-system-science-posters>) can help students visualize data using remotely sensed satellite images.





Time series plot, question 5. Maximum Daily Temperature and Total Liquid Equivalent (Precipitation) time series plots for Al-Farouq Int. School in Jeddah. Inset: precipitation data for 25 January 2011

Question 6: What do you notice about the data in the time series plot? Do these data seem reasonable? Hold the mouse cursor over the spike in precipitation in January of 2011 to discover the values entered into the database. Explain.

Al-Farouq Intermediate School at Jeddah(1000-01):Precipitation:Total Liquid Equivalent, 2011-01-25, 765

Answer: Students should find the spike of 765 mm in precipitation data (image of data pop-out above) uncharacteristic when looking at the entire 4 year dataset since no other annual cycle exhibits precipitation amounts of any similar amount. Students should consider these data suspect.

Torrential flooding hit the western Saudi Arabian city of Jeddah on January 26th through 28th. At least **10 deaths** were blamed on the flooding and another three people were reported missing. Jeddah received 4 inches (111 mm) of rain in just three hours. Nearly **2,000 people** had to be rescued — ground teams rescued 1,451 people and another 498 were rescued by helicopters. Power was cut to 70,000 residents of the Jeddah province. These floods were reminiscent of extreme flooding which hit the city in **November 2009**.

NCDC article, question 6. Portion of NCDC report noting torrential floods in Saudi Arabia.

Question 7: Does this information help explain the precipitation dataset? Explain.

Answer: Students should be able to connect the report on torrential floods in Jeddah, Saudi Arabia in January 2011 to the spike in rainfall in the time series plot. An Internet search could provide additional information. They may also wish to investigate the precipitation data for November of 2009 for this school to see if a spike also coincides with the floods mentioned in the last sentence.

Additional Search Parameters

Searching for GLOBE data can be monotonous and frustrating without the proper tools. The “In Search of GLOBE Data” series can be used as an introduction to searching and using GLOBE data. Projects 1 and 2 of “In Search of GLOBE Data – Student Worksheets,” offer step-by-step instructions on searching for data by mapping data by measurement and date and using isotherms, by entering a specific school name, and by narrowing the number of data counts displayed by measurement protocol. However, other methods of searching for GLOBE data exist. Try the following:

Searching by Geographic Location

Have students click on **Add +** to the right of Data Layers on the Layers/Filters tab and select the measurement protocol from the drop-down list. Have them select the appropriate radio button (if necessary) and click on the Add Layer button. Have students click on the Filters tab and click on Location/Site. The default of the Select by drop-down is Schools. Click on Schools and select Places. Type the name of the desired country, U.S. state or major city and select the appropriate option that appears (note: if a name does not appear, that indicates that the location is not available with the search function).

Here’s an example search: click on Water Temperature under Hydrology, then on Data Counts; type Maine in the Places text field and click on Go. The map will redraw to show the state of Maine and show only water temperature data within the boundaries of Maine. Type 100 in the text field between Within and km. The map will redraw to include parts of neighboring states.

Searching by Elevation

Continuing from the example above, click on the small x to the right of Places. This will remove the restrictions of water temperature data in Maine. Water temperature data will populate the global map. Scroll down below the Location/Site fields and click on Elevation. This will open up two text fields populated by elevation values in meters and two slider bars below the fields. Move the left slider to the right until the lower elevation reaches about 500 meters. The number of data on the map will reduce based on this change. The right slider can also be moved to the left to search for data within certain elevation restrictions.

Advanced Data Access

For those wanting to search for raw datasets, an Advanced Data Access Tool has been developed on the GLOBE website (www.globe.gov) to allow users to search the database by protocol, data range and data count with additional filters for site name, country or state/territory, proximity to physical features, school or teacher name, elevation range, latitude and longitude range, and proximity to a given latitude and longitude. Once parameters have narrowed the users search, data can then be downloaded in a .CSV file for analysis in a spreadsheet program.

This is not meant to be an exhaustive collection of search tools available on the GLOBE website, but rather just enough to whet your appetite. GLOBE data await – enjoy!