

MY NASA DATA Lesson:

Creating Climographs

Purpose:

To use NASA satellite data to compare surface temperature and precipitation of different islands in the Pacific Ocean

Grade Level: 6 – 8

Estimated Time for Completing Activity:

One 50 minute class period

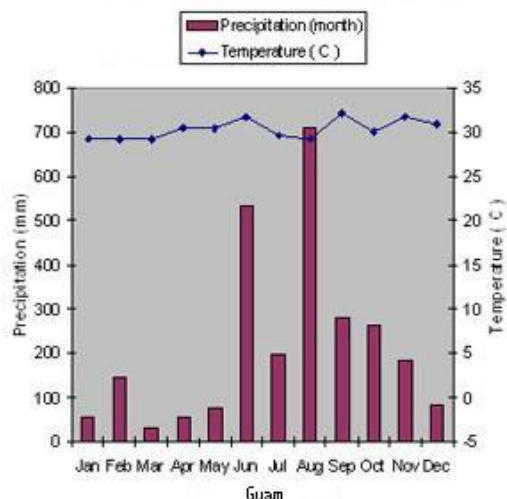


Image courtesy Aileen Ortega Canos

Learning Outcomes:

- Make inferences about an area's climate based on interpreting data on a climograph
- Make inferences about an area's climate based on interpreting data on a weather graph
- Create graphs using Microsoft Excel
- Explain the difference between weather and climate

Prerequisite

- Familiarity with using the computer to access the internet and to create Excel spreadsheets
- Familiarity with finding locations on a world map using latitude and longitude coordinates

Tools

- Classroom Computers
- MY NASA DATA web site
- Spreadsheet software (such as Excel)

- [World Maps](#)

AP Environmental Science Topics

- [Major terrestrial and aquatic biomes](#)

Vocabulary:

- [climatic diagram](#)
- [precipitation](#)
- [temperature](#)
- [weather](#)

Lesson Links:

- [Powerpoint Presentation](#)
- [Koppen Climate Classification](#)
- [Weather Graphs](#)
- [Live Access Server \(Earth System Data Explorer\)](#)

Background:

Weather is the state of the atmosphere at a particular place and time. It includes variables such as temperature, atmospheric pressure, wind, cloudiness, precipitation, and relative humidity.

Climate is the long-term weather conditions for a region, generally determined by 30 or more years of records. Climate zones can be defined using parameters such as temperature and rainfall. Climate in various places can be affected by many factors such as location of latitude and longitude, land mass distribution and proximity to oceans and mountain ranges. Because of these factors, climates around the world differ. The five major climate classifications in the Koppen classification are Dry, Mountainous (Highland), Tropical, Temperate (mild mid-latitude, severe mid-latitude), Polar..

In this lesson, you will make climatic diagrams called climographs which will relate weather and climate for a particular location. Monthly average values of weather data such as temperature and precipitation can be graphed to explain the climate classification for that location.

Procedure:

Overview: Students will create climographs for the island of Guam and 2 other islands found in the Pacific Ocean using the MY NASA DATA Live Access Server as a resource. To keep it simple, only one year of data will be analyzed. A real climograph would include all data available for that location.

Part 1: Obtaining Temperature Data

1. From the lesson links above, click on the link labeled Live Access Server (Earth System Data Explorer).
2. Click on Atmosphere Investigation Protocols from the menu that will appear. Should the drop down menu not automatically appear click on the 'Choose Data Set' button in the top left of the screen
3. Click Surface Temperature and then click Monthly Surface Clear-sky Temperature (ISCCP).
4. From the menu under the world map in the top left of the screen select Time series (t) under the 'Line Plots' heading in red lettering.
5. To input your location in the latitude and longitude boxes below the world map to the left, enter 13 N and 144 E.
6. Under date, from the pull-down menu, select Jan-2004 to Dec-2004.
7. At the top of the page click 'Update Plot'.
8. In order to get the data values you will now need to click on 'Save as' and then select ASCII from the drop down menu and then click Save at the bottom of the window.
9. A text table of the Mean Clear Sky Temperature should appear.
10. You will then need to go to File and 'save as' or 'save page as' from your internet browsers menu to save the file to your computer.

Part 2: Obtaining Precipitation Data

1. Repeat steps 1 and 2 of Part 1, except choose 'Water' instead of 'Land'.
2. Click on Atmosphere Investigation Protocols, then click Precipitation.
3. Click on Monthly Precipitation (GPCP).
4. Select Time Series from the menu under the world map.
5. For your location, in the latitude and longitude boxes under the map, enter 13 N and 144 E as in Part 1.
6. For time range, select Jan-2004 to Dec-2004.
7. At the top of the page click 'Update Plot'.
8. In order to get the data values you will now need to click on 'Save as' and then select ASCII from the drop down menu and then click ok in the window.
9. A text table of the Average Monthly Precipitation (GPCP) should appear in a new window on your desktop. Save this data for later use in the excel plot.
10. You will then need to go to file and 'save as' or 'save page as' from your internet browsers menu to save to the file to your computer.

Part 3A: Inputting Data into Excel

1. Using the data tables you had obtained for the Monthly Precipitation and Clear Sky Temperature, input this data into Microsoft Excel.
2. Open Microsoft Excel and create a new spreadsheet.
3. In Column A, label it 'Months'. Under this column, in rows 2-13, label each number with the names of the months of the year listed in chronological order (i.e., Jan, Feb, Mar, etc.).
4. In Column B, label it 'Precipitation (day)'.
5. In Column C, label it 'Precipitation (month)'.
6. In Column D, label it 'Temperature (K)'.
7. In Column E, label it 'Temperature (C)'.
8. Using the data you collected in Parts 1 and 2, fill in your Temperature and Precipitation data under the appropriate column headings. Do not input any data into Column C and E.

Part 3B: Changing Kelvin into Celsius

1. Once all your data is inputted into your table, you will create a formula that will convert the Temperature from degrees Kelvin into degrees Celsius.
2. In Column E Row 2, type in this formula ' = D2 - 273.15 '.
3. Next, copy and drag the formula into the remaining cells below Column E Row 2 (ex. Column D Row 3 to 15.)
4. The new information you should have will reflect the new temperature stated in degrees Celsius.

Part 3C: Changing mm-day into mm-month

1. Once all your data is inputted into your table, you will create a formula that will convert the Precipitation Measurements from millimeters per day into millimeters per month.
2. In Column C Row 2, type in this formula ' = B2 X 30 '.
3. Next, copy and drag the formula into the remaining cells below Column C Row 2 (ex. Column C Row 3 to 15.) Note: If you want to be really exact, you can instead enter individual formulas for each month, using the actual numbers of days in the month. Remember that 2004 was a leap year.
4. The new information you should have will reflect the total amount of rainfall in one month.

Part 4A: Creating a Climograph

If using an older Excel version, follow these steps

- 1a. On your Excel spreadsheet, highlight Columns A, Column C and Column E.
- 2a. Using the chart wizard on Excel, click on the tab labeled Custom Types. Select, Line-Column. Click Next.
- 3a. On Step 2 of 4, click Next.
- 4a. On Step 3 of 4, under the tab labeled Title. Input the following information:

- a. Chart Title – Climograph for Guam
 - b. Category (X) Axis – Data 2004
 - c. Value (Y) Axis – Average Precipitation (mm)
 - d. Second Value (Y) Axis – Average Temperature (C)
 - 5a. On Step 3 of 4, under the tab labeled Axes, look for Secondary Axis and check mark the box in front of Value (Y) Axis.
 - 6a. click Finish. Your climograph will be placed on the spreadsheet you just created
- 4B. If using a newer of excel, follow these steps
- 1b. On your excel spreadsheet, highlight Columns A, Column C, and column E.
 - 2b. Create an X-Y scatter chart using the Insert chart option
 - 3b. Highlight the precipitation data series by clicking on the data points within the chart
 - 4b. Choose Column graph and the data points for the precipitation will convert to a column graph style while the temperature points remain in X-Y scatter plot format.
 - 5b. Edit the axis and names of your graph using the instructions in step 4a.
 - 6b. Click Finish. Your climograph will be placed on the spreadsheet you just created.

Part 4C: Fixing Scales on Temperature Axis

1. Click on the climograph you just created. On the climograph, double click on the right x-axis where the temperature scale is located. A pop-up box will appear.
2. In the pop-up box, click on the tab labeled Scale. Remove the check marks that are located under Auto.
3. Change Minimum to -5.
4. Change Maximum to 35.
5. Change Major Unit to 5.
6. Change Minor Unit to 1.
7. Change Category X Axes Crosses at to -5.
8. Click Ok.

Part 5: Obtaining Climate Data for other Pacific Islands

1. Repeat Parts 1 to 4 for the following island locations found in the Pacific Ocean – Fiji and Aleutian Islands.
2. In Step 5 of Part 1 and Step 6 of Part 2, be sure to change the latitude and longitude to the following: Fiji 18 S and 175 E.
Aleutian Islands 54 N and 164 W.
3. When inputting your data into Excel, be sure to create new spreadsheets for each island. Also, remember to change the island names to reflect the data that you collected.

Part 6. Plotting Coordinates

1. On a world map, plot the coordinates for each island location. Guam 13 N, 144 E, Fiji 18 S, 175 E, and Aleutian Islands 54 N 164 W.

Questions:

1. How do you think location (latitude and longitude) affects the weather on each Pacific island?
2. How do temperature and precipitation differ in Guam and Fiji? How are they similar?
3. Why is the weather at the Aleutian Islands different from the weather found at Guam and Fiji?
4. What kind of climate region (Dry, Mountainous (Highland), Tropical, Temperate (mild mid-latitude, severe mid-latitude), Polar) can you expect to see if you visit Guam? Fiji? the Aleutian Islands??
5. Are there any notable differences between the sample climograph and the one that you created (see vocabulary link)? If so what are they. If not, give supporting evidence for your reasoning.
6. What are the trends that can be seen in a climograph and what do they tell us about the particular climate that is being studied

Extensions:

1. Students can research Climate Data (Temperature and Precipitation) for the islands and create climographs for each island nation and other cities and countries found around the world.
2. Using data obtained, students can make predictions about the biome found at each island location.
3. Students can create travel brochures for each island location.

Lesson plan contributed by Aileen Ortega Canos, Yigo, Guam

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