

How Can We Observe, Represent, Analyze, and Compare Climate Patterns?Introduction

Most people want to know only, “Hot? Cold? Wet? Dry?” So patterns of temperature and precipitation often provide the best ‘snapshot’ of an area’s climate. Monthly averages contain a 30-year record. This is long enough to provide expected patterns, even if there are years when unusual events occurred.

In Part 1 of this activity, you’ll use data found online to create graphs that will allow you to describe the climate of your chosen locations. You’ll look at data for **average (mean) monthly temperatures, average maximum monthly temperatures, and average minimum monthly temperatures**. Since temperature forms a continue pattern, you’ll shows these using **line graphs**.

You’ll also represent **average monthly precipitation**. Unlike temperature, precipitation (rainfall) is not continuous, so you’ll use **bar graphs** to show these records.

In addition to tables and graphs, climate can be shown in color-coded maps. In part 2, you’ll example and interpret some of these.

Climate scientists often use **anomalies** to highlight patterns. An *anomaly* means how much some value is above or below the expected value. In part 3, you’ll learn much more about the benefit of studying anomalies for understanding climate.

Part 1: Temperature and Precipitation (Rainfall) Patterns

There are many online resources you can use to find climate data. Here are two starting links:

NOAA National Climatic Data Center (NCDC) US Climate Normals: http://cdo.ncdc.noaa.gov/cgi-bin/climatenormals/climatenormals.pl?directive=prod_select2&prodtype=CLIM20&subnum=

NJ State Climatologist Office
http://climate.rutgers.edu/stateclim_v1/norms/monthly/index.html

- 1) Select one of these and follow the links to obtain average (mean), maximum, and minimum temperature data for either Newark or New York City.
- 2) A. On the left “Climagraph,” include as much of the information at the top as you can.

B. Now use the data and plot the average monthly temperatures. Connect these to form a line graph.

C. Next, follow links to obtain and plot the monthly precipitation data. Present these as a bar graph.
- 3) With the Summer Olympics coming soon, it will be interesting to compare the climate of our area with the climate in Rio de Janiero, Brazil. You can use the link below to find climate data for Rio, or many other places..

A. Do a web search to locate suitable climate information (monthly temperatures and precipitation) and record it in the table provided. Here is one useful link, but you can find others:

<http://www.worldweatheronline.com/>

Source (if other): _____

(If you need to convert:

Temperatures provided in deg C → need to be converted into deg F for chart

Precipitation provided in mm → need to convert 25 mm = 1 in for chart

_____ Climate Data (Provide appropriate headings for the columns used, including units.)

Jan						
Feb						
Mar						
Apr						
May						
Jun						
Jul						
Aug						
Sep						
Oct						
Nov						
Dec						

B. On the right "Climagraph," plot the patterns of the temperatures (as a line graph) and precipitation (as a bar graph.) Also record as much of the information at the top about Sochi as you can.

C. WRITE A 2-3 PARAGRAPH COMPARISON OF THE CLIMATE IN OUR AREA WITH THE CLIMATE IN YOUR CHOSEN LOCATION..

- 4) Computers are excellent for storing data and presenting it in various formats. Climate data can often be better understood looking at **trends** over time periods. To explore examples of these, go to:

<http://www.ncdc.noaa.gov/oa/climate/research/cag3/cag3.html>

Then follow the links to "Statewide" and then a specific state, such as NJ.

- A. Select first "Temperature" and a month. Describe the trend. Then compare this with another month.
- B. Next, select "Precipitation" and make similar comparisons.

REMINDER: ALWAYS WRITE YOUR IDEAS IN COMPLETE SENTENCES AND PARAGRAPHS

Part 2: Color-Coded Climate Data

Most people are 'visual,' so color-coded maps effectively show climate patterns.

First, to become familiar with these, examine some of the images available at

<http://www.ncdc.noaa.gov/cag/mapping>

Use the selection boxes to open and examine various maps.

- 5) On an attached sheet of paper, describe at least five examples of what you view and what you have learned from this format. .

Next, go to

http://www.osdpd.noaa.gov/data/sst/fields/FS_km5000.gif

The image shows the **sea surface temperatures** over the past few days.

- 6) Write a paragraph describing the patterns you observe. Tell the general latitude pattern, going from the equator to the poles. Also, identify areas where the waters are warmest.

Part 3 Using Anomalies to Understand Patterns

"Anomalies" means variations from the expected. Scientists often use anomaly maps to learn more about processes. For example, it means one thing of a temperature measurement is 20 ° C, but much more if this is 2 ° C above normal or 3 ° C below normal.

Here is a link to an animation that shows sea surface temperature anomalies over the past few months:

<http://www.ospo.noaa.gov/Products/ocean/sst/anomaly/anim.html>. You can watch where the ocean is unusually warm or cold. Since the ocean is **coupled** with the atmospheric circulation, these patterns play a major role in create weather and climate worldwide.

One area to pay special attention to is the west coast of South America. Normally, waters are cool, but over the time period shown, you'll see that the area closest to the coast of Chile becomes unusually warm. This is called an **El Nino** event, and is associated with weather changes.

Now look at this image of temperature anomalies:

http://chartsgraphs.files.wordpress.com/2009/02/2008anom_image.png

Observe the **departure from normal** with latitude, especially in the northern hemisphere.

- 7) Discuss what you have learned with these. (At least 2 -3 paragraphs.)

TRMM (Tropical Rainfall Measuring Mission) is a satellite that monitors precipitation and other variables, primarily between 35 ° N and 35 ° S. Go to http://trmm.gsfc.nasa.gov/affinity/affinity_3hrly_rain.html and study the images. Then click on the animations and study them.

Now look at the monthly data and anomaly images at http://trmm.gsfc.nasa.gov/images_dir/avg_rainrate.html Even though the data is no longer updated in this format, it still provides valuable information about our planet

- 8) Explain at least three advantages and three disadvantages of "current data," "anomalies," and "animations."

Summary

Write four-five paragraphs summarizing what you have learned in these activities.

Enrichment and Extra Credit:

Attach your responses on additional sheets to these cover sheet.

- 1) Go to: <http://sealevel.jpl.nasa.gov/science/elinopdo/learnmoreninonina/>

This site provides more information about El Nino and La Nina observations made by NASA satellites.

Images of current and recent El Nino-La Nina conditions are available at

<http://sealevel.jpl.nasa.gov/science/elinopdo/latestdata/>

Read about and describe some of the concepts you have learned.

- 2) **Sustainable water resources** is one of the major problems facing the world in this century. **Drought** (unusually high dryness in a region) is another climate variable that can best be shown using color-coded maps.

Go to <http://droughtmonitor.unl.edu/> . Explore the website.

Also explore the resources at:

<http://www.climate.gov/news-features/decision-makers-toolbox/monitoring-drought>.

Then write 2 -3 paragraphs about what you have learned.

- 3) The American Meteorological Society provides a teacher enhancement course, **DataStreme Earth's Climate System**.

Explore some of the resources on the home page, <http://www.ametsoc.org/amsedu/ecs/home.html>, and describe what you learn.

- 4) Identify other suitable resources to understand climate patterns, and provide them to your teacher and class.