PATHWAYS to INQUIRY

Comparing the Effects of El Nino and LaNina

Adapted from: My NASA Data Lesson Plans
http://mynasadata.larc.nasa.gov/preview_lesson.php?&passid=99

Focus on Inquiry

The student will focus on inquiry by using the Internet to collect real satellite surface temperature and precipitation data of two locations that share the same latitude. The student will make predictions regarding these two locations, and then compare the data, look for patterns, and provide explanations for the findings.

Lesson Overview

The lesson requires the students to compare the effects of El Nino and La Nina at two different longitudinal locations, but at the same latitude, using sea surface temperature and precipitation from real satellite data.

Duration	Setting	Grouping	PTI Inquiry Subskills
2 50-minute class periods	Classroom/computer lab	Small groups of 2-3	**3.1, 3.3, 3.6, 3.8, 4.2, 4.3, 5.2, 5.3, 7.2, 7.3**

Lesson Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
Engage	10 minutes		Internet/ computer	1	Students interact in a class discussion about El Nino and La Nina.
Explore	40 minutes	3.1, 3.6, 3.8, 4.2, 4.3	Internet/ computer; Microsoft Excel (optional)	2	Students gather sea surface temperature and precipitation data on two locations that have the same latitude and create graphs and maps of each.
Explain	10-20 minutes	3.3, 4.2, 5.2, 5.3, 7.2, 7.3	Internet/ computer	3	Students analyze the resulting graphs on sea surface temperature and precipitation, make predictions, look for patterns, and develop explanations for the data.
Expand	10-20 minutes	5.3, 7.2, 7.3		3	Students compare and discuss graphs with one another and predict future climate changes.
Evaluate					Student answers to questions can be used as assessment.

Level of Student Engagement

1	Low	Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction
2	Moderate	Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance
3	High	Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered

National Science Education Standards – Inquiry
Use appropriate tools and techniques to gather, analyze and interpret data
Develop descriptions, explanations, predictions, and models using evidence
Think critically and logically to make the relationships between evidence and explanations
Communicate scientific procedures and explanations

National Science Education Standards – Earth Science
Global patterns of atmospheric movement influence local weather. Oceans have a major effect of climate, because water in the oceans holds a large amount of heat.

Louisiana Grade Level Expectations – Inquiry
Gr. 8, Inquiry GLE#6 - Select and use appropriate equipment, technology, tools, and metric system units of measurement to make observations (SI-M-A3)
Gr. 8, Inquiry GLE#9 – Use computers and/or calculators to analyze and interpret quantitative data (SI-M-A3)
Gr. 8, Inquiry GLE#11 – Construct, use, and interpret appropriate graphical representations to collect, record, and report data (e.g., tables, charts, circle graphs, bar and line graphs, diagrams, scatter plots, symbols) (SI-M-A4)
Gr. 8, Inquiry GLE#12 – Use data and information gathered to develop an explanation of experimental results (SI-M-A4)

Gr. 8, Inquiry GLE#13 – Identify patterns in data to explain natural events (SI-M-A4)
Gr. 8, Inquiry GLE#16 – Use evidence to make inferences and predict trends (SI-M-A5)
Gr. 8, Inquiry GLE#19 - Communicate ideas in a variety of ways (e.g., symbols, illustrations, graphs, charts, spreadsheets, concept maps, oral and written reports, equations) (SI-M-A7)
Gr. 8, Inquiry GLE#22 - Use evidence and observations to explain and communicate the results of investigations (SI-M-A7)

Louisiana Grade Level Expectations Earth Science
Gr. 8, GLE#25 - Explain and give examples of how climatic conditions on Earth are affected by the proximity of water (ESS-M-A11)
Gr. 8, GLE#26 – Describe and illustrate the layers of Earth's atmosphere (ESS-M-A11).
Gr. 8, GLE#27- Identify different air masses, jet streams, global wind patterns, and other atmospheric phenomena and describe how they relate to weather events, such as El Niño and La Niña

Materials List (per group)

- Computer with Internet and printer access
- Map of the United States showing latitude and longitude lines
- Microsoft Excel (optional)

Advance Preparation

1. Check to see that the browser being used is compatible with the Live Access Server (LAS) http://mynasadata.larc.nasa.gov/las/servlets/dataset and have this website already open on each group's computer before the activity begins.
2. Make sure the pop-up blocker is turned off on the computer's browser.
3. Make sure the students will be able to print their graphs from each computer.

Other Information
Learning Objectives

- Students will be able to obtain real sea surface temperature and precipitation data from satellite.
- Students will be able to create maps and line graphs of data. Students will be able to make comparisons and conclusions regarding the effects of El Nino and La Nina

Prior Knowledge Needed by the Students

- An Overview of El Nino and La Nina
- Understand latitude and longitude coordinates
- Familiarity with Microsoft Excel

Procedure

Engage

1. Generate a class discussion to access student's prior knowledge about El Nino and La Nina. Ask students how long the storm lasts and how often it occurs? When was the last El Nino storm? So when should it occur again?
2. An article can be found at http://www.oar.noaa.gov/k12/html/elnino2.html to read to students for background knowledge.

Explore

Part I: Compare the effects of ENSO in two different locations in the United States. Latitude: 37 degrees North, and Longitudes: 116 degrees West (California) and 99 degrees West (Kansas).

1. Provide the students with a map of the United States showing latitude and longitude lines. You can have them use MapQuest (http://atlas.mapquest.com/maps/latlong.adp) or print one from National Geographic (http://www.nationalgeographic.com/xpeditions/atlas/index.html?Parent=usofam&Rootmap=&Mode=d&SubMode=w).
2. Make sure all computers are connected to the Live Access Server (Armstrong). http://mynasadata.larc.nasa.gov/las/servlets/dataset.
3. Have the students follow the directions on the **Blackline Master 1** provided. Be sure pop-up windows are allowed on the computer's browser or else students will run into issues with viewing their results.

Part II: Make maps of sea surface temperature in the Pacific Ocean during El Nino and La Nina phases.
1. Have the students follow the directions on the **Blackline Master 1** provided. Be sure pop-up windows are allowed on the computer's browser or else students will run into issues with viewing their results.

Part III (Optional): To create a data table and graph of precipitation comparisons in Excel, have the students follow these directions:
1. Connect to the Live Access Server (Armstrong) http://mynasadata.larc.nasa.gov/las/servlets/dataset.
2. Select Atmosphere, then Precipitation, and then check the Monthly Precipitation (CMAP) box. Click Next.
3. Select View: Time Series, Select Output: ASCII file, and then to the right of the map, enter the latitude and longitude of the CA site. Click the "Go" button underneath these boxes.
4. Select time range Nov 1997 and Feb 1999 and then click next.
5. Click the "Your ASCII file" link from the pop up window.
6. Save the data to your desktop to import into Excel. (Go to File → Save As → Click the Desktop → then click Save.
7. Repeat steps 3 - 6 for the Kansas site.

   Excel Directions: *Note: These directions may vary based on the version of Excel you have.*

8. Open Microsoft Excel, create a new spreadsheet, and select Import or Get External Data under the Data menu. Click on Import Text File.
9. Use the Browse window to select the CA precipitation file on your desktop.
10. A Text Import Wizard window may appear. If prompted, select "Delimited" as the file type. Start the import at the headings row. Again if prompted, select "Space Delimited" and then click Finish. The data should now be neatly organized in the spreadsheet.
11. Delete all of the columns except the date and precipitation amounts columns.
12. Highlight these two columns labeled Date and Precipitation Amount. (They may or may not have a label).
13. Click the Insert option of the menu bar, and Select Chart.
14. A Chart Wizard may appear. Choose the XY Scatter plot with smooth connecting lines and no markers. Click Next or Finish. If prompted, you may enter a chart title and label the axis.
15. Repeat steps 8-14 for the second data file and graph.

   Here is a screenshot of what the file should look like as a guide.
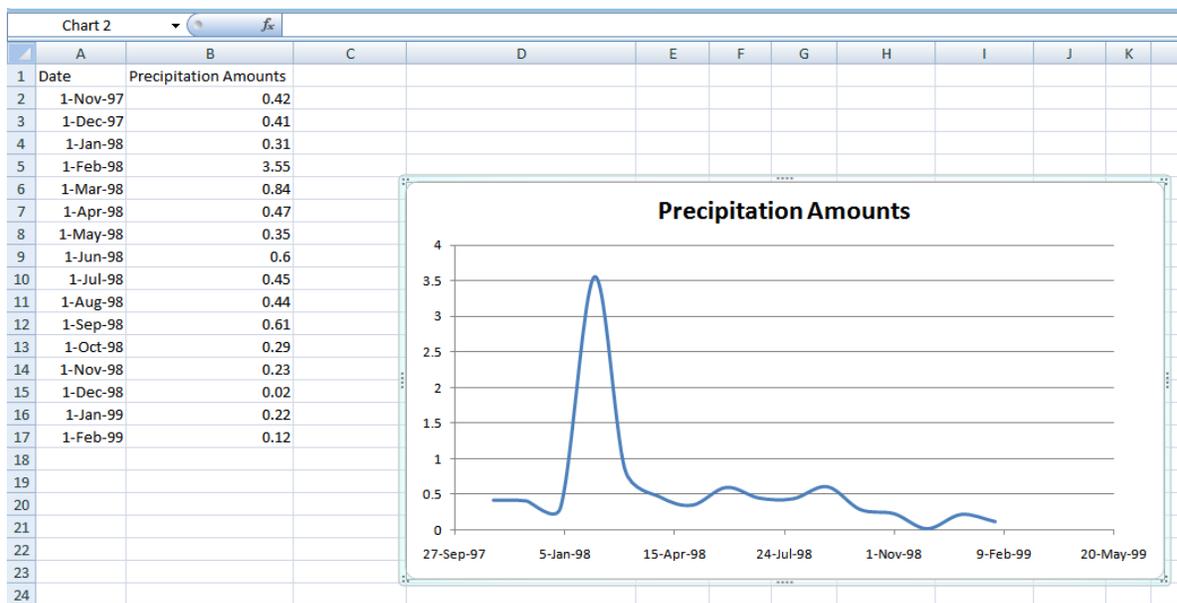
Explain
1. Have students answer the questions on the **Blackline Master 1** provided.

2. If you completed Part III of this activity, have your students use the Excel charts to assist them in answering the questions and have them compare their charts with other groups.

Expand
1. Have students compare their graphs and conclusions with students in other groups. Have them discuss how their findings are similar or different from the others.
2. How do you think any future climate change will affect the El Nino and La Nina phenomenon?
3. What information would you need to make this prediction?
4. How do you think this will affect the two comparison sites?

Evaluate
1. Student responses on the **Blackline Master 1** can be used as assessment.

Blackline Master
1. Comparing the Effects of El Nino and La Nina

Supplementary Resources
Teachers
Directions for using Excel can be found on the website.
See website for additional information.

Students
See website for additional information.

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Name: _____ Date: _____

Comparing the Effects of El Nino and La Nina

Procedure:

Part I: Compare the effects of ENSO in two different locations in the United States.

Location 1: Porterville, CA   Latitude: 37 N   Longitude: 116 W
Location 2: Hays, KS   Latitude: 37 N   Longitude: 99 W

1. With the provided U.S. map, locate and plot the latitudes and longitudes of the two selected locations above (Porterville, CA, and Hays, KS).
2. Within your group, predict similarities and differences in weather patterns over the past ten years of these two areas.

   Similarities: _____

   Differences: _____

3. Make an overlay line plot of precipitation using the Live Access Server (Armstrong). http://mynasadata.larc.nasa.gov/las/servlets/dataset.
4. On the website, first select Atmosphere, then Precipitation and then click the Monthly Precipitation (CMAP) box. Click Next.
5. Click the "Compare Two" tab on the left menu.
6. Select View: Time Series.
7. Select Output: Overlay Plot.
8. Click on variable 1 to the right of the map and enter the latitude and longitude of the CA site. Click "Go" underneath these boxes.
9. Then click on variable 2 and enter the latitude and longitude of the KS site. Note: For some reason, if you click "Go" the second time, it messes up the resulting graph and only shows one line. So, do not click "Go" this time.
10. Select the time range underneath the map to be Nov 1997 and Feb 1999. Click Next.
11. Look at the graph that appears in the popup window. If possible, print this graph. This will be your **Precipitation** graph.
12. Answer Questions 1-3 below.

Part II: Make maps of sea surface temperature in the Pacific Ocean during El Nino and La Nina phases.

1. To create sea surface temperature comparison maps, return to the Live Access Server (http://mynasadata.larc.nasa.gov/las/servlets/dataset).
2. On the website, first select Oceans, and then check Weekly Sea Surface Temperature (MCSST). Click Next.
3. Click the "Compare Two" tab on the left menu.
4. Select View: Longitude-Latitude map (xy).
5. Select output: Adjacent plots (GIFs only).
6. Select Region: Equatorial Pacific.
7. Enter dates: November, 1997, and February, 1999. Click Next.
8. Look at the graph that appears in the popup window. If possible, print this graph. This will be your **Sea Surface Temperature** graph.
9. Answer Questions 4-6 below.

Questions:

1. Analyze the **Precipitation** graph. Which line is California? Which line is Kansas?

   _____

   _____

2. In which location would you rather live based on the precipitation amounts? Why?

_____

_____

3. How accurate were your predictions of the similarities and differences of the precipitation between these two locations?

_____

_____

4. Analyze the **Sea Surface Temperature** graph. Which one is the El Nino phase and which one is the La Nina phase?

_____

_____

5. Write a paragraph comparing and contrasting the **Sea Surface Temperature** graph **(on a separate sheet of loose-leaf paper or using the space provided).**

6. Compare and contrast both sites and write a paragraph on your observations. Relate the observations to the ENSO phases **(on a separate sheet of loose-leaf paper or using the space provided).**