Real World Investigation 8-A

Skill Check

Initiating and Planning

✓ Performing and Recording

✓ Analyzing and Interpreting

✓ Communicating

Recognizing the Effects of El Niño and La Niña on Southern Canada

You may have heard a lot of news reports about how El Niño and La Niña events have affected weather worldwide. But how can the temperature of the ocean surface affect the climate several thousands of miles away? In this investigation, you will look at the specific effects of these events on the weather in southern Canada.

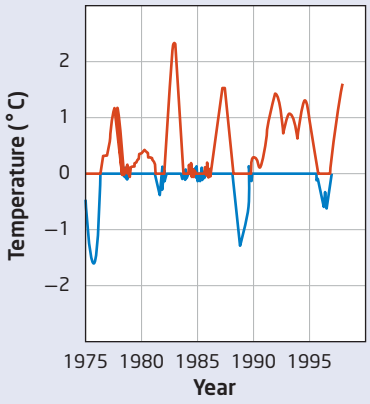
Materials

- graph paper
- coloured pencils (red and blue)

Question

How do El Niño and La Niña events affect weather in Canada?

Sample Graph



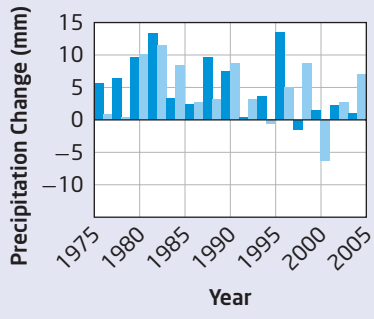
Organize the Data

1. Construct a graph like the sample graph shown on the left by plotting the data from the table on the next page.
2. Use red to colour areas of the curve above the 0°C line, and blue to colour areas of the curve below the 0°C line.

Analyze and Interpret

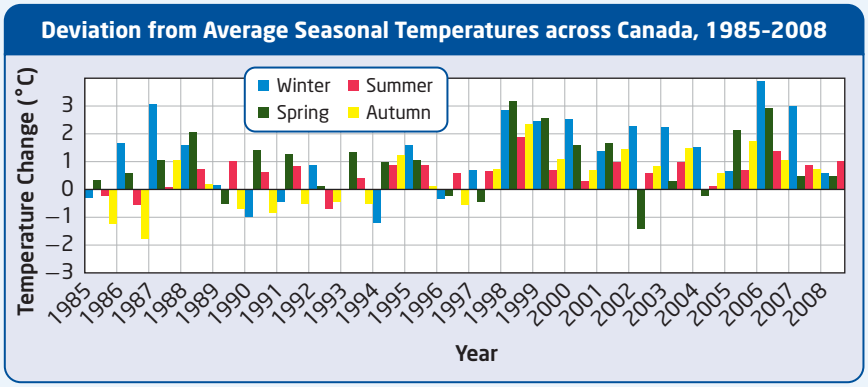
1. During El Niño events, the surface temperature of the ocean is more than 0.5°C higher than average. In what years did El Niño occur?
2. During La Niña events, the surface temperature of the ocean is more than 0.5°C lower than average. In what years did La Niña occur?
3. Which years were "normal" (non-event) years?
4. Examine the graphs below. What do they show? Use these graphs to answer the questions on the following page.

Precipitation Departures from Average in Canada, 1975-2005



Source: Environment Canada, 2003

Deviation from Average Seasonal Temperatures across Canada, 1985-2008



Source: Environment Canada, 2006

5. What temperature and precipitation trends in southern Canada are related to El Niño events?

6. What temperature and precipitation trends in southern Canada are related to La Niña events?

7. Based on the pattern in your graph, in what year do you think the next El Niño is likely to occur?

Conclude and Communicate

8. Describe how an increase in the surface temperature of the South Pacific Ocean can affect air currents moving over Canada.

9. Research major winter weather events, floods, and droughts in Ontario. Which of these events coincide with El Niño or La Niña events?

10. Write a summary paragraph that explains how knowledge of El Niño and La Niña events can benefit residents of Ontario.

Extend Your Inquiry and Research Skills

11. **Research** Research the term ENSO (El Niño–Southern Oscillation) and explain why climatologists and meteorologists use this term instead of "El Niño."

12. **Research** Research information about sea-ice anomalies, and compare the area covered by sea ice to the occurrence of El Niño and La Niña. What relationship, if any, exists between the amount of sea ice and whether one of these events is happening?

Deviation from Normal Temperature in the Equatorial Pacific Ocean (°C)

Year	March	June	September	December
1977	0.3	0.4	0.5	0.8
1978	0.0	-0.3	-0.4	-0.1
1979	0.1	0.0	0.3	0.6
1980	0.3	0.3	-0.1	0.0
1981	-0.4	-0.3	-0.2	0.0
1982	0.2	0.7	1.5	2.3
1983	1.6	0.7	-0.5	-0.7
1984	-0.2	-0.4	-0.2	-1.1
1985	-0.8	-0.6	-0.6	-0.4
1986	-0.3	0.0	0.6	1.2
1987	1.2	1.2	1.6	1.1
1988	0.1	-1.3	-1.3	-2.0
1989	-1.2	-0.4	-0.4	-0.1
1990	0.3	0.2	0.3	0.4
1991	0.3	0.8	0.9	1.6
1992	1.5	0.9	-0.1	0.3
1993	0.5	0.7	0.3	0.3
1994	0.2	0.4	0.7	1.3
1995	0.6	0.1	-0.5	-0.8
1996	-0.5	-0.2	-0.1	-0.4
1997	-0.1	1.3	2.2	2.5
1998	1.4	-0.1	-1.1	-1.5
1999	-0.9	-0.8	-1.0	-1.7
2000	-1.0	-0.6	-0.4	-0.7
2001	-0.4	0.1	0.0	-0.2
2002	0.2	0.8	1.1	1.4
2003	0.5	0.0	0.5	0.4
2004	0.2	0.4	0.9	0.8
2005	0.4	0.5	0.2	-0.8
2006	-0.3	0.3	0.7	1.1
2007	0.1	-0.1	-0.8	-1.4

Plan Your Own Investigation 8-B

Comparing Heat Absorption of Water and Soil

In this investigation, you will observe and analyze the temperature changes of soil and water when they absorb heat.

Skill Check

- ✓ Initiating and Planning
- ✓ Performing and Recording
- ✓ Analyzing and Interpreting
- ✓ Communicating

Safety Precautions

- Use heat-resistant gloves when touching the lamp.
- Do not let the lamp or its cord come in contact with the water.
- Ensure that the lamp is securely clamped.

Suggested Materials

- retort stand
- ruler
- 2 clear plastic containers
- overhead light with clamp
- 2 thermometers
- watch or clock
- water
- dark, dry soil
- masking tape

How do soil and water absorb heat differently?

Question

How does the amount of heat absorbed by water differ from the amount of heat absorbed by soil?

Hypothesis

Formulate a hypothesis about the ability of soil and water to absorb and release heat.

Plan and Conduct

1. Develop and record your hypothesis.
2. List the steps you will need to take to test your hypothesis. Include in your plan how you will safely use your equipment to compare the rates of heat absorption and release by soil and water. If it is available, use probeware to measure temperature changes.
3. Have your teacher approve your investigation method.
4. Conduct your investigation.
5. Create line graphs to represent your data. Show the rate of heat absorption and heat release for both soil and water.

Analyze and Interpret

1. Which material do you think absorbed the most energy? Explain your reasoning.

Conclude and Communicate

2. Did your results support or contradict your hypothesis? Explain your answer.
3. Based on your findings, predict how a large body of water might influence the climate of a region.

Extend Your Inquiry and Research Skills

4. **Inquiry** Design an experiment to test the heat absorption of snow and ice. Use the results of your experiment to explain the effect that glaciers and icecaps have on the climates of nearby regions.

Problem Solving Investigation 8-C

Skill Check

- ✓ Initiating and Planning
- ✓ Performing and Recording
- ✓ Analyzing and Interpreting
- ✓ Communicating

Safety Precautions

- Use caution when handling the lamp, since the light bulb will become very hot.

Suggested Materials

- 2 glass jars or transparent soft-drink bottles of the same size and shape
- light bulb socket with clamp
- 100 W light bulb
- ring stand with clamp
- 2 thermometers or temperature probes
- watch, stopwatch, or clock
- clear plastic wrap
- elastic band
- graph paper
- 2 small pieces of cardboard
- masking tape

Modelling the Greenhouse Effect

Earth would be uninhabitable by humans if not for the natural greenhouse effect. In this investigation, you will model the natural greenhouse effect.

Challenge

Design and build a model to simulate the natural greenhouse effect.

Design Criteria

1. You must use one container for a control and the other for the model simulating the greenhouse effect.
2. You need to use all of the materials listed to construct your model.
3. The control should be an open system, and the greenhouse effect container should model a closed system.
4. You must show a temperature difference between the control and the model after a 15 min trial.

Plan and Construct

1. Review the problem and materials. Decide how you will use the materials to model the greenhouse effect.
2. Have your teacher approve your plan.
3. Build your model and your control.
4. Conduct a 15 min trial, and observe and record your data.

Evaluate

1. Compare your temperature data from the model and the control.
2. In what ways was your model an accurate representation of the greenhouse effect? In what ways was your model an inaccurate representation of the greenhouse effect?
3. Share your design and results with a classmate. How could you refine your design to model the greenhouse effect more accurately?
4. Use your model to explain the anthropogenic greenhouse effect.

Extend Your Inquiry and Research Skills

5. **Inquiry** How could your design be modified to model the anthropogenic greenhouse effect?