

N.C. Standard Course of Study and Grade Level Competencies

Grade 7 – Competency Goal 3

The learner will make observations and build an understanding of weather concepts.

Objectives

3.05 Examine evidence that atmospheric properties can be studied to predict atmospheric conditions and weather hazards:

- Humidity.
- Temperature.
- Wind speed and direction.
- Air pressure.
- Precipitation.
- Tornadoes.
- Hurricanes.
- Floods.
- Storms.

Objectives

3.06 Assess the use of technology in studying atmospheric phenomena and weather hazards:

- Satellites.
- Weather maps.

Web Sites

For Teachers:

<http://www.elnino.noaa.gov/>

<http://www.pmel.noaa.gov/toga-tao/el-nino/>

<http://www.cdc.noaa.gov/>

<http://www.pmel.noaa.gov/>

<http://www.aoml.noaa.gov/>

<http://www.cpc.ncep.noaa.gov/>

<http://www.pbs.org/wgbh/nova/el-nino/>

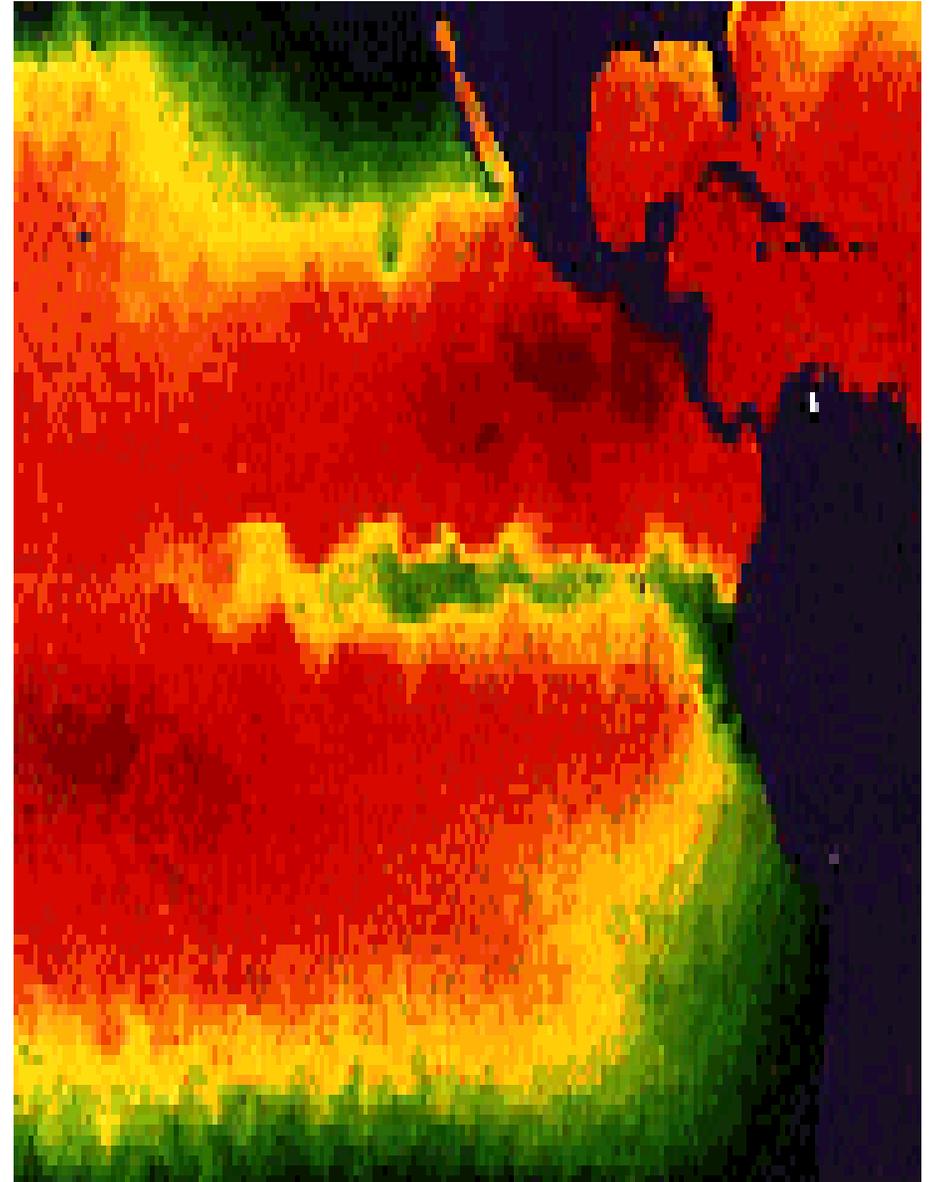
<http://www.ncdc.noaa.gov/oa/reports/febstorm/february98storms.html>

For Kids:

<http://www.oar.noaa.gov/K12/>

http://whyfiles.news.wisc.edu/050el_nino/1.html

El Niño



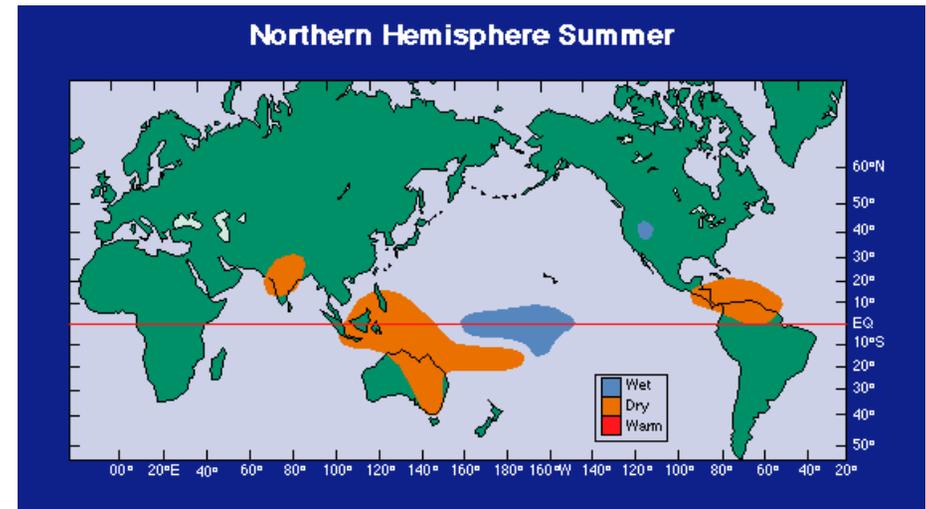
El Niño

Interesting Facts about El Niño

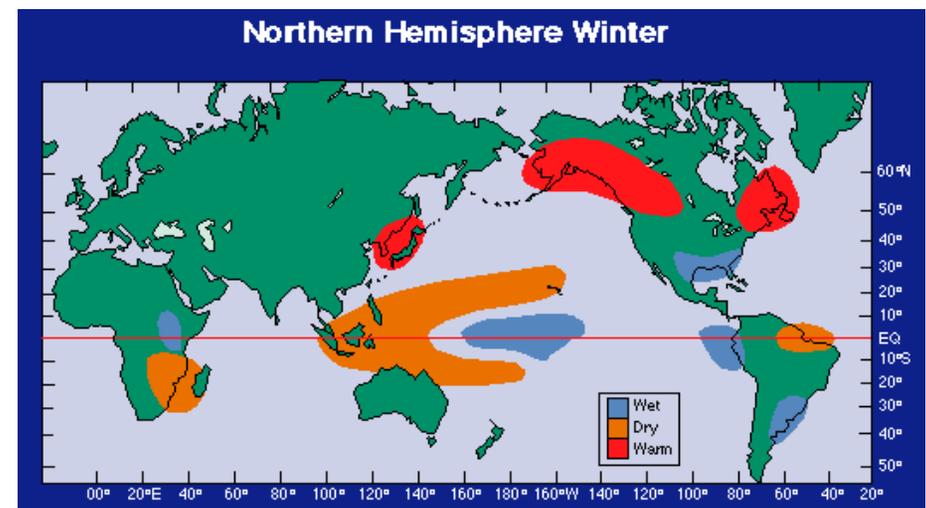
- In normal years, the cold water in the eastern Pacific Ocean off the coast of Peru and Ecuador is blown west by trade winds. As it makes its way toward Australia, it is warmed by the tropical sun. By the time it gets to the western Pacific, it is a few degrees warmer. The water warms the air above it, the air rises and created clouds that bring rain. During El Niño, the trade winds are weaker, the sea surface temperatures are warmer over the equatorial east pacific, and the rains shift from the western to the central Pacific.
- El Niño were originally recognized by fisherman off the coast of South America as the appearance of warm water in the far east Pacific Ocean, occurring near the beginning of the year, El Niño means “The Little Boy” in Spanish. This name was used for the tendency of the phenomenon to arrive around Christmas.
- Recent years in which significant El Niño events have occurred are 1957-1958, 1965-1966, 1972-1973, 1982-1983, 1986-1987, 1991-1992, and 1997-1998. The first year listed refers to the time the event first developed, typically in spring. The second year listed refers to the time of decay, typically summer. Every El Niño is somewhat different in magnitude and in duration.
- The El Niño of 1982-83 was responsible for the loss of near 2,000 lives and displacement of hundreds of thousands from their homes. The losses were caused by droughts and fires in Australia, Southern Africa, Central America, Indonesia, the Philippines, South America and India. There were floods in the USA, Peru, Ecuador, Bolivia and Cuba. More hurricanes than usual affected Hawaii and Tahiti.
- El Niño is now widely studied and its predictability has increased since climate researchers were caught off-guard by the 1982-1983 event. Once an El Niño gets going in late spring/early summer, it usually sticks around for at least 6 months.
- El Niño cycles cause a small fluctuation in the “length of day” (it gets longer), The reason this happens is that the entire Earth system (land, air, and water) must conserve its total angular momentum (related to the speed of rotation around the earth’s axis), like a spinning top, or a twirling ice skater. During El Niño, the average eastward speed of the winds around the globe increases. Since the angular

approximately \$500 million. The previous record for the highest tornado death toll in Florida history was 17 on March 31, 1962. The tornadoes were strong due to an abnormally strong jet stream with warm and humid air out ahead of the cold front. This is common in an El Niño pattern.

Global Consequences of El Niño



Global precipitation anomalies during El Niño in Summer



Global precipitation anomalies during El Niño in Winter

Analysis Questions:

1. Which are the two main parts of the Earth system involved in an El Niño?
2. Which wind belt is responsible for water moving across the Pacific?
3. In a normal year, which way do those winds blow?
4. In an El Niño year, what happens to those winds?
5. What happens to the upwelling of cool water during an El Niño?
6. When the cold water was added to the pan of hot water, what happened? Why?
7. What property of matter is the reason that the warm and cold water don't mix?
8. What does the hair dryer/fan represent?
9. What happens to the surface layer of water when the hair dryer is turned on?
10. Where does the cold water layer go when the surface layer moves?
11. When the hair dryer is turned off, what happens to the slope between the hot and cold water? Why?

California Flooding

During the month of February 1998, California was struck by a series of storms due in part to the effects of El Niño. The current estimated indicate over \$550 million in damages for the state, and 17 storm-related deaths for the winter. 35 counties were declared federal disaster areas. Clear Lake in northern California reached its highest level since 1909 and flooding portions of Lakeport about 90 miles of San Francisco.

Florida El Niño Outbreak

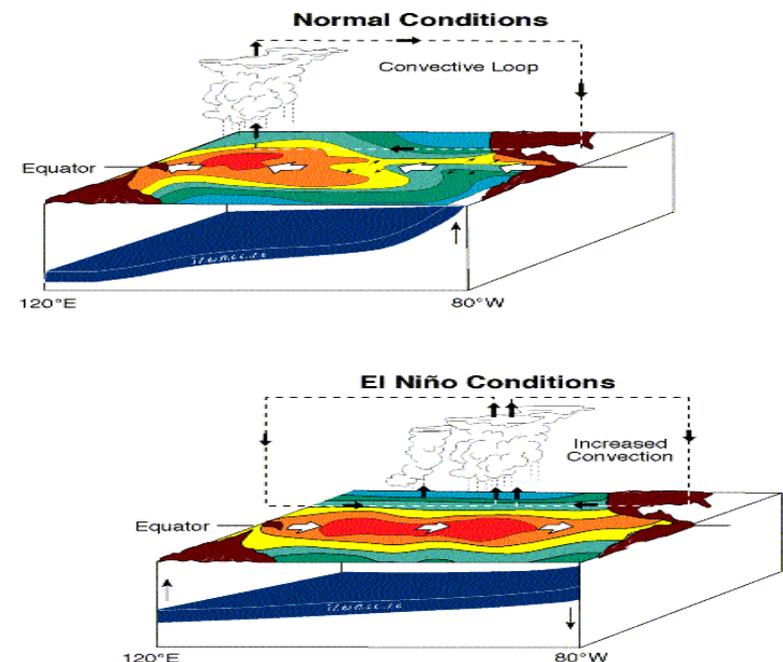
During the late evening of February 22 and early morning of February 23, 1998, seven tornadoes ripped across central Florida. One of the tornadoes reached an estimated F4 intensity. Forty-two people were killed and 260 injured. Damages from the tornado outbreak exceeded \$60 million, and Florida's overall storm damage total since last fall was

momentum of the air increases, the rotational speed of the solid earth must decrease, in compensation. Of course, the resulting increase in the length of the day is very small, but still quite important for applications such as global satellite positioning and navigation.

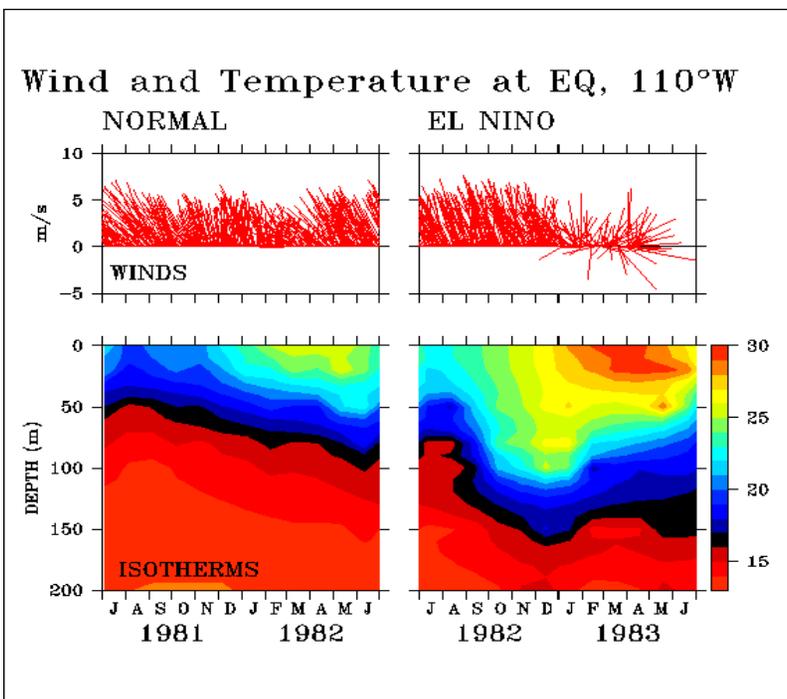
- Many different ecosystems are impacted due to El Niño. For example, the red kangaroo of Australia has adapted so well over time to the changes brought about by El Niño that it can put off reproduction until conditions are more favorable.
- Believe it or not, not everything about El Niño is bad: Temperature warming over North America in the winter is beneficial for consumers of energy; rain-bearing storms, when not severe, are beneficial; severe weather (i.e. tornadoes over the interior U.S. are reduced in El Niño springs.

What is an El Niño?

El Niño is a phrase now applied to the abnormal warming of the sea surface along the equator from South America to the Dateline. The phenomenon typically lasts 12-18 months, and occurs irregularly with a 4-7 year recurrence interval.



Schematic diagram of normal El Niño conditions in the Pacific Ocean.



Temperature on the Equator at 110 W

Build Your Own El Niño

Materials:

- Glass Pyrex loaf pan (or other glass pan approx. 4" deep)
- Hot water
- Red food coloring
- Cold water
- Blue food coloring
- A funnel
- Hair dryer or fan
- Container

Procedure:

1. Half-fill the glass loaf pan with **very** hot water. Add 3 drops of red food coloring to the water.

Note: Add more food coloring if using larger pan.

2. In a separate container, add 3 drops of blue food coloring to **very** cold water.
3. Using the funnel, slowly add the cold water to the bottom of the loaf pan until it is full.

- Observe how the hot and cold water do not mix.

Note: This represents a typical stratification of ocean temperatures with depth.

4. Direct a stream of air from the hair dryer (or fan) over the surface of the water.

- This sets up the conditions of a normal year, with no El Niño.

- As the air blows across the surface of the water, the hot water will move to the other side of the loaf pan.

- The cold water will rise to the surface near the fan, replacing the hot water.

- This represents the usual blowing of the winds that drive the warm water west to Australia.

5. Turn off the fan and watch the slope between the warm and cold water.

- Observe what happens to the water.

Note: In reality the ocean's water is not exactly half hot and half cold. The warm layer is really a very thin layer at the surface. While this model helps you to understand the process at work, it doesn't really give an accurate representation of El Niño. However, it provides a visual model to help understand what goes on between the ocean and the atmosphere during normal years and an El Niño event. For scientists to really understand what's happening in real life, they have to closely monitor the oceans and the atmosphere over a long period of time.