Ocean in Motion 7: El Nino and Hurricanes!

A. Overview

1. Ocean in Motion -- El Nino and hurricanes

We will look at the ocean-atmosphere interactions that cause El Nino and hurricanes. Using vocabulary and terms learned in the earlier broadcasts, we will briefly discuss the changes in the ocean and the atmosphere that must occur to cause these phenomenon. Consequences of each will be discussed. Materials for this broadcast were gathered from local television and radio stations. You might want to contact your local television station to obtain materials about El Nino and hurricanes, and their effects on your local weather patterns.

2. Contents of Packet

Your packet contains copies of the following activities:

I. Local El Nino effects.

II. Atlantic Hurricane Tracking Map.

B. Program Preparation

1. Focus Points

- What is El Nino?
  a. decreasing strength or reversal of trade wind direction
  b. weather pattern changes
  c. high and low pressure system changes
  d. influence on world climate
  e. result is drought and flooding
  f. opposite phenomenon is called a La Nina
- What is a Hurricane (Atlantic Ocean) or Typhoon (Pacific Ocean) or Cyclone (Indian Ocean)?
  a. strong storm with rain, wind and flooding
  b. formation of a hurricane
  c. devastating rain, and flooding
  d. giving a storm a name

2. Program preparation

Words to know:

El Nino- a change of pressure in a persistent high pressure cell is the Southeastern Pacific Ocean and a persistent low pressure cell over the East Indies

Typhoon- a severe tropical storm in the western Pacific

Hurricane- tropical cyclone in which winds reach velocities above 120 km/h

cyclonic- rotation of storms about a low pressure center in Northern Hemisphere, high pressure in Southern Hemisphere

Tropical storm- tropical cyclone having winds ranging between 48 to 121 kph or 30 to 70 mph

equator- zero degrees latitude circumscribing the earth dividing the Northern and Southern Hemisphere

anticyclonic- rotation of storms about which a high pressure system rotates in the N. Hemisphere, low pressure in S. Hemisphere

Cyclone- atmospheric disturbance characterized by masses of air rapidly circulating clockwise in the Southern, counterclockwise in the Northern Hemispheres about a low pressure center, usually accompanied by stormy, often destructive weather.

C. Showtime

1. Broadcast Topics

This broadcast will link into discussions about ocean-atmosphere interactions and their effects, changing weather patterns, and storm production.

a. Brief Review

We know that the ocean and the atmosphere are linked: the ocean gives heat and moisture to the atmosphere; winds move the ocean's surface currents. We have looked at some of the physical and chemical ways in which they interact. Now we will look at the major climatic impacts that these ocean-atmosphere interactions have on the world's ecosystems: El Nino and hurricanes.

b. El Nino

Normally in the Pacific Ocean, near the equator, there is cold water in the east, off the coast of South America (Peru). There is an area of warm water in the west, called the 'Warm Pool'. Over this warm pool region, there is a lot of evaporation, and consequently a lot of cloud formation and convection. In the atmosphere, the trade winds (in the tropics) blow from east to west. There is high pressure over Tahiti, and low pressure over Darwin, Australia.

During El Nino conditions, the trade winds stop blowing, or even reverse direction. The water off Peru becomes warmer. The water in the Warm Pool becomes cooler. The areas of rainfall also change; normally where it rains, it is now dry (droughts); normally where it is dry, there is now a lot of rainfall (floods). The high pressure over Tahiti becomes lower, and the low pressure over Darwin gets higher. This phenomenon affects the world climate, because the atmospheric pressure patterns have changed.

The opposite extreme is called La Nina. In this case, the water off Peru gets colder than usual. The high pressure areas get higher, the low pressure areas get lower. The trade winds from east to west get stronger. The dry areas of the world are drier, and the wet areas of the world are wetter.

c. Hurricanes

Hurricanes and typhoons are tropical cyclones in which winds reach constant speeds of 74 miles per hour or more, and blow in a large spiral around a relatively calm center. This is known as the eye of the hurricane. Every year, these violent storms bring destruction to coastlines and islands in their erratic paths. Some hurricanes become severe, while others do not.

Stated very simply, hurricanes are giant whirlwinds in which air moves in a large tightening spiral around a center of extreme low pressure. In the northern hemisphere the air spins in a cyclonic (counter-clockwise) direction. In the southern hemisphere, the air spins anti-cyclonically (clockwise). The intensification of the weak circulation causes moisture-rich air at the sea surface to move toward the storm center. The strengthening storm extracts large amounts of water vapor from the ocean. As the water vapor rises near the center, it cools and condenses; and air is drawn toward the center, contracting the storm and further spinning up the winds. Once cut off from the warm ocean, the storm begins to die, starved for water and heat energy, and dragged apart by friction as it moves over the land.

Hurricane winds do much damage, but drowning is the greatest cause of hurricane deaths. As the storm approaches and moves across the coastline, it brings huge waves, and storm tides which may reach 25 feet or more above normal. The rise may come rapidly, flooding coastal lowlands. The torrential rains that accompany the hurricane produce sudden flooding as the storm moves inland.

If a storm develops rotary circulation and wind speeds above 39 miles per hour it is classified a tropical storm. The National Hurricane Center, near Miami, FL., gives the storm a name and follows its development. Not all storms become hurricanes, but naming them greatly reduces confusion when two or more tropical storms occur at the same time. When the winds reach a speed of 74 miles per hour (118 kph), it is classified as a hurricane, typhoon, or cyclone depending on its location. Men's and women's names are included in the list of short, distinctive names used to identify hurricanes. The advantage to naming storms is important in exchanging detailed storm information between hundreds of widely scattered stations, airports, coastal bases, and ships at sea.

D. Activities

I. Local El Nino Effects

Materials: Old newspapers or news magazines from the past few months.

Objective: Study local El Nino effects.

Method: Looking at newspaper articles over the past few months, or surfing the web, find different ways in which this year's El Nino has effected your local area. Discuss these in class.

Teacher's notes for Classroom Discussion

This activity can include a wide variety of topics. Different weather than usual is one of the effects, for example, less hurricanes this year. Other ways in which people have been affected could be changes in the price of food items, because a flood or drought has destroyed the crops. This could lead in to a discussion on economics. There are many web sites that discuss El Nino. A good start is the El Nino Theme Page, at:

http://www.pmel.noaa.gov/toga-tao/el-nino/home.html

To investigate the impacts of the El Nino, try:

http://www.pmel.noaa.gov/toga-tao/el-nino/impacts.html

II. Atlantic Ocean Hurricane Tracking Map

Materials:

- Copy of Hurricane Tracking Map
- Pencil
- Access to national weather coverage

Objective: To follow the progressive movement of hurricanes

Method: Follow the daily coverage of the path of a hurricane. Mark the locations (latitude and longitude) the weather person states for the hurricane. Follow storm until it dissipates.

Teacher's Guide for Classroom Discussion:

This activity is will be very useful to have the students put lecture to use; using the latitude and longitude of the storm. You might also want to track the hurricane and discuss different categories of individual hurricanes and the characteristics of each.

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