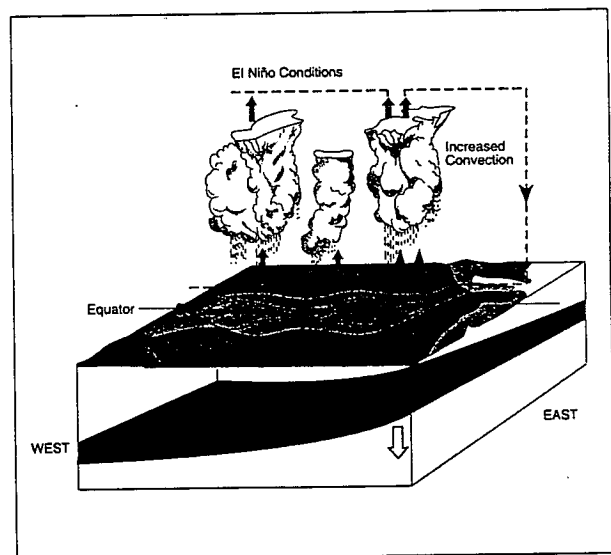## Science Reading Selection: EL NIÑO

Introduction: Every 3-5 years in the months of December and January, fish in the coastal waters off of western South America virtually vanish, causing the fishing industry to come to a stand still. South American fishermen who work the waters off of Peru and Ecuador have known about this phenomenon for centuries. They have given this event the name "El Niño", Spanish for "The Child", because it occurs around the Christmas holiday.

The key element of the El Niño phenomenon is the interaction between the winds in the atmosphere and the surface of the ocean. Without this interaction, El Niño would not occur. In a normal year, the trade winds blow from east to west across the Pacific, dragging the warm surface water to the west across the ocean. This causes an "upwelling" of cold, deep ocean water to rise to the surface off the coast of South America, bringing with it the nutrients that would otherwise lie near the ocean floor. The fish population of the region depends on these nutrients for survival. During an El Niño, the westward trade winds weaken, causing the upwelling of deep water to cease. The consequent warming of the ocean surface further weakens the trade winds and strengthens El Niño. Without upwelling, the nutrients from the deep ocean are no longer available and the fishing industry comes to a halt until the time that conditions return to normal.
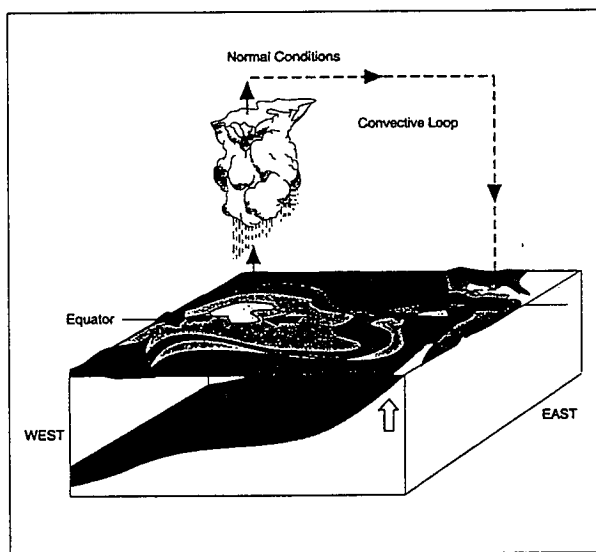
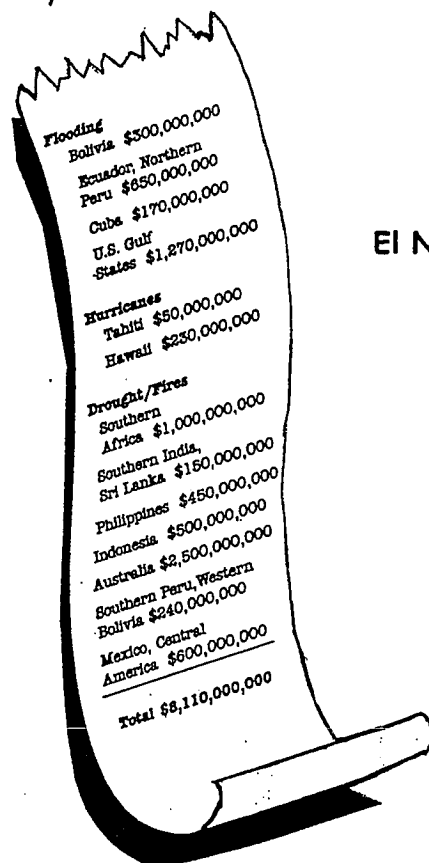**Normal conditions over the Pacific Basin**   **Disturbed conditions during El Niño**

Effects of El Niño are not limited to the regions off Peru and Ecuador. They are transmitted long distances and can cause major disruptions in the normal climate, resulting in tragic societal and economic consequences. Drought related fires in Borneo and Australia, unusual flooding in Texas and intense storms along the east coast and the Rocky Mountain region of the United States are all outgrowths of El Niño.

The prediction of El Niño is now the focus of major scientific investigation requiring sophisticated computer models which are able to simulate: 1) changes in the ocean surface temperature, 2) changes in atmospheric convection and clouds due to surface warming, and 3) changes in surface winds as a result of convective disturbances. The societal impacts of successfully forecasting El Niño up to a year in advance are huge, allowing agricultural and economic policy makers to adapt to these short term climate fluctuations in a beneficial way.

Australia, Ethiopia, Brazil, India and Peru are already successfully using predictions of EL Niño in connection with agricultural planning. It is not a coincidence that all these countries lie at least partially within the tropics. Tropical countries have the most to gain from successful prediction of El Niño because they experience a disproportionate share of the impacts. They also occupy the part of the world where the accuracy of climate prediction models is greatest. For many countries outside the tropics, such as Japan and the U.S., more accurate prediction of El Niño will also benefit strategic planning in such areas as agriculture, and the management of water resources and reserves of grain and fuel oil.

Encouraged by the progress made in the past decade, scientists and governments of many countries are working together to design an build a global system for: (1) observing the tropical oceans, (2) predicting El Niño and other irregular climate rhythms, and (3) making routine climate predictions available to those who need them for planning purposes, much as weather forecasts are made available to the public today. The ability to anticipate how climate will change from one year to the next will lead to better management of water supplies, agriculture, fisheries and other resources. By incorporating climate predictions into management decisions, humankind is becoming better adapted to the irregular rhythms of climate.

El Niño Impacts

Flooding
Bolivia $300,000,000
Ecuador, Northern
Peru $650,000,000
Cuba $170,000,000
U.S. Gulf
States $1,270,000,000

Hurricanes
Tahiti $50,000,000
Hawaii $230,000,000

Drought/Fires
Southern
Africa $1,000,000,000
Southern India,
Sri Lanka $150,000,000
Philippines $450,000,000
Indonesia $500,000,000
Australia $2,500,000,000
Southern Peru, Western
Bolivia $240,000,000
Mexico, Central
America $600,000,000

Total $8,110,000,000

Science Reading Selection: EL NIÑO

READING COMPREHENSION ACTIVITIES

PART I: VOCABULARY

1. Give the meaning of each of the terms below in a simple sentence:

a. phenomenon   e. consequence

b. interaction   f. climate prediction

c. upwelling   g. computer model

d. nutrients   h. global system

PART II: CRITICAL THINKING

1. Give as many reasons as possible supporting the idea of El Niño as a natural climate event.

2. Create a simple drawing of the cycle of events that make up and El Niño. Use arrows, etc.

3. What type of feedback mechanism would you consider increased sea surface temperature, positive or negative? Explain.

4. Why could it be said that climate change will have a greater impact on the developing countries than on the developing countries? (HINT: Refer to the list of El Niño impacts.)

PART III: PROBLEM SOLVING: Create a map of the world showing the locations of the major El Niño Impacts from the 1982 event and the costs incurred by each.
- Label the countries.
- Indicate the amount and type of damage done.
- Color in the countries affected.