Check Your Understanding

1. Why is the climate along the Peruvian coast of South America very dry during normal, non–El Niño times?
2. How do southerly winds along the coast of Peru cause upwelling there?
3. Why are the ocean surface waters along the Peruvian coast of South America unusually warm during an El Niño event, even though upwelling still operates?

Pacific form a coupled system. The system can exist in two different states, and perhaps some minor "trigger" can flip the system from one state to the other. Much more research is needed before geoscientists have a full understanding of El Niño.

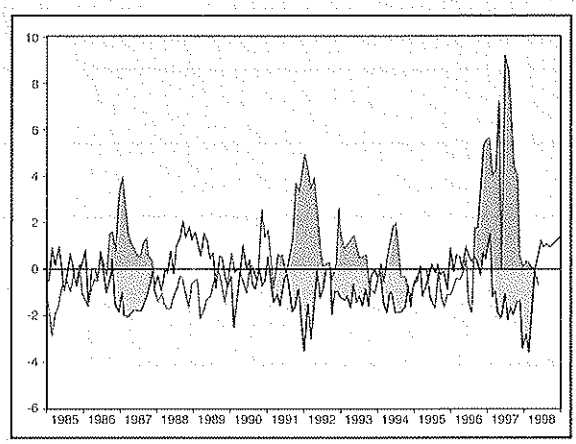
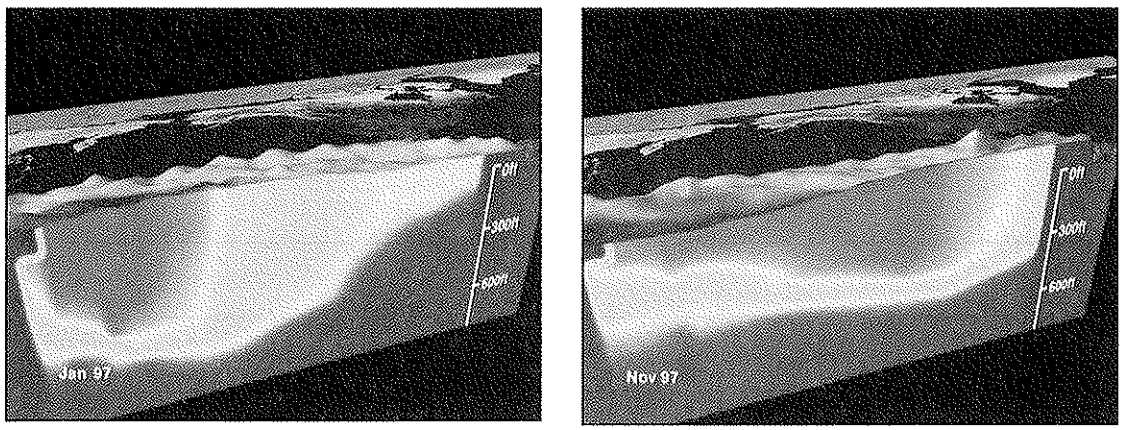


Figure 4 The red line gives sea surface temperature anomalies at Puerto Chicama, Peru, an indicator of El Niño. The blue line represents the Southern Oscillation Index (SOI) that is the difference in sea-level pressure between Darwin, Australia and Tahiti. Major El Niño events are shaded in.

Understanding and Applying What You Have Learned



The images shown are cross sections of the equatorial Pacific Ocean. Red indicates warmer water temperature, and blue indicates colder water temperature. The January 1997 image represents "normal" non–El Niño conditions, while the November 1997 image illustrates El Niño conditions.

1. Under non–El Niño conditions:
   a) What happens to deep water at the eastern boundary of the Pacific Ocean (around 80° W longitude)?
   b) Are there places where deep water is exposed to conditions on the ocean surface?
   c) Are deep water circulation and surface water circulation interconnected in certain places? Why or why not?
   d) In which direction does the surface wind blow at the Equator?
   e) What explains the westward spread of cold surface water off the coast of North and South America?
2. Under El Niño conditions:
   a) How do deep circulation patterns change in the equatorial Pacific Ocean?
   b) Are the surface water temperatures along the eastern boundary of the equatorial Pacific Ocean warmer or colder during an El Niño event? Why?
   c) In which direction does the surface wind blow at the Equator?
   d) What happens to the location of the warm surface water during El Niño?

Preparing for the Chapter Challenge

Meet with your group and decide which area of your **Chapter Challenge** could be strengthened with more information. Keep in mind that you will be examining the effects of El Niño on weather, climate, and the food chain in upcoming activities. Visit the *EarthComm* web site to find Internet sites where you can pose your questions to a scientist.

Inquiring Further

1. **Technology used to study ocean–atmosphere interactions**

   How do scientists collect the data you studied in this activity? To learn more about the instruments scientists use to help them better understand El Niño events, visit the *EarthComm* web site to investigate the following El Niño research projects:

   - TOPEX/Poseidon
   - TAO (Tropical Atmosphere Ocean Project)

2. **La Niña**

   What is La Niña? What are the impacts of a La Niña event? How are they different from an El Niño event? Which do you think affects your community more?