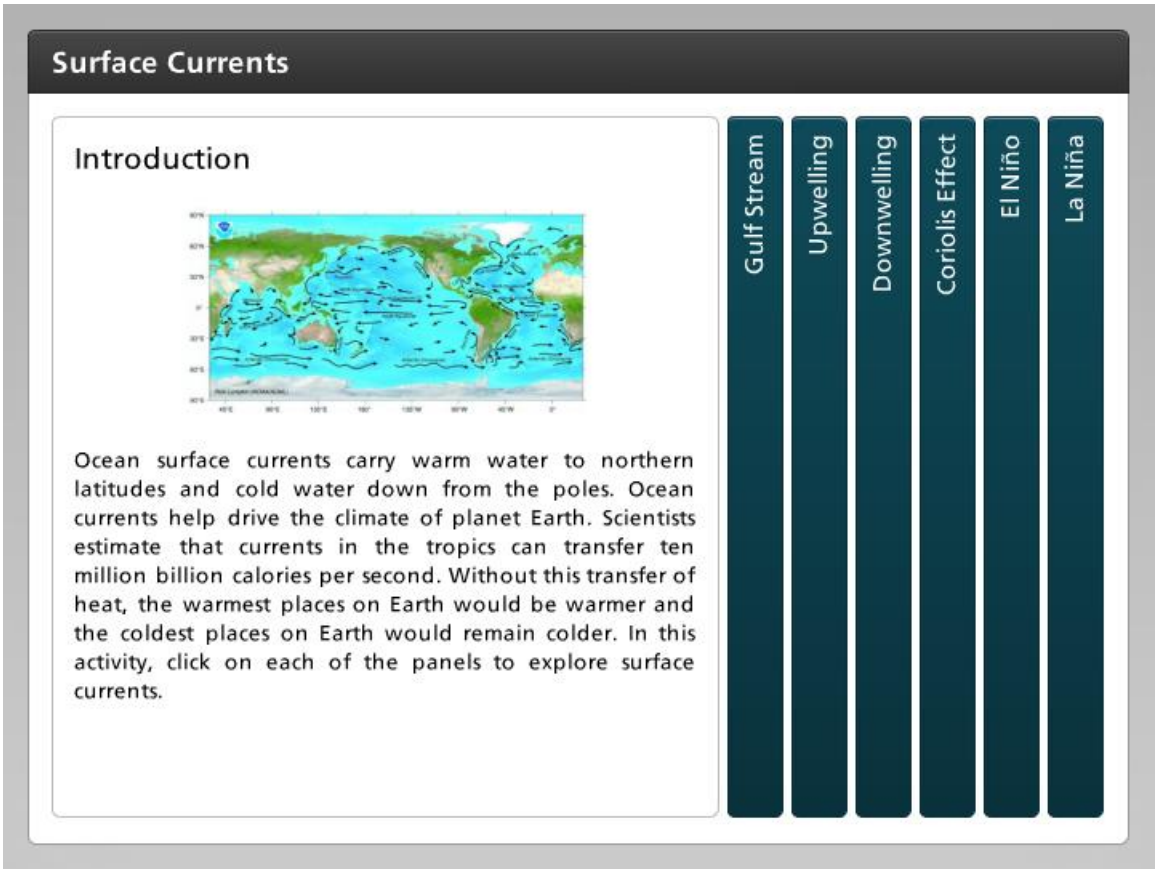
Module 12: Oceanography
Topic 3 Content: Surface Currents Notes

Introduction



Ocean surface currents carry warm water to northern latitudes and cold water down from the poles. Ocean currents help drive the climate of planet Earth. Scientists estimate that currents in the tropics can transfer ten million billion calories per second. Without this transfer of heat, the warmest places on Earth would be warmer and the coldest places on Earth would remain colder. In this activity, click on each of the panels to explore surface currents.

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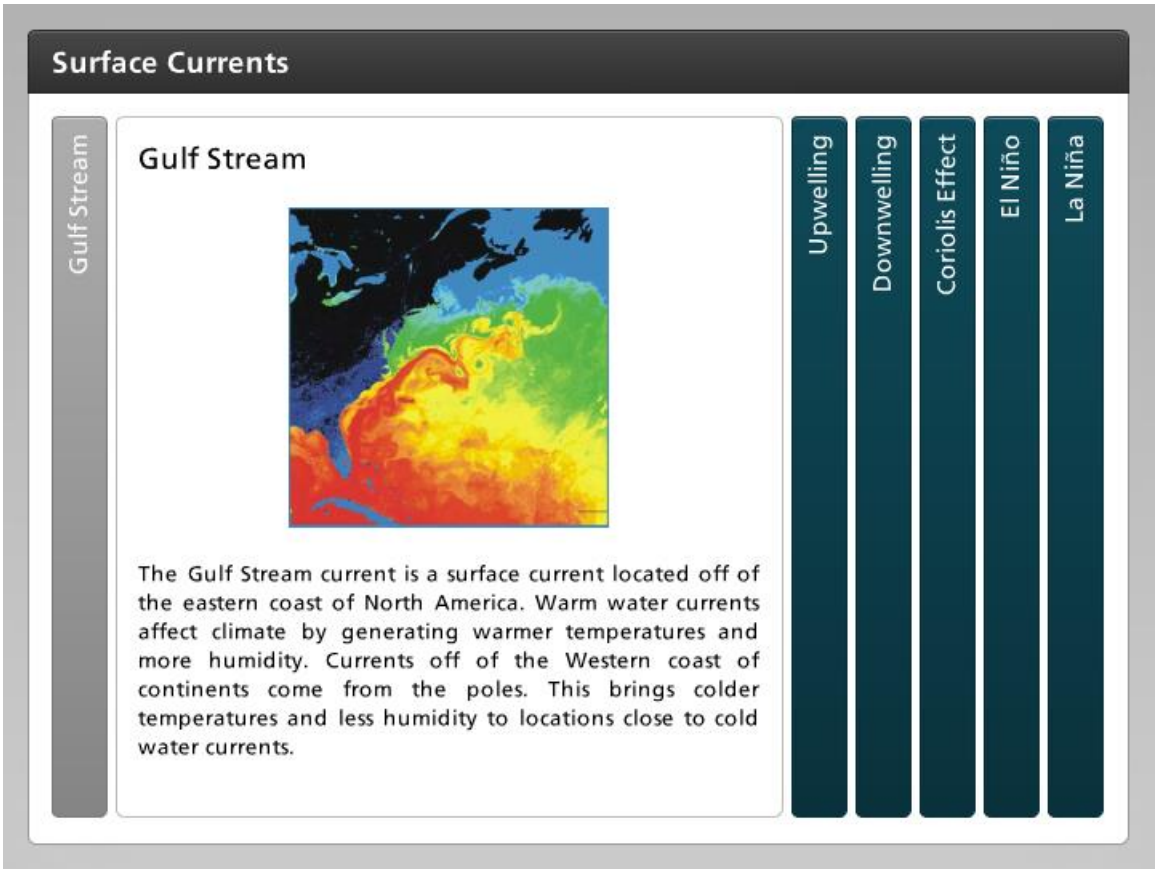
Gulf Stream



The Gulf Stream current is a surface current located off of the eastern coast of North America. Warm water currents affect climate by generating warmer temperatures and more humidity. Currents off of the Western coast of continents come from the poles. This brings colder temperatures and less humidity to locations close to cold water currents.

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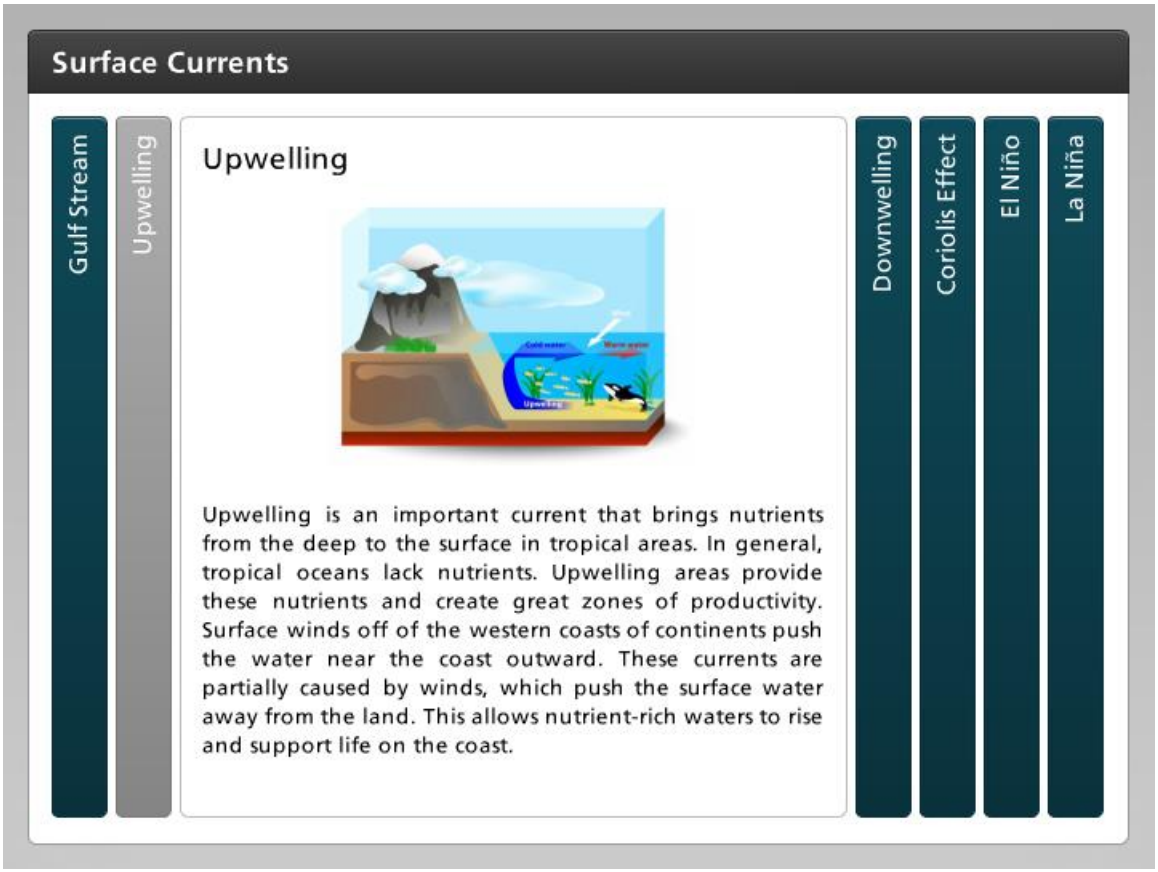
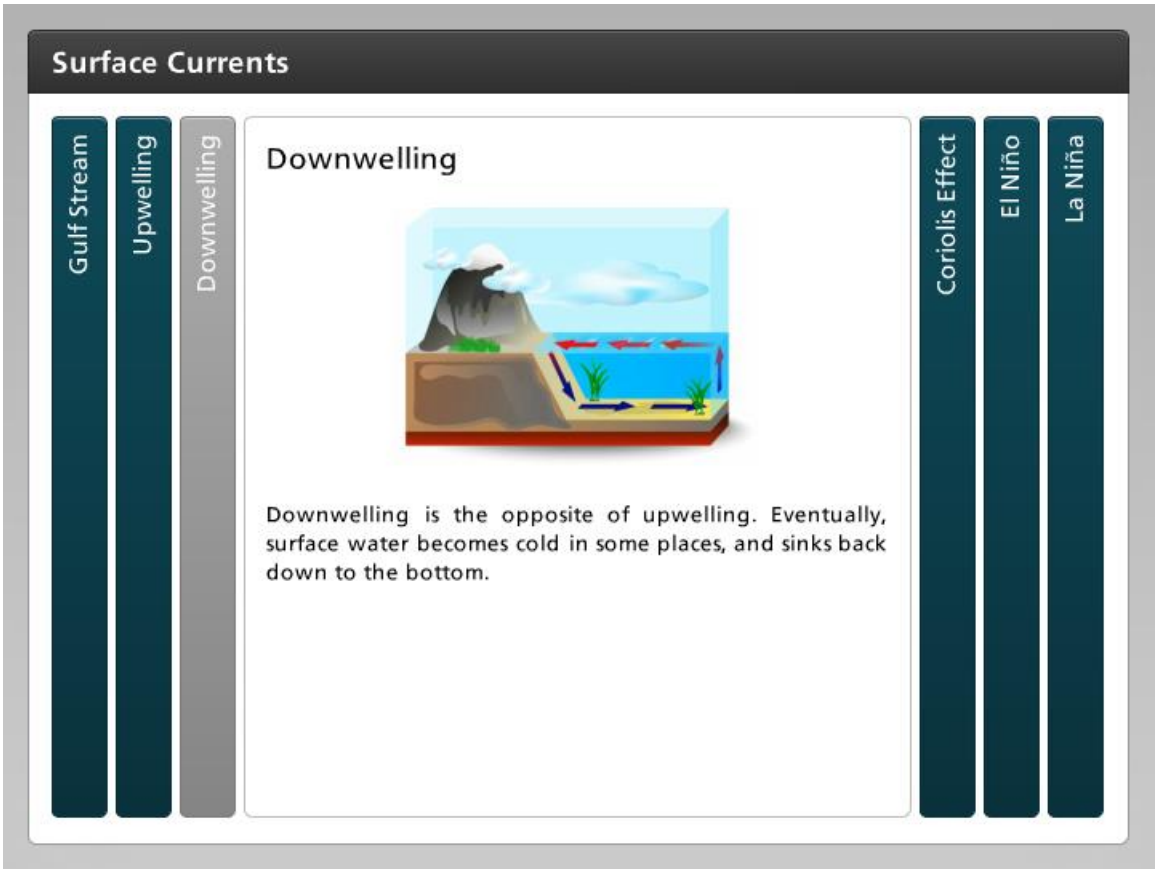
Upwelling



Upwelling is an important current that brings nutrients from the deep to the surface in tropical areas. In general, tropical oceans lack nutrients. Upwelling areas provide these nutrients and create great zones of productivity. Surface winds off of the western coasts of continents push the water near the coast outward. These currents are partially caused by winds, which push the surface water away from the land. This allows nutrient-rich waters to rise and support life on the coast.

Downwelling



Downwelling is the opposite of upwelling. Eventually, surface water becomes cold in some places, and sinks back down to the bottom.

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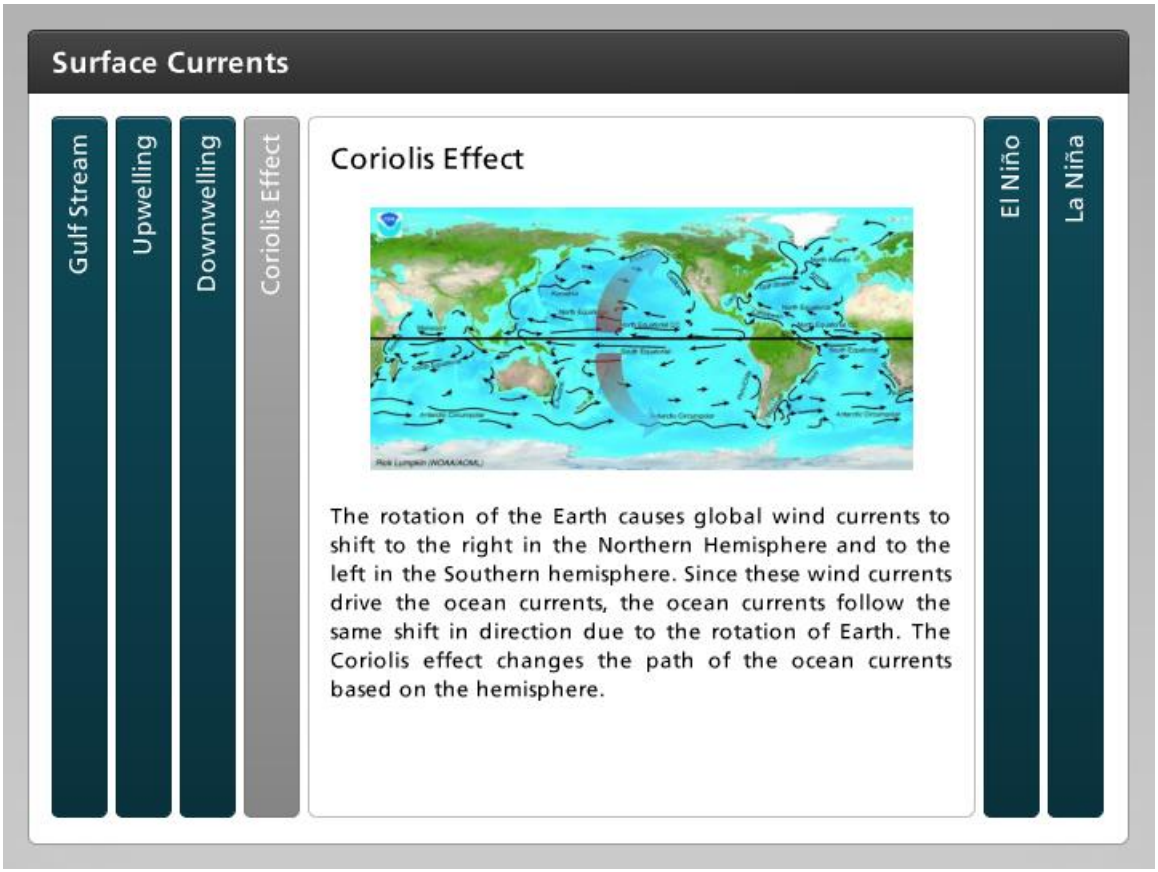
Coriolis Effect



The rotation of the Earth causes global wind currents to shift to the right in the Northern Hemisphere and to the left in the Southern hemisphere. Since these wind currents drive the ocean currents, the ocean currents follow the same shift in direction due to the rotation of Earth. The Coriolis effect changes the path of the ocean currents based on the hemisphere.

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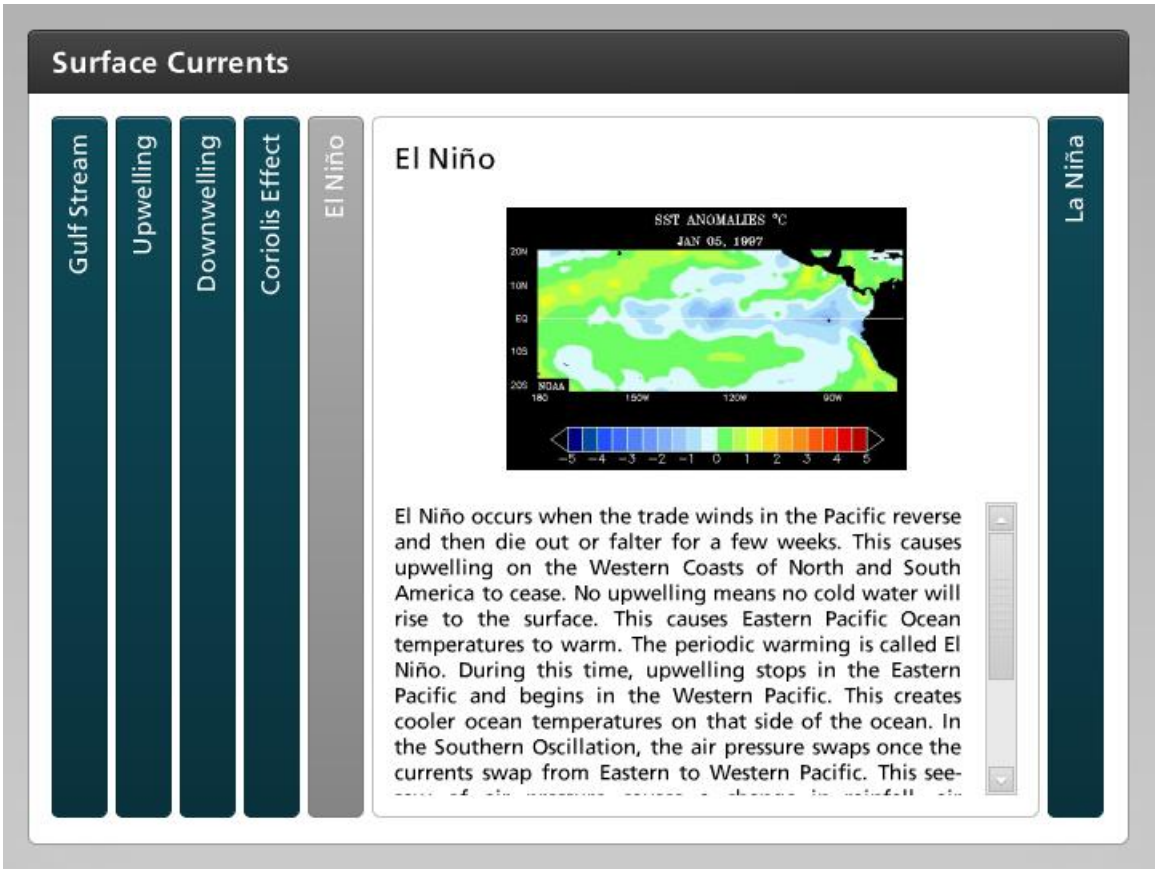
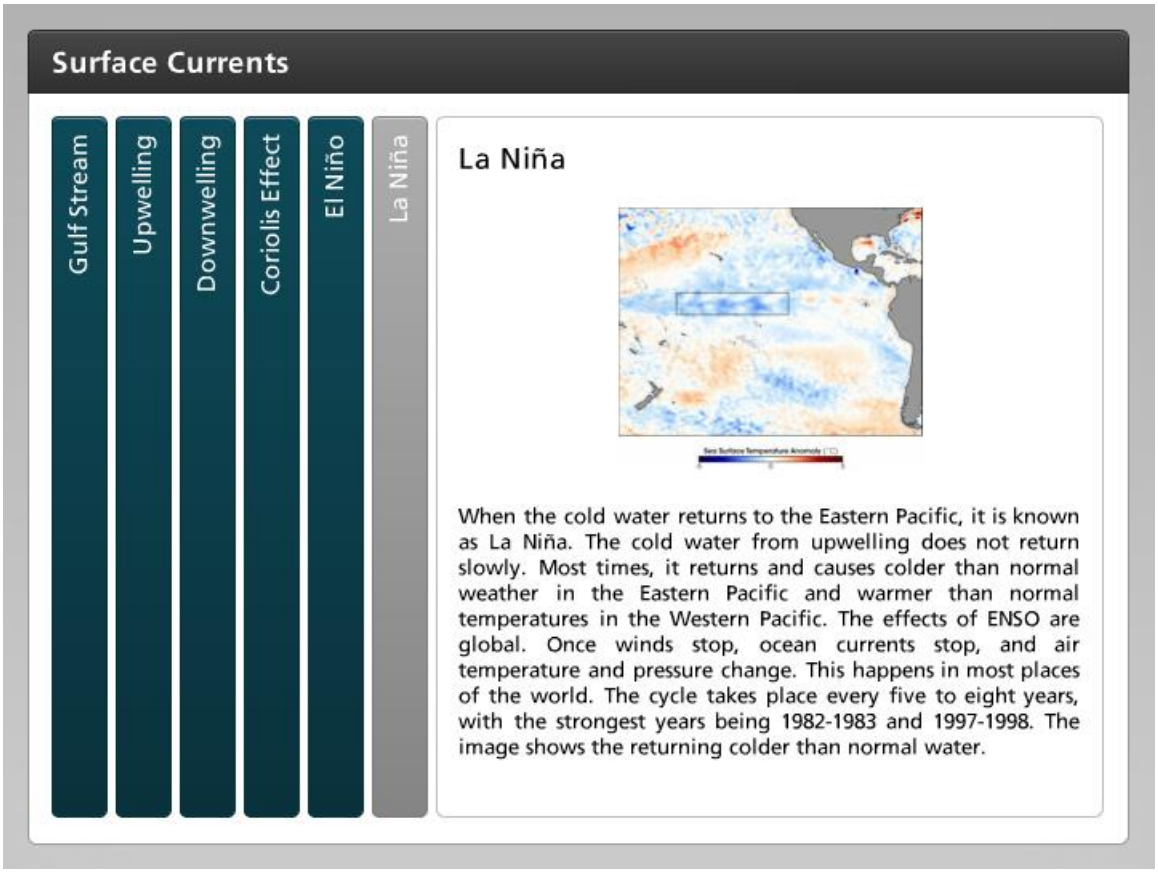
El Niño



El Niño occurs when the trade winds in the Pacific reverse and then die out or falter for a few weeks. This causes upwelling on the Western Coasts of North and South America to cease. No upwelling means no cold water will rise to the surface. This causes Eastern Pacific Ocean temperatures to warm. The periodic warming is called El Niño. During this time, upwelling stops in the Eastern Pacific and begins in the Western Pacific. This creates cooler ocean temperatures on that side of the ocean. In the Southern Oscillation, the air pressure swaps once the currents swap from Eastern to Western Pacific. This see-saw of air pressure causes a change in rainfall, air temperature, and air movement over the Pacific Ocean. Since both El Niño and the Southern Oscillation are connected to each other, scientists group them together with the acronym ENSO, which stands for El Niño and the Southern Oscillation. The image shows the changing sea surface temperatures caused by El Niño.

La Niña



When the cold water returns to the Eastern Pacific, it is known as La Niña. The cold water from upwelling does not return slowly. Most times, it returns and causes colder than normal weather in the Eastern Pacific and warmer than normal temperatures in the Western Pacific. The effects of ENSO are global. Once winds stop, ocean currents stop, and air temperature and pressure change. This happens in most places of the world. The cycle takes place every five to eight years, with the strongest years being 1982-1983 and 1997-1998. The image shows the returning colder than normal water.