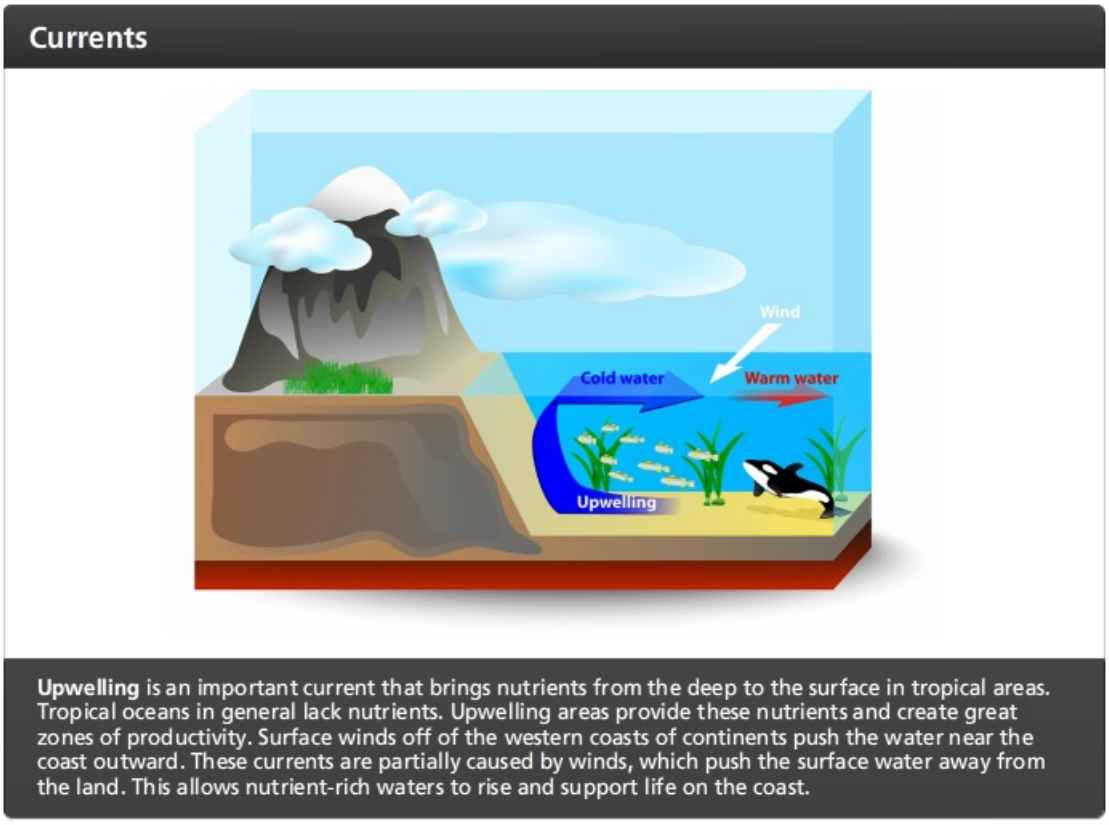
Module 7: Ocean Motion
Topic 1 Content: Currents Notes



Upwelling is an important current that brings nutrients from the deep to the surface in tropical areas. Tropical oceans in general 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.

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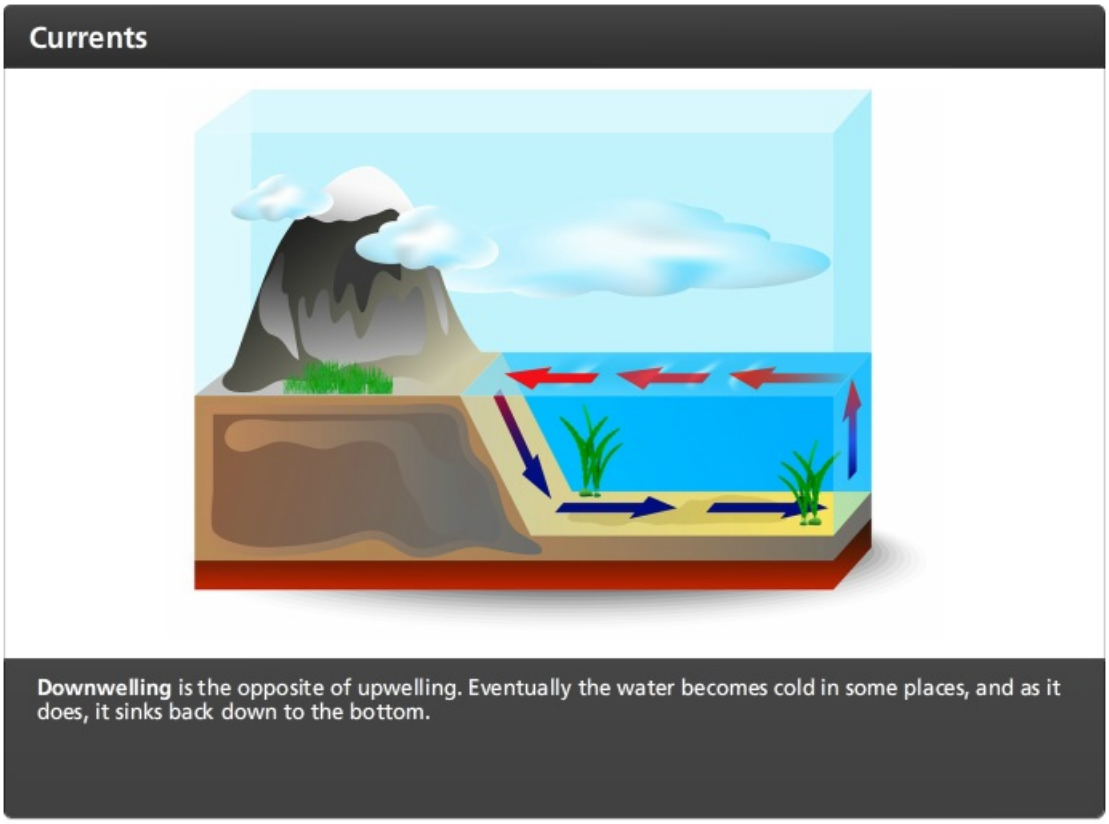

Downwelling is the opposite of upwelling. Eventually the water becomes cold in some places, and as it does, it sinks back down to the bottom.

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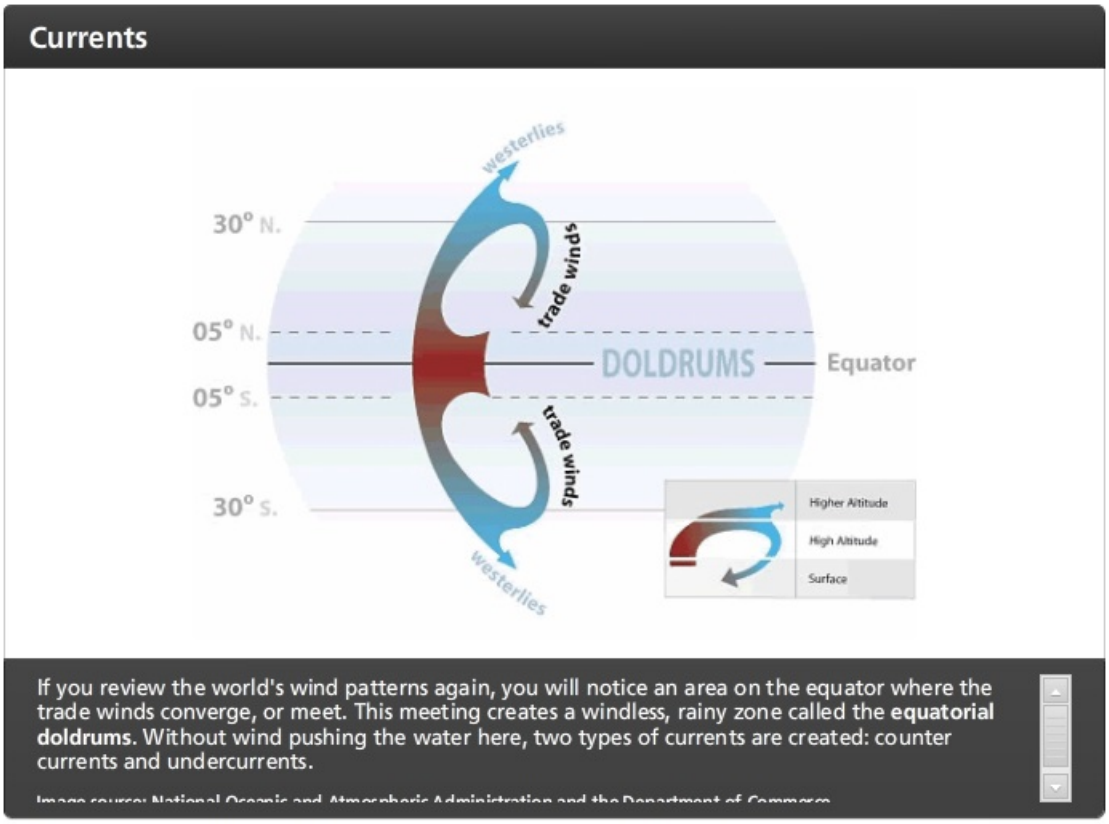

If you review the world's wind patterns again, you will notice an area on the equator where the trade winds converge, or meet. This meeting creates a windless, rainy zone called the equatorial doldrums. Without wind pushing the water here, two types of currents are created: counter currents and undercurrents.

Image source: National Oceanic and Atmospheric Administration and the Department of Commerce

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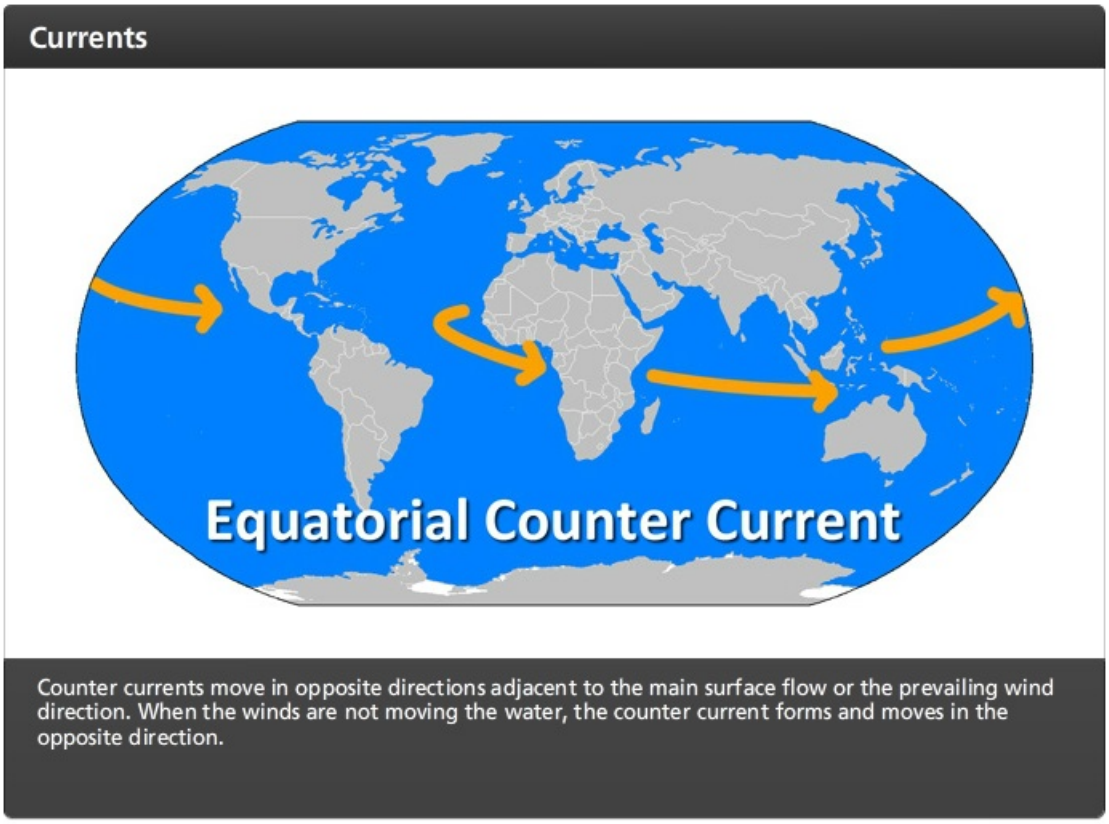

Counter currents move in opposite directions adjacent to the main surface flow or the prevailing wind direction. When the winds are not moving the water, the counter current forms and moves in the opposite direction.

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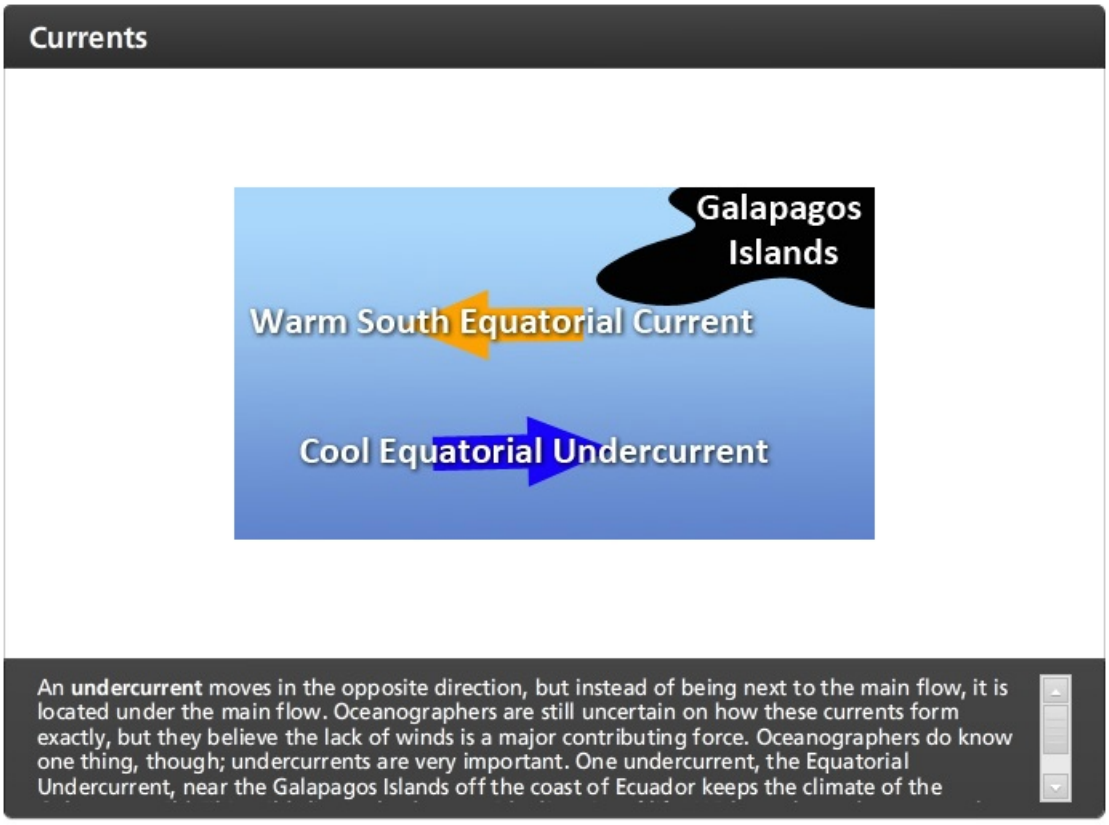

An undercurrent moves in the opposite direction, but instead of being next to the main flow, it is located under the main flow. Oceanographers are still uncertain on how these currents form exactly, but they believe the lack of winds is a major contributing force. Oceanographers do know one thing, though; undercurrents are very important. One undercurrent, the Equatorial Undercurrent, near the Galapagos Islands off the coast of Ecuador keeps the climate of the Galapagos mild. This mild climate leads to a wide diversity of life! Without the undercurrent, the Galapagos Islands would be much warmer and tropical!

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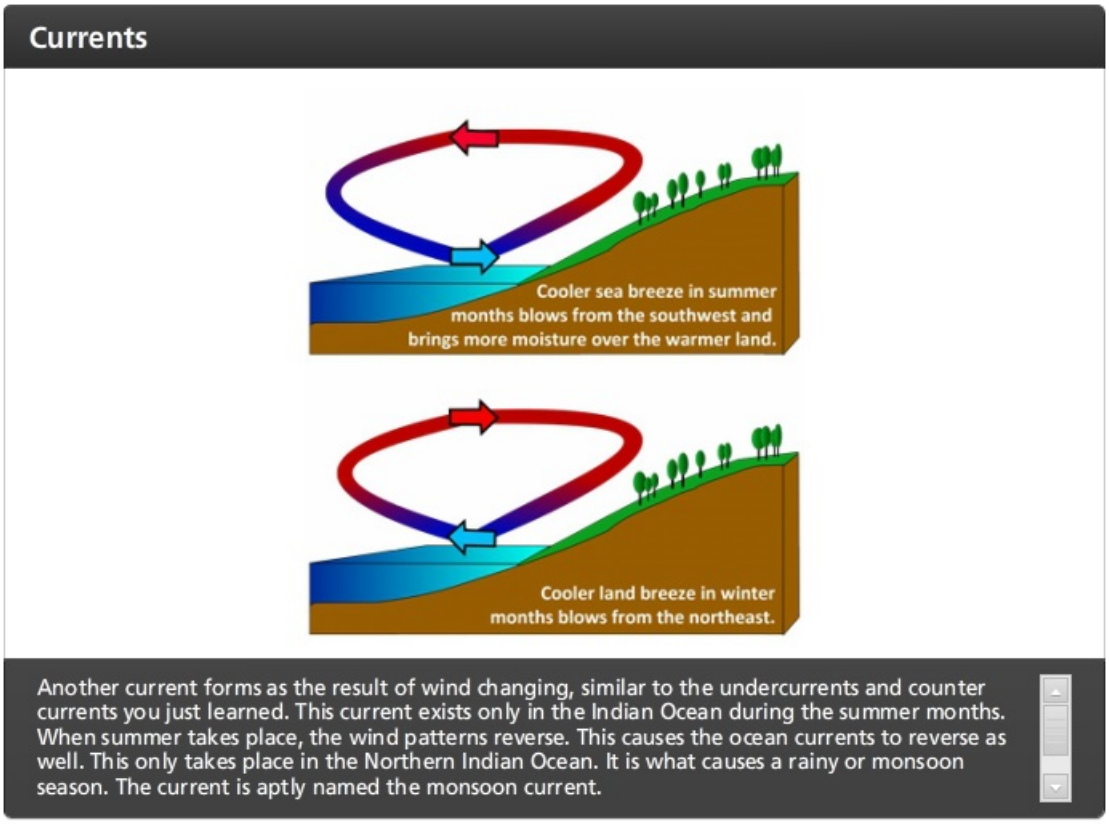

Another current forms as the result of wind changing, similar to the undercurrents and counter currents you just learned. This current exists only in the Indian Ocean during the summer months. When summer takes place, the wind patterns reverse. This causes the ocean currents to reverse as well. This only takes place in the Northern Indian Ocean. It is what causes a rainy or monsoon season. The current is aptly named the monsoon current.

Original image source: Jesús Gómez Fernández

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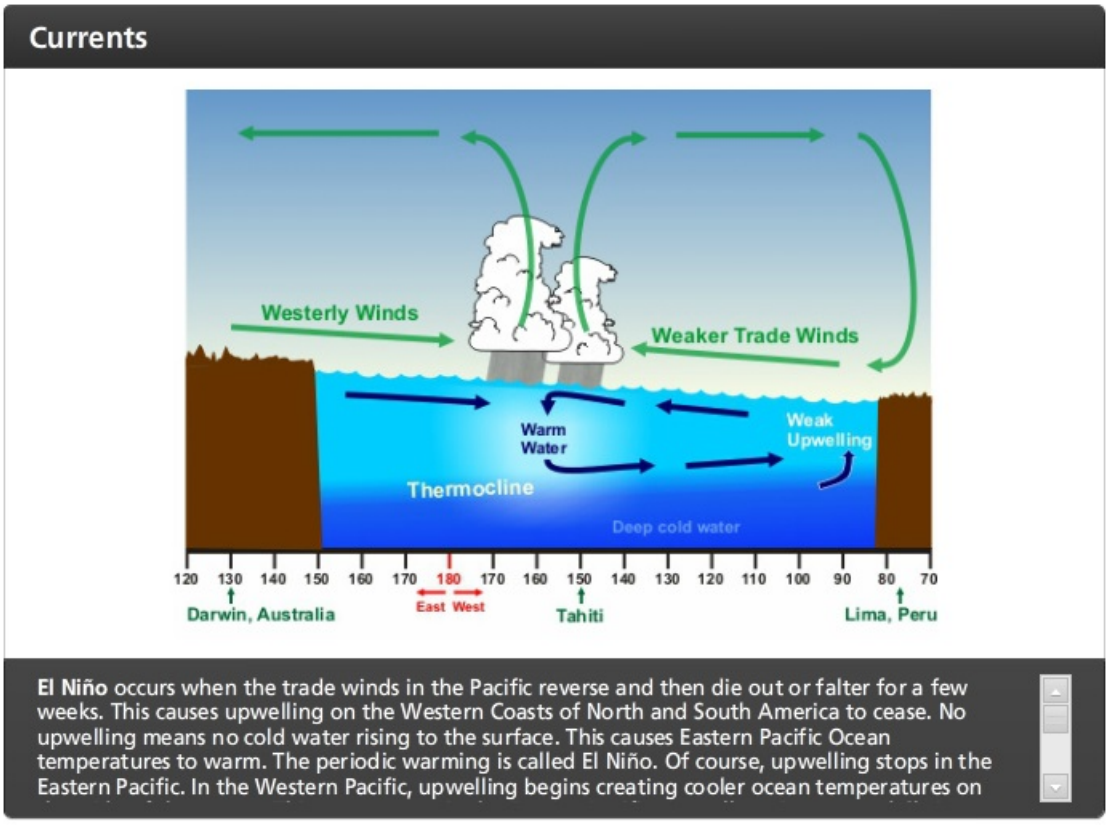

El Niño occurs when the trade winds in the Pacific reverse and then die out or falter for a few weeks. This causes upwelling on the Western Coasts of North and South America to cease. No upwelling means no cold water rising to the surface. This causes Eastern Pacific Ocean temperatures to warm. The periodic warming is called El Niño. Of course, upwelling stops in the Eastern Pacific. In the Western Pacific, upwelling begins creating cooler ocean temperatures on that side of the ocean. This warm water in the Eastern Pacific normally arrives around Christmas time, so anglers from Peru named it the current of the Christ child (el corriento del Niño). In Southern Oscillation, once the currents swap from Eastern to Western Pacific, the air pressure swaps as well. 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 have grouped them together in the acronym ENSO (El Niño and the Southern Oscillation).

Image source: National Oceanic and Atmospheric Administration and the Department of Commerce/National Weather Service

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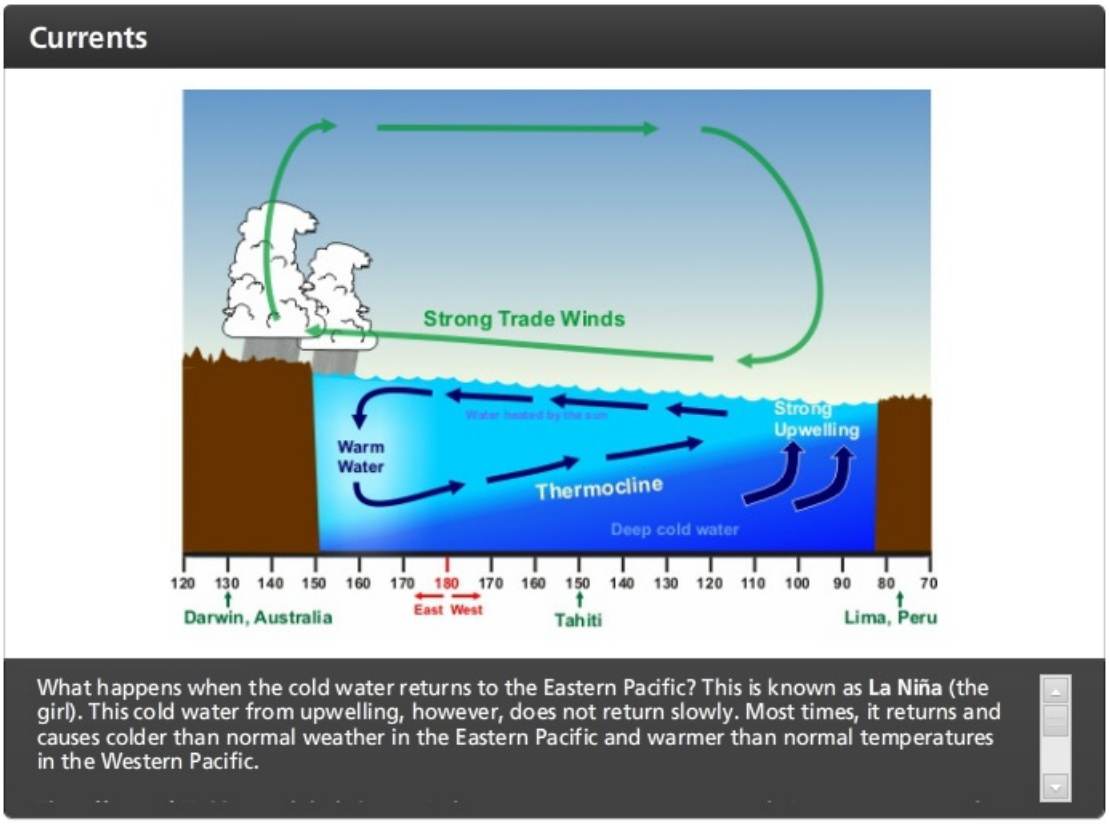

What happens when the cold water returns to the Eastern Pacific? This is known as La Niña (the girl). This cold water from upwelling, however, does not return slowly. Most times, it returns and causes colder than normal weather in the Eastern Pacific and warmer than normal temperatures in the Western 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.

Image source: National Oceanic and Atmospheric Administration and the Department of Commerce/National Weather Service