

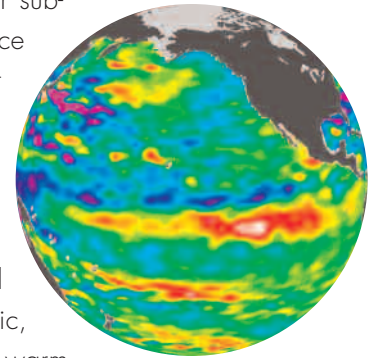
Voyager

FEBRUARY 2007

For kids of all ages

Scripps scientists take on questions from students curious about ocean and earth sciences.

Answer. El Niño affects temperature and rainfall patterns around the globe, but affects different regions in different ways. Although it is best known for substantially warmer-than-normal sea surface temperatures off the Pacific Ocean coast of equatorial South America, El Niño originates in a weakening of winds that normally blow across the Pacific from east to west. Normally these winds push the strongest storms and warmest waters into the western Pacific, but when they weaken, the storms and warm water shift thousands of miles to the east, leading to El Niño conditions. The relocation of these storms changes the patterns of atmospheric motion, altering temperature and rainfall patterns in many regions around the globe.



Question.

“When we have an El Niño, it usually means more rain in southern California. Are other areas affected the same way?”



Top left: A developing El Niño, Nov. 2006 Above: El Niño-spawned surf smashes Ocean Beach Pier

During an El Niño event, storms tend to flow across the United States along a different track than in non-El Niño years. In winter, this brings more storms into California from the tropics, as well as wetter conditions in the southern Midwest and along the Atlantic and Gulf coasts. The jet stream also settles into a more west-to-east flow than normal, preventing cold air in Canada from creeping into the upper plains states and leading to warmer conditions across the Pacific Northwest to the Great Lakes.

Elsewhere in the world, dry conditions prevail over the western Pacific when El Niño shifts storms to the east, while South and East Asia have warm winters. Eastern Pacific circulations also suppress rainfall over northeast Brazil, and Argentina experiences wetter summers. In addition, hurricanes tend to form more often along the Pacific coast of Central America, but tropical storms are less frequent in the Atlantic and Caribbean.

—Submitted by the National Ocean Sciences Bowl team at The Preuss School, University of California, San Diego, La Jolla, California.

—Alex Ruane, Climate Research Division, Scripps Institution of Oceanography

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Question. What causes the “high pressure” and “low pressure” the weatherman is always talking about?

—Submitted by the National Ocean Sciences Bowl team at The Preuss School, University of California, San Diego, La Jolla, Calif.



Answer. “High pressure” and “low pressure” correspond to geographical locations where the surface pressure of the atmosphere is higher or lower than average. Although air is much less dense than water, it still has mass, and surface pressure is simply caused by the weight of the atmosphere pressing down on the Earth. The average value of atmospheric pressure at sea level is 1013 millibars (the conventional meteorological unit) or 14.7 pounds per square inch in English units. The amount of mass in the atmosphere is not uniformly distributed around the globe, and areas with less mass of overlying air have low surface pressure, and areas with more mass have high surface pressure.



Above: Dry conditions are associated with high-pressure systems. Left: Rain is associated with low-pressure systems.

At middle latitudes, where the United States is located, areas of high pressure and low pressure typically travel from west to east and are associated with changes in weather. In regions of low pressure, air generally moves upward and cools, leading to condensation of water vapor, clouds, and precipitation. In regions of high pressure, air generally moves downward and warms, leading to drying and clear skies. One exception to this is San Diego, where the marine layer brings in low-level clouds even though the air higher up is dry and moving down. High pressure prevails in San Diego during most of the year, which is why it so seldom rains here. Only in winter do low pressure systems occasionally propagate into our neighborhood.

Areas of low pressure in the tropics typically travel from east to west and are also associated with upward moving air and precipitation. Sometimes these low pressure systems intensify and become hurricanes.

—Joel Norris, Climate Research Division, Scripps Institution of Oceanography