

Buoy oh buoy: Comprehensive El Niño data

The El Niño Pacific warming of 1997 and 1998 shut down the nutritional conveyor belt to a vast swath of ocean surface, newly released data show. The 1998 La Niña cooling, in turn, switched this belt to fast forward, fertilizing the biggest bloom of microscopic plants yet measured in the equatorial Pacific.

"This is the largest El Niño-La Niña event ever observed, and it was observed in great detail," comments biological oceanographer Michael R. Landry of the University of Hawaii at Manoa in Honolulu. Landry says the new measurements provide a first overview of how ocean ecosystems, global carbon dioxide concentrations, and the physical forces behind El Niño interrelate. "This is a tremendous technical and conceptual achievement," says Landry.

The data come from two sources: buoy-mounted sensors, which transmit readings from 72 equatorial sites, and an optical satellite sensor. The combined systems report wind speed and direction, temperature, and marine concentrations of carbon dioxide, nutrients, and chlorophyll—the green, light-harvesting molecule that plants produce.

The measurements show that during the 1997–1998 El Niño, the equatorial Pacific ceased producing carbon dioxide and became a net absorber of that greenhouse gas.

While scientists had already surmised from scattered shipboard readings that such a transition had occurred, marine geochemist Taro Takahashi of Columbia University comments that the new data detail the phenomenon for the first time. He says these numbers will figure critically in global-warming predictions.

Other measurements confirm that across most of the equatorial Pacific, El Niño deepens the warm-water layer inhabited by the primary producers in the ocean food web—the photosynthetic plankton.

Earlier evidence suggested that this deepening would diminish the nutrient supply to these microbes by pushing the cold equatorial undercurrent downward and farther from the plankton. The cold water originates near South America and carries nutrients to the relatively infertile midocean region along the equator. Scientists have proposed that trade winds draw this cold water upward.

Multiple measurements confirm the basic elements of this system. During the last El Niño, nutrient upwelling halted as winds flagged, the undercurrent lost strength, and chlorophyll concentrations across the equatorial Pacific plummeted to their lowest recorded levels.

During the subsequent La Niña, these trends reversed, with a vengeance.

"The dramatic bloom that occurred after El Niño was completely unexpected," says Francisco P. Chavez, a biological oceanographer at the Monterey Bay Aquarium Research Institute in Moss Landing, Calif. He and his colleagues describe the recent findings in the Dec. 10 SCIENCE.



L. Stratton, Tropical Atmosphere Ocean Project, NOAA

A buoy, carrying instruments above water and on an anchored line below, transmits readings via satellite.

—O. Baker