Another Try at Forecasting El Niño

There are signs in the Pacific Ocean, and in some mathematical models, that an El Niño is on the way, but most experts remain cautious

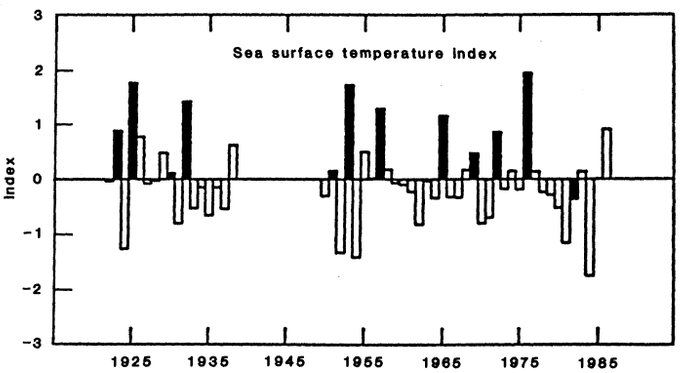
WITHIN a few months meteorologists will know just how far their understanding of El Niño, the sometimes disastrous warming of equatorial Pacific waters, has advanced since their predictive ability was last tested in 1982.

The National Weather Service's Climate Analysis Center (CAC) in Washington, DC, is not yet in the business of predicting El Niños, but its monitoring of the Pacific leaves little doubt that at least a warming of the tropical Pacific if not a full-blown El Niño is under way. On 11 February, the CAC issued a "watch," saying that, for the first time since the most powerful El Niño of the century in 1982–83, "the pattern of sea surface temperature anomalies in the tropical Pacific is consistent with the incipient stages of an El Niño." The surface waters of both the western and the eastern equatorial Pacific had become warmer than normal in recent months, as happens in the early stages of typical El Niños.

That was encouraging news to Mark Cane and Stephen Zebiak of the Lamont-Doherty Geological Observatory in Palisades, New York. Beginning in December, they had been telling their colleagues that their mathematical model of the tropical Pacific was predicting an El Niño next winter. In fact, model runs beginning in each of the previous 10 months had produced the same prediction. Tested on previous years since 1970, forecasts were always correct when they were based on the agreement of monthly model runs from August to December.

Cane and Zebiak's model is of a new, more sophisticated class in that the model's atmosphere and ocean are coupled to each other, allowing changes in one to affect the other. Still, compared with the real world or even other atmospheric models, it is simple. Some meteorologists say it is too simple, but Cane and Zebiak argue that it includes the essential ingredients. One is the potential for a feedback between the temperature gradient of the equatorial Pacific, its eastern end normally being colder than its western end, and the east-to-west winds normally blowing along the equator. Since the temperature gradient drives these winds that normally keep the warm water at bay in the west, a warming in the east would weaken the gradient and thus the winds, leading to a further warming, and so forth. This positive feedback has been a part of most models of El Niño since Jacob Bjerknes made the connection in the 1960's between El Niño and its associated atmospheric phenomena, called the Southern Oscillation.

The other essential element, added by Cane and Zebiak, is the need for the heat content of the upper tropical Pacific to be higher than normal. Without that precondition, they believe, the feedback cannot take hold. The model seems to be saying that that threshold will be exceeded this year as solar heating and ocean currents finally recharge the tropical Pacific 4 years after the last El Niño–Southern Oscillation (ENSO) episode discharged it. If the model is right, there is a major implication: the mechanism that generates an ENSO episode is a simple one that is directly dependent only on the state of the tropical Pacific Ocean, and influences beyond the tropical Pacific play no crucial role.



One forecast of what the Pacific Ocean will do. *Plotted here is an index involving the rate at which the waters off Peru warm during the Southern Hemisphere summer. Solid bars are El Niño years. In the words of a CAC advisory, "All years in which the index values equaled or exceeded the 1986 value were El Niño years."*

On 13 March, CAC issued an "advisory" that noted the continuation of the warming and concluded that "it seems prudent to call attention to the possibility of an ENSO episode developing during 1986." Perhaps the most intriguing aspect of the advisory was an index that compares the sea surface temperature change from November through February west of Peru with the behavior of previous El Niños. The index "indicates a high probability of an ENSO episode this year." "We've never had a rise of that magnitude," says Eugene Rasmusson of the CAC, "without having what we called an El Niño." To the extent that any analysis can estimate the strength of a forthcoming event, it appears that a 1986 event, if one occurs, will be a moderate one.

As in its February watch, the CAC still had reservations. Warming had not progressed southward along the Peruvian coast. Heavy rains over the desert regions of northwestern Peru had not appeared yet. And the east Pacific warming seemed to be unusually shallow. These and other negative observations have made many El Niño experts cautious. "To me, there is at present no indication that anything is in progress," says Klaus Wyrtki of the University of Hawaii, or even that the equatorial Pacific is charged sufficiently, although something could happen anyway. Experience has also taught caution, he notes. A developing El Niño fizzled in early 1975 even as oceanographers sailed out to study it. At the other extreme, the early stages of the severe 1982–83 event did not develop in the eastern Pacific and that ENSO event eluded detection until it was full blown.

Within a few months the winners, if any, in the El Niño sweepstakes will be known. In the meantime, any possible clues are being scrutinized. The seabirds of Christmas Island in the central Pacific are one clue. The last event eventually devastated the seabird population of the island through its effects on the food supply. Ralph Schreiber of the Los Angeles County Museum of Natural History reports that in early March of this year the seabird population was down, there were no young, and egg-laying had ceased. Those are all responses to curtailed food supplies. "Something unusual is going on," says Schreiber, "but I'm not sure what." Time will shortly tell. ■

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