El Niño News

Current El Niño Most Studied in History
### New Tools Available

This year's El Niño already has fully earned its claim to fame; this is the first such event predicted so far in advance. Also, the extent to which this year's event is being studied and observed is unprecedented.

As a result, significantly more El Niño information now is available than in 1982-83 when El Niño caught scientists by surprise. They were hardly aware of the event until it peaked. This year, new and improved monitoring and predictive techniques enabled the National Oceanic and Atmospheric Administration to issue an El Niño forecast in May.

Computer Models

Credit is due to new strategies and technologies that enable scientists to study El Niño and better anticipate its effects. Foremost among these are new computer modeling programs. Early statistical models referred to past events to predict future occurrences. Statistical models recorded Pacific temperatures and winds and searched records to find similar or comparable patterns.

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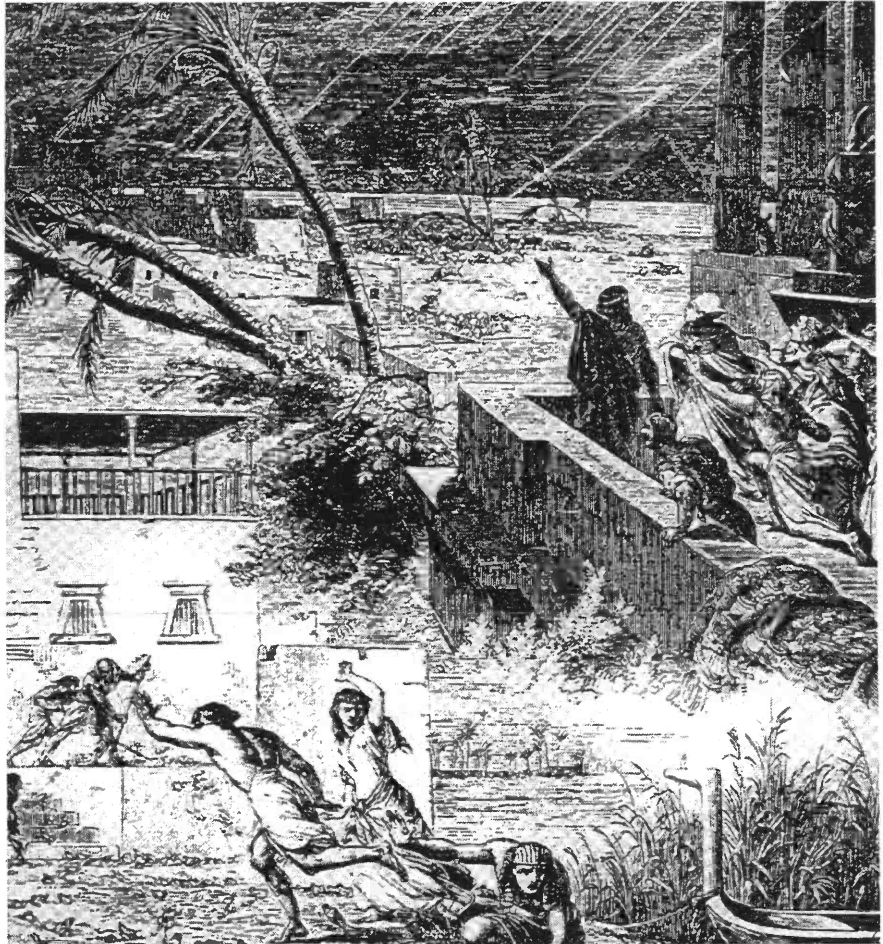
The above is from a flier distributed by a Southern Californian roofing company attempting to drum up business in response to threatened El Niño rains. The text states, "The condition of your roof and raingutters will be more important than any previous winter in the past 13 years. You can enter into El Niño with confidence if you act now." Southern California roofing companies report record business; Arizona roofers report business as usual. Tire, truck, rain gear and various other merchants are seeking an El Niño bonanza.

Recognizing the limitations of statistical modeling, climate scientists began in the mid-1980s to develop computer models capable of simulating the actual forces of nature causing Pacific warming. The models were used to predict the movement of heat within the Pacific basin. Later more complex models were built and linked to computer models of the atmosphere. Linking variables relating to both air and water was considered a major advance in the modeling of El Niño conditions.

El Niño of 1997 will test the effectiveness of computer models now tracking Pacific conditions in various parts of the world. The NOAA Climate Prediction Center's ocean-atmosphere model has fared particularly well, sensing the 1997 El Niño as early

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as November 1996. A previously successful model, however, proved a disappointment this year. A model operated at Lamont-Doherty Earth Observatory in Palisades, New York, had earned the esteem of researchers by accurately predicting Pacific warmings in 1986 and 1992. Despite operating accurately for over a decade, the model forecasted a cold Pacific this year. Researchers are puzzled at its failure.

Even models that accurately predicted the current El Niño, however, fell short in certain areas. None predicted such a large, early developing 1997 El Niño. Also, models are providing mixed signals about when this El Niño will peak and end, and whether it will continue into next winter. This information is critical to predicting U.S. weather.

More work evidently needs to be done to develop models capable of coping with El Niño. Gerald D. Bell, a Climate Prediction Center forecaster says, "Obviously there's room for improvement. These models are in their infancy compared to where they will be in ten to 15 years." Scientists caution, however, that variables affecting climate are too unpredictable to expect that a model will be 100 percent accurate in El Niño forecasting.

Buoys and Satellites

Improved computer modeling is not the only advantage El Niño observers now have over scientists studying previous events. Since 1982-83, scientists installed about 70 buoys, stretching across about one-third of the globe in the tropical Pacific, some anchored to a depth of about 15,000 feet. Called the Tropical Atmosphere Ocean Array, the buoys measure wind speed, currents, air and water temperature. The data are transmitted to satellites, beamed to scientists and fed into computer programs.

More technically advanced satellites are another tool available to scientists to better track this year's El Niño. Two Geostationary Operational Environmental Satellites, GOES 8 and 9, provide climatologists and atmospheric scientists with better and more extensive information than was available during previous El Niño events.

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The satellites for tracking 1982-83 El Niño conditions observed and imaged conditions on Earth only during about five percent of their operational time. Also the satellites gyrated and wobbled as they spun to maintain stability in space. This movement affected the quality of the images sent back to Earth.

GOES 8 and 9 focus on the same area 24 hours a day, GOES 8 on the eastern United States and GOES 9 on the western United States and eastern Pacific. They operate full-time and have multiple capabilities. The stability of these satellites enables them to transmit more images, and with higher resolution than was possible with earlier satellites. Today's satellites also can provide more detailed information; e.g., they are able to profile a wide range of temperatures, from the earth's surface, including the ocean, to the top of the atmosphere. Also, the latest generation of GOES has greatly improved computer processing, with more equipment including high-quality sensors.

Whatever precipitation El Niño does or does not deliver to the U.S. Southwest, scientific and technological advancements ensure a more complete and accurate understanding of El Niño.

Multivariate ENSO Index (MEI)
For Recent El Niño Events
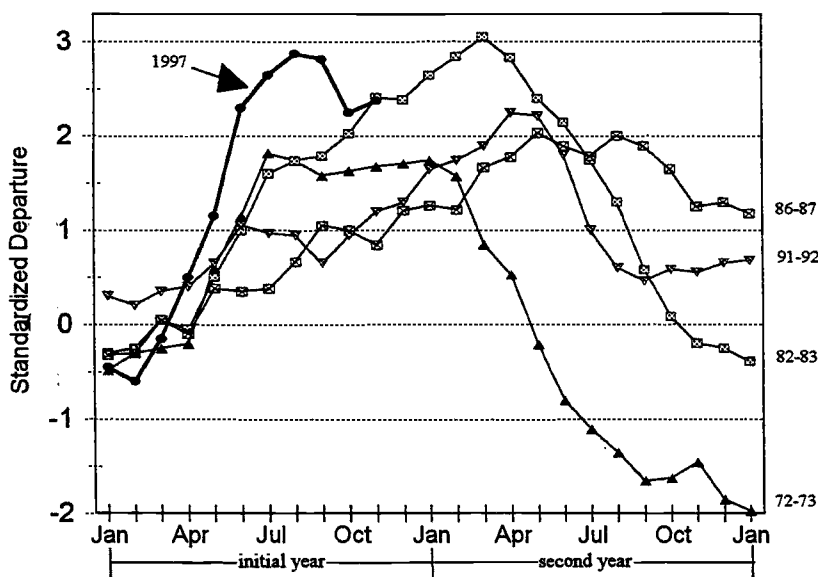
© Klaus Wolter and Michael Timlin, NOAA-CIRES Climate Diagnostics Center

The graph shows Multivariate ENSO Index values over two years from the beginning of an El Niño event. The MEI consists of six main variables describing ENSO events, including sea surface temperature, surface air temperature, sea-level pressure, zonal and meridional components of the surface wind, and total cloudiness fraction of the sky. The 1997 El Niño event resembles early events (such as '57-'58, '65-'66 and '72-'73) in that it reached its peak early in the normal two year cycle. More recent events (such as '82-'83, '86-'87, '91-'92) reached their peak in the spring of the second year or later. The current event is the most intense event earliest in the development cycle. However, the current event has fallen behind the 1982-83 event for intensity at this point in the development cycle, and, unless there is an unexpected reinvigoration of the current event, the race for the all-time strongest event in terms of peak MEI value is over, with Feb/March reading from the 1982-83 event remaining the highest.

El Niño and Global Warming

Today's most talked about climatic events are global warming and El Niño. Not surprisingly some scientists question whether any connections exists between the events. Following are two stories suggesting that El Niño and global warming may interact in some ways.

Warmer World May Cause More El Niños

Some scientists are suggesting possible links between global warming and El Niño occurrences. Other researchers, those unconvinced that global warming is even occurring, are unlikely to take the suggestion seriously. Yet the premise that stronger, more frequent El Niños would develop in a warmer world is feasible. And some evidence exists that the world has warmed during the past two decades. During this same time span El Niños have been more frequent. Prior to 1976, El Niños occurred at intervals of about three to seven years. Since 1976, nine El Niños have occurred or one every 2.2 years. Therefore some grounds for speculation about a link would seem to exist. Even accepting the controversial premise that global warming is happening, however, a vast range of opinions exists about whether, and to what extent warming is the result of human activity.

Regardless of whether a link between global warming and El Niño does or does not exist, some scientists consider an El Niño occurrence an opportunity to study the effects of climate change. Managing and maintaining land and water resources in response to El Niño's generally short-term climatic variables will enable scientists to determine appropriate strategies in a climate-changed world.

El Niños May Slow Buildup of Greenhouse Gas

Researchers recently have found evidence to suggest that El Niños, by temporarily warming global climate, may help halt the ongoing rise in atmospheric carbon dioxide caused by human activities, at least in the short term. Other periodic warm spells may have the same effect as well.

Such warm periods cause a delayed burst of plant growth worldwide that may absorb excess levels of greenhouse gas. To researchers this suggests a possible interaction between soil microbes and plants that might help account for terrestrial responses to climate change. Scientists, however, are uncertain whether the reduced buildup of carbon dioxide due to increased vegetation is a long-term phenomenon.

Using satellites researchers studied short-term fluctuations in carbon dioxide levels and global temperatures and plant growth occurring after irregular warm spells. The researchers discovered a significant decrease in the rate of carbon dioxide build-up in the atmosphere about two years following each of the four warm spells occurring between 1980 and 1991. This period includes the 1992-93 El Niño. Also global vegetation increased after a comparable time lag suggesting that the plants absorbed the excess carbon dioxide.

The two-year period that elapsed between the warming events and the increase in vegetation, with the reduction in the rate of carbon dioxide buildup, seems to indicate that these changes were not simply due to a gradual increase in temperatures. The delay linked the temporary warming phenomenon to the increased growth of vegetation. Researchers continue work to understand the activity of soil microbes and their effect on plant growth during periods of warming. One theory is that the warming increases the activity of the microbes. This causes more fertilizers in the soil and stimulates plant growth.

Will Pima County Rivers Overflow?

In what is a likely case of pre-El Niño jitters, some Pima County residents are questioning whether flood-control measures taken after the 1983 El Niño may cause a new set of problems if heavy rains occur this winter.

Pima County has spent $104,752,000 thus far stabilizing river banks to prevent the kind of erosion that damaged bridges and destroyed buildings along the Rillito River during 1983 flooding. When river banks are stabilized, however, development can occur closer to the channel. County regulations require a 500-foot setback along major waterways with unprotected banks, but allows only a 50-foot setback if banks are protected.

Some experts are saying that protected banks have the potential to overflow during a heavy flood event. This means that development permitted close to the channel of a bank-protected river could be threatened by rising waters. And much of this type of development has occurred since the 1983 El Niño.

These experts expect heavy flooding to cause less damage when river banks are soil cemented but say a different kind of damage will likely result. Flooding from the 1983 El Niño caused about $226.5 million worth of damages in Pima County.

Also, some believe that floods flowing through bank-protected rivers in Tucson will peak higher and move more rapidly to down-river areas. As a result, the town of Marana could suffer the effects of more forceful floods. Marana experienced extensive damage from the 1983 flooding and feels very vulnerable given the increased possiblity of flooding this year due to El Niño.

Pima County officials disagree that soil cementing river banks will have adverse effects.

Economic, Social Effects of El Niño Studied

Current El Niño research is concerned with more than just atmospheric and climatological data; researchers and various officials also are looking at the economic and social consequences of El Niño. This represents an advance from previous El Niños when merely forecasting the event was problematic.

The implications are far-ranging, with El Niño now seen as a force to be reckoned with in varied situations. For example, organizers of the 1998 Winter Olympics are concerned that an El Niño weather pattern will create unseasonably warm weather this winter in Japan, the site of next year's international event. Insufficient snow could affect certain events, with economic losses possible.

On a more positive note, researchers at Oregon State University report that improved El Niño forecasting could help stem the decline of coho salmon on the West Coast. During El Niño years, West Coast water temperatures become abnormally high. This disrupts the upwelling of colder, nutrient-rich water containing the species that coho depend upon for food. Less salmon survive these conditions. If fishery experts are forewarned of El Niño, they can take measures to protect the salmon. Researchers estimate that the value of improved El Niño forecasting to the coho fishery varies from $250,000 to $900,000 per year.

An activity very much at the mercy of the weather is agriculture, and this area has much to gain from accurate long-range El Niño forecasting. According to an article published in *Climatic Change*, consumers and producers of agricultural products could save between $240-$324 million per year by responding early to El Niño conditions.

Figuring into this economic analyses is agricultural research that studied differences in climate conditions during El Niño/Southern Oscillation (ENSO) events and the consequences for U.S. crop yields. In some cases, depending upon the phase of ENSO, average monthly temperature and precipitation changes stimulated yields of important crops such as corn, wheat and soybeans by 15 to 30 percent. Farmers obviously would greatly benefit from accurate long-term forecasts for making optimal planting and harvesting decisions. Lower prices would be the result, benefitting American consumers and agricultural exporters.

Significant property costs are avoided when long-range forecasting enables mitigation measure to take place, thus reducing the need for — and cost of — disaster relief. For example, the town of Marana, Arizona, has stockpiled 10,000 sandbags in case the Santa Cruz floods. This will have been a wise investment if it prevents the recurrence of town flooding that took place during the 1983 El Niño.

National Oceanic and Atmospheric Administration (NOAA) officials are touting the economic advantages of forecasting. "These studies clearly demonstrate the economic benefits of improved long-range forecasting," said NOAA Administrator, D. James Baker. "It is yet another example of how investments in ocean and atmospheric research and observing systems is a sound use of public resources to produce a beneficial return for the economy."

Strategies still have to be worked out to ensure that El Niño information is available to those who could use it, to avoid threats to life and property or conversely to take advantage of favorable El Niño conditions. Long-range El Niño forecasting, however, is relatively new and unproven. People still need to become more aware of what information is available and where it can be obtained.

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