La Niña and Its Impacts

Facts and Speculation

Edited by
Michael H. Glantz

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Contributors:

Michael McPhadden, James O'Brien, Joseph Tribbia, George Kiladis, Kevin Trenberth, Martin Hoerling, Gerald Meehl, Nicolas Graham, Stephen Zebiak, Anthony Busalacchi, Allan D. Brunner, Ray Garnett, Amir Shabbar, Maurice Roos, Nathan Mantuna Warren Wooster, Roger Pielke Jr., Chris Landsea, Guillermo Berri, Pilar Cornejo-Grunauer, Lino Naranjo-Diaz, Norma Ordinola, Peter E.O. Usher, Tsegay Wolde-Georgis, Mark Majodina, Kamal Kishore, A.R. Subbiah, Wang Shao-Wu, Wei Gao, R.H. Kripalani, Ashwini Kulkarni, Ekram Hossain, Charles "Chip" Guard, Gary Sharp, Tahl Kestin, Mikiyasu Nakayama, John Kermond, Anthony Barnston, Edward Harrison, N.K. Larkin, Arun Kumar, Kenneth Broad, Cecile Penland

La Niña and Its Impacts is based on a meeting of researchers, forecasters, and users of La Niña forecasts, held at the U.S. National Center for Atmospheric Research in Boulder, Colorado. La Niña, the result of air-sea interaction, can briefly be described as the appearance of cold surface water in the central and eastern equatorial Pacific Ocean. While people around the globe have become familiar with El Niño and its impacts, its counterpart, La Niña, is not so well known. Researchers at this La Niña Summit indicated that for many societies La Niña events can be as devastating as those of El Niño.

The overriding purpose of the Summit was to draw attention to the importance of improving our understanding of the La Niña phenomenon, identifying what is known, what is not yet known, and what societies need to know in order to prepare for La Niña's impacts. This volume provides the current state of the science of forecasting La Niña as well as case studies of La Niña impacts around the world and in different economic sectors.

La Niña and Its Impacts presents updated La Niña Summit papers to introduce the reader to La Niña and offers a glimpse of the state of scientific knowledge about cold events and their impacts in developing as well as industrialized societies.

Michael H. Glantz is a Senior Scientist in the Environmental and Societal Impacts Group (ESIG), a program at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado. He is interested in how climate affects society and how society affects climate, especially how the interaction between climate anomalies and human activities affect quality of life around the globe.

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La Niña, El Niño, and US Atlantic hurricane damages

Roger A. Pielke, Jr. and Christopher W. Landsea

Recent research strongly suggests that US Atlantic hurricane damages are modulated by the phase of ENSO, with increased losses during La Niña events and reduced losses during El Niño events (Pielke and Landsea, 1998, 1999). Our analyses support the following statements:

1. La Niña means a greater frequency of damaging storms *and* more damage per storm. During cold events in the Pacific, the odds are significantly higher that the US East and Gulf Coasts will experience greater impacts because of a larger number of tropical cyclones and higher intensities for each storm.
2. Because damage increases with the square (or more) of wind speed, the greater intensity translates to a substantial increase in damage. The average damage in the United States per storm in El Niño years (Table 3-3) is $800 million vs. $1,600 million in La Niña years.

On an annual basis, because the distribution of damaging events is highly skewed by a few very large losses, we suggest that the median is an appropriate measure of central tendency. However, some decision makers with an interest in expected losses (e.g., the reinsurance industry) will be interested in the mean. Decision makers should focus on variance in losses as well as central tendency because even in a relatively inactive season, a single storm can have significant impacts. This was the case of Hurricane Andrew (1992), which resulted in more than $30 billion in losses. The largest loss in the record (normalized for inflation, population, and wealth) is the 1926 Miami hurricane which caused more than

Table 3-3 Categorization of the Atlantic hurricane season into El Niño and La Niña events

El Niño years	La Niña years
1925	**1933**
1929	**1938**
1930	**1942**
1940	1944
1941	1945
1951	1948
1953	1949
1957	**1950**
1963	1954
1965	**1955**
1969	1956
1972	1961
1976	**1964**
1977	1967
1982	**1970**
1986	1971
1987	**1973**
1990	1974
1991	**1975**
1993	1978
1994	**1988**
1997	1995

El Niño events (based upon the August-September-October Niño3.4 anomalies warmer than or equal to +0.4 °C) and La Niña events (August-September-October Niña3.4 SST anomalies cooler than or equal to −0.4 °C) from 1925–97. The ten most intense events of each type are highlighted in bold (Pielke and Landsea, 1999).

$60 billion in damages. This hurricane had a second landfall in the Florida Panhandle/Alabama region, which added about $10 billion in losses.

- The occurrence of an El Niño does not mean that there will be no hurricanes. Several El Niño years have seen large hurricane impacts. The 1997 hurricane season was quiet in terms of overall activity, and losses were minimal ($100 million). However, this is not always the case. In 1965 Hurricane Betsy resulted in more than $13 billion in normalized losses and in 1972 Hurricane Agnes caused more than $11 billion in damage. Thus, large losses are possible in any year, and three of the top five normalized storm losses occurred in neutral years (the remaining two were in La Niña years).
- The record suggests that Niño3.4 SSTs for the months of August–September–October provide a statistically significant indicator of damage, but the use of this relation in decision making should be with consideration of its limitations.

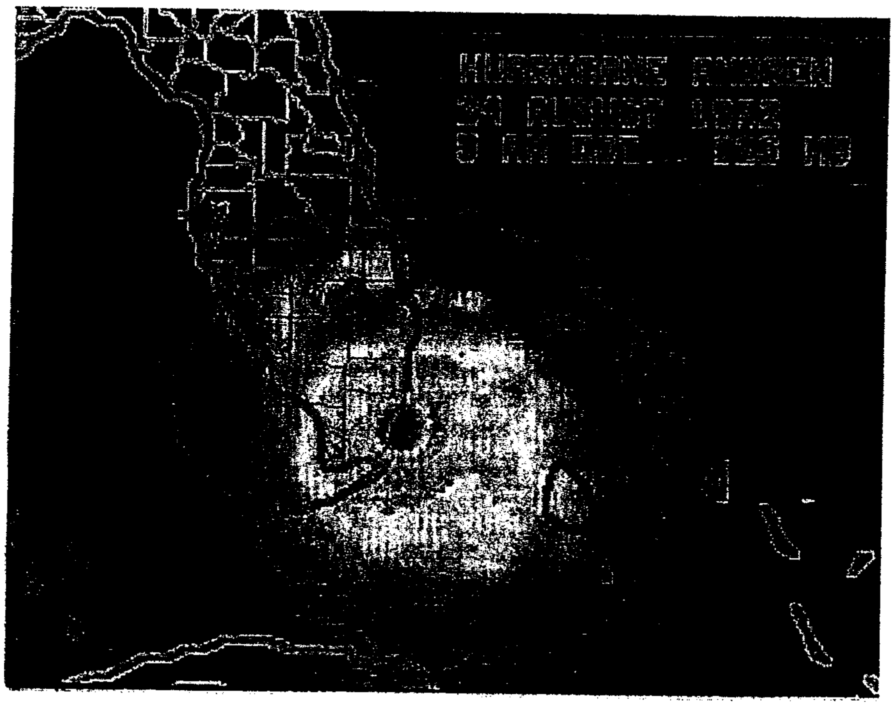

Fig. 3-11 Hurricane Andrew hitting the coast of Florida.

Common sense suggests that, with a reliable prediction of tropical sea surface temperatures in the August–September–October period, certain decision makers might be able to derive benefits. But this raises a series of questions: How reliable? Which decision makers? What benefits? Furthermore, experience offers three reasons for decision makers to exercise caution in the use of this information.

1. First, predictions are always uncertain, and a significant error in the prediction of SSTs might lead to costs rather than benefits, compared with a situation in which there is no prediction (Sarewitz et al., 2000).
2. Second, these relations, while significant, provide information with which to hedge, but should not be used to "bet an entire stake." Climate patterns change. There is always uncertainty as to how closely the future will resemble the past.
3. Third, this information will likely be of most potential value to sophisticated decision makers who can finely balance risk using probabilistic information. For an average coastal resident or community, this information might suggest accelerating preparedness plans in

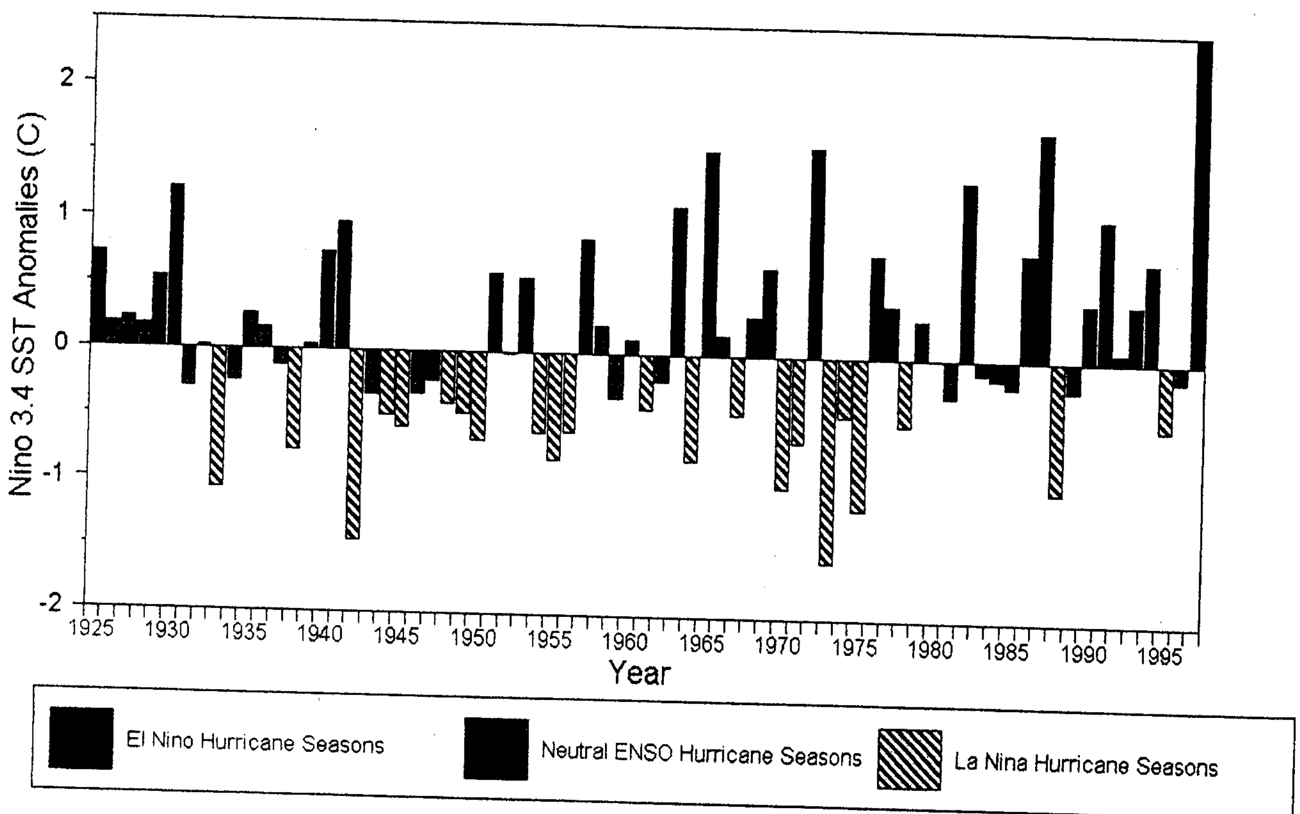

Fig. 3-12 ASO (August-September-October) Niño3.4 sea surface temperature anomalies (SSTA) for the period 1925–97. Anomalies are from a 1950–79 base period.

the face of a pending La Niña event, but improved preparedness also makes sense at any time.

- ENSO is not the only climate factor related to US hurricane damage, there are others that sophisticated users should consider. Other environmental factors impact Atlantic hurricanes (at least partially independent of ENSO) – such as Atlantic sea surface temperatures, the stratospheric QBO, Caribbean sea level pressures, and West African Sahel rainfall (e.g., based on the work of William Gray, 1984a,b).

About 40 percent of the years analyzed in this study (1925–95) had no significant El Niño or La Niña event occurring during the peak of the Atlantic hurricane season. Yet, substantial variations of Atlantic hurricanes and US hurricane-caused damage occur in neutral years.

A judicious use of the environmental factors, as controls in statistical models, has produced skillful experimental seasonal hurricane forecasts by Gray et al. (1993). The strong relationship between Pacific sea surface temperatures and Atlantic hurricane damages in the United States offers a tantalizing opportunity for the direct use to society's benefit of scientific information about the ENSO phenomenon. It also offers an opportunity for a closer connection between scientists and decision makers to the enrichment of both.

REFERENCES

Gray, W.M., 1984a: Atlantic seasonal hurricane frequency. Part I: El Niño and 30-mb quasi-biennial oscillation influences. *Monthly Weather Review*, 112, 1649–68.

Gray, W.M., 1984b: Atlantic seasonal hurricane frequency. Part II: Forecasting its variability. *Monthly Weather Review*, 112, 1669–83.

Gray, W.M., C.W. Landsea, P.W. Mielke Jr., and K.J. Berry, 1993: Predicting Atlantic basin seasonal tropical cyclone activity by 1 August. *Weather and Forecasting*, 8, 73–86.

Pielke Jr., R.A. and C.W. Landsea, 1998: Normalized hurricane damages in the United States, 1925–97. *Weather and Forecasting*, 13, 351–61.

Pielke Jr., R.A. and C.W. Landsea, 1999: La Niña, El Niño, and Atlantic hurricane damages in the United States. *Bulletin of the American Meteorological Society*, 80(10), 2027–33.

Sarewitz, D., R.A. Pielke Jr., and R.A. Byerly Jr., 2000: *Prediction: Decision Making and the Future of Nature*. Covelo, CA: Island Press.