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Climate Extremes Past and Present: A 40-Year Perspective

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The first a few Climate Diagnostics Workshops (CDWs) from the mid-1970s through the early 1980s were held during a period of rather extreme seasonal weather events, ranging from a sequence of extremely cold winters (1976–77 through 1978–79) (Diaz and Quayle, 1980) in the U.S. (Figure 1) to the occurrence of worldwide impacts associated with the great 1982–83 El Niño—which was then labeled the El Niño of the century (Figure 2).

The series of late 1970s very cold winters and the Great El Niño of 1982–83 spurred national action on the role of climate variability on the Nation's socioeconomic activities and led to enhanced funding for research activities and a greater focus on improving observations and prediction capabilities (*e.g.*, EPOCS, TOGA). Some of the major accomplishments resulting from those efforts include the Comprehensive Ocean-Atmosphere Data Set (COADS—now referred to as ICOADS), the TOGA-TAO array of equatorial buoys, and the development of the Multivariate ENSO index (MEI) (Wolter *et al.*, 2011). Furthermore, that event engendered a renaissance of interest in the global workings of the El Niño phenomenon and its atmospheric twin the Southern Oscillation (concatenated into ENSO).

Subsequent studies (*e.g.*, Kiladis and Diaz, 1986) showed that a close analog to the 1982-83 event occurred in 1877-78, but with much greater societal impacts—with famines resulting in the death of more than a million people worldwide (Davis, 2001). Fifteen years after the early 1980s event, the 1997-98 El Niño matched and in some areas exceeded the strength and impacts of the earlier event (McPhaden, 1999). Eighteen years later a powerful El Niño is developing again in the equatorial Pacific with impacts already being felt in many parts of the world (Figure 3), with resulting anomalous rainfall patterns already evident in mid-October of 2015 (Figure 4). An ongoing extreme 4-year drought in California (Diaz and Wahl, 2015) may turn into severe flooding this 2015-16 winter with attendant severe geomorphic impacts throughout the State.

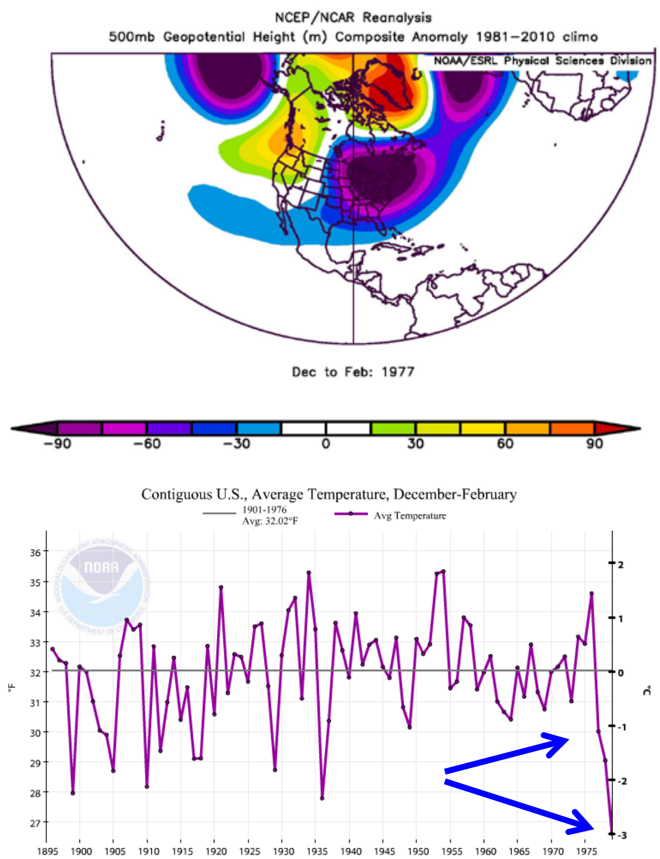

Fig. 1 Top image: 500 hPa geopotential height anomalies for winter (Dec.-Feb.) of 1976–77. Bottom image: Time series of DJF temperature for the contiguous USA.

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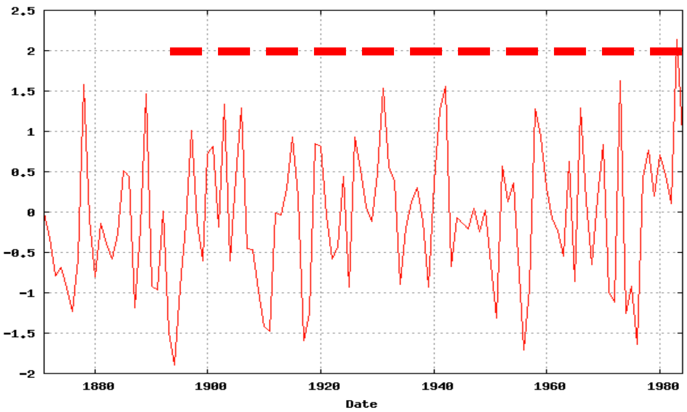

Fig 2 April to March averaged MEI time series (1871–1984). The 1982–83 El Niño was the strongest on record up to that time. (From NOAA/ESRL PSD)

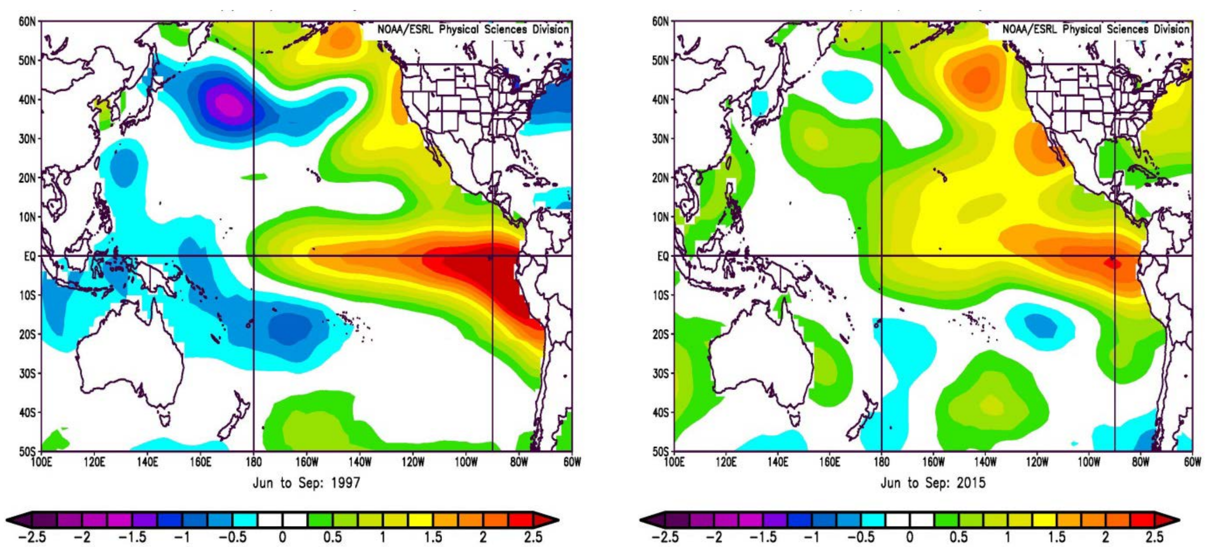

Fig. 3 Comparison of sea surface temperature (NOAA ERSST v4) composite anomaly pattern for June-September of 1997 (left panel) and 2015 (right panel) from 1981-2010 climatology.

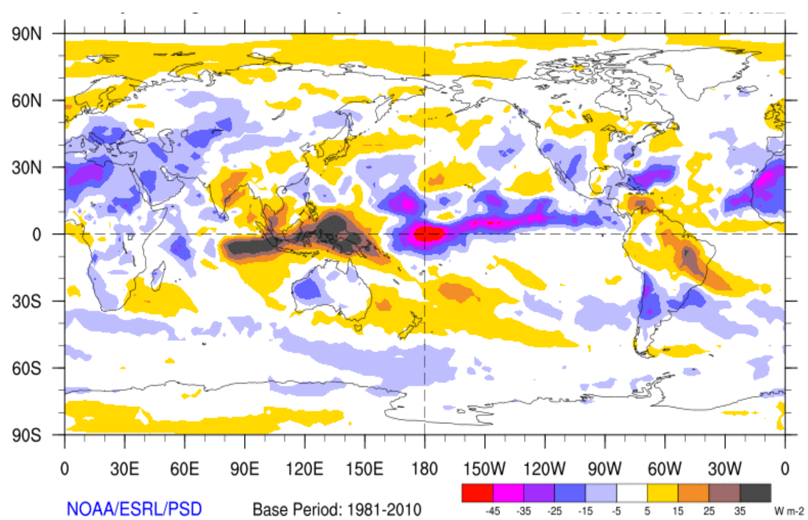

Fig. 4 Average OLR anomaly map for the 30-day period ending October 22, 2015. Extreme drought is evident in Australasia and wetter than normal in the usual regions typically affected by El Niño.