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## India, Indonesia experiencing opposite effects from 1997 El Niño

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It is now well recognized that the El Niño/Southern Oscillation (ENSO) phenomenon is the single most important cause of year-to-year climatic variability. Several studies have documented that a majority of the warm extremes (El Niño events) cause below-normal rainfall over Indonesia, while cold extremes (La Niña events) cause above-normal rainfall over India.

During the current ongoing El Niño episode, temperature anomalies in the Niño 1+2, Niño 3, and Niño 3.4 regions have been the largest values observed in the last 50 years. The pattern of anomalous tropical convection with enhanced activity across the central and eastern equatorial Pacific and suppressed convection over the Indonesian and western Pacific has prevailed since March 1997. This has resulted in drought over Indonesia. Much of Indonesia is suffering its worst drought in 50 years as a result of the effects of the latest El Niño system on weather. However, during this episode, the June–September Indian monsoon rainfall (IMR) was normal—102% of the long-term average. In fact, some regions experienced severe floods. We propose a new hypothesis to explain this.

The IMR has shown distinct above- and below-normal epochs. The periods 1880–95 and 1930–63 are characterized by above-normal rainfall, while the periods 1895–1930 and 1963–90 are characterized by below-normal rainfall (Kripalani and Kulkarni, 1996). The standardized IMR for 14 El Niño cases during below-normal epochs and 9 El Niño cases during above-normal epochs is -1.5 and -0.4, respectively. These means are significantly different at the 1% level, suggesting that the impact of El Niño is more severe during the below-normal epochs than it is during the above-normal epochs. A close examination of the epochal behavior of IMR indicates that

around 1990, the IMR tends toward an epoch of above-normal rainfall, implying that after 1990, the impact of El Niño may not be severe for a decade or two. This may be why India did not experience a drought during the 1997 El Niño episode (for details, see Kripalani and Kulkarni, 1997a).

A similar analysis with Indonesian rainfall reveals that whereas the average standardized rainfall during the below-normal epoch is -1.1 (based on seven El Niño cases), it is -0.7 (based on 6 El Niño cases) during the above-normal epochs. The difference between the means is not statistically significant, suggesting that the El Niño can cause drought over Indonesia during the below-normal epoch as well as the above-normal epoch (Kripalani and Kulkarni, 1997b). This explains the 1997 El Niño-related drought over Indonesia.

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