Department of Atmospheric Sciences
Ph.D. Dissertation Announcement

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Ph.D. Dissertation Title:

CHARACTERIZATION OF NON-EL NIÑO INDUCED DRY CONDITIONS ACROSS THE U.S. AFFILIATED PACIFIC ISLANDS

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Abstract:

The U.S. Affiliated Pacific Islands (USAPIs), located in the Western Pacific, have limited water resources making them very susceptible to severe drought conditions. The rainfall over the USAPIs north and south of 7N shows different annual cycles and response to ENSO. Southern stations show a canonical negative correlation between dry season (December to May) rainfall and ENSO. Northern stations, on the other hand, show little correlation with ENSO if the three super El Niños are excluded. Instead, they exhibit two distinct rainfall regimes, the Canonical regime, and a Non-Canonical regime, in which the dry season rainfall is positively correlated with ENSO. Non-Canonical years pose an important forecasting challenge and in their Cool Dry phase are linked to several emergency and disaster level droughts across the Northern USAPIs, making Cool Dry events of particular interest. Composite analysis of the Canonical and Non-Canonical regimes show stark differences between dry season atmospheric and SST patterns. Comparing to Canonical composites the Non-Canonical composites show clear and previously undescribed anomaly patterns during the dry season. Circulation anomalies over the Western Pacific are anticyclonic, with a band of anomalous dry conditions extending from the central Pacific towards Micronesia that causes unexpected droughts in the Northern USAPIs. Canonical Cool Wet events on the other hand show cyclonic West Pacific circulation anomalies and a La Niña like horseshoe rainfall pattern over the Pacific Basin. Non-canonical Cool events also show SST anomalies narrowly constrained near the dateline while Canonical cool events show largest anomaly magnitude east of the date line. Both Non-Canonical and Canonical Cool events show negative rainfall and Western Pacific anticyclonic anomalies before the onset of the Dec-May dry season. In Non-Canonical events, these anomalies persist throughout the duration of the dry season while for Canonical events, the shift rapidly becoming positive rainfall and cyclonic circulation anomalies during the dry season. SST anomalies also evolve differently, with Non-Canonical Cool events showing anomalies that extend eastward from the central Pacific rather than intensify in place over the eastern Pacific. The features are similar and opposite for Canonical and Non-Canonical Warm events. Differences in evolution of anomalies suggest that the psychical mechanisms governing the Non-Canonical and Canonical ENSO regimes are distinct. These differences provide the groundwork for development of forecasting methodology that can provide local governments and decision makers with guidance for mitigation and relief during these events.