

El Nino, Indian Ocean dynamics and extremely rainy years in East Africa

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El Nino has long been known to affect rainfall in the Indian Ocean basin. For example, drought in Indonesia and failure of the Asian monsoon are both more likely during El Nino events. The relationship between El Nino and African rainfall is, however, more complex, with spatial variation in both the polarity and strength of the teleconnection. Therefore to understand the controls on African rainfall, it is necessary to study the interaction between the ENSO cycle, Indian Ocean dynamics and convection near the African coast. This study focuses on the short rains of coastal, equatorial East Africa. Collation of observed SST and rainfall data shows that excessively strong short rains are associated with positive SST anomalies in the western Indian Ocean and negative anomalies in the eastern part of the ocean - a pattern similar to the Indian Ocean dipole or zonal mode (IOZM). Comparison between the time series of Pacific Ocean SST and the DMI (dipole mode index - a measure of strength of the IOZM) suggests that, in certain circumstances, the IOZM and consequent strong rainfall in East Africa can be triggered by an El Nino event. Composites of SST during the October and November preceding an El Nino show a generalised warming of the Indian Ocean. However, superposed on this, there are localised areas of cooling in the eastern Indian Ocean that may be associated with ENSO-induced changes to the Indonesian through flow. It is suggested that this cooling drives anomalous southerly winds along the Sumatran coast, which cause the enhanced upwelling in the eastern Indian Ocean that characterises the onset of an IOZM event. This relationship is, however not universal. There are several strong El Ninos which do not trigger an IOZM and are not associated with strong rainfall in East Africa. Analysis of individual events suggests that both the phase and strength of the El Nino are important. These observations are used to derive a set of criteria for El Nino triggering the IOZM that, in the long term, may be useful for seasonal forecasting of East African rainfall.