



Changes in Tropical Precipitation Extremes: Secular or Cyclical?

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An appropriate measure of the wet/dryness of a region is its annual accumulation. Using GPCP and GPCC data, we provide evidence that the probability of encountering very high and very low annual tropical rainfall has increased significantly during 1998-2013, as compared to the preceding warming era (1979-1997). These changes are spatially coherent and comprise of a rearrangement of very wet regions and a systematic expansion of dry zones. While the increased likelihood of extremes is consistent with a higher average temperature during the pause (as compared to 1979-1997), it is important to note that the periods considered are also characterized by a transition from a relatively warm to cold phase of the El Niño Southern Oscillation (ENSO). To further probe the relation between contrasting phases of ENSO and extremes in accumulation, a similar comparison is performed between 1960-1978 (another extended cold phase of ENSO) and the aforementioned warming era. Remarkably, in this cold-to-warm transition, a near-exact reversal of extremes is noted both statistically and geographically. This is despite the average temperature being higher in 1979-1997 as compared to 1960-1978. *Thus, in addition to exerting a dominant influence on the wet/dryness of a region, the imprint of changing phases of ENSO is clearly seen in the waxing and waning of extremes of tropical rainfall accumulation.* While the focus of this work is on annual accumulation over the entire tropics, it is interesting to note that a similar analysis over smaller regions (e.g., continental US) clearly shows that previously reported “trends” in short duration extremes are in fact a subset of this aforementioned ENSO footprint. This hypothesis is verified using high-resolution TRMM rainfall observations during the past two decades. Finally, taking advantage of the temporal resolution afforded by TRMM, the change in extremes is seen to go hand in hand with a progressive increase in variance and intensity, and a decrease in number of rainy days over the tropics.