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Revisiting tropical climate interannual variability and ENSO teleconnections using relative sea surface temperature

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Tropical climate interannual variability has important environmental and socio-economic impacts globally, notably in the heavily populated and fragile tropical band. Earlier studies aimed at understanding global warming impacts have introduced relative SST anomalies (i.e. SST anomalies minus their tropical mean) and shown that tropical atmospheric deep convection is more strongly tied to relative SST than to absolute SST anomalies. Here we show that this relation also holds for observed interannual climate anomalies, i.e. that deep atmospheric convection (and related wind) anomalies are better explained by relative SST than by absolute SST anomalies. We hence revisit tropical coupled modes and El Niño Southern Oscillation (ENSO) teleconnections based on relative SST. Empirical orthogonal function (EOF) analysis of relative SST anomalies highlights tropical Indian Ocean (IO) and Atlantic SST variations that are not only more consistent with precipitation anomalies, but also better isolate ENSO-independent variability, than the usual absolute SST EOFs. In the IO, during boreal fall, the peak season of Indian Ocean Dipole (IOD) events, the leading EOF becomes a monopole in the east equatorial IO with a temporal variability strongly correlated to ENSO. The second EOF characterizes the IOD diversity, and is independent of ENSO. In the Atlantic, for which strong interdecadal variations of the influence of ENSO on the Atlantic Niño had been observed when using absolute SST, using relative SST yields a significantly stronger and interdecadally more stable relation. And both the IO basin-wide and north tropical Atlantic absolute warmings in response to El Niño in winter-spring tend to dissapear, or even to reverse to a relative cooling (vice versa during a La Niña). These findings suggest that relative SST is a useful tool to highlight ocean-atmosphere coupling in the Tropics and to better understand ENSO teleconnections and inter-basin interactions, e.g. through model experiments forced by relative instead of absolute SST anomalies.