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Linear trends in the sea surface temperature of the Tropical Pacific Ocean and implications for the El Niño- Southern Oscillation

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A simple decomposition of monthly sea surface temperature (SST) variability in the tropical Pacific Ocean demonstrates that nearly all of the linear trends over the past 60 years are found in two leading patterns. The first pattern is strongly related to SST variations in the Niño-3.4 region, an area commonly used to monitor the El Niño-Southern Oscillation (ENSO). The second pattern resembles the canonical ENSO pattern, but unlike the first pattern, its existence solely depends on the presence of linear trends across the tropical Pacific Ocean. The decomposition also uncovers a third pattern, often referred to as "El Niño Modoki" or the "Central Pacific El Niño," but no significant linear trend is evident. Therefore, linear trends across the equatorial Pacific have their most direct impact on the classical ENSO SST pattern and should be considered when using ocean-based indices to define ENSO.