Last Echo of El Nino Revealing a Regional Coupled Mode over the Indo-western Pacific Warm Pool

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El Niño-Southern Oscillation (ENSO) induces coherent climate anomalies over the Indo-western Pacific warm pool, and these anomalies outlast sea surface temperature (SST) anomalies of the equatorial Pacific by a season, with major effects on the Asian summer monsoon. Specifically, a large-scale anomalous anticyclone (AAC) is a recurrent pattern in post-El Niño summers, spanning the tropical Northwest Pacific and North Indian Oceans. Regarding the ocean memory that anchors the summer AAC, competing hypotheses emphasize either SST cooling in the easterly trade wind regime of the Northwest Pacific or SST warming in the westerly monsoon regime of the North Indian Ocean and South China Sea. Recent studies reveal a coupled ocean-atmosphere mode that builds on both mechanisms in a two-stage seasonal evolution. In spring when the northeast trades prevail, the AAC and Northwest Pacific cooling are coupled via wind-evaporation-SST feedback. The Northwest Pacific cooling persists to trigger a summer feedback that arises from the interaction of the AAC and North Indian Ocean warming, enabled by the westerly monsoon wind regime. This Indo-western Pacific ocean capacitor (IPOC) explains why El Niño stages its last act over the monsoonal Indo-Northwest Pacific and casts the Indian Ocean warming and AAC in leading roles.

Conflicting views exist regarding the climatic role of the Indo-western Pacific warm pool. Some argue for a disproportionately important role as mean SSTs there well exceed the threshold for deep convection. By citing weak local correlations between SST and rainfall, on the other hand, the opposing camp argues that SST variability there is passive and of limited atmospheric effect. The talk will trace historical developments in the study of Indo-western Pacific warm pool variability. Recent studies consistently show that the warm pool is coupled with the atmosphere, but this coupling is not always local, rendering the local SST-rainfall correlation a poor metric. While ENSO is a dominant forcing, regional ocean-atmospheric coupling and feedback select preferred patterns of the regional response. Such regional modes (e.g., the IPOC and Indian Ocean dipole) are important in determining the season and spatial pattern of predictable climate variability.