



Rare Central Pacific El Niño Events Caused by Interdecadal Tropical Pacific Variability

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The frequency of Central Pacific (CP) El Niño events displays strong decadal-variability but the associated dynamics is still not clear. The Inter-decadal Pacific Oscillation (IPO) and the Tropical Pacific Decadal Variability (TPDV) are two dominant modes of the Pacific low-frequency variability that can modify high-frequency behaviors. Using a 500-year control integration of Geophysical Fluid Dynamics Laboratory Earth System Model simulation, we find that the mean state, determined by the two independent modes of tropical Pacific decadal variability, strongly affects CP El Niño frequency and the associated developing processes. A positive TPDV features a shallow thermocline and cool sea surface temperature anomalies (SSTAs) across the central-to-western tropical Pacific, and a negative IPO features cool SSTAs and strong trade winds along the equatorial Pacific. The combination of a positive TPDV and a negative IPO generates a decadal mean state, in which the climatological zonal temperature gradient is reduced, equatorward and westward current anomalies are harder to be generated over the central-to-western tropical Pacific, resulting in the lack of CP El Niño.