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Eastern and Central Pacific ENSO and their relationships to the recharge/discharge oscillator paradigm

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One of the leading theories to explain the oscillatory nature of ENSO is the recharge-discharge oscillator paradigm, which roots on warm waters exchanged between the equatorial and off-equatorial regions. This study tests the relevance of this theory to account for the Eastern and recently mediated Central Pacific El Nino events. The recharge-discharge of the equatorial Pacific, measured here as changes in Warm (>20C) Water Volume (WWV), is analysed using monthly 1993-2010 sea level anomaly (a proxy for WWV) obtained from altimetry, and a validated 1958-2007 DRAKKAR simulation. An Agglomerative Hierarchical Clustering (AHC) technique performed on the observed and modelled WWV shows the existence of five distinct clusters, which characterize the Eastern Pacific (EP) and Central Pacific (CP) El Nino, La Nina, after EP El Nino and neutral conditions. The AHC results, complemented with an analysis of 3-month composites of typical EP and CP El Nino events, indicate that the equatorial band WWV discharge during CP is not as pronounced as during EP El Nino. To understand the differences, we analyze the balance of horizontal mass transport accounting for changes in WWV. The analysis indicates an overall poleward transport during EP El Nino, which is not the case during CP El Nino. Instead, a compensating effect with a poleward (equatorward) transport occurring in the western (eastern) Pacific is evident, in line with changes in the zonal thermocline slopes. The WWW changes are discussed with respect to the conceptual phases of the recharge-discharge oscillator paradigm