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Comparison of geographical trend patterns in sea level and sea surface temperature in the Pacific Ocean during 1993-2011

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It is now well established that geographical trend patterns in satellite altimetry-based sea level are mostly caused by non uniform steric trend patterns, the largest contribution being due to the thermosteric component. In the Pacific Ocean, the observed sea level trend pattern over 1993-2011 results from a superposition two types of signals: (1) a strong positive trend V-shaped anomaly located 120°E and 160° E in longitude and ∼20°S-20°N in latitude and (2) another V-shaped anomaly of much broader scale –extending to mid-latitudes in the central Pacific-, quite similar to the dominant large-scale trend pattern observed in sea surface temperature (SST). Previous studies have shown that the type (1) signal is related to El Nino Southern Oscillation (ENSO). The type (2) signal reflects the Pacific Decadal Oscillation (PDO), the dominant component of large-scale SST variability in the Pacific. In this study, we analyze altimetry-based sea level, steric sea level and SST over the 1993-2011 time span to discriminate between the near surface and deeper thermosteric contributions to sea level. The sea level and SST data are based on the recently available products from the ESA Climate Change Initiative project and several other products like HadiSST, ERAINTERIM. Steric data are based on an updated version of the Ishii and Kimoto (2009) data. We compute the thermosteric contribution to sea level in different layers from the surface to the 700 m depth, and through correlation and Empirical Orthogonal Function analyses, explore the spatio-temporal coherence between the three variables (sea level, depth-dependent steric sea level and SST).