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El Nino-Southern Oscillation Signals in Steric and Non-Steric Sea Level

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We use a coupled Earth system model to simulate and quantify the impact of the El Nino-Southern Oscillation (ENSO) on monthly to inter-annual variations of steric and non-steric global mean sea level (GMSL), as well as the corresponding hydrological mass redistribution in the atmosphere and on the continents. The analysis utilizes 200 years of simulated monthly data from the ECHAM5/MPI-OM coupled atmosphere-ocean general circulation model, which includes a land-surface and runoff scheme. In the model, GMSL is dominated by non-steric variations on monthly to inter-annual time scales, but less than 10% of the non-steric variance is related to ENSO. In contrast, steric GMSL correlates linearly in phase with ENSO with an explained variance of nearly 46%. Non-steric sea level anomalies are mostly balanced by continental water storage. Large non-steric sea level changes (up to 7 mm over 3 years) and continental water storage occur concurrently with some of the simulated ENSO events, but sign and amplitude vary, whereas atmospheric water vapor content is strongly correlated with ENSO variability. Together, these model results imply that there is only a weak linear correlation between total GMSL variations and ENSO. We will also compare our model results with sea level observations from altimetry and hydrography.

F. W. Landerer, J. H. Jungclaus and J. Marotzke, 2008: El Niño–Southern Oscillation signals in sea level, surface mass redistribution, and degree-two geoid coefficients, J. Geophys. Res., 113, C08014, doi:10.1029/2008JC004767