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Causal factors contributing to global sea level change on different timescales

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Causes for global sea level change (GSLC) on inter-decadal & sub-decadal timescales cannot be diagnosed with confidence using general circulation models (GCMs) at present since the description of atmosphere-ocean-ice processes and interactions is far from complete, which corresponding with the fact that the physical models provide wrong projections and underestimated uncertainties. Meanwhile, correlative approaches, specifically talking about Pearson correlation, based on lower-pass filtered datasets hindered us from unravelling the true nonlinear associations on relative shorter timescales. Here, we use convergent cross mapping (CCM), a data-driven approach for uncovering causality in multivariate time series from complex nonlinear system, to test the role of Pacific Decadal Oscillation (PDO), El no-Southern Oscillation (ENSO) and zonal-wind cross western equatorial Pacific Ocean region in shaping GSLC on different timescales. We find: Through hydrological cycle, ENSO acts as main cause with the highest CCM skill among the three drivers that influencing GSLC on all examined timescales. Via information transfer from ENSO, zonal-wind acts as an indirect cause. Finally, through its own midlatitude dynamics, PDO appears to shape GSLC on interdecadal timescale. All the results above provide us a new perspective in finding drivers for GSLC.