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Sources and sinks of interannual steric sea level variability

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It is now well established that sea level rise is not uniform and presents large deviations from its global mean trend.
Indeed, some regions such as the western Pacific ocean or the Indian ocean experience a linear rise 3 times larger than the global mean sea level trend since 1993 (Cazenave and Llovel, 2010; Llovel and Lee, 2015).
Superimposed to the long-term trend, the interannual variability may enhance or reduce sea level change over a shorter time period (few months). It is well known that these variations are linked to the interannual variability of the steric sea level driven by natural modes of climate variability such as El Nino Southern Oscillation (in the tropical Pacific ocean) and the Indian Ocean Dipole (in the north Indian ocean, Llovel et al., 2010). Therefore, investigating the mechanisms of interannual variability of steric sea level appears to be highly relevant for understanding processes at play in regional sea level variability.

In this work, we investigate the local sources and sinks of interannual steric sea level variability using the ECCOv4 (Estimating the Circulation and Climate of the Ocean, Forget et al., 2015) state estimate over 1993-2014. We find that the variability is, in almost all regions, sustained by interannual fluctuating winds via Ekman transport and damped by both interannual variations of the net heat flux from the atmosphere and by the rectification effect of subannual oceanic circulation.

This method allows not only the identification of the physical process at play in the interannual steric sea level variability, but also if the latter is a source or a sink of the interannual steric sea level variability. This method presents evident advantages especially to assess the reliability of coupled climate models used to predict future sea level changes.