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Western boundary circulation and sea level patterns in northern hemisphere oceans

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The sea level changes along the Atlantic coast of the US have received a lot of attention recently because of an increased rate of rise north of the Gulf Stream separation point since the late 1980s (Sallenger et al., 2012 ; Boon, 2012). While sea-level rise is a major issue for coastal community, sea-level measurements in the region are key to understand the past of the nearby Gulf Stream and the large-scale ocean dynamics. Tide gauges on the coastline have measured the inshore sea-level for many decades and provide a unique window on past oceanic circulation. So far, numerous studies have linked the interannual to multi-decadal coastal sea-level changes to ocean dynamics, including the Gulf Stream strength, the divergence of the Sverdrup transport in the basin interior and the Atlantic meridional overturning circulation. However, other studies argue that local and regional processes, such as the alongshore winds or the river discharges, are processes of greater importance to the coastal sea level.

The general picture in the Atlantic is hence unclear. Yet, the northwest Atlantic is not the only western boundary region where sea-level has been well sampled. In this study we extend the analysis to the northwest Pacific, where links between the state of the Kuroshio and sea-level are evident (Kawabe, 2005; Sasaki et al., 2014). We discuss similarities and dissimilarities between the western boundary regions. We show for each basin, that the inshore sea level upstream the separation points is in sustained agreement with the meridional shifts of the western boundary current extension. This indicates that long duration tide gauges, such as Fernandina Beach (US) and Hosojima (Japan) could be used as proxies for the Gulf Stream North Wall and the Kuroshio Extension state, respectively.

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