## Spatial trend patterns in observed sea level: internal variability and/or anthropogenic signature ?

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We investigate the spatio-temporal variability of sea level trend patterns observed by satellite altimetry since 1993, focusing on the tropical Pacific. The objective of this study is two fold. On the basis of a past 2-D sea level reconstruction (over 1950-2009) -based on observations- and multi-century control runs from two coupled climate model runs (developed by the Centre National de Recherche MÈtÈorologique -CNRM- and the Geophysical Fluid Dynamics Laboratory - GFDL-), we investigate how these sea level trend patterns evolved during the last decades and centuries, and what are their characteristic life times. Using 20th century model runs, we also examine whether we can already detect in the observed trend patterns some imprint of external forcing factors (solar or volcanic activity and anthropogenic forcing) or if they essentially result from natural climate variability. For this analysis, we computed sea level trend patterns over successive 17-year windows -i.e., the length of the altimetry record- (both for the reconstructed sea level and model runs). We compared them to altimetry-based observed trends. The 2-D sea level reconstruction shows in the past similar spatial trend patterns as those observed during the altimetry era. The patterns appear to have oscillated with time following a low frequency (< 1/7 yr-1), ENSO-related modulation. The characteristic lifetime of the patterns is on the order of 25-30 years. Similar behaviour is found in 500-yr long control runs of the CNRM and the GFDL coupled climate models. In these runs, that have no external forcing, sea level patterns resemble those seen in the observations. A similar analysis, performed with 20th century model runs (i.e., with anthropogenic and solar/volcanic forcing.) displays almost similar results, suggesting that regional sea level trend patterns reported by altimeter satellites so far mostly reflect internal natural variability of the ocean-atmosphere coupled system.