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Explaining trends and variability in coastal relative sea level

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Comprehensive understanding of trends and variability in coastal mean sea level is vital for protecting shores under a changing climate. To understand the behavior of coastal relative sea level (RSL), it is crucial to identify all relevant processes. We combine data from various geophysical models and observations to determine whether the trends and decadal variability observed in relative sea level at tide gauges can be explained by the sum of all known contributors.
A key contributor to RSL is vertical land motion, which is caused by glacial isostatic adjustment (GIA), solid earth response to surface loading, tectonics, and local effects. We explicitly model low-frequency loading effects to correct GPS records, which leads to a more consistent trend than only using GIA models.
Secondly, we create sea level fingerprints based on estimates of ice melt and changes in land hydrology, which provide the RSL contribution due to large-scale mass transport.
Since coastal areas are often located on shallow continental shelves, steric effects will generally be small, and a large fraction of the decadal sea level variability will have a remote steric origin. Therefore, we determine a relation between coastal sea level and deep sea steric variability.
For the period 1950-2012, we find that for many locations, including the European coast, the observed and modeled RSL time series agree well on decadal and secular scales.