Geophysical Research Abstracts
Vol. 15, EGU2013-12864-2, 2013
EGU General Assembly 2013
© Author(s) 2013. CC Attribution 3.0 License.

Sea level reconstructions from tide gauge records and satellite altimetry data: how reliable are they?

Francisco M. Calafat (1,2) and Don P. Chambers (1)

(1) College of Marine Science, University of South Florida, United States (francisco.calafat@noc.ac.uk), (2) National Oceanography Centre, Southampton, United Kingdom

Sea level reconstructions are commonly obtained by using methods that combine long tide gauge records with the shorter but spatially more complete satellite altimetry data set. While sea level reconstructions have been used in a considerable number of studies to explore past sea level variability and even for projections of future sea level rise, there has been little quantitative research to date on the accuracy of the reconstruction methods. In this study we use an ensemble of surrogate sea level data sets to examine the reliability of sea level reconstructions based on the reduced spaced optimal interpolation (OI) method, paying particular attention to global mean sea level (GMSL) variability and trend. The ensemble of surrogates is generated by applying a phase-randomized Fourier transform algorithm to a 138-year ocean reanalysis (SODA 2.2.4) with a spatial resolution of 1/2º x 1/2º. The spatial resolution of the ocean reanalysis is sufficient to partly resolve coastal features without excessive computational expense, and thus to account for the decoupling between coastal and deep ocean sea level reported in recent studies. A sea level fingerprint of continental ice mass changes is added to the ocean reanalysis in order to account for the non-uniform pattern of sea level changes associated with the melting of ice sheets, which is not accounted for in the model. Here we explore the performance of the OI method in reconstructing GMSL with and without the use of a homogenous pattern. Results of the OI method are compared to those obtained from the regularized expectation maximization (RegEM) method. The GMSL trend is largely underestimated by both OI without a homogenous pattern and RegEM. Including a homogenous pattern in the OI method significantly improves the estimate of the trend (albeit significant biases are still present), but it alters the reconstruction in various ways. In particular, the interannual to decadal variability is largely overestimated, and it tends to follow that shown by a simple average of the tide gauges, more and more so as the instrumental error used in the OI increases. In terms of both the correlation coefficient and the RMSE, RegEM performs better in reproducing the low-frequency variability than OI, although with some variance loss.