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Sea level reconstruction from satellite altimetry and tide gauge data

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Ocean satellite altimetry has provided global sets of sea level data for the last two decades, allowing determination of spatial patterns in global sea level. For reconstructions going back further than this period, tide gauge data can be used as a proxy. We examine different methods of combining satellite altimetry and tide gauge data using optimal weighting of tide gauge data, linear regression and EOFs, including automatic quality checks of the tide gauge time series. We attempt to augment the model using various proxies such as climate indices like the NAO and PDO, and investigate alternative transformations such as maximum autocorrelation factors (MAF), which better take into account the spatio-temporal structure of the variation.

Rather than trying to maximize the amount of variance explained, the MAF transform considers noise to be uncorrelated with a spatially or temporally shifted version of itself, whereas the desired signal will exhibit autocorrelation. This will be applied to a global dataset, necessitating wrap-around consideration of spatial shifts.

Our focus is a timescale going back approximately 50 years, allowing reasonable global availability of tide gauge data. This allows for better sensitivity analysis with respect to spatial distribution, and tide gauge data are available around the Arctic Ocean, which may be important for a later high-latitude reconstruction.