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Bivariate wavelet-based clustering of sea-level and atmospheric pressure time series

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The atmospheric pressure is responsible for a downward force acting on the sea surface which is compensated, to some extent, by corresponding sea-level variations. The static response of the sea surface can be linearly modelled, a decrease (increase) in atmospheric pressure of 1 mb raising (depressing) sea level by 1 cm. However, the dynamic sea surface response to atmospheric pressure loading, associated with ocean dynamics and wind effects, is scale-dependent and difficult to establish. The present study addresses the co-variability of sea-level and pressure time series in the Baltic Sea from the bivariate analysis of tide gauge and reanalysis records. The time series are normalised by the corresponding standard deviation and the wavelet covariance is computed as a measure of the association between sea-level and pressure across scales. A clustering procedure using a dissimilarity matrix based on the wavelet covariance is then implemented. Different classical clustering techniques, including average, single and complete linkage criteria are applied and the group linkage is selected in order to maximise the dendrogram's goodness-of-fit.