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Regional changes in the seasonality of Baltic sea-level

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The seasonal cycle is an ubiquitous feature in sea-level records. In the Baltic Sea the seasonal cycle exhibits a marked minimum in the Spring and accounts typically for about 40% of the total sea-level variability. In a climate change context changes are expected to occur not only in mean levels but also in sea-level seasonal characteristics. Such changes, even if not large in magnitude, are extremely important for ecosystems adapted to seasonal changes of the environment. Furthermore, quantifying and comprehending changes in seasonality is important to understand the mechanisms influencing regional sea level variability. Previous studies of Baltic sea-level suggested the existence of long-term changes in the seasonal cycle, in particular a possible increase of the annual amplitude. The present study addresses the quantification of changes in the seasonal cycle of sea-level in the Baltic Sea from a discrete wavelet analysis of long tide gauge records. As a pre-processing step all tide gauge records are linearly detrended, thereby removing long-term changes in the mean (either from oceanographic or vertical land movement origin). The seasonal cycle is then extracted from a multiresolution decomposition based on the maximal overlap discrete wavelet transform and changes in both amplitude and phase are quantified. Long-term changes in the seasonal cycle are further examined by comparing the results from different methods including autoregressive-based decomposition, singular spectral analysis (SSA) and empirical mode decomposition (EMD). To assess the potential mechanisms determining the identified changes in the seasonal cycle, a coherence analysis is performed on atmospheric pressure, temperature, and precipitation reanalysis data.