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Baltic Sea level variability in the last 500 years estimated from climate reconstructions and long tide gauge records

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In coastal regions and semi-enclosed seas, as the Baltic Sea, atmospheric circulation patterns and others may cause large deviations from the global sea-level trends. For more accurate prediction of the regional sea-level trends, an understanding for the regional sea-level variations at decadal, multi-decadal and centennial timescales is relevant. But the analysis of sea-level variations at longer timescales is hindered by the lack of long observational time series, not only of sea level but of climatic datasets as well. Fortunately, increasing efforts are being recently made to reconstruct the climate of the past centuries at global (Jones and Mann, 2004) and European scales (Luterbacher et al., 2002, 2004, Pauling et al., 2006). The climate influence on Baltic Sea level within the past 500 years is estimated from joint analysis of long instrumental Baltic Sea level time series and proxy based climate reconstructions. Therefore, 500 years long climate reconstructions obtained from Luterbacher et al. (2002, 2004) and Pauling et al. (2005) were regionalized with standard statistical downscaling methods, which relate meteorological forcing (wind, temperature and rainfall) and sea-level variations. For this purpose, a statistical transfer function, developed by Hünicke and Zorita (2006) to estimate decadal variations of Baltic Sea level in the past century, was applied and extrapolated to longer time scales. The analysis was done for the winter (December-January-February) and summer (June-July-August) season. The results (500 year long reconstructed Baltic Sea level anomalies) together with the longest Baltic Sea-level time series (180 to 200 years long), were statistically analysed. The climate reconstructions did not include Baltic Sea level in their predictor set. Because the level of uncertainty is necessarily larger than in the more recent data sets, the interpretation of the results is more focused on the agreement of trends and long-term

behaviour than in quantitative assessments of the real physical links among the different data sets. One main result: the widely held view that Baltic sea-level variations in wintertime can be explained to a large extent by the wind forcing linked to the North Atlantic Circulation (NAO) and other atmospheric patterns could be confirmed. This supports the quality of the SLP reconstructions and of the sea-level records.