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Contribution of regional climate drivers on future sea-level changes in the Baltic Sea estimated by statistical methods and simulations of climate models

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Present estimations of future global sea-level change are based on simulations with coarse-resolution global climate models (GCMs). In regions with complex coastlines, such as the Baltic Sea, sea-level changes may additionally depend on other factors not adequately reproduced by GCMs. The estimation of future regional climate changes by statistical downscaling relies on the skill of large-scale gridded predictors to determine local-scale variables. By establishing a statistical relationship between sea-level and climatic data sets in the observational record it is found that the statistical analysis of Baltic Sea level as regional variable and its relationship to large-scale sea-level pressure (SLP) and precipitation at decadal timescales back to 1800 shows considerable variations among gauge stations: in the Central and Eastern Baltic SLP is a good predictor, in the Southern Baltic Sea area-averaged precipitation shows a higher predictive skill. If the future trends of these predictors diverge, they may imply spatially diverging trends in sea-level. To test this hypothesis, statistical regression models are applied to the output of five different GCM simulations driven by 4th IPCC SRES future scenario A2 of greenhouse gas concentrations. For these simulations the contribution of SLP and precipitation changes to future winter sea-level change are estimated for four stations in the Baltic Sea. Results indicate that the (upward) trend in sea-level rise caused by these regional factors is larger than the past variability and might be of the order of 1 mm/year, depending on the GCM.