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Extreme Sea Levels in the Baltic Sea in Climate Change Scenarios

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An ensemble of regional climate change scenarios for the Baltic Sea is validated and analyzed with respect to extreme sea levels. The ERA40 reanalysis and three representative concentration pathways (RCPs) times five CMIP5 global General Circulation Models (GCMs) have been downscaled with the coupled atmosphere-ice-ocean model RCA4-NEMO. Validation of 100-year return levels against observational estimates along the Swedish coast show that the model estimates are within the confidence limits for most stations. The ensemble mean 100-year return levels turns out to be the best estimator. During the scenario period until 2100 none of the RCPs generates significant changes in the ensemble mean 100-year return levels in the Baltic Sea. Changes in extreme sea levels relative to bedrock are expected to be determined by the regional signal of global mean sea level rise and the glacial isostatic adjustment. Rising by up to 60 cm in the southwestern Baltic Sea and falling by -20 cm in the Bothnian Bay for the RCP8.5 scenario.

Sea levels have also been predicted with alternative set ups of the regional climate model (RCM) forced by the atmospheric part of the RCA4-NEMO model. For the historical period, extreme sea levels are more sensitive to the RCM setup than to the GCM variance. For the scenario projections the fractional uncertainty (Hawkins and Sutton, 2009) for extreme sea levels in the Baltic Sea is dominated by internal variability. The spatial pattern of fractional uncertainties where model uncertainty makes up a large fraction shifts during the 21st century. The scenario uncertainty is the smallest contributor. It is important only in the Skagerrak, Kattegat and the Bothnian Bay and only towards the end of the century.