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Regional Mean Sea Level Changes in the German Bight

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The regional mean sea level of the German Bight is analysed. The time span considered ranges from the mid of the 19th until the end of the 21st century. Tide gauge data of 15 locations is used to analyse past regional mean sea level changes. A time series representing the regional mean sea level of the German Bight is reconstructed following two different methods. Both approaches lead to very similar results for the period 1924-2008. The linear long-term trend is ranging from 1.64+-0.28mm/yr to 1.74+-0.28mm/yr (90%-confidence interval). Decadal trends are analysed to detect a possible acceleration in the mean sea level time series. The result shows that the trends are rising in the recent past, however they are not extraordinary high compared to earlier periods.

Further, the impact of large-scale atmospheric changes to the regional mean sea level is analysed. For that purpose a statistical relationship between the regional mean sea level and the sea level pressure field of the North Atlantic is derived, using a multiple linear regression. For the time period 1924-2001 the sea level pressure explains 58% of the inter-annual variability and 33% of the long-term trend. However, a cross-validation of the model shows that these results depend on the time period considered.

Finally, the derived statistical model is applied to 78 climate change experiments of the 21st century using climate model data. This results in a distribution of that part of the regional mean sea level that is caused by the sea level pressure. The projections show a rise of 1.4cm in the median until the end of the 21st century. When these projections are classified by the considered climate scenarios, some differences within the scenarios can be seen. However, the magnitude of the rise does not exceed a few centimeters and the statistical uncertainties are large. The analysis suggests that the sea level pressure field of the North Atlantic is not a major contributor to future regional mean sea level long-term trends in the 21st century.