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Analysing Mean Sea Level trends and variability in the southwestern Baltic Sea

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In this contribution we present a comprehensive analysis of sea level data around the Baltic Sea from 1777 to the present with a focus on the southwestern part, concentrating on quantifying and understanding long-term trends and the influence of inter-annual and decadal variability. Our analysis focuses on a new monthly mean sea level (MSL) dataset, generated from a first time available compilation of high-resolution sea level measurements combined with already existing monthly MSL time series. Our final MSL dataset consists of records at 139 sites in the Baltic Sea with a temporal resolution of at least 19 years. Additionally, we analyze outputs of barotropic and baroclinic reanalysis runs from a 3D hydrodynamic numerical ocean model to quantify different meteorological and climatological processes contributing to the local sea level budget.
Throughout the 20th century (1900 to 2015), an average linear trend for the whole Baltic Sea of 1.66 $\pm$ 0.14 mm/yr could be determined (corrected for the in the region dominant vertical land motion signal from Glacial Isostatic Adjustment). This is in principal consistent with current GMSL trend estimates (1.3 to 2 mm/yr) for the same period (Church and White 2006, Hay et al., 2015; Dangendorf et al., 2017) within their specific error bars. However, within the basin large differences in trends from different stations are found, which reach from minimum values in the southwestern part (0.94 $\pm$ 0.15 mm/yr in Kolobrzeg) to maximum values in the eastern Gulf of Finland (2.21 $\pm$ 0.32 mm/yr in Kronstadt). These differences can primarily be explained by an intensification of westerly winds and a decrease of atmospheric pressure over the 20th century pushing lowering MSL rates in the west and increasing them in the east.
With our study we outline major existing knowledge gaps in understanding sea level change and variability in the southwestern Baltic Sea. A better understanding of the past and present development of the MSL provides the basis for deriving more reliable future projections of sea-level rise.

Church and White (2006): A 20th century acceleration in global sea-level rise. In: Geophysical Research Letters, Jg. 33, 1, n/a. doi: 10.1029/2005GL024826.
Dangendorf et al. (2017): Reassessment of 20th century global mean sea level rise. In: Proceedings of the National Academy of Sciences of the United States of America, Jg. 114, 23, 5946-5951. doi: 10.1073/pnas.1616007114.
Hay et al. (2015): Probabilistic reanalysis of twentieth-century sea-level rise. In: Nature, Jg. 517, 7535, 481-484. doi: 10.1038/nature14093.