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Past and future changes of hypoxia in the Baltic Sea simulated with a Regional Climate Model

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Hypoxia is a well known phenomenon in the deep basins of the Baltic Sea. Moreover, observations show that hypoxia increased by about 4 times since 1960. Climate change model studies indicate that this trend will continue within the 21st century. The reasons for recently expanding hypoxia are man-made as for instance due to increased nutrient loads and rising temperatures, respectively. Nevertheless, sediment proxy studies show that hypoxia was also prevalent during the Medieval Climate Anomaly (MCA). Here, it is an open question to what extent this was connected to climate variability or human influence. Some studies indicate that a surplus of nutrient loads released from the Vikings could have significantly contributed to the increase of hypoxia.

The goal of this study is to assess whether natural climate variability or the Vikings played the main role for the spreading of hypoxia during the MCA. Therefore, climate simulations of the last 1000 years have been carried out with the Rossby Center Ocean model (RCO). RCO is a biogeochemical regional climate model which covers the entire Baltic Sea. The model simulates a warmer and fresher Baltic Sea during the MCA. Moreover, oxygen concentrations are reduced up to 1ml/l in the Gotland deep due to climate variability only. However, this is not sufficient to change the general high oxygen conditions into hypoxia in the model. Therefore, in addition, sensitivity studies will be presented for the MCA with increased nutrient loads or stronger temperature signals to further investigate the interaction of climate variability and human made impact.