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The Baltic Sea natural long-term variability of salinity

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The Baltic Sea is one of the largest brackish sea areas of the world. The sensitive state of the Baltic Sea is sustained by a fresh-water surplus by river discharge and precipitation on one hand as well as inflows of highly saline and oxygen-rich water masses from the North Sea on the other. Major inflows which are crucial for the renewal of the deep water occur very intermittent with a mean frequency of approximately one per year. Stagnation periods (periods without major inflows) lead for instance to a reduction of oxygen concentration in the deep Baltic Sea spreading hypoxic conditions. Depending on the amount of salt water inflow and fresh-water supply the deep water salinity of the Baltic Sea varies between 11 to 14 PSU on the decadal scale.

The goal of this study is to understand the contribution of different driving factors for the decadal to multi-decadal variability of salinity in the Baltic Sea. Continuous measurement series of salinity exist from the 1950 but are not sufficiently long for the investigation of long-term fluctuations. Therefore, a climate simulation of more than 800 years has been carried out with the Rossby Center Ocean model (RCO). RCO is a biogeochemical regional climate model which covers the entire Baltic Sea. It is driven with atmospheric data dynamical downscaled from a GCM mimicking natural climate variability.

The analysis focus on the role of variations in river discharge and precipitation, changes in wind speed and direction, fluctuations in temperature and shifts in large scale pressure patterns (e.g. NAO). Hereby, the length of the simulation will allow to identify mechanisms working on decadal to multi-decadal time scales. Moreover, it will be discussed how likely long stagnation periods are under natural climate variability and if the observed exceptional long stagnation period between 1983-1993 might be related to beginning climate change.