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Influence of Sea Level Rise on the Dynamics of Salt Inflows in the Baltic Sea

Robinson Hordoir (1), Lars Axell (1), Ulrike Löptien (2), Heiner Dietze (2), and Ivan Kuznetsov (1)
(1) SMHI, Norrköping, Sweden, (2) IFM-Geomar, Kiel, Germany

The Baltic Sea is a marginal sea, located in a highly industrialized region in Central Northern Europe. Based on a numerical ocean model covering both the Baltic Sea and North Sea, we explore the impact of anticipated future sea level changes on the dynamics of salt water inflows which transport salty water masses from the North Sea into the Baltic Sea. This deep water renewal is an essential ventilation mechanism that determines the oxygenation of the Baltic Sea. We illustrate in a hindcast simulation for the period 1961-2007 that the ocean model is capable of producing recent ventilation dynamics. Further we explore the effect of sea level changes with an additional suite of hindcast simulations, which differ by prescribed mean sea level increases between 0.5 and 1.5m. We find that with rising sea level, salt water inflows intensify, become longer and more frequent.
Expressed in terms of a salinity increase in the deep central Baltic our simulations suggest a sensitivity of more than 1PSU for a sea level increase of 1.5m. This substantial increase in ventilation is predominantly a consequence of the increasing cross-section in the Danish Straits. In addition there is an amplifying contribution that can be explained by a reduced vertical mixing.