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Sensitivity of Baltic Sea deep water salinity and oxygen concentration to variations in physical forcing

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In this study, the Baltic Sea deep water exchange is investigated with focus on oxygen conditions. Salinities, temperatures and oxygen concentrations are modelled for some Baltic Sea sub-basins during a 50-year period. The removal of oxygen associated with decomposition of biological material is assumed to progress at a constant rate below the thermocline. Hence, factors that may influence the rate of decomposition - such as changes in biological production, temperature and oxygen concentration - are disregarded. Different rates are however applied to different sub-basins. Modelled salinities, temperatures and oxygen concentrations are found to agree well with observations within the different layers of the Baltic Sea water column. It is however apparent that the oxygen dynamics in the surface layer and upper deep water would probably be better reproduced if a proper plankton model were used. The results suggest an increase in oxygen removal rate from the eastern Gotland Basin to the Arkona Basin just inside the Danish Straits. Moreover, it is suggested that a drier climate would result in a more frequent ventilation of the deeper deep water due to more numerous sufficiently dense inflows. However, the strengthened stratification would prevent less dense inflows from reaching below the surface layer, thus causing a rather poor ventilation of the upper deep water. A wetter climate on the other hand is found to markedly improve the oxygen conditions in the upper deep water as a consequence of a weakened stratification and a more intense wintertime mixing due to stronger winds. Wet and windy periods are thus probable to result in larger than usual volumes of rather well oxygenated water, which was actually the case towards the end of the 1983-1993 stagnation period.