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Influence of North Atlantic variability on the North Sea

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To study the impact of the North Atlantic variability on the North Sea, observations and coupled model data were used. Temperature increases in the North Atlantic have been reported for the last twenty years and similar changes are observed in the North Sea. This study using the ocean model MPI-OM (Max Planck Institute for Meteorology, Hamburg) and ship borne observations will focus on the transfer of variability signals between the North Atlantic and the North Sea. The grid structure of the MPI-OM allows for the combination of a global ocean model with a regional high resolution area and resolves scales of 5-15 km in the North Sea. Furthermore, the MPI-OM can be run in a regionally coupled mode using the REMO regional atmosphere model and includes a module for ocean tides.

Atlantic inflow into the North Sea provides a major contribution in terms of water masses and a potential link of long term variability generated in the deep ocean onto the shallow shelf sea. Observational evidence of inflow variability is limited in space and time and for a better understanding of the underlying processes high resolved model data are needed. The model runs analyzed here comprise hindcasts using NCEP forcing and scenario runs for the 21 century. T/S diagrams from the model hindcast runs are -validated against the available in-situ observations and show generally good agreement. Hindcast data are used to study the annual evolution of water mass properties in the inflow region and the lateral spreading of the Atlantic Water. Variations in the water mass properties of the Atlantic Inflow between Scotland and the Orkneys and over the Shetland shelf are responsible for the interannual variations in deep TS properties. Transport time series of the Atlantic inflow also show high correlation with the atmospheric forcing and increase during NAO+ phases. The scenario simulation shows areas of large temperature and salinity change along the shelf edge which are probably related to changes in the North Atlantic Current branches towards the Nordic Seas. The resulting changes in deep TS properties in the NS are contrasted with the hindcasts.