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Interannual variability in the hydrography of the Norwegian Atlantic Current: local forcing versus advection

Kristin Richter (1,2) and Sönke Maus (2)

(1) Uni Research AS, Bjerknes Center, Allegaten 70, 5007 Bergen, Norway, (2) Geophysical Institute, University of Bergen, Bergen, Norway

The warm and saline inflow of the North Atlantic Current to the Nordic Seas is known to be highly relevant for regional and global climate. Crossing the Greenland Scotland Ridge east and west of the Faroe Islands, it continues northward as the Norwegian Atlantic Current (NwAC) along the Norwegian continental slope. Near 63°N, the NwAC consists of two 40-60 km wide branches, situated at the slope and 150-200 km offshore, respectively. Observations have indicated that the slope branch is primarily barotropic, while the offshore branch is baroclinic. To interpret changes in these branches in terms of climate variability triggered in the Northern North Atlantic, it is important to understand their spatio-temporal response to local atmospheric forcing and advection.
We analysed 30 years of synoptic hydrographic observations of the branches' variability, with particular focus on the response to the North Atlantic Oscillation (NAO) and related wind stress curl changes in the Nordic Seas and the subpolar gyre. As an instantaneous response to the NAO we find a deflection of the offshore branch towards the coast. This shift seems to persist for 2 years and is not related to temperature and salinity changes. A similar correlation of the position of the slope branch with the wind stress curl in the Nordic Seas indicates a rapid local dynamic response. No immediate response of hydrographic properties to changes in the NAO is found but lagged correlation analysis reveals a negative correlation of NAO and temperature and salinity in the slope branch, hydrography lagging the NAO by 3-5 years. In the offshore branch the correlation coefficients are of the same sign but appear with 5-7 years lag. We interpret this difference in terms of different source areas of the branches' inflow from the subpolar North Atlantic, and its delayed response to the NAO.