



Influence of Atlantic circulation on the North Sea under a climate change scenario.

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The North Sea interacts with the North Atlantic through water mass exchanges at the Northern boundary and through the English Channel. The climate change related alterations in the strength and location of the Gulf Stream, the intensity and extent of the subpolar gyre (SPG) and sub-tropical gyre (STG) would impact this exchange and can potentially alter the hydrographic features of the North Sea. The analysis of the global RCP 8.5 CMIP5 scenario runs performed using the MPI-ESM (IPCC AR5) has revealed a cold anomaly and relatively weakened warming some parts of the North Atlantic. This would point to a possible change in strength and position of the Gulf Stream. The effect of these events in the Atlantic would potentially affect the water mass transport to the Nordic Seas. Because the spatial resolution of the global CMIP5 models is too coarse it is difficult to study the water mass changes in the North West European shelf using these runs. We employ a regionally coupled ocean-atmosphere-biogeochemistry model system (MPIOM-REMO-HAMOCC) with a hydrological discharge (HD) model. The ocean model has a zoomed grid which provides the highest resolution over the North West European Shelf by shifting its poles over Chicago and Central Europe. Compared to the global runs, the regionally coupled model also replicates the cold anomaly in the North Atlantic in the future (with a much stronger amplitude), coinciding with a freshening in the same area. Eddy kinetic energy changes along various locations show a weakening of the Gulf Stream and increased freshwater input from the Labrador Sea to the central North Atlantic. The relationship between the strength and extent of SPG and STG and the water mass changes at various locations along the eastern Atlantic and North West European shelf is analyzed to explain the changes. Analysis of surface currents in the future shows that there is a weakening of the Norwegian Atlantic slope current in the future, the impact of this weakening on hydrographic properties of the North Sea are also investigated.