Fourth International Conference on Earth System Modelling
4ICESM-116-1, 2017

Atlantic Inflow to the North Sea Modulated by the Subpolar Gyre

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The oceanic inflow to the North Sea is known to be mainly forced by the winds. Here we show that a part of this inflow, which acquires its properties south of the Rockall Trough, may be influenced by the North Atlantic Subpolar Gyre (SPG). We analyze historical simulation (1850-2005) from the Max Planck Institute Earth System Model (MPI-ESM). In this model, the canonical SPG index, defined as the first principal component of the sea surface elevation, represents decadal variability of both the strength and shape of the gyre, which is important for the redistribution of subpolar and subtropical water masses. Source water masses in the eastern North Atlantic are identified using salinity and oxygen profiles. We find a close connection between the northward penetration of water mass of subtropical origin and the canonical SPG index. A weak SPG results in the westward retreat of the subpolar front allowing saline waters, such as the Eastern North Atlantic Water, to invade most of the eastern North Atlantic. The core of this saline water is seen at depths shallower than 700 meter in the Rockall Trough moving close to the shelf edge, and subsequently crossing over the Greenland-Scotland Ridge into the Faroe Shetland Channel (FSC). In the FSC, even though the properties of the saline core are slightly diluted its volume transport still follows the SPG variability. There is a close connection between the three regions, the Rockall Trough, the FSC and the northern North Sea, with northern North Sea following salinity variability of the other two regions with one year lag. Overall, we find that volume transport of the saline inflow to the North Sea is significantly correlated with the canonical SPG index, and therefore this oceanic influence may be a source of decadal predictability.