EGU21-2220, updated on 24 Oct 2021
https://doi.org/10.5194/egusphere-egu21-2220
EGU General Assembly 2021

A satellite-based Lagrangian view on the origin of water-masses in the northern European shelf seas

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Knowledge about water-mass properties is critical to understanding how ocean climate variability impacts the shelf seas. Disentangling the origin of shelf sea water-masses and associated driving mechanisms is, therefore, a significant step towards improving the predictive skill related to water-mass evolution. Especially more conservative water-mass properties, even of surface waters, have the potential to reveal links between the shelf seas and large-scale ocean circulation regimes when traced back to their origin. The northern North Sea for example as the main gateway for water-masses to one of Europe's largest shelf sea areas is largely supplied by water-masses from the open North Atlantic, a connection which can be seen from, e.g., sea surface salinity.

The aim of this study is to identify the origin of northern North Sea water-masses and distinguish pathway variability relative to the subpolar gyre regimes. This is done using Lagrangian trajectories, calculated using satellite-derived velocity fields. The results of the Lagrangian statistics mainly indicate that on inter-annual time-scales the North Atlantic subpolar gyre strength largely influences the water-masses found in the North Sea. The relation is found to originate from varying pathways and therefore origin. We conclude that on inter-annual time scales the subpolar gyre strength is a good proxy and skillful predictor of water-mass variability in the North Sea.