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The two-branch structure of the Norwegian Atlantic Current - transport variability and atmospheric forcing

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The Norwegian Atlantic Current (NwAC) in the Norwegian Sea is studied using remote sensing, surface drifters, hydrography, and ASAR Doppler surface currents. Focus is on the northward transport of Atlantic Water (AW) in the two branches of the NwAC. Analysis of satellite derived absolute geostrophic velocity fields (1993–2015) shows a general spin up of the circulation in winter. An exception is over the Mohn Ridge where it is strongest in summer. The results highlight the dynamical importance of large scale atmospheric forcing and topographic steering.

Combining altimetry with hydrographic data, we demonstrate that the variability in surface velocities of the Norwegian Sea is also reflected in the deeper layers, and that altimetry therefore can be used to monitor the variability of the pole-ward transport of AW. Surface currents, in particular in the selected regions, are compared to ASAR Doppler derived surface currents, as well as moored current meters.

As expected, strengthening or weakening of the Atlantic inflow east of the Faroe Islands has a consistent response along the entire slope current. However, a stronger western inflow, observed north of the Faroe Islands, is to a lesser degree associated with velocities in the downstream western branch of NwAC, and is instead associated with more flow of AW into the slope current increasing the transports here. Consequences of this finding are that a substantial fraction of AW that eventually enters the Barents Sea or the Arctic through the Fram Strait, may originate from the western inflowing branch of AW to the Nordic Seas, and that the two branches of northward flowing AW cannot be considered separate flows.