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Assessments on Atlantic water transport in the Arctic Ocean based on NABOS CTD-transects

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CTD-transects across continental slope of the Eurasian Basin performed during NABOS (Nansen and Amundsen Basins Observing System) project in 2003–2015 are used to assess transport and propagation features of the Atlantic Water (AW) in the Arctic Ocean. One branch of AW enters the Arctic through the Fram Strait (FAW – Fram Strait branch of AW) and forms eastward subsurface baroclinic current with a core of increased temperature and salinity adjacent to the continental slope. Potential density contours diverge towards the continental slope margin (to the south), shallowing above the warm/saline core and sloping down beneath it, which in view of geostrophic balance, corresponds to eastward subsurface flow, and, therefore, allows to estimate volume rate of the FAW current.

CTD-transects across the St. Anna Trough displayed a pool of dense (cold and saline) water in the bottom layer adjacent to the eastern slope of the trough which corresponds to geostrophically balanced near-bottom gravitational northward flow (note that in this case the no-flow zero level for geostrophic calculations is implied to be well above the current). This near-bottom current carries waters of Atlantic origin too, the Barents Sea branch of AW (BAW), which is strongly cooled and desalinated due to mixing with shallow waters of the Arctic shelf seas. In the Nansen Basin just east of the St. Anna Trough (at longitude <92˚E), one can observe both BAW and FAW branches separately, the former is adjacent to the continental slope and the latter is adjacent to the former from the north. Further east (>92˚E) the denser BAW dives under the FAW, and a pattern of potential density is characterized by sloping down density contours towards the North which corresponds to eastward geostrophic flow provided that the zero level is well above.

Finally, more far to the east at longitude ≥142˚E the potential density contours become almost flat implying no geostrophic flow along the continental slope margin.

Using potential density distributions on the NABOS CTD-transects the following geostrophic estimates of volume transport V of the along-slope current carrying AW, its mean value V_{mean}, and standard deviation σ_V for N transects were obtained:

FAW flow (longitude range 31–92˚E): V =(0.10–0.80) 10^6 m^3/s , V_{mean} =0.44 10^6 m^3/s, σ_V =0.28 10^6 m^3/s, N =6;

BAW flow (St. Anna Trough): V =(0.73–0.89)10^6 m^3/s , V_{mean} =0.79 10^6 m^3/s, σ_V =0.09 10^6 m^3/s, N =3;

Combined FAW+BAW flow (longitude range 94–107˚E): V =(0.09–2.23)10^6 m^3/s , V_{mean} =1.03 10^6 m^3/s, σ_V =0.86 10^6 m^3/s, N =9.

Note that the above presented mean estimates of FAW at longitude ≤92˚E and BAW volume rates fits within 20% the mean estimate of combined FAW+BAW volume rate at longitude >92˚E. Also it can be concluded that the BAW flow volume rate is about twice larger than that of FAW (0.79 10^6 m^3/s vs 0.44 10^6 m^3/s).

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