

Observational study of Davis Strait fluxes and water masses

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Davis Strait is a key location for investigating freshwater exchange between the Arctic and North Atlantic Oceans. Freshwater from the Arctic enters the subpolar North Atlantic through two gateways, the Canadian Arctic Archipelago (CAA) and Fram Strait. After modification within Baffin Bay, the integrated CAA outflow (excluding the small contribution from Fury and Hecla Strait) and runoff from West Greenland passes through Davis Strait, continuing southward to the Labrador Sea. Sustained quantification of fluxes and water mass variability at Davis Strait provides an important upstream boundary condition for Labrador Sea deep convection and critical data for assessing Atlantic meridional overturning circulation sensitivity to Arctic freshwater input. Arctic outflow through Davis Strait also has strong impacts on Labrador shelf ecosystems. These measurements are necessary in order to close Arctic volume and freshwater budgets and contribute to understanding the role played by the Arctic and sub-Arctic in steering decadal scale climate variability.

An ongoing observational program to quantify volume, freshwater and heat fluxes through Davis Strait has been operational since September 2004. The year-round program consists of velocity, temperature and salinity measurements from 15 moorings spanning the full width (330 km) of the Strait. Over the shallow Baffin Island and West Greenland shelves, moored instrumentation provides temperature and salinity measurements near the ice-ocean interface. Autonomous gliders (average profile separation = 4 km) and autumn ship-based hydrographic sections improve the spatial resolution of the array. Gliders have captured the first high-resolution wintertime sections across the Strait. Full Strait volume, freshwater and heat fluxes are estimated from daily objective maps.

No clear trends are observed in the 2004-2010 net fluxes. However, a decrease in Arctic Water salinity is observed in the more recent data (2008-2010), consistent with decreasing freshwater inventory within the Beaufort gyre and enhanced mass loss from West Greenland and Canadian glaciers. Interannual flux variability is large and mean volume, liquid freshwater and heat fluxes are -2.6 ± 0.8 Sv (negative indicates southward transport), -114 ± 36 mSv and 21 ± 4 TW, respectively. Net volume and freshwater transports through Davis Strait are similar in magnitude to those estimated for Fram Strait.