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Overflow transports in Denmark Strait and the Faroe Bank Channel derived from combined moored ADCP and PIES measurements during 2011-2014

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The Denmark Strait (DS) and Faroe Bank Channel (FBC) are the major pathways of dense water leaving the Arctic Mediterranean. The water formed in the Nordic Seas crosses the sills of this passages and descends into the deep North Atlantic Ocean where it becomes part of the North Atlantic Deep Water. Estimates of strength and variability of these overflows are useful to observe temporal changes and understand mechanisms that may affect the Atlantic Meridional Overturning Circulation.

The velocities in the overflows have been measured with Acoustic Doppler Current Profilers (ADCPs) for almost two decades. For transport estimates the thickness of the overflow plume is typically derived from the depth of maximum velocity shear.

During 2011 and 2014 Pressure Inverted Echo Sounders (PIES) were added to the mooring sites. The thickness of the plume of overflow water that is usually characterized to be denser than σ_Θ=27.8 kgm^{-3} can be estimated from hydrographic profiles that were obtained from travel time measurements of the PIES.

The volume transports in DS, calculated from ADCPs only and in combination with the plume thickness derived from PIES measurements, are compared. The mean difference between both is about 3% of the total transport of 3 Sv. Nevertheless, daily estimates can differ within the same magnitude, whereas the difference of monthly estimates reduces to about 0.3 Sv.

The heat transport of the overflow relative to 0°C calculated from combined PIES and ADCP measurements across the DS varies within the order of 10 TW.

Estimates of transports from hydraulic control theory were derived from PIES data upstream of the sills in DS and FBC and compared to transport observations at the sills.

Additionally, the variability within the vertical structure of the water column in DS and FBC are analysed.