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Fates and transformation of Denmark Strait Overflow Water revealed by Lagrangian particles in a high resolution ocean model

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The Denmark Strait Overflow Water (DSOW) accounts for one third of the North Atlantic Deep Water and is a key component of the global thermohaline circulation.
The water mass properties of the overflow are modified during their transfer through the Irminger Basin by mixing and the volume flux doubles through entrainment. Understanding of the evolution of DSOW downstream of Denmark Strait is still incomplete due to spatio-temporal variability of the flow. Mesoscale variability influences the fate and transformation of the deep water: the bulk of the plume exits Denmark Strait as 30-50km diameter dense boluses which carry a distinct surface signature. Dense water also spills from the East Greenland shelf.

This study employs synthetic Lagrangian particles ("floats") deployed in a high
resolution ocean model to study the transit of dense waters through the Iriminger Basin. The Lagrangian framework is ideal for addressing the fate and transformation of DSOW because the water masses are defined on water particle trajectories. The floats are integrated using velocity fields from a 2km resolution simulation with 97 vertical levels. Most of the floats deployed in the dense water plume at the Denmark Strait Sill transit the Irminger basin to the Angmagssalik mooring line (63.5N) in two weeks. Some floats on the western side of the sill recirculate in the Kangerdlugssuaq Trough and then follow an alternative southward route on the continental shelf. Using relative dispersion statistics and a new clustering approach we present spatial distributions of eddy diffusivity and eddy fluxes to quantify the effect of eddies in the mixing and entrainment processes.