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# Drivers of deep heat uptake in the North Atlantic Subpolar Gyre

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**The decadal to multi-decadal temperature variability of the intermediate (700 – 2000 m) North Atlantic Subpolar Gyre (SPG) significantly imprints the global pattern of ocean heat uptake. Here, the origins and dominant pathways of this variability are investigating with an ocean analysis product (EN4), an ocean state estimate (ECCOv4), and idealized modeling approaches. Sustained increases and decreases of intermediate temperature in the SPG correlate with long-lasting warm and cold states of the upper ocean – the Atlantic Multidecadal Variability – with the largest anomalous vertical heat exchanges found in the vicinity of continental boundaries and strong ocean currents. In particular, vertical diffusion along the boundaries of the Labrador and Irminger Seas and advection in the region surrounding Flemish Cap stand as important drivers of the recent warming trend observed during 1996-2014. The impact of those processes is well captured by a 1-dimensional diffusive model with appropriate boundary-like parametrization and illustrated through the continuous downward propagation of a passive tracer in an eddy-permitting numerical simulation. Our results imply that the slow and quasi-periodic variability of intermediate thermohaline properties in the SPG are not strictly driven by the well-known convection-restratification events in the open seas but also receives a key contribution from boundary sinking and mixing. Increased skill for modelling and predicting intermediate-depth ocean properties in the North Atlantic will hence require the appropriate representation of surface-deep dynamical connections within the boundary currents encircling Greenland and Newfoundland.**