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Reconciling the role of the Labrador Sea overturning circulation in OSNAP and climate models

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The AMOC (Atlantic Meridional Overturning Circulation) is a key driver of climate change and variability. Since continuous, direct measurements of the overturning strength in the North Atlantic subpolar gyre (SPG) have been unavailable until recently, the understanding, based largely on climate models, is that the Labrador Sea has an important role in shaping the evolution of the AMOC. However, a recent high profile observational campaign (Overturning in the Subpolar North Atlantic, OSNAP) has called into question the importance of the Labrador Sea, and hence of the credibility of the AMOC representation in climate models. Here, we reconcile these viewpoints by comparing the OSNAP data with a new, high-resolution coupled climate model: HadGEM3-GC3.1-MM. Unlike many previous models, we find our model compares well to the OSNAP overturning observations. Furthermore, overturning variability across the eastern OSNAP section (OSNAP-E), and not in the Labrador Sea region, appears linked to AMOC variability further south. Labrador Sea densities are shown to be an important indicator of downstream AMOC variability, but these densities are driven by upstream variability across OSNAP-E rather than local processes in the Labrador Sea.