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Mechanisms linking the Labrador Sea with subtropical Atlantic overturning

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We analyze the causal chain linking sea surface buoyancy anomalies in the Labrador Sea and variability in the subtropical Atlantic meridional overturning circulation (AMOC) in the ECCO ocean state estimate on inter-annual timescales. Our study highlights the importance of Lower North Atlantic Deep Water (LNADW) for the north-south connectivity in the Atlantic Ocean. We identify important mechanisms that allow the Labrador Sea to impact the southward transport of LNADW. We show that NAC plays an essential role in the export of buoyancy anomalies from the Labrador Sea – and it furthermore exerts a positive feedback that amplifies these upper ocean anomalies in the eastern subpolar gyre – before they reach the denser water masses along the lower limb of the AMOC. Our results also highlight the contribution of the western Labrador Sea for the surface uptake of tracers that penetrate the LNADW near Denmark Strait, which has implications for the redistribution of ocean heat anomalies.