



The impact of Labrador Sea temperature and salinity variability on density and the subpolar AMOC in a decadal prediction system

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Labrador Sea density variability is important for Atlantic Meridional Overturning Circulation (AMOC) dynamics and hence decadal variability in the Atlantic. We investigate whether temperature or salinity dominate top 500m interannual Labrador Sea density variability in gridded observations, an assimilation of the observations, and a set of multi-annual hindcasts. We find that salinity dominates in the observations and assimilation. In the hindcasts salinity remains dominant for the first year but from year three these revert to the same temperature dominance seen in the underlying climate model. This is due to damping of the interannual salinity variability, possibly caused by unrealistically large convection that develops. Crucially, the hindcasts have high correlation skill in temperature/salinity throughout, but no skill in density, dynamic sea-level, or the subpolar AMOC due to the incorrect drivers. This highlights the importance of correctly simulating both the sign and magnitude of temperature/salinity variability in a prediction system. This analysis provides a framework to assess the systematic biases of dynamical prediction systems and improve the quality of decadal forecasts.