The authors performed simulations with the use of the climate model EC-Earth3P with 3 different spatial resolution, which are eddy-parametrised (SR), eddy-Permitting (HR) and eddy-rich (VHR). The goal is to examine the resolution impact on the oceanic mixing processes, their drivers and AMOC. They firstly compared the simulated mixed layer depth distribution in the North Atlantic, vertical profiles in density/temperature/salinity in Labrador Sea with observations, showing the best performance of the VHR. They then show the resolution effect on the links of North Atlantic westerlies and surface salinity with the Labrador Sea mixed layer depth, as well as the link between Labrador Sea mixed layer depth and AMOC. The authors did a good job. Their work highlight the importance of using high resolution models to accurately capture realistic ocean properties and processes associated with AMOC. The manuscript is well-written, and the conclusions are generally supported by the presented analysis. I would recommend minor revisions for this stage.

Specific comments:

1 The authors focus on the Labrador Sea mixing and its connect with AMOC, as this region has been considered a key region affecting AMOC. Though it is true that all experiments show a deeper MLD in the Labrador Sea than other deep water formation regions, it doesn't mean the Labrador Sea processes are more important than the Irminger and the Nordic Sea in modulating the AMOC. For example, Ma et al (2024) shows that the Irminger basin could be the most effective region leading to AMOC changes though MLD is the deepest in the Labrador Sea. I would suggest to perform a lagged correlation between AMOC indices and mean surface density in all the three deep water formation sites, to first check which area is the key. An example is Fig. 5 in Shi and Lohmann (2016)

Ma, Qiyun, et al. "Revisiting climate impacts of an AMOC slowdown: dependence on freshwater locations in the North Atlantic." Science Advances 10.47 (2024)

Shi, X., & Lohmann, G. (2016). Simulated response of the mid-Holocene Atlantic meridional overturning circulation in ECHAM6-FESOM/MPIOM. Journal of Geophysical Research: Oceans, 121(8), 6444-6469.

Minor comments

2. How the simulated AMOC compared to modern estimation? Is the VHR also better in simulating AMOC strength/streamfunction than other two resolutions?

3 In Section 3.1 The authors show that the VHR behaves the best in simulating the vertical profile of Labrador Sea properties, is this improvement mostly related to more accurate eddy effects or more realistic presentation of ocean properties and processes,

e.g., topography, currents...

4. Regarding the different propagation speed in surface water in VHR versus other setups, and the differences in how the mixing propagates and impacts the AMOC, what kind of role is played by the meso scale eddies and high-resolution topography here?

5. Caption of Figure 7, please indicate who leads whom when lag >0.

6. Caption of Figure 8, if I understand it correctly, the figure is for correlation between MLD and density. Is the “stream function” a typo here?