Reviewer 1

This is a well written manuscript addressing the topic of sea-ice thickness distribution configuration, which is important for those who use the NEMO-LIM ocean-sea-ice model. Therefore the paper is suitable to be published in the Nucleus for European Modelling of the Ocean - NEMO special issue. The manuscript provides useful results for NEMO-LIM modellers based on advanced statistical and visualisation methods that appear valid. To my opinion, these results sufficiently substantially advance in modelling science. In particular, the main result that no clear benefit is obtained from increasing the number of sea ice thickness categories beyond the current usual standard of 5 categories in NEMO3.6-LIM3 is useful so that a model user will not waste time in testing a range of number of sea-ice categories for better results.
We thank the Reviewer for the appreciation and the thoughtful comments. In the following we answer each specific point (in blue).

In Discussion the authors conclude that changes in the ice thickness distribution configuration need re-tuning parametrizations and parameter values. Would be useful for future approaches to list which parameters needed re-tuning. In the current version no specifics has been discussed.
We referred to the typical parameters of the sea ice models, which include, among others, snow thermal conductivity, bare sea-ice albedo, and compressive ice strength, P*. This is now discussed in the revised manuscript (Lines 383–389).

The other aspects for a reviewer to consider, seem adequately addressed too, but there are a few things that might be useful for the NEMO community if added or expanded the paper. There are also a small amount of corrections that the text requires. Due to these, a minor revision is required with the details following.

Detailed comments:
• line 14 ’coherence across’ would be more precise to say ’correlation across’
Corrected.

• line 16 Here ’atmospheric variability’ does not point to synoptic one, as one might guess when reading the abstract, but longer, large-scale atmospheric modes. This could be specified by rewriting ’long-term atmospheric variability’.

Clarified as suggested

• line 24 You could mention why there is 'overly large simulated sea-ice growth'. Is it due to the fact that thin ice grows faster?
Massonnet et al. [2019] show that this is because of a net increase in basal ice growth rate, which is indeed promoted when the relative area of thin ice is large. This is indicated in the revised manuscript now (Line 23)

• line 26 'Antarctica' comes sudden here as improvements there has not been mentioned before in the abstract. I suggest adding a sentence how Antarctic sea-ice was improved by better resolved thin ice after the sentence ending in line 21.
Done.

• line 33. '... Antarctica. These modes drive ...'
The sentence has been clarified.

• line 40. '... variability in modes such as the NAO ...'
Corrected.

• line 45. '...determines its important physical processes, such as salt and ...'
We think the word properties, as in the original manuscript, is more precise than processes to describe quantities like heat capacity or resistance to deformation. The line therefore has not been modified.

• line 81. To me 167 mm/day is not weak but strong restoring. Drop word 'weak' in line 80.
Done.

• line 81. 'concentratio' -> 'concentration'
Corrected.

• line 127. '... (namely Duda-Hart ...'
Corrected.

• line 142. '... the optimal number ...'
Corrected.

• line 153. '... clusters presented later ...'
Corrected.

• line 171. '... emerging from ..'
Corrected.

• line 244. '... configuration with single category ...'
Corrected.

• line 247. '... where the single category ...'
Corrected.

• line 252. 'In the Antarctic summer ...'
Corrected.

• line 257. '... increases especially with respect ...'
Corrected.

• line 287. '... repartition of detrended data ...'
Corrected.

• line 289. '... their third clusters ...'
Corrected.

• line 294. '... all the clusters in the S3 configurations ...'. In S2 max categories is 15, so it says nothing can be said about categories beyond 30.
Corrected.

• line 298. '... other configuration, the ...'
Corrected.

• line 303. '... suggests only marginal ...'
Added.

• line 308. Using the word 'trend' in this context is confusing because trend is commonly understood as a change in time. I suggest you replace 'trend' with e.g. linear fit or something else more suitable.
Corrected as suggested.

• line 315. Is enhanced bottom grow because thin ice grows faster? You should explain the physics behind the enhanced bottom grow.
This has been explained (Lines 339–342).

• line 319. '... more thick categories ...'
Added.

• line 320. '... in the Central Arctic that can potentially compensate for this decrease in terms of SIE ...'
Added.

• line 329. Explain what expression in parenthesis mean in OSI-SAF and NSIDC. Are they needed here? Data are already described in section 2.
This has been removed as that information is already given in Section 2.

• line 330. '... done by both including and excluding long-term trends.'
Corrected.

• line 336. '... such as the 2007 SIE minimum'.
Added.

• line 350. This is a one-sentence paragraph. Merge it with the earlier one.
All the Discussion section has been reformulated.

• line 360. '... are adjusted to reproduce ...'
Modified as suggested.

• line 364. '... computationally more efficient than configurations with more categories.'
Added.

• line 366. '... sea ice to changes in model parametrization.
Added.

• Fig 5. caption. 'anomalies in the range of ±15
Corrected.