

## ***Interactive comment on “On the discretization of the ice thickness distribution in the NEMO3.6-LIM3 global ocean–sea ice model” by François Massonnet et al.***

### **Anonymous Referee #1**

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This paper investigates the sensitivity of the ORCA1-LIM3 model to the choice of ice thickness distribution discretization. It stands to reason that an improved representation of the ice thickness field should also lead to more realistic simulations of the coupled sea ice-ocean system. However, this is not always the case, and there has been only a handful of papers devoted to clarifying why this is so. This manuscript is therefore welcome. It is a worthwhile attempt to shed some light on this important issue by focussing on physical processes that may explain the simulated sea ice response to changes in the formulation of the IDT. I am not sure, though, the authors entirely succeed, especially as regards elucidating the reason for the non-convergence of total ice volume as the number of ice categories increases. We do not learn enough

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from the paper about the sensitivity of the different physical processes that control ice growth to the choice of ice thickness categories. The authors show the average bottom ice growth for experiments S1 and S3, but there is virtually no discussion in the paper as to the physics that controls the ice growth, notably, air-ice and ice-ocean heat budgets and snow and ice thermal conductivities (others?). There also seems to be a strong nonlinearity in the system's response to the number of thin ice categories, as evinced in Figs. 4 and A2, and this, I believe, should be explained through a more detailed process analysis. In its present form the paper is basically a summary of the experimental results rather than a discussion of the said results. While I understand that the authors might not desire to embark on a major overhaul of the paper, I would certainly advise that, at the very least, they report in greater depth on the mechanisms and non-linearities that control the increase in basal ice growth as the number of thin ice categories is increased.

Minor comments. The article is very well written and very clear. I commend the authors for the care taken in creating the figures. Some other punctual comments and corrections can be found in the attached pdf.

Please also note the supplement to this comment:  
<https://www.geosci-model-dev-discuss.net/gmd-2019-16/gmd-2019-16-RC1-supplement.pdf>

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Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2019-16>, 2019.

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