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Insights on the discretization of the ice thickness distribution in large-scale sea ice models

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Heterogeneities in the thickness of the sea ice cover are of importance for a number of ocean-ice-atmosphere interaction processes. In advanced current models, the subgrid-scale thickness variability is often taken into account using an ice thickness distribution. The latter is discretized into a number of thickness categories that must be kept small for computational cost reasons. For instance, five categories have been used for virtually all large-scale applications with the Louvain-la-Neuve sea Ice Model (LIM3.6). Here, we present the results of a series of experiments conducted with LIM3.6 embedded in NEMO 3.6, in which the number and the boundaries of the thickness categories are varied. The Southern Ocean sea ice shows little sensitivity to the discretization of the ice thickness distribution. On the contrary, it is shown that an increased number of categories, especially in the thick ice range, is required for the simulated Arctic sea ice volume to converge. We conclude with recommendations on how to achieve the convergence of the ice volume with a limited number of well-chosen ice thickness categories.