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Interactive comment on "Implementation and Performance of Adaptive Mesh Refinement in the Ice Sheet System Model (ISSM v4.14)" *by* Thiago Dias dos Santos et al.

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The paper entitled "Implementation and Performance of Adaptive Mesh Refinement in the Ice Sheet System Model (ISSM v4.14)" by Thiago Dias dos Santos et al., presents the implementation of adaptive mesh refinement (AMR) in the finite element ice flow model ISSM.

The performances of the implementation in terms of accuracy and computing time are assessed using the setups of two recent marine ice sheet intercomparison exercises. Accurate modelling of the grounding line dynamics is particularly important to assess the dynamical contribution of the Antarctic Ice-Sheet to sea-level rise. The recent marine ice sheet model intercomparisons (MISMIPs) have confirmed the sensitivity of the

results to the mesh resolution. Saving numerical resources while maintaining accuracy is then essential for simulations at the scale of the whole ice-sheet. Thus this paper address an interesting question for the community.

I find the paper well written and the experiments clearly described and discussed, so I have no general nor specific comments. Previous works on the subjects are clearly detailed in the introduction. Many models use an heuristic criterion based on the distance to the grounding line to prescribe areas of high mesh resolution. Here, this heuristic is compared with the results obtained using an error estimator. It is shown that for complex bed topographies the results based on the distance-to-GL criterion are also sensitive to the distance of refinement, advocating for the use of proper error estimators as refinement criteria. This result is important to motivate further theoretical work on such estimators. The implications for real bed topographies (usually no smooth and not noise free) are discussed in the last section and will motivate further numerical studies.

Interactive comment on Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2018-194, 2018.