General Comments:

The paper presents results of barotropic tidal dynamics simulated using a newly developed ocean general circulation model ICON. In particular, the paper discusses the effect of various grid resolutions, and the inclusion of two specific processes, namely tidal bottom drag (TBD) and Self Attraction and Loading (SAL), on the barotropic tidal dynamics. The paper is clearly written, and has scientific relevance to the broader ocean modeling community. However, most of the dynamics discussed in this paper have been looked at in some detail in recent publications. For example, use of tides in an OGCM has been investigated in MPAS-Ocean (the ocean component of the Energy Exascale Earth System Model) (e.g., "Barotropic tides in MPAS-Ocean (E3SM V2): impact of ice shelf cavities", Nairita Pal, Kristin N. Barton, Mark R. Petersen, Steven R. Brus, Darren Engwirda, Brian K. Arbic, Andrew F. Roberts, Joannes J. Westerink, Damrongsak Wirasaet; Geoscientific Model Development 16 (4), 1297–1314, 2023). The model in that paper has a topographic wave drag (what the authors call TBD in this manuscript) and self attraction and loading (SAL), very similar to what is reported in the current manuscript. Therefore, it might be better to explore the ICON model in some more detail and explain how tides in ICON-O are unique/different from several other existing OGCMs. The authors should include some more science explanations behind the model results (e.g., the reasons behind why the tidal errors occur in the specific locations). Once these points are addressed, I will be happy to read the revised manuscript. Some specific issues are discussed below.

Specific comments:

1. Please include references to published works exactly aligned with the current manuscript. Especially, in Line number 45 the authors mention "T*o our knowledge, modelling tides using global OGCMs (for the purpose of studying internal tides) have only been carried out in HYCOM simulations using the HYbrid Coordinate Ocean Model (Arbic et al. (2010); Arbic et al. (2012)) and in STORMTIDE / STORMTIDE2 using the Max-Planck Ocean Model (MPIOM) (Mueller et al. (2012); Li and von Storch (2020))"* . This is only partially true, since recently (2022 and 2023) tides have been studied in the MPAS-Ocean global model. The specific references are listed here:
    a) "Barotropic tides in MPAS-Ocean (E3SM V2): impact of ice shelf cavities", Nairita Pal, Kristin N. Barton, Mark R. Petersen, Steven R. Brus, Darren Engwirda, Brian K. Arbic, Andrew F. Roberts, Joannes J. Westerink, Damrongsak Wirasaet; Geoscientific Model Development 16 (4), 1297–1314, 2023
    b) "Scalable self attraction and loading calculations for unstructured ocean tide models"; Steven R Brus, Kristin N Barton, Nairita Pal, Andrew F Roberts, Darren Engwirda, Mark R Petersen, Brian K Arbic, Damrongsak Wirasaet, Joannes J Westerink, Michael Schindelegger; Ocean Modelling, 102160, 2023
    c) "Global barotropic tide modeling using inline self‐attraction and loading in MPAS‐Ocean";Kristin N Barton, Nairita Pal, Steven R Brus, Mark R Petersen, Brian K Arbic, Darren Engwirda, Andrew F Roberts, Joannes J Westerink, Damrongsak Wirasaet, Michael Schindelegger; Journal of Advances in Modeling

Earth Systems, e2022MS003207; 2022.

The same comment holds for the paragraph after line 275. Please mention notable works.

2. As I understand, in Fig. 9, there is no SAL and TBD. In Fig.11 however, there is SAL and TBD. It might be good to see the corresponding figures for Fig. 9 (a) and (b) when SAL and TBD are included. Fig.11 can be removed altogether, and instead, in Fig.9(a), (b), (c), (d) a comparison of SAL/TBD and no SAL/TBD can be done for deep and shallow ocean cases.

3. It might be good to see the corresponding figures of Figs. 6, 7, 8 with SAL/TBD effects included as well. It might help us know if SAL/TBD improves M2 amplitude / phase errors.

4. The use of the term “tidal bottom drag” is slightly confusing, since bottom drag generally refers to a friction with the bottom boundary layer (e.g., as the authors mention just before line 295, a quadratic drag). Here the tidal bottom drag possibly refers to the internal wave drag over rough topography as mentioned in Jayne and St. Laurent (2001), and also in reference 1 mentioned above. An explanation is needed of why the authors use the term “tidal bottom drag” instead of the standard internal or topographic wave drag.

5. In the paragraph of line 305, the authors mention that they choose \kappa=50 km. I was wondering if the authors have explored experiments with other values of \kappa. More specifically, do the M2 phase errors and amplitude errors reduce when other values of \kappa are used?

6. Figs. 6, 7, 8 show that the errors in the Drake passage are considerably reduced when using BCT grid. The resolution there seems to be between 24 to 32km. However, the resolution of the R2B8 grid is 10km uniform globally. I was wondering why the errors improve in the Drake passage (for the BCT grid) even though the resolution is coarser than the R2B8 grid.

7. Why are the errors so high in the Southern Ocean? Please elaborate.

8. In Fig. 9(a) why are the M2 phase errors for R2B8 considerably higher than R2B6 in the deep ocean? Does it point towards any processes incorrectly captured?

Typographical errors

1. Line 138 “Hy- drographic” → “Hydrographic”

Overall, the paper is well written. It might be useful to include the science behind the observed results for better impact.