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Geoscientific Model Development Discussions
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Interactive comment on "A fully consistent and conservative vertically adaptive coordinate system for SLIM 3D v0.4, a DG finite element hydrodynamic model, with an application to the thermocline oscillations of Lake Tanganyika" *by* Philippe Delandmeter et al.

Anonymous Referee #2

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GENERAL REMARKS

The paper presents a new version of 3D hydrodynamic code SLIM 3D v0.4 intended for broad range of marine and limnological applications. The main new feature of the model is an algorithm for vertical grid adaptation to tackle hydrodynamic processes at sharp density gradients. The new model is tested in both idealized scenarios of wind forcing and lake stratification, and realistic simulation of Lake Tanganyika. An

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Discussion paper

impressive correspondence between the model simulations and analytical solution for the steady-state thermocline tilt is achieved, as well as very good preservation of sharp density gradient at very coarse (6 vertical levels) resolution. Simulations of Lake Tanganyika demonstrate promising capabilities of the model for future studies of the lake circulation and thermal regime. The paper is well structured, the conclusions are clear and enough supported by results presented. Despite the overall high quality of the paper, I see space for improvement, especially in representation of the material and in clarifying some methodological issues.

SPECIFIC COMMENTS

1. The title seems too long. Also consider substituting abbreviation “DG” by the full term.
2. p.4, line 13. When you first refer to “consistency”, could you provide definition?
3. There is no general information on the model equation set and boundary conditions
4. Could you provide a clear definition of what is “fixed domain” and what is “moving domain”
5. p.6, line 1. “equations” → “equation”
6. p.6, line 9: please provide explanation to “P1”
7. p.6, line 16: could you explain what is “lateral and horizontal interfaces”?
8. I could see no information on the order of approximation of the model scheme.
9. p.7, line 7. Does the zero vertical velocity at the bottom fits the simulations of Lake Tanganyika with uneven bottom shape? Rather, normal component of velocity should be zero.

10. Not all symbols in equations are explained. I recommend to add a List of symbols.
11. p.8, lines 15-20. I suggest that you provide a 3D picture of the model grid, as this text is somewhat difficult to follow.
12. eq. (15). Is this constant in time or in depth?
13. p.9, line 2 : “adaptivity” $\rightarrow$ “adaptation”
14. p.9, lines 8-9: the definition is difficult to understand, please consider rephrasing
15. Figure 4 : please explain what do the numbers mean
16. p.10, line 21. At this stage, not clear which “model” is meant
17. p.11, line 5: COSMO-CLM^2, “2” looks like footnote
18. How does modeled stress at Figure 6 compare to measured at Figure 5?
19. Eq. (19) Is there any special reason for parameterizing heat flux by this crude scheme, rather than to apply standard surface flux schemes, based on Monin-Obukhov similarity?
20. Figure 8. What are the black lines? Could you depict the grid levels, at least in the inset?
21. I found no details on which computing system has been used. Was the model parallelized, what number of cores has been utilized?
22. Figure 14. There is larger vertical diffusion of heat in observations, than in the model. What could be the reason?

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