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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.

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We would like to thank Prof. Jon Hill for his careful reading and its constructive comments. Please find our replies below.

On behalf of all the authors,

Philippe Delandmeter

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Discussion paper

This paper presents a novel method for using vertically adaptive meshes in a DG finite element formulation. The method is implemented in SLIM3D and made available under a suitably permissive licence. The method is comprehensively described and then verified on an idealised test case. The new method is then demonstrated on a real-world example to show its capabilities. The paper is well-written, clear and thorough. I see no major issues with the paper and recommend it be published pending some minor corrections/suggestions.

Thank you!

Minor suggestions:

Page 2: Line 25. Is it worth making it explicitly clear that hr-adaptivity can add or remove nodes as opposed to r-adaptivity here. There are advantages and dis-advantages to both (Piggott et al, 2005). This might then clarify for the reader throughout that the number of nodes in the model remains constant through-out the simulation, which in places is lacking (e.g. figure 10, where the adaptive models look to perform no better than fixed, but of course, their numerical per-formance is better as the same computational cost). This lack of clarity in the number of nodes being fixed also crops up on line 15 (pg 8) and line 10 (pg 9).

Thank you for highlighting this point. We will follow your suggestion and explain clearly the differences between our r-adaptive method and the hr-adaptive method. As you explained, Figure 10 aims to show that the adaptive method is not more expensive than the non-adaptive method, such that the better result of the adaptive method (in Figure 9) does not require a higher computational cost. This will be written explicitly in the revised manuscript.

Page 18, line 10. What was the horizontal resolution?

The horizontal mesh resolution is 10 km. We will add this information in the revised manuscript.

Page 21-22. Is it possible to produce a figure or stats on where the mesh resolution was placed alongside these figures? It would be interesting to see the temporal dynamics of the mesh movement.

Yes, the mesh vertical distribution for the Lake Tanganyika simulation will be shown in the revised manuscript, by drawing the levels along the main axis of the lake (similar to Figure 16). It will help the reader to see the mesh dynamics during the simulation and also highlight an important point: in the simpler benchmarks, there is one single large physical discontinuity and the mesh resolution is increased only in this region. But in the realistic simulation of Lake Tanganyika, the thermocline is not that sharp, and the mesh resolution is more regular, although it still follows the thermocline oscillations.

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