Response to the reviewers comments.

December 7, 2023

1 Response

Dear Editor,
We found very relevant and fruitful the comments made by the two reviewers. We believe that the overall quality of the paper has been improved thanks to this discussion. In particular, we could illustrate in the revised version the benefits of high-order reconstructions for advection in terms of effective resolution. You will find below a response to the points made by the two reviewers.

1.1 Reviewer #1

We followed the main suggestion made by the reviewer #1, and we included in the revised version a plot illustrating the evolution of the enstrophy for the vortex wall experiment at the bottom of Figure 10. We corrected the typos carefully pointed out by the reviewer.
Regarding the other suggestions:

3. We added a sentence line 30 page 2 to explain how to include bottom topography in QG equation and pointed to a reference in which it is explained.

13. We mentioned the fact that smoothness indicators are computed using first and second order derivatives, and pointed to a second reference.

15. We changed the last sentence at the bottom of page 10 for sake of clarity.

1.2 Reviewer #2

We adressed the referee's questions and included its suggestions in the revised manuscript as follows:

1. We added a section "3.3.4 Numerical cost" where we discuss precisely the cost and limitations of the capacitance matrix method.

2. We added in section 4.5 the a paragraph on the limitation of our spectral solver to regular grids and the possible use of our solver to give a first guess for iterative solvers that would be suited to curvilinear coordinates and irregular grids.

3. We completed the section 4.9 Performance with measure of full CPU performance as well as the Watt consumption for CPU and GPU. We mentionned the possible improvement of our solver's CPU parallelism.

4. About Vortex shear instability. We added a section 4.10 to discuss the order of accuracy of our solver, which is second-order. To demonstrate the benefits of fifth-order WENO reconstruction, we plot the evolution of the enstrophy in the vortex shear experiement with both WENO-3 and WENO-5 at different resolutions. We also added a new figure (Figure 13) in Appendix C to illustrate the benefits of WENO-5 compared to WENO-3.

5. We added a new figure (Figure 12) with the statitics of the double gyre configurations at lower resolutions (27km, 40km, and 53km) to show the sensitivity of the eastward jet is to resolution.

6. We added a discussion at the end of the conclusion on the relevance of using high-level languages like Python to implement the hierarchy of ocean models.

We thank again the reviewers for their valuable comments.
Sincerely,
Louis Thiry on behalf of the authors.