

## ***Interactive comment on “The CO5 configuration of the 7 km Atlantic Margin Model: Large scale biases and sensitivity to forcing, physics options and vertical resolution” by Enda O’Dea et al.***

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Review of “The CO5 configuration of the 7km Atlantic Margin Model: Large scale biases and sensitivity to forcing, physics options and vertical resolution” by O’Dea et al. - Robinson Hordoir

This article describes a new Nemo based configuration of the North West European Shelf, and compares it with previous similar configurations. The article is well written and nice to read, and as the developer of a similar configuration (Nemo-Nordic) I have actually learned a lot of things about biases that I had not thought about. I recommend this article for publication in GMD Nemo Special issue, but I have a few remarks on some points which I found not self explicit enough in the article. Further I also think

there are a few things that could be added in terms of results. Also if I had one critic on the article, it would be that the comparisons are mostly from one model to another, with a lot of changes like the vertical resolution, the boundary conditions etc. . . . so at the end it is a bit hard to know what causes what. A part that could be really nice would be to have also comparison of CO5 with itself but for example with different Baltic outflow parameterizations or different runoff sources etc. . . to provide a better understanding of how this affect processes.

Part 2: there is a mention of CO4 as a reference, which obliges the reader to read O'Dea et al 2012, so for example there is not explicit mention of the vertical grid of CO5. I guess it is  $z^*$ -sigma coordinates but it would make the article a lot easier to read if this was mentioned explicitly, this part is described in many details in O'Dea et al 2012 so it would be nice to have a little summary, especially after what comes just after.

Especially, at lines 31&32 page 3: So just to be sure. Viscosity here concerns only momentum of course, and there are 2 types of viscosity at once, both applied on momentum. Which means, if I understand rightly is that the Laplacian viscosity is applied using a rotation to fit geopotentials, and Bi-Laplacian is applied using model levels, and both at the same time ? Is it possible to activate both Laplacian and Bi-Laplacian in Nemo natively or some code has been developed ? At first I thought it was a confusion between Laplacian which would be applied to diffusion and Bi-Laplacian applied to momentum, but obviously not. Anyway, this is very original, and I think it should be described in more details, what is the advantage of this method ? And by the way, how is tracer diffusion handled ?

Figure 3: It would be really nice to have mean values of all runoff datasets. And perhaps mean values per basins.

Part 5 on results. The only result concerning SSH is on the M2 tidal harmonics. Since sea level and sea level variability is a driver of the entire ecosystem I think this part

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should show more results. Why not include Taylor diagrams ? And perhaps also a better assessment of the wind driven SSH ? My experience is that models have biases to represent SSH which greatly depend of the frequency. Further, SSH variability is the driver of barotropic currents like the cyclonic loop in the North Sea, having a right SSH representation affects therefore greatly the export of freshwater for example, and therefore the possible salinity biases, which can be explained not only by the amount of river runoff. Additionally, in places like the North Sea, SSH variability does not only create transport but also mixing and tidal straining which greatly affect freshwater dynamics. So the salinity bias explanation that comes after could also be related with a bias in barotropic dynamics, not only the runoff. A deeper analysis could include a computation of the North Sea gyre circulation, and that of the Strait of Dover.

Part 3: About the Baltic boundary approach using GETM, the approach is interesting but a bit heavy to carry. Basically one needs always to run GETM, and there is little estimation of the impact of having a realistic Baltic Sea outflow. It would really nice to see a real sensitivity experiment of the impact on salinity structure along the Swedish/Norwegian coasts. The Baltic Sea outflow is mostly a barotropic process driven by wind forcing over the Baltic: GETM is a cool model, but that is a lot of complexity for such a process.

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