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Geoscientific Model Development Discussions
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Interactive comment on "GO5.0: The joint NERC-Met Office NEMO global ocean model for use in coupled and forced applications" *by* A. Megann et al.

Anonymous Referee #2

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General comments :

One interest of this paper is to give good references and useful information about a standard global ocean configuration based on NEMO OGCM which is used by several groups in Europe for research and operational applications, for climate, short term forecast , ocean reanalysis . . . The description of the configuration, the simulation protocol and the validation are well presented. Authors have performed a significant number of interannual simulations, the selected period to perform validation and analysis is long enough to be confident in the interpretation of the results. The paper focuses mainly on the surface layers, on the bias in temperature and salinity, on the mixed layer depth, on the ability of the model to simulate the sea ice extend and especially its seasonal cycle

and also on the Atlantic meridional overturning and transport through critical straits. References and observations are used to validate all these topics. This part of the paper gives interesting information that could be useful for other modelers to validate global simulation, but nothing new in term of ocean modeling is presented here. It is also a pity to have nothing about the general circulation which could be validated thanks to the altimetry observations. The paper focus on the surface layer and there is in the text few comments or remarks about the atmospheric forcing, I suggest adding some figures to illustrate impact of the atmospheric forcing which is the main driver of the ocean and which can explain lot of bias discussed in the paper. For example, it will be useful to know how the surface fluxes, computed with the bulk formulae, are impacted in the experiments. Do we have a large difference in the mean fluxes between GO1 and GO5.0?

The more interesting part could be the sensitivity study with the comparison between the two simulations GO1 and GO5.0 and the sensitivity experiments. Unfortunately these sections (5.2 and 5.3) are really poor in term of results, interpretations, conclusions, recommendations and we can't find real contribution in the understanding of modelisation approach or parameterization . . . I suggest that authors complete this section using the sensitivity experiments to quantify improvements or to explain in a more detail way process and/or numeric involved in these changes. Authors shall also justify in a more precise and scientific way the sensitivity tests performed and described in the paper. I am not sure that there is sense to talk about some tests as geothermal heat flux or lakes for example. If yes, explain what is expected, how it works and justify why there is no impact. I suggest adding almost a new sensitivity experiment to understand the differences changing NEMO version separating vertical mixing parameterization (or mistake in parameter) and computation of salt flux.

Specific comments :

Section 3 : More information about Calvet and Siddorn (2013) will be useful. What kind of sensitivity experiments? Which configuration? What kind of validation? How

conclusion obtains with 1° resolution model are available at $\frac{1}{4}°$? . . .

There is a long list of differences between the GO1 and GO5.0 simulation but it is not clear what are exactly the differences between GO1 (based on NEMO 3.2) and N3.4 (based on NEMO3.4). I understand that there is a bug correction in TKE and new way to convert freshwater flux in salt flux. This is briefly discussed in section 5.3 but there is no way to separate the 2 effects.

Section 4 :

How do you initialize the 10-year sensitivity experiments? From rest or from another experiment as GO1?

More information about the namelist parameters in the NEMO TKE implementation will be useful. What are the expected effect of rn_ebb, rn_mxl0, nn_htau ?

How do you justify the sensitivity experiment changing at the same time geothermal heat flux and double diffusion of tracers? What are the expected effects of these parameters? Can you provide reference or can you explain what is done?

Same remark for the bottom boundary layer and lakes. If we can understand that BBL can impact your solution and especially some really important diagnostic/process described in the following, what about the lakes?

P5727 l10, Last paragraph: reader needs more explanation to understand what are these parameters. Is the 10-year simulation performed with N3.4 and 0.01 one of the sensitivity tests listed in table 2?

Section 5 :

P 5758 l24 : more information about the MLD climatology in the deep convection area (WEDDEL sea and North Atlantic) is needed to validate the simulation. What are the uncertainties in this area in the climatology? Most of the observations are not deeper than 2000m. There is no observation during austral winter in the climatology in the

Weddel sea (figure 2).

P5759 l23 : Can you compute this correlation? Is there a time lag between the density in the Labrador sea and the MOC at 26°N?

P5760 l8 : If 30% of the AMOC variability is explained by the meso scale, can you discuss this percentage for the $\frac{1}{4}°$ model which clearly underestimate the meso scale variability. Can you discuss which part of the variability is explained by the atmospheric forcing, by the general circulation, by other process and phenomena. What is expected in this kind of simulation in term of correlation between MOC observation and simulation?

P5762 l11 : You suggest that the overestimation of the transport at Bering is due to the SSH slope. But why there is this too strong slope between Pacific and Arctic Ocean? Can you suggest some hypothesis about local wind fields, water masses, sea ice, geometry of the strait . . . ?

P5764 l28 : You write that there is no atmosphere ocean feedback in your simulation. As you use bulk formulae there is a feedback and it will be useful to illustrate flux differences between the simulations.

P5765 l2 : I don't understand the last sentence of this section. What do you mean with "significant reduction in model skill"?

P5767 l24 : Why do you choose an empirical criterion for significance? It will be more convincing with an objective criteria based on the variance of the signal.

P5768 l5 : I think you can't say that the upgrade of version has significant effect, effect is due to difference in the way to use several option in the two versions of the code. I suggest to better document this part and I think you can't discuss this point if you don't have at least one simulation with in a first step the modification in the vertical mixing and in a second step the salt flux computation. It is also your conclusion of this part p5770 l5, you have to identify what are the differences between this two versions which

induced these largest differences in the results.

P5769 : If there is no illustration and no more comment on these sensitivity experiments I don't think it is useful to keep them in the paper. Can you argue on the choice for the sensitivity tests, what are the expected impacts, can you quantify the impact at global scale and in interested areas, what changes are significant . . .

P5769 l1 : what are the modification in the bathymetry?

P 5769 l11 : Why are you not sure that the background term is always smaller that the explicit mixing term? You don't have the vertical mixing coefficient in the output files?

P5769 l26 : where is the freshening in the Atlantic Ocean? In the bottom layer? Is a 0.05psu decrease really negligible?

P5770 l3 : Is there really a change in the pathway of the deep western boundary current with BBL. In this case you have to illustrate that point.

Section 6:

P5773 l1 : can you explain what is a PEG. What kind of implication on which performance? can you add comment on this interesting point?

Technical corrections :

P5766 l9 : the later configuration is GO5.0?

P5768 l26 : V3.2 instead of 3.4

P5785 table2 : what is the column "UM job id"? Add in the legend definition of the NEMO namelist parameters.

P5786 table 3 : sign of the transport in the indonesian througflow

P 5790 Fig4 : no data for GO1 from 1984 to 1991 ? what is the time period for the mean on figure b ?

Interactive comment on Geosci. Model Dev. Discuss., 6, 5747, 2013.