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Geoscientific Model Development Discussions

Interactive comment on "Impact of horizontal resolution on global ocean-sea-ice model simulations based on the experimental protocols of the Ocean Model Intercomparison Project phase 2 (OMIP-2)" *by* Eric P. Chassignet et al.

Anonymous Referee #1

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This paper shows the impact of horizontal resolution on ocean-sea-ice model simulations by comparing the outputs from four models at low and high horizontal resolutions. Several biases in the low-resolutions models are improved when the resolution becomes high. The impacts of model resolution on temperature and salinity bias depend on the model. Although the model configuration differences between low and high resolutions differ among the four models, several improvements in high-resolution models compared to low-resolution models seem to be robust. On the one hand, the biases of temperature and salinity fields depend on the model and region. The report in this

paper is informative for readers of GMD. I recommend this paper for publication after some minor modifications.

Comments The time evolution of the global temperature was examined in Section 3.2. Levitus et al. (2005) showed a warming of the world ocean over 1955-2003 based on the observations. The warmings in the models seem to be consistent with the observation including its decadal variations. As well as the sea surface height, the impact of global warming should be discussed.

Figure 9 shows the surface temperature and salinity differences between the simulated fields over 2009-2018 and the initial fields, which discusses about how the simulated field changes from its initial state. Global warming appears to influence much the temperature difference. The model bias compared to the observation should be correctly verified. The simulated surface temperature and salinity are constrained to atmospheric forcing and the restoring to the observation respectively. Because these constrain are not perfect. Therefore, it is worth verifying the surface temperature and salinity biases compared with recent observations such as Argo float in the same period.

Minor comments There are not a few typos in the texts. The lead-author should be responsible to make readable paper. In Section 2, the model descriptions of four models are shown. It seems that different authors responsible to each model wrote the texts for each configuration, which makes the texts unreadable. The configuration of each model should be written in the same writing style.

GMD recommend the unit with negative exponent (e.g. m sˆ-1 instead of m/s).

L82: 'AMOC' appears first. 'Atlantic meridional overturning circulation' should be shown.

L98: $\sigma 2$ should be defined.

L107: Δx should be defined such as 'zonal grid spacing'.

L145-146: ‘m2 s-1’ should be modified by using superscript.

L313: ‘section 2b,c’ should be ‘section 3.2 and 3.3’.

Sec.3.4: The surface temperature and salinity averaged over 2009-2018 are compared to the initial state (Fig. 9). On the one hand, the vertical structures averaged over 1980-2018 are compared to the initial state (Fig. 10, 11, 12). Why are the average periods different?

Sec.3.7: Please plot the EKE time series along the ACC, if possible. Were the EKE in the models were increased by the zonal wind intensification since the 1970s.

L580: I cannot find Ollitrault and Colin de Verdière, 2014 in References.

Fig. 27: Please add the curves of heat transport of IAP-LICOM high resolution in Fig. 27.

‘summer’ and ‘winter’ in the captions of Fig. 30 and 31 should be ‘winter’ and ‘summer’ respectively.

L242, 553, 1170: Renault et al. (2019) should be Renault et al. (2020).

L909-918: Please confirm the sequence of references.

L963 includes two references.

L1204 includes two references.

Table.1: Please show the initial conditions.

Table.1: ‘Relative wind stress’ should be ‘Absolute wind stress’ for FSU-HYCOM’.

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