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Geoscientific Model Development Discussions
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Interactive comment on "HighResMIP versions of EC-Earth: EC-Earth3P and EC-Earth3P-HR. Description, model performance, data handling and validation" *by* Rein Haarsma et al.

Anonymous Referee #2

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In the present manuscript, the authors summarized basic model performance/drifts of EC-Earth3P-HR in comparison with lower resolution version, EC-Earth3P, together with optimization procedure of model code, data handling, how to post-process. The manuscript is well-organized, and basically I consider that the present manuscript will be worth publishing in GMD. In general, however, physical explanations on causes of model biases, drifts, and differences between EC-Earth3P-HR and EC-Earth3P are quite limited throughout the manuscript. After minor revisions in order to answer the suggestions and comments listed below, the manuscript will be more suitable for publication.

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Discussion paper

Comments

L. 373-374: How did you generate atmospheric temperature perturbations? Gaussian random noise with a certain amplitude? Please specify the method.

L. 380: How did you change the oceanic mixing parameters? Please describe more details.

L. 399-408: There are almost no explanations on cause of model biases described here. Please give possible reasons or speculations for the biases which may be arisen from, for example, deficiencies in parameterizations for cloud microphysics, (deep, shallow, strat) cumulus, insufficient horizontal resolution, albedo parameterization of snow, sea-ice, etc.

L. 411: Why the MSLP over Antarctica is higher (worse) in EC-Earth3P-HR than EC-Earth3P? Please give possible reasons or speculations for the biases. In addition, if the biases in stationary eddies (Fig. 9) MSLP (Figs. 7 and 10) are evaluated, you may want to show wintertime storm track activity defined as subweekly eddy meridional temperature flux at the 850 hPa for EC-Earth3P-HR than EC-Earth3P, which may be useful for interpreting differences of model biases between two models.

Figure 6, 7, and 8: In order to evaluate model errors quantitatively, please calculate root-mean-squared errors (RMSE) for EC-Earth3P-HR with respect to observations/reanalysis and add the RMSE to somewhere in the corresponding figures, for example, just right of the figure title as “Diff DJF SAT EC-Earth3-HR ERA-Int (0.8 K)”.

Figure 10: Panels showing difference between EC-Earth3P-HR and EC-Earth3P may be replaced by the errors between EC-Earth3P and observations/reanalysis as in Figs. 6-8. And, RMSEs for EC-Earth3P may be given.

Figure 12: Top label “2040-2049 minus 1950-1959” may be wrong.

L. 444: Why does not the activation of deep convection in EC-Earth3P-HR occur and why do global-mean SAT and AMOC transport keep stable in EC-Earth3P-HR?

Figure 14: For comparison, Figs. 14c and 14f may be replaced by observations. Also Z500 anomalies regressed onto NINO3.4 index, which can be superimposed onto Fig. 14de by contours, are useful for evaluating atmospheric teleconnection pattern.

L. 473-476: SST variability is closely related to the frontal structure seen in the climatic-mean SST. So, you may want to add DJF climatic-mean SST to Figs. 14a-c by contours.

Figure 15: Again, please add the corresponding panels for observations/reanalysis.

L. 512: Please capitalize “Rapid”.

L. 525: ERA-Interim is just reanalysis data, not observations. You may want to redraw the green lines in Fig. 18 based on observations, for example, HadCRUTv4.4 with keeping consistency of undefined grid point between observations and models. And then, please rewrite Section 4.2.4.

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