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Geoscientific Model Development Discussions

Interactive comment on "High Resolution Model Intercomparison Project (HighResMIP)" *by* R. J. Haarsma et al.

Anonymous Referee #2

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General comments ————————

This paper presents the rationale and experimental design of the internationally coordinated experiments of the intercomparison project HighResMIP proposed within the framework of the WCRP CMIP6 experiments. This set of experiments aim at investigating the role of spatial resolution with the objective to evaluate the impact of very high resolution (from 50 down to 25 kms). The paper presents very well the state of the art and how much previous work allows expecting improvements in the representation of small to large-scale phenomena. The ensemble of simulations from different climate models is expected to provide a robust estimate of the impact of high resolution. The experimental design is divided in three tiers including atmospheric alone models and coupled atmosphere-ocean models and complemented by some possible additional sensitivity experiments. Within the CMIP6 framework, HiResMIP will bring insights into

the specific issue of better understanding the origin and consequences of systematic model biases as well as the grand challenges associated with clouds, water availability and climate extremes. The paper is needed to describe the experimental design of HighResMIP. In overall it is clear and promising, although some aspects need to be improved and some redundancies reduced (see specific comments).

Specific comments ————————

Introduction: in the first paragraph describing the state of the art on the impact of resolution, the authors should be more explicit on which resolution are concerned by the cited experiments. In the second paragraph, it would be good to know how many coupled models have been run at very high resolution.

Section 2: The 3 Tiers are clearly defined but it is not clear whether there is a ranking behind: are Tier 1 experiments a pre-requisite minimum to participate to HiResMIP ?

How HighResMIP is linked to CMIP6 (sections 2., 4.1 and 4.2) is ambiguous: since the very high resolution are not run under the DECK conditions (4.1), I guess only the standard resolution is supposed to be in CMIP6 and the very high resolution are complementary to CMIP6 but not really part of CMIP6 (in 2. It is said "linked" but in section 4.2 it says HiResMIP as one of the endorsed MIPs)? Please clarify.

Section 2, Page 5, second paragraph on Tier 2: coupled runs are only mentioned as an opportunity to understand the role of natural variability but they are also required to investigate future climate change.

Section 2, Page 5, lines 21 to 26: the lack of tuning will most probably be more critical for coupled runs than for atmospheric alone models which are constrained by a fixed SST. This should be mentioned.

Section 2, Pages 5 and 6: For clarity I would recommend to put the sections on common forcing fields (2.1, 2.1.1, 2.1.2, 2.1.3) together with the description 3.1 of the Tier 1. For other Tiers, reference to Tier 1 is then sufficient.

There are some redundancies between section 4.2 on links with other MIPs, section 6 on applications and section 7 on analysis plan. I understand the need for some redundancies but I have the feeling the order of arguments could be optimised. For example, it would be clearer to first describe the analysis plan, emphasizing at the same time the related MIPs (eg CORDEX, CFMIP, GMMIP) and some applications related to analyses, and then the list of other potential applications. For the interactions with other MIPS, they could be spread among the analyses and the description of the additional experiments. A table could summarise all these interactions.

Section 5, page 11, on data: In this part, it is not clear whether the plans for the list of variables to be stored is already fixed or not. Please clarify. It would also be good if an order of magnitude of the storage needed could be given. What is meant by the "design of CORDEX will be taken into account"?. What are priorities 1, 2 and 3 ?

Section 6: lines 24-25: Tier 3 experiments are also limited by using atmosphere only models.

Page 18, the data availability part should not be in this section but rather with section 5.

Technical comments ————————-

Page 4, line 11: results rather than representation ?

Page 4, lines 30-32: should be more explicit on which resolution.

Page 5, lines 10-11: the list of model names do not correspond to the list of models used in the references: models MIROC, GFDL, SINTEX-F2 whereas in the references SINTEX-F2, GFDL, Hadley, CESM

Page 5, line 34, please mention explicitly RCP8.5.

Section 2, Page 5, lines 41-42: the use of a delta to the climatological forcing is not clear enough.

Page 6, Figure 1: would be good to add 1, OA and A for Tiers 1, 2 and 3 respectively on the graphs.

Page 7, line 20. It would be good to add here that 3 runs are recommended but not mandatory (rather than page 8 lines 40-43)

Page 7, line 36-37: unclear. Is it for detection/attribution ?

Page 8, line 6: what is EN4 ?

Page 8, lines 34-38: has already been said

Section 3.2.1, Page 9, 3.2.4 is the use of EN4 recommended ? not fully clear

Page 12, line 12 the European Copernicus Climate Data Store

Page 13, line 22: rather the air quality than the aerosol only effect on health ?

Page 13, line 32: very few models will use eddy-permitting ocean. This is misleading.

Table 1: give a reference to "Historic" boundary conditons. Tier 2 future add coupled.

Table 9.1: what is the standard resolution of NorESM ? missing information for GFDL.

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