

# ***Interactive comment on “Dynamical downscaling of the western North Pacific from CCSM4 simulations during the last glacial maximum and late 20th century using the WRF model: model configuration and validation” by J. Yoo and J. Galewsky***

## **Anonymous Referee #2**

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General comment: The authors performed a dynamical downscaling experiment with a regional climate model (WRF) based on GCM (CCSM4) output as boundary conditions for glacial (LGM) and present day climate conditions, respectively. Unfortunately (I agree with Referee #1), this study exhibits some clear deficits, which prevents this manuscript from being published in Climate of the Past.

Major Points: (1) A general problem of this study is the missing scientific question. This study only compares two different model data sets (which are not independent since

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GCM data is used as boundary conditions for downscaling) without explaining why this is of importance.

(2) In general, models can only be validated by comparing model output with observational data and not by comparing them solely against each other. This study completely ignores both (i) observational data (e.g., reanalysis datasets ERA, NCEP, . . . ) for evaluation of present day performance of the models and (ii) paleoclimate proxy data to validate the ability of the models to simulate the climate under glacial conditions (refer to proxy data sources from referee #1). How do you know that the WRF model corrects biases of the GCM if you don't validate the model against observations?

(3) Although the dynamical downscaling seems to be technically correct (considering glacial boundary conditions e.g., ice sheets, drop of sea level), the length of the simulations of only 10 years seems to be bit to short. I wouldn't say that 50 or even 100 years are needed for comparison of the different time slices (since this implies high computational costs), but in my opinion you should simulated at least a period of 20 years to create a sufficient amount of data. In contrast to referee #1, I think the CCSM4 LGM run is in equilibrium state (if you used the data as stored in the PMIP3/CMIP5 database), since the PMIP3 data are only the last 100 years of the corresponding model run (model spin-up has been considered for all PMIP3 LGM experiments while only data since equilibrium was reached is stored in the PMIP3/CMIP5 database). A question arises which run you precisely take for present day conditions? Is it the historical run, which is NOT in equilibrium since it is forced by changing greenhouse gas concentrations, or do you use the output of the pre-Industrial run, which uses constant greenhouse gas (GHG) concentrations during the whole integration? Would it make sense to compare an equilibrium run to a model run with additional internal forcing? This is not mentioned in the manuscript.

Minor comments and examples for major comments (1) - (3)

P2L8: Model validation requires observational data

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P2L17: How do you know about model errors when you don't compare to observational data?

P2L19: Is the warming induced by ice sheet retreat and rising sea level (this is how it reads), or is this a consequence of warming?

P2L22: Is the drop of GHG concentrations and the greater extend of ice sheets really the important forcing changes or are they just a consequence of reduced incoming solar radiation? How can you precisely rate theses different forcing effects and consequences?

P3L15: Reference missing for CCSM4

P3L14: should read "...to downscale the Community..."

P3L26: What is discussed in Sect.4 if you discuss already in Sect. 3? Be more precise.

P4L4: Version 3.5.1?

P4: Citations for all considered parameterisations is missing.

P5L2: Why PMIP2? Shouldn't you use recommendations for PMIP3? Or are they the same?

P5L17: "ice sheets over" rather than "ice sheets in"

P6L2: What is tropical channel?

P6L24: What is MOAR? Which simulations do you exactly use for present day? Is it also a PMIP3/CMIP5 run? Needs clarification.

P7L17: Year 1871 is definitely not the second year of the LGM simulation. PMIP3-runs are all performed with a sufficient spin-up time until the model reaches equilibrium. The PMIP3 output in the database contains only the last 100 years of the simulation.

P7L19: Why do you reinitialize your model each year? This ignores internal model dynamics at the start of each year. If you consider only winter (DJF) for analysis, you

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might get different results. Since you used 6-hourly data as forcing data you don't have to reinitialize the model each year (unless there is a reason you didn't mention...)

Chapter3 and rest: Validation of model results makes only sense when considering observational/proxy data. Since this is totally missing, I'm not going into details.

P16L28: You should acknowledge for the PMIP3/CMIP5 data as suggested on their homepage.

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