Paper #GMD-2024-87 | Model experiment description paper**: 'Design, evaluation and future projections of the NARCliM2.0 CORDEX-CMIP6 Australasia regional climate ensemble'**

Author Comments (ACs) – Referee 3

Table 3. Anonymous Referee 3 (RC3) Comments

#	Issue Description	Discussion	Revision (in re-submitted manuscript)
	Referee #3: General Comments		
1	The authors present the regional climate model NARCliM2.0 and evaluate it using various GCM and RCM ensembles, as well as its precursor versions 1.0 and 1.x. The research topic is highly interesting, and the research work has been conducted meticulously and comprehensively, making it very valuable for regional climate model evaluation and future climate projections in Australia. The research framework is also inspiring for regional climate science, particularly for other regions with large populations. The manuscript is well-written and well-structured. In conclusion, I recommend publication in GMD after the specific comments listed below have been addressed.	We thank the reviewer for reviewing this manuscript, for the positive and constructive remarks on our work, and for recommending publication after addressing your specific comments below.	
	Referee #3: Specific comments		
2	Line 81: "and 3) summarise the climate projections produced by CMIP6-NARCliM2.0 and how these" to "3) summarise the climate projections produced by CMIP6-NARCliM2.0 and how these".	Thanks for pointing this out – text changed as suggested.	Text revised.
3	Line 83-88: "section x." to "Section x". Please check all "section x.x" and "sect. x.x" in the manuscript.	Agreed.	Text revised as suggested.
4	Line 108-109: "NARCliM2.0 RCMs have a 20 km resolution CORDEX-Australasia domain (versus 50 km) and 4 km (versus 10 km) domain over southeast Australia and use 45 (versus	There is no strict requirement for vertical resolution to match horizontal resolution. However, in NARCliM 2.0,	No change in the main text.

	30) vertical levels". The horizontal resolution in NARCLiM2.0 has more than doubled resolutions, yet the vertical resolution is from 30 to 45 vertical levels. What do authors think of the choice of 45 levels instead 60 or even more?	we carefully balanced the horizontal and vertical resolutions. By increasing the number of vertical levels from 30 to 45, we primarily enhanced the vertical resolution within the boundary layer, allowing for a better representation of vertical profiles of temperature, moisture, and winds. The vertical grid spacing in the boundary layer is around 50–200 meters, which is sufficient to resolve important vertical processes. In early testing for NARCliM2.0, we also tested using 60 and 75 vertical levels. The surface climate produced was very similar to when using 45 levels, but the computational cost was substantially larger. Given that finding and resource constraints, we determined that 45 vertical levels could effectively meet the objectives of NARCliM 2.0.	
5	Line 142: "manuscripts describe elements shown in Figure 2, and which are therefore only summarised briefly in", remove "and".	Agreed: 'and' not needed.	Text revised as suggested.
6	Line 164-167: "The performances of the different test RCM configurations are evaluated, ultimately selecting a subset of seven RCMs for subsequent downscaling of ERA5 reanalysis and comprising the CORDEX evaluation experiment." To "The performance of the different test RCM configurations is evaluated, ultimately leading to the selection of a subset of seven RCMs for subsequent downscaling of ERA5 reanalysis as part of the CORDEX evaluation experiment".	Agreed, text revised as suggested.	Text revised.
7	Line 170: 'production' should be "production". Please check all 'something' in the manuscript.	In the revised manuscript, we have avoided the use of text like 'production'	Text revised as follows:

		– production is sufficient, hence quotes removed as per example right.	"Evaluating these ERA5-forced simulations informs selection of two production RCMs for CMIP6-forced downscaling"
8	Line 190-191: "Non-normally distributed variables (e.g. snow depth and precipitation) are checked for global minima and maxima only." To "Non-normally distributed variables (e.g., snow depth and precipitation) are checked only for global minima and maxima." Please check all "e.g." in the manuscript.	Text in sentence corrected as suggested, including correction for all "e.g." as suggested.	Text revised.
9	Line 201: "Check that changes over time are within realistic ranges (i.e. assess temporal gradients)." To "Check that changes over time are within realistic ranges (i.e., assess temporal gradients)." Please check all "i.e." in the manuscript.	Text changed as suggested.	Text revised throughout.
10	Line 354-355: "Some studies have shown using this option improves modelling of soil moisture (e.g. Zhuo et al., 2019)." to "Some studies have shown **that** using this option improves **the** modeling of soil moisture (**e.g.,** Zhuo et al., 2019)."	Thanks – changes implemented as suggested.	Manuscript text revised.
11	Table 9: I am confused about how exactly the "R1-R7" RCMs are shortlisted. It said in Line 609 that "RCMs are shortlisted from the set of 20 if they rank highly for both performance and independence", but it is not clear how the RCMs are ranked from "R1" to "R7". Please explain it in more detail.	We shortlisted the 7 RCMs from the shortlisted 20 candidates based on their performance and independence ranking. However, there was no ranking from R1 to R7 per se, this is just a naming convention chosen at the point of embarking on the next stage of the design/model evaluation process with was the ERA5-forced RCM simulations conducted for the CORDEX ERA5 evaluations. Only after completing these CORDEX ERA5 evaluations did we compare the performance of R1-R7 and at that point we selected R3 and R5 for the subsequent CMIP6-forced RCM simulations – please see Di Virgilio et	We have added the following note to the revised main text: "We note here that R1-R7 are simply a chronological naming convection and do not imply any ranking."

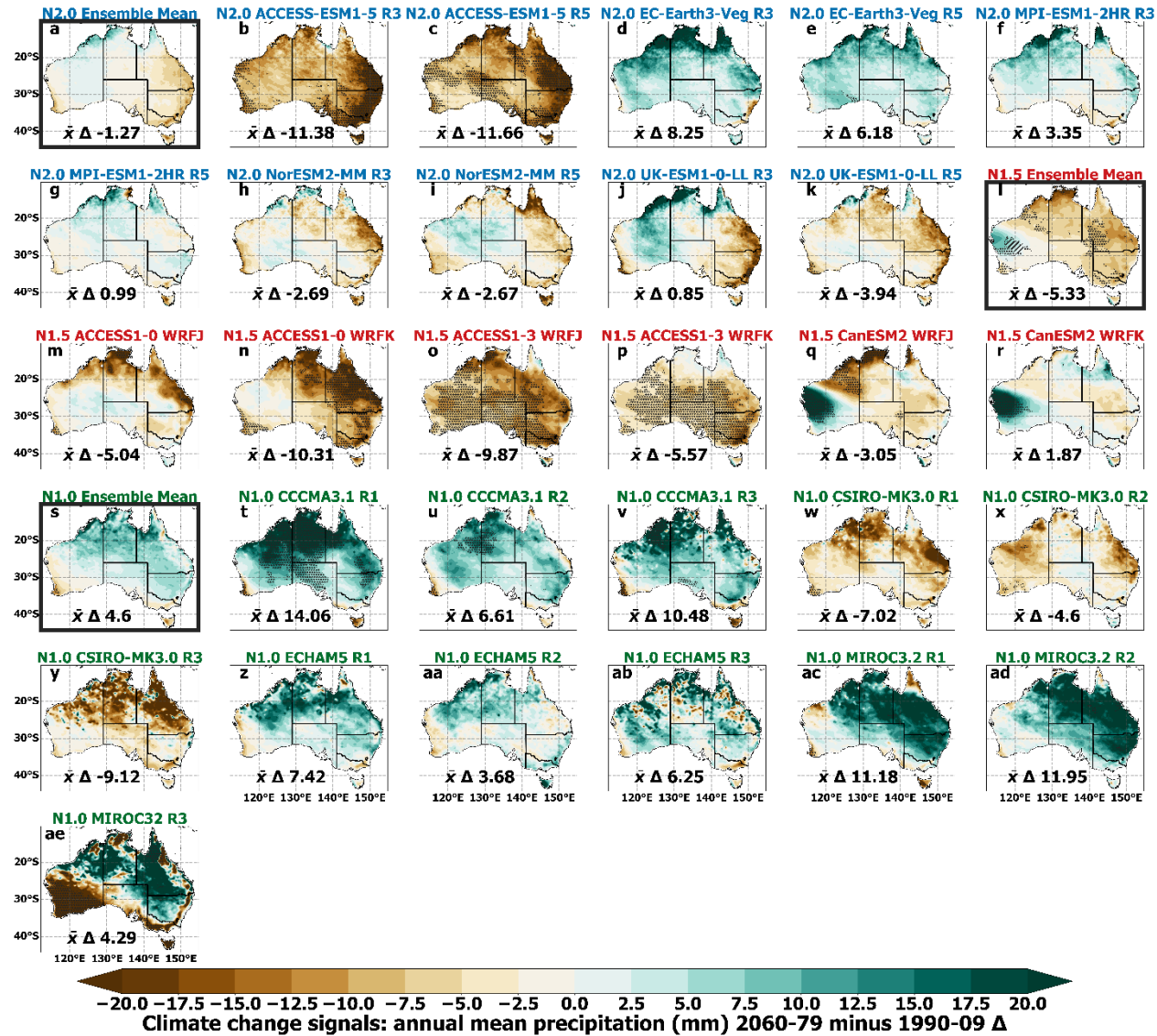|		al.,(https://gmd.copernicus.org/preprints/gmd-2024-41/gmd-2024-41.pdf) for further details.	
12	Figure 15: there are many subfigures and their titles are not easy to read. Please consider improve the visualization.	Agreed, the original Figure 15 was of insufficient quality (e.g. 300 DPI), so we have increased to 600 DPI and improved clarity of stippling and titles as far as is possible for a figure with 31 individual plot panels.	Figure 15 revised, please see example below this table.
13	Line 777: "with 4 RCMs using BMJ, 2 RCMs using Tiedtke, and 1 using Kain-Fritsch." Please give the references to the cumulus parameterisations.	This is a good idea – we have included references for all physics used in the study.	References for all physics settings used added into Table 3 in the revised manuscript.

Figure 15: revised version