

## ***Interactive comment on “BARRA v1.0: Kilometre-scale downscaling of an Australian regional atmospheric reanalysis over four midlatitude domains” by Chun-Hsu Su et al.***

### **Anonymous Referee #2**

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The "BARRA v1.0: Kilometre-scale downscaling of an Australian regional atmospheric reanalysis over four midlatitude domains" paper evaluates the performance of high resolution downscaled regional reanalysis datasets over four Australian cities, collectively BARRA-C, derived from the coarser resolution continent-spanning BARRA-R dataset.

The paper rightly points out the relative lack of very high resolution, in this case, km-scale, reanalysis datasets over Australia (and the Australasian region in general) and goes on to evaluate the four BARRA-C domains against observational datasets on annual and seasonal timescales and for case study events, acknowledging the inherent biases often present in these km-scale models.

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Recommend acceptance for publication in GMD with consideration for the following comments and revisions (mostly around readability):

1. Throughout the text the phrase "km-scale" and "kilometre-scale" are interchanged. Advise picking one form and sticking with that.
2. Section 1, Line 30: consider changing "over global models" to "beyond current global models" and highlight some of these new insights
3. Section 1, Line 33: change "four km" to "four kilometres"
4. Section 1, Line 55: remove comma in "instruments, to form"
5. Section 1, Line 63: consider changing "Higher resolution reanalyses is needed" to "Such scales are needed"
6. Section 1, Line 72: consider changing "Germany with assimilation of conventional" to "Germany, assimilating conventional"
7. Section 1, Line 72: consider changing "rain rates and demonstrated improved" to "rain rates, demonstrating improved"
8. Section 1, Line 76: consider changing "scale finer than coarser-resolution" to "scale finer than those of coarser resolution"
9. Section 1, Line 87: consider changing "10 minutes" to "10 minute"
10. Section 2, Line 103: change "includes 4 " to "includes four"
11. Section 2, Line 109: consider changing "to hot summer" to "to hot summers" and "differs with cooler" to "differs with a cooler"
12. Section 2.1, Line 124: consider changing "model in BARRA-C" to "model used in BARRA-C" and remove comma after "time step"
13. Section 2.1 details differences between the BARRA-R and BARRA-C model configurations and compares these to the RAL1 science configuration, now available in the Unified Model. Given neither BARRA-R nor BARRA-C uses RAL1 as the core science configuration, not convinced this adds much to the discussion about the performance of BARRA-C, other than to point out a newer science configuration is available for use. This discussion might make more sense if some BARRA-C runs had been done using the RAL1 configuration and comparative results presented. Otherwise would be consider re-wording to describe the OS36 science configuration used by BARRA-C.
14. Section 2.2, Line 183: consider changing "benefits of analysis in BARRA-R is inherited" to "benefits of the BARRA-R analysis is inherited"
15. Section 2.2, Line 190: consider changing "to the UM grid" to "to the BARRA-C UM grids."
16. Section 2.2, Line 192: consider changing "In other words, the" to "Therefore the"
17. Section 2.2,

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Line 193: consider changing "considered short, and is chosen to meet computational constraints and regular reinitialisation is needed" to "considered short, but is chosen to meet computational constraints with regular reinitialisation needed" 18. Section 3.2 As part of the discussion comparing BARRA against AWAP observations, the authors begin to discuss the impact that choosing the closest model grid cell to an observation location can have on validation results, especially if the closest model grid point is of a different land use type or not even a land point at all. At this point, it would be good to see in a bit more detail about the datasets used to define these characteristics and, at least for one observation site, how different these land cover fractions or land use types are across the BARRA models. Can this assertion be backed up? Could be added to the Supplemental material. 19. Section 3.4, Line 299: consider changing "in all but TA domains." to "in all the TA domain." 20. Section 3.5, Line 318: consider changing "blended with the gauge" to "blended with gauge" 21. In relation to Figure 9(v), despite being orographically tied, is there anything that stands out about the storm case that might lead to BARRA-R rainfall performing markedly different from BARRA-C in this case, and from the other BARRA-R storm events shown? 22. Section 4, Line 349: consider changing "positive (negative) bias during light (strong)" to "positive (negative) during light (strong)" 23. Section 4, Line 354: change "reference therein" to "references therein" 24. Section 4, Line 365: be consistent with use of "z" or "s" in parameterization/parameterisation throughout the document 25. Section 4, Line 368: consider changing "in other studies; Lean et al. (2008) and Hanley et al. (2016) found that" to "in other studies. For example, Lean et al. (2008) and Hanley et al. (2016) found that" 26. Section 5, Line 417: consider changing "pressure-level grids from BARRA-C" to "pressure-level gridded data from BARRA-C" 27. Section 5, Line 427: consider changing "albeit high rainfall bias exists." to "albeit with high rainfall bias." 28. Line 441: consider changing "UM is available" to "The UM is available" 29. Line 445: consider changing "available as part of the version 3" to "available under Version 3" 30. Line 455: consider changing "are subjected to" to "are subject to" 31. For general consistency across the document should decide whether all URLs are to

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be hyperlinks or plain text. Currently have a mix of both formats. 32. Figure 1: for clarity, worth changing last sentence to "Red dots indicate the location of the state capital cities." 33. Figures 2, 4 and 8 are quite hard to read as printed. Wonder if these would benefit from changing to a landscape orientation. In Figure 8 especially, it is hard to see the black curves indicated in the caption and these means are not mentioned in the manuscript otherwise that I noticed. 34. Figures 3 and 7: consider changing "AWAP grid with the nearest neighbour" to "AWAP grid using the nearest neighbour" 35. Figure 5: consider changing "in each domain" to "in each BARRA-C domain". Also remove/add extra spaces in the coordinates of each city for consistency. 36. Figure 10: change "6h" to "6-hour" for consistency with rest of the document. Wonder if the last sentence in the caption is best moved to the main text of the manuscript as part of the main discussion (Section 3.5) rather than left in the Figure caption.

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