

***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 #1

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This paper is an evaluation of BARRA v1.0 reanalysis. The authors compare BARRA-C, a 1.5 km downscaled re-analysis against various observations, and investigate added value to BARRA-R, which is the 12 km continental version.

This is a highly valuable paper and generally very well written. I recommend acceptance in GMD subject to the following revisions:

1. The paper would benefit by having an “Observational data-sets” section or similar, where all observations used are described in a bit of detail. Currently details of observations are only provided when results are shown. This would fit well in section 3 of the paper. More details are needed about the point observations and gridded analy-

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ses. Could you also provide some background on MERRA2? Why do you choose to use MERRA2 specifically? Some context is needed here. Details about AWAP also needed.

2. Figure 3 – comparisons with AWAP. Interpolation errors within AWAP are available as “RMSE Analysis” from BOM’s web-page. It would be useful to show or talk about this to put the biases in context of errors in AWAP?

3. Section 3.2, Figure 3 – you do not discuss the very large bias in Daily max temp in South Australia, which is up to 7.6 degrees C, in the north-west part of the domain. This is a very large bias in both BARRA-C and BARRA-R, and this needs some more attention. MERRA2 has a similar bias in south Australia to BARRA-C and BARRA-R.

4. Figures 3, 4 and 7 – Some analysis of trend would also be useful? Rather than just means. Also, what about variability? It may be useful to examine the standard deviation from AWAP versus the models?

5. Figure 4 – this is a very busy figure, and I urge the authors to find better ways to summarize/plot the data. It is very hard to compare with the different y-axis limits. I suggest to have fewer plots, 1 plot per domain, for tmax and tmin separately. Don’t plot the difference, but plot AWAP as solid black line, and each model for that domain as a different color/marker. This is currently too much to digest. By plotting on the same plot, with similar axis, one can actually makes sense of all of this. This Figure is much too busy to digest. Reduce the number of plots, it is very common to plot up to 4-5 lines on a single plot.

6. Figure 5 – could you make the models dotted lines do they are easier to distinguish from AWAP in solid blue. Line 270 – BARRA-R and BARAA-C have too many warm days in Perth, but also, all other models seem to have too few, or close to AWAP. For Adelaide in SA, it seems that BARRA-C does worst than BARRA-R for warm extremes?

7. Figure 8 and related text – same comment as for Figure 4.

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8. Can you come up with some objective measure of added value of BARRA-C over BARRA-R? There are many metrics used to quantify added value. There is a lot of literature on quantifying added value of downscaling GCMs using RCMs for example. The same concepts could be applied to quantify added value of BARRA-C over BARRA-R. Producing re-analysis at 1.5 km resolution, takes a lot of effort and the data storage is difficult, as I am sure the authors would know very well. Quantifying the added value would be useful I think.

9. The discussion and conclusion mostly speculates for reasons to explain model biases, that is to be expected. But the paper would be much more interesting if some dynamical analysis were carried out to better understand differences between the models. This could be comparing MSLP patterns during very hot extreme events, just as one example. I think this would make the paper much more interesting. I would like the authors to think a bit more about this. The paper would benefit from some more actual analysis of model dynamics. You cannot do everything, I understand, but there is room for the basic dynamics analysis I think.

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