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Interactive comment on "BARRA v1.0: The Bureau of Meteorology Atmospheric high-resolution Regional Reanalysis for Australia" *by* Chun-Hsu Su et al.

Anonymous Referee #1

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The manuscript "BARRA v1.0: The Bureau of Meteorology Atmospheric high-resolution Regional Reanalysis for Australia" provides a description of a novel regional reanalysis system covering Australia, New Zealand and Southeast Asia. Comparison of meteorological parameters from BARRA-R with observations and the forcing global reanalysis ERA-Interim shows that the regional reanalysis provides sound estimates of the atmospheric state and exhibits clear advantages over ERA-Interim, especially in the case of near-surface parameters.

The manuscript is well-written and clearly structured. It provides an introduction on regional reanalysis, a sound description of the model and data assimilation systems

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Discussion paper

with references to more detailed descriptions with respect to single components of the system and a brief first look into the performance of the system.

My only issue is that the comparison with global reanalyses is only performed against ERA-Interim. I think it would enhance the significance of the results if the authors could include comparisons with the MERRA-2 and JRA-55 reanalyses (see also first minor comment). It would also help to identify biases in BARRA-R originating from the forcing ERA-Interim reanalysis.

Minor comments:

Page 1 Line 19: "[...]Âăthan leading global reanalyses." This is kind of a stretch, as the manuscript only contains comparisons against the global reanalysis ERA-Interim.

Page 2 Line 6: "The latter is currently replaced [...]" instead of "The latter will be replaced [...]"

Page 2 Line 16: "The first [...]" instead of "One of the earliest [...]"

Page 2 Line 19: "[...] as in the global ones [...]" instead of "[...] as the global ones [...]"

Page 3 Line 22: "[...] downscaling [...]" instead of "[...] downscaled reanalysis [...]"

Page 8 Line 12ff: I am a little curious about how well the soil moisture is represented in BARRA-R. In the mid-latitudes, such a system would be started in the late fall or early winter, when the soil is saturated with moisture. However, I can see that for Australia there are a lot of arid or semi-arid regions where such an approach is not feasible. It would be nice if the authors can elaborate on that as soil moisture is not shown in the results but is an important parameter (memory effect) especially in the context of reanalysis compared to NWP.

Page 10 Line 7ff: I understand why it is important to compare the results against the forcing global reanalysis (ERA-Interim). However, as mentioned above, I think it would be good to include comparisons against MERRA-2 and JRA-55 also. On the one hand,

it would help to identify errors or biases in BARRA-R originating from the forcing ERA-Interim, and on the other hand it can be used to look into the confidence of the verifying gridded data sets which might also be error prone.

Page 10 Line 10: "[...] the model levels [...]" instead of "[...] the model's model levels [...]"

Page 12 Line 27: "[...] will be more erroneous [...]" instead of "[...] will be erroneous [...]"

Page 12 Line 28f: I suggest the sentence to be "The accuracy of BARRA-R is expected to worsen during the warm season and at low latitudes, and to improve during the cooler season and at high latitudes where non-convective precipitation is dominant." instead of "The accuracy of BARRA-R is expected to poorer during the warm season and at low latitudes, while better during cooler season and at high latitudes where non-convective precipitation is dominant."

Page 13 Line 6: A comparison over land could also be made with the GPCC data set which is quality controlled and also contains a lot of additional non-public data.

Page 13 Line 11: "row" instead of "column"

Page 13 Line 23: "amounts" instead of "amount"

Page 14 Line 3: "amounts between" instead of "amount"

Page 14 Line 15: Did the authors really see so many "grid-point storms" in the data? Could it also be a misrepresentation / unresolved scale in TMPA?

Page 16 Line 2f: An example of successful statistical post-processing for error correction of regional reanalysis (albeit for radiation) is provided in Frank et al. 2018 (in Solar Energy).

Page 16 Line 4f: The reference should probably (also) be provided in section 3.

Figure 5: Perhaps it would be good to only show the difference plots for ERA Interim and BARRA-R. The color table for the absolute values has too many levels to be useful.

Figure 7: The comparison of AWAP with the other data sets would be easier if all data are plotted with the same domain.

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