

Interactive comment on “The weather@home regional climate modelling project for Australia and New Zealand” by Mitchell T. Black et al.

Mitchell T. Black et al.

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Dear Dr Williams and readers,

Please find attached our revised manuscript with changes from the original version highlighted in red (see revised_manuscript.zip). We found the reviewers' comments to be very helpful and have responded to these comments below.

Reviewer 1: Dáithí Stone

Reviewer's summary: This paper describes the experimental setup of an atmospheric modelling system for examination of extreme weather over the land territories of Australia and New Zealand in the context of anthropogenic climate change. It is well de-

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signed, well described in this paper, and various aspects of the output of the modelling system are adequately summarised. I recommend the paper for publication. I have some minor comments and suggested edits below, but I do not consider any of them to be required.

1. Reviewer's comment (general): You examine DJF and JJA values, and some SONDJF values. The onset/cessation seasons for temperature and (I think) rainfall occur during the SON and MAM seasons, and I believe extreme early/late onsets/cessations can be at least as important e.g. for water resources and agriculture. Have you done these analyses for those seasons and are you able to summarise them? It probably does not have to be in the sort of detail done for DJF and JJA, but could just highlight any cases where e.g. the model might happen to be rather late (as proxied by the mean during the onset).

Authors' response: This additional analysis has been completed and is included within the supplementary material (see new Figures S11–S13). Overall, the weather@home model is seen to adequately resolve the onset/cessation seasons for temperature and precipitation.

2. Reviewer's comment (technical): page 1, lines 6-7 "more robust estimates of uncertainty" than what? You are using a single modelling system, so I am not sure how you can e.g. robustly estimate the uncertainty due to approximations in model design.

Authors' response: The manuscript has been revised to address this point (see page 1, line 7).

3. Reviewer's comment (technical): page 1, lines 12-13. Where or how? I do not see the URL of any data portal listed in the document, for instance.

Authors' response: The relevant information for accessing the data has been added under the section Data and code availability. Members of the research community wishing to access the data are encouraged to contact the authors directly. An online

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data portal (with public URL) will become available in the future.

4. Reviewer's comment (technical): page 1, line 16. I suppose wildfire might be considered a "climate-related" process, but I usually think of it as an ecological process.

Authors' response: The lead author (Mitchell Black) is currently completing a PhD thesis that is using the weather@home ANZ framework to investigate the influence of anthropogenic climate change on wildfire risk. This material will be published in due course.

5. Reviewer's comment (technical): page 1, lines 16-20. Are there any reports that document such "loss" and "tasks"?

Authors' response: Citations have been included within the revised manuscript (see page 1 of revised manuscript, lines 17-19).

6. Reviewer's comment (technical): page 2, line 1. Reisinger et alii (2014) (IPCC AR5 WGII Ch25) might be an appropriate reference here, as it is in this chapter of the IPCC AR5 that trends in Australian/New Zealand climate are assessed specifically

Authors' response: This citation has been included within the revised manuscript (see page 2, line 3).

7. Reviewer's comment (technical): page 2, line 10 "Distinguishing between internal" -> "Distinguishing between the responses to internal"

Authors' response: Text revised accordingly (see page 2, line 12)

8. Reviewer's comment (technical): page 2, line 12. While the magnitude of the response is more or less the same at regional and global scales?

Authors' response: This sentence has been revised to allow the message to be clearer. (see page 2, lines 13-16).

9. Reviewer's comment (technical): page 2, lines 20-22 Are these "drivers" or mecha-

nisms? For instance, atmospheric blocking over Australia is a manifestation of climate variability over Australia, not a driver thereof.

Authors' response: This sentence has been revised to remove this confusion between drivers and mechanisms (see page 2, lines 23-27).

10. Reviewer's comment (technical): page 2, line 31 "respond to anthropogenic" -> "respond to the absence of anthropogenic" This discussion concerns estimation of the counterfactual climate, correct?

Authors' response: This sentence has been revised accordingly (see page 2, line 35).

11. Reviewer's comment (technical): page 6, line 9 Might the observations have any deficiencies?

Authors' response: A sentence has been added to section Observational datasets (page 6, lines 11-13) to acknowledge potential limitations of the observational datasets used in this study. However, as indicated in the revised text, these datasets are nevertheless well regarded for use in model evaluation studies.

13. Reviewer's comment (technical): page 6, lines 10-11 How do DJF and JJA project onto the wet, dry, onset, and/or cessation seasons over these regions?

Authors' response: As indicated for point 1 above, additional analysis has been undertaken to examine the model's ability to resolve the onset/cessation seasons for temperature and precipitation. Overall, the model appears to adequately resolve this timing for each region. The supplementary material has been updated to include these additional figures and a brief summary of these results are included in the main body of manuscript. (see page 6, lines 22-23).

14. Reviewer's comment (technical): page 8, lines 3-4 This is not clear to me for Tmin. The uncertainty on the median should be $\sqrt{75}$ times smaller than the range of the whiskers: are the respect Tmin median values larger than this? I cannot tell from the plot.

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Authors' response: Figures 8-10 have been updated to make the box plots clearer.

15. Reviewer's comment (technical): page 8, line 27 Maybe a 360-day calendar?

Authors' response: Manuscript updated accordingly.

16. Reviewer's comment (technical): page 8, lines 32-33 How is "model uncertainty" estimated with just the single model?

Authors' response: This has been corrected to indicate 'sampling uncertainty', not 'model uncertainty'.

17. Reviewer's comment (technical): page 9, lines 4-5 I am not sure, the observations lie within the spread of the simulations. page 9, lines 9-10 The observations lie within the spread of the simulations for 11d, and are pretty much bang on for 11e.

Authors' response: Indeed, this section of text was incorrect as the observed values fell within the model spread. This section of text has been updated to remove these incorrect statements (see page 9, lines 17-22).

18. Reviewer's comment (technical): page 9, lines 30-31 Re the sea ice extent, does this make sense for the Antarctic, where the recent trend has been toward slightly larger extent?

Authors' response: This point was investigated during the beta-testing phase of the weather@home Australia-New Zealand experiment. During this testing counterfactual climates were simulated using: 1.) sea ice extent corresponding to the year of maximum sea ice extent in the Southern Hemisphere from the OSTIA records (1985–2014), and 2.) sea ice extent corresponding to the year of minimum sea ice extent in the Southern Hemisphere. While not shown here, the results of these experiments identified that the choice of counterfactual sea ice extent had negligible impact on the resulting climates of Australia and New Zealand. Therefore, the weather@home Australia-New Zealand experiments presented in this manuscript used the maximum observed sea ice extent as a proxy for the counterfactual sea ice extent, for both hemispheres.

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This is consistent with the methodology of the existing weather@home projects – that is, weather@home Europe (Massey et al. 2015) and weather@home Pacific North-West (Mote et al. 2015).

19. Reviewer's comment (technical): page 9, lines 32-33 You did not mention when describing the simulations if anything is done concerning land use/cover change. Is this included and, if so, how is this treated in the counterfactual simulations?

Authors' response: The weather@home ANZ setup uses the MOSES1.0 land surface scheme. The surface type is fixed and is the same between the historical and counterfactual climate simulations. The manuscript has been revised to include this information (see page 4, paragraph 1).

20. Reviewer's comment (technical): page 10, line 18 "quantified" -> "characterised" I do not see any reason to believe that these 10 estimates can be assumed to be uniformly sampled from a plausible posterior distribution. Rather than producing a posterior distribution, I think you are testing robustness against plausible alternative estimates.

Authors' response: Manuscript updated accordingly.

21. Reviewer's comment (technical): page 10, lines 29-30 Where and/or how?

Authors' response: The relevant information for accessing the data has been added under section Data and code availability (page 12, paragraph 1).

22. Reviewer's comment (technical): "allows extreme events" -> "allows certain types of extreme weather events"

Authors' response: Manuscript updated accordingly.

References

Massey, N. et al (2015). Weather@home – development and validation of a very large ensemble modelling system for probabilistic event attribution. Quarterly Journal of the

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Royal Meteorological Society, doi:10.1002/qj.2455

Mote, P. et al (2015). Superensemble regional climate modeling for the western US. Bulletin of the American Meteorological Society, doi: 10.1175/BAMS-D-14-00090.1

Please also note the supplement to this comment:

<http://www.geosci-model-dev-discuss.net/gmd-2016-100/gmd-2016-100-AC1-supplement.zip>

Interactive comment on Geosci. Model Dev. Discuss., doi:10.5194/gmd-2016-100, 2016.

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