

## ***Interactive comment on “Atmosphere-only GCM simulations with prescribed land surface temperatures” by D. Ackerley and D. Dommenget***

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### General comments

This paper describes a method for prescribing land surface temperatures in an atmospheric model and then applies the method in a series of sensitivity tests. It is suitable for publication with minor revisions, although a restructure of the paper might make it an easier read (see specific comments).

### Specific comments

Sec 2.2.2 and Figure 1: There appears to be a discontinuity at 0Z in the 1-2 January timeseries plots in the middle column of the figure. While other step changes appear commonly every 3 hours, presumably related to the radiation time-step, the 0Z step

C1

appears more consistent/worse, at least for Australia and N Asia. For N Asia this becomes the dominant feature in the figure rather than any diurnal cycle (and so appears to contradict the statement that ‘a clear diurnal cycle can be seen at each of those grid points’ (p6, line 9)). While I don’t expect this issue to have any implications for the work presented here, a comment/explanation in the text would be useful to satisfy a curious reader.

Sec 2.2.3: Are there any implications for the surface energy balance in prescribing the surface temperature, or is any implied imbalance absorbed in the radiation terms? Did you do any checks to confirm this?

Section 3: Please check references to east and west as they sometimes seem to be mixed up (see technical comments for examples).

Restructure of paper: There are two aspects to the paper. The first is checking whether the prescribed land surface temperature reproduces the original simulation and the second is the set of example sensitivity experiments. I think the paper would be easier to follow if the two aspects were dealt with separately in the results/discussion section, i.e. present all the ‘CON1-FREE’ and ‘CON2-CON1’ results first and discuss these before moving onto the presentation of the sensitivity experiments. These also might be best presented as groups of experiments with the results and discussion presented together for each group. It may just be personal preference, but I would find it easier to be able to look at the temperature, precipitation and pressure differences together for one experiment (or set of related experiments) before going on to consider the next experiment. If a restructure is undertaken, I would move the comment about Antarctic temperatures (p6, line 17 and line 22-23) into the results/discussion of ‘CON1-FREE’, e.g. ‘Initial tests showed ....’, ‘This was resolved by ....’ giving ‘CON1-FREE’ results as shown in Figure ...

### Technical comments

p3, line 7: list Bi et al (2013) before Frauen et al. (2014) and perhaps note that from

C2

the Bi et al. paper it is the ACCESS1.0 version that is most relevant.

p3, line 5: suggest adding 'configured similarly to ' before 'Hadley Centre ...'

p3, line 9: delete repeated 'the'

p3, line 19: 'constraint' mis-spelled

p5, line 8: delete 'the' before 'ATMOS\_PHYSICS2'

p6, line 5: Might be worth noting that the grid-cell values shown are the mean across the tiles in the grid-cell, assuming that is the case.

p7, line 4: 'The first three experiments ...' not four.

p7, line 9: insert 'is the' before 'same'

p8, line 29 and 30: western Pacific, western Indian Ocean?

p9, line 6: south-east of the Amazon?

p9, line 10: the remote responses in the AUS10K temperature show some similarity to the con2-con1 differences. Do you think this is just coincidence?

p9, line 12: east of the continent?

p9, line 32: did you mean south-east, as this would be more consistent with the temperature anomaly?

p10, line 6: 'increased precipitation coincides'

p10, line 15: add 'be' before 'representative'

p10, line 17: 'assess' mis-spelled

p12, line 6: add 'Antarctic' after 'allowing the'

p12, line 26: delete space between T and 1.5

### C3

p12, line 27: delete 'the' at start of line

p16, line 10: 'an' not 'and' towards end of line

p16, line 13: Should be figures 11(a) and 11(e) not (b) and (f)

p16, line 31: replace 'or' with 'of'

p17, line 5: ')' after 'respectively'

p18, line 1: 'the' before 'imposed'

p20, line 3: 'GCM' instead of 'GCMS'

p20, line 21: 'model' not 'mode'

p21, line 4: 'of' repeated

p22, line 13: 'Cook' needs capital

Figure 1, middle column: the orange line is not defined in the figure caption (though the three-hourly input is mentioned for the right column but not shown?). Is the thickness of the black line significant or just for readability?

Figure 11: The colour bars in panels (a), (b), (e), (f) appear to be swapped.

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### C4