

# ***Interactive comment on “Implementation of an optimal stomatal conductance model in the Australian Community Climate Earth Systems Simulator (ACCESS1.3b)” by J. Kala et al.***

## **Anonymous Referee #2**

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This paper explains the impacts of including an improved stomatal conductance scheme in the CABLE land surface model on climate biases in the ACCESS global climate model. The new stomatal conductance model is based on global observations with PFT-specific values for the parameter  $g_1$ , and it has been documented in a few previous papers. The large biases in the climate model are still present with the new stomatal conductance model, but at least this revision shows some improvement. For example, due to lower ET the daily  $T_{max}$  is increased, and the bias in the annual maximum  $T_{max}$  is reduced.

This manuscript is well written, and the results are clearly presented. It clearly represents an improvement in both the land surface model and in the coupled modelling

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system. I have a few questions for clarification and some recommendations to improve the paper.

General comments/questions for the authors:

1. My first question relates to the impact of the model on  $T_{min}$ . Mechanistically, what causes the changes in  $T_{min}$ ? Is it small differences in  $g_s$ , or is it due to residual effects of the higher daytime temperatures (i.e.: changes in boundary layer height or turbulence due to the changes in the surface energy budget)? I would expect stomatal conductance to be 0 overnight since there is no assimilation. What is the magnitude of the  $g_0$  term in Equation 3?

2. I also have questions regarding the impact of the changes on NPP shown in Figure 8. The authors state that the differences in NPP between the models is due to changes in precipitation, but shouldn't there also be a first-order effect from the different approaches to  $g_s$ ? In CABLE, is the stomatal conductance equation solved iteratively so that the original  $A$  is impacted by the  $g_s$ ? If this is true, the relationship between the primary productivity and  $g_s$  needs to be explained, and I would like to see more explanation for the changes to NPP. If this has been addressed in one of the previous papers implementing this stomatal conductance model, that could be mentioned here instead of a full explanation in this text.

3. The authors state in the Discussion that the changes 'first and foremost' result in changing the ET, and this causes the changes in temperature and precipitation. So why not lead in the results section with the impacts on global ET?

4. It would be useful to provide more explanation of some of the overall biases in the model. For example, at line 14 on Page 5243, it is stated that the biases in  $T_{min}$  over North America in JJA are due to clouds – can this be elaborated upon?

5. For the DTR results, to my eye it looks like the DTR improvements are mostly due to the increase in  $T_{max}$  - is this true? If anything, it looks like the increase in  $T_{min}$  in

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the boreal forest regions would serve to decrease the DTR.

6. What is meant by “other warm extremes” in the Discussion, Page 5246 Line 8? Does this mean the TXx index, or something else?

Tables and Figures:

Figure 1 is not referenced in the text.

Minor typographic comments:

Introduction, page 5238: The last two sentences of the introduction could be made clearer. For example, in the phrase “We seek to determine whether these problems, affecting these and other extreme indices . . .” the repeated use of “these” in this sentence makes it vague. Also you could remove the “We also note that” in the last sentence of the section.

Results, page 5244: In reference to the dry bias in the JJA precipitation (lines 15-20), I think this should be the region to the north east of the Mediterranean.

Conclusions: There are only two goals discussed in the introduction and conclusions, so is the first sentence “three gaols” is a typo (or else something is missing in the paper!)?

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Interactive comment on Geosci. Model Dev. Discuss., 8, 5235, 2015.

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