

Review of: “The impact of surface climatology from changing the land surface scheme in the ACCESS(v1.0/1.1) climate model”

The paper describes the impact of using CABLE rather than MOSES (the default LSM) within the ACCESS model system. This is a highly relevant paper as ACCESS is a widely used model within the Australian climate science community. The paper is well written, and the physical mechanisms behind the changes are very well explored and explained. The description of the model differences between CABLE and MOSES is also very valuable. Hence the paper is suitable for final publication in GMD with minor revisions. The following comments may help improve the manuscript.

Major comments:

Title: Suggest changing to “The impact of changing the land surface scheme in ACCESS (v1.0/1.1) on the surface climatology” – Reads better

Abstract:

It is mentioned that CABLE results in a warmer winter and cooler summer in the NH, but no mention is made if this improves or degrades the bias?

The abstract should have a sentence or two, describing the overall effect of replacing MOSES with CABLE. The dynamics are very well explained, but it would leave a non-expert reader wondering: “was it worth the effort to replace MOSES with CABLE?” Although this is not the aim of this paper, an ACCESS user who is not an LSM-expert should be able to use the abstract as a guide to decide if they want to use CABLE versus MOSES. A few sentences could make this clearer.

Section 2.1: It is mentioned that subsurface tiling is used in CABLE. Would be useful to provide information if the maximum number of tiles per grid-cell is user-specified, or automatically computed?

In the same section, would it be possible to tabulate the differences between CABLE and MOSES in table format? That would be a useful summary for ACCESS users to be able to refer to.

Section 3.3: It is fine that you are using the offline simulations to focus on model behaviour rather than reproduce the online results, but a reader would be left wondering why you did not use same versions for the offline simulations.

In the same section, line 21, provide a CABLE version, and perhaps state the UM version with the different atmospheric physics.

Figure 4: The improved bias during JJA with ACCESS1.1 (CABLE) as compared to 1.0 (MOSES) over NA and northern Europe could be mentioned in the abstract.

The discussion of the physical mechanisms behind the differences between CABLE and MOSES in ACCESS is very thorough and convincing. The conclusion could use a few sentences on “what this all means”. It seems to me that CABLE in

ACCESS, with its more realistic method of energy portioning etc, is an important step forwards in ACCESS development. I suggest a paragraph, aimed at a non-LSM experts, which paints the broader picture.

There should be some rationale for the use of Era-Interim. This has been raised by the first reviewer. Perhaps the authors should clarify that they use ERA-Interim such that they can investigate L-A feedbacks in a consistent manner? i.e., one can make inferences about temp, precip, cloud feedbacks using Era-Interim, but this is harder to do using pure observational data-sets. The aim here is to investigate the feedbacks, and the use of Era-Interim seems appropriate to me.

The first reviewer has also commented on the lack of statistics used in this paper. I do not think the use of statistical significance testing would add much to this paper. The aim is to investigate the physical mechanisms, as the authors have carried out. So, I would disagree with the first reviewer on this point.

Editorial comments:

Page 1, line 8, replace “placement of canopy” with “placement of the canopy”.

Page 1, line 11, replace “lowers diurnally” with “lowers the diurnally”

Page 2, line 11, replace “while (Kowalczyk et al. 2013)” with “while Kowalczyk et al. (2013)”.

Page 2, line 24, the “HadGEM2 Development Team: et al. (2011)” reference seems strange?

Page 2, line 28, suggest to add/provide some references after “interpret the results from ACCESS1.3”.

Page 3, line 15, replace “structural placing” with “the structural placement”.

Figure 1 caption: provide descriptions of H, Hv, Hs, sigma_v etc.

Page 3, line 24, L does not appear in Eq. 1

Page 4, line 2, Fig. 2 should be in brackets? Or “as shown in Fig. 2”, and elsewhere in the manuscript, e.g., line 4.

Page 4, line 4, what “many other LSMs”, should provide references. Are you referring to CLM, NOAH, ORCHIDEE etc? or is this a broad statement?

Page 4, line 8 – Should note that it is possible to parameterize snow-free albedo in CABLE as described in Kala et al. (2014) (www.geosci-model-dev.net/7/2121/2014/), but this is yet to be tested coupled to ACCESS and not usually activated.

Page 9, line 1, replace “In boreal summer” with “During the Boreal summer”.

Page 10, line 12, replace “giving lower surface albedo” with “simulating lower surface albedo”. The phrase “CABLE gives....” is used a lot through the manuscript. Suggest to use “simulates” instead.

Page 9, last line, impacts “the” overall

Page 10, line 29, “The” Boreas grid-cell

Page 15, last line. Recent work would suggest that stomatal opening to CO₂ is equally important: Kala et al. (2015):

<http://www.nature.com/articles/srep23418>