

Interactive comment on “Implementation of a soil albedo scheme in the CABLEv1.4b land surface model and evaluation against MODIS estimates over Australia” by J. Kala et al.

Anonymous Referee #1

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In this study, a simple parameterisation for snow-free and vegetation-free (background) land surface albedo is implemented into the land surface model (LSM) Community Atmosphere Biosphere Land Exchange CABLEv1.4b. The simulated land surface albedo is evaluated with MODIS MCD43GF albedo product. Simulated surface parameters of CABLE with parameterised and prescribed soil albedo are compared to investigate the models sensitivity to the parameterisation.

With this content, the paper is within the scope of GMD. But it becomes not clear, if the presented soil albedo parameterisation is useful; and the evaluation against only MODIS seems not sufficient. With regard to science, there is no innovative approach in it. There are more advanced methods for background albedo parameterisations

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available, which are also cited in the paper, but not applied here.

Major Comments:

1. On the one hand, the authors state that incorrect parameterisation of surface albedo can result in large model biases. On the other hand, the CABLE LSM with the new albedo parameterisation simulates larger differences compared to MODIS albedo than the LSM with prescribed albedo. Assuming that MODIS product represents realistic surface albedo values, the new parameterisation would potentially lead to larger model bias. As demonstrated in figure 8, net radiation is up to 50 Wm^{-2} higher than in the control run, also sensible heat and temperature show high sensitivity. The high sensitivity of the simulated surface parameters demonstrate the large importance of an accurate representation of land surface albedo. Accordingly, you state on p. 1682, l. 26, that the new parameterisation should be used with caution. But for which purpose can it be used then? It is correct that with the new parameterisation dynamic soil moisture - albedo feedbacks are enabled, but how realistic will those feedbacks be represented?
2. The prescribed soil albedo in the CABLE control run is derived from MODIS data. The evaluation of the simulated total surface albedo is also done with MODIS data. Thus, it is no surprise that CABLE results with prescribed soil albedo shows high agreement with MODIS data, as you also state in line 24, p.1683. The new soil parameterisation leads to larger differences compared to MODIS, but this does not automatically mean, to larger errors. Only, if we assume that MODIS perfectly represents the real values. First, I suggest to avoid the absolute word "error" and use the relative word "difference" or "deviation". Second, I recommend to compare the simulated albedo with another data source, e.g. land surface albedo from MERIS data.
3. With respect to the soil albedo parameterisation: soil moisture in LSMs are model specific quantities, and in most cases more an index of moisture state for a 3D soil layer, than a reliable absolute quantity (Koster et al. 2009). You also discuss this issue on p. 1685, but does it make sense then, to use this model quantity for your

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parameterisation? For the relation between soil moisture and soil colour, an absolute quantity is necessary which represents realistic near surface soil moisture. Is this the case? How is soil moisture parameterised in CABLE? For which soil depth is it representative? And is it comparable to AMSR-E soil moisture?

4. At several places, the authors state that there are more advanced methods for background soil albedo available, e.g. Jiang et al. 2005, and others. The strong dependence of desert albedo on solar zenith angle is pointed out. Why is this not represented in your background albedo parameterisation? Can you give an estimation on the relevance and magnitude of potential effects on the LSM simulations by factors that are not directly represented in your parameterisation?

Minor Comments

p-1672, l-10: with differences "compared to" MODIS, instead of "with"

p-1676, l-1: "Land albedo", instead of "Albedo"; I assume, that you also consider albedo of fractional water surfaces in the LSM

p. 1686, l-24: the expression "soil wetness" stands not necessarily for a certain soil moisture concept in LSMs, in many cases, "soil wetness" and "soil moisture" are even used as synonyms;

p. 1699, fig. 1: in the first box with red line, some text is missing in the end

p. 1702, fig. 4 and p. 1703 fig. 5: the colour bar is not well chosen, it is not possible to distinguish between the first 2 yellow and green colours

p. 1707, fig. 9: the relevance of this comparison to FLUXNET observations is not clear

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