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Interactive Comment

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.

J. Kala et al.

Jatin.Kala.JK@gmail.com

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General Comments This paper raises the problem of implementing soil-moisture-albedo feedbacks in the CABLE land surface model (LSM). However, despite finding that importing a simple (two-line) parameterisation from another LSM significantly degrades model performance and "should be used with caution", no improvements are trialled. The paper in its current form does not represent a significant advance in land surface modelling, but could be made suitable for publication in GMD if an improvement on the parameterisation presented here could be proposed, implemented and tested.

We thank the reviewer for their comments. We have worked hard to improve the pa-

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rameterization and the differences between CABLE and MODIS and an alternative remotely sensed albedo dataset, SPOT, is now acceptable. Our original goal was substantially around documentation of model developments, it is clearly preferable to document model improvements and the reviewer's comments have helped us considerably in this direction.

Specific Comments

p.1677, l 11-17: What is the origin of the coefficients in Eq 1, and are they specific to the soil moisture parameterisation in BATS. If so, is it reasonable to transfer the scheme directly to CABLE without re-calibration?

Reply: Based on the BATS model documentation, these coefficients were chosen to represent the soil albedos range in a nonlinear manner between their saturated and dry values. Based on how this scheme was implemented within CLM, we adopted the same approach of calibrating the soil color maps, rather than the coefficients. We make this clearer in the discussion:

"Whilst we re-calibrated the soil colour maps, we have not re-calibrated the coefficients used in Eq. 1 as this formulation was designed such that the soil albedos range in a nonlinear manner between their saturated and dry values (Dickinson et al., 1993). Rather than altering the formulation, we choose to re-calibrate the soil colour maps"

p. 1683, l10. I notice the above issue is touched on here, and a suggestion made to use relative soil moisture instead of absolute soil moisture. A physical or empirical justification for this suggestion would be helpful.

Reply: We have removed this section from the manuscript.

Do results improve if the parameters in Eq 1 are re-calibrated using model-(CABLE)-specific relative or absolute soil moisture?

Reply: Yes, we have carried out a re-calibration of the soil color map and this has improved comparisons with MODIS and SPOT albedo. Please see the revised results

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and discussion.

p.1681, l6-10: “The CNTL experiment (with prescribed soil albedo), shows that CABLE simulates albedo well”: there is no mention of the significant overestimate of Blue-Sky NIR albedo (byâĹij0.1) over regions of high vegetation cover (eg Tasmania). This is a known problem for “two-stream” type radiation transfer models (of which the CABLE schme is a simplification). For example, Widlowski et al. (2011) found that both ACTS (Ni-Meister et al., 2010) and JRC2S (Pinty et al., 2006) (which both use a clumped two-stream approach) tend to underestimate canopy absorption and overestimate canopy reflectance when compared with a 3-D Monte Carlo reference model. This finding is consistent with Pinty et al. (2011) who state that, in order to correctly account for absorption due to multiple scattering in a structurally heterogeneous canopy, the near infrared (NIR) leaf scattering coefficient in JRC2S had to be lowered relative to its true value.

Reply: We have added this to the results section:

“We also note that that there is a consistent difference of 0.05 to 0.1 for the blue-sky NIR albedo in densely vegetated areas of Tasmania and the northern tropics. This has been documented elsewhere for other LSMs which use a similar two-stream radiation transfer scheme, as is used in CABLE. For example, Pinty et al (2011) report that the lowering of the NIR leaf scattering coefficient below it’s true value was required to correct the absorption due to multiple scattering a structurally heterogeneous canopy.”

p. 1680, l12-119: What is the relevance of energy partitioning to the accuracy of albedo simulation? If data from flux sites are to be used, it would be more helpful to look at the radiometric observations, rather than the observations of turbulent fluxes.

Reply: We have removed the comparison with flux site observations on the grounds that on reflection we agree with the reviewer’s implied criticism.

Interactive comment on Geosci. Model Dev. Discuss., 7, 1671, 2014.