

Interactive comment on “Biophysics and vegetation cover change: a process-based evaluation framework for confronting land surface models with satellite observations” by Gregory Duveiller et al.

Anonymous Referee #2

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The manuscript presented by Duveiller et al. intends to evaluate the representation of the effect of various land-cover transitions on several components of the Surface Energy Balance in land surface models (LSMs). For this purpose, they developed a framework to be able to conduct a meaningful and consistent comparison between a remote sensing-based dataset and LSM simulations. Then they applied this framework to four different land surface models in a consistent way. This allowed them to identify some important limitations of the LSMs under scrutiny in their current representation of the impact of land-cover transitions on the Surface Energy Balance, which they

C1

illustrate by a few examples.

The manuscript is very well-written and the methodology employed by the authors is sound and well-described. Moreover, the effort undertaken by the authors is very important given the accumulating evidence that the biogeophysical impacts of land-cover changes play a crucial role for local climate conditions, but that there is a troubling lack of agreement between LSMs when it comes to represent them.

In my opinion, the associated data set fulfils the criteria of uniqueness, completeness and usefulness required by ESSD. I therefore recommend acceptance of the manuscript for publication if my comments listed below are addressed.

My most important comment is that the manuscript would benefit from detailing the limitations that are intrinsically linked to the employed RS dataset. Especially, the identification of the impact of land-cover transitions on LE are based on the MODIS evapotranspiration (ET) dataset. Michel et al. (2016) have compared the performance of four ET datasets – including MODIS – against flux-tower data, and identified substantial limitations of MODIS. In a parallel effort to evaluate these datasets against independent ones (such as river discharge data), Miralles et al. (2016) showed that MODIS was performing worst across most ecosystems and climate regimes. This points at uncertainties on the LE (and therefore H+G) data from the RS dataset, which have been appropriately mentioned by its authors (Duveiller et al., 2018, Nature Communications). However this manuscript offers the opportunity to repeat these while specifically addressing to the community of land surface modellers. They should therefore be mentioned in the discussion here as well.

The reanalysis data used to force the LSMs are subject to considerable errors and uncertainties, especially over data-poor regions. These errors can eventually significantly impact the components of the Surface Energy Balance simulated by LSMs, for example LE. LUMIP activities (Lawrence et al., 2016) for example plans to investigate the repercussions of these for the biogeophysical effects of land-cover transitions. This

C2

therefore constitutes a limitation of the methodology employed by Duveiller et al., which I recommend to mention in their manuscript.

In the introduction, the authors mention that “a vegetation cover transition from forest to grassland typically causes [...] a decrease in summer evapotranspiration (because grasses typically have shallower roots and thus cannot access water in deeper soil horizons”. A lower aerodynamic conductance is another possible explanation for this behaviour (see e.g. Bonan, 2008).

From reading the Methods and especially Table 1 it seems to me that the Grasses and Crops simulations are the same in JSBACH and ORCHIDEE. Could the authors please confirm in the text if this is the case, or clarify their descriptions in the opposite case?

Section 2.1, line 29, “consist”. Please check the grammar

Section 2.4, line 15. Consider replacing “remains numerically” by “remains numerically unchanged”?

Section 3, line 29, “it is a good example of how this is a process-based evaluation”. Please reformulate

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C3

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C4