Geoscientific
Model Development
Discussions

Interactive comment on "Closing the Energy Balance using a Canopy Heat Capacity – A physically based Approach for the Land Component JSBACHv3.11" *by* Marvin Heidkamp et al.

Anonymous Referee #3

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General Comment

The manuscript describes the application of the land component JSBACH of the MPI-ESM model on a short time scale as the diurnal cycle closing the energy balance for shallow vegetation within a soil layer of a finite heat capacity. Additionally, a new approach for the model in which the energy balance is closed within an infinitesimal thin surface soil layer is performed. Both approaches are compared with observations of net radiation, turbulent heat fluxes and ground heat flux obtained by eddy-covariance measurements during the CASES-99 experiment. Unfortunately, the ground heat flux

derived from the measurements is questionable (see Specific Comments below). The improvements of the new approach are stressed. Its impacts on the results of a global coupled land-atmosphere evaluation on a longer time scale are investigated in comparison to a run with the former approach. For this investigation the canopy heat capacity for regions with high vegetation is considered in JSBACH in a new scheme called SkIn+. The manuscript is well written and organized. The description of the models and of the changes made is understandable. The results are well discussed and the conclusions are comprehensible. The paper contributes to better represent weather and climate with models. Thus, I recommend the manuscript for publication in Geoscientific Model Development. However, I have some comments and questions to be answered before acceptance.

Specific Comments

P3, line 1-3: To my opinion, the question in bold letters relates to the reference model only and doesn't include the SkIn scheme. Or, is the SkIn scheme deemed to be correct?

P4, line 13: The term "offline experiment" first appears in the Introduction (line 32). Thus, the definition should already be given there.

P4, line 15: Up to which depth reaches the multi-layer vertical grid?

P6, Eq. (6): please define, whether the relative humidity within or above the canopy is meant.

P6, Eq. (6): Inserting Eq. (6) into Eq. (4) would lead to a time dependence of qsat which is more realistic than a simple dependence on Tsfc because qsat can also vary at constant temperature. Eq. (4) should be modified in this context.

P9, Fig.2 and P10, line 3,4: In contrast to DICE, in eddy-covariance experiments the ground heat flux is usually measured. Nevertheless, eddy-covariance generally doesn't close the energy balance. To close the balance, the missed energy (frequently exceed-

ing 200 W m-2) is usually partitioned to the sensible and the latent heat flux according to the Bowen ratio. The full allocation of the residuum to the ground heat flux G leads to an overestimation of G which will be considerable for large residua. In turn, the green plots in Fig. 2 represent the sum of G and the residuum at daytime and G at nighttime when the residuum is close to zero. Please, comment this issue.

Technical Corrections

P7, Fig. 1: The yellow color is hardly visible. I suggest the authors should use another color for the incoming sw radiation.

C3