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Hydrology and Earth System Sciences
Discussions

Interactive comment on "The effect of chalk representation in land surface modelling" *by* M. Rahman and R. Rosolem

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We would like to thank the reviewer (Dr Andrew Ireson) for his detailed comments and suggestions. Here we initially address the three main issues highlighted by the reviewer:

1. Emphasis on the simplicity of proposed Bulk Conductivity parameterization

The reviewer has mentioned that one of the potential strengths of our work is the simplicity of the Bulk Conductivity (BC) model which could aid large scale modelling applications. We thank the reviewer for this comment as this is very encouraging for us. We will make sure to better emphasize this important aspect in our revised manuscript.

2. More in-depth analysis of the BC model

We thank the reviewer for pointing out additional suggestions for analysing the BC model in depth. We will carry out sensitivity analysis and calibration of key parameters while also expanding our analysis to evaluate changes in soil moisture and potential recharge. However, we would like to emphasize that our main focus is to demonstrate the soil moisture – evapotranspiration interactions from a land surface modelling perspective, when explicitly representing the soil-chalk layering system within the catchment in JULES (as a first step of a more comprehensive analysis of hydrological processes in the region). Hence, we focus on analysing actual soil moisture magnitudes in the current manuscript.

3. Absence of river runoff plots

We believe that a detailed analysis of river flows is beyond the scope of our work as we mainly focus on the surface water and energy partitioning as represented by the interaction between soil moisture and evapotranspiration after explicitly representing soil-chalk layers in the model (as noted earlier). This is because JULES prescribes a free drainage bottom boundary condition without representing groundwater dynamics, and does not consider topography. These are common assumptions often made in traditional land surface models (such as JULES) which can substantially affect the routing of runoff to the river network. In our studied catchment, groundwater plays an important role on hydrology. Hence, we focus on the annual water balance that corroborates the fact that the overall magnitude of the hydrological fluxes simulated in the catchment is consistent with observations.

Once again, we would like to express our sincere gratitude to the reviewer for the careful and detailed review, which will be very valuable in adding to the quality of the revised manuscript.

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