Hydrology and Earth System Sciences Discussions

Hydrol. Earth Syst. Sci. Discuss., author comment AC1
https://doi.org/10.5194/hess-2020-672-AC1, 2021

Comment on hess-2020-672

Tobias Sebastian Finn et al.

Author comment on "Ensemble-based data assimilation of atmospheric boundary layer observations improves the soil moisture analysis in idealized limited-area experiments" by Tobias Sebastian Finn et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2020-672-AC1, 2021

We appreciate the review by referee #1 and are grateful for his useful insights into why the text currently appears illogical and difficult to understand. Here, we briefly respond to the major issues raised and we will provide a detailed response along with a revised manuscript later on.

We agree with the concerns raised with respect to comprehensibility and we have decided to improve the language, the technical details provided and revise completely the structure of the paper as follows:

We will reduce the use of jargon and provide explanations, e.g. for terms like "flow-dependency" in the context of data assimilation and "nature run" in the context of twin experiments

We will provide a new introduction section in which we outline the physical coupling between the land surface and the boundary layer and why boundary layer observations might be beneficial for the estimation of land surface states in data assimilation. We will elaborate more on the separated NWP data assimilation cycles for the atmosphere and land surface, as well as the concept of twin experiments with synthetic observations. We will additionally address our scientific questions that are answered in our study.

Furthermore, we will re-arrange the material in the current sections 2 and 3 into the following new sections with additional details:
Section 2 - Twin experiment case
Section 3 - Data assimilation methods
Section 4 - Experiments

Section 2 will be about the twin experiment case including a description of the model and the data used in the paper, what the nature run is and how synthetic observations are generated from this nature run. We will also talk about the general meteorological conditions in our simulated time period.

Section 3 will describe the used data assimilation methods and how we apply them together with observation operators. We will provide technical details and equations in a new appendix.

Section 4 will outline our experiments and related to this, details about the variables in the state vector, and we will additionally show how our ensemble is generated and constructed.

We believe that these changes will address the specific comments made by referee #1 and improve the readability of the paper significantly.