Hydrology and Earth System Sciences Discussions

Hydrol. Earth Syst. Sci. Discuss., referee comment RC3
https://doi.org/10.5194/hess-2020-672-RC3, 2021
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Comment on hess-2020-672

Anonymous Referee #2

Referee 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-RC3, 2021

I recommend major revision of the manuscript before accepting it for publication.

The study assimilates synthetic 2-metre temperature observations into soil moisture in a fully-coupled limited-area model system for a seven-day period in Summer 2015. The study investigated many assimilations schemes and compared it against each other and also against the Nature run. The outcome of the study is interesting and explains certain land-atmosphere coupling aspects that are already known. The data assimilation experiments are detailed and explained. However, there are various weakness in the synthetic setup of the model and the assumptions made in the models initial conditions are unphysical, moreover the phenomenon of land-atmosphere interaction cannot be explained with a 7-days experiment window.

Major comments:

- Setting up different scenarios with wet, moderate, and dry soil profile conditions for major hydroclimatic regions of the world is critical to highlight the importance and

applicability of the work. With the current setup as described in Section 3.2 is totally unphysical. See the comment given in the manuscript.

- The 7-days timeframe of the synthetic experiment is inadequate. To capture the whole gamut of the physical processes of land-atmosphere interactions a longer time window is critical that may cover different seasons. Otherwise synthetic experiments for different seasons are recommended with a longer timeframe.
- Another suggestion is to validate the outcome the study with a real scenario in a hindcast experiment. As the authors using an operation system. This approach will validate the outcome of the data assimilation experiment and capability for future operational implementation with the incremental improvement in the analysis of the 10m air temperature.

I have recommendation to make the manuscript more relevant and easy to read and understand. Cut some flabs and curtail Section 4.

More remarks are provided in the manuscript as comments.

Please also note the supplement to this comment:
https://hess.copernicus.org/preprints/hess-2020-672/hess-2020-672-RC3-supplement.pdf