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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Joint assimilation of soil moisture retrieved from multiple passive microwave frequencies increases robustness and quality of soil moisture state estimation" *by* A. I. Gevaert et al.

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The manuscript provides useful insight into the added value of various combinations of soil moisture retrievals from different passive microwave frequencies by assimilating them individually and jointly into a hydrological model and comparing the results with in situ measurements. The manuscript is very well written, using clear language and properly justifying the use of the various methods used throughout the study. The method is sound and the discussion is thorough. Good work!

I have a few questions and minor suggestions to further improve the manuscript.

My first question concerns the inflation factor. This inflation factor (let's call it gamma) was applied increase the ensemble spread to avoid having a disproportionate ratio of model and observation errors, which would lead to observations having no impact on the model analysis. From my understanding of the text (p.7, l.15-16), the actual value of this inflation factor is not specified, but is chosen in such a manner as to avoid the model error (for both top layer and root zone?) from ever falling below 2%. Is this correct? In this case, what is the value of gamma?

My second question relates to variables boundaries. The inflation factor works well for unbounded variables, but problems may arise when an ensemble member approaches a boundary. Ensuring physical realism (e.g. by adjusting negative values to zero) may introduce a bias. How are boundaries handled for modelled variables?

On a similar note, how do you perturb the observations? The errors attributed to the C-band retrievals is said to be 0.24 in AWRA-L wetness units and 0.18 for the other retrievals (p.16, l.29-30). I am assuming these are standard deviations? Either way, in the original EnKF procedure, the observations are perturbed to reach these errors. What type of distribution is used and how are observation boundaries handled? Using a Gaussian distribution on a bounded variable leads to values falling outside the boundaries. Also, observation values of 0% or 100% cannot be perturbed without introducing a bias. If this is the case, I believe a discussion on the matter would be beneficial.

As for suggestions, the first concerns the title, which I believe is misleading. The manuscript showed there was little added value to the joint assimilation schemes compared with assimilating individual bands. While the possibility of added value was mentioned where individual soil moisture retrievals are more informative in different locations

I would also recommend mentioning the ensemble Kalman filter somewhere in the abstract as it is an important part of the method and would facilitate the search for

relevant information for readers.

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