

Interactive comment on “Spatial horizontal correlation characteristics in the land data assimilation of soil moisture and surface temperature” by X. Han et al.

Y. Liu (Editor)

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In general, I agree with all the comments from the two anonymous reviewers and would encourage the authors to address them carefully in the revised version. I have some additional comments (as described below) that also need to be adequately addressed before this manuscript can be accepted for publication in HESS.

Major Comments:

The entire experiment design could be improved and simplified. Since the purpose is to investigate the value of incorporating spatial correlation in LETKF for estimating soil
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moisture/temperature for both covered and uncovered grid cells, one could simply compare the open-loop CLM ensembles to the results from LETKF for the entire domain with different levels of observation selection. In this case, using only one observation for those cells with ‘direct’ observations is equivalent to the common assimilation strategy of ignoring spatial correlation. The current design involving strategy-1,-2, and 3 seems to be a bit confusing and unnecessarily complicated.

I would also suggest that the authors make a distinction between grid cells that are covered with observations and those that are not when calculating the statistics. Currently all grid cells are lumped together, making it difficult to understand the net benefit from using spatial correlation in the assimilation procedure for either covered or uncovered grid cells. One would expect that incorporating spatial correlation can have a larger impact on the estimation for uncovered cells than for covered cells; this however needs to be tested / confirmed by making a distinction between the two types of cells as described above.

When discussing the improvement from data assimilation, only mentioning the relative percentage improvement in RMSE and NSE without referring to the absolute values of these metrics is not that meaningful, as the first reviewer also pointed out.

The study uses a cloud mask from Feb. 2008 that has an observational coverage of 72%, while in some cases the observation coverage could be way below 72%. Hence other cases with different degrees of observational coverage (e.g., 50%, 25%) should also be investigated to determine the minimal level of coverage necessary for the spatial correlation assimilation approach to have a meaningful impact.

How the model parameters for the four statistical models were determined, and what dataset the fitting was based on need to be clarified in the manuscript.

Minor comments:

P18, L379: for the calculation of RMSE, the number of grid cells N should also be

included. P19, L402-404: Please rephrase this sentence by discussing RMSE and NSE separately for clarity and easier comprehension. Figure 6, caption: do you mean “the ensemble mean of soil moisture” here? Figure 6(a) is not mentioned in the text.

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