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Discussions

Interactive comment on "SMOS brightness temperature assimilation into the Community Land Model" *by* Dominik Rains et al.

Anonymous Referee #1

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Title: SMOS brightness temperature assimilation into the Community Land Model

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Major Comments

This paper presents a data assimilation (DA) study where the SMOS brightness temperature is assimilated into the CLM model, forced with ERA-Interim surface meteorological fields, over the Australia area. The CMEM model is taken as the observation operator to simulate the 42.5^o incidence angle brightness temperature in H polarization and the LETKF algorithm from the DasPy package is used to perform the filter update.

The model ensemble is generated by perturbing both model parameters and forcing inputs. Three sets of DA experiments are carried out (DA1, DA2, DA0) with different numbers of soil layers included in the filter update and different ways to perturb the soil parameters. The filter updates are performed over brightness temperature anomalies (with seasonal cycle removed), which is different from most other studies. CDF matching is performed on the anomalies. Validations are carried out against ISMN in-situ observations. The results and analysis are focused on the soil moisture increments during the filter update and low soil moisture quantiles (10

This is a very carefully designed and carried out data assimilation study with its main novelty in assimilating brightness temperature anomalies. The investigation and results are significant and the quality of both the research and its presentation is very good – I see no major issues with the choices of the processing methods along the entire chain of DA procedures. The DA improvement, as measured by soil moisture skills (against ISMN), is reported as moderate, which is consistent with similar studies.

The discussions are relatively weak, especially on the effects of DA at different temporal scales. Draper and Reichle, 2015 decomposes the soil moisture time series into dynamics at different time scales (long-term, seasonal, and short-term) for the analysis. It is not exactly clear how (and why) the anomaly assimilation (which has the seasonal signals removed) changes the way the DA behaves at seasonal to longer time scales. Some time series plots and related analysis are needed to help on this. Also, the study area is very large and heterogeneous in terms of soil and vegetation – should there be any stratification on the analysis of the results, e.g., statistics over different types of soil/vegetation?

I think the paper can be published in HESS with minor revisions.

Details:

Page 9, line 6-7: the unites for observation errors are confusing – should they all be K^2 if they are all variances? Or they should all be in K if they are the standard deviation?

My guess is that they are all in K because $4^2 + 3^2 = 5^2$.

Figures 2, 4, 6, 7, 8: Maps here contain both negative and positive values and the sign of the data also matters. So it'll be much easier for the readers if a particular color (e.g. white) is used for the 0 values and two different sets of color shades (e.g. one set of warm shades and one set of cool shades) are used for positive and negative values.

Figures 6, 7, 8: What is [%/100]? Should it be just [%]? Change "0.1 quantile" to "10% quantile".

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