Review of Li et al., HESSD

This is a useful paper dealing with an issue, namely (as I understand it), correction of biases of analysed soil moisture fields, which is of interest to the land data assimilation community. The paper should eventually be published in HESS, but before this the authors need to address a number of general and specific points. These general points are: (i) clarify statements; (ii) quantify statements; and (iii) rewrite the last section (I suggest you split it into two sections, a discussion proper and a conclusions section), which is too long and does not allow the message from this work to come through. The authors should also address the following specific and technical/style points.

Specific points:

P. 8132, L. 6: I think this statement is incorrect. Assimilation of the retrievals may correct the model bias in the sense that the analyses are less biased than the model, but the model bias due to model deficiencies remains (although by improving the analysed initial state, the bias in the model forecast may be reduced). Please reword. Along these lines, the title may need to be addressed, as (to me) it implies that you are improving the bias of the model fields, but not of the analysed fields. Furthermore, my reading of what the "Control" run is suggests that you are not testing whether the model forecast is improved by use of a better initial state.

P. 8132, L. 12: Please define what you mean by the "actual value". You should also do this when this term is first introduced in the main manuscript.

P. 8135, L. 7-8: As indicated in the general comments, Sect. 5 should be split into a discussion proper section, and a shorter conclusions section, where the main message from this paper, plus further work to be done, is conveyed.

P. 8136, L. 15: Draper et al. (2009) only assimilate descending AMSR-E data, as the nighttime soil moisture retrievals are more accurate. Is it worthwhile assimilating the ascending data? Would it be sufficient for your goals just to assimilate the descending data?

P. 8136, L. 23: Could you quantify the "some bias"?

P. 8139, L. 25: I would think that this procedure incurs an error of representativeness. Do you include this in the observational error? Even if not included in the observational error, I think it would be helpful to at least mention/discuss this error and provide an estimate.

P. 8142, L. 25: Based on my understanding of what you are trying to do in this paper, I would suggest rephrasing this by stating that the objective is to reduce and correct analysis bias, and as a result improve the mean of the analysed fields (see also comment for P. 8132, L. 6). As indicated above, the data assimilation procedure does not correct the model bias (the model deficiency remains), but corrects the impact of the model bias on the soil moisture estimated fields (analyses and/or forecasts).

P. 8144, L. 3: Quantify the reduction in the overestimation.

P. 8144, L. 18: Quantify by how much the soil moisture is lowered. If appropriate, refer to Table 3.

P. 8145, L. 5+: Do you need both Figs. 3 and 4? They seem to provide similar information.

P. 8145, L. 21: Quantify the underestimation by “Control”.

P. 8148, L. 16+: Quantify the comparison, which you describe as “compare reasonably well”.

P. 8149, L. 18: To help the reader, please indicate that the water budget should be equal to the precipitation.

P. 8149, L. 25: What do you mean by “loss water budget”?

P. 8150, Discussion: I suggest Sect. 5 be split up into a discussion proper section and a conclusions section. To help the reader, I also suggest that acronyms used in the conclusions section be introduced again.

P. 8152, L. 8: The model evolution is included in 4D-Var. Could you please clarify your statement about model physics and the variational method?

P. 8160, Table 2: Remind the readers what the variables are. Indicate if the perturbation is multiplicative/additive and whether it is a percentage or an absolute amount.

P. 8161, Table 3: I suggest you identify in bold the lowest values of the bias and rmse corresponding to the model experiments (with/without data assimilation).

P. 8163, Fig. 2: I suggest you identify in the caption the line styles.

P. 8164, Fig. 3 (and similar figures): I suggest you identify in the caption the depth of the soil layers, the soil moisture units (e.g. m^3/m^3) and the line styles/colours.

P. 8169, Fig. 8 (also for Fig. 9): I suggest you identify in the caption which is the top and the bottom figure.

Technical/style points:

P. 8133, L. 12: “interests” -> “interest”.

P. 8133, L. 28: “challenge” -> “challenging”.

P. 8136, L. 2: “publically” -> “publicly”.

P. 8144, L. 4: “even” -> “uniform”.

P. 8145, L. 24: I suggest you use “The deficiencies of the free…”.

P. 8146, L. 4 and 16: Avoid the anthropomorphisms “elects” and “struggled”.

P. 8148, L. 1: “rainfalls” -> “rainfall”.

P. 8148, L. 28: I suggest you replace “probably” by “likely”.