Thank you for your reviews and detailed comments which should help improving the quality of this paper. The following are our responses to your suggestions and questions.

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.

>We understand your view about using 'model bias' in L. 6. A phrase such as "analyzed fields" may sound stranger to people not in the field of data assimilation. So we will change 'model bias' in L. 6 to 'bias in estimated soil moisture fields'. The title can be changed to "Improving estimated soil moisture fields through assimilation of AMSR-E soil moisture retrievals with an ensemble Kalman filter and a mass conservation constraint".

>The 'Control' run represents the baseline performance of the model without any data assimilation. We did not test if the 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.

>The "actual value" means the soil moisture value as it is provided by the AMSR-E data set without scaling or any other pre-processing. We will add this explanation in the revision.

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.

>We agree. The Discussion section is too long and will be split into two sections.

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?

>We did not notice any significant degradation in the quality of the ascending AMSR-E data in our study area. As to whether assimilating descending data is enough, it may depend on precipitation patterns since the reemergence of bias at the surface layer is largely associated with precipitation as shown in the study. A future study over different climate conditions should be able to answer such question with certainty.

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

>We cannot quantify it since we do not know how much it is. But your point is well taken. We will just say 'bias' instead of '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.

> We do not think this procedure should incur an additional error. The partitioning can be looked at as downscaling in which the first moment is always maintained across different scales (Crow and Wood, 2002).

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).

> We will rephrase this to "improve the mean of estimated soil moisture".

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

> This line describes the graph. But we will make the quantification in L. 21 when Table 3 is mentioned.

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

> We will do that.

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

> Both are needed. Figure 3 illustrates how each assimilation method impacts Noah soil layer. Figure 4 shows how the assimilation results compare with in situ soil moisture at different depths and is also needed to show the deficiency of model physics that failed to capture the increasing soil wetness as depth increases.

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

> The "underestimation" used here just states the fact that 'Control' underestimated soil moisture in the low profile. The exact quantity of underestimation does not matter.

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

> We purposely avoided calculating bias and RMSE for the stream flow because of the nature in which the modeled stream flow was derived. But we will use more quantitatively descriptive phrasing to describe the graph.

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

> The text will be changed to emphasize this point.

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

> This will be restated as "loss of the water budget given by precipitation".

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.

> We will take your suggestions.

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?

We will remove the reference to 4D-Var in this sentence.

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.

The reminder and clarification will be inserted into the text.

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).

Good suggestion. The table will be updated.

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

The line styles have been clearly identified in the legend and so we do not believe they need to be repeated in the caption.

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.

We will add the unit to soil moisture in the caption. The layer depths have been given in the text and so no need to be repeated. The line styles and colors have been clearly identified in the legend.

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

The text will be updated to reflect this suggestion.

Technical/style points:

We accept all your following corrections and suggestions.

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".