**Hydrology and
Earth System
Sciences**

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Discussions

Interactive comment on "Integrating ASCAT surface soil moisture and GEOV1 leaf area index into the SURFEX modelling platform: a land data assimilation application over France" *by* A. L. Barbu et al.

Anonymous Referee #1

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The paper discussed the impact of joint assimilation of RS SSM (from ASCAT) and LAI (from GEOV1) into the ISBA-A-gs LSM within the SURFEX modelling platform. The significant improvement can be seen on reducing the delay in the LAI seasonal cycle produced by the model, after assimilating LAI and SSM. The data assimilation reduces the duration of the crop phenological cycle that tends to be too long in the model. For soil moisture results, the impact of data assimilation is not significant (e.g. 1%). The topic discussed in this paper shows its potential to be published in HESS. I would like to recommend a major revision for the current manuscript before being accepted.

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Interactive Discussion

Discussion Paper

Major Comments: 1. The author emphasized several places about the advantage of joint assimilation of RS SSM and LAI, and even highlighted that these two observation data are somehow conflicting. However, in the manuscript, there is no discussion on the difference between the assimilation results calculated by jointly assimilating both observations and the results calculated by assimilating only one of these two observation. To convince readers on this point, such kind of comparison is needed;

2. The determination of the weighting factor is not discussed in details. It is understood that the cover fraction occupied by each patch is adopted as the weighting factor. However, the correctness of such method is not clarified. The paper used one observation per grid box for a number of land covers inside this grid box. In terms of soil moisture observation, the response of soil moisture in the bare soil, the crop and the grass to the wetting-drying cycle is expected to be different. Such kind of response in the bare soil is expected to be quicker than the other two land covers. The differences in such responses from different land covers should be considered into the weighting factor as well. Although it is understandable that bigger cover fraction will contribute more to the analysis, there is a necessity in explaining the effect of soil moisture response on the determination of the weighting factor, in a way, to verify the exclusion of such consideration.

3. The state vector for the analysis consists of two prognostic variables, root-zone soil moisture (WG2) and LAI, corresponding to two observations SSMsat and LAIsat. The SSMsat represents the first 5cm soil moisture content, while the WG2 represents the soil moisture at rooting depths depending on the vegetation type, with a maximum thickness of 2.5m. Does it mean that the assimilation of SSMsat refers to the simply replacement of the SSM in the ISBA-A-gs LSM with the SSMsat? If this is the case, please specify clearly in the manuscript. Does it mean the SSM is not a prognostic variable in the ISBA-A-gs LSM in this study?

Minor Comments: 1. Line 2-7, Page 9074, can the author detailed the issue related to this part of description?

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2. Figure 4. There is no detailed discussion on Figure 4.

3. Line29 Page 9077 - line 3 Page 9078, where are the results to support this statement?

4. Figure 2. It would be illuminating to include the original ASCAT data before rescaling in this figure.

5. Figure 6. The results for soil moisture should be shown.

6. Figure 7. The results for soil moisture should be shown.

7. Figure 8. The results for soil moisture should be shown.

8. Figure 11. The results for soil moisture should be shown.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 9057, 2013.