

## ***Interactive comment on “Monitoring of water and carbon fluxes using a land data assimilation system: a case study for southwestern France” by C. Albergel et al.***

**Anonymous Referee #2**

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Review of: “Monitoring of water and carbon fluxes using a land data assimilation system: a case study for southwestern France”; C. Albergel et al.

General comments: The assimilation of SSM and LAI at the SMOSREX experimental site using the ISBA model to improve the accuracy of water and carbon fluxes is presented in this study. The aims of the study as well as international contributions on this topic are described very detailed. Data sources, methods and models which are used for the investigations are described in a proper way. The authors tested several settings to determine the best combination of data to be assimilated with the SEKF method. These findings are presented, showing the promising improvement especially

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when using a combination of SSM and LAI assimilation. Nevertheless it is not quite clear if these findings are only valid for the SMOSREX site for which the model and the data sets have been trained or if the findings are applicable and valid for other regions too. I recommend this paper for publication, taking into account some minor revisions (see below).

Scientific Significance: good Scientific Quality: good Presentation Quality: good

Specific comments: P1708, L14+: Information about the three model configurations are mentioned at this point, at P1709, L6+ and P1710, L13+. Maybe this can be combined to one passage about configurations, also explaining the motivation why the authors are testing a case without precipitation data, but no cases with leaving out other data sources.

P1709, L20: What is the domain for the model? Is it only one grid point located at the SMOSREX measurement site or is the model run for a larger domain?

P1710, L13+: The control simulations are run without data assimilation?

P1711, L9: Is the ECOCLIMAP value of 1.82 used during the model run or is it overruled already at the beginning? What is the impact of arbitrarily changing the soil depth?

P1712, Eq(1): What is the index 0 at  $h(x_0)$ ? What is  $t$ ?

P1712, L15: Which temperature is used as threshold?

P1713, L15+: What is the impact if changing the value for  $T$  and can this value be used for other regions of the world too?

P1714, L22+: Did the authors also use SSM data from satellites for assimilation/verification and if so, how well is the agreement to ground measurements?

P1717, L1+: With a low background error, there will be no seasonal cycle in  $w_2$ ?

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P1717, L6+: Is the optimisation of Bw2 valid only for the SMOSREX site or also for other regions?

P1717, L11+: I think this should be a separate chapter, maybe called verification as there is mentioned nothing more about error setting. Is the LAI used both for assimilation and verification during the tests?

P1721, L3+: Does this mean that precipitation values were set equal to zero or that no precipitation information was provided at all?

P1723, L10+: For a low correlation of TB-derived SSM and in-situ SSM, the authors found a degradation of the results for w2. I am missing some conclusions about the impact of this result for further investigations (e.g. when taking into account satellite measurements which probably won't be correlated to the in situ measurements that well too).

P1726: There should be an outlook providing some examples what this model can be used for due to the knowledge gained by the investigations presented.

Table4: What does "standard and increased input error parameters" mean?

Fig1: Did the authors investigate these time series in detail, e.g. are there annual trends or climatological significant events (e.g. drought in summer 2003) which might explain the differences in the statistical measures from year to year?

Fig2: For this experiment, only screen level parameters are assimilated, but no SSM or LAI?

Fig3: Why do the authors use a third order polynom to fit the data and not a polynom of higher order which might better fit the data set? For which time period this matching has been done?

Fig5: What happened in June to explain this large value for the Jacobians? Are there observations for w2 and LAI available for this time? If so, please include them in the

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plot for comparison reasons.

Fig6: What do the authors mean by "model error multiplied by 4"? Is it the background error Bw2, which was increased from 0.02 to 0.06? If in the open loop run no SSM is assimilated, there is no precipitation forcing and the value for w2 is zero (from middle of 2003), how can the model create SSM-values higher than zero?

Technical comments:

Typing errors: Page1719, Line4 "or" instead of "and" P1719, L19 -1.84 P1719, L20 3.25 (text) or 3.53 (table 3)? P1720, L3/4 word order? P1720, L19 word order? P1727, L18 bi dimensional variationnal P1729, L5 heat and carbon fluxes P1729, L34 AMSR-E P1730, L1 this article is not mentioned in the text P1730, L14 Quintana-Segui P1730, L18 this article is not mentioned in the text P1731, L19 Blöschl Table2: different experiments Table4: Nash-Sutcliffe criterion (N) Fig.4 black curve on the middle graph (w2) Fig.7: for the data assimilation.

Figures: Fig4: The black dots for assimilation can be hardly distinguished.

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