

Interactive comment on “The Influence of Assimilating Leaf Area Index in a Land Surface Model on Global Water Fluxes and Storages” by Xinxuan Zhang et al.

Anonymous Referee #2

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General comments:

Synthetic observations are used to assess the impact of assimilating satellite-derived LAI estimates into the Noah land surface model. A major shortcoming of the assimilation system used in this study is that LAI assimilation has no direct impact on soil moisture. As a result, dry precipitation biases cannot be compensated for. This issue was at least partly solved in other assimilation systems. Unfortunately, the relevant literature is not completely cited. This paper is not well written, not complete for understanding, and cannot be published in the present form. Methods description is incomplete. Interpretation of results is made in the Result section instead of the Discussion

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section.

Recommendation: major revision.

Particular comments:

- L. 39-4: Examples of joint assimilation of LAI and soil moisture in a land surface model can be found in the literature.
- L. 95-97: In the same context and at the continental scale, Albergel et al. showed that sequential LAI assimilation can be used to analyse soil moisture at various depth, in addition to vegetation biomass (<https://doi.org/10.5194/gmd-10-3889-2017>). This property is particularly useful in dry conditions, when surface soil moisture tends to be decoupled from deeper soil layers.
- L. 109 (Section 2): A section describing the DA method is needed. What are the analysed variables? Does LAI DA impacts soil moisture?
- L. 138: How are subsurface waters represented? Do you represent inundations plains? Lakes?
- L. 188 (ensemble members): How is this ensemble generated?
- L. 196-197: Why are these instabilities generated by DA?
- L. 203 (Eq. 1): Why do you use NCRMSE and not standard score metrics such as RMSE or ubRMSE (i.e. standard deviation of differences)?
- L. 217 (Figure 3): Please change evaporation units. Since these time series are daily, should be per day instead of per second. It seems that CWS anomalies are 3 order of magnitude larger than ET anomalies. Why? Define here what you mean by "anomaly" (not defined in the text). NR anomalies: with respect to what? Is NR the benchmark or not? Real values have to be showed at some stage. Not only anomalies.
- L. 243 ("thus the NCRMSA . . . becomes smaller"): Why?

- L. 276-277 (LAI assimilation unable to correct for dry precipitation bias): Why?
- L. 320-322: I don't see the logics. I would expect that large water-holding capacity would enhance the impact of LAI DA.
- L. 323 (forests and woodlands): Is this because of large rooting depth?
- L. 331: Water-holding? Do you mean interception reservoir or soil reservoir?
- L. 374-375: This could be because the used DA system is not able to analysed RZSM from LAI observations. Please explain.

Editorial comments:

- L. 251 (Figure 4): Color scale is difficult to interpret. Please use several colors (e.g. blue in addition to red).
- L. 289 (Figure 5): Time axis labels are not readable. Please improve!
- L. 291 (Figure 6): Time axis labels are not readable. Please improve!

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