Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2019-504-RC1, 2019

Hydrology and Earth System Sciences
Discussions

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 #1

Received and published: 11 November 2019

article amsmath setspace

General comments

The authors aim to assess to what extent the Noah-MP model can be optimized through the assimilation of leaf area index (LAI) observations at global scale. By utilizing two observing system simulation experiments (OSSEs) and the EnKF algorithm, the efficiency of assimilating LAI and model performance for water related variables are discussed.

At first in my opinion this manuscript needs to be proofread/revised carefully for academic writing.

Something that I do not understand is that the authors use the simulated LAI from the nature run as the 'truth' instead of observations. If nature run can achieve the "truth", why did the authors conduct assimilation based on different conditions (wet or dry)?

Other important comment is that why did the authors use the precipitation which are extremely biased instead of using a more precise precipitation forcing. Furthermore, did the authors run the assimilation experiment using the MERRA-2 precipitation instead of halving or doubling the value?

In conclusion, the manuscript in its current form suffers from several issues that prevent it to be published as is. In my opinion the paper still worth to be published after addressing all these issues, and a major revision is asked.

Specific comments

1. P3L56-57: As far as I know, LSMs not only couple with dynamic vegetation models, but also involve some dynamic vegetation modules. So the statement is not appropriate.
2. Section 2.2: Why do you use the precipitation forcing data which are strongly biased.
3. Why did you choose the LAI simulations from the nature run as the "truth" instead of using the LAI observations? As you have described the reasons from P9L171 to L172, there are many other LAI products without missing data which can be used for assimilation.
4. Did you evaluate the LAI or other variables from the natural run by using remote sensing LAI datasets or other kinds of observations?
5. P9L178-P9L184: How did you determine the values of multiplicative perturbations (such as, the shortwave radiation and precipitation with a mean of 1 and standard deviations of 0.3 and 0.5, the standard deviation for longwave radiation of 50 W/m2, the standard deviation for LAI of 0.1)?

6. Have the evaluation and error metrics been used in former studies? If so, please list at least one references.
7. How did you determine the initial conditions?
8. The discussion section should include the discussion of the results in the context of other papers dealing with the same of similar subjects.
9. A more in-depth analysis of the results is necessary. In this paper the authors only talk about the statistical characteristic variables (such as the NCRMSE, NIC, etc) of LAI and water related variables. Why not focus on the LAI and water related variables themselves?
10. Why only perturb the meteorological forcing and not the initial conditions and/or model parameters?
11. How sensitive is LAI with respect to the meteorological forcing?

Technical corrections

1. P2L27-L28: Can you illustrate which land surface model you use here? And the same to P2L38, P5L104, and so on.
2. P2L28-L29: Remove "the" from the phrase of "at the global scale", and the same to P5L100, P5L100, P22L361, and so on.
3. P3L44: Do not need to leave two blank spaces here.
4. P3L46: It's not appropriate to use "between" among vegetation, precipitation, and soil moisture.
5. P3L51: The related references cited here are not enough to illustrate the phenomenon that "these land surface processes and feedbacks have been examined through numerical modeling experiments". List more. . .

6. P3L54: You needn't capitalizes the first letter for leaf area index.
7. P4L67: "the Moderate Resolution Imaging Spectroradiometer" has been abbreviated to "MODIS" before.
8. P4L88-P5L90: Please refine this sentence.
9. P5L95: Change "model simulated LAI" to "simulated LAI".
10. P5L97: Please refine the statement of "focused on small regions".
11. P5L106-L107: Please define the abbreviation of all the water related variables when they first appear in this manuscript. Furthermore, "evapotranspiration" has been abbreviated to "ET" in P5L93.
12. P5L110: Please specify which land surface model.
13. P6L116-120: Please refine this sentence as it is too long.
14. P6L121: Please define "NASA".
15. P6L126: Keep the tense consistent.
16. P6L133-P7L138: Please define the abbreviation of all the water related variables when they first appear in this manuscript.
17. P7L150: I am not sure whether the state of "a LAI EnKF" is appropriate.
18. P7L153: The phase of "on a global scale" is not appropriate.
19. P10L188-L189: Keep the tense consistent.
20. P10L194-L195: The water related variables have been defined before, and you can use their acronyms.
21. P10L203: What does i and N in Equation 1 mean?

22. P10L208: the word “O” in the denominator looks like “zero” in Equation 2.

23. P11L209: There are two periods.

24. P12L220-L222: As Figure 3 shows the GLOBAL averaged LAI anomalies, it is better to use the statement of month (or JJA and SON seasons) instead of winter/summer season.

25. P12L229: Please refine this sentence.

26. P12L241: Remove “the”. Furthermore, this sentence is a little too long in my opinion.

27. P14L263: Please change the “has higher chance” into “is more likely to”.

28. P14L268-269: I think this is the first appearance that positively biased is wet condition (or negatively biased is dry condition), or maybe earlier, and this statement does not need to be repeated each time it appears in this paper (see P14L277, P16L296-L297, P21L337, P21L339).

29. P15L282-L287: It is better to use the statement of month instead of season.

30. Please add the description for the Y-coordinate for Figure 7, 8 and 9.

31. P21L357: Please specify which land surface model.