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Geoscientific Model Development Discussions

Interactive comment on "Representation of disturbance in the Joint UK Land Environment Simulator Vn4.8 (JULES)" *by* Chantelle Burton et al.

Anonymous Referee #1

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In this work the authors attempted to evaluate the representation of the land-use change and fire as separate disturbances on the simulated vegetation covers in a land surface model (i.e., JULES). The structure of the paper is loose while the context and figure quality may need an improvement. Some issues with respect to the method descriptions is not accurate and sounds vague. The clarification of these issues is critical to understand results presented in this study. I recommend the major revision of the paper before the possible acceptance of GMD by addressing my following comments.

Major comments:

1. The section 2 reads like a literature review on the interaction between fire and

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Discussion paper

LULCC and is suggested to be included in the Introduction.

2. In the abstract and the context of the paper, the authors used a lot of “up to xx%”. I don’t think this quantification metric is sound because it stands for the maximum situation. Please use median or mean for the quantification.

3. In the paper, the authors used the HYDE data to represent the land-use change. However, the citation of this dataset is not accurate. Please include the original publication of this dataset to appreciate the efforts by the dataset developers. Also, please add the dataset version used in this work and longer description of this dataset. http://themasites.pbl.nl/tridion/en/themasites/hyde/publications/index-2.html

4. It is not clear to me that the unit of each variables in Eqns. (1)-(8) in the paper. Could you clarify the unit of each variable in the revision and make sure the the unit is consistent between the left-hand and right-hand of equations?

5. Page 6, lines 16-17, the authors calculated the litter due to land-use change from the previous time step. What is the time step of the model? Since the land-use change is yearly data, how do you incorporate the land-use change data in the model?

6. Page 7 line 4, the authors noted the model version of JULES as Vn4.9 but the model version in the title of the paper is Vn4.8. Please correct one of them to be consistent.

7. Page 7 Line 18, what does the TRENDY stand for?

8. The authors emphasized that they made an attempt to improve JULES by including EXPLICIT representation of fires and land-use change. Also they mention “Previously in JULES, fire disturbance has not been represented as a separate process, but included in a generic large-scale disturbance term as a spatially-constant turnover rate” (in Page 2, lines12-14). According to Eqns., the fire disturbance in this work is PFT dependent. My question is: What is the difference in the impact of fire disturbances on vegetation covers between the explicit PFT-dependent treatment of fire (implemented in this work) and the previous simple treatment with constant disturbance from fires? If

you run a new simulation S4, the difference between S4 and SF2 should be able to tell you if there is any improvement of this explicit treatment of fire or not compared with the previous treatment of constant disturbance. Does this explicit treatment of fire disturbance improve vegetation representations through all vegetation types or just within specific vegetation types?

9. According to Table SI-4, the burned area and seasonal phase simulated in this work does not have so much difference between S2F and S3F. By visual comparison, I did not see much difference in burned area between S2F and that present in in Figure 2 of Mangeon et al. (2016). You may state this with respect to burned area in the context according to Table SI-4 and Figure 2.

10. In Figure 5, what does uncertainty bar stand for? Does that relate the spatial uncertainty? Please clarify.

11. According to the figure given in the last column of Table 3 (i.e., improvement from control), I figured, for instance for S3, the improvement (%) = |S3-S2|/S3x100 (i.e., |0.6-0.78|/0.6=0.3). Should the percentage improvement be |S3-S2|/S2x100 since S2 is the control simulation? Please clarify this metric in the method section. Also, please calculate statistical significance regarding to this improvement?

12. The color bar of Figure 3 partially appears. Please fix it.

13. The font size of figure labels is not consistent (comparing Fig. 4 vs Fig. 5). Please fix it.

References: Mangeon, S., Voulgarakis, A., Gilham, R., Harper, A., Sitch, S., and Folberth, G.: INFERNO: a fire and emissions scheme for the UK Met Office's Unified Model, Geosci. Model Dev., 9, 2685-2700, https://doi.org/10.5194/gmd-9-2685-2016, 2016.

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