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Geoscientific Model Development Discussions

Interactive comment on "Modeling long-term fire impact on ecosystem characteristics and surface energy using a process-based vegetation-fire model SSiB4/TRIFFID-Fire v1.0" *by* Huilin Huang et al.

Anonymous Referee #1

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The paper describes the adaptation of the Li et al. (2012, 2013, and 2017) fire modelling to SSiB4/TRIFFID and assessed its impact on terrestrial characteristics, carbon flux, and surface energy simulations. Although the paper itself is well written and organized, it lacks novelty in both model development and evaluation. The fire modelling is simply an adaptation of the Li et al. scheme without providing advances in model development. One may see this fire model as an inferior version of the original Li et al. fire modelling scheme implemented to CLM, because SSiB4/TRIFFID does not simulate peat soil and associated fire emissions unlike CLM. It is a pity that although the

short-temporal simulation of SSiB4/TRIFFID-Fire could have led to a better seasonal pattern of fire emissions, the paper failed to elaborate the impact. For the further development of fire modelling, the authors should ask themselves critical equations: what are the lessons learned from the FireMIP, which parts of the Li et al. scheme are still uncertain and can be improved, etc.?

The second half of the paper, the evaluation of SSiB4/TRIFFID-Fire and impact on ecosystem characteristics, is kind of repetitive of what has already been done. Li et al. and subsequent papers have already evaluated their fire modelling scheme with respect to the GFED data, and the long-term decline of the fire emissions has already been demonstrated by other studies (e.g., Arora and Menton, 2018 Nat. Commun.). From the title and Introduction, I expected that the key results would be presented in regard to the impact of fire on vegetation distribution, but the analysis was short of the level to be useful to the community. Reduction of tree cover fractions, LAI, and vegetation height, and the corresponding increase of grass cover fractions (Fig. 10) are an obvious consequence of fire occurrence, aren't they? So are the results of surface energy (Fig. 11).

I don't question authors' efforts on the SSiB4/TRIFFID-Fire development and model performance. However, to be novel among many existing studies, this paper needs to provide more rigorous analyses, such as comparison with the aerosol index from remote sensing, CO emissions from MOPIT (Yin et al., 2015 ESSD), or recent CO inversion (Zheng et al., 2019 ESSD).

In sum, this paper in current form serves very well as a SSiB4/TRIFFID model report, but not as a scientific paper. I strongly recommend to include original features either/both in model developments or/and evaluation methods.

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