Geoscientific
Model
Development
Discussions

Interactive comment on "SPITFIRE-2: an improved fire module for Dynamic Global Vegetation Models" *by* M. Pfeiffer and J. O. Kaplan

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Works on developing global fire scheme are suitable for publication in this journal, and are important to quantify and understand the fire-climate-ecosystem interactions on a global scale. The manuscript "SPITFIRE-2: an improved fire module for Dynamic Global Vegetation Models" proposed by M. Pfeiffer and J. O. Kaplan describes a modified version of SPITFIRE. In the SPITFIRE-2, many new equations, assumptions, and parameters are introduced into the original SPITFIRE that has been a complex process-based fire model. However, majority of the modifications has not been justified. In addition, as a global fire model, its global performance (at least the burned area) must be evaluated against the commonly used benchmarks (e.g. MODIS or GFED3 fire products) like another modified version of SPITFIRE (Prentice et al. 2011, GBC). The global evaluation of SPITFIRE-2 will be helpful for other global fire modelers and also make their and other user's reconstructions, mechanism analyses, or projections

credible.

Specific comments are as follows, which I hope will help improve the ms.

(1)Abstract, "With its unique properties of being able to simulate preindustrial fire...". Why the authors think that other global fire models can not simulate preindustrial fire?

(2) In introduction section,

Para 6-10 is clearly a part of the introduction in Li et al. (2012, Biogeosciences) with a few modifications. Please cite the paper. Also, many of the modifications are incorrect, and the authors should read their references more carefully. E.g.,

P2352, L4-15, most simple type of fire models do not include all of the "three key processes". E.g. modeling fire as "time-invariant loss rate" is impossible to include "fire occurrence" and "fire spread" processes.

P2352, L21, please cite "Arora (2003, Agr. Forest. Meteorol) after CTEM.

P2352, L22, please change "CLM4-CND" to "CLM4-CNDV"

P2353, L15-18, if no reference can justify the statements, please remove them.

P2354, L24-27, SPITFIRE is not "the only one that is potentially able to both represent human-vegetation-fire dynamics...trace gas and aerosol emissions...", Li et al. (2012) can do this too.

(3)In Section 2,

P2355, L20, the first reason for improving SPITFIRE, "(1) burned too much in some parts of the world and not enough in others" is inaccurate. So far, no global fire model is perfect. It should be addressed more accurately (i.e., where), and it will be better if simulations in Sect. 4 can show the improvement in these regions.

P2356, L16-17, about a(ND) in SPITFIRE. In SPITFIRE, a(ND) is a global constant, human ignition is a function of population density. Why the authors think that SPITFIRE

is "difficult to apply to describe anthropogenic burning in the past"?

(4)Section 3,

Please provide references, experiment data, or field and satellite observations to justify Eqs (2), (3), (5), (12), (13), (20), (21), (22), (28), (30), and related parameters and assumptions.

Units and meanings of terms in Eqs (6)-(10) are inconsistent, please revise them.

Sect. 3.1.3, please provide how to separate human populations into three groups based on their subsistence lifestyle: hunter-gatherers, pastoralists, and farmers?

P2369, L16, SPITFIRE allowed fires to burn no more than 241min rather than one day,please revise it.

P2370, L7-16, How does the increase of maximum crown area and maximum sapling establishment rate influence other regions?

P2378, L13-14, please quantify "too many trees being killed".

(5)Section 4,

Lack simulation results to show the advantage of human ignition described in 3.1.3.

Global performance (at least burned area) of the fire scheme need be evaluated against GFED3 or MODIS fire product. Comparing with the global performance of original SPITFIRE is also helpful.

It's better to shorten the evaluation of fire simulations in Alaska.

(6) In section 6,

P2399, L24-25,Without the evaluations of its global fire simulations, how the authors conclude "The updated fire model SPITFIRE-2 is a major improvement on past global fire models and will be particularly useful for studying changes in global fire on millennial timescales"?