

## ***Interactive comment on “The influence of vegetation, fire spread and fire behaviour on biomass burning and trace gas emissions: results from a process-based model” by K. Thonicke et al.***

**Anonymous Referee #1**

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I am very pleased to review this manuscript. Ecosystem disturbance is of major importance to ecosystem structure and function and is one of the major elements missing in the current generation of Earth System models. This paper provides an advanced mechanistic fire model suitable for rapid incorporation into global climate models. I appreciate the past data scarcity to both parameterize and evaluate such models, and I am pleased the authors have attempted an evaluation from multiple new sources including those from Earth Observation. Although this is primarily a model description paper there is sufficient model application and use of data sources to warrant publication in a journal such as BG, rather than a specialized software-oriented journal. Indeed the topic and its presentation would appeal to both large-scale ecosystem mod-

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elers and field scientists alike. I would recommend publication with minor revision. I am not entirely happy with the approach the authors have taken to present SPITFIRE. Although it represents a major advance, it is not an entirely new model, rather it represents an important development on previous fire models within LPJ. In particular there seems commonality in the approach and formulations as adopted by Reg-Firm (Venevsky et al.), e.g. the adoption of the Nesterov Index, Rothermel fire spread, and approach to model natural and human ignition sources. I would like to see an extra table (similar to that in Cramer et al., 2001) listing the key process representations (e.g. fire spread, fire ignition, mortality) adopted by the three LPJ fire models. This way the reader can clearly identify the novel advances and new and modified functionality (e.g. prognostic mortality, trace-gas calculation, human ignition) introduced into this latest generation fire model. I would like to see more discussion and analysis as to why the model (i) overestimates the fire season length in most biomes and (ii) underestimates fires during the extreme fire years in the boreal forest. The latter seems particularly important as the infrequent, large stand replacing fires plays a major role in the ecology of boreal forests. Minor comments: I would like to see all parameters listed in the tables, e.g. I can not see value(s) for the moisture of extinction. Also Uforward is not defined when it is first mentioned. What is the difference between tau(l) and tfire ?

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