

## ***Interactive comment on “Upscaling methane emission hotspots in boreal peatlands” by F. Cresto Aleina et al.***

**Anonymous Referee #1**

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The work by Aleina and co-authors addresses the scientific question: How can models better account for peatland micro-topography in large scale methane emission models? The question is scientifically relevant, and could be of interest for the readers of GMDD and GMD. Results are based on the application of HH model by Aleina et al. (2015). The model was run in Microtopography configuration (small scale description of hydrological flux heterogeneity), Single Bucket configuration (average and fluxes), and the new Hotspot configuration. The Hotspot configuration seems to provide a good estimate of large methane emission and saves computational time. It is not clear to me if the Hotspot configuration also implies significant changes of the physical processes accounted for in the Microtopography configuration of HH model. The authors should address clearly if there is any difference between the flux definitions in the three configuration. Below, find a list of detailed comments that could better clarify what are my

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major concerns.

1) The new Hotspot model configuration somewhere is referred as parameterization, somewhere as new numerical approach. This is a bit confusing maybe the author could choose the best definition of what they did.

2) Equations (1) and (2): how is the lateral flux estimated in the two cases? Does the spatial distribution of the Hotspots have an influence on the soil moisture flux and thus, indirectly on soil saturation and methane emission? Equation (2): if there is only one bucket, what is lateral flux R? Eventually, they could provide a schematic representation of the three configurations within Figure 1. Are there hummocks and hollows in the Single Bucket configuration? How is the spatial distribution of Hotspots in the Hotspot configuration?

3) Equations (4) and (7):  $q$  is used for fraction of saturated surface and for methane emission. Change symbols to avoid confusion.

4) Figure 3: The Hotspot configuration mimic the Microtopography when methane emission is very high, and the Single Bucket when the Hotspot are not active (if I understood correctly, at low methane emission), underestimating the methane flux, apparently. Could you comment on that?

5) Equation (6): is the methane flux from the HH model in the Single Bucket version estimated by averaging over the whole model domain or over the unsaturated part of the domain only? Please specify and comment on that.

6) Section 3.1, second line: specify what are the three surface classes.

7) Finally, a few comments on the ecological relevance of the results presented in the manuscript under discussion as well as a discussion on the reason why we need such accurate estimation of methane emission could be added. Would similar literature models predict the same results?

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