Interactive comment on "Modeling forest evapotranspiration and water balance at stand and catchment scales: a spatial approach" *by* Samuli Launiainen et al.

Anonymous Referee #1

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General comments

The paper introduces a model for "upscaling evaporation and other hydrological processes from grid cell to a catchment level". The manuscript is well written, well-structured, and comprehensive, including parameter sensitivity analyses and evaluation against different sites and hydrological flows.

The motivation for the study is stated in the introduction as: (1) "to improve evaporation description by more physiologically-based approach", and (2) to take full advantage of open spatial data. In relation to this, the only substantial revisions I would like to propose is to (1) compare the simulation results from the "physiologically-based approach"

with an "empirical and simple approach" and (2) compare the simulation results from a model run that makes use of the detailed GIS data and one that does not. I think such analyses would help the reader better relate the results to the motivations stated, and better understand the added-value of the presented "improved approach".

Specific comments

Symbols: Please consult the HESS manuscript guidelines Symbols and equations. E.g., (b) "Multi-letter variables should be avoided. Instead use single-letter variables with subscript (e.g. E_{RMS} instead of RMSE. . . "

Terminology: Please consider using evaporation for total evaporation, instead of evapotranspiration (Savenije, 2004).

Names of sites: Please consider using a naming system that is easier to remember and relate to for the reader. E.g., FIHy-Pine instead of just FIHy.

Figures: Please consider adding letters (and sometimes subtitles) to subplots for easier identification. Please add legend to the figures and not only explain in caption (e.g., Fig 7).

Title: Please consider adding "boreal" to the title to be more precise, i.e., "Modeling boreal forest. . .."

P2L8-L19:

Please consider providing a more balanced review of the different types of models that recognize more merits and disadvantages of the different model types. The reference (Reed et al., 2004) cited, for example found lumped models to have a "better overall performance than distributed models" and (Winsemius et al., 2006). It would also be worth adding a coupled of sentenced on the models that integrate combine lumped features with distributed physically based ones (Gao et al., 2013; Khakbaz et al., 2012), particularly since the study itself presents a semi-distributed solution. The statement at P2L13 "problematic for ungauged catchments" also leaves the impression

that lumped approaches are not relevant for ungauged basins, while for example (Hrachowitz et al., 2013; Hundecha et al., 2008; Winsemius et al., 2009) do not dismiss their relevance in such contexts. (Hrachowitz et al., 2013) for example states: "During the PUB Decade, an increasing understanding of the importance of openness towards different approaches, and the willingness to communicate and search for opportunities developed."

Please also note that distributed models can have conceptual components, and are not always necessarily "physically-based" (as implied by the sentence formulation at P2L10).

Please also consider placing the models used in the study in context with other model types reviewed in the introduction.

P2L33 "Penman-Monteith equation": Please consider citing the original reference (Monteith, 1965).

P3L9 "to derive a model": I am not sure I understand the word choice "derive" here, do you simply mean "used in"?

P5L16: Please explain the threshold parameter and refer to where its values can be found.

P5L18 Eq 7: Please consider adding reference to the equation. Is it (van Genuchten, 1980)?

P5L20: Please write out the equation (?). In general, please consider referring to Table 3, each first time the parameters listed are mentioned.

P10L24: Please consider putting Fig S1 in the main manuscript.

P1213: Please consider referring back to the methods section.

P16L12-13: Please note that methods for determining root zone storage capacity using satellite based information has been developed e.g., (Gao et al., 2014; Wang-

Erlandsson et al., 2016).

P.19L1- : Please consider discussing a bit more in detail in what way the model is advantageous for the applications listed.

P31 Caption: How many days are included/excluded? How much of the mean annual evaporation is taken into account when considering only the dry canopy conditions?

P34 Fig 7: Please spell out IQR. Should the right axis of subplot b be blue? Please add units.

P33Fig 6: Please consider including a measure of the runoff performance? And present the measure for all catchments?

Fig 35: Pleas state the catchment name considered.

P38: Please provide justification, explanation or reference for of all values selected.

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Discussion paper

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