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Interactive comment on "Seasonally frozen soil modifies patterns of boreal peatland wildfire vulnerability" *by* Simon J. Dixon et al.

Anonymous Referee #3

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The paper is a modelling study to investigate moisture dynamics during the thawing period in the northern peatland. The scientific question of the paper is pressing for cold region hydrology and relevant for the HESS. However the methods used in the paper are not appropriate to get results and make conclusions suitable for publication in HESS.

The model and model setup have several important limitations:

1) The model doesn't account for heat transfer in the soil profile but it is used for investigation of frozen layer influence on water transfer.

2) Frozen layer is assumed to be impermeable and permanent in time at the same depth for several weeks that is not a case in natural conditions where thawing/freezing

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front is constantly moving

3) Model outputs are not compared with any observed soil water content data to evaluate the model performance

4) The model does not take into account changing weather conditions at the peat surface like air temperature, air moisture and rain

5) Fixed daily evaporation rate of 4.5 mm/day looks unrealistic

6) Initial conditions are set in arbitrary way. The soil just after the snowmelt is not necessarily thawed and fully saturated. It could be frozen with different degree of saturation depending on autumn weather conditions

7) Statement “all these assumptions (no thaw, evaporation rate, hritA and initial conditions) are within 1-2 mm/day, and are constant between scenarios” (lines 481-482) looks unfounded in terms of quantitative assessment.

The chosen simulation design does not reflect dominant natural processes that govern soil moisture and water table dynamics: heat transfer and water phase change within the profile, variable in time air temperature, air moisture and precipitation and moving thawing/freezing front. It is not validated with observations and thus could not be used as a ground for drawing conclusions about water behavior in real peat profile under natural conditions.

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