Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2017-678-RC1, 2018

Hydrology and Earth System Sciences
Discussions

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

Anonymous Referee #1

Received and published: 7 February 2018

As well articulated in the short comment on the manuscript by S. Carey, this paper is not suitable for publication in its present form.

First, the paper does address a relevant scientific question and is within the scope of HESS. The issue of frost in controlling soil moisture content in boreal landscapes (and the potential influence on fire) is an interesting topic. However, the model used (the well-established and regarded Hydrus 2D) simply isn't the tool for the job. The authors gloss over much of the details regarding model setup, ignore reality by presenting unrealistic boundary conditions, and then deliver bold and over-reaching statements as to the impacts.

Hydrus has been used to simulate permafrost and frozen ground before, but the literature has advanced well beyond this. Works by Evans, Ge, McKenzie, Kurylyk and

others all clearly show the advances and importance of appropriately simulating heat and mass in frozen ground (with or without permafrost). The simple geometry utilized to represent frozen ground along with the 'static' nature of frost (in an unrealistic climate boundary), the addition of water at some point somewhere, etc., simply provides model outputs that have no grounding in physical reality. It would have been much more informative if an appropriate model was compared with field data in a number of different scenarios. This would then allow simulations and 'gaming' regarding the role of ice. Clearly the descent and decline of the ice lenses is what is important here. Regarding the water conserving/productive peats, this concept is not well realized and I'm unsure of the authors rationale for its setup in the model is. Is this based on actual field data?

The conclusions of the model are speculative and not valid at this point. I suggest the authors take a more guided and nuanced approach by coupling an appropriate model with the undoubted wealth of field data in this region. From this, hopefully real insight into the role of frost position, descent and geometry have on soil moisture in near-surface soils will be realized.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2017-678, 2018.