

Interactive comment on “Soil infiltration characteristics and pore distribution under freezing-thawing conditions” by Ruiqi Jiang et al.

Anonymous Referee #2

Received and published: 8 January 2021

The manuscript describes experiments of infiltration into frozen and thawed soils, and calculations of pore distributions and their changes with freezing. Laboratory experiments are carried out on three soil types and infiltration of a glycol solution. The results should be of interest for researcher interested in hydrology in areas that undergo seasonal freezing or have permafrost, and perhaps in particular modelers who intend to represent these processes. Especially the pore size distribution results seem novel. The manuscript is generally well-written but could need a checking of the language as some sentences are long and not easy to follow. I recommend major revisions and that the authors take another look at the language and structure so that the paper is easier to read after revision.

Major comments

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My main concern about the manuscript regards how the results can be related to infiltration of water in soil, as the solution used here has different properties from water (e.g. viscosity). Are the presented values of estimated hydraulic conductivity for the glycol solution or for water? It would be most helpful to present values for water, or perhaps permeability values rather than hydraulic conductivity values.

Clarification of the water content of samples is needed to understand how these freezing processes can be related to freezing of soil in field conditions. Is there water in the samples before the solution is added, and if so how much? Is it the water (which was already in the soil before addition of solution) that freezes in the soil pores or is it the added solution that partly freezes?

Clarifying the two points above would make the manuscript much more valuable for scientists looking to relate these laboratory experiments to field conditions.

Minor comments

L20-24: The sentence seems incomplete. L26: replace first comma with “and”
Throughout, insert space after semicolon when several references are listed within a parenthesis Table 1. What are the soil textures for meadow and chernozem soils?
L188-189: Remove subscript format from reference.

Methods: What was the initial water content of samples? Was water or the aqueous solution used for the experiments, or both? How much of the liquid was frozen?

Big difference in viscosity for water and the aqueous solution. So conductivity is for this solution and not for water – should be converted to water?

Figures 3 and 4 – are both needed? Don't they more or less show the same thing?

L45: Do you mean figures 3 and 4?

Figure 5 would benefit from a more detailed description and discussion in text. There is a lot of information in this figure and I cannot distinguish 12 separate lines in each plot.

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What is really unsaturated hydraulic conductivity and why is this included? Hydraulic conductivity should vary with saturation, but is there a fixed level of saturation and if so, what saturation level is this?

L273: What is meant by “stable frozen”? Is all water/liquid turned to ice at this temperature?

Fig 6: check Y axis title Fig 6: is there any uncertainty related to these estimates?

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2020-280>, 2020.

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