

## ***Interactive comment on “Three-phase numerical model for subsurface hydrology in permafrost-affected regions” by S. Karra et al.***

**Anonymous Referee #1**

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A premise: I'm not a geologist and have very little understanding of the scientific domain in question. Nevertheless, I've been collaborating in the past with various environmental science related groups helping them building scalable large scale computational solutions, so I have a certain experience in the computational aspects described in this paper.

For this, will only review the PFLOTRAN implementation and scalability description.

In particular, the paper seems to emphasize the scalability of the PFLOTRAN-based implementation to solve the balance equations of mass and energy for the water component; for this, I would recommend to expand more the part where the implementation is described as in the current version, no details are provided on why the proposed method scales. It is only because of the initial assumptions ? Is there an explanation

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why the scalability point is at 1k cores ? Was the potential limitation of the Newton-Krylov iterative process considered as a possible scalability reduce factor ?

There seems to be a discrepancy between what is stated in paragraph 2.4 (Solution methodology) and the caption in Figure 1: When considering 12 million degrees of freedom, the system scales seems to scale at 2k cores (at 4k cores does not really seems to bring any consistent advantage in respect of the considerable size of the system required).

Finally, a comparison with a more 'commodity' system would also help understand the possible impact of the proposed solution (not everybody can afford a Jaguar Cray XK6)

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Interactive comment on The Cryosphere Discuss., 8, 149, 2014.