The Cryosphere Discussions

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Comment on tc-2021-151

Anonymous Referee #1

Referee comment on "Drainage of an ice-dammed lake through a supraglacial stream: hydraulics and thermodynamics" by Christophe Ogier et al., The Cryosphere Discuss., https://doi.org/10.5194/tc-2021-151-RC1, 2021

Review of "Drainage of an ice-dammed lake through a supraglacial stream: hydraulics and thermodynamics" by Christophe Ogier et al.

General comments

This paper describes:

- a) stable drainage at low rates out of an ice-dammed lake through a supraglacial channel dug across the ice dam, thus successfully averting an outburst flood with high peak discharge. This is a valuable lesson of practical mitigation of a glacial hazard.
- b) the flow of the lake water through the artificial channel and presents a unique comprehensive data set of observations of the channel geometry, hydraulic potential, discharge, and temperature of the water which can be used to quantify hydraulic characteristics of the flow resistance (the Darcy-Weisbach friction factor) and the heat transfer at the ice/water interface (Nusselt number), i.e., the relation between ice melt and water temperature. The results suggest that both the factors describing friction and the heat transfer of water flow in ice channels may be variable, hence using constant values in hydraulics modelling studies could be inappropriate. This is valuable contribution. So far, the physics of heat transfer from flowing water to the surrounding ice has not been satisfactorily described in theory.

The paper is well written. I recommend publication as it is.

Specific comments:

I have only a few questions.

Am I right that the ice-dammed lake is located at the margin of the ablation zone of the Glacier de la Plaine Morte where 4--5 m thick winter snow was removed by snowcats and the ice channel then dug into solid ice (cut by an excavator)? Hence, the channel wall was made of solid ice impermeable to water.

Line 16. Has drainage through englacial conduits from an ice-dammed glacial lake been reported?

Line 19/23. Pre-existing veins rather than cracks?

Line 57. “Purely driven by physics” i. e. by physical processes or hydraulic processes.

Line 97. Does the constructed supraglacial channel connect the lake to an englacial moulin?

Line 239 0.5 m.