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Interactive comment on "Modelled subglacial floods and tunnel valleys control the lifecycle of transitory ice streams" *by* Thomas Lelandais et al.

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I appreciate this modeling attempt. I am not aware of any other work on modeling subglacial hydrology since G. Catania and C. Paola, 2001, Braiding under glass. Geology, 29(3), 259-262. I believe it is relevant and should be cited.

Models inform our intuition. They cannot prove anything but they can lead us to a better understanding of physical processes if we understand the limitations of the model set-up. I would like to see the model and its limitations more fully described. What about model is not like real world? What are the shortcomings? How could these shortcomings affect model results and deviate from real-world processes? I would offer these as an example:

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Discussion paper

-Your experiment represents a very coarse-textured bed when scaled to the ice sheet. To overcome issues of density that can help address problems with grain-size effects in small models, hollow glass spheres have been used.

-Your model has a very permeable bed unlike most ice sheets. Till would change the behavior of water beneath the ice and potentially alter ice stream and tunnel development.

-The style of water injection is convenient but not very realistic. Water is most likely accumulating over a large area of the bed. Water pocket development and migration is highly dependent on the way water was introduced.

I am not able to follow the descriptions of the physical set-up (for example, how water is being introduced) in the text and the figures and photos are very small. It appears I need to refer to the earlier paper. Can this be avoided by providing a bit more here and making images larger?

I would like to see a cleaner description of model observations and then have those discussed in a separate section. Currently model results and your interpretations are interwoven. Some of the events you describe/interpret seem out of logical order. For example:

-How would tunnel valleys influence the location of ice streaming if they only happen after streaming is already occurring? I would expect the ice stream to evolve prior to the tunnel valley formation.

-Are you sure ice streaming isn't when the bubble reaches margin, immediately prior to TV formation? Why would decreasing basal water pressure lead to streaming? Why would ice streams switch on precisely when water drains?

-How do ice streams migrate headward in this scenario?

As part of the discussion, I would like to read about what is seen in real world that is not well explained by this model. For example:

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Discussion paper

-I see field relationships that suggest this order of events: 1) ice streaming; 2) drainage through tunnel valleys; 3) stagnation of the ice margin. Stagnation, not acceleration follows tunnel discharge.

-I think the ice stream migration timescale is very different than the water drainage timescale. You refer to timescales in a vague way in the beginning of the paper. Can you say anything more about time scales with your model? The discharge through tunnels where I have mapped is very short-lived and episodic based on fan development. However ice-streaming redevelops again and again and is of much longer duration.

-It does not appear that tunnels of the S. Laurentide ever evolved to be efficient drainage systems in ice lobes of the S. Laurentide.

-Large glaciotectonic thrust masses at ice margins are located near tunnel valley fans and seem to represent the fast-flow stage immediately prior to tunnel drainage.

-I do not see field evidence of two scales of floods or two styles of fan formation. I suspect that the first one you observe is more a result of the unusual way you are building water pressure beneath your ice sheet (at a single point) and the very coarse grain size of your bed.

-We see ice stream locations and tunnel systems becoming fixed. Tunnels are reoccupied again and again as an ice sheet retreats. I'm not saying that ice streams don't migrate, just at a longer time scale.

And finally, a caution: be careful about references citing review papers or recent papers that are not the earliest work on a topic. See specific comments in the paper.

Please also note the supplement to this comment:
https://www.the-cryosphere-discuss.net/tc-2018-71/tc-2018-71-RC1-supplement.pdf

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