The paper uses a model of subglacial hydrology to investigate processes of lake filling and drainage beneath a synthetic ice stream that resembles the Recovery Glacier System. The conclusion is that the system is characterized by (i) water accumulation at the bed that results in intermittent channel formation and meltwater drainage that leads to lake filling; (ii) subsequent steepening of downstream hydraulic gradients that drive increasing efflux from the lakes, (iii) downstream channel formation that allows lake drainage, and (iv) eventual shutdown of the channels as water supply decreases due to drainage of the stored water volume. It is also argued that the system is characterized by slow-moving pressure waves.

I found the story quite interesting, but since it is based largely on model results with limited observational constraints, I was left wondering how well it compares with reality. Certainly it provides a mechanism to explain the lake filling/drainage events that are suggested by altimetric studies (which show rapid uplift/subsidence cycles in restricted locations). However, I felt that the presentation lacked the depth of insight and understanding displayed by some other work on Antarctic subglacial meltwater drainage (such as that by Tulaczyk, Christoffersen and Bougamont). I think this is because the authors never really identify a set of well-posed research questions that they address with the model, so the whole paper has the feel of a report on the results coming out of a black box, and it isn't at all clear how the study advances knowledge and/or understanding of the system. The paper left me feeling intrigued by the problem, but unconvinced that it will influence thinking about these systems very significantly. It might provoke work that will, but I think the authors could make a lot more of their results than they do if they were really clear about what are the issues they want to resolve through conducting and publishing the work.

Detailed comments (referenced to page and line number)

3.4-3.8: over a period….has been found…. over a period
3.9: Is this interconnection permanent or intermittent? If permanent – I assume the flux itself is time-varying. I think discussing this issue more fully here will help provide more compelling motivation for the paper.
3.15: "impact of subglacial lakes on hydrological development" – it could very well be that looking at this connection in reverse could be useful (i.e .the issue could be how hydrological evolution drives lake behaviour – rather than opposite). I think failure to look at the system in this way may be the biggest weakness of the paper (I recognize that feedbacks may be such that it is hard to figure out what the actual drivers for change and evolution are – but the paper just seems to sidestep the issue)
3.25: "assessing lake volume from altimetry is challenging" – I agree – it can suggest where lakes are, and surface height changes may suggest volume changes are underway, but quantifying this is really an inversion problem that has yet to be tackled. I agree with the final sentence of the paragraph but am not convinced that this paper really changes the situation
4.2: do you mean "drainage" in the generic sense here (i.e. water flow over the bed) or do you just mean "lake drainage" – important to be clear about this.
5.24: has been shown to have…(or maybe just "has up to 13…")

6.23: over a period of..
7.18-19: I assume you mean the modeled water pressure, not "the model" as stated
7.21-7.23: If you have low water pressures because the cavities do not fill with water, how are you sustaining the basal velocities at rates that keep the cavities open? Seems to be a feedback missing from the model somewhere.
8.24: in terms of either the magnitude of the water pressure or its persistence
10.9: I doubt the over-deepening itself forms and drains on these timescales. I assume you refer to the lake within it?
10.11: We also vary…
10.11: "When the rate is decreased." – the rate of what? Basal melt I assume?
10.12 The depth of the lake is also smaller.....
10.16: water levels fluctuate over a similar range
11.21: and it therefore takes more time to reach near-overburden….
11.24 conductivities within which the lake…
11 – Section 5 – the range of parameter values used in the sensitivity analysis seems quite limited. It would be useful to explain this – is it based on physical reasoning , or just a means of limiting the number of model runs required? Either way, how did you settle on this specific range?
12.5: "a lake does not grow" – this implies a lake that maintains a stable volume – is this what you mean, or are you actually discussing whether or not a lake will form at all?
12.8: Little is known about the spatial and temporal evolution of the subglacial meltwater drainage systems of Antarctica and their…
12.11: the system may be substantially…
12.12: What do you actually mean by "and to some extent. Greenlandic outlet glaciers" – that they are only to some extent more closely studied, or that the difference between Antarctic subglacial systems and Greenlandic systems may be less than the difference between Antarctic systems and mountain glacier systems? It seems pretty obvious that systems fed by supraglacial inputs that vary seasonally and diurnally and also have extreme input events will be significantly different from systems fed primarily by basal melt and subglacial storage release events.
12.13: features is that there is no water input… surface, so variability in water fluxes (and pressures?) does not occur on diurnal, weather-related, or seasonal timescales, but over years or even decades (BUT I think you need to discuss the sources of variability over these timescales – is it just drainage system instabilities?)
12.16: the phrase "basal hydrology develops" is tricky because you seem to be confounding the issues of time varying water fluxes with those of drainage network structure and channel morphology. I really think you need to be much more careful about this and think about each of these separate but connected issues clearly and distinctly – even if you do this solely in terms of what your model is simulating (which may or may not bear some resemblance to reality. I think the paper is struggling here simply because your thinking about the issues is not yet clear.
12.17: surprising there is no mention of basal friction here (including friction between entrained debris and bedrock), or of the heat generated by the water flow itself – these terms are minor in temperate systems so are typically ignored – I'm not sure we can make the same assumption here.
12.21: predicting the development of Antarctic subglacial drainage systems

12.19-12.22: Need to recognise that the best you can do is generate testable hypotheses – until it is possible to do in situ measurements in these systems, the models will remain untested and their results no more than hypotheses
12.24: are forced by seasonally varying and weather-related water inputs
12.25: Do you know for sure there are no seasonal forcings on these systems - from snow loading variations for instance (self-organised criticality…) , or non melt-related sources (e.g. Kulessa, B., Hubbard, B. & Brown, G. (2003). Earth tide forcing of glacier drainage. *Geophysical Research Letters* 30(1)). These may be minor in alpine/Greenland systems but could become very significant where the surface melt signals are missing.
13.2: water volume per unit area
13.4: the development of these hydrological systems will also be different
13.9: similar phenomenon
13.11: suggest that funneling
13.15: channels beneath the ice stream….therefore do not induce temporal…
13.18: channels is a key enabler of spatially propagating pressure waves
13.19: phenomenon that has ..
13.21: allow the waves to develop
13.22: realistic to assume a unidirectional relationship between hydraulic gradients and water fluxes. This whole sentence is pretty arm wavy and doesn't give the impression that the issues have been thought through clearly. I have a similar problem with the next sentence as well.
13.24: it is water pressure gradients that drive water flow, not the pressure per se
13.27: distributed system water thickness –but there seems to be an unstated assumption that the change in film thickness is directly/linearly related to the change in water pressure. Is this true?
14.2: might be identifiable at the surface.
14.4: do arise in constricted systems
14.7: for a period…
14.18: pressure for between …surge-type
14.21: do you mean transit, rather than transition?
14.23: such bulls-eye patterns have also been found on outlet glaciers in northern Ellesmere Island by Laurence Gray (published too)
14.24: period of 2 to 4.5 years…
14.26: "due to similar criteria" is a strange way to say this.
15.1-15.3: you seem to treat lake water volume and water pressure as synonymous here, but I don't think that is correct if the system is in contact with the ice and water outside the lake basin
15.15: can span two pressure waves
15.16: pressure wave forms to conduct
15.19" pressures from developing downstream
15.20: wave passes…sizes of channels….are crucial….demonstrate that
15.25: how can a lack of cycles be similar to a model of cycles?
15.29: drainage cycles
16.3: do you mean "linked to the passage of the wave"?
16.8: not that 2-D hydrological networks exist in reality!
16.11-16.12: rather than prevents it – but would this be geometry specific or general?
16.16: exist at pressures slightly below…
16.19: and at the top of the adverse slope is a key….
16.24: data have been (data = plural of datum)

16.26: where are these cycles seen?
16.28: and drainage demonstrated by the model..
17.1: and to extend the record…. (but why no reference to CryoSat2 as a source of altimetry data?)
17.3: forms in the overdeepening….basin to a depth of 150m
17.4: for attempts to calculate
17.7: water flux across a hydraulic equipotential surface
17.15: are important for..
17.19: rates inferred from altimetry.
17.20: meters are also consistent with rates…..over Recovery
17.22: The area of our lake is…
17.25: and has an area of 60 km^2
17.26: directly with observations from the Recovery system which consists of many lakes within a region of complex topography (bed, surface or both?) . Should cite a source of information about this system
17.28: increased in volume by…
18.1: flux (not flux rate)
18.2: yield lake growth…
18.4: Final sentence of para needs rewriting (clearly your results are not **located** between the 2 lakes and, even if they were, this would have no bearing in their quality)!
18.9-10: This sentence needs rewriting – I don't think channels move water..
18.12: negative in the region around the lake
18.14: I think this sentence needs some elaboration
18.17: I presume you mean measurements rather than calculations here? But you seem to be treating ice velocity and water pressure fluctuations as synonymous, which is not wise.
18.17: such high pressure…
18.23: attain large sizes – (though the actual sizes reported are not especially large, given the size of the system being studied)
18.25: The faster rate of shrinkage, relative to the rate of channel growth, is (BUT is it not really just a consequence of the non-linear form of the flow law of ice and the fact that water pressures drop very rapidly when a channel ceases to be full of water?)
19.1: as a pressure wave migrates through..
19.4: that can cause channel growth over many years
19.5: smaller, so water flux through these systems will be lower during the winter months.19.11-19.15: Para is really irrelevant unless you make a case that channels incised into bedrock influence the pattern of drainage development and pressure wave propagation in subsequent years
19.17: is highly simplified. For instance….rates, or variable
19.19-19.20: but you only gain insight into the real system if the model simplifications don't significantly change the physics
19.22-19.24: The justification presented here is really weak
19.24: Why can't you have linked cavity systems at the surface of a sediment substrate, especially if it contains large clasts?
20.1: tests to assess whether the pressure waves are …
20.4: obtain similar results as..

20.4: “errors” – don’t you mean differences – you have no idea what is reality so how can you refer to them as errors?
20.8-20.19: The question raised by this paragraph is how value are the insights derived from the study given its obvious limitations?
20.22: could allow downstream flow of water to occur….model, perhaps reducing the local…
20.23: Why is it unlikely?
21.3: through internal dynamics alone.
21.2-21.5: I would argue that the model results generate potentially testable hypotheses. As things stand we really have no idea whether we should believe them or not – so to argue they produce new insights seems like a stretch to me.
21.7: delete development – you aren’t simulating how the drainage network develops as far as I can tell
21.11: efficient drainage networks
21.13: delete “instead”
21.16: water pressure peak
21.18: can persist at such levels
21.20: over scales similar to those observed beneath Antarctic ice streams.
21.22: occurs only when
21.25: do these pressure waves result in hydraulic jacking at the bed?
22.3-22.5: Final sentence need rewriting