Response: We thank the reviewer for the comments and suggestions to further improve the manuscript. We have addressed all your points alongside your review.

This study examines the hydrology and subsequent freshwater discharge of the glaciers of Kongsfjord, Svalbard. Results of a previous modelling study (same first author) of surface melt and runoff are used as input for a simple and a more complicated routing model, and discharge hydrographs for each outlet are produced.
Overall I found the figures of this paper to be clear and well presented, and the explanations of the previously published methods utilized here to be well explained, but the explanations of the new science done here and the conclusions drawn require significant work before I could recommend this paper for publication. Although the hydrograph outputs are of interest to the field, it was not clear to me exactly what question the authors were trying to answer with this study.

Section 5.2 is the key area that is currently lacking in clarity. The choices of these parameter values determine the main output of the study, but I did not find clear justification for the choices made. Furthermore, the choice of why the HydroFlow model is used here seems unclear.

Response: We agree that the parameter choice of simple routing model is very simplistic in nature. To have a robust estimate of discharge, a detail understanding of subglacial hydrology is required with complex modelling and observational data. At present, there is not enough understanding about the subglacial hydrology of the glaciers of this region. Our aim was to simulate discharge at all the outlets of Kongsfjord basin, and with the absence of enough observational subglacial data, we applied a simple approach to give a coarse estimate of discharge. However, if these discharge data are used for daily time period, then we argue that the discharge will have less uncertainty considering that the area of the basin and associated delay from the farthest grid cell of the basin.

The runoff produced at the surface takes some time to reach the glacier front which is termed here as delay, and water storage, if any, is considered as negligible in comparison to discharge. Therefore, the sum of discharge and sum of runoff should be equal over a season, however, the discharge hydrograph with and without delay should be different. We agree that the delay depends on many factors, such as channel shape, bed property, etc., and these are unknown to us. Therefore, we used a single parameter box model to simulate discharge hydrograph. A further approach can try to parameterize the processes governing the delay with a higher-order model, however, that is beyond the scope of this study. Additionally, a higher-order model, such as GlaDS, has many numbers of parameters, which, in the absence of observation, would add further uncertainty.

Furthermore, we would like to mention that in a recent paper by Mankoff et al., 2020, a similar approach was taken to calculate subglacial drainage delineations of Greenland basins. In that study, discharge hydrographs are being simulated for all the outlet glaciers in Greenland, where the transition from runoff to discharge was considered instantaneous. In this paper we took a further measure to incorporate delay to runoff in a coarse way. We argue that with the paucity of observational data simple and conceptual routing model can serve the purpose of discharge calculation, and the robustness increases with smaller basin and with lower-temporal resolution.

Line by line comments:

Line 10: Is the fact that larger glaciers produce more runoff than smaller ones really a key finding to include in the abstract? Was this not known before the study? Or was it influenced by the water piracy?

Response: The water discharge is influenced by water piracy for the two big tidewater glaciers. However, it is not the finding of the study that larger glaciers produce more runoff, hence we would remove it from the abstract.

Line 18: Are there no supraglacial channels here?

Response: We have rewritten the statement as "Meltwater generated at the glacier surface reaches the glacier front after travelling through supraglacial channels, crevasses, moulins, and englacial and subglacial channels, emerging at or near the base of the tidewater glacier front to create buoyant plumes."

Line 42: Leeson et al 2012 for supraglacial routing (if appropriate here)

Response: We could not find this reference. It would be good for us if you kindly mention the link of the paper. If it is Clason et al., 2012 paper, we agree that it would be appropriate to include here.

Line 47: Capitalized "Water"

Response: We have corrected it.

Line 60: Is the Pramanik 2019 study relevant here?

Response: Here we tried to mention the interdisciplinary studies combined with glaciology. Therefore, we feel the reference is relevant here.

Line 63-4: The wording here is confusing. Is there sea ice now? Can you be more specific with exact dates the sea ice was not present.

Response: We will add that in the revised manuscript.

Line 94: You mention 2010-2016 but the work presented here mainly starts at 2013?

Response: Corrected it.

Line 98-100: (and similarly in the Appendix) Why was the resampled grid so low resolution? When you had such a high-resolution DEM did you not test your simulations with much higher surface resolutions? What was the justification for making the resampled grid so coarse?

Response: Yes, there is high-resolution surface DEM available, but the highest resolution of bed DEM is 150 m (Lindback et al., 2018). The spatial resolution of runoff is 250 m (Pramanik et al., 2018). Therefore, we used 150m, 250m and 100 m resolution DEMs for drainage delineations and 250 m resolution DEM for routing model.
Furthermore, sensitivity analysis with different DEMs do not show much change in subglacial drainage delineations.

Line 139: Can the grid cells that don't receive any flow still produce in-situ melt (that may then travel outside of the boundary)?

Response: Yes, the grid cells that do not receive any flow can produce in-situ melt, but they would follow the slope of the basin. First basin boundaries are demarcated from the DEMs. Therefore, the in-situ melt of edge grid cells must follow the slope of the basin.

Line 144: If the hydraulic potential is so sensitive to this why not try lower DEM resolutions?

Response: We have conducted the analysis with 100m, 150m, and 250m DEM resolutions. The highest resolution of bed DEM is 150 m, whereas the runoff resolution is 250 m. We resampled the runoff, surface DEM and bed DEM to different resolutions and conducted the analysis.

Line 146: Can you quantify the results of the Monte Carlo simulations here? The description in the appendix seems subjective.

Response: In the method section we mentioned that we have conducted Monte-Carlo simulations for subglacial drainage delineations. The Monte-Carlo simulation results are mentioned in the results section of the main article (L210-214) while a detailed discussion is provided in the appendix.

Line 152: What do you mean by "distance" here? The distance from production to discharge? Or between grid cells? I'm also a bit confused what you mean by water wave speed, is this the same as flow speed? At some points you just refer to "water speed" later on in the text, is this the same thing?

Response: Here 'distance' means the length of the stream for each grid cell to its corresponding outlet point. So, it is the distance from production to discharge.
Water wave speed is same as flow speed. We will now correct it throughout the text and use it as flow speed.

Line 159: What is the justification for a uniform speed? Will this not be significantly affected by channel size, presence of firn, etc?

Response: Yes, the flow speed is significantly affected by different things, which are difficult to quantify/measure to finally get a robust estimate as most of the subglacial parameters are unknown to us. Therefore, we took a simplistic approach by considering a uniform wave speed (Cowton et al., 2013, Slater et al., 2017). Thereby, we mention a simple or conceptual single parameter routing model. A further approach can try to parameterize the processes governing the delay with a higher-order model (such as GlaDS), however, that is beyond the scope of this study.
Furthermore, we have mentioned these shortcomings of the simple routing model in the discussion section.

Line 162: How did you determine that this speed was optimal? This seems quite key to not justify in more detail.

Response: In the absence of actual discharge measurement, we considered discharge and plume area as two different signals and tried to match them by varying the flow speed.
In the revised version, we will mention that finding an optimum wave speed is too much detail with this simple model. Therefore, we will present the discharge hydrograph as band with the prescribed flow speed range, a preliminary figure for Kronebreen is attached here (Fig. Res1).

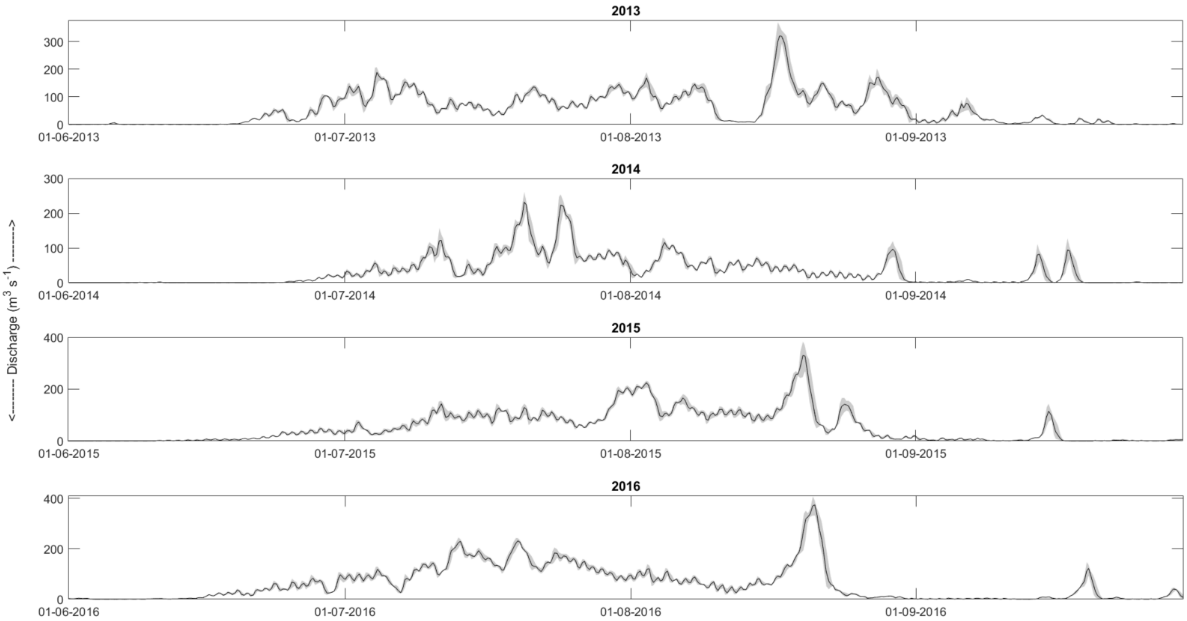

Fig. Res1. Discharge hydrograph for Kronebreen.

Line 173: Can you define the Nash-Sutcliffe coefficient and give a brief explanation of how it is used. This will likely be unfamiliar to many readers.

Response: We agree that Nash-Sutcliff coefficient term can be unfamiliar. We would provide brief explanation of it in the revised manuscript.

Line 191: What is the justification for the choice of using HydroFlow here? If subglacial hydrology is important was this model really the right choice if you're having to use similar calibrations to the simple model? It's unsurprising in this case that the results don't differ so much.

Response: Our primary aim was to use a conceptual model as well as a physically based model (HydroFlow) to derive discharge hydrograph. HydroFlow is not a fully physically based model for subglacial hydrology, but it works well for supraglacial hydrology. Therefore, we will use HydroFlow for the land-terminating glaciers only where supraglacial hydrology is dominant.

Line 227: "Visual inspection" doesn't suggest to me that this key choice has been made rigorously.

Response: We agree with the comments and therefore did not try to find an optimum wave speed. Instead, we presented our discharge hydrograph as a band.

Line 235-263: I don't follow your use of "therefore" here. I can't see justification for the choice of k=0.8.

Response: The subglacial water piracy is evident for a range of k values from 0.5 to 1, and for any of these k values the results will be same. Therefore, considered a median k value. "The hydraulic potential analysis shows a prevalence of water piracy from Isachsenfonna to Holtedahlfonna occurred for k values between 0.5 and 1, therefore, we use the hydraulic head for k = 0.8 (the average of the k value range) to derive water routing." (L234-236)

Line 250: The reader needs knowledge of NSC to understand these numbers- why do they show good agreement?

Response: We will provide brief information and importance of NSC (Nash-Sutcliff coefficient) in the revised manuscript.

Line 279: Can you elaborate on how the simulations and data support this, or we just have to take your word for it.

Response: We have done 10000 runs of Monte-Carlo simulations with randomly varying k values and calculated subglacial drainage delineations where we found water piracy from ISF to HDF in 94% cases. Here, by observational data, we mean the plume data at the two tidewater glaciers front (Fig. A6). The observational data and the simulation both support that there is a possibility of subglacial water piracy between ISF to HDF.

Line 282: How do the DEM resolutions compare between the studies?

Response: We used updated DEM of Lindback et al. 2018, where How et al, 2017 used an earlier version. We suspect that there lies the little discrepancy. However, the discrepancy between two findings is not substantial.

Line 317: Have you tried your simulations at a sub-hourly timescale? (If not, why not?)

Response: The simulation is done on 6-hourly timescale as the gridded runoff data from Pramanik et al., 2018 was simulated on 6-h timescale.

Line 324-326: Can you elaborate on exactly how your conclusions will affect this?

Response: As the tidewater glaciers contribute most of the water through different locations in the fjord, depending upon their appearance fjord circulation and ecosystem would evolve in space and time. For example, higher freshwater discharge from glaciers in the inner fjord would increase the possibility of sea ice formation which may affect the foraging of birds. Therefore, an accurate quantification of discharge through different outlets and their relative sizes are important.

Line 380: How was the choice of cut-off made?

Response: The choice of cut-off is elaborated in the following sentences. "We choose a cut-off frequency to filter out low frequency components and compare the high frequency of plume with the high frequency of discharge data. We did not find good correlation of plume and discharge data for all cut-off frequency. We used different cut off frequencies and calculated normalized cross-correlation. A good correlation is observed for the cut-off frequency of 59 hours and above. Therefore, we use that as the final cut-off frequency to extract high-frequency signal to calibrate the water speed of the routing model" (L380-384)

Line 383: Can you use a number instead of "good" which is subjective.

Response: We would provide the correlation/rmse here instead of 'good' in the revise manuscript.

Figure 4: The grey here is hard to see.

Response: We would use here a corrected figure with hydrograph shown as a band. A preliminary figure is attached here.