Interactive comment on "Subglacial drainage characterization from eight years of continuous borehole data on a small glacier in the Yukon Territory, Canada" *by* Camilo Rada and Christian Schoof

Anonymous Referee #3

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General comment

The authors report a new set of observations of water pressure at the base of a glacier. The amount and quality of data acquired in this study are particularly impressive and unique. Based on this comprehensive dataset, a thorough analysis is conducted in order to distinguish typical behaviors of the subglacial hydrology network based on analyzing characteristic spatio-temporal patterns in the measurements. Observations are generally in agreement with expectations from theory, except the finding that many portions of the bed are observed to be hydraulically isolated, a feature that yet is not ac-

counted for in subglacial hydrology models. To overcome this lack, the authors present a modelling framework (based on the adaptation of existing theory) that allows explicitly treating these hydrologically isolated parts of the bed.

Overall, I find the study particularly interesting and novel, since it provides new observational constraints on subglacial hydrology, as well as a unique and comprehensive dataset of interest by a large community. For these reasons I strongly recommend this paper for publication. However, before so, significant revision is needed in order to clarify text in places, better structure observations and clarify results. Below I provide specific comments that hopefully will help the authors to improve this. Moreover, the complexity and lengthiness of the paper is further reinforced by the inclusion of a modelling part at the end. Although I clearly appreciate the modelling effort, I am not convinced that this section really fits in this observational paper. As is I feel like lots of readers won't even notice the modelling part of the paper, especially given the strong imbalance between the long and extensive analysis of data and the short modelling analysis provided at the very end. For these reasons I strongly recommend the authors to consider publishing this modelling work separately, and my comments below are limited to the observational part.

Detailed comments

Section 2

Some context information about the glacier and its environment is missing. I think this information is needed for the reader to make best sense on what type of general glacier and hydrology regime.

What are the typical values for glacier surface speed (in winter versus in summer)? what are the expected sliding velocities (even rough estimates would be useful to know)? Can the authors give a qualitative sense on the potential effects of basal water pressure on glacier dynamics for this glacier and at this particular location where water pressure is monitored? What are typical outlet water discharge values and how much

do they typically vary from winter to summer? Since the the study is motivated by understanding the links between hydrology and sliding (see intro), I think it would be good to give a sense on these aspects to the reader, even if these statements are brief and qualitative.

There is also missing information about how the glacier evolved over the past 8 years during which basal water pressure has been monitored. In particular, did glacier thickness vary over the course of the 8 years of experiment? If yes please give an estimate about how much.

Section 3

Figure 4: I find it quite complicated to identify which hole goes with which measurement. Would there be a way to improve clarity in this figure? Maybe zoom in the map, or make two map subsets to make the color code easier to see.

Line 16 p 7 to line 6 p 8 : unclear text with long sentences.

P 7 to p 8: the whole discussion on what aspects borehole measurements have been grouped is quite vague, and repetitive. It would be good to have a single, short paragraph explaining how boreholes have been grouped, even if the criteria are qualitative (by eyes is a good enough justification), and then go on with the description without repeating how the selection has been done.

Label of Fig 6: amplitude offset? Or phase offset? Looks like it's amplitude.

I suggest to split section 3.1 into two sections. One would be something like "global overview of the dataset" with Fig 4 and 5 and the other would be something like "Diurnal and seasonal cycles in slow and fast flowing water" (Fig 3, 6 and 7). I think this would make it easier to read.

Line 5 to 15, p 12: unclear paragraph. Too long sentences.

Line 10 p 13: Comparing panel b with panel e in Fig 8 I do not see the "inverted" or

C3

anti-correlated relationship... Wording and support from figures is confusing here.

Line 28 p 13: Fig. 9 is very lately introduced here. Actually figure 9 seems to help in the understanding of "inverted" or anticorrelated signals, but it comes too late. Perhaps to be place earlier?

P 17: I find the difference between the title of 3.4 (seasonal evolution) and title of 3.1 (annual cycle) to be too weak... As is I get lost trying to understand what's new in 3.4 that could not be observed or has not been said in 3.1.

Section 3.6: I suggest to put this section in supplementary material, and just have a single paragraph in the main text that states how and to which extent observations could be biased by changes in data quality. If kept in the main text, this paragraph could even be placed in a separate section before results are exposed.

Section 4

Would be good to have a section or a paragraph that summarizes all key observations, which would be placed outside the discussion section. Then the discussion section would only be based on the summarized, main observations. As is it is embedded and its makes it hard to read.

I don't see what is the difference between 4.4 data interpretation and what's discussed earlier. Isn't the earlier discussion also data interpretation?

Section 5

I suggest to remove that section from the paper, and write a separate paper on the modelling aspects.

C4