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The Cryosphere Discussions

Interactive comment on "Seasonal and Diurnal Dynamics of Subglacial Channels: Observations Beneath an Alpine Glacier" *by* Ugo Nanni et al.

Anonymous Referee #2

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The work by Nanni and co-workers represents a significant contribution to our understanding of using glacial seismology to monitor glacial hydrology. This work utilizes seismic data and observations of subglacial discharge acquired over two full melt season. They then use the theory of Gimbert et al. (2016) to investigate of seasonal variations in seismic tremor can be used to make inferences about seasonal to daily variation in the subglacial hydraulic system.

I find the significant results of the this paper to be: 1) Significant advances in documenting methodology for conducting this sort of analysis. For example, robustly combing multiple seismic records to forms continuous measure of seismic tremor, differentiating anthropogenic noise from glacial tremor (figure 3), and presenting quantitative measures of hysteresis (i.e., equations 15-17)

2) Demonstrating that seasonal variations exist between seismic power and discharge (Figure 6) which are most likely related to changes in the subglacial hydraulic system and that the relationship between seismic power and discharge varies depending on the season (section 6.2)

3) Demonstrating how the theory of Gimbert et al. (2016) can be used to investigate daily to seasonal variations in subglacial dynamics. However, occasionally the authors refer to their model derived parameters as observations when in fact they are a model result. For example on line 462, the authors use the phrase ". . .channels are observed. . .", the channels are in fact not observed but ". . .channels are inferred to be at equilibrium. . ." based on the theory of Gimbert et al. (2016). Other instances occur at line 551-555. To summarize, I think it is important to remain clear that the derived values of hydraulic radius (R) and pressure gradient (S) are in fact NOT observations but model derived parameters.

Other Comments:

Diurnal Variability, Hysteresis, and Phase lags: Figure 7 clearly shows the seasonal variability of the phase lag and hysteresis in Pw and Q. However, I was surprised to see no measure of coefficient of variation (Cv) as is done in figure 9. Figure S3 appears to show that Q often does not display diurnal variability. Is this true or is this just a figure resolution issue? If there are days when there is no diurnal variability in Q, what is the meaning of the phase lag or the hysteresis measurements?

Detail Comments: Title: Should include a mention of seismology.

Line 1: should be ". . .knowledge of the. . ."

Line 165: remove "days"

Line 173: perhaps "Subglacial water discharge is monitored.."

Line 186 (and elsewhere). I believe that Bar should be replaced with Pa.

Line 197:perhaps “borehole type sensors”

Line 203: should be “A few data gaps. . .”

Line 230: specify as synthetic.

Figure 5: in caption rephrase “Shaded red area” as “Red shaded area” and “Shaded blue area” as “blue shaded area”

Line 285-289: Specific days need to be specified.

Line 298: I would prefer that “in response” should be changed to something like “correlates with”. The phrase in “in response” is an interpretation that already presumes Q is the driver of Pw.

Figure 6 (and line 371): Over what time period is Qref and Pwref defined?

Line 371: “We invert for . . ..”

Figure S3: I think that the legend has Pa and Pw switched.

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