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The Cryosphere Discussions

# *Interactive comment on* "Geophysical constraints on the properties of a subglacial lake in northwest Greenland" *by* Ross Maguire et al.

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We agree that the GPR analysis needed improvement. We have added more details to Section 2.1 to clarify the data collection and processing methods. The new GPR Methods section reads as follows:

*"The GPR data was collected across a 5.5 km transect roughly parallel to the seismic survey (Fig. 1C), using an acquisition system specially adapted to be towed by a motor sled traveling at approximately 10 km/hr (e.g., Welch Jacobel, 2003). The system used a Kentech pulse transmitter that produces +/- 2000 V pulses with a variable pulse repetition frequency of between 1 and 5 kHz. The antennae are resistively loaded wire dipoles with nominal frequency of 5MHz, and the receiver uses an 8-bit NI USB-5132*



*digitizer and a computer. Between 16 and 64 radar shots were stacked were stacked and filtered 2 to 8MHz to produce each final trace on the radargram. A GPR reflection image was created by converting the radar data to depth using a radar velocity of 172* $m/\mu s$*."*

Additionally, we have updated the radar image in Figure 3 which now shows a sharper picture of the ice bottom reflection (see attached). Finally, we included some analysis of the ice bottom reflectivity. We find that the reflectivity above the lake is approximately 10 dB stronger than the surrounding region, which is broadly consistent with the results of Palmer et al (2013), who found a variation of between 10 - 20 dB. However, we disagree that a detailed discussion of the differences with Palmer et al. (2013) would be useful. Comparing radar reflectivities obtained from multiple surveys conducted at different times (and here different collection methods) is challenging and only rarely done (e.g., Schroeder, D., Hilger, A., Paden, J., Young, D., Corr, H. (2018). Ocean access beneath the southwest tributary of Pine Island Glacier, West Antarctica. Annals of Glaciology, 59(76pt1), 10-15. doi:10.1017/aog.2017.45).

Using the radar reflections to constrain salinity would be an exciting possibility. However, in our GPR results, there are no clear returns from signals that have traversed the lake (i.e., lake bottom reflections). This is likely because the water layer is too highly attenuating. The highest likelihood of detecting lake bottom reflections may be near the edge of the lake where the water layer is thin, yet we can not confidently interpret any signals beyond the primary ice bottom reflection near the lake boundary. We have added some discussion about this to the manuscript.

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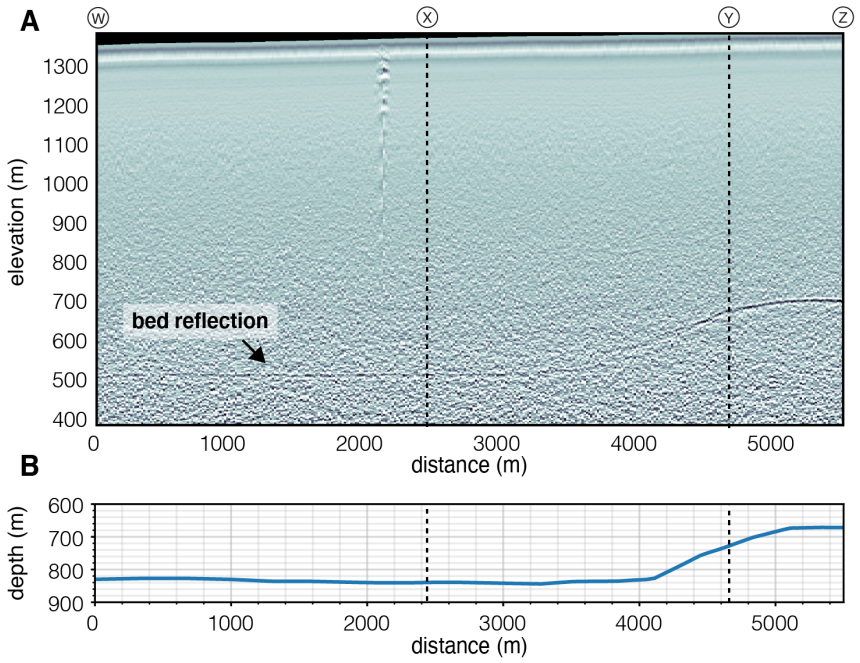
A
W
X
Y
Z
1300
1200
1100
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900
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700
600
500
400
elevation (m)
bed reflection
0
1000
2000
3000
4000
5000
distance (m)
B
600
700
800
900
depth (m)
0
1000
2000
3000
4000
5000
distance (m)

**Fig. 1.**