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# ***Interactive comment on “Mapping the bathymetry of supraglacial lakes and streams on the Greenland Ice Sheet using field measurements and high resolution satellite images” by C. J. Legleiter et al.***

**Anonymous Referee #1**

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In this paper, the authors investigate the potential for using optimised ratios of spectral bands of multi-spectral satellite imagery (specifically WorldView2 imagery) to derive new, and better, estimates of supraglacial lake and stream bathymetry on the Greenland ice sheet. The authors build on their previous work by applying techniques devised for use in land-based fluvial remote sensing to the ice sheet environment, for which accurate estimates of water storage remain elusive. The authors conclude that depth estimates derived from band ratios optimised on a location-by-location basis are very accurate, however optimal band ratios are found to differ quite significantly between

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images and locations.

The paper is well written and easy to read. The method is robust and the analysis comprehensive. The authors offer a critical discussion of their results which nicely highlights the limitations and potential benefits of their study, and provide sensible directions for further work. The work described in the manuscript offers a valuable contribution to knowledge in the fields of cryospheric remote-sensing and ice-sheet hydrology. I have a couple of specific comments, which are relatively minor and I imagine can be answered without much difficulty.

Can you compare depth retrieved using your method to depth retrieved using empirical methods e.g. Fitzpatrick et al. 2013?

What were the r<sup>2</sup> values for each individual site, when depth was estimated using the optimum band ratio devised using all data?

On page 4743, Lines 20-23, when you refer to supraglacial lake volume estimates inferred from remote sensing, shouldn't you also refer to estimates from modelling studies such as Luthje et al. 2009 and Leeson et al. 2012?

In Figure 1, it is hard to see on map (a) where each of the study sites is located.

## References

Fitzpatrick, A. A. W., Hubbard, A. L., Box, J. E., Quincey, D. J., van As, D., Mikkelsen, A. P. B., Doyle, S. H., Dow, C. F., Hasholt, B., and Jones, G. A.: A decade of supraglacial lake volume estimates across a land-terminating margin of the Greenland Ice Sheet, *The Cryosphere Discuss.*, 7, 1383–1414

Leeson, A. A., Shepherd, A., Palmer, S., Sundal, A., and Fettweis, X.: Simulating the growth of supraglacial lakes at the western margin of the Greenland ice sheet, *The Cryosphere*, 6, 1077-1086, doi:10.5194/tc-6-1077-2012, 2012.

Luthje, M., Pedersen, L. T., Reeh, N., and Greuell, W.: Modelling the evolution of

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