

Interactive comment on “Self-affine subglacial roughness: consequences for radar scattering and basal thaw discrimination in northern Greenland” by Thomas M. Jordan et al.

Anonymous Referee #1

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The ms demonstrates a theoretical relationship between the signal abruptness (a relative measurement of the signal decay) of the radar bed echo and the self-affine properties of roughness, the latter being a proxy for the thermal state of the bed. Then, a comparison of the signal abruptness with a thermal state map of the GIS bedrock illustrates how the signal abruptness can be used to outline at first order thawed and frozen bed.

The ms provides a valuable effort to introduce self-affine descriptors to classify glaciers' bed properties from radar return. The ms is well-written, the theoretical part is clearly shaped, and the discussion provides interesting insights into the qualitative relationship between bed properties and roughness as seen by radar. I have mainly few ques-

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tions/minor revisions and technical remarks that, I hope, would enhance the quality of the ms.

General Questions

1) What kind of signal processing should be avoided to optimize your technique? For example, the waveform abruptness is mainly made from incoherent signal scattered by the surface. Does this mean that any coherent processing (coherent pre-summing or Doppler focusing) will tend to reduce the abruptness and its spatial contrast?

2) There is no mention of volume scattering in your ms while it is known to also contribute to the radar signal decay. What length scale for the heterogeneities of the volume scatterers would be needed to contribute to the abruptness? Could it explain some local mismatches between A and H on your maps? Is volume scattering a fair assumption in the context of bed and thawed glaciers' bed?

3) How do you choose the location of the bed echo in the case of the green waveform ($A=0.05$) on Fig.4? Do you compute P_{agg} ? From fore and aft the chosen pick or just after it? Could you justify your choices and discuss putative bias arising from the specific case of this kind of waveform?

Specific Remarks

I.131: "proportional the rms deviation" should be "proportional to the rms deviation".

I.162-3: For clarity, the origin of the profiles should be moved in the first part of the paragraph (when you introduce the figure) and added in Fig.1 caption.

I.203-4: Could you briefly summarize the main signal processing applied to L1B data if any (any focusing or coherent pre-summing)?

I.240: "is also is consiststent" should be "is also consistent".

I.270: How long is the range window across wich you aggregate the power to get P_{agg} ?

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I.302: "can then obtained" should be "can then be obtained".

I.507-8: Specify that this H-A apparent correlation stands in the context of frozen/thawed glaciers bed. Your study does not show this relationship stands in other environments, especially where volume scattering could be involved.

[Interactive comment on The Cryosphere Discuss.](#), doi:10.5194/tc-2016-283, 2017.

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