

***Interactive comment on* “Evaluating Airborne Ku-Band Radar Altimetry over Landfast First-Year Sea Ice” by Paul Donchenko et al.**

Anonymous Referee #1

Received and published: 12 January 2021

Review Evaluating airborne Ku-band radar altimetry over landfast first-year ice

Major comments:

The paper evaluates Ku-band radar penetration into snowpack acquired from ASIRAS system. Field datasets were acquired from ECCO coordinated field campaign near Eureka in 2014. The study is timely given the growing need for more reliable sea ice thickness estimates from ongoing and upcoming radar missions. The methodology of the study is very thorough. However, the paper is not well written for a scientific research article to be published.

The biggest concern I have is that this paper lacks sufficient literature review for a research article. Details on previous key studies on radar altimeter and its uncertain-

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ties due to snow variability need to be elaborated. Gaps and challenges in previous altimeter retracking methods need to be addressed to justify the research objectives.

Fig. 5 demonstrated mean penetration variability for different snow surface characteristics and explained in line 193-203. I do not think the authors can not comment straight forward on penetration variability just based on surface characteristics where other variables are already affecting the penetration variability. A sensitivity study is required to demonstrate the contribution of individual surface characteristics to penetration depth. Also, a discussion on the partial contribution of other snow properties is missing in the discussion section.

This discussion needs to be revised with a focus on analysis results and geophysical explanation of observed variability of penetration. A thorough discussion is required. The discussions should be supported by previous studies, where only Landy 2020 was mention without proper discussion. I suggest 'Major revision' for this paper.

Minor comments:

Line 15 "... in some case to not penetrate...". Please rewrite. Fig 1 'the Twin Otter flights are in light grey' – is confused with grey land area. Try different color codes for flight lines, or rewrite the captions to clarify the flight lines and land area. What is Natural Earth? Provide a reference or weblink for natural Earth. Please use a larger font for coordinates. Line 138 How the level ice area was defined? Were there any quantifications of the surface roughness? Line 147-148 The acronyms do not correspond to Fig 2. Check throughout the manuscript. Line 164-168 This section belongs to the method section. Line 214 "... the in.." should be 'in the'? Line 214-221 This section is more like an outlook, which should be in the conclusion. Line 249 Should be 'radar'

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2020-283>, 2020.

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