

Interactive comment on “The role of electrical conductivity in radarwave reflection” by Slawek M. Tulaczyk and Neil T. Foley

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Thank you for further clarifying your review of our manuscript. If at all possible, given your review and the review that will come from the second reviewer, we will re-format our manuscript into the shorter TC format.

One issue I want to follow up on is the issue of Peters et al. (2005) being widely cited in the radioglaciology literature. It is certainly true that this paper is widely cited and that it includes a complex reflection coefficient with electrical conductivity taken into account through the loss tangent term (their table 1 and equations 6 and 7). However, this does not mean that all papers citing Peters et al. (2005) take electrical conductivity into account when calculating radar reflectivity. Just the opposite, only a few papers

C1

citing Peters et al. (2005) seem to do that (e.g., MacGregor et al., 2011; Christianson et al., 2016). I went back to the five recent papers on radar reflectivity of glacier beds that I read when writing this manuscript (Jordan et al., 2017, 2018; Chu et al., 2018; Oswald and Gogineni, 2008; Oswald et al. 2018) and none of them makes use of the loss tangent values for subglacial materials from table 1 of Peters et al. (2005). Jordan et al. (2018) uses the table 1 from Peters et al. (2005) but only copies their values for relative permittivity and does not use the loss tangent values given in the table. They also use the real version of the reflection coefficient (the one we derive using the low-loss assumption in our manuscript), not the complex one given by equations 6 and 7 in Peters et al. (2005).

Somehow, the radioglaciology community uses Peters et al. (2005) a lot but seems to overlook the fact that this paper clearly points out the need to consider both, relative permittivity and electrical conductivity (or at least its representation in the form of the loss tangent) in calculations of radar reflectivity. This 'blind spot' is particularly perplexing since the same community is used to dealing with the fact that electrical conductivity causes radar wave attenuation in ice. For instance, Oswald et al. (2018) use the loss tangent concept to treat attenuation in ice but their expression for radar reflectivity (equation 7) is only based on relative permittivity of subglacial materials, although such materials can be many orders of magnitude more conductive than glacier ice. Again, I believe that this is because few want to deal with complex numbers in Peters et al. (2005) formulation of the reflection coefficient. We offer an alternative approach that avoids this problem. With our equations any radioglaciologist can calculate reflection coefficients using just real values of electrical conductivity and permittivity.

All scientific papers have pedagogical dimension. We are trying to teach each other something about how Nature works. One of the reviewers of my early paper on till deformation (Tulaczyk et al., 2000) criticized that manuscript as being too pedagogical because we were using basic concepts from soil mechanics to help explain observed features of subglacial till deformation. Yet, this paper has been cited nearly 400 times,

C2

more than any Science or Nature paper that I have been part of. Apparently, the community appreciates if you teach them something useful.

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