

## Responses to Reviewer #1

AUTHORS: We thank the reviewer for his/her insightful and constructive comments. We have addressed all of them and made the suggested changes in the new version of our manuscript. Please refer to the attached pdf for our point-by-point responses (in black) to the critical comments (in blue). Please note that the page/line numbers in our responses refer to the new line numbers.

The authors use a model to estimate this contribution that was developed by Dr. Liu previously but do not discuss the expected accuracy of such model, although error bars are provided. This is relevant since Table 2 shows that this contribution is more or less constant for the 2004-2015 interval compared to the contribution from segregated ice which exhibits more noticeable variability.

AUTHORS: The methodology subsection 4.4 includes a brief description of the method for estimating uncertainties of the modeled subsidence due to thawing of pore ice, quoted below.

“We also estimate the uncertainties of  $d_{\text{pore}}^{\text{max}}$  by propagating the standard deviation of the ALT measured within the footprint (i.e., 6 cm) and the uncertainties in the assumed model parameters for calculating water content (see equation 16 of Liu et al., 2012)” (Page 9, Lines 26-28).

We added a new time series plot (Figure 4c, Page 13) to show that the active layer thickness at SG27 varied little during the period of investigation. We point out that this fact contributes to the small variability of  $d_{\text{pore}}^{\text{max}}$  (Page 15, Lines 6-7).

There are minor points that should be addressed, such as: a) this paper does not introduce a new technique, the GNSS IR, but applies it to a different problem

AUTHORS: We agree and rephrased the relevant wording from “introduce a new method” to simply “use” the GPS-IR method (Page 1, Line 10).

references to figure 3 (a-c) should be figure 4

AUTHORS: We fixed this referencing mistake.

i recommend to use a different expression for ground reflector, such as reflecting surface

AUTHORS: As suggested, we changed “surface reflector” to “reflecting surface” (Page 1, Line 14; Page 2, Line 25; Page 13, Line 2). However, we still use the term “reflector height”, which is defined as “the height of the GPS receiver antenna's phase center above the reflecting surface” (Page 7, Line 5), throughout the manuscript, including figure labels. This term is widely used in the GPS-IR literature.

other suggestions are highlighted in the enclosed pdf.

AUTHORS: See our specific responses below.

Page 1, Lines 12 and 18; Page 2, Line 24: As suggested, we changed “continuous” to “continuously-operating”.

Page 2, Lines 4, 8, and 21; Page 20, Line 16: We now use ‘GPS campaigns’ consistently throughout the manuscript.

Page 2, Lines 15-16: We rephrased as “Furthermore, it is difficult to locate stable reference points over permafrost areas without bedrock outcrops” (Page 2, Lines 15-16).

We still use the term “footprint” in Figure 1 caption (Page 5, Line 4) and point the readers to Section 4.2 for more details. This is appropriate for the readers of The Cryosphere. In Section 4.2 the explanatory text

reads as “In fact, each track has a different reflecting point, which depends on the azimuth and elevation angles, as well as the antenna height. Using the first Fresnel zone of the reflected signals for the elevation angle of 5 degrees (Larson and Nievinski, 2013), we estimate the average extent of the footprints as having a radius of 90 m from SG27 (Figure 1)” (Page 8, Lines 11-14).

We added a further explanation that degree day of thawing is defined as the sum of the daily surface air temperatures for all days with above 0 °C since the thaw onset (Page 10, Lines 2-3).

Page 20, Line 19: As suggested, we changed ‘Firstly’ to ‘First’ (Page 21, Line 10).