

Dear Prof. Courville,

Thank you very much for reviewing the manuscript and for your valuable comments to improve our manuscript. We would like to first address your specific and technical comments/questions (in red), and then integrate them into the final manuscript.

**Specific Comments:**

**Page 5, Line 6: need more technical information about the GPS receiver.**

We revised the sentence of line 6 on page 5 and added more information about the GPS receiver as follows (in green):

We also installed a **Topcon Legacy E** GPS receiver between the transmitters and receivers to record geolocations **with NMEA \$GPGGA messages every 0.1 seconds.**

**Page 9, line 11: The truss, since it has such a large impact on the transmit power mismatch, should be introduced and explained in more detail (geometry? Construction? Materials?) in Section 2.**

We revised line 11 on page 9 as below:

The 12.7-dB transmit power mismatch between TX1 and TX2 is because of the **aluminum** truss effect ...

We revised line 17 and 18 on page 9 as below:

The real truss structure is much more complicated than the simulated one (see Fig. Sxx),...

We will provide the following picture in supplementary document to illustrate truss construction and geometry:

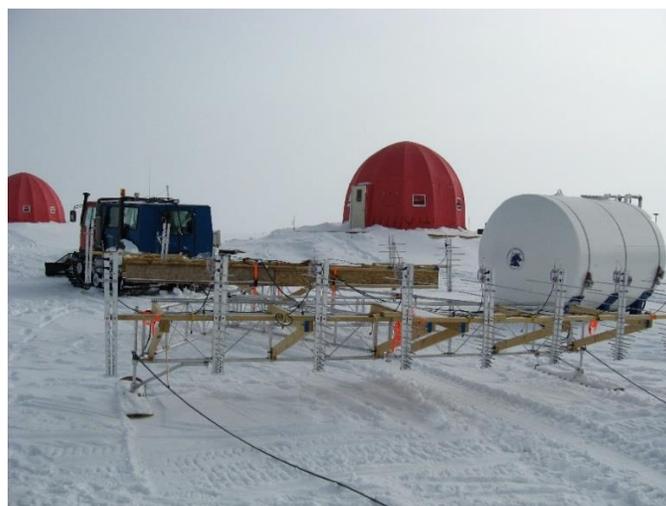


Fig. xx A picture of the truss construction and geometry

Page 19, section 4: suggest adding a brief description of the COF methods, for instance, in Figure 16 there is mention of thin sections. It would probably be good to mention that the COF are obtained from thin sections in the text. (or in the caption of Figure 16, instead of saying “projected into the thin section plane” name what that plane (guessing that it is vertical, but actually not sure).

We did not give a brief description of the COF methods because the cited references describe them in detail. We revised the first sentence in Section 4 as below:

The COF along the full NEEM ice core was measured from vertical thin sections of the core in the field by an automatic ice texture analyzer every 10 m from a depth of 33 m down to 2461 m [Weikusat and Kipfstuhl, 2010], presented using the second-order orientation tensor  $\mathbf{a}^{(2)}$  [Eichler et al., 2013; Montagnat, et al et al., 2014].

We revised the caption of Fig. 16 as below:

Figure 16: Fabric represented in stereographic projection/pole figure projected into the vertical planes of the thin sections at depths of 330, 561, 849.8 and 1025.8 m. The *OY* direction in the pole figure is approximately the vertical ice core axis. The center of the diagram corresponds to the approximate horizontal. Only 10,000 data points randomly selected are plotted for each thin section. The color bar corresponds to the density of plotted data points.

Page 23, line 7: Earlier (Page 9, line 13), there is mention that the power reduction is due to these two factors as well as other unknown factors. That there are unknown factors contributing to the power reduction should also be mentioned in the summary.

We revised the summary as below:

..., we identified a power reduction of about 12.7 dB transmitted towards the nadir in V-polarization because of the effects of the structure truss, mutual coupling on the antenna radiation pattern, and other unknown reasons. ...

Technical Comments:

Throughout: don't need a comma after the name and before “et al.” in citations (i.e., in lines 10 and 11), but do need a comma after et al. (i.e., line 17).

We have removed the comma after the name and before “et al.” and added a comma after et al. in all citations. Thanks for pointing out these minor but important things.

Page 1, Line 19: define VHF.

We have revised it to “VHF (very high frequency)”.

Page 3, Line 15: Why is km bold and italicized?

We have corrected it.

Page 3, Line 24: should be, “plane also rotates.” (or “the planes also rotate..”) if this is referring to the vertical planes.

We have revised it to “the plane also rotates”. Thanks for pointing out this grammatical error.

Page 4, Line 7: should be comma after “Marathe” in citation.

We have added a comma after “Marathe”. Thanks for pointing out this.

Page 5, line 4: “snow tractor” is not a term I’ve heard before. We typically call these “tracked vehicles.”

We have revised “snow tractor” to “tracked vehicle”. Thanks.

Page 5 and throughout: should be consistent if there is a space after period in Fig or not (i.e., there is a space on page 4, Line 25 after Fig. 3, but not on lines 4 and 5 on page 5).

We have added a space after “Fig.” on line 4 and 5 on page 5, and kept this consistent throughout the manuscript. Thanks.

Page 6, line 22: why is the m in bold?

We have corrected it.

Page 8, several instances: why is dB in parentheses here, and not above? Should be consistent at least.

We ignored the dB units in the equations, so we put dB in parentheses at the end of these equations.

Page 9, line 9: Fig. 7 should be capitalized.

We have corrected this. Thanks.

Page 11, line 4: seems like you should say something along the lines of, “The plane wave is of linear, circular, or elliptical polarization when this curve is, respectively, a straight line, a circle, or an ellipse, [Ulaby, 1981].” To make this sentence clearer.

We revised the sentence as suggested as below:

The plane wave is of linear, circular, or elliptical polarization when this curve is, **respectively**, a straight line, a circle, or an ellipse [Ulaby, 1981].

Page 17, line 15: do the authors mean, optic axis instead of optical axis here?

We have replaced “optical” with “optic” throughout the manuscript. Thanks for pointing out this.

Page 19, line 21: think that this is actually supposed to be referring to Figure 15, not Figure 14.

We have corrected this. Thanks.

Page 21, line 4: The variable beta should be defined.

The variable beta was defined at line 20, page 12. We reiterate it here by adding the following:

“where  $\beta$  is the angle between the principal axis  $z_p$  and the z-axis,...”.

Page 22, line 21: This is the first mention of thin sections in the text. I think there should be a brief discussion of the methods on Page 16, or refer to these as “samples,” but be consistent.

Please see our responses to your specific comments about Page 19.

Page 22, line 16: “tile” should be “tilt”.

We have corrected this typo. Thanks for pointing out it.

Figure 2: Maybe add a label with the dipole lengths in the figure?

We have labeled the dipole lengths as suggested, see the revised Fig. 2 below:

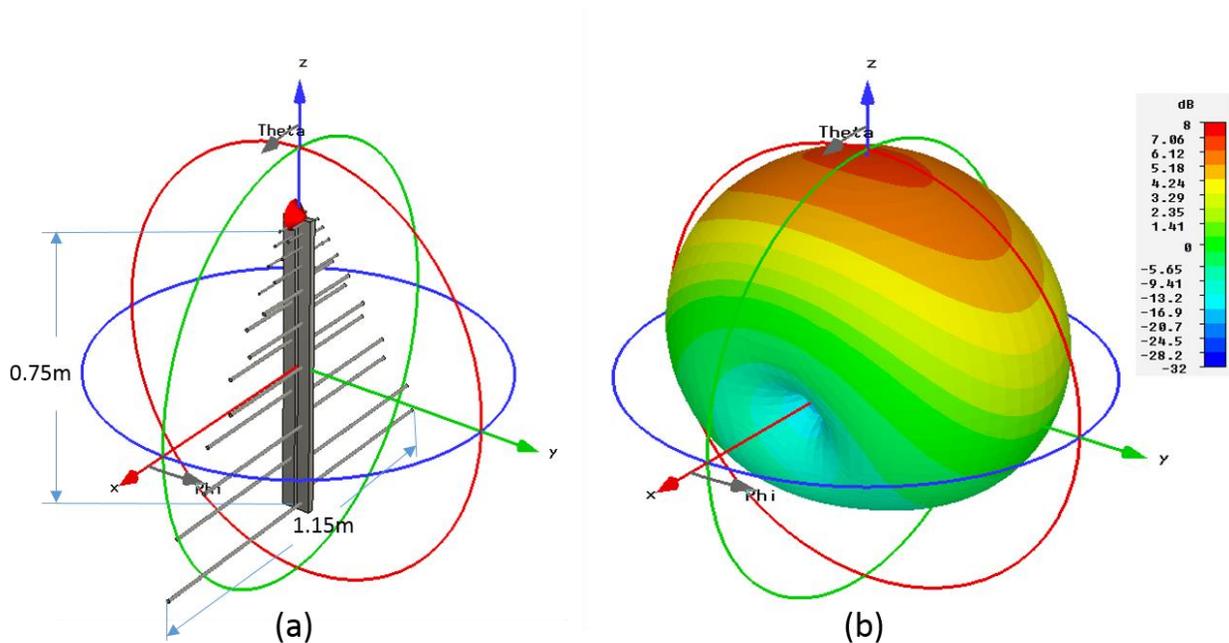
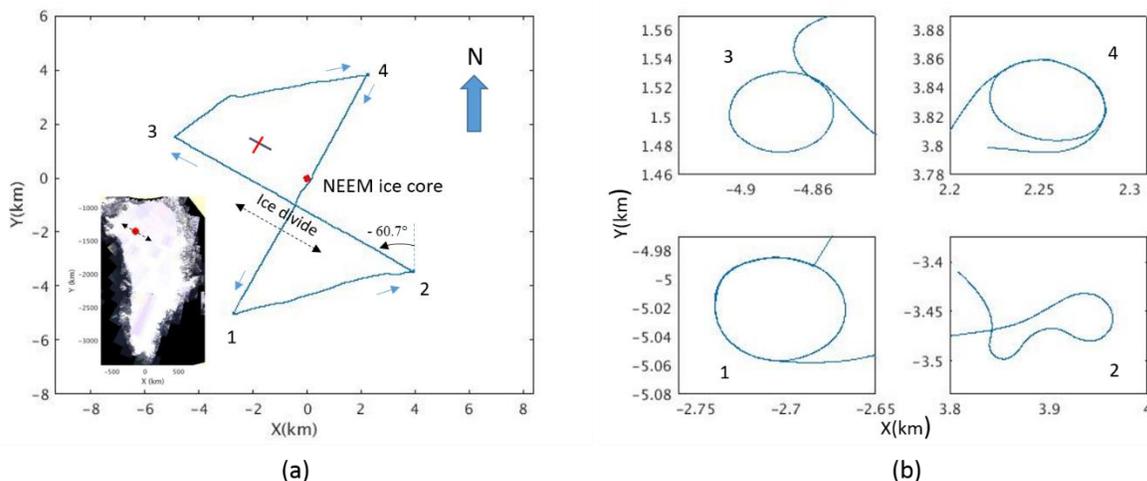


Figure 5: Better label the ice divide? Right now, it looks like the “Ice divide” label is associated with the arrow, which I think is just supposed to indicate direction of travel. If the Ice divide label and arrow were spaced further apart, it might be more obvious that the ice divide is the path from 2-3. And maybe make the inset a little larger and label the ice divide on the map of Greenland?

Also, just a suggestion if it doesn't make it too cluttered is to add more labels (i.e., the 60.7 degrees from north)

We have revised Fig. 5 and its caption to avoid the ambiguity, as shown below:



**Figure 5: Paths of multi-polarization measurements: (a) Paths along ice divide and perpendicular to ice divide. (b) Circular paths at turns. The paths are plotted in the local ENU (East-North-Up) coordinate system at the NEEM ice core camp site ( $77.45^{\circ}\text{N}$   $51.06^{\circ}\text{W}$ ), marked by a red dot at (0,0). The travel direction is illustrated by the arrows along the paths. The local ice divide is along the path from location 2 to 3, as marked by the dashed line with arrows on both ends. The red dot and the dashed line with arrows in the inset map show the location of the NEEM site and the direction of the local ice divide in Greenland. The cross formed by a red and a blue segment shows the location of a crossover where the data were collected with the non-polarimetric HH polarization antenna configuration (see discussions on Fig. 14).**

Figure 6: a-d should be described in the caption, i.e., the caption should say something like, "Averaged power-depth profiles along the straight line perpendicular to the divide for the 4 different polarization combinations (a-d).

We have revised the caption of Fig. 6 as below:

**Figure 6: Averaged power-depth profiles along straight line perpendicular to the ice divide (from pt. 1 to pt. 4 in Fig. 5) for the four different Tx-Rx polarization combinations. (a) HH and VH; (b) HV and VV; (c) HH and HV; and (d) VH and VV. The insets show three specular reflection peaks from layers at depths of 1142, 1181 and 1271 m.**

Figure 14: hard to read all the axis labels due to the resizing of the text, especially the x-axis title and labels, and the vertical labels as well.

We will pay attention to and address the above resizing issues during the final submission of this manuscript.

Figure 16: see note about Page 19...should define the thin section plane, or rename it in terms of the ice axis. Also, if the mention of “thin section” is left in this caption, the methods used to determine COF should be better described on page 19. At the very least, thin sections should be mentioned.

Please see our responses to your specific comments about Page 19.

Figure 17: The text of the figure labels looks strange due to resizing the figure (as do the data markers). Everything looks stretched out.

We will pay attention to and address the above resizing issues during the final submission of this manuscript.