

The Cryosphere Discuss., referee comment RC3
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Comment on tc-2021-266

Anonymous Referee #3

Referee comment on "High-resolution subglacial topography around Dome Fuji, Antarctica, based on ground-based radar surveys over 30 years" by Shun Tsutaki et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-266-RC3>, 2021

Summary

The manuscript presents recent high-resolution radar surveys around Dome Fuji, Antarctica with the motivation to inform future selection of oldest ice core drilling locations. They extract high-resolution bed topography and make a convincing case of the advantages of using a radar system with a highly directive beam pattern to study this region. The authors also combine recent and earlier surveys to generate new gridded ice thickness data covering the Dome Fuji region which is useful for oldest-ice drilling projects. However, it is unclear how the authors combine data from multiple systems and there could be missed opportunities to integrate the JARE data further with AWI or University of Kansas/University of Alabama data that was also mentioned in the manuscript. The new high-resolution survey and gridded product provide new and useful details on bed topography. However, the authors miss opportunities to provide further radar analysis and interpretation of the subglacial environment which would better narrow down locations for potential oldest-ice drilling.

Major Issues:

- **Radar Processing:** To create the gridded ice thickness data, the authors combine data from multiple systems, which could suffer many potential issues. The manuscript does not provide enough evidence for how potentially data-combination issues were measured, dismissed, or corrected for, which is needed for the reader to evaluate the findings clearly. This should be added to the relevant sections on the radar processing steps involved in developing the gridded product before discussing the uncertainties in ice thickness which is separate for potential issues involved in combining data from

different radar systems. The authors also discuss data from AWI and the University of Kansas/University of Alabama, which seems could be added to the gridded ice thickness. Or if not added, this should be convincingly explained why not.

- **Radar Analysis:** Regarding the analysis and interpretation of the subglacial environment, the radar analysis does not go further than plotting ice thickness and extracting bed topography. Hence, the analysis does not provide sufficient evidence to demonstrate that there is an improvement in knowledge of the subglacial environment needed for selecting ice core drilling locations. There is no updated analysis of the basal thermal state or the bed roughness. I suggest more analysis on quantifying the subglacial environment such as extracting bed power/radar reflectivity/roughness to demonstrate the improvements of this new radar dataset in constraining the subglacial conditions.

Minor Issues:

- NDF is not defined anywhere
- Figure 2: The values for the color range is not specified. It would be best to add colorbars or at least state the range in power that is plotted in these radargrams. Are the color ranges the same for a and b? Are the colors saturated?
- Figure 3: Plot/label NDF for consistency and comparison to figure 1.
- Figure 4: I suggest writing frequency on all the furthest left y-axes for clarity (instead of just the middle row). Same for delta H for the columns.
- Figure 6: again colorbar for the background radargram power.
- Figure 7: it would be helpful to have NDF labeled
- In section 4.3, the authors suggest that even higher spatial resolution is needed to resolve the best candidate points for drilling. The authors should suggest what radar system design might be needed to achieve this spatial resolution.
- Discussion around Line 275 should be tied back to the radargram figure along with more concrete discussion. For example, I would like to see a list or examples of what portions of the radar survey shows undisturbed layers just above the bed.