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Earth System Science Data Discussions

Interactive comment on "Subglacial topography and ice flux along the English Coast of Palmer Land, Antarctic Peninsula" *by* Kate Winter et al.

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Review of "Subglacial topography and ice flux along the English Coast of Palmer Land, Antarctic Peninsula" by K. Winter et al.

Joseph A. MacGregor 24 August 2020

This manuscript concerns a new airborne radar-sounding dataset collected across Palmer Land along the southwestern coastline of the Antarctic Peninsula. The manuscript reports the motivation for collecting the dataset, the instrument used, visuals of the data collected and their overall significance. In this case, the bed topography near the grounding zone of multiple outlet glaciers is described in substantial detail, with its potential consequences for the future evolution of these glaciers carefully con-

sidered.

This is a carefully structured manuscript on a new and important dataset for Antarctic science. Having reviewed several similar manuscripts in the past, this one is undoubtedly among the best of this category. Thorough, fair and thoughtful about the data collected. I found little to fault and consider my concerns no more than minor. The most significant of these can be grouped into two categories: 1. How ice flux is calculated and represented, even though it is not a direct part of the dataset reported it is discussed at some length. Some of these concerns may require recalculation of ice flux. 2. The other potential implications of the dataset.

Which dataset is shown/used in this study? The 1us or 4us pulse radargrams? I went to the DOI and found both. Should be stated in the MS in §3.1.

116: This value of the radio-wave velocity (168 m/us) is equivalent to a real part of the relative permittivity of 3.1844. CReSIS typically uses a value of 3.15 (double-check what they use for Antarctica, but I believe it's the same as for Greenland). Was the difference reconciled prior to the cross-over analysis?

121: Include appropriate data citation to MCoRDS data, e.g., was it this one? https://nsidc.org/data/IRMCR2/versions/1

124-125: It's understandable that high-elevation OIB transits where MCoRDS was operating would produce worse cross-over comparisons, particularly over regions of high topographic relief. However, as written it's a little unclear if Paxman et al. (2019) did the same cross-over analysis on this dataset but without the high-elevation flights? My broader recommendation is that high-elevation MCoRDS transits (assuming >2000 m AGL as opposed to typical $\sim$500 m AGL) not be included in the cross-over analysis even if they were included in BedMachine v1. Currently what's discussed is not just an apples-to-apples comparison between low-AGL PASIN2 and low-AGL MCoRDS.

153: Better than "close to" would be "immediately upstream of".

153: The history of flux-gate selection for these types of analyses is surprisingly complex relative to the task at hand (a line on a map) and involves various decisions that limited reproducibility of past landmark results. Based on the reported dataset itself, the authors' decision-making here is sensible, clearly explained and illustrated. However, I encourage the authors to consider adding a comparison against modern, openly distributed fluxgate positions and flux values, in particular Gardner et al. (2018; doi:10.5194/tc-12-521-2018). Not because their locations are better (they certainly aren't, given that they predate this dataset), but because they offer a direct point of comparison against the best recent study involving fluxgates in this region.

Further, I strongly encourage the authors to amend their excellent Figure 2 with a flux calculation from BedMachine v1 also. Why do this, given that these data were directly used in BedMachine? Because BedMachine's algorithm does not require perfect fidelity to radar observations, its uncertainty assessment is different and it is also much more likely to be the source of choice for independent flux calculations in the future.

161: The value of ice density used is oddly precise given the other given the other values used, sometimes with only one significant figure (e.g., 10 m firn correction). I understand that this is a reference value for ice density, but does that mean a value so precise is justified for this real-world application?

The discussion of ice thickness, flux and bed topography is excellent. It clearly outlines the similarities and differences between the outlet glaciers in this region. There is some limited discussion of apparent bed reflectivity that is fine, but no direct discussion of the potential value of whether this radar system/survey is likely to permit robust reflectivity analysis or the potential for analysis of radiostratigraphy (e.g., continuity index or direct tracing). A paragraph on these topics would be helpful to contextualize these datasets for obvious other applications. The radargrams focus on the bed and don't highlight any coherent radiostratigraphy, and I wouldn't expect much in this region to begin with, but still that should be clearly stated.

Figures

The figures are in general excellent and should be commended. The presentations of the radargrams, bed topography and flux are direct and clear.

All figures except 2# (bed elevation) use a rainbow color scale (surface speed), whose future is bleak. I recommend switching to another color scale for longevity, e.g., "hot" in MATLAB. Further, given the spatial scales considered, I'm not getting much out of the continuous color bar. I strongly recommend switching to a discrete one ($\leq$20 intervals).

I've never seen an L-shaped scale bar before, and it mostly works. However, much of the discussion concerning the topographic setting wisely revolves around the bed elevation not just ice thickness. It would be very helpful for the reader if the radargrams could be amended with a horizontal line at the elevation of sea level, so that it becomes unambiguous how deep the various troughs are.

Grammar, etc.

121: IceBridge 227: they are about three times slower 228: few tens of metres 308: use same unit of tonnes as the rest of the MS, i.e., Gt 403: order of hundreds of metres 435: principal investigator

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