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Open Access Earth System Science Data Discussions

# *Interactive comment on* "Subglacial landforms beneath Rutford Ice Stream, Antarctica: detailed bed topography from ice-penetrating radar" *by* E. C. King et al.

**E. C. King et al.**

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We thank the referees for their observations and corrections and we offer the following responses (in italics in the text below, page and line references are to the revised manuscript).

Referee #1

General Comments: This manuscript presents a novel dataset covering a relatively large portion of an Antarctic ice stream bed at a fine enough resolution to pick out individual bedforms. It clearly builds on the past work done by the authors. I do not



have any big issues with the manuscript as it is except for one: the interpretation of landforms. Philosophically, I wonder if any interpretation should be included here or if it should be saved for a follow-on publication, as is indicated to be coming. But more specifically, there is little detail provided about how the interpretation was done. What sets apart these different features – is it size? elongation?

*The intention in this paper was primarily to present the data as a resource for the community. The inclusion of a preliminary interpretation is not to attempt to declare the final word on these bedforms but to suggest that this is an interesting data set that will reward further, more intense study. We prefer to retain a section that points out that there are a variety of bedforms in the survey area. It is an important observation because the flow regime is uniform so the different bedform shapes must be controlled by factors other than flow speed such as sediment properties and water availability. Our classification is a simple, subjective, visual one and it makes no claim to be mathematically rigorous – that is for the next stage. We would argue that straightforward empirical observation remains a valuable first stage of analysis.*

There is no discussion as to why the previously identified MSGL is now called a drumlin. Is that because smaller features are now observable?

*One key difference is that it is now possible to identify at least six features that have well-defined stoss ends; that have lee ends that taper both in width and height; and that are of larger amplitude than those features we continue to label MSGL. This collection of attributes merits a distinct class and label. We are aware that many geomorphologists regard MSGL as a sub-class of drumlin and that there is no agreed criteria for distinguishing them.*

Additionally, there is mention of how the features taper in cross-section, but these data are not provided – to what resolution can you detect that a feature tapers or not? Could the MSGL also taper, but be out of the resolution of the data?

*The tapering of the features is a simple visual observation of the 3D and map views.*

*Some features have parallel sides, some have sides that converge. An additional figure is included to make this clear.*

Further, how are grooves identified?

*The term grooves is used here to indicate a linear trough in an otherwise generally flat area, no process origin is implied.*

I think it might be good to remove this interpretation altogether and simply provide the dataset without it, but perhaps include some figures showing how individual landforms differ in cross section and/or plan view.

*It is our hope that the preliminary interpretation provided will stimulate others to take an interest in this dataset and we therefore believe it adds value to the paper and wish to retain it. An additional figure (Fig. 8) shows profile data that illustrates the difference between a drumlin and an MSGL in this dataset.*

Specific Comments:

1. How did the authors choose their smoothing resolution? Were other values tried initially? *The smoothing resolution was arrived at by trial and error. The selection criteria was subjective and the method chosen was the simplest available. Researchers using this dataset may choose to perform spatial wavelength filtering in a number of quantitative or subjective ways, working either from the profile data or the interpolated grid.*

2. How is curvature calculated? *It was calculated using a tool in ArcGIS that computes the second derivative value of the input surface on a cell-by-cell basis. A fourth-order polynomial is fit to a surface composed of a 3 x 3 window centred on the cell of interest.* Is there a quantitative value that designates "High" curvature vs. "Low"? *The designation 'High' and 'Low' is an error, the scale should read from +0.5 to -0.5 in units of cm, positive numbers indicate upward convexity, negative numbers indicate upward concavity. The figure and caption have been corrected.*



Technical Comments:

Pg. 919; Line 11: Reference needed for Fresnel zone-based estimates of resolution. *Reference to Yilmaz page 470 included (Page 6, line 151).*

Pg. 921; Line 1: I have no idea what a "cow catcher" is! *Sentence removed.*

Line 921; Line 20: Correction – these landforms are interpreted, not identified.

*We have removed the word to avoid a fruitless argument. The landforms exist and we are putting names to them, so' identify' is a legitimate term.*

Pg. 921; Line 23: where is the NE trough? On Fig. 3, the authors have labelled Eastern and Western troughs. Do they mean the northern part of the eastern trough?

*Text corrected (Page 8, line 231).*

Similarly, what is the "left" margin. I know what the author's mean from Fig. 5, but it would be nice to be consistent.

*The use of left and right margins with the convention that the observer is facing downflow is a standard in glaciology (and river hydrology). We have included text to make this clear (Page 8, line 235).*

Pg. 922; Line 1: It would be nice to see profiles of the drumlins since this is mentioned in the text. Also, in this paragraph it would be good to refer to the figures occasionally.

*A figure has been added (Fig. 8) and the text modified (Page 9, lines 243-246).*

Pg. 922; Line 7: what is an elongation ratio? I assume a ratio of length to width?

*Indeed: we have added a clarification (Page 8, line 232).*

Pg. 922: Seems like the section on limitations to the data should be presented after discussing acquisition. Also, some of the information presented in this section (eg. of firn correction) is repeated from earlier parts of the manuscript.

*Section moved and text amended to remove the repetition (Page 7, line 202).*

Pg. 923; Line 25: Actually, this is the 2nd publication to provide such data. The first was the earlier one by King and others.

*Text corrected (Page 11, line 265).*

Fig. 1: Perhaps a better inset map showing Rutford in context of regional glaciology would be helpful. The authors could then show where the seismic surveys from Andy's work were located. Perhaps the seismic data were acquired in the same region as Fig. 1, but I couldn't tell from Andy's publication.

*The location of seismic line C1 from Smith and Murray 2009 has been added to Fig. 1 and a reference to King, Annals of Glaciology, 2009 has been added at Page 2, Line 32 which provides the regional context.*

Fig. 4: add some scale bars *Scale bars don't work well on a 3D diagram so grid lines that give scale have been emphasised and the caption amended accordingly.*