

## ***Interactive comment on “Temporal and spatial variability in surface roughness and accumulation rate around 88 S from repeat airborne geophysical surveys” by Michael Studinger et al.***

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General comments:

The authors of this well-presented study make good use of existing, open datasets to address an important aspect of remote sensing. Centred around the validation of 2 contemporary remote sensing platforms widely used by others, the study site and datasets place this article well within the remit of the journal. Multiple sources of geophysical data remotely sensed from airborne platforms are used to investigate surface roughness, slope and wind direction along the whole latitude of 88°S, along with a novel way to model accumulation rate.

The use of MSWD is here justified through use in other studies, although it seems as though the very low surface gradient and low accumulation rates would make it difficult to find a balance of scales that would show a clear relationship. Low accumulation rates and relatively low amplitude roughness at the scales studied present a similar issue. As a suggestion for further possible investigation (and being aware that the authors acknowledge a lack of 3D data), I wonder if surface anisotropy would show any correlation with accumulation? Particularly as sastrugi are widespread and have a directional element.

Overall the work was structured logically, clearly articulated and would be reproducible. The methods are well explained and justifiable, with some reasonably thorough interrogation of the findings. I think this is a worthwhile contribution despite the overall negative outcome. The authors are aware of the limitations of the data used and are frank about not being able to achieve the initial aim. Importantly, they don't try to overstate their findings. I would recommend the study be published with the minor corrections suggested here, along with any suggestions from other reviewers.

Specific comments:

Lines 94-94 – what is the normal annual layer thickness? An example and a citation here would be helpful

Line 106 – insert (sastrugi) after “distinct elongated snow surface features” and delete next sentence on line 107.

Lines 131, 160, 182 & 185, 324 – ‘herein’ should be ‘therein’

Line 134 – no need to define sastrugi again. This sentence can be merged with the following sentence.

Line 160 – Merge Gow (1965) citation into previous citation, separated by a semicolon.

Line 165 – change “Slope-dependent accumulation are” to “Slope-dependent accumulation is”

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Line 188 & 191 – I guess by ‘3rd order polygon’ you mean 3rd order polynomial?

Line 189-191 – did you test the different methods of detrending? If so, I think including a brief summary in the supplementary information would be appropriate; if not, I’d change the language (‘significant difference’ implies a statistical test was applied) and cite a study that has shown this to be the case.

Line 192-194 – you refer to range bins in the sentence before defining them in the next sentence. These two sentences can be merged.

Line 198 – how many points were discarded? Maybe include a value or percentage here

Line 201 – include velocity value here for reader-reference

Line 203 – ICESSEN doesn’t seem to be defined anywhere

Line 235 – is the reason for discounting ice-dynamics related roughness just to be sure that features interpreted as sastrugi are sastrugi, for mapping wind direction? Otherwise, why make the distinction?

Line 252-253 – if the dunes move ~60m in 34 years, would the ~7 m movement in 4 years make that much difference to the coverage of the data? Also, what kind of process moves the dunes, is it aeolian or ice dynamics?

Figure 5 – do the semi-circular artefacts in panels (a) and (b) have elevation values, or are they no-data? (My eyes aren’t good enough to tell!). Do they affect the roughness values at all? Why do they not appear in (e)?

Line 324 – units missing from slope value, i.e. slopes  $\geq 0.002^\circ$

Figure 6 – Slope units also missing here, assuming the correct unit for MSWD is degrees?

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