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Interactive comment on "Two cases of aerodynamic adjustment of sastrugi" *by* C. Amory et al.

Anonymous Referee #1

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General points

In this paper the authors use wind profile data collected during austral winter at an Antarctic automatic weather station to study how drag coefficients change as a result of wind direction variations relative to the orientation of sastrugi. It is found that as the wind changes from blowing along the axis of the sastrugi to partly across the axis, the drag coefficient initially increases substantially but relatively rapidly (over $\sim$ 3 hours) returns to its previous (lower) value. The authors suggest that this indicates that, following a change in wind direction, sastrugi are rapidly realigned with the new wind direction as a result of redistribution of blowing snow.

The methodology used is sound. Very strict quality control criteria were applied to the wind profile data before drag coefficients were calculated. This may explain why only

two cases were chosen for analysis from a whole winter of collected data. However, it would be useful to know how many other cases (if any) could have been selected and why they were not presented here. If there are other cases that do not fit the pattern of the two described in this paper, this fact should be mentioned.

One weakness of the study is that no direct measurements of sastrugi orientation are available, so this parameter has had to be inferred from the measurements that were made. The authors suggest that a mini laser scanner could provide valuable information on sastrugi form and alignment. This is certainly true, but even a simple camera system could provide some useful data and might be considerably simpler to install and operate at this remote site.

Overall, this is a good paper that contributes significantly to our understanding of how aeolian processes affect surface drag over polar snow surfaces. The measurements presented have been put into the context of previous work in this field and clear recommendations have been made for future work and the development of parametrisations. I recommend publication of the manuscript in The Cryosphere following attention to the specific points that I have listed below.

Specific points

1. P6005,l21-24: Confusing sentence, "...greater but slower..."?

2. P6009, l6-10: If FlowCapt cannot distinguish between precipitation and blowing snow, surely the FlowCapt flux is an upper bound to the blowing snow transport?

3. P6011/Fig 4: What are the uncertainty bounds on the calculated CDN10 values? These can be deduced from the confidence limits on the log-lin profiles fitted to the wind data. Are the temporal variations seen in Fig. 4 outside these uncertainty bounds?

4. P6011, l9-12: ECMWF analyses only "indicate" modelled precipitation, which may or may not relate to what was actually happening. Have you checked weather/precipitation observations from the nearby Dumont D'Urville station?

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5. P6011, section 3: For the first event, how long had the wind been blowing from around 140 degrees at above the threshold value? Was this long enough for the sastrugi to become aligned with the wind before it changed direction to 160 degrees? For the second event, there is little snow flux during the period before the wind direction changed, so how confident can we be that we know the sastrugi orientation during this period? I think it is worth noting that there is a strong correlation between wind direction and drag coefficient during period A2, with the lowest drag coefficients occurring for a wind direction of around 140 degrees, suggesting that this was the sastrugi alignment before erosion started and the wind changed direction.

6. P6013, l13 onwards: I think the suggestion is really that the presence of blowing snow may affect CDN10 by introducing an additional source of surface drag. The wind profile measured well above the saltation layer will then reflect the total drag – i.e. that due to surface roughness plus the additional contribution from the saltation layer. I'm not sure whether you are suggesting that the Owen parametrisation is wrong or that, in your observations, variability in CDN10 due to Owen's effect are swamped by those due to sastrugi alignment.

7. P6016, l21: Presume you mean "real-time observations of the form of the sastrugi. . ."?

Interactive comment on The Cryosphere Discuss., 9, 6003, 2015.