

Interactive comment on “The evolution of snow bedforms in the Colorado Front Range and the processes that shape them” by Kelly Kochanski et al.

Anonymous Referee #2

Received and published: 25 March 2019

General comments:

This study uses an interesting set of pictures of the snow surface collected in a mountainous location to propose a comprehensive and original synthesis on snow bedform dynamics that undoubtedly contribute to improve our understanding on this quite undocumented subject. The manuscript is really well written, the semantics is appropriate and I really enjoyed reading it. The various and pertinent descriptions made from analysis of the footage and field measurement as well as the efforts put to physically relate and interpret them in terms of driving processes is really appreciable. Ways forward are provided and remaining gaps are identified. I recommend the paper as suitable for

C1

publication providing the authors can address the following minor comments.

- P6, L8: “unsintered, unbroken snowflakes”: Strictly speaking this sounds like idealized conditions since sintering starts naturally with vapour transfer as soon as snow is deposited and overburden pressure causes breaking of original crystal forms. Prefer simply loose snow or fresh snow layers.

- P6, L32-33: “Instead of the other way round”: Do you mean that your conclusion, which is self-sufficient and quite relevant to me, is less intuitive than the reversal involving an influence of dune velocities on blowing snow fluxes? Because it is actually the opposite.

- P18, L13: “In the aeolian world”: such a seductive phrase. I know rules are sometimes meant to be broken, but yet this is not suited for a scientific paper I’m afraid. Stop the sentence after “analogous” or replace with “among aeolian features”? I’m just suggesting.

- P20, L07 and elsewhere: Prefer “friction velocity” to “shear velocity”.

- P20, L4-6: Comparatively to the wide range of z_0 values that have been reported for aerodynamically rough surfaces, 0.2 mm is not “much lower” than 1 mm. See for instance Jackson and Carroll (1978) who reported centimetric z_0 values for winds blowing perpendicularly to the sidewalls of high sastrugi (there seems to be a confusion in the actual value of z_0 for planar snow since 0.5 mm is higher than 0.2 mm). Note that changes in z_0 of several orders of magnitude can also occurs depending on small shifts in wind direction without changes in wind speed, which may involve a few comments on the wind directional range at your study site. But, in line with my next comment, I don’t see the added-value of this section.

- P20, L1-15: A bit of confusion here. Friction velocity intervenes for the lifting of particles of the surface and must overcome the cohesive and gravitational forces to trigger saltation. Once airborne, suspension of particles is ensured by a (wind) drag

C2

force high enough to compensate for the gravitational pull. Moreover, there is no need to my opinion for such approximative calculations to finally state that smaller and lighter particles are preferably carried out by suspension than larger ones. Just evoking that the suspension transport mode is governed by a local dynamical balance between the downward gravitational force and the upward drag force due to turbulence logically permits such a statement without any quantitative illustration. From this perspective the estimation of the friction velocity in the above paragraph is not needed anymore. In addition I don't see clearly the link of this paragraph with the rest of the text. Maybe consider removing it.

- P21,L3: Could you give references to support the values attributed to the effective density and diameter of saltating snow grains?

- P21,L27: How do you know? Any reference?

- P21, L27-31: That final part of the discussion is not really convincing and does not shed light on anything. As you can't provide any measurements of grain size there is no need to speculate, even qualitatively, on suspension rates. You could remove it without altering the quality of the discussion, which is already quite long.

- P25, L5: This generalization sounds a bit hasty. This is not necessarily true in windswept regions subject to quasi-unidirectional flows and relatively high snowfall rates and where erosional bedforms prevail, such as crest and/or windward slopes in mountainous regions, the accumulation zone of the Greenland ice sheet or a large portion of the Antarctic coast. That is, in many regions. Be more specific on the conditions required for your assertion to hold true.

Typo and misspelling: - P1, L20: You have reversed last and first names: "Bellot" is Hervé's last name. - P1,L20: Spell Naaim-Bouvet instead of Naiim. - P6, L32: "blowing snow" instead of "blowing slow" - P10, L12: I guess "collected" must be used instead of "collect" - P10, L12: "continuously" instead of "continuosly" - P21, L30: "grains" instead of "grans" - P22, L3: "a too large number" instead of "too large a number" - P24, L4:

C3

"are they" must be removed

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2018-293>, 2019.

C4