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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Turbulent Characteristics of Saltation and Uncertainty of Saltation Model Parameters" *by* Dongwei Liu et al.

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Reply to SC2: We wish to thank SC2 for her efforts to work through our paper and providing very helpful comments.

Our reply to her comments are as follows:

Comment to Fig 3: thanks for this very good suggestion. We will slightly change the graph to make the hysteresis clearer

Comment to Fig 4: As suggested, we will modify the figure. Figure in preparation.

L247: Accepted

L268-269: Yes. This can be seen from size solved Q data

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L378-387: Thanks to SC2 for this comment, in which she stated that “I think making this conclusion here is somewhat problematic, because it is based on data sampled for Q < 3 g/m/s. Although Q depends on u* and therefore small Q are likely to coincide with small u*, u* might not be the only reason for Q to be small. Therefore, sampling for small Q might introduce a bias by selecting only those Q that already tend to have small c0, in particular around 3 g/m/s, the selected cut-off. The result of smaller c0 for smaller fluxes can therefore in my opinion not unambiguously be used to prove a dependence of c0 on u*/turbulence.”

This discussion motivated us to think deeper about the process of saltation and we would like to retain our argument in the text. Basically, weak saltation occurs in case of smaller friction velocity. We now know that for smaller friction velocity, saltation becomes gradually more intermittent. Therefore, c0, a description of the relation between time averaged saltation flux and time averaged friction velocity becomes smaller. We added a sentence and hope it becomes clearer.

L410-412: Clarified.

General comments: SC2 made two general comments as follows: “I have two general comments/questions: (1) I wonder whether there might be a (small) temporal delay between measured winds and the associated measured Q_1s which could depend on particle size (due to the particles’ inertia) and which might have an effect on the parameter results. Perhaps this could be worth exploring, even if only to rule it out. Due to the necessary temporal integration of u*, this is likely invisible though (if present at all). (2) How do you think the parameter PDFs would change for a different (perhaps less ideal) surface? I think that a brief discussion on that would be very interesting.”

Due to data limitation, we do not have shear stress data with one second resolution. Consequently, we were unable to check the correlation of shear stress and sand drift at frequency of 1 Hz. The question rated by SC2 is certainly important, which we will investigate with better experiment design and instrumentation. Our data show that

the two quantities are well correlated at the frequencies of large eddies and synoptic events, a pronounced phase shift between the two quantities is so far not identified. Earlier studies (e.g. Butterfield, 1991) suggest that the response time of the aeolian surface is about 1 second, therefore, we do not think there are phase differences between saltation flux and shear stress on time scales over one minute or longer.

We thank SC2 for this comment. We will add a paragraph of our view on the problem. We will also cite two recent papers by Raffaele et al. (2016; 2018). The added paragraph will be as follows:

In this study, we highlighted the need to better understand parameter uncertainty in saltation models and the processes responsible for the uncertainty. The concept of threshold friction velocity as a stochastic variable was first proposed in Shao (2001). Raffaele et al. (2016) more systematically examined the probabilistic distribution of u*t using data compiled from earlier publications. Raffaele et al. (2018) then studied how u*t uncertainties propagate in saltation flux calculations and reported that in the case of small excess shear stress, all models they tested amplify the uncertainty in estimated saltation flux, especially for coarse sand. This finding is consistent with our notion that c0 also is a stochastic variable. Our estimates of the parameter uncertainties are based on the data of a relatively simple aeolian surface. For more complex surfaces, we expect the parameter uncertainties to be even more pronounced.

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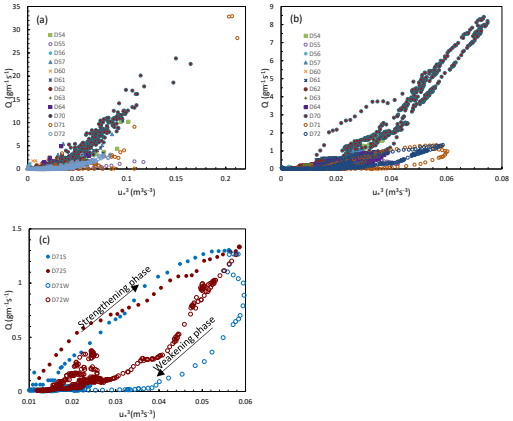

Fig. 1. Fig 3.

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