Review on the "Persistent and non-negligible aerodynamic entrainment during dust emission: new evidence from field observations and wind tunnel experiments" by Yang et al.

While saltation bombardment is considered as a major driver for mobilizing surface soil into dust, aerodynamic entrainment is also considered to make some contribution. However, the contribution of aerodynamic entrainment is still highly uncertain. The present study investigates the impact of saltation and aerodynamic entrainment on dust emission using the field measurements and wind tunnel experiments. The study has used well-established measurement methods to estimate the impact of both soil mobilization processes including threshold friction velocities, PM10 emission flux, and saltation number. The study further employs two theoretical models namely, LH00 and Zender-03 schemes, to examine the mobilization processes. The paper lastly proposes a new conceptual model to explain the persistent aerodynamic entrainment.

Overall, the paper has conducted an extensive measurement and wind tunnel experiment which provides useful information for dust emission processes in real world. They found non-negligible and persistent aerodynamic entrainment from both field measurement and wind tunnel experiments which can ranging 16~62% of total dust emission. The finding is potentially beneficial for the research community to better understand current dust emission processes. However, the study needs more data analysis, error correction, improve figure and analysis. I would recommend the paper to "major revision", however I also have suggestions in many places throughout the manuscript which I would like to see in the revision.

Major comments:

The study has highlighted that the contribution of aerodynamic entrainment is 16~62% from the wind tunnel experiment, without enough explanations for the large variability. The study needs more systematic and thorough analysis to explain these large variabilities and what factors are involved in. For example, what are physical explanations for the large variability of the contribution of aerodynamic entrainment in Figure 7, with varying friction velocity and saltating particle size? What are the statistics of the dataset such as mean, median, and standard deviation of the data in field measurements and wind tunnel experiments?

Is soil texture data available for field measurement site? Then I think that you can examine dust emission by saltation and aerodynamic processes with soil-texture, which is relevant to the current study. This analysis is currently ignored.

Another missing point is that the size range is only limited to D<10 um, while many global models have size range to 20 um or larger, and many field campaigns measure dust particles larger than 20 um. I would strongly suggest adding results for the extended the size which will have better size representation for other dust studies. The study defines that the saltating particles are larger than 125 um, and therefore it seems they

have data for the particles in size of 10~125 um. Why saltation particles are defined as larger than 125 um and what are the effects of the saltation of the particle size <125 um?

Figure 4: The figure is confusing and it need to be more improved. Why M01 shown in (a), but not (b)? There are five samples missing in (b). Maybe you can list M01 in (b), but without data shown and so on. Secondly, I would think TFVs is lower than TFVa, however, I see TFVa values are often lower than TFVs. Please explain it. Thirdly, different variables are plotted for PCFDS and PCMDS between (a) and (b). It makes very difficult to understand the relationship between TFV and PM10 data.

Figure 9 and the conceptual model: The major difference between Figure 9b-d and Figure 9e-g is that saltation exists constantly in Figure 9b-c, however saltation only exist in the first part in Figure 9e-g. I do not understand what process explains the absence of saltation in Figure 9g? Please elaborate it.

The conclusion needs a major improvement. The current manuscript does not have much of useful information to summarize the whole analysis conducted.

Minor comments:

L11-12: Please state what is the primary mechanism. I think it is saltation.

L15: Please specify what does a in TFVa stand for.

L17-18: The aerodynamic range of 16~62% is very large. I have a strong feeling for more analysis is necessary to explain the variaiblty.

L22-24: Please specify how often the study found the persistent and non-negligible aerodynamic entrainment? Always or sometimes? What causes the occurrence frequency?

Paragraph of L52: It need to be more specific about what is current estimates of aerodynamic entrainment contribution to total dust emission.

L62-64: Please be specific if the goal of the paper is (1) whether aerodynamic entrainment can persist, (2) the extent of its contribution to dust emission, and (3) what role saltation bombardment plays in the emission process?

L64, End of section 1: Add a few sentences how the paper is organized.

L88: "Following previous studies," Add references.

L91: May be u_*, not u^* (subscript or superscript)? Please be consistent it throughout the manuscript.

L108-109: Equation 2 is definitively not for threshold friction velocity and threshold friction velocity cannot be obtained from Equation 2. It needs to be corrected.
s and a in TFVs and TFVa: Consistent either regular or subscript font.

L111: Method for TFVa calculation is not given.

L129-130: PCMDS and PCFDS. They need to be more clearly described. What is the exact acronyms for them? Is it size concentration of certain size range such as <10um?

L132-134: Please elaborate how TFVa and TFVs are estimated from the PM10 content.

L133: Please be specify which TFV between TFVs and TFVa.

L156: Can you specify the soil sample location? Maybe you can list Table 1 here.

L155-159: This is not a physically based reason. I would suggest delete it. Add reference to the second reason.

L166: "external sand" It needs to be explained more detail. It seems me it is related with the characteristics of the saltating particles, however it is unclear now. For example, how it is defined and what processes were done to acquire “external sand”?

L167: do x-y-z have specific units for them?

Figure 2: It needs more description. For example, what are cylinderical object in Development stage? What are the different colors for? Where are the external saltation sand located? Please state of comparison stage.

L189: 0.87 is from Zender et al. (2003) in LH00 model? Please check reference again. If 0.87 is indeed from Zender, then what is the value in LH00 and why not taking the number from LH00?

L218-219: Please further explain reasons for no data?

L220-221: Confusing. Please rewrite it.

L223-225: The sentence needs to be more elaborated. Why no saltating particles are detected? Is it real soil texture conditions or measurement related issue? It is hard for me to imagine that the surface is consist of particles only less than 10um in diameter.

L232-238: Is it Case (I)? If then move it to before case (II).
Please be more specific how you can separately estimate TFVa and TFVs, where they are happening simultaneously?

L234-235: It is confusion. Saltation and aerodynamic emission occurring simultaneously. However, it states that saltation is not necessary? Please improve it.

L237-238: The sentence is misleading since the presented result have not shown the relative impact of aerodynamic entrainment in dust emission.

L242-243: "limited dust supply is not valid". It is confusing and maybe misleading. It need to be explained more detail.

L241-245: The paragraph is incorrect and it needs rewritten. Figure 4a compared with PM10 however Figure 4b compared with Salting Particle contents. What would happen if PM10 is compared in Figure 4b?

Figure 3: Add unit of Saltation Number. There is no saltation in this group. Is it related with the size of Saltation particle is too large (D > 125um)? Please add wind speed (U or U*) of each panel and discuss the relationship between PM10 and wind.
Is Time Local Time?

Figure 4 title: Please be specific about PCFDS and PCMDS somewhere in capture of in text.

L260-264: Please explain how Type A and B are determined in Figure S4 and Table 3.

How Type A and B are different from scenario II?

L268-269: The result of M09 is confusing and it needs to be improved. My point is that the sum of Type A and B is 29.5% and 7.4%, however it states in L270 that 70.4% is due to Type A and B.
What is the wind velocity or friction velocity for M09 during the experiment?

L269-270: PM10 and saltation particle number in M09 look highly correlated. I am not sure how can you tell if M09 emission is from saltation (65%) and aerodynamic (35%) processes?

Table 3: Please explain Type A and B in table caption.

L290: Maybe consider change F with Fobs, to distinguish from models.
I think Fa, Fs, and Q are model values and they are highly uncertain due to the complex surface conditions. How confident are you for Fa, Fs, and Q in estimating saltation and aerodynamic emission?

Figure 5 and 6: Result shows that PM10 values increase with wind speed of 8~12 m/s. It would be interesting if you can expand the emission flux relationship with wind speed.

L327-330: Please specify why PM10 emission varies by saltating particle size.

L392 and paragraph: The pattern of model time series is reasonably similar with observation in Figure 5, although its magnitude is an order lower. Does it mean that model also includes tuning constant issue?

L409-418: I am not sure what is this about. Please improve the sentence.

L476-478: I would suggest to provide how much of aerodynamic entrainment is in total emission flux in terms of range or mean values.

Section 4.3(3): I would not agree on this, i.e., saltation can occur continuously in a few hour time scale. Right? Please improve this part in the revision. Or you should more elaborate why saltation process cannot sustain in longer timeline.