This paper uses wind tunnel simulation and modelling to investigate the response of the sediment entrainment rate to large scale, quasi-convective eddies in boundary-layer air flows. This is a very important topic of interest within the aeolian research community, such that this paper is well aligned with current research needs.

With moderate revision, particularly the inclusion of a great deal of missing information, it may be suitable for publication.

<u>Minor corrections</u>:

Title: Define the term 'dust' in the context of this study. You should be clear that you actually do not measure/profile the aerosol concentration of the airflow in this study, so the title is misleading. Perhaps you should say 'silt' instead, or drop it altogether.

Line 20: Circular argument or poor wording, "turbulent flow is also turbulent"

Lines 27-28: Poor wording - "impact" (geophysical process associated with saltation) should be "effect". In addition, "flow is turbulent, and aeolian processes also." Aeolian processes are affected by turbulence but are **stochastic**.

Line 74: "scan valve" perhaps should read "scanivalve"

Lines 84-84: Define what you mean by 'flutter" versus "flap".

Line 80: Define what you mean by "positive skewness" with regard to vertical velocity fluctuation. Does positive refer to eddies bursting up away from the bed (+ve w) and negative to eddies sinking down toward the bed (-ve w)? This section is a bit vague.

Line 89: The fan speed in rpm is meaningless to the reader. Provide free stream velocities for WP instead.

Line 93: Either provide the standard deviations to indicated the sorting for each test sediment or a figure showing the full distribution of particle diameter within each sample. This is important as most test beds will undergo some degree of grain scale armouring when subjected to an air flow and this is likely to be strongly affected by τ'.

Figures Much too small and almost impossible to read.

Symbols A number of mathematical symbols appear in the manuscript well before they are defined and sometimes they are either not defined at all or the symbol has an inconsistent typeface.

Line 165 Specifically you mean the **net** mass loss (integrated over time).

Lines 163 and 170 "Emission rate" interchanged with the "entrainment rate". The former is usually used when talking about dust and the later with the mass transport of sand. This may confuse some readers. Since you are not measuring the dust flux (aerosol concentration) then if might be best to just say "entrainment rate" everywhere.

Substantive comments:

Figure 1 and Section 2. This is the weakest section of the paper with a great deal of missing information and weak justification of the experimental design.

Flapping cloth:

i) This is not a novel solution for creating turbulence in wind tunnels. Provide one or more references to previous work.
ii) Details of the flapping cloth are missing. What type and weight of fabric? Width is given but more importantly, how long was the sheet? What was the wavelength, amplitude and frequency of its oscillation?
iii) Rationale is not provided for the placement of the cloth relative to the test surface. Is the elevation scaled with the length of the cloth or distance from the leading edge of the sample tray?
iv) Spires are much more commonly used to generate large scale eddies in wind tunnel simulation work and these are typically placed upwind of the roughness element array. There is also a large literature on the effect of spires on turbulent flow and shear. Why did you elect to use a flapping cloth over spires?

Pitot tubes:

i) Provide dimensions. Pitot tubes come in a range of sizes, while large tubes places in a fixed vertical array can initiate flow stagnation – bluff body effect.
ii) What did you sample the pressure difference with? State precision and sampling time.

Measurement of the mass transport rate:

i) One of the greatest challenges with accuracy in measuring mass in the lab using an electronic balance is drift associated with changing air pressure in the room. So it is possible that any instantaneous fluctuation in F is the a consequence of both the change in mass of particles in the tray and the pressure perturbation in the flow. This would be particularly exacerbated by the presence of large scale eddies. Please explain in detail how you accounted for this in your analysis. Was the total mass loss obtained from measurements in the absence of an airflow or did you average the instantaneous mass transport rate throughout the test?

Hot wire anemometer and Irwin sensors:

ii) Please state in line 70 that the instrument only samples in 1D
iii) Was the wire ruggedized to withstand particle impact during saltation? If so, how did this affect sensitivity (time constant and precision)?

iv) Please provide exact dimensions of the Irwin sensor rather than a citation. The height of the central port does vary from study to study and is important to know relative to the roughness of the bed surface. Describe also the roughness of the bed surface upwind of the sample trays. Was it smooth or roughened to give a suitable aerodynamic roughness matched to that of the sand in the tray?

Section 2.1 Results

Table 1

i) Why so many missing experiments? Indeed, there are so few experiments at the 0.5 X1000 rpm increment that it might be better to exclude these data altogether. Add the freestream velocity values for the NP experiments, as rpm will make little sense to the reader.

ii) Describe the bed surface composition for your control runs without a tray/soil.

Figure 3

i) I am not clear on the surface/sediment texture characteristics pertaining to these data. Have the data for all textures been lumped together?

ii) The NP vertical profiles of the total velocity look great – a deep well-structured boundary-layer flow following the law of the wall. The WP profiles also look very good, but I think even more might be inferred from them than what is provided. There is indeed a high degree of flow stagnation in the upper part of the profile above 20 cm associated with partitioning of momentum to the flapping cloth turbulent but also turbulent energy dissipation within the wake flow downwind. However, little is said about the proportionate acceleration of the air flow (~0.5 m/s) at all levels below 20 cm in all WP experiments. This is unexpected and could be a wind tunnel artifact associated with a small degree of compression of the flow that was redirected beneath the cloth and between the confining walls.

iii) It is really unfortunate in this study that the vertical component of the total wind speed was not isolated and sampled, as required for analysis of the eddy structure. As first identified by Thom (1975) for truly unstable conditions with convection, mechanical effects (roughness) dominate the near surface flow, but in moving away from the surface the eddies are stretched vertically and the momentum flux is enhanced. Since the vertical velocity is generally one to two orders of magnitude smaller than the horizontal component, the total wind speed as sampled in this study cannot be particularly sensitive to the eddy perturbation that was intentionally created.

Table 2

i) Again, I am not clear on whether the data have been averaged across all sediment textures or this is just one example for a specific texture.

ii) Why is the threshold friction velocity also not reported here?

iii) Over what elevations were the wind speed data used to calculate u*? If the boundary layer depth is taken to be 20 cm for the WP experiments and the inner constant stress region 15-20% of that, then your calculation might only be based on 4 data points. That is, the shear stress values for the WP experiments would carry greater error than those for the NP experiments. How does this uncertainty compare with the roughly 7% increase in u* associated with introduction of the flapping cloth?
iv) Under what conditions were the Irwin sensors calibrated – NP or WP? This has a large bearing on an explanation for why the Irwin sensor u* values sit slightly higher than for the WP data.

Section 2.1.3

Line 171

"Convective turbulence is much more efficient in lifting particles into the air". Caution should be exercised in making such a broad statement. This may well be true for very light particles (aerosols) entering suspension, given a settling velocity that is lower than the vertical velocity at which eddies burst away from the bed surface, but not so for very large sand particles. Once again, it is unfortunate that you can only infer such effects because you don't have the vertical component measurements.

Figures 4 and 5

There is no question that positive skewness in the instantaneous bed shear stress should increase the particle entrainment rate at low values near threshold, but the fact that the near surface flow is accelerated (especially at lower elevations) by insertion of the flapping cloth is likely to be equally if not more important in this particular study.

Conclusions

Logic dictates and your study shows that intermittent generation of large shear stresses on the bed surface enhances the entrainment of sand and silt sized particles. This should be qualified by some form of statement to indicate that this effect is greatest at low wind speeds around threshold and when transport is intermittent. In really strong winds mechanical or impact entrainment dominates, while the particle borne stress largely determines the transport under saturated conditions.

"we showed that wind-tunnel turbulence lacks energy containing eddies even compared with ABL flows in neutral conditions, highlighting the deficiency of traditional wind-tunnel experiments on aeolian studies". Again, this is a bit of an **overstatement**. Most traditional wind tunnel studies have modelled saturated flows (see above) where the particle cloud itself is so dense that it alters the turbulence structure. Since the development of fast response pressure transmitters, cross-wire probes, and laser Doppler anemometers more than 2 decades ago, aeolian researchers working in wind tunnels have indeed provided detailed measurements of the turbulence structure and intensity associated with sediment entrainment and transport while also investigating the effects of wind gusting (e.g. Li and McKenna Neuman 2012, 2014 etc). Similarly, there are many means by which we can and do generate large scale eddies in wind tunnel simulation and these are widely practiced in engineering applications, particularly in investigations of wind loading on urban structures.