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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effects of three-dimensional electric field on saltation during dust storms: An observational and numerical study" *by* Huan Zhang et al.

Anonymous Referee #1

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At present, there are many researches focus on vertical electric field in dust storm. This manuscript reports the observation of three-dimensional electric field generated in dust storm, and establishes numerical simulation model to study the effect of three-dimensional electric field on sand saltation.

1. The paper shows the observation of 3D electric field in dust storms. However, the characteristics of 3D electric field has been reported in another paper of the author (Atmos. Chem. Phys., 18, 17087–17097, 2018.), thus, ". . ...performed the first-ever measurements of 3D E-field. . ." is questionable.

2. In this manuscript, the observation values are decomposed into streamwise E-field,

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spanwise E-field and vertical E-field by mathematical method. However the manuscript does not explain why streamwise E-field and spanwise E-field happens, and why are they an order of magnitude larger than the vertical electric field? The effects of streamwise E-field and spanwise E-field on sand saltation are not clearly explained. In fact, this should be the highlight of this manuscript.

3. In Section 3.2, how to determine the value of charge-to-mass ratio? Is a specified value, or the charges generated by sand particles collision, in fact, the charges generated by the collision of 100 uncharged particles in the calculation domain should be very small.

4. In Section 3.2.1, the effect of turbulence on the movement of sand particles does not consider in severe dust storm, which obviously affects the charged characteristics of sand particles and electric field distribution in dust storm.

5. In Section 3.4, how to determine the value of rho(hj), the value adopted in the model should be given.

6. Section 3.5, about the computational domain 0.5 m $\times$ 0.1 m $\times$ 1.0 m, the electric field in the x and y directions is an order of magnitude larger than the z direction, while the length in the y direction in the calculation region is only 0.1 m, although periodic boundary conditions are set, the particle collision characteristics have changed.

7. Fig. 5(c), the author should give the reason for vertical component E3âĹŮ increases monotonically as height increases in the saltation layer.

8. The boundary conditions in the simulation are not exactly the same as those in the observations. Section 4.1, the author should give a calculation method of the total mass flux in the simulation.

9. Section 4.3, the conclusion of “3-D E-field enhances the total mass flux even up to $\sim$63%” is not sufficient. The manuscript does not give the basis for lambda(i), and the meaning of specified value of lambda(i) in Figure 9(b) is also not clear.

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