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Interactive comment on "A simulation of the large-scale drifting snow storm in a turbulent boundary layer" *by* Zhengshi Wang and Shuming Jia

Anonymous Referee #2

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General Comments :

The submitted manuscript described novel large-eddy simulations of large-scale blowing snow-storms. While the models utilized are well-established, such a phenomenon has not been previously explored using LES. The results of the simulations and their description and analysis are interesting and this reviewer feels that this study may be published in TC.

However, there are some major concerns that should be addressed before hand. The comments are listed below ordered by section.

Specific comments :

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Discussion paper

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Section 2.1 : There seems to be misunderstanding about the use of the SGS velocity approach of Vinkovic et al. The SGS velocity is defined with respect to the frame of reference of the particle and not the flow. Thus, the splitting of local wind velocity as 'large-scale' and 'subgrid-scale' computed using Eq. 4 is incorrect.

Section 2.3 : Note that τ is not the total fluid shear stress but the total shear stress. When there are negligible particles, say at z > 1 m, τ and τ_f are equal. In lines 148-149, why is the ejection number set to 1 ? where does this value come from ? Sugiura and Maeno measured a much higher value .

Section 2.4 : Why is the initial potential temperature and relative humidity of the atmosphere described ? Is it relevant for the discussion ?

Section 2.4: The imposition of constant heat flux at the surface is perhaps the most questionable point for this reviewer. The study of Pomeroy and Essery found the 50 W/m2 flux for a brief period of time (20 mins perhaps) during which, there was no blowing snow. Infact for most of the study, the sensible heat flux is either negligible or negative. The imposition of a constant heat flux at the surface is in effect creating a convective boundary layer that is providing a constant supply of energy in the form of vertical motions.

Section 2.4: line 179: How many snow particles are present in one particle parcel ?

Section 2.4: What is simulation time step for the flow as well as for the particle dynamics ?

Section 3.1 : This reviewer (as well as the readers !) would highly appreciate vertical profiles of horizontal wind speeds simulated for different $u_\star$.

Section 3.2 : lines 250- 253 : The exponentially decaying transport flux profile is used to describe the saltation layer only and not the suspension layer.

Figure 7 and the corresponding text is a good result - but how are these numbers affected by the surface heat flux imposed ?

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Section 3.3 : Lines 273-274 and Figure 8 : what is meant by snow storms without atmospheric turbulence ? How was this simulation achieved ? This is extremely unclear.

Section 3.3 : Figure 10 and the corresponding text : This reviewer feels that this result is extremely dependent on the imposed heat flux at the surface – How is this 'thickness' dependent of the surface heat flux ? The snow particles in the present case seem to reach the top of the computational domain !

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