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Interactive comment on "The impacts of moisture transport on drifting snow sublimation in the saltation layer" *by* N. Huang and X. Dai

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We'd like to thank Referee 1 for the comments. We have studied the comments carefully and the responds are as follows.

This contribution addresses an important problem, which is globally unresolved namely how much snow mass is lost back to the atmosphere during drifting and blowing snow. The contribution now tries to quantify snow sublimation in the saltation layer, which is typically regarded as insignificant because of quick saturation. The authors present a concise and well-written article, which nicely discusses her main hypothesis that continuous transport of moisture out of the saltation layer may play a significant role.

Reply: Thanks for the reviewer's recognition of the importance and the writing of our manuscript.

However, their model assessment is fundamentally flawed and the paper must therefore be rejected. In the quantitative model assessment, the authors introduce (p.7 l.11) a completely arbitrary sink of moisture due to "advective" transport, which is contradicting the model set-up as a boundary layer model. The rest of the model uses the assumption of an equilibrium boundary layer in which forces or sinks/sources are balanced by vertical turbulent transport. By superimposing an artificial and completely unjustified horizontal moisture transport term, you can produce any number for sublimation. The calculation results are therefore not a scientifically sound basis for the conclusion that "DSS rate in the saltation layer can be several orders of magnitude greater than that of the suspended particles".

Reply: As we know, the term (i.e. Q in our paper) described the advection of mean total moisture by the mean wind basically exists in the moisture conservation equation (Roland B. Stull, 1988). Normally, this term is ignored under the hypothesis of horizontal homogeneous, which leads to the condition mentioned by the referee "an equilibrium boundary layer in which forces or sinks/sources are balanced by vertical turbulent transport". Although it is an effective way to simplify the moisture conservation equation for an infinite planar snow cover, this hypothesis is sometimes hard to be satisfied because of some common phenomena, such as patchy mosaic of snow or heterogeneous snow drifting over rough surface (Liston, 1999). In the paper, we did not artificially add the horizontal moisture transport term, but took into account of the ignored term under more complex situation. Actually, the effect of advection is considered via the setups of the entrance boundary and the egress boundary of moisture for the simulated region in our paper. Two extreme conditions were discussed: qin=qout , which represents the advection was not took into account and the other case qin represents moisture of dry air and qout equals to the moisture of air affected by the snowdrift sublimation in the simulated region. Although these two cases may not correspond to the really situation exactly, it is an acceptable and useful way to discuss the possible influence of horizontal advection. Similar method was employed by other researchers, such as Richard Bintanja (2001). Anyway we honestly appreciate the referee for the suggestions and we also found there are some irrelevant descriptions which may cause misunderstanding in our paper. We will carefully check the presentation (including relevant equations) of this part and improve it in the revised version.

There are a (small) number of minor comments such as a missing discussion on surface sublimation or a splash function description on p.9 l.18, which appears to not match the corresponding equations but these are not important compared to the erroneous model set up described above.

Reply: In this manuscript the initial relative humidity profile is set as equation 16 , therefore there will be a saturated layer near the surface for the surface sublimation. As for the description of the splash function and other writing problems, we will try our best to check our manuscript carefully again and improve it in the revised version.

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