Review “Numerical Simulation of a Severe Blowing Snow Event over the Prydz Bay Region” by Ding et al.

Review by Michael Lehning

General:

The paper is a very detailed meteorological analysis of a sequence of an interesting weather event in East Antarctica, namely the propagation of a cyclone from the mid-latitudes. The paper is generally well written and the analysis easy to follow. Figures are of high quality. My main comment is on the descriptive nature of the presentation, which reads as a weather protocol rather than a journal paper. The main result section is too long and detailed and would profit from shortening. The discussion section is very good and an example of the style that could also be applied to the main result section to achieve conciseness. It is further suggested that the authors try to focus on some of the more novel observations such as the height of the blowing snow cloud in the diverse stages from the hydraulic jump to the passing of the cold front. It would also be interesting to analyse the total mass balance of snow during the event and name contributions from precipitation to transport and sublimation.
One major comment is that I did not understand how the authors distinguish between blowing snow and snowfall in their measurement data. Please clarify.

Detailed comments:

l. 47: Make the statement more specific
l. 66: “A study” please give the reference
l. 98: “Another study” please give the reference
l. 105: “A study” please give the reference
l. 112 – 114: This is very old and almost general knowledge, please reformulate and add references if needed
l. 139 – 145: Sentence too long, complicated and probably grammatically wrong
l. 183: Why “Prize” now?
l. 191: Analog OR digital?
l. 142: How did you initialize the snow for the SNOWPACK module? This is quite important as it may help to explain the high threshold friction velocities you find later.
l. 294 – 295: Would give the wind speed range in numbers
l. 322 ff: Shouldn’t blowing snow almost always have a distribution with maximal values close to the ground, if the wind erodes particles or under sustained saltation, the maximum concentrations are found close to the ground and if deposition dominates, it also reaches the ground. Please see also a glossary type of definitions in the appendix.
l. 373 ff: Can you discuss the role of grid resolution in potentially explaining discrepancies?
l. 414: Specify the moment
l. 437: The fine-scale structure of BS mixing ratio in Fig. 7d looks suspicious. It almost appears that y and x axis are exchanged. Otherwise, the repeated pattern of high BS declining with distance from left to right and then jumping again to a high value is not

realistic. It may simply be a problem of the plotting but needs to be looked into to make sure this is not a model problem
l. 472 ff: It is true that turbulence dissipates energy but the primary reason for low wind speed should be the pressure gradient across the hydraulic jump with the turbulence then a consequence of high shear and accelerations, right?
l. 539: Maybe better to say “erosion” here instead of “saltation”?
l. 553: Not clear, do you mean the saltation parameterization?
l. 577: Figure 12a: How can it be that the first layer above ground has significantly lower BS over the whole profile? This is not realistic
l. 601: Do you really mean rain or just precipitation, please clarify
l. 618: Specify the moment
l. 640: Consider introducing a new sub-title as this section includes results from all stages
l. 697: These threshold wind speeds are unrealistically high. Can you explore whether they have to do with your snow initialization or find out why they are so high otherwise?
l. 732: Nice figure, which I would place much earlier in the paper to introduce the three stages
l. 736: Can you also comment on the direction of the katabatic wind since in East Antarctica katabatic winds are typically also influenced by Coriolis because of their long running distances
l. 739: See comment on TKE above

Appendix: Clarifying terms in snow transport

Drifting snow is preferably used synonymously with saltation and blowing snow with suspension, potentially including preferential deposition during precipitation. Preferential deposition (as introduced in my 2008 paper) is strictly only deposition of precipitation, albeit it becomes a bit philosophical if a short rebound at the surface is then counted as erosion / deposition or still preferential deposition. Airborne snow is everything that is in the air regardless of the process behind and I would use it synonymously with aeolian snow. Snow transport is everything that moves snow not only in the air.