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Interactive comment on "Drifting snow measurements on the Greenland Ice Sheet and their application for model evaluation" *by* J. T. M. Lenaerts et al.

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Summary: In this article, the authors report drifting snow fluxes measured on the Greenland Ice Sheet that are then used to evaluate a coupled regional climate model (RACMO2) and blowing snow routine. The measurements were conducted during a field campaign in the fall of 2012 and provide half-hourly records of meteorological variables and drifting snow particle counts 1 m above ground. The simulations capture well the evolution of wind speed, air temperature and relative humidity observed at the study site (station S10 that is part of the K-transect in west Greenland) including the passages of synoptic storms and katabatic wind events. The blowing snow routine

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captures the timing and frequency of blowing snow events but overestimates the typical size of drifting snow particles and the horizontal transport fluxes.

This paper is generally well-written and provides some interesting results and much needed measurements of drifting snow. My detailed report on the paper follows:

General Comments:

1) The field experiment lasted only from 7 September to 6 October 2012 due to instrument to failures. While it is particularly difficult to obtain extended time series of meteorological and drifting snow conditions on the Greenland Ice Sheet, are the measurements of sufficient length (one month) to assess the performance of the regional climate/drifting snow simulations? This is a concern as there are perhaps only 10 or so drifting snow episodes during the study period.

2) It is interesting to note the discrepancies between the simulated and observed distributions of particles 1 m above ground as well as the local drifting snow fluxes. Perhaps further investigation is warranted here to establish the source of those discrepancies and sensitivity experiments with the numerical model should be attempted. For instance, the mean particle diameter, assumed to be 200 microns in PIEKTUK-B at a height z = 0.1 m above the snow surface, could be increased to verify if the model is then able to capture more accurately the observed drifting snow particle distribution at z = 1 m. In addition, PIEKTUK-B assumes the drifting snow particles are at the density of ice (917 kg m-3) and sensitivity to this value should be tested. Perhaps sensitivity tests should also be carried on the shape parameter α of the gamma distribution (say values of 5 to 8 as reported in the present study). Finally, what is the lower range of detection (in terms of drifting snow particle diameter) of the Snow Particle Counter (SPC)? During both case studies, the SPC does not seem to capture drifting snow particles below a diameter of 60 microns – is that accurate?

3) More information on the numerical simulations needs to be provided. How are the model simulations initialized and updated? Is there a model spin-up? What is

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the timestep for the integrations? What information is transferred back and forth from RACMO2 to the blowing snow routine?

Specific Comments:

1) P. 24, lines 18 and 21: Change to "three months" and "nine months".

2) P. 25, line 18: This should be "917 kg m-3".

3) P. 26, line 1: Rewrite as "an 8 m high".

4) P. 26, line 7: Should this be: "H2O/CO2"?

5) P. 26, line 18: How much of the experimental data are omitted in the present study?

6) P. 27, line 25: Is this relative humidity with respect to water or ice?

7) P. 28, line 13: Is there a reference for this assumed snow density of 300 kg m-3?

8) P. 30, line 26: Are the simulated drifting snow particle size distributions also for z = 1 m?

9) P. 31, line 10: The simulated horizontal transport fluxes are highly sensitive to the simulated wind speed. How do the simulated and observed wind speeds compare during the two case studies presented here? Slight overestimations of the simulated wind speed could cause large overestimates of the simulated horizontal transport fluxes compared to observations. Another source of discrepancy may be the detection accuracy of the SPC.

10) P. 39, Table 1: Please use upper case letters for the titles of each column in the table.

11) P. 47, Figure 8: Why are transport rates are expressed in kg m-2 s-1 elsewhere in the paper but here are presented in units of kg m-1?

12) PP. 49 and 53, Figures 10/14: The captions should state: "1 m height"?

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