Geophysical Research Abstracts
Vol. 16, EGU2014-15010, 2014
EGU General Assembly 2014

A Lagrangian model to describe drifting snow in the turbulent boundary layer

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Drifting snow mass fluxes can strongly fluctuate on time scales of few seconds and spatial scales of less than a meter, as has been shown frequently in observations. Most drifting snow models, however, rely on mean flow fields and assume equilibrium saltation. These can therefore not accurately describe drifting snow on short time scales. We use a model combination of flow fields from large-eddy simulations and a Lagrangian stochastic model to calculate snow particle trajectories and infer snow mass fluxes. Such a model approach may allow us to gain more understanding of the influence of turbulence on the temporal and spatial variability of drifting snow on small scales. In this model setup, particle aerodynamic entrainment is driven by the shear stress retrieved from the large-eddy simulations. Results show that this highly influences the snow mass flux varying in space and time, as the aerodynamic entrainment appears to affect the formation of streamers. The obtained fluctuating snow mass flux is compared to field and wind tunnel measurements and shows qualitative agreement. We also address the influence of measurement volumes of different sensor types on the retrieved fluctuations of snow mass flux. The comparison shows that the model results are plausible yet differences between modelled turbulent structures and those likely to be found in the field complicate quantitative comparisons.