Geophysical Research Abstracts, Vol. 7, 06004, 2005
SRef-ID: 1607-7962/gra/EGU05-A-06004

Application of a three-dimensional Lagrangian Stochastic numerical model to blowing snow scenarios; comparisons with observations

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Snow particles in naturally occurring blowing snow events are of different sizes, and the particle size distribution is height dependent. In this study, we have developed an approach to determine a single equivalent particle size to be used in our numerical model to calculate vertical concentration profiles of snow particles in different blowing snow scenarios. The particle size is determined based on the best-fit vertical profile of particle number density from field measurements and the eddy diffusivity inferred in the diffusion limit of a Lagrangian Stochastic (LS) model. Our numerical model is a three-dimensional (3-D) inertial particle - Lagrangian stochastic model for heavy particles in turbulent flows. In this model, particle velocities are computed by adopting a nonlinear drag law, while fluid velocities are calculated in the vicinity of a particle satisfying a 3-D Langevin equation. Vertical profiles of particle number density predicted by our model have shown to be in good agreement with the best-fit profiles from field measurements. The role of the universal constant in the Lagrangian structure function for the inertial subrange to the model prediction will also be discussed.