Geophysical Research Abstracts, Vol. 8, 06181, 2006
SRef-ID: 1607-7962/gra/EGU06-A-06181

Modeling the transport of heavy particles using Lagrangian stochastic models coupled with large eddy simulations

J. Overney (1); E. Bou-Zeid (1); M. Lehning (2); M.B. Parlange (1) ; C. Meneveau (3)

(1) School of Architecture, Civil, and Environmental Engineering, The Swiss Federal Institute of Technology at Lausanne-EPFL, Switzerland (2) the Swiss Federal Institute for Snow and Avalanche Research, Davos, Switzerland (3) Center for Environmental and Applied Fluid Mechanics, the Johns Hopkins University, Baltimore, USA (Contact: jan.overney@epfl.ch)

Particle transport in atmospheric boundary layer turbulence is simulated using Lagrangian Stochastic Models (LSM) coupled with a Large Eddy Simulation (LES) of atmospheric boundary layer flow. The aim is to improve the accuracy of transport modeling of various natural tracers such as snow flakes and pollen and anthropogenic tracers such as reactive and non reactive pollutants. Lagrangian Stochastic Models are based on the assumption that the pair of variables describing position and velocity of a particle evolve as a Markov process. The particle's trajectories in six-dimensional phase space can be modeled based on concepts similar to those in the modeling of Brownian motion. The LSM technique, modified by Weil et al. (2004) to be compatible with LES, is extended to heavy particles. In this technique, the particle follows the resolved turbulent motion simulated by the LES, while the motion due to the unresolved scale is included as a stochastic contribution. The effect of the particle mass is accounted for by imposing a settling velocity and reducing the velocity autocorrelation time-scale along a particle trajectory relative to its value along the fluid pathline. The model results are validated against experimental data from laboratory experiments (convective tank) and field measurements (glass beads dispersion in the surface layer).