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Shape Corrected Settling Scheme in the Lagrangian Dispersion Model FLEXPART

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The shape of radioactive particles varies significantly, 'from compact small-sized crystalline single particles to large amorphous aggregates' (Salbu and Lind, 2005). However, many atmospheric transport models assume perfect spheres. Since non-spherical particles experience a larger drag in the atmosphere, i.e. reduced gravitational settling, the atmospheric residence times and transport distances will be underestimated by these models. In this study, we present a new settling scheme in the Lagrangian dispersion model FLEXPART, which considers particles of different non-spherical shapes and orientations. The scheme is based on the drag coefficient prediction model of Bagheri and Bonadonna (2016) and was tested experimentally by printing particles of various shapes in the size range 50-300 μm (volume equivalent diameter), which were then released in a settling column to determine their settling velocities. We show that the shape correction can extend atmospheric lifetime of non-spherical particles substantially as compared to spheres. The new version of FLEXPART gives the opportunity to prescribe the particle geometry and orientation of falling. These options allow to reduce the uncertainty regarding particle shape and conduct more accurate model simulations of atmospheric concentrations and deposition patterns after potential weapons tests and/or nuclear accidents.

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Promotional text

This study focuses on the atmospheric transport and distribution of non-spherical particles, which are often ignored in the atmospheric transport models. Developed Lagrangian dispersion model FLEXPART allows to prescribe the particle geometry and orientation of falling.

Oral preference format

in-person

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