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Validation of the Monte Carlo model for resuspension phenomena

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Abstract

In this study we present a simulation model based on a Monte Carlo method to describe the resuspension of particles deposited on a flat surface due to air flow. Particles are attached to the surface through an adhesion force, and roughness effects between the particles and the surface are taken into account using a reduction factor. Two versions of the model are developed. In the first, the stochastic process used for particle resuspension is based on the evaluation of probabilities depending on the ratio between adhesion and aerodynamics forces and using a Metropolis function. In the second version, the resuspension probabilities are evaluated from a balance between the adhesion and the aerodynamics moments acting on each particle. A detailed comparison between the model results and different previous experiments is presented. Despite its simplicity, the model has a high capacity to describe the observed behavior of the resuspended particle fraction as a function of the air velocity. The good performance of the moment balance MC model version reveals the importance of considering the rolling mechanism in the resuspension phenomena modeling.

Keywords: Resuspension, Monte Carlo simulation, roughness, air velocity.

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