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Monte Carlo simulations of two-component drop growth by stochastic coalescence

L. Alfonso[1], G. B. Raga[2], and D. Baumgardner[2]
[1]Universidad Autónoma de la Ciudad de México, México City, 09790 México
[2]Centro de Ciencias de la Atmósfera, Universidad Nacional Autónoma de México, México City, 04510 México

Abstract. The evolution of two-dimensional drop distributions is simulated in this study using a Monte Carlo method. The stochastic algorithm of Gillespie (1976) for chemical reactions in the formulation proposed by Laurenzi et al. (2002) was used to simulate the kinetic behavior of the drop population. Within this framework, species are defined as droplets of specific size and aerosol composition. The performance of the algorithm was checked by a comparison with the analytical solutions found by Lushnikov (1975) and Golovin (1963) and with finite difference solutions of the two-component kinetic collection equation obtained for the Golovin (sum) and hydrodynamic kernels. Very good agreement was observed between the Monte Carlo simulations and the analytical and numerical solutions. A simulation for realistic initial conditions is presented for the hydrodynamic kernel. As expected, the aerosol mass is shifted from small to large particles due to collection process. This algorithm could be extended to incorporate various properties of clouds such several crystals habits, different types of soluble CCN, particle charging and drop breakup.

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