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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Monte Carlo simulations of two-component drop growth by stochastic coalescence" *by* L. Alfonso et al.

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Final Response to Reviewers:

First, we would like to thank the anonymous reviewers for their comments that improved the quality of our revised paper. The revised version for ACP includes several of their suggestions.

Reviewer # 1

1) The main concern of reviewer # 1 was related to the comparison of the Monte Carlo algorithm with solutions of the two-component kinetic collection equation for the hydrodynamic kernel. Now, in the revised version, a detailed comparison is presented. The numerical integration of the two-component kinetic collection equation was per-

formed using the fourth order Adams-Moulton predictor-corrector scheme (Gerald and Wheatley, 2004), following the approach adopted by Valioulis and List (1984) for the one-component KCE. The use of the predictor-corrector method severely restricts the number of particle sizes, because of the computational cost, but this is not a limitation for the purposes of comparison between the two methods. For both the Monte Carlo and the finite difference scheme, droplet and aerosol masses are expressed as multiples of the mass of the initial particles. The accuracy of the finite difference method was checked by a comparison with analytical solutions of the KCE. Additionally, for the hydrodynamic kernel , the numerical solutions for the 2-D case were compared with numerical solutions of the 1-D KCE with very good results. Finally, the Monte Carlo algorithm for the real kernel with realistic initial conditions was compared with the integration of the two-component KCE. An excellent agreement was obtained between the two approaches.

2) The Monte Carlo algorithm is a computationally intensive method, but it is extremely fast when compared with finite difference methods with a dense droplet and aerosol grid.

Reviewer # 2

1) The differences between the comparison presented by Luarenzi et al. (2002) and the one presented in our paper are now detailed in the revised version for ACP. Although the same analysis was performed by Laurenzi et al. (2002), there are some differences with the results outlined here since in Laurenzi et al. (2002) the simulations were performed for different values of the constant kernel and with a large number of particles (10 000 and 20 000 particles in the initial species). On the other hand, only a single stochastic experiment was run. In the simulations presented in our work (section 3.1 of the paper), the initial number of particles was much smaller (60) and the average was calculated over 1000 realizations.

2) The selecction of the drop and aerosol grid is now explained in more detailed. Some

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corrections were made following the reviewers comment while explaining the species counting approach. Actually, *N(m,n;t)* is the average concentration of particles consisting of m and n monomers of the first and the second kind respectively (m,n mers), not the number of species (type of particles with drop mass , and aerosol mass).

3) The units of the coefficients for the kernels are now corrected in the revised version as suggested by the reviewer.

4) In the revised version, the real hydrodynamic kernel was used instead of the Long kernel. For the kernel the terminal velocities of the falling particles are calculated following Beard (1976) and the values of the collision efficiencies were taken from Hall (1980).

5) A detailed comparison of the Monte Carlo algorithm for the real kernel with the finite difference solution of the two-component solution of the KCE is now presented in the revised version.

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