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Interactive comment on “The validity of the kinetic collection equation revisited” *by* L. Alfonso et al.

L. Alfonso et al.

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Anonymous referee # 2

First, we would like to thank the anonymous referees for their comments, that will improve the quality of our paper. Our revised version will include several of their suggestions.

Specific comments:

1.

a) According to H. Tanaka and K. Nakazawa (1994), for kernels of the form $B(x_i + x_j)$, the KCE remains valid before bodies grow to the mass comparable to the total mass (M_T). That is when the mass of the largest droplet (M_{L1}) becomes $\approx M_T$. In other words the ratio

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$$\frac{M_{L1}}{M_T} \approx 1$$

b) For the sum kernel works the same criterium as in a).

c) In the case $C(x_i \times x_j)$ (product kernel), the KCE is valid until the stage in which the mass of the largest droplet (M_{L1}) becomes comparable or larger $M_T^{2/3}$. That is, when the ratio $M_{L1}/\ M_T^{2/3} \approx 1$.

Then, by calculating the maximum of $STD(M_{L1})/M_{L1}$(which is the estimate of the breakdown time for the KCE), and estimating (with the MC simulations) the ensemble mean of the largest droplet mass at that time (when the maximum of $STD(M_{L1})/M_{L1}$ is reached) we are able to estimate α in a general relation of the form:

$$\frac{M_{L1}}{M_T^{\alpha}} \approx 1$$

As an example, we can calculate the coefficient α in the former equation for the kernel $K(x_i, x_j) = \min(x_i, x_j) \times \left(x_i^{1/3} + x_j^{1/3}\right) \times (x_i + x_j)$, where x_i and x_j are the masses of the colliding droplets). As in the previous cases, we have calculated the validity time for an initial mono-disperse distribution of 100 droplets of $14\ \mu m$ in radius (droplet mass 1.1494×10^{-8}g). For this functional form of the kernel, the maximum of $STD(M_{L1})/M_{L1}$ is obtained at 505 sec. At this time, the ensemble mean of the largest droplet is 16.91 times larger than the initial $14\ \mu m$ droplets. Then, the parameter α can be estimated as $\alpha = \ln(M_{L1})/\ln(M_T) = \ln(16.91)/\ln(100) = 0.6141$, which is almost equal to $3/5$. For the same kernel, Inaba et al. (1999) estimated theoretically that the KCE remains valid before the largest droplet becomes (M_{L1}) becomes $\approx M_T^{3/5}$.

In the revised version, this question will be commented more carefully.

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2. In all the paper, the moment is with respect to mass distributions. This will be fixed in the revised version.

3. P13735, P 13742: The corresponding modifications were made

4. P13741: Thanks. The corresponding modification was made.

5. P13742: N_0 is the initial droplet concentration. It is now defined in the revised version

6. P13743: In this case, the total mass of the system is the total mass of the droplet population. A modification was made in order to clarify this sentence.

7. P13744: a) Yes, the notation is confused since sigma is usually used for the standard deviation. We will change the notation in the revised version. b) Yes, the sentence belongs to the first sentence of the following paragraph.

8. a) x_i is the mass from bin with index i b) The paragraph (with the explanation about the application of the K-S test) will be deleted.

9. Last paragraph (P13753): These new references will be added and commented properly in the revised version.

10. Thanks. Some modifications were made in order to improve the English presentation.

11. The reference to Aldous (1999) will be added in the revised version.

References:

Tanaka, H., Nakazawa, K.: Validity of the statistical coagulation equation and runaway growth of protoplanets, Icarus, 107, 404-412, 1994.

Inaba, S., Tanaka, H., Ohtsuki, K., and Nakazawa, K.: High-accuracy statistical simulation of planetary accretion: I. Test of the accuracy by comparison with the solution to the stochastic coagulation equation, Earth Planet Space, 51, 205-217, 1999.

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Interactive Comment