Review of "Collection/Aggregation in a Lagrangian cloud microphysical model: Insights from column model applications using LCM1D (v0.9)" by Simon Unterstrasser, Fabian Hoffmann, and Marion Lerch.

I would like to recommend this paper for publication after my concern is addressed, but which may require a major revision.

In this study, performance of several collection/aggregation algorithms for Lagrangian cloud models (LCMs) and bin models are compared in detail. The assessment was conducted in a one-dimensional columnar domain. Compared to their previous study in a single grid box, the tests are more relevant to three-dimensional cloud simulations, and hence the results are insightful.

My major concern is the limiter introduced in p.15, l.5. I think this may considerably diminish the performance of WM3D LinSamp. Instead, I suggest that the authors consider splitting the SIP, as detailed below.

Major Comments

1) p.15, l.5, limiter
   Now the limiter is implemented as follows: If $\nu_{coll} > \nu_j > \nu_i$,

   $$\nu_i' = \nu_i, \quad \mu_i' = (\nu_i \mu_i + 0.99 \nu_j \mu_j)/\nu_i,$$

   $$\nu_j' = 0.01 \nu_j, \quad \mu_j' = \mu_j.$$

   I think this is not a good idea because this could oversample small droplets. Instead, I recommend you to split the SIP i as follows.

   $$\nu_i' = \nu_j' = \nu_i/2, \quad \mu_i' = \mu_j' = (\nu_i \mu_i + \nu_j \mu_j)/\nu_i.$$

   With this procedure, we can use more SIPs for large droplets. Then, we can expect that the number of limiter events N_{LI} decreases because ν_{coll} tends to become smaller though the weighting factors of small SIPs (ν_j) are not changed. Note that similar procedure is already incorporated in Shima et al. (2009) (see (5b) on p.1313), but this is not the same because weighting factor (multiplicity) is considered as integer in Shima et al. (2009) and therefore (5b) rarely happens.

Minor Comments

2) p.4, l.17; p.26, Fig.12; collision efficiency
   It is not clear which collision efficiency you are using for the default case.

3) p.14, ll.31-23
   The feature that each SIP does not appear in two pairs enables parallel computation. Somewhere in the paper, this favorable property of WM3D LS should be mentioned.

4) p.29, Table 2
From this result, I would conclude that WM3D LS is the most efficient.

5) p.31, Eq.(28c)
From this equation, we can derive the expected number of SIP pairs that actually collide:

$$N_{SIP}^{coll} = N_{combs}\overline{p_{crit}} \propto N_{SIP}^{\alpha+\beta-1}\delta t = N_{SIP}\delta t,$$

i.e., N_{SIP}^{coll} is proportional to N_{SIP}. This would imply that linear sampling is reasonable.

References

Shima, S., Kusano, K., Kawano, A., Sugiyama, T. and Kawahara, S. (2009), The super-droplet method for the numerical simulation of clouds and precipitation: a particle-based and probabilistic microphysics model coupled with a non-hydrostatic model. Q.J.R. Meteorol. Soc., 135: 1307-1320. doi:10.1002/qj.441