

Comments to the manuscript with MS No. gmd-2020-404

General comments:

The authors explored the application of the Multidimensional Positive Definite Advection Transport Algorithm (MPDATA) in simulating the condensational growth of cloud droplets. They have demonstrated that the MPDATA is able to reduce the artificial diffusion of bin-method at the cost of computational resources.

The upwind scheme should be equivalent to a high-order scheme. What is the advantage of using upwind scheme instead of high-order schemes, computational cost?

The authors have demonstrated that the “best variant” is 10 times more costly than the upwind scheme, how feasible is it to use the “best variant” in 3-D cloud models?

This manuscript reads like an early draft that is far from being ready to be peer-reviewed.

To improve the readability of the manuscript, I would suggest the authors summarize the key points of those cited papers and merge those paragraphs that only consists of two sentences in the introduction. Also, the English writing of this manuscript can be improved substantially. I’ve listed several examples that can be improved in the instruction. But the authors should go through the entire manuscript and try to make the writing more concise.

Theories and numerical methods for “condensational growth of cloud droplets” is well-established, which are even validated against the laboratory experiment. I would suggest the authors consider using common nomenclatures such that the work can be understood by a wide range of audiences in the cloud-physics community.

I **cannot** recommend the publication in its current form. A major revision is required for further consideration.

Specific comments:

1. L.80: Why is the Eulerian scheme is robust in representing particle collisions?  
First, the Eulerian scheme is a mean-field approach, which is not able to represent fluctuations during collisions.  
Second, it is suffering from artificial numerical diffusion in modelling the collision process (Li. et al, 2017).
2. L.90-91: I don’t understand the logic of transitioning to Kelvin effect here. Could you elaborate more on this transition?
3. L.112: Do you mean “more significant .... than ...”?
4. L.115-117: I couldn’t find the verb of this sentence. Could you please rewrite it?
5. L.125: Please check the grammar.
6. L.132: ... p to x with x being ...

7. L.149: Do you mean “as the following”?
8. L.151: What is “GC” exactly? Is “G” the same as the
9. L.152: Why is the Courant number is “the velocity ...”? Do you mean “... to warrant ... ”?
10. L.161-163: Could you please reword this sentence to improve the readability? For example, we can use short sentences and connect them in a logical way?
11. L.169: You may define what the “S” is first.
12. L.174: Please cite the reference where you got these number.
13. L.186: What is “(1; 26)  $\mu\text{m}$ ”?
14. L.187: Please check the grammar. Do you mean “in the first ...”?
15. L.188: the second. What is “in the range of (0.03; 0.07)”?
16. L.189: Please rewrite the sentence and make it clearer and avoid mistakes in grammar.
17. L.191: shows.
18. L293: Double-Pass Donor-Cell (DPDC). Please check other parts of the manuscript thoroughly.
19. L.381: If the “best variant” is 10 times more costly than the upwind scheme, how feasible is it to use such a scheme?

#### Technical corrections:

20. In the title and other parts of the paper, please replace “particle size spectra” by “particle-size spectra” as only two nouns are allowed to be connected at a time in English grammar.
21. MPDATA (Multidimensional Positive Definite Advection Transport Algorithm) should already be fully spelled out in the abstract.
22. Please use consistent key terminologies to improve readability, such as “particle-size distribution” or “particle-size spectra”.
23. L.45: Shouldn’t the reference be in a bracket?
24. L.47: large-scale models; climate-timescale simulation
25. L.48 : What does “there” refer to? Please check the grammar in this sentence.
26. L.49: What is “particle size-spectrum dynamics ”?
27. L.50: What is “size effects”? Do you mean simulation domain-size? Also, please check the grammar of this sentence. For example, “...that...are”?
28. L.53: a population.
29. L.58: What is “the effects”?
30. L.62: “see” $\rightarrow$ “we refer to”. Please also check the format of citations in this sentence.
31. L.63: the application.
32. L.71: size distribution of cloud droplet. Please see my comment 1 in this section.
33. L.79: large-scale.
34. L.81-84: I suggest the authors to shorten the sentences such that they are concise and easy to read.
35. L.86: ... can likely be...
36. L.88: Brown (1980) also covers ...
37. L.90-91: due to its ...

38. L.96: “which is focused on the evaporation of an “aerosol cloud”” does not read right. Also, what is “aerosol cloud”?
39. L.98: compared to.
40. L.99: was used.
41. L.102: Tsang and Rao (1988) pointed out that ...the upwind scheme...the prediction accuracy of the mean radius.
42. L.105: ...in a chapter focusing...
43. L.106: was presented.
44. L.108: What is “particle size computations”? The latter lists ...
45. L.110: ...the condensational growth...
46. L.120: what is “sic!”?

## References

Li, X.-Y., Brandenburg, A., Haugen, N. E. L., and Svensson, G.: Eulerian and Lagrangian approaches to multidimensional condensation and collection, *J. Adv. Model. Earth Syst.*, 9, <https://doi.org/10.1002/2017MS000930>, 2017.