Comments to revised manuscript acp-2019-886
Jun 21 2020

Reproducibility

According to ACP Data Policy[1] "Data do not comprise the only information which is important in the context of reproducibility. Therefore, Copernicus Publications encourages authors to also deposit software, algorithms, model code, ... on suitable FAIR-aligned repositories/archives whenever possible."

While the mentioned policy merely encourages to do so, let me urge the authors to do so, to do better than "parcel model and DNS model used to produce the dataset are available upon request" by making the code publicly available on a persistent repository (and/or as an electronic supplement to the paper).

LWC profile and single/double precision issue

The origin of the problem is somewhat surprising. Let me just note that in the reply to the first round of reviews, the authors made an apparent error in definition of the growth rate of particles expressed in the third power of radius. From the introduced equation for the growth rate dR^2/dt it is evident that Kf_vS has the unit of m^2/s, which is inconsistent with the later definition of dR^3/dt. It should read $dR^3/dt = 3RKf_v(S - f(solu, curv))$.

Spectral discretisation

The figure C provided in the reply to the first round of reviews confirms significant sensitivity to the spectral discretisation with low number of "moving bins". Consequently, it is hard to agree with the statement that "the resolution of the size spectrum will also have no numerical impact on the evolution of the droplet spectrum" (reply to the reviews). Please acknowledge the sensitivity in the text. I suggest including Fig. C in the manuscript.

Lognormal spectrum initialisation

The geometric standard deviation seems to be mismatched with the spread parameter (see caption of Table. 1 in Xue et al. 2010) as the geometric standard deviation must have values above unity. On a related note, doesn't the vertical axis of Fig. 2c denote $dN/d(ln(r))$ as in Fig. 4? Same concerns colour scale in Fig. 3.

Supersaturation definition inconsistency

Note that in order to arrive at eq. (1), one needs to define supersaturation as $S = e/e_s$ (passage from 7.15-7.16 to 7.17 in the Rogers & Yau book) – worth clarifying as the manuscript involves the alternative definition of S using mixing ratios just below eq. (1).

Seeding nomenclature

Starting from the abstract, the manuscript mentions "seeding more aerosols", "seeding aerosol", "aerosols injected", etc; while in fact the seeded particles, given their size would classify as droplets being four or eight micron in radius. In the case of D1 and D2 runs, these particles are well above their critical sizes, hence would also classify as droplets because of being activated (the D3 seeding particles are below their critical sizes). To sum up, I suggest elaborating on the somewhat arbitrary choice of dry/wet sizes of the seeded particles, and switching from calling them "seeding aerosol" to "seeding particles".

On a related note, "CCN-embedded droplets" and "aerosol-embedded cases" seem misleading, if not incorrect, to me. Please rephrase.

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[1]https://www.atmospheric-chemistry-and-physics.net/about/data_policy.html

Parcel-mean term

For easier reading, I suggest refraining from using the "parcel-mean" term when referring to DNS simulations, to avoid confusion with the parcel model used for initialisation. Bulk or macroscopic might be better terms.

Miscellaneous notes

- p2/l28-29: the sentence "no benchmark "truth" from either measurements or modelling exists to gauge the performance of various microphysics schemes" arguably does not require the "Up to this date" opening – do the authors envisage that such "truth" will ever exist?;

- p2/l34-37: The mention of wall effects in cloud chambers in the very first paragraph of the introduction seem misplaced – suggest not to deviate too far from the scope of the paper in the introduction;

- p2/l74-75: suggest removing second part of the sentence ("to seamlessly ...");

- p3/l82: "ascending process" $\rightsquigarrow$ "ascent";

- p4/l91: suggest removing "and aerosol activation is unimportant" (previous sentence mentions that no new activation occurs);

- p4/l92: "Outputs from the parcel model" $\rightsquigarrow$ "Parcel model state"

- p6/l130-131: suggest removing the sentence "In this way, the numerical diffusion..." (out of scope);

- p6/l131: "at the given ..." – missing beginning of the sentence

- p6/Table 1: moving-bin method is contrasted with Lagrangian particle method – both are Lagrangian-in-particle-size; is there, in practice, any difference in the context of this work? Please elaborate or avoid contrasting them;

- p7/l156-161: background/motivation mixed with model description;

- p7/l164: "when small aerosols are introduced" – no small aerosols are introduced, right?

- p7/l172: correct "same other then";

- p9/l194: "aerosol ... broaden the DSD" – rephrase so that particular property of the aerosol population is mentioned

- p13/l179: ditto ("modulation by aerosols" – concentration, size, hygroscopicity?)

- p11/l251: please add a reference

- p14/Fig 7: x axis label missing in subplots (a) and (b)

- p16/l343: Lagrangian supersaturation: please elaborate

Raster graphics

Please replot all figures ensuring vector graphics format (not raster as it is currently provided)[2].

Hope that helps.

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[2]see Manuscript composition: Figure composition in `https://www.atmospheric-chemistry-and-physics.net/for_authors/manuscript_preparation.html`