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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Towards a Bulk Approach of Local Interactions of Hydrometeors" *by* Manuel Baumgartner and Peter Spichtinger

Anonymous Referee #2

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1 General Comments

This article deals with models for the evolution of water droplets and ice crystals in clouds where bother kinds of hydrometeor are present. The individual modelling steps are mostly well explained, although I have a few comments below. However, the overall structure is not as clearly presented - the discussion at the start of S2.1 leads straight into moderately complex equations. This referee would appreciate some abstract form of the model with terms that are then explained/defined/expanded in following subsections.

My research focuses on particles that are not hydrometeors, so it is difficult for me to assess exactly how significant the progress made in this article is. My impression is that

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Discussion paper

it is a useful next step in extending the models available for large scale computations, but the results in the paper are not particularly remarkable in themselves.

2 Specific Comments

p1 l26 I would appreciate a comment on the relation to Ostwald ripening of crystals/emulsions.

p4 l12 Turning the surface of a sphere with radius R_d into a shell of thickness $2r_E$ seems to be more or less equivalent to the assumption that r_E is small compared to R_d. Please comment on why this key assumption is reasonable.

p6 l27 "using the exchange rate J_d/V" directly" cannot amount to anything since V is still to be defined. I think the explanation at this point could be improved. J_d is a flux, if we assume that the shell around the ice crystal remains well mixed, then naturally the change in concentration is the flux into the shell divided by the volume of the shell and if there are multiple fluxes they should be summed (which here reduces to multiplying by N_d). My suggestion is to eliminate both V and Z.

p8 l2 Please explain why n cannot be estimated from the diffusion constant of water vapour. Effectively n seems to be a fitting parameter for the model, which is fine, but it would be helpful to know why n and not some other quantity should be a free parameter.

p27 I think the conclusion is much too long, because a large number of observations are repeated. I suggest stressing the most important one or two observations, discussing the prospects for future work and not taking more than half of a page!

3 Minor remarks

p1 l25 "it may evaporate nearby droplets and grow at their expense". Please rephrase, one cannot use evaporate like this. Perhaps "... may accelerate the evaporation of nearby droplets by growing at their expense".

p2 What is "ice saturation" please?

p2 Figure 1 should be made far more compact.

p4 l1 What are "objective estimates", perhaps measurement based ...

p4 l2 about -> around

p4 l12 I suggest avoiding bloat/bloated in physical science writing, perhaps "expand" or "dilate" would be suitable.

p7 eq15 seems to be a trivial rearrangement. I think it is safe to assume that readers can calculate the volumes of spheres and spherical shells.

p9 Figure 4 is superfluous, I suggest just writing a perfectly regular distribution of droplets at the vertices of a cubic lattice.

p14 l14 A slightly more detailed description of the parcel model would help this referee. I think we are talking about a parcel of gas moving in the overall flow field.

p14 l22 It is not clear to me exactly what w is. Is it the vertical velocity of the atmospheric flow field at the centre of the air parcel?

p21 l12 "get subsaturated", better style would be "become subsaturated". This comment applies throughout the manuscript.

p21 l21 "exists" -> exist p21 l32 "droplet" -> droplets

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