

Interactive comment on “Uncertainty assessment of current size-resolved parameterizations for below-cloud particle scavenging by rain” by X. Wang et al.

Anonymous Referee #2

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General comment: This paper summarizes the current knowledge on below-cloud aerosol particle scavenging by rain and studies sensitivity of scavenging coefficient to collection efficiency, raindrop size distribution and terminal velocity by using different formulations. Moreover, authors have made a comprehensive comparison between several different scavenging models and two field measurements.

This paper provides new information about the significance of different processes in scavenging and is an important summary of existing material. The theoretical study is performed carefully and discussed in appropriate way. The manuscript is very well written and it was a pleasure to read. I only have some minor comments to take into

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account prior to publication.

1. Does the paper address relevant scientific questions within the scope of ACP? YES
2. Does the paper present novel concepts, ideas, tools, or data? YES
3. Are substantial conclusions reached? YES
4. Are the scientific methods and assumptions valid and clearly outlined? YES
5. Are the results sufficient to support the interpretations and conclusions? YES
6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? YES
7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? YES
8. Does the title clearly reflect the contents of the paper? YES
9. Does the abstract provide a concise and complete summary? YES
10. Is the overall presentation well structured and clear? YES
11. Is the language fluent and precise? YES
12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Mostly yes, please, see my comments
13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? NO
14. Are the number and quality of references appropriate? YES
15. Is the amount and quality of supplementary material appropriate?

Specific comment: As the authors conclude, field scavenging measurement data is biased by aerosol processes like condensation and coagulation and in addition, espe-

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cially turbulence could enhance the value of collection efficiency between the raindrop and aerosol particles significantly. Therefore, the comparison of existing theoretical studies and measurements is somewhat difficult. For example in the case of the urban aerosol distribution (Fig. 10), it could be estimated that how many particles are removed for example by the coagulation compared to that of scavenging during the same time period?

Technical comments: Page 2504, line 22: "The differences for submicron-sized particles..." The word submicron is used throughout the paper to describe the particles between 0.01-1 μm (particles in Aitken and accumulation mode). However, literally submicron refers to all particles below 1 μm . To avoid confusion I would give a size range when it is not all particles < 1 μm in question.

Page 2508, line 20: For some reason the table numbered as 4 is used for nomenclature?

Page 2510, lines 16-17: " α is an empirical parameter that can vary between 0, which corresponds to neutral particles and 7, which corresponds to highly electrified clouds". This is a bit confusing sentence because α exists both in raindrop and particle charge equations. At the same time, is it possible to use different value for α to raindrops and particles? If yes, for instance the symbols α_p and α_r could be used.

Page 2512, line 6: "...seem to be better in..." Is it better or not and how this conclusion was made?

Page 2512, line 7: "...small-particle end..." should probably be small raindrop end.

Page 2515, line 3: Ultrafine particle size range is not determined until here although it has been used already earlier.

Page 2515, lines 4-5: "...Stokes number St..." and "...Stokes number St*..." Parenthesis around St and St* are missing.

Page 2523, lines 8-10: "...this parameterization is valid only for particles 0.01-0.5 μm ..."

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μm ...". However, the next sentence says: "Fig. 8 suggests that this parameterization overestimates λ values for < 0.01 μm and > 10 μm particles". This is trivial, because they just told that parameterization shouldn't be used outside the given range. Also, that should be noticed in Figure 8.

Page 2525, line 26: smaller instead of "small".

Page 2530, line 19: full stop is missing in the end of the sentence.

Table 3: Explain "Types" in the caption.

Figures in general: in print, it is difficult to distinguish different colors. Also different line types or symbols should be used.

Figure 4, in caption: "MP and DE represent stratiform rain, JD drizzle rain, ..." If these parameterizations are meant for different rain types, they should only be compared inside the rain type in question.

Fig 9: Y-axis could be normalized to for example 100 or 1.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 2503, 2010.