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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol size-dependent below-cloud scavenging by rain and snow in the ECHAM5-HAM" *by* B. Croft et al.

Anonymous Referee #2

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The article is well-written and comprehensive. As referee 1 has discussed some of his concerns in detail there is no reason to repeat those comments.

The main comment is the assumption

"The collection efficiency is assumed to be zero for aerosol particles that are 10 nm or less in radius since collisions at this size range are predicted by molecular dynamics that are not well understood or easy to represent. The final assumption is that all collisions result in collection."

Later on, it is written:

"Figure 4 shows how the scavenging coefficients might vary for ultra-fine particles if instead of assuming the collection is zero for particles less than 10 nm size, the Brow-

nian motion behavior is extrapolated. Differences of a few orders of magnitude are found. These coefficients are used in sensitivity simulations to investigate the impacts of thermophoresis and ultra-fine scavenging assumptions on the below-cloud scavenging budgets and aerosol lifetimes in the model."

However, there are studies on e.g. gas molegule scavenging, and the collection efficiency of gas molecule is certainly different from zero. Even if gas molecules behave differently from particles, it would be natural to assume that small particles approach this values with certain uncertainty. I do not think that just sensitivity studies are enough, but I think the parameterizations and calculations should be corrected with respect to this assumption. Then, additional calculations on sensitivity could be carried out.

As a referee, I'm sorry for this kind of comment which I know creates much work, but without additional arguments, I can not see how this assumption would be justified.

A small comment: Rain intensity is typically represented in units mm hr-1. However, scaveniging coefficients are typically in SI-units i.e. s-1. I think the units in figures should be changed to s-1

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 7873, 2009.