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Interactive Comment

Interactive comment on "Estimated variability of below-cloud aerosol removal by rainfall for observed aerosol size distributions" *by* C. Andronache

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Review of the paper 'Estimated variability of below-cloud aerosol removal for observed aerosol size distributions' by Constantin Andronache

Comments

This manuscript is a well-written presentation of calculations of below-cloud scavenging (BCS) of aerosol particles by rainfall. The main difference between this manuscript and previous work on the subject is the use of measured below-cloud aerosol size distributions in the calculations, instead of assumed ones.

There are no real surprises in the results. BCS was found to be greater for particles

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smaller than 0.01ţm and larger than 2um compared with particles in the range 0.1-1um, and increases with rain rate. BCS was generally negligible compared with in-cloud scavenging for accumulation-mode particles, except for intense precipitation. None of these conclusions are different from the 'textbook' presentation of the subject of below-cloud scavenging (e.g., Pruppacher Klett, Seinfeld Pandis), but it is refreshing to see several different real datasets being used in the calculations.

The 'Method' section contains a detailed and clear presentation of the formula used in the calculations. I found it (both in this section and elsewhere) to rely perhaps a bit too heavily on two sources: the textbooks of Pruppacher Klett, and Seinfeld and Pandis. These are both eminent references, and without a doubt contain all the pertinent details of the equations used in this manuscript. It would have been nice, however, to see more citations of the original literature. A specific comment about equation (1): the diameter and fall speed of cloud droplets is not included in this equation, but is explicitly shown in the one presented in Seinfeld Pandis (Eqn. 20.51). It would be nice to retain these details for the sake of consistency.

While in-cloud scavenging is not the subject of this paper, a comparison is made in section 3.1 (and in Fig. 3b) between below-cloud and in-cloud scavenging. The in-cloud scavenging values are calculated using a rather old treatment (Scott, 1992) of this process. Since a lot of work has been done on this subject in the last decade, it would have been interesting to see it incorporated here. I doubt whether the major conclusion would change (in-cloud is greater than below-cloud scavenging), but the details may be different.

The aerosol distributions used in the calculations are derived from a number of different measurement campaigns, and are treated carefully in the paper. On the other hand, the raindrop size distribution is taken to be a Marshall-Palmer distribution that is a function of rain rate, and is never compared with measurements. Since below-cloud scavenging is a function of both the aerosol and raindrop distributions, I found it a bit odd that the aerosol was treated so carefully, and yet the raindrop distribution was not

ACPD

2, S809–S811, 2002

Interactive Comment

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examined at all.

I found the figures to be nicely presented, informative, and felt that they complemented the text of the paper well. It was nice to see results from a range of conditions presented in the same figure.

In general, I found this manuscript to be a solid presentation of below-cloud scavenging of aerosol particles. As mentioned previously, the results are not surprising, but the use of a number of real datasets in the calculations makes this paper a valuable contribution to the literature on the subject.

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