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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Development of a parameterization scheme for calculating dry deposition velocity of fine, coarse and giant particles" *by* L. Zhang and Z. He

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We greatly appreciate all the comments, which helped us to improve the paper. Our responses are detailed below.

RC – Review Comments; AC – Authors Comments

RC - Leiming Zhang has made major contributions to model development for particle deposition previously and this is also a contribution (all be it of a technical nature). Nevertheless, some aspects could be improved: The lack of validation except to his original model might be seen as a weakness (i.e. the approximations are able to reproduce the

results from a more detailed model, but do they reproduce the REAL world?) What do these approx. mean in terms of applications in a model (regional/global) - i.e. show results from an application of the approximations. Also maybe there could be some physical discussions of the functional forms (e.g. Eq. 5 - are these models physically based and parsimonious?) The figures are rather poor in terms of quality and actually presenting results (lots of scatterplots, but maybe they could be synthesized into one or two or difference figures - as it is the scatterplots don't add much in terms of insights!). The tables are hard to follow and maybe not consistent; rice is LUC 4 in Table 1 but is in category 2 in Table 2b.

AC: Thank you for recognizing my previous work. As we responded to the first reviewer who raised the same question, the development of this new simplified algorithm taking the size-resolved model of Zhang et al. (2001) as the benchmark model is based on the assumption that the original model has been validated and can produce reasonable Vd values under various conditions (e.g., Petroff and Zhang, 2010, GMD; Zhang et al., 2012, ACP). Thus, comparing Vd produced from the new scheme with those from the original scheme (as shown in Figures 2, 5 and 6) is a validation of the new scheme. We do not have field-measured flux data and thus could not conduct more validation using real-world flux data. Model sensitivity within the framework of regional chemical transport models can certainly be done, but will be a significant effort that should be published separately. Besides, the new scheme is aimed for applications at monitoring network where only bulk aerosol mass is typically monitored. In sectional regional scale aerosol transport models, the original size-resolved model (or similar ones) should be used.

Equations (5) and other similar equations are not physically based, they are empirically based. To make this clear, we modified the title of the paper to: "Technical note: An empirical algorithm estimating dry deposition velocity of fine, coarse and giant particle".

Regarding the figures: We have tried to use minimum number of figures to show maximum information. Because Vd results from the two schemes are very close, the scatter

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plots of Vd over most LUCs shows a perfect 1:1 line. The regression equation in each figure gives the differences between the two schemes. Thus, we think this type of figure shows all the important information for this particularly case.

The 26 LUCs in the original model are still used in the new scheme, as explained in Section 2: “The 26 LUCs was also used in the present study, although they were put into different groups (3.1) or categories (3.2 and 3.3) for easy presentation.” For PM2.5, many LUCs have similar empirical parameters, and thus, the 26 LUCs can be grouped into five groups for easy presentation. “Rice” is always LUC 16 for the three aerosol size groups. It belongs to the new group 4 in Table 1, and it stays as LUC 16 for PM2.5-10 and PM10+.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 31289, 2013.