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Geoscientific Model Development Discussions

Interactive comment on "On the analytic approximation of bulk collision rates of non-spherical hydrometeors" *by* A. Seifert et al.

Anonymous Referee #2

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Review of paper for GMD entitled "On the analytic approximation of bulk collision rates of non-spherical hydometeors" by A. Seifert, U. Blahak, and R. Buhr

«GENERAL COMMENTS»

This is a very informative paper proposing bulk parameterizations on the binary collision rates of hydrometeors. The key idea is to use the Atlas-type fall speed relation for rain and snow, and to adopt the variance formulation introduced by Seifert and Beheng (2006). The present analytic approximations of the bulk collision rates can be an alternative to look-up tables, which often deteriorate the code readability and portability, and can replace the rather drastic Wisner approximation. This paper will contribute to modeling science, particularly to the bulk cloud microphysics community. I don't have any major concerns and support its publication in GMD. Below I offer some minor

comments.

«SPECIFIC COMMENTS»

[Comment-1] L1 in P5082: Correct the unit of omega_r. It should be [1/m] or [1/mm], not [m].

[Comment-2] L10 in P5083: I'm a little worried about the negative fall velocity for very small equivalent diameter. Below I did some calculations: (i)According to the parameter values in L8 in P5083, vr(Dr)<0 for Dr<32um. (ii)According to the parameter values in SB2006, vr(Dr)<0 for Dr<110um. In this sense, the present formulation is safer than SB2006. Is this the reason why you modified the values? It may be required to implement some limiter to avoid the side effect of the negative fall velocity. It would be informative to readers if you can show some know-how regarding the limiter.

[Comment-3] The paragraph starting at L11 in P5087: The bulk velocity formulations are not straightforward to me. In L16 in P.5087, you mention 'Dˆ2-weighted fall speeds for both species', but Eq (17) shows a Dˆ2x weighting.

[Comment-4] I cannot really follow Eqs. (19) and (20). Why integration over dD_i*dx_j in Eq. (19) and dD_i*dx_j in Eq. (20)? Shouldn't they be dx_i*dx_j or dD_i*dD_j? Similarly, why f(x) and f(D) are mixed in the two equations?

[Comment-5] Overbars of xr, vg, Dr, Ds, Dg, Di, Dj –in Eqs. (29), (33), (34), (35), (36), (45), (46), (51), (54) and (55)– are not defined.

«TECHNICAL CORRECTIONS»

(1)L15 in P5080: "As most earlier parameterizations DID, SB2006 limited. . ."

(2)L18 and below in P5080: consistency on "Sect" or "Section".

(3)L27 in P5080: remove 'in' before 'discussed'.

(4)L10 in P5086: M_j,0 not M_0,j.

(5)Eq.(22): subscript ‘g’ is missed for x.

Interactive comment on Geosci. Model Dev. Discuss., 6, 5077, 2013.