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Corrigendum to "Fragmentation of ice particles: laboratory experiments on graupel–graupel and graupel–snowflake collisions" published in Atmos. Chem. Phys., 23, 13505–13521, 2023

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An inadvertent error was made regarding a coefficient fitted with Phillips et al. (2017) parameterization:

$$N = \alpha A(M)\left(1 - \exp\left(-\left[\frac{CK_0}{\alpha A(M)}\right]^{\gamma}\right)\right), \quad (2)$$

with α being the surface area of the smallest ice particle, $A(M)$ the number of breakable asperities of the ice crystal per area, C the fragility asperity coefficient, K_0 the collision kinetic energy, and γ the shape parameter.

We fitted the $A(M)$ coefficient (the number of breakable asperities of the ice crystal per area) with the data of our experiments using the definition $\alpha = \pi r^2$, which is the cross-sectional area of the particle (r is the radius of the ice particle). However, it came to our attention, as noted by Phillips et al. (2017), that α is defined as the surface area of the smallest ice particle, given by $\alpha = 4\pi r^2$.

We therefore used α that was 4 times lower than the correct value, leading to an overestimation of the $A(M)$ coefficient by a factor of 4. Rectifying this discrepancy by adopting the accurate definition $\alpha = 4\pi r^2$, we recalculated the coefficients, resulting in $A(M)$ being 4 times lower, as illustrated in Table 3.

Regarding the description of the results, one sentence in Sect. 4.1 needs to be modified as follows: "The fit with Eq. (2), which is from the theoretical formulation of Phillips et al. (2017), is represented by a dashed line in Fig. 11 and gives the values $A(M) = 4.75 \times 10^7\ \mathrm{m}^{-2}$, $C = 10^8\ \mathrm{J}^{-1}$, and $\gamma = 0.78$."

Table 3. Re-fitted parameters of the Phillips et al. (2017) theoretical formulation for ice–ice collisional fragmentation (see Eq. 2) based on our experiments for graupel–graupel with dendrites, bare graupel–graupel, and graupel–snowflake collisions.

Collision type	$A(M)$ (m^{-2})	C (J^{-1})	γ
Graupel–graupel with dendrites	4.75×10^7	1.0×10^8	0.78
Bare graupel–graupel	1.60×10^6	9.7×10^5	0.55
Graupel–snowflake	5.0×10^6	5.8×10^8	0.78

A second sentence in Sect. 4.2 needs to be modified as follows: "The fit parameters were determined using the least squares method with no additional assumptions and resulted in $A(M) = 5 \times 10^6\ \mathrm{m}^{-2}$, $C = 5.8 \times 10^8\ \mathrm{J}^{-1}$, and $\gamma = 0.78$."

As $A(M)$ can vary by several orders of magnitude, correcting it by a factor of 4 does not affect our previous conclusions. However, this correction is important for any future work using our fitted coefficients.

References

Phillips, V. T. J., Yano, J.-I., and Khain, A.: Ice Multiplication by Breakup in Ice–Ice Collisions. Part I: Theoretical Formulation, J. Atmos. Sci., 74, 1705–1719, https://doi.org/10.1175/JAS-D-16-0224.1, 2017.