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Fragmentation of atmospheric ice particles due to collision

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Experiments were conducted in the cold room of the wind tunnel laboratory at Johannes Gutenberg University Mainz, encompassing collisions between bare graupel-graupel, bare graupel-ice sphere, bare graupel-graupel with dendrites and bare graupel-snowflake. This study addresses the underrepresented domain of secondary ice processes in clouds, focusing on fragmentation due to ice-ice collisions and their role in augmenting ice particle concentration. For this study, graupels were created using a setup that simulates the natural rotation and tumbling motion of freely falling graupels. The first set of experiments aimed to recreate previous collision experiments by producing more realistic nature-like graupels, while also improving the ice crystal fragment detection and counting process. 2mm and 4mm sized graupels were chosen based on previous observational studies.

This research contributes vital preliminary data, including fragment number and size distribution, as well as their dependency on collision kinetic energy. For this purpose, new coefficients fitted on our experiments following the theoretical framework have also been proposed, which can be used to parameterize the number of fragments resulting from ice-ice collisions. Our study attempts to bridge the gap between laboratory observations and numerical simulations, advancing the accuracy of atmospheric models.