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Laboratory studies upon the fragmentation of ice particles due to collision

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The production of secondary ice in clouds is crucial for cloud microphysical processes but remains poorly understood. Collisions between ice particles are a key process potentially responsible for producing high concentrations of ice crystals. However, limited laboratory studies on ice collisions have constrained our ability to accurately model this phenomenon. In response, we conducted laboratory experiments in a walk-in cold chamber to investigate the fragmentation of ice particles due to collisions.
Our experiments focused on collisions between graupel-graupel and graupel-snowflake particles. We collected and examined all fragments from graupel-graupel collisions under a microscope, while an in-house-developed holographic instrument captured ice fragments from graupel-snowflake collisions. From these data, we derived fragment number and size distributions, alongside their dependence on collision kinetic energy. We observed fragment counts reaching several hundreds, with size distribution peaks at 75 µm for graupel-graupel and 400 µm for graupel-snowflake collisions. Based on experimental data and theoretical frameworks, we propose new coefficients for parameterizing fragment production from ice-ice collisions.
Ultimately, our project aims to integrate laboratory findings, radar observations, and numerical modeling to improve understanding of ice multiplication due to collisions.

VAT

Session

Enhancing Process Understanding: New observations for modeling and parameterization development

Preferred Contribution Type

Oral Presentation

Presenting Author

Miklós Szakáll

Email Address of Presenting Author

szakall@uni-mainz.de

Affiliation of Presenting Author

Institute for Atmospheric Physics, University of Mainz, Germany

Address of Presenting Author

J.-J.-Becherweg 21

Authors: Dr THEIS, Alexander (Johannes Gutenberg University of Mainz); SZAKÁLL, Miklós (Johannes Gutenberg University of Mainz); GRZEGORCZYK, Pierre (Johannes Gutenberg University of Mainz); Dr MITRA, Subir K. (Johannes Gutenberg University of Mainz); YADAV, Sudha (Johannes Gutenberg University of Mainz)

Presenter: SZAKÁLL, Miklós (Johannes Gutenberg University of Mainz)