Analytical approaches for modeling cloud glaciation: ice multiplication

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Drastic simplification of the representation of processes in models can enable the success of theoretical analysis of the behaviour of phenomena in meteorology.
Analytical solutions may even be found and feedbacks may be elucidated in a system.

We apply such an approach to view the possible scenarios for explosive ice multiplication by mechanical break–up in ice–ice collisions. Such ice multiplication was observed in the laboratory and is treated with our idealized model. This model assumes a rate of generation of primary ice fixed at a constant value over time. It is also assumed that the generated primary ice is transformed into small graupel, then the latter is further transformed in large graupel under fixed times. Collision between small and large graupel, in turn, leads to explosive ice multiplication.

There are two basic scenarios leading to explosive ice multiplication. The present study presents a special case for systematically examining physical sensitivities of a given system by exploiting various analytical methods available under a framework of the dynamical–system theory.