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A microphysical scheme for secondary ice in ICON – evaluation and case studies

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Several physical mechanisms of secondary ice production are proposed and studied in laboratory experiments and observational measurements. We implemented a selection of empirical parameterisations for rime splintering, frozen droplet fragmentation and ice-ice collisional break-up in the two-moment microphysics ice modes scheme within the atmosphere model ICON.

The newly developed ice modes scheme distinguishes between different ice modes of origin including homogeneous nucleation, deposition freezing, immersion freezing, homogeneous freezing of water droplets and secondary ice production respectively. Each ice mode is described by its own size distribution, prognostic moments and unique formation mechanism while still interacting with all other ice modes and microphysical classes
like cloud droplets, rain and rimed cloud particles. This allows to evaluate the contribution of each ice formation mechanism, especially
secondary ice, to the total ice content.

Using this set-up we investigated the sensitivity and behavior of rime splintering, frozen droplet fragmentation and ice-ice collisional break-up for various parameterisations, coefficients and environmental conditions. We will present findings from idealized convection simulations as well as synoptic simulations of Europe and the North Atlantic.