



Contribution ID: 49

Type: **Poster**

A hierarchy of ice cloud models

Tuesday 8 October 2024 13:41 (6 minutes)

Clouds are one of the most important component of the Earth-Atmosphere system. They influence the hydrological cycle and the energy budget of the system via interaction with solar and infrared radiation. For clouds at lower levels consisting of water droplets, these effects are quite well understood, but for clouds containing ice particles (i.e. at lower temperatures) there are still open issues.

The description of clouds containing ice particles is still quite uncertain. Some processes (as e.g. ice nucleation) are not well known, for some others the parameters are not precisely determined. Since it is not always feasible to use the most complex formulation of all processes, we have to find meaningful approximations and reduced order models, which should have comparable properties as the complex models.

In this contribution, a hierarchy of ice cloud models formulated as ODE systems is presented, including also mathematical analyses of their qualitative properties using theory of dynamical systems.

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Session Classification: Postersession & Coffee