Geophysical Research Abstracts
Vol. 17, EGU2015-6862, 2015
EGU General Assembly 2015

Forecasting and understanding cirrus clouds with the large scale Lagrangian microphysical model CLaMS-Ice

Christian Rolf (1), Jens-Uwe Grooß (1), Peter Spichtinger (2), Anja Costa (1), and Martina Krämer (1)

(1) Forschungszentrum Jülich, IEK-7, Jülich, Germany (c.rolf@fz-juelich.de), (2) Institute for Atmospheric Physics, Johannes Gutenberg University of Mainz, 55122 Mainz, Germany

Cirrus clouds play an important role by influencing the Earth's radiation budget and the global climate (Heintzenberg and Charlson, 2009). This is shown in the recent IPCC reports, where the large error bars relating to the cloud radiative forcing underline the poor scientific knowledge of the underlying processes. The formation and further evolution of cirrus clouds is determined by the interplay of temperature, ice nuclei (IN) properties, relative humidity, cooling rates and ice crystal sedimentation. For that reason, a Lagrangian approach using meteorological wind fields is the most realistic way to simulate cirrus clouds. In addition, to represent complete cirrus systems as e.g. frontal cirrus, three dimensional cloud modeling on a large scale is desirable. To this end, we coupled the two momentum microphysical ice model of Spichtinger and Gierens (2009) with the 3D Lagrangian model CLaMS (McKenna et al., 2002).

The new CLaMS-Ice module simulates cirrus formation by including heterogeneous and homogeneous freezing as well as ice crystal sedimentation. The boxmodel is operated along CLaMS trajectories and individually initialized with the ECMWF meteorological fields. In addition, temperature fluctuations are superimposed directly to the trajectory temperature and pressure by the parametrization of Gary et al. (2006).

For a typical cirrus scenario with latitude/longitude coverage of 49° x 42° on three pressure levels, 6100 trajectories are simulated over 24 hours in time. To achieve the model results in an acceptable time, the box model is accelerated by about a factor of 10 before coupling to CLaMS. Now, CLaMS-Ice needs only about 30-40 minutes for such a simulation. During the first HALO cloud field campaign (ML-Cirrus), CLaMS-Ice has been successfully deployed as a forecast tool.

Here, we give an overview about the capabilities of CLaMS-Ice for forecasting, modeling and understanding of cirrus clouds in general. In addition, examples from the recent ML-Cirrus mission will be shown where the forecasted large scale situations are compared with satellite observations.