



Inhomogeneous cirrus clouds during the AIRTOSS campaign

Matthias Voigt and Peter Spichtinger

Johannes Gutenberg-University, Institute for Atmospheric Physics, Mainz, Germany

The aircraft campaign AIRTOSS-ICE in May and September 2013 provided measurement data of cirrus clouds over North Sea and Baltic Sea in various meteorological situations. The measurements were carried out with a Learjet and a towed sensor shuttle below the aircraft [2]. This configuration allows us to obtain almost horizontally collocated measurements at different vertical levels (inside and outside clouds). Microphysical properties of cirrus clouds, as ice water content, ice crystal number concentrations, diameter and shape of ice crystals were measured. In this study we concentrate on the comparison of in situ measurements with model simulations. For these case studies, the issue about the main formation mechanism (homogeneous vs. heterogeneous or both) will be addressed. In a first step the meteorological conditions leading to the cirrus formation are analyzed using meteorological analyses as obtained from the European Centre for Medium-Range Forecasts (ECMWF). The ECMWF wind fields are then used to calculate backward trajectories with the Lagrangian analysis tool LAGRANTO [4]. From these investigations the large-scale/mesoscale motions are derived and analyzed. Finally, the meteorological analyses and measurements (temperature, wind, humidity) are used as initial conditions for cirrus cloud simulations where the small scale motions are derived and analyzed. We used EULAG as LES model, including a state-of-the-art ice microphysics scheme [3] for 2D and 3D idealized and quasi-realistic simulations. In order to address the impact of dynamics vs. microphysics (i.e. heterogeneous nucleation [1]), we investigated different environmental conditions. The microphysical and macrophysical properties of the simulated cloud are finally compared to the measurements, in order to get some information about the most probable scenarios.

References

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