Geophysical Research Abstracts, Vol. 9, 07668, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-07668

Internal dynamics of cirrus clouds - some sensitivity studies

P. Spichtinger

Institute for Atmospheric and Climate Science, ETH Zurich, Switzerland

Cirrus clouds are important modulators of Earth's radiation budget, it is assumed that (thin) cirrus clouds can contribute to a net warming of the Earth-Atmosphere system. Usually, in large scale models cirrus clouds are treated as homogeneous layer clouds. However, even from surface observation the internal structure or "patchiness" of cirrus clouds is obvious, hence this could lead to additional radiative effects. In recent measurements campaigns the presence of slightly stable or even neutral mixing layers within the ice supersaturated layers was observed (e.g. during CIRRUS II, November 2004). These layers were probably formed by strong wind shear near the jet regions. From first simulations with a cloud resolving model it was observed that latent heat release from growing ice crystals could lead to the formation of small "convective" cells with relatively high vertical velocities (up to 2 m/s). This leads to ice crystal formation by homogeneous nucleation and to discontinuities in the ice crystal number densities within the supersaturated layer of some orders of magnitudes.

This effect is investigated in more details in sensitivity studies. The 2D/3D anelastic, non-hydrostatic model EULAG with a recent developed two moment bulk ice microphysics, including nucleation (homogeneous and heterogeneous), diffusion growth/evaporation and sedimentation, is used for idealized 2D studies: An ice supersaturated layer is prescribed at 10-12 km, which is lifted by a synoptic scale vertical velocity (1-10 cm/s). Within the supersaturation layer a "mixing" layer with a thermal stabilty different to the stable environmental profile is prescribed. The stability of this layer ranges between weakly stable over neutral to weakly unstable. The simulations were carried out using high spatial ($\Delta x = 10 \ldots 100\ m, \Delta z = 10 \ldots 50\ m$) and temporal ($\Delta t \sim 1\ s$) resolutions. The formation and evolution of "convective" cells and nucleation events within these cells is investigated.