Acknowledgement - The EarthCARE Workshop 618248

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Abstract Title

Evaluating cloud vertical structure in numerical weather prediction models

Abstract Text

A correct description of the vertical hydrometeor distribution in atmospheric models is essential in order to correctly predict the onset and strength of precipitation and calculate realistic heating rates. However, comparisons between model predictions and observations at well equipped ground stations have shown large discrepancies between different mesoscale and regional climate models with none of the models providing a satisfactory agreement with the observations (van Lipzig et al., 2006). Differences were found both in total liquid water and in the vertical position and extent of the clouds (Van Meijgaard and Crewell, 2005; Willen et al., 2005). Because these studies are based on observations at a few sites in North and Central Europe with focus on the Netherlands an urgent need exists to cover larger regions. Within the German priority programm on quantitative precipitation forecasting a General Observation Period (GOP) is currently performed over the full year of 2007. Within this framework a long-term evaluation of atmospheric quantities related to the hydrological cycle will be performed. The duration of one year will open up the possibility to statistically approach model problems and better pin down specific model weaknesses. The long-term evaluation can also help to identify representative cases to be investigated more thoroughly in process studies. The evaluation will make use of both an observation-to-model and an model-to-observation approach.

A central focus of the GOP will be the vertical cloud structure which will be observed at several sites including the Atmospheric Radiation Measurement (ARM) program Mobile Facility (AMF) based in the Murg valley within the Black Forest, Germany. Through scanning observations and further observations at three more supersites in the close neighborhood during the three summer months of the Convective and Orographically-induced Precipitation Study (COPS), we will further investigate the spatial variability of cloud vertical structure. This will be of particular interest for EarthCare which will be only observing a small curtain by radar/lidar observations. After all, we apply the Integrated Profiling Technique (IPT) using cloud radar, ceilometer and microwave radiometer observations and further instrumentation. By comparing the retrieved vertical profiles with radar/lidar-only techniques an accuracy assessment of potential EarthCare observations can be performed. Because the IPT gives the full thermodynamic profile it will also be possible to investigate the performance of models radiative transfer schemes.

At Deutscher Wetterdienst, in addition to the 7-km forecast model with parameterized convection (named LME), a 2.8-km short-range convection-resolving version of this model (named LMK) has been introduced recently. The GOP model evaluation will concentrate on these LMK forecasts, but also LME forecasts will be considered for assessing the possible benefit of the high-resolution convection-resolving model version.

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Topic

03 Modelling of Clouds, Aerosols and Radiation

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