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Evaluating model predictions of the atmospheric hydrological cycle by remote sensing observations - the case study and the long term perspective

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Numerical weather predictions (NWP) models with horizontal grid spacings in the order of a few kilometers and complex microphysics can give a detailed description of the atmospheric hydrological cycle. In order to verify these forecasts remote sensing observations like satellite (e.g. from Meteosat Second Generation), (polarimetric) radars and profiling stations are well suited. Several case studies using such observations for model verifications have been performed in the past. However, since the aforementioned sensors are operated continuously it is furthermore possible to extent this analysis to longer time scales and perform a long term evaluation. This presentation will discuss, based on examples, the benefits of both the case study and the long term perspective and will highlight in particular the synergetic uses of both.

We will illustrate the potential of case study verification by two examples of the BALTEX Bridge Campaigns (BBC), which were held in the Netherlands in 2001 and 2003. Ground-based remote sensing data from the Cabauw Experimental Site for Atmospheric Research (CESAR) and space born observations of MODIS are compared with the output of the non-hydrostatic Lokal-Modell (LM) of the German Meteorological Service (DWD), using a grid spacing of 2.8 km. For the selected cases, the LM underestimates the lifetime of clouds, the frequency of occurrence of small clouds and is unable to represent the large fraction of observed clouds with moderated optical thickness. The result of sensitivity runs with altered microphysical and turbulence schemes will be discussed to give reasons for these deficiencies.

The example of a long term evaluation is based on MSG and radar observations as

well as test-suites of the upcoming short-range Lokal-Modell version LMK (2.8 km, 24h forecast time) in July and August 2004. The LMK is operated as lumped ensemble since it is started every 3h. Therefore it is possible to discriminate between effects due to initial conditions and due to model formulation. Systematic model deficiencies are detectable by the long term evaluation, e.g. the error of predicted cloud cover exhibits a clear diurnal cycle with a maximum in the morning.

It is recommended to make synergetic use of both perspectives: Case studies provide hypothesis which can be verified by the long term evaluation. Furthermore the long term evaluation can be utilized to select situation for case studies at which certain model problems are pronounced. Sensitivity runs for such targeted case studies can explain model errors and help to remove them.