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Lagrangian verification of precipitation forecasts

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The new generation of limited area models for numerical weather prediction with a grid-spacing in the order of 2 km, like e.g. COSMO-DE from German Meteorological Service (DWD), can resolve - at least partly – deep convection. How realistic are these convective cells of precipitation? It is difficult to address this question in an eulerian framework of e.g. a gridpoint-by-gridpoint comparison of model forecasts with radar observations. As alternative, we will present an object oriented, lagrangian approach: the radar tracking scheme Rad-TRAM, which was originally developed by the German Aerospace Center DLR for nowcasting purposes, is applied to detect cells and their tracks independently both in radar observations and model forecasts. The resulting cell histories are used to derive specific cell characteristics, like e.g. their lifetime, size or location of initiation. Finally it is checked whether the model is able to reproduce the observed statistics of these characteristics.

This technique has been applied to the operational COSMO-DE forecasts and four corresponding long-term model experiments with modified parameterization during the COPS period of summer 2007. Observational reference is provided by the German radar network of DWD. Based on this comprehensive example, we will discuss the benefits and deficiencies of the lagrangian technique: It is for example straight forward to relate model changes with cell characteristics. Model experiments with a less active parameterization of boundary layer processes results in a clear improvement of the diurnal cycle of cell initiation. Surprisingly, all model versions can predict the distribution of cell life time quite accurately. However, the verification procedure depends on the subjective choice of certain tracking parameters, in particular on the threshold of precipitation that must be exceeded to detect a cell. Sensitivity studies show that these parameters have a clear impact on the absolute numbers of all cell statistics. But relative differences between statistics from models and observations are hardly affected making the presented approach valuable for model evaluation.