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Scale-dependent evaluation of COSMO-EU/DE precipitation forecasts

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The German Weather Service (DWD) has two non-hydrostatic operational weather prediction models, with different spatial resolution and for e.g. total precipitation different temporal resolution (15 min to 1 hr). The more coarser model is the COSMO-EU with spatial resolution of 7 km, the finer model is the COSMO-DE with 2.8 km gridspace. To improve the numerical weather prediction (NWP) models, it is necessary to understand the precipitation processes. First a central goal is the statistical evaluation of precipitation forecasts with dynamical parameters. Here, the newly designed Dynamic State Index (DSI) is used as dynamical threshold parameter. The DSI theoretically describes the change of atmospheric flow fields as deviations from a stationary adiabatic solution of the primitive equations (Névir, 2004). In the synoptic scale the DSI constitutes ageostrophic and in the meso–scale diabatic and non–stationary processes. These processes are particularly aligned with extreme events. For seasonal area means (DJF, JJA 2006/2007) the DSI shows a remarkably high correlation with the precipitation forecasts of the COSMO-DE data of the DWD, even without explicitly regarding the specific humidity fields. These results are compared with the correlations between the DSI and total precipitation, based on the COSMO-EU data, to expose the scale dependent behaviour as a function of the grid resolution. An independent precipitation analysis, in a resolution corresponding to the COSMO-EU and COSMO-DE grid was developed at the Freie Universität Berlin (FUB) (Reimer and Scherer, 1992). The FUB-analyses provide hourly data and are compared to the DSI and the precipitation, based on the COSMO-EU/DE data. For the winter storm Kyrill on 18th January 2007, analysed with the COSMO-EU and COSMO-DE, the convective cells along the cold front becomes more clearer with the higher resoluted

COSMO-DE. So the DSI features the frontal structure and convective cells. Especially, the DSI reflects the precipitation pattern. Thus, the DSI opens the possibility as a new dynamical forecast tool for severe precipitation events.