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Intercomparison of simulations using 4 WRF microphysical schemes with dual-Polarization data for a German squall line

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The ability of a 2.7 km version of the WRF model to reproduce accurately the microphysical structure of a squall line is evaluated. This is done by comparing simulations using four different microphysical schemes to detailed observations gathered by the DLR polarimetric radar POLDIRAD on August 12, 2004. The evaluation is based on synthetic polarimetric radar observations which are calculated from the model forecasts using the polarimetric radar forward operator SynPolRad. The Ebert-McBride contiguous rain area method of verification is tested on the simulated PPI scans of reflectivity. Furthermore, the vertical distribution of reflectivity as well as hydrometeor types is evaluated. The latter one is derived from the observed and simulated polarimetric quantities employing a classification scheme. The comparison of results focused on a 270 by 270 km domain having 2.7 km grid spacing, nested within a larger domain having 8.1 km grid spacing. No convective parameterization was used on either grid. The four microphysical schemes used included the Lin et al, the Thompson, the WSM6 and WSM 5 schemes. Only the WSM 6 version seemed to have the correct timing for when the squall line was best organized, intense, and oriented north-south, around 17 UTC. The other three versions were too fast by roughly 1 hour. The stratiform region was well-developed in the radar data by 19-20 UTC, but it evolved differently in all four simulations. Subjectively, the best agreement with observations in the general location of the stratiform rain took place at 20 UTC in the Thompson and WSM5 runs. However, in the WSM 6 run, the best agreement was with the 20 UTC model output and 19 UTC observations, and in the Lin et al. run, best agreement was at 19 UTC. None of the models showed as much organization to the stratiform region as observations indicated.