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Case study – simulation of the storm from 15 August, 2010, by a high resolution COSMO NWP model

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The aim of this study was to verify whether a high resolution COSMO NWP model is able to simulate a heavy hail storm which occurred on 15 August, 2010 in Prague. The model was applied with horizontal resolutions 2.8 km and 1.1 km. The latter model used initial and boundary conditions calculated from prognostic fields of the lower resolution model and its initial and boundary conditions were based on the COSMO-EU model outputs. The COSMO NWP models were used with two configurations of the Seifert-Beheng cloud microphysical scheme, which differed in the concentrations of cloud condensation nuclei: (i) with a high concentration representing continental conditions (CC) and (ii) with a low concentration typical for maritime conditions (MC). The models were also applied with and without the assimilation of radar reflectivity. To identify hail occurrences we applied an algorithm based on applying several criterions to radar reflectivity data. Beside that we had available eyewitness observations.
The main result of this study is that the COSMO NWP model with the Seifert-Beheng microphysics is able to simulate the studied hail storm, which agrees with results of previous studies. Although forecasted hail does not agree in the localization and time with observations it still may be useful because it indicates areas with a higher probability of hail or graupel occurrence and in case of a very short lead time (in our case 90 minutes) even the localization of hail is useful.
The lower resolution model (2.8 km) also forecasted hail but the amount was very low and the areas were too large. These forecasted values cannot be used directly but areas with hail can be interpreted as areas with increased probability of hail occurrences.
In case of the high resolution model (1.1 km) forecasted values seem to be realistic but areas covered by hail were overestimated. The CC and MC influenced small scale features of hail fields and the continental condition provided higher mean hail amounts. The study confirmed that the assimilation of radar reflectivity apparently improved precipitation forecasts for the high resolution model. Nevertheless the assimilation technique should be re-examinated for the two moment cloud microphysics because it was developed for one moment cloud microphysics. The model provided better results with higher number of vertical levels than it is used by the lower resolution model.