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Precipitation simulation with radar reflectivity pre-processing in the Harmonie model

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The data assimilation system in the HARMONIE numerical weather prediction model has been further developed by involving radar reflectivity measurements. The focus was on optimizing pre-processing procedures. The thinning and superobbing approaches with different internal parameters were explored at the pre-processing step. Results have shown that radar data allow for a better simulation of precipitation due to the correction of water content in the low troposphere and as a result increasing the rain rate at the surface. Assimilating radar reflectivity influences the model output only over the radar location area. However, the impact is sensitive to the choice of a pre-processing approach and its internal parameters. The difference between the control and radar assimilation runs shows heterogeneous intermittent form with the opposite signs, although the rain rate has increased up to 10 mm/12 hours in total over the selected part. The vertical distribution of precipitable water in the atmosphere has also been increased. The main changes have occurred within the layer between 850 and 600 hPa and achieved values up to 5-7 mm/hour. The series of numerical experiments with various thinning and superobbing parameters have shown similar impacts in general mapping, however, there were visible differences in the fine-scale cells. Their sizes, configuration and signs were dependent on the thinning values and superobbing meshes. Thus, in pursuing the compatibility between the model resolution, radar observation density and dominating precipitation patterns, further tuning of optimal parameters for a superobbing mesh size will be performed for particular regions and atmospheric flow regimes.