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The role of smoothing parameters in radar data treating

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The forecast of precipitation is still behind the prediction of other atmospheric variables due to several reasons. The major ones are the complex microphysics acting on scales smaller than the resolution in numerical models and various sources of errors affecting the accuracy of measurements. Weather radar observations become an important tool for improving precipitation forecasts due to providing 3D volume information of a high resolution. The impact of the domain resolution both vertical and horizontal on the simulation of major precipitation properties is in the focus of the study. The attempt is made to take into account the incompatibility between scales of precipitation structures and scales resolved on a model domain. The influence from the non-uniform vertical profile of reflectivity, conversion of radar reflectivity into rain rates as well as contamination by non-meteorological echoes are not considered, but the attention is paid to the filtering and smoothing procedures used for retrieving precipitation patterns, in particular their structure functions and observation error correlations. The assimilation of radar information requires a complicated observation operator, which takes into account horizontal correlations in either reflectivity or precipitation fields. The 1D humidity pseudo observation vertical profile derived from reflectivity is necessary as well.

Radar observations both single and mosaic gathered during the BaltRad experiment are used. They provide precipitation maps with high temporal ($\sim$5 min) and spatial ($\sim$250-500 m along a beam) resolution. However, the latter is heterogeneous and is a function of the distance from a radar location, while the initialization of NWP models requires gridded data.

The results showed the sensitivity of the retrieved precipitation characteristics to tuning parameters used in the filtering and interpolating procedures. The oversmoothing provides more stable numerical integration in a model however looses small-scale cells and weakens heavy rain patterns. The latter is the main target in forecasting of extreme precipitation events. Contrary, the use of non-filtered original radar data leads to noised fields and numerical instability in case of heavy precipitation. Thus, the contribution of the study is to determine the optimal smoothing parameters for a given relation between radar measurements and model resolution.