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Quantifying errors in radar rainfall estimates using a data assimilation method

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Quantification of radar rainfall measurement errors is of ongoing interest for application both in meteorology and hydrology, for example for weather prediction or rainfall runoff simulations. Radar reflectivity measurements are affected, amongst other influencing factors, by calibration errors, noise, ground clutter, or attenuation. These sources of errors show complex interdependencies and their combined impact on measurement accuracy is difficult to quantify. A better description of error magnitude and distribution, especially with regard to spatial and temporal structure, is desirable for an improved quality assessment of radar rainfall estimates. Radar ensembles are one promising approach for analysing spatially and temporally variable radar rainfall errors.

The authors intend to generate a radar ensemble describing the uncertainty of radar rainfall estimates and to produce a consistent spatial error structure and temporal evolution. The spatial error structure of the uncertainties is obtained from a statistical relation between radar errors and parameters like distance from radar or rainfall intensity, extracted from data of a radar network. This relation allows for the quantification of an error margin for each pixel of a given, measured reflectivity field. An ensemble nowcast is generated from measured reflectivity fields using a correlation-based advection scheme, and assuming an uncertainty in advection and in internal cell development. With this ensemble nowcasting, temporal evolution and consistency of radar reflectivity errors is achieved by predicting the evolution of the reflectivity field and repeatedly assimilating new radar reflectivity observations with associated error margin field, using the Ensemble Transform Kalman Filter (ETKF).

This contribution will present the concept of the envisaged work as well as preliminary results.