Geophysical Research Abstracts,
Vol. 11, EGU2009-11698, 2009
EGU General Assembly 2009

Stochastic Simulation of Precipitation Fields Conditioned on Radar and Gauge Information

T. Pfaff and A. Bárdossy

University of Stuttgart, Institute of Hydraulic Engineering, Department of Hydrology and Geohydrology, Stuttgart, Germany (thomas.pfaff@iws.uni-stuttgart.de)

Precipitation is the main input variable for hydrological modelling. Operational precipitation data are usually provided by rain gauges, weather radar and sometimes satellite observations., Precipitation data with very high spatial and temporal resolution is necessary especially for flash flood forecasting in small catchments. Usually these can neither be provided by rain gauge networks nor satellite measurements. However, radar data has not been used widely in operational flood forecasting yet. Modelling results obtained with radar derived precipitation forcing still don't show a better skill than those obtained by using gauge observations.

Radar data suffers from a set of errors. The common ones are uncertainties in the Z-R relation, attenuation effects and uncertain vertical profiles of reflectivity. Corrections for any of these errors have been devised but it has also been shown that some corrections just shift the uncertainty from one source to another.

Since the 'true' rainfall field cannot be known, true error statistics cannot be calculated. A measure of uncertainty can be obtained by comparing radar (R) and gauge data (G).

Recent developments towards radar ensemble generation focus on the generation of relative uncertainty fields. They are based on comparisons of radar data with gauge data or of radar fields with reference fields obtained by gauge adjustment. The generated fields are then multiplied with the radar field to create the realizations.

The proposed approach aims at stochastic simulation of precipitation fields conditioned on radar data In addition, the approach incorporates the additional information available from gauge measurements similarly to radar gauge adjustment. If radar data is adjusted by gauge data using either a multiplicative or an additive correction term, this single correction term can produce unrealistic results when it is regionalized to the radar cells surrounding the reference gauge.

This problem can be avoided by splitting the total absolute uncertainty εghich is defined byg$G = R + \varepsilon$nto an absolute and a relative part $G = R \cdot (1 + \varepsilon_1) + \varepsilon_2$

ε_2 can then be used to adjust small radar precipitation rates, while ε_1 is used to correct towards the gauge measurement if radar estimates are large.

For the simulation ε_1 and ε_2 are calculated from gauge measurements and co-located radar observations. The results are used to condition a stochastic simulator. The simulated fields of ε_1 and ε_2 are then applied onto the radar field. The main property of the resulting ensemble is that its mean is identical to the value of the gauge measurement at the gauge locations. This way, the ensemble mean can be used as a deterministic, gauge adjusted field in a meaningful way even if the ensemble members themselves cannot be used.

In our presentation we will show an analysis of the spatial and temporal structure of the separated uncertainty terms as well as simulation results for hourly data.