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Copula-based assimilation of radar and gauge information to derive bias corrected precipitation fields

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This study addresses the problem of combining radar information and gauge measurements. Gauge measurements are the best available source of absolute rainfall intensity albeit their spatial availability is limited. Precipitation information obtained by radar mimics well the spatial patterns but is biased for their absolute values.

In this study Copula models are used to describe the dependence structure between gauge observations and rainfall derived from radar reflectivity at the corresponding grid cells. Only the positive pairs (radar > 0, gauge > 0) are considered. As not each grid cell can be assigned to one gauge, the integration of point information, i.e. gauge rainfall intensities, is achieved by considering the structure and the strength of dependence between the radar pixels and all the gauges within the radar image. Two different approaches namely Maximum Theta and Multiple Theta are presented. They finally allow for generating precipitation fields which mimic the spatial patterns of the radar fields and correct them for biases in their absolute rainfall intensities.

The performance of the approach, which can be seen as a bias-correction for radar scenes, is demonstrated for the Bavarian Alps. The bias-corrected rainfall fields are compared to a field of interpolated gauge values (Ordinary Kriging) and are validated with the available gauge measurements. The simulated precipitation fields are compared to an operationally corrected radar precipitation field (RADOLAN). This comparison of the Copula-based approach and RADOLAN by different validation measures indicates that the Copula-based method successfully corrects for errors in the radar precipitation.