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Reconstruction of precipitation fields out of rain-gauge data in comparison to radar based products

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During the last decades large progress was made in the area of precipitation observation mostly related to new methods for remote sensing of precipitation. Radar observations together with passive microwave precipitation measurements have proven to be reliable in this context. However, there is still a need for more extensively exploiting the spatial and temporal variability of the obtained signals, motivated - for instance – by the demand of reliable flood warning systems.

To estimate precipitation with the required accuracy the current study examines a technique to construct precipitation fields out of data of a number of spatial distributed rain-gauges by a combination of kriging and fuzzy-logic. This method was applied for a period of 3 years (2005-2008, with 133 rain gauges for about 40.000km^2) for one state (Rhineland-Palatinate) in Germany. The method was compared to the operational RADOLAN product of the German Weather Service (DWD). This hourly data set is based on a radar composite created from 16 German radar sites and adjusted to online available high-resolution rain gauge observations. Both procedures were tested independently from each other by cross-correlation.

It is shown that the rain-gauge based method on average closely measures up to the accuracy of the RADOLAN product, but in convective situations RADOLAN clearly shows an enhanced performance. For stratiform precipitation fields RADOLAN possesses larger deviations compared to the rain-gauge based product. Due to restrictions in the number of rain gauges an integration of radar-data is indispensable.

Thus, it is concluded that the described technique together with thoroughly quality controlled Radar measurements can give reliable estimates of quantitative precipitation suitable for numerous applications in hydrology and meteorology.