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# Application of correlation calculated from radar data in a time series generator for precipitation on the ground

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The Pearson product-moment correlation coefficient is frequently used to describe the relationship of precipitation time series measured at two different locations. Usually rain gauges are used to register precipitation on the ground. In stochastic generation of simultaneous precipitation time series, correlation for ungauged locations is needed. Hence the correlation between any pair of ungauged locations needs to be estimated.
A comfortable way of measuring precipitation for larger areas is radar. From time series of radar images correlation can be calculated too. Due to the different marginal distributions of ground gauged and radar measured precipitation, correlation calculated from these data for the same locations will differ. Hence correlation derived from radar data cannot be used straight forward in time series generation for locations on the ground.
In a case study in southern Germany a method to estimate correlation of rain gauges from radar data is shown. A set of 101 rain gauges registering precipitation in hourly resolution for 7.5 years is used. For the same period and area hourly radar data in six classes is available. Comparison is accomplished at the gauge locations between the gauged time series and the time series of the radar raster points closest to each gauge's location.
The influence of the different marginal distributions of gauge and radar data is causing the difference in correlation. Hence both data sets are transformed to a standard normal distribution. From the normal transformed time series correlation is calculated for both data sets. Thereby the influence of the frequent occurrence of 'zero' in the original time series has to be considered. Hence correlation is estimated with

a maximum-likelihood procedure fitting the bivariate standard normal distribution to the transformed data with special treatment of the ‘zeroes’.
Correlation gained from the two transformed sets of gauge and radar data agrees well. Therefore correlation estimated from radar data can be used as an approximation to correlation estimated from rain gauge data, when both are transformed into normal distribution.
Application of this radar derived correlation in the stochastic generation of precipitation time series at the ground demands another transformation, since generation will need correlation estimated from data with non-normal marginal distribution. For this transformation parameters of the gamma distribution are estimated at each rain gauge. From the correlation of the transformed radar data, time series of random numbers are generated. These time series are converted with the estimated gamma distributions into precipitation time series. The correlation of these converted time series is the correlation needed for generation.
The presentation will give a short introduction on the data used in this case study. The focus will be the description and application of the method described above.