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Spatio-temporal variability of erosivity estimated from highly resolved and adjusted radar rain data (RADOLAN)

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Rainfall events exhibit high spatio-temporal variability and cause soil erosion when thresholds of rainfall amount or intensity are exceeded. Analogously high variability in space and time is assumed for erosivity (R). RADOLAN, from the German Weather Service, provides radar rainfall data at high spatio-temporal resolution (1 x 1 km^2, 5 min), adjusted in 60 min intervals by measurements from a dense rain-gauge network that potentially could overcome present limitations of R estimations from sparse rain gauges. This new database was used to analyse the spatio-temporal variability of rain depth and R for single events (event R) which occurred in an area of ∼15000 km^2 in southern Germany over a period of two years to illustrate the need for such high spatio-temporal resolution in rain data for R estimations. Further, the effect of calibrating 5 min resolved radar data using hourly adjustment factors to rain-gauge data was explored. The spatial gradients of event R were steep, even steeper than for rain intensity, and call for such highly resolved data. Erosivity exhibited a clear maximum late in the afternoon. Daily rainfall differed from erosive rainfall due to rain breaks and rain extending over more than one day. Event R between adjacent 1 km^2 cells differed by up to 120 N/h. Even on an annual scale, erosivity at grid cells not further than 10 km apart could differ by more than a factor of five. Adjustment of the rain data was indispensable when calculating event R because adjustment could change event R by a factor of two. Even if long-term averages are used, differences by lacking adjustment would not be levelled. RADOLAN thus provides, for the first time, rain data as required in distributed erosion modelling for time periods shorter than 20 years.