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Convective rain cell contours inferred from a very dense gauge network

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Statistical information on the size of rain cells is of interest to a variety of disciplines: from meteorology and hydrology to microwave propagation e.g. for planning satellite communication systems. Rain cell size distributions are often based on weather radar data because of the high spatial and temporal resolution. The measuring accuracy of ground-based in situ sensors like rain gauges is admittedly higher, however, typical rain gauge networks exhibit a too coarse grid to adequately capture the spatial variability of precipitation, especially of convective cells.
In the course of the present work, data originating from a very dense rain-gauge network was used: WegenerNet is a climate station network in Styria, Austria, consisting of 153 stations within an area of about 20 km $\times$ 15 km. The network provides well serviced and supervised datasets since January 2007. Multilevel quality flags are used to indicate integrity and plausibility of the data. Based on the point measurements of rainfall, interpolations on a 200 m $\times$ 200 m grid are provided.
The detection of rain cells in the grid-data was accomplished by identifying contiguous areas where the rain rate is equal to or higher than a specified threshold value. Once a connected area of a defined magnitude was identified, its dimension was determined and the equivalent circular diameter of the rain cell was calculated. Only rain cells with contours higher than 5 mm per 5 minutes were considered, because the study area with its about 300 square kilometers often did not allow the complete detection of more widespread rainfall events associated with lower intensity contours. In any case it was made sure that rain cells, which were only partially detected, did not distort the results.
The period of observation comprises up to now a 7-year timespan from 2010 to 2016. An extension of the period back to 2007 is planned in order to take advantage of full 10 years of high-resolution data. For the analysis only intervals with the highest data quality index were chosen. So far, several hundreds of heavy rainfall contours (5 mm within 5 minutes) were detected. In each of the investigated years, rain rates of more than 9 mm within 5 minutes were exceeded. Such events are quite rare - about one hundred contours were found within the period of investigation, where individual ones exhibited an equivalent circular diameter of more than 3 km.