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Development of a spatial-temporal rainfall generator based on high-resolution radar data

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Spatial and temporal variability of rainfall input plays a critical role on the performance of the urban runoff simulations. This suggests the need to use rainfall data at high spatial and temporal rainfall resolution. High-resolution and high-quality radar rainfall estimates became available in recent years. However, due to its relatively short history, the use of radar data for long-term applications (such as sewer system design) is not feasible. In this regard, the generation of stochastic rainfall data with realistic spatial and temporal characteristics is critical and would provide a good basis for urban-scale applications.

This work aims at refining the stochastic spatial-temporal rainfall generator developed by Willems (2001) for urban hydrological applications. Whereas Willems (2001) characterized rain storm and cell properties based upon a dense network of rain gauges, this work explores the use of high-resolution radar rainfall images. An enhanced rain storm and cell tracking algorithm developed by Muñoz et al. (2017) is employed. This new tracking algorithm enables accurate identification and tracking of rainfall structures at different scales from high-resolution radar reflectivity data. The identified storm cells and their traces can be further used to estimate the statistical properties that are used for generator calibration. These include, for example, maximum intensities, extents, storm motions, storm and cell inter-arrival times, durations, spatial patterns, and grow/decay rates. Results suggest that using radar data for rainfall generator calibration can describe rainfall fields with more realistic spatial and temporal characteristics.