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An improved method for the temporal disaggregation of rainfall at a finer time scale

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Erosion modeling requires high resolution precipitation data of at least 30 minutes time step. However, such data is often not available, since measurements are costly and time consuming. For climate change studies, future climate scenarios are used, which are generally available on daily or six hourly time step. Therefore it is necessary to develop a disaggregation procedure which is applicable to a wide range of daily and hourly precipitation data.

This study evaluates the generation of temporal high-resolution 10 minute rainfall intensities at 10 stations with different amounts of yearly precipitation and varying elevations to cover a range of rainfall patterns in central Germany. The cascade approach and the coupling of Hyetos model and cascade approach (Hyetos+Cascade) are compared for temporal disaggregation of daily rainfall data into 10 minute rainfall intensities. A criterion by dividing the daily rainfall data into four magnitude categories has been developed to improve the generating rainfall intensities of the Hyetos model. This scheme is tested on summer and winter precipitation to keep the seasonal variation for Hyetos model.

Dividing the rainfall amount into magnitude categories reduces the variation between the events and gave good results for calibration and validation. It especially improves the simulation of high rainfall intensities, which occurs occasionally. Hyetos model in category mode with seasonal variation is performing better than the using Hyetos without categories on monthly basis. Standard deviation of observed and simulated hourly precipitation for Hyetos model is around 56.2% in winter and 79.4% in summer in the validation mode. Comparison of Hyetos and Hyetos+Cascade model was verified by comparing observed and simulated kinetic energy using 10 minute rainfall intensities. Simulated kinetic energy for winter is 74.6% and for summer is 91.6 % in validation using Hyetos+Cascade model. By dividing the daily rainfall into magnitude categories the result of different statistics, BL parameters and hence the intensities of the rainfall is significantly improved compared with using these methods without rainfall magnitude categories.

The generated rainfall can be used for different type of studies where high resolution is an issue.