Stochastic Generation Of Synthetic Precipitation Time Series With High Temporal And Spatial Resolution For Engineering Practice

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Hydrologists and engineers of today require precipitation time series with long duration and high temporal resolution (e.g. to plan urban hydraulic or sanitary systems). This paper presents the stochastic precipitation time series generator NiedSim. NiedSim can generate time series having a maximum duration of 44 years and a maximum temporal resolution of five minutes for an arbitrarily selected point within the 70,000 km^2 system area.

NiedSim consists of two parts - a database and a stochastic generation tool. The database contains statistical parameters for different time scales, fuzzy rule based classified CPs and a complete time series for a reference station, interpolated to a 1 km^2 grid using external drift Kriging.

The stochastic generation of a time series for a given point takes two steps:

1. Hourly values are generated taking local statistics into account. An objective function is formulated from the statistical properties of the generated time series and local statistics. Using simulated annealing, this objective function is minimized.

2. The related time series is disaggregated to five minutes values applying simulated annealing using a similar objective function leaving the hourly sum unchanged.

The time series generated is valid for a point. It can be assumed as representative for a certain area around this point. For larger areas a second or multiple points are needed. Here the second station shall be generated using a first generated station as reference.

To implement this, the cross correlation of time series between any two given points in the project area must be estimated. Different techniques based on Kriging are presented to gain the interdependency between two points. Cross-validations show that a four-dimensional ordinary Kriging delivers a good estimate for the cross correlation.