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Simulating the complex output of rainfall and hydrological processes using the information contained in large data sets: the Direct Sampling approach.

Fabio Oriani

Geological Survey of Denmark and Greenland, Hydrology Department, Copenhagen K, Denmark
(fabio.oriani@protonmail.com)

The unpredictable nature of rainfall makes its estimation as much difficult as it is essential to hydrological applications. Stochastic simulation is often considered a convenient approach to asses the uncertainty of rainfall processes, but preserving their irregular behavior and variability at multiple scales is a challenge even for the most advanced techniques.

In this presentation, an overview on the Direct Sampling technique [1] and its recent application to rainfall and hydrological data simulation [2, 3] is given. The algorithm, having its roots in multiple-point statistics, makes use of a training data set to simulate the outcome of a process without inferring any explicit probability measure: the data are simulated in time or space by sampling the training data set where a sufficiently similar group of neighbor data exists. This approach allows preserving complex statistical dependencies at different scales with a good approximation, while reducing the parameterization to the minimum.

The straights and weaknesses of the Direct Sampling approach are shown through a series of applications to rainfall and hydrological data: from time-series simulation to spatial rainfall fields conditioned by elevation or a climate scenario. In the era of vast databases, is this data-driven approach a valid alternative to parametric simulation techniques?

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[2] Oriani F., Straubhaar J., Renard P., and Mariethoz G. (2014), Simulation of rainfall time series from different climatic regions using the direct sampling technique, Hydrol. Earth Syst. Sci., 18, 3015-3031, http://dx.doi.org/10.5194/hess-18-3015-2014
[3] Oriani F., Borghi A., Straubhaar J., Mariethoz G., Renard P. (2016), Missing data simulation inside flow rate time-series using multiple-point statistics, Environ. Model. Softw., vol. 86, pp. 264 - 276, http://dx.doi.org/10.1016/j.envsoft.2016.10.002