# Models for fine-scale precipitation relevant to urban catchment applications

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There are a number of stochastic point process models that can be used to generate rainfall data at hourly or higher aggregation levels. For most hydrological applications rainfall data collected at these aggregation levels are sufficient. Nevertheless, for some catchment studies such as the analysis of urban drainage system, rainfall time series at finer resolution are required to make more accurate estimation of quantities of interest. Poisson cluster based stochastic models are capable of generating rainfall at hourly (or higher) aggregation levels. However for sub-hourly time scale, unless one uses 2 levels of clustering, one has to rely on stochastic disaggregation models to disaggregate hourly rainfall series simulated by cluster based models using either the Bartlett-Lewis or Neyman-Scott processes. This would involve combining two stochastic models which naturally increases the model uncertainty. In view of this, it is useful to have a single stochastic model which has the ability to generate rainfall time series at a finer as well as other time-scale of interest, and which is easier to fit than a Poisson-cluster model. Therefore, our aim in this study is to explore a class of doubly stochastic Poisson process models that can address this problem.

For this class of stochastic precipitation models it is possible to write down the likelihood function and hence we use maximum likelihood methods to estimate parameters of the models. The proposed models are used to analyse rainfall bucket tip-times series over a network of stations in a catchment. These multi-site doubly stochastic point process models incorporate local covariate information in an attempt to capture the effect of atmospheric covariates on rainfall characteristics. The variables used in the analysis are elevation of the recording station above sea-level, local temperature, sea-level pressure and relative humidity. The performance of the models is assessed by comparing various statistical properties of the observed rainfall accumulations at high resolution with the corresponding ones from the fitted models. Results reveal the potential of this class of models in reproducing temporal and spatial variability of rainfall properties over the catchment area, especially at fine time scale.