Some stochastic models for seasonal rainfall at fine time-scales

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Abstract: Stochastic point process models have been widely used to model rainfall time series. Doubly stochastic Poisson processes provide a rich class of models for analysing fine time-scale rainfall data. Models of this type have been used by several authors to describe fine-scale rainfall characteristics at a single site as well as at multiple sites. Ramesh *et al.* (2013) developed a class of multisite models for analysing tipping-bucket rainfall data recorded over a number of stations in a catchment area.

In this paper, we extend the univariate class of models for fine time-scale rainfall to accommodate seasonality and study a number of seasonal doubly stochastic Poisson process models. This includes models incorporating atmospheric covariates in the analysis. The application of these models is illustrated in the modelling of sub-hourly rain gauge data from England. One of the advantages of this class of models, when compared with similar models, is that their likelihood function can be calculated in a tractable form suitable for numerical optimisation. This allows us to use the maximum likelihood approach to estimate the parameters of the proposed stochastic models. We use some of the second-order properties of the fine-scale rainfall aggregations in discrete time intervals for model assessment.

References

[1] Ramesh, N.I, Thayakaran, R and Onof, C. (2013). Multisite doubly stochastic Poisson process models for fine-scale rainfall. Stochastic Environmental Research and Risk Assessment, 27 (6):1383-1396.