POINT PROCESSES AND INFERENCE FOR RAINFALL FIELDS

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ABSTRACT

We treat the role of point processes in the statistical analysis of rainfall fields. We look in specific at Poisson-based models of the Le Camian type. These represent rainfall fields as a smoothing transformation of a Poisson random measure. We provide a number of examples of particular interest to hydrologists who analyze rainfall fields and we outline strategies for their assessment. Here we find a place for novel applications of statistical techniques, such as simulation, method of moments, nonlinear regression, and image and life history analysis.

1. **Introduction** Rainfall fields refer to the observed pattern of ground-level intensity of rain falling from precipitating cloud systems. Reflecting the nonequilibrium thermodynamic origins of such systems, these patterns manifest highly-structured distributions of rainfall over space. Our discussion here concerns modeling and inference for the temporal evolutions of these distributions.

The temporal evolutions of rainfall fields proceed from the changing thermodynamic conditions governing the phenomenon of precipitation. As part of a family of processes involved in global atmospheric circulation, precipitation is a process of complex geophysical origins. To model the dynamics of rainfall fields is obviously beyond the scope of present endeavors. In substitute, we treat phenomenological models of rainfall fields, that aim to describe the phenomenon as observed.

Nicolis and Prigogine (1977) note that the *observable* behavior of many nonequilibrium thermodynamic systems is well represented by a stochastic process. We take this view in modeling rainfall fields with a spatial stochastic process. In particular, we look at models that represent such fields as a smoothing transformation of a Poisson random measure. The general framework for these was introduced in Le Cam (1961). Nonetheless, it was not until after the GATE experiment of 1974 that Le Cam's work began to have impact. From this observational study of tropical rainfall over the Atlantic Ocean, meteorologists reported new understandings of the organization and structure of precipitating cloud

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