

Statistical Modeling of Rainfall in Time and Space: Some Results and Challenges

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Abstract:

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Statistical modeling of rainfall has been an active research area over the past 40 years. It is motivated by the importance of rainfall as a driving process of many other hydrologic processes, streamflow and flooding included. Traditionally time series models of rainfall accumulations were based on rain gauge data. More recently, space-time models have been developed based on radar-rainfall observations. While the latter provide a more comprehensive description of rainfall, they are affected by uncertainties on the radar observational process. This paper focuses on illustrating the effects of these uncertainties on the statistical inference about rainfall. Numerous sources of these errors are due to parameter estimation, the observational system and measurement principle, and not fully understood physical processes. Even though evaluation of RR uncertainties has been object of several studies in the past two decades, some questions still remain unanswered:

- What are the spatial and temporal dependences of these errors?
- What is their statistical distribution?
- Do these uncertainties exhibit any scaling properties (in time and space)?
- Can they be modeled by means of time series analysis?
- How do the abovementioned characteristics relate to the rainfall process itself?

This study aims at shedding some light on some of these issues and at presenting and discussing problems not yet solved. The results of this work are based on a large dataset (about seven years) of rainfall measurements by a highly dense rain gauge network deployed during the HYdrological Radar EXperiment (HYREX) in the Brue catchment, south-west part of England, as well as other experimental data sets.