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Evaluation of space-time rainfall models for hydrologic scaling studies

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To study scaling of different hydrologic processes in which rainfall input is a significant component, it is important to separate its effects. This is often accomplished using simulation as the main methodological tool. Simulation allows systematic study of the propagation effects of different characteristics of rainfall as opposed to those of other processes such topography, channel network topology and hydraulic geometry, soil characteristics, vegetation, etc. Space-time rainfall is modeled using three different models: a) a model accounting for the spatio-temporal covariance structure and intermittency b) String of Beads model accounting for the spatial power spectrum, intermittency and modeling the temporal correlation of rainfall as combination of autoregressive processes at pixel and image scales and c) universal multifractal model based on multiplicative random cascades. A comprehensive evaluation of the above models is carried out by comparing various statistical properties of modeled rainfall with those of observed rainfall for a storm event. To “calibrate” the three models, the authors use customized radar-rainfall products based on NEXRAD Level II data over central United States, where the effects of orography are negligible.