Geospatial and temporal daily rainfall data generation

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Abstract

Agricultural systems have evolved in response to spatial and temporal rainfall variability, but in most regions of the world, rainfall variability continues to be a major source of risk for farmers. Adequate quantification of this variability requires rainfall records over a long time period. However, the availability of daily rainfall data over long time periods continues to be a problem. To increase rainfall record lengths, statistical methods are used to generate daily realizations of rainfall for many applications. The problem with most currently available weather generators is that they create daily realizations for points in space without considering spatial correlation or persistence of rainfall events and amounts over space. Spatial variability may not be a problem if ones interest is in temporal properties of rainfall and its effects in crop production at points or fields. But if spatially independent generated data are used to aggregate rainfall or model outputs over space for subsequent analyses, spatial correlations of the variables must be taken into account for the same time scale at which the data are used as inputs to models. A method based on correlations of daily rainfall events and amounts among weather stations and on the rainfall geographical trend is proposed. The method incorporates climate, weather, geographical–trend, and daily–stochastic components. Daily rainfall data for seven weather stations located in North Central Florida were obtained from the National Climate Data Center and used in this study. Results were compared to those produced by an existing weather generator (WGEN). The spatial structure was measured by Moran's I test after generating rainfall using uni– and multi–site rainfall generators. Results showed that both methods maintained the temporal structure of the data that occurred in the climatology; however the spatial structure of the data was only preserved by the new geospatial method.

Key words: Rainfall, weather generator, geographical trend, modeling, rainfall, spatial correlation

Challenge: Climate variability and climate change factors impacting water resource sustainability.
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