

Changes in rainfall patterns in the Southeast U.S.A.

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Abstract

Global temperatures have increased during the last several decades affecting ecosystems around the world. Rainfall patterns have also changed globally, but these changes may differ considerably from the global trend and need to be studied. Assumptions of temporal stationarity rainfall must be tested before using the records to calculate climatological values and for use in modeling applications that make use of the historical record. Daily rainfall data from 1048 weather stations in Alabama, Florida and Georgia were obtained from the National Climate Data Center (1915 – 2004). After organizing and checking for errors and missing values, only 523 weather stations were retained. Fewer than 25 weather stations had the 90-year historical record almost complete making it difficult to detect whether significant shifts in spatial and temporal rainfall had occurred over this period. Therefore all available monthly rainfall data across the 90-year period were spatially interpolated using ordinary Kriging. The interpolation was performed on the residuals after removing spatial trends modeled by a polynomial equation using latitude and longitude as predictors. In doing so, the need to interpolate the geographical trend due to not fulfilling the stationary assumption of semi-variogram models was avoided. Observed rainfall was preserved by forcing the semi-variograms' Nugget to zero. Resulting monthly maps were divided into 6 periods of 15 years each and statistically compared using Analysis of Variance F statistics for each grid cell. Duncan's multiple range test was performed for each grid cell where significant differences were found ($P \leq 0.05$). Monthly matrices of maps showing the areas where differences were detected when comparing each 15-year period against the other periods were obtained. Changes in rainfall patterns occurred in some areas but not over the entire region. Changes in rainfall were detected across time, but not only during the last 15-year period. In areas where changes occurred, rainfall tended to increase during winters and decrease during summers over the 90-year time period.

Key words: Rainfall, climate, spatial variation, semivariograms

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

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