

## **Spatio-Temporal Changes of Rainfall in São Paulo, Brazil (1973-2012): A Gamma Distribution and Cluster Analysis**

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**Abstract :** An important feature of rainfall regimes is the variability, which is subject to the atmosphere's general and regional dynamics, geographical position and relief. Despite being inherent to the climate system, it can harshly impact virtually all human activities. In turn, global climate change has the ability to significantly affect smaller-scale rainfall regimes by altering their current variability patterns. In this regard, it is useful to know if regional climates are changing over time and whether it is possible to link these variations to climate change trends observed globally. This study is part of an international project (Metropole-FAPESP, Proc. 2012/51876-0 and Proc. 2015/11035-5) and the objective was to identify and evaluate possible changes in rainfall behavior in the state of São Paulo, southeastern Brazil, using rainfall data from 79 rain gauges for the last forty years. Cluster analysis and gamma distribution parameters were used for evaluating spatial and temporal trends, and the outcomes are presented by means of geographic information systems tools. Results show remarkable changes in rainfall distribution patterns in São Paulo over the years: changes in shape and scale parameters of gamma distribution indicate both an increase in the irregularity of rainfall distribution and the probability of occurrence of extreme events. Additionally, the spatial outcome of cluster analysis along with the gamma distribution parameters suggest that changes occurred simultaneously over the whole area, indicating that they could be related to remote causes beyond the local and regional ones, especially in a current global climate change scenario.

**Keywords :** climate change, cluster analysis, gamma distribution, rainfall

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