

# Global multivariate point pattern models for rain type occurrence

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**Abstract:** We seek statistical methods to study the occurrence of multiple rain types observed by satellite on a global scale. The main scientific interests are to relate rainfall occurrence with various atmospheric state variables and to study the dependence between the occurrences of multiple types of rainfall (e.g. short-lived and intense vs. long-lived and weak; the heights of the rain clouds are also considered). Commonly in point process model literature, the spatial domain is assumed to be a small, and thus planar domain. We consider the log-Gaussian Cox Process (LGCP) models on the surface of a sphere and take advantage of cross-covariance models for spatial processes on a global scale to model the stochastic intensity function of the LGCP models. We present analysis results for rainfall observations from the TRMM satellite and atmospheric state variables from MERRA-2 reanalysis data over the tropical Eastern and Western Pacific Ocean, as well as over the entire tropical and subtropical ocean regions. Statistical inference is done through Monte Carlo likelihood approximation for LGCP models. We employ covariance approximation to deal with massive data.

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