Point process models for diurnal variation rainfall data

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Norazlina binti Ismail

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Abstract

The theoretical basis of the point process rainfall models were developed for midlatitude rainfall that have different temporal characteristics from the tropical rainfall. The diurnal cycle, a prominent feature in the tropical rainfall, is not represented in the point process models. An extension of the point process models were developed to address the diurnal variation in rainfall. An observed indicator of the rainfall, X is added to the point process models. Two point process models, Poisson white noise (PWN) and Neyman-Scott white noise (NSWN) model were used as the main rainfall event, Y. The rainfall is modelled assuming two cases for the variable X, independent and dependent. Bernoulli trials with Markov dependence are used for the dependent assumption. To allow the model to display the diurnal variation and correlation between hours, the model was fitted to monthly rainfall data by using the properties of two hour blocks for each month of the year. However, the main point process models were assumed the same for each of the 12 blocks, thus having only one set of point process parameters for the models for each month. There are 12 rainfall occurrence parameters and 12 Markov dependence parameters, one for each block. A total of six models were fitted to the hourly rainfall data from 1974 to 2008 taken from a rain site in Empangan Genting Klang, Malaysia.

The PWN and NSWN models with X were first fitted with the assumption that the rainfall indicators are independent between the hours within the two hour block. Simulation studies showed the model does not fit the moments properties adequently. The models were then modified based on a dependence assumption between the hours within the two hour block. These models are known as the Markov X-PWN and Markov X-NSWN models. Both models improve the fit of the moment properties. However, having only one point process model to represent the rainfall events for Malaysia rainfall data was not sufficient. Since tropical rainfall consists of two types of rain, convective and stratiform, the PWN and Markov X-NSWN model were superposed to represent the two types of rainfall. A simple method by assuming non-homogenous PWN process for every two hour block did not fit well the daily diurnal variation. A comparison between the six models show that the superposed PWN and Markov X-NSWN model improved the fitting of mean, variance and autocorrelation. The superposed model was then simplified to an 8-block model to reduce the number of parameters. This modification to the point process models succeeded in describing the diurnal variation in the rainfall, but some of

the models were not able to fit other properties that were not included in the parameter estimation process such as the extreme values.

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Alhamdulillah. The perfect, most beautiful praise is only for ALLAH. Thank you ALLAH.

2:286 On no soul doth ALLAH place a burden greater than it can bear. It gets every good that it earns, and it suffers every ill that it earns.

2:216 ... But perhaps you hate a thing and it is good for you; and perhaps you love a thing and it is bad for you. And ALLAH knows, while you know not.

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65:2-3 And whoever fears ALLAH - He will make for him a way out. And will provide for him from where he does not expect. And whoever relies upon ALLAH - then He is sufficient for him. Indeed, ALLAH will accomplish His purpose. ALLAH has already set for everything a [decreed] extent.

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