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Modelling a bivariate counting process. An application to the occurrence of extreme heat events

Abaurrea, J.[1], **Asín, J.**[1], **Cebrián, Ana C.**[1]

SUMMARY

This work studies the occurrence of extremes in a stochastic bivariate framework using an approach based on the common Poisson shock model (CPSM). This model is a bivariate point process with univariate marginal Poisson processes that takes into account the dependence between them. One advantage of the CPSM is that it can be represented by three independent Poisson processes. Due to this simple representation, we can generalise the model to allow for time varying parameters and readily apply to real data. The required tools to fit and validate the model are presented, including a new test to check the local conditional independence between non homogeneous Poisson processes. Among other extremes, the bivariate model is adequate to model heat waves. This is a complex phenomenon that cannot be properly characterized by only the daily maximum temperature, and that can seriously affect health, energy management and regional economies (catastrophic crop failures, physical damages, etc.). The series of extreme heat events in daily maximum and minimum temperatures in Huesca (Spain) is used to exemplify the modelling process.

Keywords: bivariate Poisson process, non homogeneous Poisson process, test of independence between point processes, heat waves analysis

AMS Classification: 60G70, 62M99, 62P12.

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[1]Departamento de Métodos Estadísticos. University of Zaragoza
acebrian@unizar.es