Advanced analysis of forest fire clustering

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Analysis of point pattern clustering is an important topic in spatial statistics and for many applications: biodiversity, epidemiology, natural hazards, geomarketing, etc. There are several fundamental approaches used to quantify spatial data clustering using topological, statistical and fractal measures. In the present research, the recently introduced multi-point Morisita index (mMI) is applied to study the spatial clustering of forest fires in Portugal. The data set consists of more than 30000 fire events covering the time period from 1975 to 2013. The distribution of forest fires is very complex and highly variable in space.

mMI is a multi-point extension of the classical two-point Morisita index. In essence, mMI is estimated by covering the region under study by a grid and by computing how many times more likely it is that m points selected at random will be from the same grid cell than it would be in the case of a complete random Poisson process. By changing the number of grid cells (size of the grid cells), mMI characterizes the scaling properties of spatial clustering. From mMI, the data intrinsic dimension (fractal dimension) of the point distribution can be estimated as well.

In this study, the mMI of forest fires is compared with the mMI of random patterns (RPs) generated within the validity domain defined as the forest area of Portugal. It turns out that the forest fires are highly clustered inside the validity domain in comparison with the RPs. Moreover, they demonstrate different scaling properties at different spatial scales. The results obtained from the mMI analysis are also compared with those of fractal measures of clustering – box counting and sand box counting approaches.

REFERENCES

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