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Local fractality: the case of forest fires in Portugal

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Abstract

The research deals with a study of local fractality in spatial distribution of forest fires in Portugal using the sandbox method. The general procedure is the following: (a) define a circle centred in each and all events with increasing radius R; (b) count the number of other events located within the circle of radius R, $N(R)$; (c) plot the growth curve which is the functional dependence of $N(R)$ versus R; and (d) estimate the local fractal dimension as the slope on $\log[N(R)]$ versus $\log[R]$. The computation is carried out by using the location of every fire event as a centre but without the final averaging over all the fires for a given R, which is usually performed to get a global fractal dimension and to estimate global clustering. Sandbox method is widely used in many applications in physics and other subjects. The local procedure has the ability to provide the most complete information regarding the spatial distribution of clustering and avoiding non-homogeneity and non-stationarity problems. Most of the analysis was performed using the National Mapping Burnt Area (NMBA) database which accounts for 32 156 fires during the 1975 – 2013 period. The results of local analysis are compared with a randomly generated pattern in forest zones (validity domain). The results demonstrate interesting local spatial patterns of clustering. Some results on global measures are reported as well.

Keywords: Local fractality; clustering analysis; forest fires; Portugal.