



## **A 2D Multiscaling Detrended fluctuation Analysis applied to a Digital Elevation Model**

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Landscape is created and modified by human and natural processes. The type of rock and soil, the shape of the land, the amount of rainfall and type of vegetation, the river's shape, size and flow, the slopes influence and drainage pattern are factors that may act individually or interact with each other producing gradual changes in dynamic of landscape ecology or otherwise, to act abruptly producing the denominated disturbances. A digital elevation model (DEM) provides the information basis used for many geographic applications and the analysis of different patterns. Research into relationships between landscape pattern and process has been influenced by the introduction of fractal and multifractal analysis (MFA) (Aguado et al., 2014).

Multifractal detrended fluctuation analysis (MFDFA) has been well known technique applied to 1D signal, time series and soil transect data (Morató et al., 2017). It has the advantage that removes the trend of the data making possible a MFA. Recently, MFDFA algorithm has been generalized to deal with two-dimensional signals (Caiping Xi et al., 2016). This type of analysis could be a potential tool to easily simulate distinctive topography spatial distribution. Based on it, to simulate erosion or understand the main factors that create a complex dynamic in the landscape evolution becomes easily as a tool for researches.

A 2D MFDFA is applied to landscape data based on the altitude. The study zone is a matrix of 2053 x 2053 pixels, with a resolution of 5m (25 m<sup>2</sup> by pixel) and 1 m of height resolution, obtained from a digital terrain model (DTM). This zone corresponds to quite homogeneous region with respect to soil characteristics and climatology but with topographic distinctive areas, known as "Monte de El Pardo" (Aguado et al., 2014), due to the directions of the two river basins, Trofa and Manzanares, and the gradual change in the direction of the Trofa river towards Manzanares river along the centuries.

The statistical accuracy, the sensitivities of the sample size, the selection of scaling range and the choice of the q-orders are showed and discussed. Several interpretations are made based on the results obtained and compare to 1D MFDFA (Castellanos et al., 2017).

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