Structure function and Multifractal spectrum applied to Digital Elevation Model

Pedro Luis Aguado (1), Juan Pablo del Monte (1), and Ana Maria Tarquis (2)

(1) Dpto. de Producción Vegetal: Botánica, E.T.S.I.A., U.P.M, Madrid, Spain (pl.aguado@upm.es, jp.monte@upm.es), (2) CEIGRAM, Universidad Politecnica de Madrid, Madrid, Spain (anamaria.tarquis@upm.es)

A Digital Elevation Model (DEM) provides the information basis used for many geographic applications such as topographic and geomorphologic studies, landscape through GIS (Geographic Information Systems) among others. The DEM capacity to represent Earth's surface depends on the surface roughness and the resolution used. Each DEM pixel depends on the scale used characterized by two variables: resolution and extension of the area studied. DEMs can vary in resolution and accuracy by the production method, although there are statistical characteristics that keep constant or very similar in a wide range of scales. Based on this property, several techniques have been applied to characterize DEM through multiscale analysis directly related to fractal geometry: multifractal spectrum and the structure function. The comparison of the results by both methods is discussed.

The study area is represented by a 1024 x 1024 data matrix obtained from a DEM with a resolution of 10 x 10 m each point, which correspond with a region known as "Monte de El Pardo" a property of Spanish National Heritage (Patrimonio Nacional Español) of 15820 Ha located to a short distance from the center of Madrid. Manzanares River goes through this area from North to South. In the southern area a reservoir is found with a capacity of 43 hm3, with an altitude of 603.3 m till 632 m when it is at the highest capacity. In the middle of the reservoir the minimum altitude of this area is achieved.