GSSL-2018-C04

FRACTAL ANALYSIS ON RIVER NETWORKS BASED ON REMOTE SENSING DATA: AN EXAMPLE FROM KELANI RIVER BASIN, SRI LANKA

S.B.A.D.Y. Jayawardena and N.D. Subasinghe*

National Institute of Fundamental Studies, Hantana Road, Kandy, Sri Lanka

**Corresponding Author Email: deepal@ifs.ac.lk*

River networks are important components of basin geomorphology and have impacts on various natural phenomena such as river flow, sediment transport and flood. Therefore, an accurate description of river network geomorphology is crucial for investigating patterns and correlations in these natural phenomena. Traditional morphologic methods can only investigate the simple geometric configurations and poorly describe natural features of complex river networks. Fractal geometry method includes river shapes characterized by irregularities. Recent applications of models based on fractal geometry have shown the ability to describe complex geomorphologic characteristics of river networks and other hydrological variables. Hence, this initial study provides a valuable approach to quantify the river network complexity. This study employs a natural river network extracted using ASTER Global Digital Elevation Models (GDEM s – 30m resolution). Study area is located between 7° 13′ 29.5″ - 6° 47′ 20.5″ North latitude and 79° 58′ 22.5″ - 80° 25′ 47.5″ East longitude (about 2,428 km^2). Five sub – watersheds of Kalani basin were selected for the study: 1) Ambalanpiti oya, 2) Gurugoda oya, 3) Pugoda oya, 4) Pusweli oya, 5) Wak oya. 250 pixels were set as threshold and extracted network upto threshold includes a river network of six orders according to the *Strahler* ordering scheme. Fixed - size box counting algorithm was applied to obtain fractal measures. Box counting method was applied to the same river network twice; allocating weighted lines (pixel width) for different orders and allocating non-weighted line for all tributaries to check which one gives the better explanation on complexity. Both fractal and multifractal analyses were conducted. Goodness of fitted regression line (R^2) is greater than 99% for all river networks when weighted lines were used, while some of the non-weighted textures are below 99%, indicating that weighted lines are the best for analyzing the river network orders. Fractal dimension of selected sub – watersheds varies from 1.42 to 1.55 in weighted order textures and 1.39 to 1.53 in non – weighted order textures. Generalized fractal dimension obtained from multifractal analysis varies from 1.48 to 1.63 in weighted order textures and 1.47 to 1.60 in non–weighted order textures. In this study, Gurugoda oya has the highest fractal dimension and the most complex geomorphologic shape. Smallest value obtained from Pugoda oya displays the least complexity. Multifractal spectra $f(\alpha)$ are index of the river network geometric complexity. A detailed investigation is required (considering lithological and structural features of the basin) to link $f(\alpha)$ to the physical characteristics of a river network.

Keywords: *Fractal Analysis, Geomorphology, Complexity, Kelani River Basin*