Abstract

Hydrological response of a catchment is a function of rainfall as influenced by catchment characteristics comprising geomorphology, land cover, and management practices. In this study, the analysis mainly focused on how geomorphological characteristics influence the catchment hydrological response. Geomorphological analyses of catchment geometry, stream patterns, relief, and slope can be used to characterize the catchment features that affect the drainage network. These characteristics are catchment specific and therefore unique to provide an insight into its hydrologic response. The objective of this research was to quantitatively analyze geomorphologic characteristics; linear, areal, drainage pattern, and relief aspect, of Amala River catchment, using ArcGIS tools and infer its hydrological behavior. The morphometry of the catchment was derived from the DEM within the ArcMap environment. These parameters as well as mathematical map equations were used to derive geomorphological characteristics such as bifurcation ratio, rho coefficient, drainage density, infiltration number, form factor among others. The results show that the Amala River catchment is elongated with uniform lithology and a higher probability of delayed peak hydrographs due to longer lag time and time of concentration. The catchment exhibits a dendritic drainage pattern with an average bifurcation ratio of 4.26 which is closer to the upper bound value of 5. This indicates a reduction in peak flows and a delayed time to peak. The surface runoff yield efficiency was low and non-uniform with an average drainage density of 1.073 km/km2. The catchment was characterized by higher infiltration characteristics as compared to surface flows, this varied spatially, with sub-basins far North of the outlet having high infiltration than those near the outlet. The catchment relief was characterized as steep and therefore high stream velocity was inferred. The investigation and findings of this study on catchment geomorphology and inferred hydrologic behavior will be of great importance in catchment management, water resource planning within the catchment, and water harvesting at a spatial scale. Thus, the outcomes provide a baseline for informed water pan and water harvesting structures site.