



# Morphometric, statistical, and hazard analyses using ASTER data and GIS technique of WADI El-Mathula watershed, Qena, Egypt

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## Abstract

An attempt to carry out morphometric, statistical, and hazard analyses using ASTER data and GIS technique of Wadi El-Mathula watershed, Central Eastern Desert, Egypt. Morphometric analysis with application of GIS technique is essential to delineate drainage networks; basin geometry, drainage texture, and relief characteristics, through detect forty morphometric parameters of the study watershed and its sub-basins. Extract new drainage network map with DEM, sub-basin boundaries, stream orders, drainage networks, slope, drainage density, flow direction maps with more details is very necessary to analyze different morphometric and hydrologic applications for the study basin. Statistical analysis of morphometric parameters was done through cluster analysis, regression equations, and correlation coefficient matrix. Clusters analyses detect three independents variables which are stream number, basin area, and stream length have a very low linkage distance of 0.001 (at very high similarity of 99.95%) in a cluster with the basin width. Main channel length and basin perimeter (at very high similarity of 99.83%) are in a cluster with basin length. Using the regression equations and graphical correlation matrix indicates the mathematical relationships and helps to predict the behavior between any two variables. Hazard analysis and hazard degree assessment for each sub-basin were performed. The hazardous factors were detected and concluded that most of sub-basins are classified as moderately to highly hazardous. Finally, we recommended that the flood possibilities should be taken in consideration during future development of these areas.

**Keywords** Watershed · Hydrology · GIS · Morphometry · Statistics · Hazards · Wadi El-Mathula

## Introduction

The morphometric analysis provides hydrogeological understanding with complete quantitative description of watershed and/or drainage basin through study of its geological and geomorphic history from its geometry and network characteristics (Strahler 1964). Interpretation and understanding the drainage of watershed catchment physiographic characteristics (e.g., texture, density, intensity, frequency, length, slope, and size

... etc.) play an important role in its hydrological conditions correlation (Rastogi and Sharma 1976). The remote sensing and GIS technique are adequate method and efficient mechanism used essentially for morphometric analysis. Specification of drainage networks within watershed catchment drainage system can be achieved using traditional methods (manually) or alternatively with advanced DEM and remote sensing technique (Singh 1992; Maidment 2002).

For the future development and effective administration for any watershed or basin, mapping of flash flood hazard is a very important issue (i.e., for the sustainable development of the water resources and for the protection from the flood hazard and drought). The study area caught the attention of many researchers, due its future important for land reclamations and future mining projects. Therefore, the main objective of the present study is to assess geomorphic and hydrologic features and processes of Wadi El-Mathula watershed through morphometric, statistical, and hazard analysis using GIS technique and ASTER GDEM data, and applying an innovative approach through multivariate statistical analysis of the different

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