



Rainfall-runoff estimation and comparative analysis using SCS method based on GIS

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ABSTRACT

Accurate estimation of runoff and sediment yield amount is not only an important task in physiography but also important for proper watershed management. Watershed is an ideal unit for planning and management of land and water resources. Direct runoff in a catchment depends on soil type, land cover and rainfall. Of the many methods available for estimating runoff from rainfall, the curve number method (SCS-CN) is the most popular. The curve number depends upon soil and land use characteristics. This study was conducted in the Kaam watershed in north western Libya using remote sensing and GIS. SCS-CN method has been used for surface runoff estimation for five sub-watersheds of Kaam. The soil map, land use and slope map were created in the GIS environment, because the curve number method is used here as a distributed model, it is necessary to obtain information on a large number of sub-catchments in the basin. Therefore, remote sensing and GIS techniques were used. The major advantage of employing GIS in rainfall -runoff modelling is that more accurate sizing and catchment characterization can be achieved. Furthermore, the analysis can be performed much faster, especially when there is a complex mix of land use classes and different soil types, Landsat satellite image was used to obtain ground cover information. The thematic layers such as the soil map, elevation map, rainfall map and ground cover map were created in Arc GIS 10.3. Then was set the values of Curve numbers in the study area, and by applying the SCS-CN method, the results showed that the surface runoff ranged from 94 to 165 mm in the study area, when rainfall rates were received from 204.07 to 284.6 mm. To find the relationship between rainfall and runoff rates, the straight line equation was used, That was found there a strong correlation between runoff and precipitation rates. The value of the determination coefficient was 73% and the correlation coefficient between them 85%. Through these results, the study recommends taking advantage of runoff rates by reserving them at collection of sub basins and then using them for agricultural purposes in the vicinity. This would be better than reserving water from the total area of the basin, which is 2,283 square kilometres, and then will evaporate or infiltrate before reaching the dam lake.

Keywords: GIS; SCS method; Rainfall-Runoff; Watershed; Land use