

RAINFALL-RUNOFF SIMULATION IN AN EXPERIMENTAL BASIN USING GIS METHODS

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ABSTRACT

A GIS-based rainfall-runoff model was developed to simulate the runoff discharge at the outlet of a 15.18 km² gauged steep watershed that is located at the prefecture of Attica, Greece. The model's core is the time-area routing technique, which shares the assumptions of the unit hydrograph theory. This technique accounts for translation, does not account for watershed storage effects and is applicable mainly to small to midsized watersheds. GIS was used to develop the watershed cumulative travel time map that was divided into isochrones in order to generate the time-area histogram. Basic maps were the rasters of digital elevation model and landuse that were processed to derive the rasters of slope, flow direction, flow accumulation and roughness coefficient. The model was calibrated and validated using the observed rainfall-runoff data from thirty storm events. Two simulated hydrographs were calculated for each storm event, using the watershed time-area histogram and two temporal distributions of excess rainfall, estimated by the SCS and the Phi-Index methods. The simulated values of peak flow rate and time to peak were compared with the observed values, via statistical methods. A sensitivity analysis indicated the effect of various parameters on the simulated hydrographs.

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