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Study of the correlation between the spatiotemporal distribution of rainfall and the surface runoff in a torrential catchment using GIS

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Abstract
Natural disasters have important impacts in many countries worldwide and thus they are a substantial threat to the progress and development of human communities. Floods are considered to be one of the most devastating natural phenomena due to their frequent occurrence, as well as their crucial spatial spread. Several areas in Greece, very often, suffer from local flood events that caused by severe storms and they are associated with, small or medium size, catchment drained by ephemeral water courses, such as torrents. It should be noted that flash floods tend to have low frequency, but they are distinguished by high intensity. The technological progress during the last decades, especially in the field of geoinformatics, has offered new advantages in hydrological modelling. Geographic Information Systems technology, successfully, facilitates the processing of large data, in order to generate simulation models of natural processes - including the hydrological cycle - thus contributing to the study of flood events. Therefore, GIS can be a very useful tool towards water resources systems analysis and planning. This study seeks to use this technology in order to investigate the correlation between the spatiotemporal distribution of the rainfall and the surface runoff. The study area which was used is an ungauged catchment and by using mostly GIS hydrological and geomorphological analysis together with a GIS-based distributed Unit Hydrograph model, a series of outcomes have risen. Unit Hydrographs are, as it known, useful when there is lack of data and in this work, based on time-area method, a sequences of flood risk assessments have been made using the GIS technology. Essentially, using the rainfall data, derived from an Atmospheric Simulation model, a plethora of spatiotemporal patterns of rainfall and runoff have been analysed. The proposed methodology uses a spatially distributed rainfall-runoff model, in a GIS environment, and concerns the hydrological analysis of a catchment, using mosaic data (raster grid), in order to investigate the catchment's response to the hypothetical rainfall scenarios. The main objective of the simulation is to estimate the flood peaks and critical time in order to detect and identify the most adverse spatiotemporal runoff patterns.

Keywords
Flood Risk; Torrential catchment; Rainfall-Runoff Model; Unit Hydrograph; Spatiotemporal Analysis; GIS; Hydrological analysis; Geomorphological analysis.