

IMPACT OF CLIMATE CHANGE ON FLASH FLOODS USING HYDROLOGICAL MODELLING AND GIS: CASE STUDY ZARQA MA'IN AREA

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ABSTRACT

Jordan is located in an arid zone that is subject to flash flood hazard initiated by heavy rainfall storms that frequently prompt massive damage to life and infrastructure. The Zarqa Ma'in catchment area is located in the central part of Jordan, East of the Dead Sea and about 10 km southwest of Madaba city. A major flash flood event occurred in the Zarqa Ma'in area on October 25th, 2018. This event was characterized by a rainfall precipitation amount of 43 mm within 22 minutes. The impact of this flood has been disastrous, with 21 people killed and several injured. This study deals with the analysis of the various factors that caused this flash flood as well as calculation of runoff values for Zarqa Ma'in catchment area through the use of the hydrologic modeling Soil Conservation Services (SCS) method, a method that is often used by hydrologists in arid regions and Watershed Modeling System model (WMS 11) and Geographic Information System (GIS 10.7).

Rainfall and climatological data analysis and interpretation by using frequency analysis indicated an increase in rainfall amounts and temperature during the last 40 years due to global climate change. Analysis of morphometric parameters showed that the morphometric characteristics of the watershed contribute to high-speed floods with low infiltration rates. LU/LC results showed that the bare rocks and soil cover about 35% of the Zarqa Ma'in catchment area which will increase the velocity of runoff water and accelerate its flood peak. In the hydrological modeling, the HEC-HMS model was applied to Zarqa Ma'in watershed to predict the surface runoff after passing with WMS. The peak discharges obtained for the thunderstorm which occurred on October 25th, 2018. The flood hydrograph volume is about 2.98 MCM with a peak discharge of about 102.94 m³/s for sub-basin 1, 1.31 MCM with a peak discharge of about 126.66 m³/s for sub-basin 2 and 4.3 MCM with a peak discharge of 146.7 m³/s at the outlet of Zarqa Ma'in catchment. The result of the cross section of sub-basin 1 indicate a water depth of 11m from the ground, while the water depth in the cross-section of sub-basin2 from the ground was 3m.

KEYWORDS: Zarqa Ma'in, Flash Flood, Curve Number, Morphometric Parameters, Unit Hydrograph

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