

**Comparative Study on Flash Flood Vulnerability Assessment in the
Historical Makkah Region, Saudi Arabia**

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Flash flooding poses a significant threat in arid and semiarid regions, leading to property damage and population displacement. This research employs the analytic hierarchy process (AHP) and correlation methods to assess flood vulnerability in the Makkah Region, Saudi Arabia, by integrating digital elevation models (DEMs) and Landsat 8 Operational Land Imager (OLI) data within a geographic information system (GIS). Thematic layers, encompassing topographic, geomorphic, climatic, and hydrological factors, are analysed through AHP, yielding a Flash Flood Hazard Zone (FFHZ) map. This study identified five risk zones, with higher vulnerability in the southern region and moderate to low risk levels in the northern and central regions. This research integrates diverse data sources and assigns weights via AHP to generate hazard maps based on attributes such as rainfall, distance to rivers, elevation, and slope. Comparative analysis with correlation methods enhances flood hazard detection and management strategies. The findings offer valuable insights for urban planning, disaster management, and informed decision-making, serving as a resource for policymakers, research institutions, and farmers to enhance risk assessment accuracy and develop resilient strategies for agriculture and livelihoods.

Keywords: Flash flooding; Hazard mapping; AHP; GIS; DEMs; Landsat 8 OLI; Makkah