Assessment of flood hazard areas at a regional scale using an index-based approach and Analytical Hierarchy Process: Application in Rhodope–Evros region, Greece

Abstract:
The present study introduces a multi-criteria index to assess flood hazard areas in a regional scale. Accordingly, a Flood Hazard Index (FHI) has been defined and a spatial analysis in a GIS environment has been applied for the estimation of its value. The developed methodology processes information of seven parameters namely flow accumulation, distance from the drainage network, elevation, land use, rainfall intensity and geology. The initials of these criteria gave the name to the developed method: "FIGUSED". The relative importance of each parameter for the occurrence and severity of flood has been connected to weight values. These values are calculated following an "Analytical Hierarchy Process", a method originally developed for the solution of Operational Research problems. According to their weight values, information of the different parameters is superimposed, resulting to flood hazard mapping. The accuracy of the method has been supported by a sensitivity analysis that examines a range for the weights' values and corresponding to alternative scenarios. The presented methodology has been applied to an area in north-eastern Greece, where recurring flood events have appeared. Initially FIGUSED method resulted to a Flood Hazard Index (FHI) and a corresponding flood map. A sensitivity analysis on the parameters' values revealed some interesting information on the relative importance of each criterion, presented and commented in the Discussion section. Moreover, the sensitivity analysis concluded to a revised index (named FHIS) and flood mapping, supporting the robustness of FIGUSED methodology. A comparison of the outcome with records of historical flood events confirmed that the proposed methodology provides valid results.

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