



Expert-based landslide susceptibility modelling by using hierarchical fuzzy systems (HFS): an investigation from central part of Rif Mountains (Morocco)

Beyazid C. Ozer (1), Begum Mutlu (2), Hakan A. Nefeslioglu (3), Ebru A. Sezer (4), Mohamed Rouai (5), Abdelilah Dekayir (5), and Candan Gokceoglu (1)

(1) Faculty of Engineering, Department of Geological Engineering, Hacettepe University, Ankara, Turkey, (2) Faculty of Engineering, Department of Computer Engineering, Gazi University, Ankara, Turkey, (3) Faculty of Engineering, Department of Geological Engineering, Akdeniz University, Ankara, Turkey (hanefeslioglu@gmail.com), (4) Faculty of Engineering, Department of Computer Engineering, Hacettepe University, Ankara, Turkey, (5) Faculty of Sciences, Department of Geology, Meknes University, Meknes, Morocco

The main purpose of this study is to produce landslide susceptibility models by using Hierarchical Fuzzy Inference Systems (HFS) based on expert opinion, in the Beni Ahmed Region in Rif Mountains in Morocco. The investigations were carried out in four stages. These are (i) producing of landslide inventory map of the study area, (ii) evaluation of the conditioning factors in the region, (iii) construction of the hierarchical fuzzy systems and rule-based structures of the expert models, (iv) evaluation of the expert systems, mapping of the landslide susceptibilities, and performance assessments. As a result, total 237 landslides were mapped in accordance with the field studies performed in the region, interpretations of satellite images which were acquired from the Google Earth, and recent papers which were already published in current literature. The landslide inventory produced in this study was used for verification of the expert models. The Receiver Operating Characteristics (ROC) curves were implemented in order to assess spatial prediction performances of the cascaded fuzzy inference systems. For this purpose, the Area Under the ROC Curve (AUC) statistics were evaluated. According to the AUC values, the best performance was calculated to be 0.67 for the model in which narrow membership functions and Defuzzification-Free Hierarchical Fuzzy System (DF-HFS) were implemented.