Multi-Hazard Susceptibility Mapping Using Machine Learning, A Case Study of Hunza

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District Hunza are threatened by multiple hazards which pose significant threat to humans, buildings and infrastructure. The region has experienced numerous extreme climatic hazards including landslides, Debris flow, Seismic, Glofs, and Floods. Moreover, Hazards are usually studied separately and ignore multiple geo-hazards in the same area. Furthermore, this study produces multi-hazard Susceptibility map by integrating the (landslide susceptibility, Debris flow, Seismic, Glof, Floods hazard) for District Hunza, Northern Pakistan. Landslide, Debris flow, Seismic, and Glof hazard were collected from secondary sources. While the flash flood and riverine flood (Water level rise) hazards were developed using OpenLISEM and Global Mapper in this study. First, an equal number of hazard and non-hazard locations was digitized from each hazard map and then validated those randomly sampled locations in field. additionally, we have sub- divided the data by random partitioning technique into train-test chunks. 70% of these locations were randomly chosen for susceptibility map, while 30% were used for validation purpose. An intelligent learning machine called forest-based classification and regression model (RF) within an open-source R.4.3.3 software was utilized to estimates the importance of specific hazard. Then, the importance of each hazard was incorporated into-model for producing the multi-hazard susceptibility map. Finally, the spatial distribution of each hazard was assessed, and classified into nine classes named as: no hazard (8.83%), low + no hazard (58.57%), LS (12.53%), FF (6.06%), DF+FF (4.65%), FF+LS+DF (3.98%), SH+DF+LS+FF (2.87%), DF+LS+GLOF+SH (1.67%), and FF+RLR+SH+GLOF+LS+DF (0.80). The presented method will contribute to a Disaster risk reduction of disaster losses in District Hunza and will foster future efforts of harmonization of risk management strategies in the country.