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Landslide hazards assessment of Kohistan District segment of Karakorum Highway, North-Pakistan

Javed Iqbal (1,2) and Peng Cui (1)

(1) Institute of Mountain Hazards and Environment, Chinese Academy of Sciences, Key Laboratory for Mountain Hazards and Earth Surface Process, Chengdu, Sichuan, China (javediqbalgeo@gmail.com), (2) Department of Earth Sciences, Abbottabad University of Science and Technology, Abbottabad, Pakistan

Abstract

The Karakorum highway (KKH) was constructed in 1974-1978 and was opened for public in 1979. However, it has been facing the slope stability issues since its construction and usually remains blocked for traffic few months every year. In this study, the Kohistan district (upper and lower Kohistan) segment (about 150 km) of KKH with a buffer zone of eight kilometers on both sides of the highway was investigated which is the most landslide prone section of KKH. In order to achieve the goal, a comprehensive landslide inventory (over 1000 landslides) was prepared in ArcGIS 10.5 using google earth imaginaries coupled with GAOFEN-1 high resolution images followed by selective field check. In addition to this, landslide susceptibility assessment was done using weights-of-evidence (WOE) model with ten thematic layers of independent variables including slope, aspect, elevation, relative relief, NDVI, plan-curvature, prof-curvature, lithology, stream buffer, fault buffer. The model results show that 49 % landsides lie within the high and very high susceptibility zones which is very alarming situation for the highway as well the two mega hydro-electric dams (Dasu dam and Bhasha dam) which are being constructed within the vicinity of the study area. The predictive ability of AUC values indicate that the success rate and the prediction rates of WOE model are 0.86 % and 0.84 %, respectively, which shows the reliability of the model in the study area. The landslide susceptibility maps produced in this study are of great importance for the engineering and the policy makers for the future development of the KKH and China-Pakistan Economic Corridor (CPEC) which runs parallel to sub-parallel to KKH in North-Pakistan as well as for the precautionary measures for the dams before the reservoir lake filling to avoid the possible social and economic losses to the people living downstream as well as on elevation higher than the maximum reservoir levels. However, a separate study for the reservoir landslides is suggested before the reservoir lake filling for each dam.

Keywords: Karakorum highway, landslide susceptibility, weights-of-evidence, Dasu dam, Bhasha dam