Application of spatial database modeling to seismic landslides hazard

mapping with logistic regression model

[†]Yu Huang^{1,2}, *Jiamin Zhou², and Miao Yu²

¹Key Laboratory of Geotechnical and Underground Engineering of the Ministry of Education, Tongji University,

Shanghai 200092, China

² Department of Geotechnical Engineering, College of Civil Engineering, Tongji University, Shanghai 200092,

China

*Presenting author: 93312@163.com †Corresponding author: yhuang@tongji.edu.cn

Abstract

Landslides cause enormous casualties and property loss and frequently happen on a global scale, which is widely considered as a huge damage to human society compared to other natural hazards. And the earthquake-induced landslides may cause the most damage for its large scale, wide distribution and destructive power. The main aim of the study is to propose an efficient and low-cost method to assert the susceptibility of seismic landslides and offer the regional hazard mapping. The method may remedy defects of some other traditional methods in certain circumstances, especially for the poor and remote places where the field survey is difficult and only few paper maps exist. By constructing spatial database and determining the conditioning factors, a hazard mapping system is designed based on the logistic regression model. The topographic database is calculated from the digital elevation model (DEM) generated by the method of Interferometric Synthetic Aperture Radar (InSAR) based on the ALOS Radar images. Other geological database can be acquired after digitizing from paper maps on the Geographic Information System (GIS). In this paper, northern part of Sichuan Province (104°55'30″E~105°15'30″E, 32°07'30″N~32°27'00″N) was selected as a case study. The factors involved in evaluation were concluded from the local geological research including topographic characteristics, river distribution, geology, human activity, etc. With the quantized data of each factor based on remote sensing (RS) and GIS spatial analysis, the logistic regression model could be made and weight values of each factors were figured out as well as the equation of probability. According to the equation, the risk probability mapping in the study area was acquired. The hazard mapping of seismic landslides was eventually received as dividing the probability value as needed. Compared to the landslide sites triggered by the 2008 Wenchuan earthquake in the study area, the hazard map showed a high prediction accuracy. The method provides a user-friendly and efficient way of hazard mapping for risk prevention and land use planning.

Keywords: Landslides, Hazard mapping, InSAR, GIS, Logistic Regression Model.