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断裂带两侧地震诱发滑坡空间分布差异性的主要影响因素研究——以北川地区的地震滑坡分布为例

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The main factors causing the seismic landslide distribution difference on two sides of the faults —A case study of landslide distribution in Beichuan area

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摘要

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摘要 目前在地震滑坡影响因素的研究中,一般认为岩性、地形地貌、坡度、地震烈度、震中距等因素对滑坡的空间分布有重要的影响作用,忽视了发震断裂的运动方式对滑坡分布所起作用.5.12汶川地震诱发的大量滑坡崩塌灾害主要沿龙门山断裂带发育,但在断裂带两侧呈不对称分布,80%以上的滑坡、特大型滑坡主要分布于断裂带的上盘.这一现象在汶川地震重灾区之一的北川地区表现尤为明显.本文以GIS为平台,通过对北川地区地震滑坡空间分布特点及断裂带两侧的地貌高程、坡度、岩性、余震分布、地表变形、地震动加速度等因素的分析,探讨了导致该区断裂带两侧滑坡分布差异特点的影响因素.研究结果表明,北川地区地震滑坡崩塌主要分布在距断裂带5 km的范围内,上下两盘的滑坡崩塌分布在数量和面积上存在明显的差异,上盘的滑坡分布面积为下盘的8倍多;在滑坡易于发生的高程(<1500 m)、坡度(25°~40°)范围,上下两盘所占比例相当,但是出现在下盘的滑坡数量远远低于上盘,相同坡度范围内上盘的滑坡发育比例达到下盘的3倍以上;位于上盘并紧邻断裂带的寒武纪、震旦纪地层中的滑坡崩塌最为发育;由于汶川地震发震断层的逆冲性质,余震及大的地表变形都发生在断裂带上盘,地震动加速度在上盘衰减速度低于下盘,表现出一定的上盘效应.从这些分析结果可以推断,引起研究区断裂带两侧滑坡分布差异的主要因素不是地形坡度和岩性条件,发震断裂的运动方式起到了主要的作用.

关键词: 地震滑坡 空间分布 影响因素 断裂运动方式

Abstract: It is generally believed that rock properties, topography, slope degree, seismic intensity, epicentral distance etc. have a main influence on the spatial distribution of seismic landslides ignoring the influence of the seismic fault mechanics. Landslides triggered by 5.12 Wenchuan Great Earthquake mainly occurred along the Longmenshan Fault Zone, but they were distributed asymmetrically on the uplift side and foot side. More than 80% of the total landslides and almost all the huge landslides are located at the uplifted side of the faults. This phenomenon is more evident in Beichuan area where it is one of the most damaged areas during Wenchuan Great Earthquake. Based on GIS technology, this paper analyzed landslides distribution characteristics of the study area, and as well landform elevation, slope degree, rock property, aftershock distribution, surface deformation, seismic peak ground acceleration of both the uplift and foot sides. Moreover, it discusses the key influencing factors that caused the landslide distribution difference between the uplift and foot sides of the faults. The results show that in the study area landslides concentrated within 5km from the fault rupture zone, and there are significant differences in number and distribution area of the landslides between the uplift side and foot side. The distribution area of the landslides at the uplift side is more than 8 times that at foot side. Landslides are prone to occur in areas with elevation lower than 1500m and slope degree 25~40. Both uplift and foot sides have equivalent proportion of such area, but the number of landslides at the uplift side is far more than that at foot side. In the area with same slope degree, landslides at uplift side are more than 3 times that at foot side. Most landslides developed in the Cambrian and Sinian strata close to the rupture zone at the uplift side. Because Wenchuan Great Earthquake was caused by thrust faults, aftershocks and large deformation occurred at the uplift side. Also, the seismic peak ground acceleration attenuates more slowly at uplift side than foot side. It is concluded that the main influencing factors caused the obvious difference of the landslides distribution should be contributed to the mechanics of the seismic fault, not the landform elevation, slope degree and rock type.

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