

Statistical distribution of landslides triggered by the historical strong earthquake in Hachinohe, Japan

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A comprehensive analysis of the distribution of landslides induced by the 1968 M7.9 Tokachi-Oki earthquake and historical strong earthquake (1677 M7.9, 1763 M7.4, and 1856 M7.5) in pyroclastic deposits was conducted in Hachinohe, northeast Japan. This paper presents a detailed statistical analysis on the landslides distribution, geometric parameters, and characteristics using the landslide inventory, which identified by aerial photograph and 0.5 m LiDAR data in a 50 km² area. The results indicate that landslide crown mostly occur near ridge crest or ridge shoulders. Through GIS-based analysis on LiDAR map, geometric parameter is of 314 coseismic landslides triggered by 1968 earthquake were obtained, including height, length, width, sliding depth, sliding angle, and apparent friction angle (arctangent of the height-length ratio). The fitting relationship of height and length from these data is $H=0.245L+1.970$, with an average apparent friction angle of 13.8°. The coseismic 1968 landslides mostly occurred on gentle slope lower than 30° with average slope angle of 26.4° and resulted in the apparent friction angle lower than 22° with average value of 13.8°. It suggests that landslides are commonly mobile with low equivalent coefficients of friction, even for small-volume landslides. Statistics analysis of morphology of coseismic landslide, old landslide, and hillslope demonstrates that the cluster of landslide orientations tend to north-northeast-east, which appears to be related to the relative positions of the shock epicenters. This study provides a framework for susceptibility investigation of earthquake-induced landslides in pyroclastic deposits materials.

Keywords: landslide, earthquake, pyroclastic deposits, geometrical characteristics, site effects