

Cause of boulder falls near a lobate scarp on the Moon: source estimate based on the attenuation relation of peak ground accelerations

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High-resolution images obtained by the Lunar Reconnaissance Orbiter Camera (LROC) show that lobate scarps were widely distributed on the whole Moon [Watters et al., 2010; 2015]. Kumar et al. [2016] suggested that boulder falls, that produced boulder trails on crater wall, might be triggered by moonquakes in the lobate scarps. However, they did not quantitatively estimate the magnitude of the moonquake and the relationship with landslide areas. In this study, to examine whether or not boulders falls were triggered by moonquakes in nearby lobate scarps, we evaluated the moonquake magnitude required for boulder falls on inner ring the Schrödinger Basin. We identified boulder trails using LROC images and measured the entire area of source region of boulder falls. The empirical relationship between the landslide area and the maximum acceleration of large-scale earthquakes ($M > 5$) on the Earth is approximated by a power-law [Tiwari and Ajmera, 2017]. We derived the relationship between the landslide area and the maximum acceleration under the lunar gravitational acceleration from the relationship for earthquakes. Based on the relationship, the maximum acceleration for moonquake was calculated from the surface area of source region of boulder falls. We used the attenuation equation for seismic wave [Kanno et al., 2006] to estimate the magnitude of the moonquake from the maximum acceleration. Since estimated land slide area was small, we extrapolated both the landslide relationship and the attenuation equation to apply to the Moon. Based on an assumption of the epicenter on the lobate scarp, the magnitude of the moonquake generating the boulder falls was estimated to be about 2, comparable to that for shallow moonquakes observed by Apollo's seismometer. This result is compatible to the interpretation that the boulders falls were due to the moonquake along the lobate scarp.

Keywords: boulder falls, lobate scarp