

Evaluation of seismic wave amplifications in the mountainous area with a temporary seismic network in Totsukawa Village

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Seismic wave is one of the most important triggering factors of landslides. Amplification effect of seismic waves transmitted from bedrock to ground surface has been confirmed by many observations. However, very few seismic stations are located in mountain areas, so it is impossible to assess the amplification effect of seismic waves using pre-existing measured data. In addition, the fact that most earthquake-induced landslides initiate from the ridge indicates that the magnification of seismic waves may vary in different parts of a mountain. In this study, we installed a temporary seismic network in the mountainous area of the Totsukawa Village, Nara Prefecture, Japan, having four station sites at different parts of a mountain with an EW trending topography: a ridge, a valley, a north-south slope, and an east-west slope. The monitoring period of the temporary network is approximately two years from November 15, 2017 to December 10, 2019, and we selected 25 earthquakes that occurred during the period for further analyses of the seismic waves. The fast Fourier transform (FFT) was applied to each seismic wave with a duration of 81.92 s and a Parzen window of 0.2 Hz bandwidth. We obtained the EW and NS horizontal components and the UD vertical component of the observed Fourier spectrum for each earthquake at each site. The relative position of an earthquake epicenter was interpreted as the direction of the seismic wave transmitted to each station. It is found that the difference in magnitudes of seismic wave amplification seems to be related to the parts of a mountain and the seismic wave direction. This would be helpful to identify locations susceptible to earthquake-induced landslides.

Keywords: seismic wave, amplification, Fourier transform, earthquake, landslide, topography