Monitoring insights on the co-seismic responses of a deep-seated landslide

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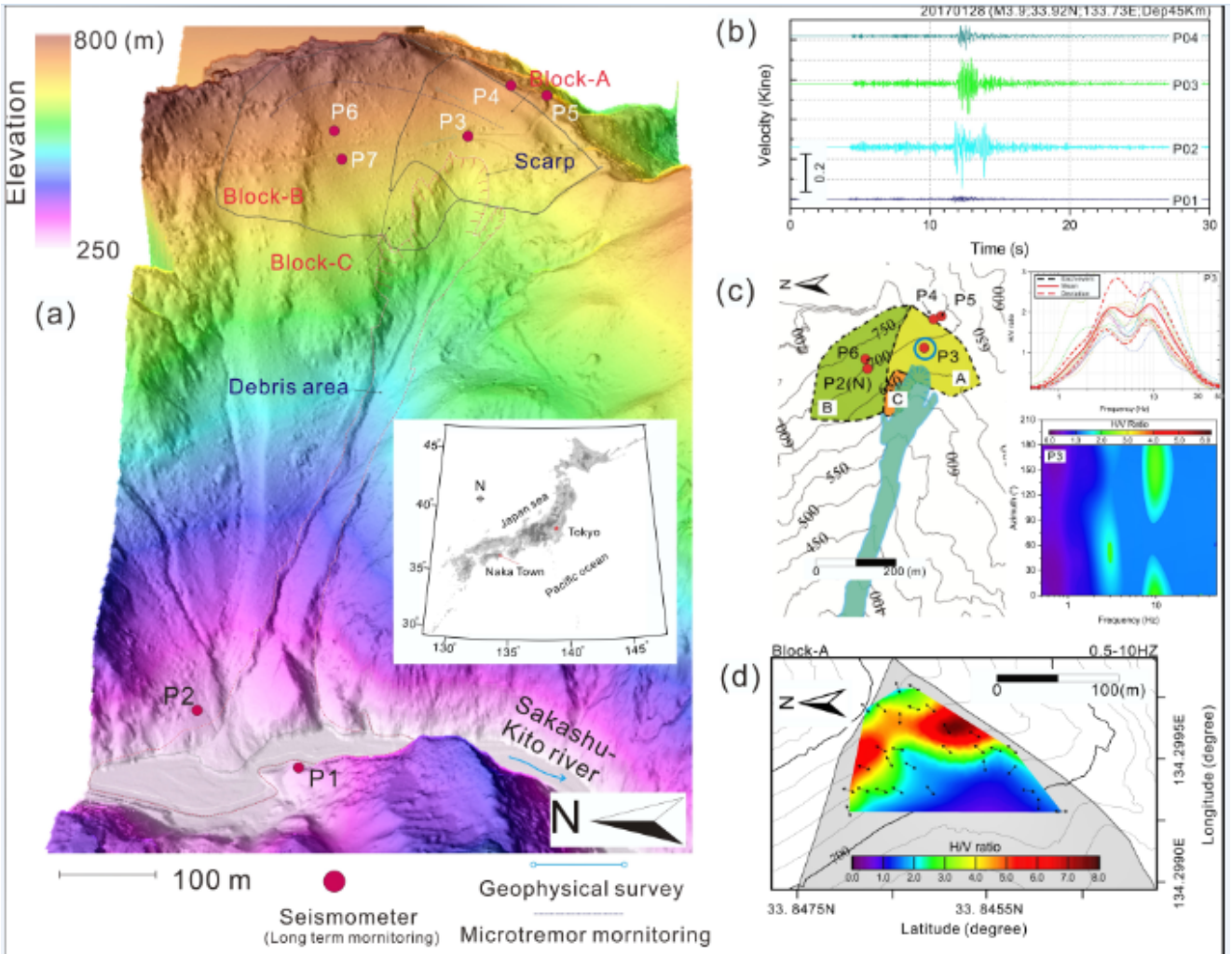
In recent years, earthquakes have triggered numerous landslides, resulting in severe damage to local properties and great loss of lives directly. To mitigate this kind of geohazards, great efforts had been paid to the study on understanding the properties of coseismic landslides. By now, the coseismic site responses, especially the amplification effects, on the initiation of landslides had been analyzed by means of various methods. However our understanding on the coseismic site response of the deep-seated landslides involved in more complicated geological and topographical conditions is still limited. Particularly, there are many potential deep-seated landslides in the accretionary prism mountains that may be activated by the coming earthquakes (Nankai and/or Tonankai mega thrust earthquakes around Japan). In order to understanding the features of coseismic response and vibrating behaviors in deep-seated landslide, some seismometers (6 stations until now) were installed on different locations of a target deep-seated landslide (reactivated by rainstorm in 2004), named Azue, which was located in Naka town, Tokushima prefecture (the potential damaged area included in the coming mega earthquakes). Based on the in-situ long-term coseismic and local ambient noise monitoring as well as some geophysical surveys (ERT and MASW), We analyzed the site responses, especially the amplification effects on different locations of the landslide. In detail, the results from the coda waves in seismic events show that the amplifications on deposit area (ancient talus) are relatively distinct with single amplification pattern. However the amplifications on landslide block are more complicated with multiple amplification patterns may due to the mixed causes (such as the relief topography and inner geological conditions in block). In addition, the amplifications on bedrock out of landslide area are weak. Meanwhile, the dense ambient noise records present that the complicated amplification patterns distributing on landslide block are evident and these may be result from seismic energy redistribution in the potential unstable blocks. Both the in-situ earthquake and ambient noise motioning records comprehensively can help us to learn the anisotropic seismic site response in layers ,with different materials, of the landslide and then we may learn the features vibrating behaviors of this type of deep-seated landslide.

Keywords: Coseismic site response, Deep-seated landslide, Amplification effect, Monitoring



(a)Azue deep-seated landslide and locations of monitoring system and the area of geophysical surveys performed

(b)One certain seismic events records (EW component) on different locations

(c)Amplification features (H/V rations) on P03. For amplification direction (right bottom graph), the values of 0 to 180 indicate the azimuths form North to South clockwise

(d)Amplification distribution on landslide block-A in frequency band of 0.5 to 10 Hz. Black arrows indicate the amplification directions

