堤防の地表面不整形性が波動伝播に与える影響
Effects of surface irregularity of embankment on wave propagation

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Phase velocity of surface wave, mainly Rayleigh wave, generated by artificial sources is used in the surface-wave exploration method to estimate a shallow S-wave velocity structure. It has been often used in soil surveys in, for example, river embankment, landfill and residential land. A horizontal layered model with the flat Earth's surface is assumed in data analysis of the method. However, the appropriateness of the assumption has not been sufficiently discussed for its application for a site which has surface and subsurface complex irregularities.
In this study, we investigate effects of surface irregularity on characteristics of surface-wave propagation through numerical experiments based on a finite-difference method to understand its applicability. First, we conducted 3D simulations of wave propagation in shallow soil models with and without surface irregularity considering realistic cases, such as embankment. Then, we derived frequency-dependent phase velocity from synthetic waves obtained on the surface of the models. we also examined effects of slope of embankment and a velocity contrast between surface layers and basement on the surface-wave phase velocity.
The effects of the 3D shape of surface topography are significantly identified in the surface-wave characters in the models with a high velocity contrast between surface layers and basement, when the model has a steep slope on a side of the embankment. In the embankment models, scattered wave generated in the upper surface and the base of the embankment was observed. The estimated phase velocity for the surface wave differs from those of the horizontally-layered model indicating difficulty to deduce a true velocity model. However, the phase velocity for the model having a low velocity contrast is similar to those in the horizontal model even in the models with steep slopes. It is concluded that effect of surface irregularity on the surface wave propagation is small in sites with a low velocity contrast with regardless of surface irregularity.

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