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Numerical modeling of seismic response of unstable rock slopes

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Steeply-dipping compliant fractures seem to play a key role in explanation of the observed seismic response of rock slope instabilities. We present 3D numerical modeling of seismic wave propagation in fractured media, representing the potentially unstable rock. This allows an interpretation of observed fundamental frequencies, amplification levels of the unstable rock slopes and study of earthquake induced strains in the rock mass as well. Such simulations involve a broad range of scales – from the kilometers long wavelengths of the seismic waves in hard rocks, down to the centimeter scale of the fractures, what requires advanced numerical methods. A finite-difference code has been adopted for the seismic wave propagation in a 3D inhomogeneous visco-elastic media with irregular free surface. It utilizes a curvilinear grid for a precise modeling of curved topography and local mesh refinement to make computational mesh finer near the free surface. In particular, ambient vibration time series have been synthetized in the frequency range of interest (1-10Hz) and processed. Models of representative real sites have been developed and used for the comparison between synthetics and observations. The results of the modeling have been used to characterize slope structure and possibly infer depth or volume of the slope instability from the ambient noise recordings in the future.