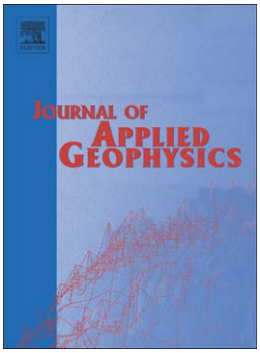

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A numerical study of the Rayleigh wave particle motions excited by a point source and Poisson's ratio for lateral inhomogeneous half-spaces

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ABSTRACT

In this paper, the dependence of Rayleigh wave particle motions excited by a point source on the lateral inhomogeneous Poisson's ratio of propagation half-spaces is studied based on the theoretical analysis and wave field numerical simulation method. First, two types of time signals named single frequency harmonic and broadband Ricker wavelet are used respectively as a point source in the simulation of homogenous half-spaces. The results shows that in the far-field region absolutely dominated by Rayleigh waves, or where body waves are well removed either by muting or polarization filtering, the ellipticity of particle motion can be approximated to be a simple inverse linear and frequency-independent relation with Poisson's ratio of rocks and soils, which has a linear correlation coefficient of over 0.9775 with the exact analytic solutions derived from theoretical formula for a homogeneous half-space. Then, two types of lateral inhomogeneous models, a vertical rock interface and a local heterogeneous body with various Poisson's ratios, are simulated. The results show that a local inhomogeneity can cause a local and wavelength-dependent ellipticity anomaly. The ellipticity is still in inverse proportion of Poisson's ratio but distorted with a high nonlinearity for the lateral inhomogeneous. The interferences of converted body waves are also studied, and the results suggest that the ellipticity estimation of Rayleigh waves suffers little from the body waves converted by the scattering of lateral inhomogeneity. The study shows that the dependency of Rayleigh wave ellipticity on Poisson's ratio is potentially beneficial for Poisson's