

Estimation of scattering strength distribution based on seismic array observation (4)

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Seismic array analysis is one of the best ways to get fine information about inhomogeneity of the Earth's interior. Seismic array can decompose scattered waves coming from various directions although spatial coverage is smaller than seismic network. If we analyze seismograms recorded by small aperture array with station separations of several tens meters, ray direction approaching to the array would be determined in more detail. We have developed a method for estimating spatial distribution of scattering strength using small aperture seismic array data. This is a method that estimates scattering strength distribution combining slant stacking and diffraction curve summation processing. Scattering strength can be evaluated from energy ration of slant-stacked energy to direct wave one and correcting factor from single scattering model. If a seismic array has enough large aperture and dense sensor distribution, an array response function will become delta function. Then, scattering strength simply obtained by multiplying the correction factor of single scattering model. However, a slant-stacked energy sequence in original ray direction leaks energy to envelopes stacked into other directions due to array response effect in actual case. Envelopes in the other slownesses do not become zero energy as far as array response is non-delta-function. In this study, we simulated array data composed of scattered waves by randomly distributed scatterer. The array has 'Y' shaped one and deployed 19 stations. In this simulation, amplitudes of slant stacked waveforms are not only observed in original direction of scattered wave, but in different directions from the directions. This implies difficulty of applying delta-function-response assumption to the array with configuration as shown in this example. In such cases, correcting factor for array response can be estimated by assuming that scattered waves coming whole directions with same energy. Then, we can estimate scattering strength correctly.

In this simulation, we discuss other factor. That is temporal variation of semblance with lapse time. Even if scattering strength is uniform, pattern of arrival of scattered wave depends on density of scatterer. For high scatterer density, scattered waves with small amplitude by weak scatterers arrive to the array continuously and randomly. Then, it is difficult to identify directions of scattered waves. However, scattered waves by strong scatterers rarely distributed approach to the array. In this case, we can easily identify the ray direction. These are directly reflected semblance coefficients. Although these cases simulates scattered wave field by same scattering coefficients, semblance coefficient is different each other. It suggests a possibility that semblance analysis can be identify density of scatterer.