

Structure of Mozumi-Sukenobu fault zone from the forward modeling of the seismic waveform using 3D finite difference simulation

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We coded the program for performing a 3D numerical simulation of fault zone waves (fault zone head waves, direct P phases propagating within the low velocity zone (LVZ) and fault zone guided waves) using the staggered-grid method with a second-order approximation for the time derivative and fourth-order approximation for the spatial one. The calculations were performed with the simple fault zone model of an elastic layer with relatively low velocity sandwiched between two elastic half spaces with relatively high velocity. We found that the general characteristics of waveforms obtained by the calculation are similar to actual data recorded in the linear array stations across the Mozumi-Sukenobu fault zone for the explosion sources, which are located inside and outside the LVZ and 2km away from the linear array. However there are still some discrepancies in the fault zone waves between calculated and observed seismograms. Based on the various observation in the excavated tunnel, the low velocity zone can be separated by three zones with different velocities. We then applied the simulation to the 5 layer model by try and error and obtained the synthetics more likely to the actual seismograms.

We also attempted the simulation to detect the segmentation of the Mozumi-Sukenobu fault for the seismograms recorded by more distant explosion experiment (4km away from the station array). According to the observation results, the surface trace of the fault has a step-over in the lateral direction between the station array and the explosion source. We then performed the simulations for the following two models; (i) fault zone without step-over and (ii) fault zone with step-over perpendicular to the fault strike. To simplify the problem, we assumed the LVZ consisting of only one layer. As a preliminary result, it was found that the amplitude of direct waves propagating within the LVZ in the model (ii) becomes smaller than in the model (i), and the duration time of guided waves within the fault zone (ii) is shorter than the model (i). Since the amplitude in the actual seismograms are attenuated due to anelasticity of the medium, the attenuation effect may affect these simulation results. In the presentation, we will discuss the model with step-over structure including the attenuation effect.