The ground motion characteristics along a north-south line in the Kumamoto Plain, using earthquake and array microtremor observation data

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In order to evaluate the ground motion characteristics in the Kumamoto plain, we are observing earthquakes on the north-south line in the Kumamoto Plain, right after the 2016 Kumamoto earthquake. We calculated ground amplification characteristics at each site using the aftershock observation data of the 2016 Kumamoto Earthquake, and estimated the S-wave velocity structures by array microtremor observation data around the seismic stations.

We installed 15 temporary seismic stations at intervals of 300m to 2.5km along a north-south line in the Kumamoto Plain, a section of 15km from the outer rim of Mt. Kinbo (northern end of the Kumamoto plain) to the Uto Peninsula (southern end). We obtained seismic data of the main shock (Mj 7.3) on 16th April, 2016 at 2 sites, northern part of a north-south line in the Kumamoto Plain. We evaluated site amplifications for temporary seismic sites to reference sites, using the seismic wave data by earthquake events occurred around Mt. Aso. Reference sites are permanent seismic station (KU.KMP1) in the outer rim of Mt. Kinbo installed by Institute of Seismology and Volcanology, Faculty of Science, Kyushu University, and temporary rock site in Uto Peninsula. We calculated the Fourier spectra for a time-window of 5 seconds after initial S-wave arrival, and the Fourier spectra with the Parzen window of 0.4Hz at temporary stations in the sediment sites were divided by that at the reference site. Site amplifications at the survey line middle and southern part sites installed in the alluvial lowland have a factor of dominantly larger than 1 in the frequency 1-2 Hz, but the amplification factor and the characteristics in the frequency above 3 Hz showed a difference for each site. At several sites close to the northern end of the survey line, the peak of the frequency is higher (2-5 Hz) than the sites in the alluvial lowland, and the amplification factor is smaller. It suggests that the surface ground structure changes complicatedly along a north-south line in the Kumamoto Plain. In addition, we confirmed that the characteristics of the NS and EW component of the spectral ratio between the northern sites of the survey line and KU.KMP1 are clearly different around 1-3 Hz. It is assumed that there is some seismic anisotropy, but we will further investigate its cause.

And also, we performed array microtremors observations at the seismic stations, to estimate the local site effects along a north-south line in the Kumamoto Plain. We installed vertically accelerometer in a double triangle with an edge length of 1.5m to 24m and its center, and measured at a sampling frequency of 100Hz for 10 to 20 minutes. We obtained phase velocities of Rayleigh waves by the SPAC method, estimated S-wave velocity structures through inversion analysis of dispersion curves with genetic algorism (GA). We confirmed tentatively that the low velocity layer was deposited on the surface at sites in the alluvial lowland and its thickness might be 15m or more. We will discuss the ground motion characteristics along a north-south line in the Kumamoto Plain, using the site amplifications estimated by seismic observation data and S-wave velocity structures estimated by array microtremor observation data.

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