Evaluation of Three-dimensional Basin Structure Model beneath Beppu bay, Oita Prefecture, using Seismic Interferometry

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A dense seismic array has been deployed since late August 2014 around the Beppu Bay area, Oita prefecture, Japan, to investigate S-wave velocity structure of deep sedimentary basin (Hayashida *et al.*, 2015; Yoshimi and Hayashida, 2017). The array consists of 12 stations with an average spacing of 12 km. Each station consists of a three component broadband seismometer (Nanometrics Trillium compact; 750 V/m/s, T=120 s) in a hole with a 24-bit data logger (Hakusan DATAMARK LS-8800; sampling rate of 100 Hz). We used the continuous ambient noise (microtremor) data of about 20 months (from September 2014 to April 2016) to obtain the ambient noise cross-correlation functions (CCFs) between 66 pairs of stations (6.4 km –65.2 km). The derived nine-component inter-station Green’s functions (ZR, ZT, ZZ, RR, RT, RZ, TR, TT, TZ) from the stacked cross-correlation functions show clear wave-trains corresponding to surface-wave propagation between sensors for station pairs that across shallow-bedrock areas, whereas it is still difficult to visually confirm the distinct wave trains for station pairs that across deep sedimentary basin beneath the Beppu Bay area. At first we investigated the spatial distribution of surface wave group velocities between two stations in different frequencies, by comparing the estimated group velocities from the derived CCFs with the multiple filtering technique (Dziewonski *et al.* 1969) and theoretical ones using an existing velocity structure model (J-SHIS v2). We also simulated theoretical Green’s functions for all stations pairs using the finite difference method (HOT-FDM, Nakamura et al., 2012), using the J-SHIS basin structure with land and seafloor topography and a seawater layer with a grid spacing of 50 m (Okunaka *et al.*, 2016). The estimated values of group velocity indicate smaller group velocities in the Beppu Bay area than those in the surrounding areas in the higher frequency range (0.3 Hz-) and generally show good agreements with theoretical ones. The comparisons between obtained and simulated Green’s functions also generally show good agreements in the areas in the frequency range between 0.1 and 0.5 Hz. On the other hand, the comparisons of group velocities and Green’s functions show systematic differences inside Beppu Bay, indicating S-wave velocity beneath the bay might be slower than those of the existing structure model.

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