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Temporal Changes of Seismic Velocity of Shallow Structure Associated With the 2000 Miyakejima Volcano Activity as Inferred From Ambient Seismic Noise Correlation Analyses

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Miyakejima Island, which is located about 170 km to the south of Tokyo, Japan, is an active volcano of basaltic magma. In 2000 volcanic activity started with magma ascent and migration northwestwardly on June 26 - 27. Then, the volcano formed a caldera on the summit in July, and large amount of volcanic gas emission continued from late August until now. We analyze the ambient seismic noise recorded at three NIED seismic stations (M KK, MKT, and MKS) in the island in order to study the volcano structure behavior associated with such significant volcanic activities. We apply cross correlation analyses to the continuous records of vertical component of short period seismometers (1 s). The data are sampled at a frequency of 100 Hz with an A/D resolution of 16-bit. We calculate cross correlation functions (CCFs) for time window of 60 s for each station pair. We stack the CCFs for each month and bandpass filter the stacked data at frequency band 0.4 - 0.8 Hz. The stacked CCFs, which may represent the Green function between two stations, at station pairs MKK - MKS (the distance is 1.8 km) and MKT - MKS (the distance is 3.9 km) show wave packets with large amplitudes at both sides (positive and negative time delays). The wave packets propagate at group velocities of about 0.8 - 1.0 km/s. The stacked CCFs for MKK - MKT (the distance is 3.1 km) is one sided (negative time delay). Such asymmetric might be due to the inhomogeneous distribution of propagation direction of ambient seismic noise, so we do not use the data for the following analyses. Comparing the CCFs obtained for periods from July 1999 to June 2000 with that of October 2002, we observe small phase difference of the main wave packet. Our results show that for station pair MKK - MKS, whose path crosses the northern part of the island, velocity increased about 1.6 % after the 2000 volcanic activity. For MKT - MKS, whose path closely crosses the newly formed caldera, we estimate the velocity decrease of about 1.5 %. Such velocity increase and decrease observed at Miyakejima Island might be caused by the stress increase or decrease in the shallow structure due to volcanic pressure sources, volcanic gas permeation in the volcanic edifice, and other phenomena associated with the 2000 volcanic activity.