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Shear-wave velocity structure beneath the Merapi complex from ambient seismic noise

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Mt. Merapi is one of the most active and dangerous volcanoes, not only in Indonesia but worldwide. As a stratovolcano, it rises to 2968 meters above mean sea level (MSL) and stands at the intersection of two volcanic lineaments, which are oriented North-South and West-East, respectively; i.e. Ungaran–Telomoyo–Merbabu–Merapi (UTMM) and Lawu–Merapi–Sumbing–Sindoro–Slamet (LMSSS).
The recognition and localization of magmatic fluids are important aspects for evaluating the volcano hazard of the highly urbanized area like Merapi Volcano. We present the result of an application of the ambient noise tomography method to construct a series of Rayleigh wave group velocity maps and shear-wave velocity structure of the Merapi-Merbabu complex region. We applied daily cross-correlations to every pair of stations to obtain the respective Green's functions. Velocity calculation was performed using the multiple filtering technique, which provided us with a means to measure velocity as the function of its period or frequency. Data used in this study were taken from the temporary DOMERAPI network, a collaborative scientific research between CNRS (France), ITB (Indonesia), and PVMBG (Indonesia). The network consisting 46 broadband seismometers, and nineteen months of continuous data recording (October, 2013–April, 2015) were used to calculate interstation Green's function. Using a least squares method we obtained group velocity maps for periods 3–12 s. Group velocity maps were then inverted using the Neighborhood Algorithm approach to obtain S-velocity structure. A set of 1-D S-velocity profiles was combined to construct 3-D Vs structure. We observed a dominantly high anomaly structure beneath Mt. Merapi and Mt. Merbabu with $\sim$152°N strike, related to the existence of old lava from the UTMM double-chain volcanic arc, which formed Merbabu and Old Merapi. The depth inversion results indicate the potential location of an active magma body on the southwest flank of Merapi.

Key words: Merapi Volcano, Ambient Noise, Rayleigh Wave, Surface Wave Tomography, Depth Inversion.