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Seismic velocity changes at Sakurajima detected by coda wave interferometry and seismic interferometry

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Sakurajima is one of the most active volcanoes and is monitored by various kinds of geophysical and geological observations. Active seismic experiments have been repeated once a year since 2008. Applying coda-wave interferometry to seismic records at 6 Japan Meteorological Agency (JMA) stations from the active seismic experiments conducted in 2011, 2012, and 2013 (Tsutsui et al., 2012, 2013, and 2014), we detect significant seismic velocity increases at northern and eastern flanks of the volcano. The velocity change is at a maximum 0.40% around 4Hz, 0.15% around 8Hz, and 0.05% around 16Hz. We also apply seismic interferometry to ambient noise during 2012 and 2013 to continuously monitor velocity changes. From the vertical-vertical cross correlations in 1-2, 2-4, and 4-8 Hz bands, we find that seismic velocity increases and decreases with a period of several months for all the station pairs. The amplitude of the velocity change is at a maximum 2%, 1%, and 0.5% in 1-2Hz, 2-4Hz, and 4-8Hz, respectively. Results from seismic interferometry are consistent with those from coda-wave interferometry. The periodic change in seismic velocity shows a good correlation with records of an extensometer shown in CCPVE (2014): velocity increase for contraction while velocity decrease for extension. The strain change is attributed to a volcanic pressure source at a few kilometers beneath the summit (Iguchi et al., 2013). For station pairs between which the summit is located, short-term velocity changes seem to be associated with precipitation. This study shows that simultaneous use of seismic interferometry and coda-wave interferometry is useful to obtain reliable measurements of seismic velocity changes.

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Keywords: seismic velocity change, Sakurajima, coda-wave interferometry, seismic interferometry