Temporal changes in source directions of Rayleigh waves at Kirishima volcano inferred from polarization analysis on 3-component continuous seismograms at a single-station

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The analysis of volcanic tremors, which are frequently observed as volcanic activity increases, is important in monitoring volcanic activities. Analyzing volcanic tremors is important in volcano monitoring. The relationships between volcanic tremors and volcanic activities have been discussed by estimating the direction of arrival or hypocenter of volcanic tremors using seismic array analysis and a hypocenter determination method such as the ASL method [e.g., Ichihara and Matsumoto, 2017]. However, these approaches require multiple seismometers, and the accuracy of the estimation is also limited by the deployment of the seismometers. In this study, we apply polarization analysis [e.g., Tanimoto et al., 2006; Sergeant et al., 2013; Takagi et al., 2018] of three-component continuous seismograms at a single-station, which is used to study seismic ambient noise field, to long-term seismic records at Kirishima volcano and verify its applicability to wave field monitoring. We used continuous seismograms between January 2011 and December 2022 (March 2017 and December 2022) at the JMA station of V.KIRA (V.IYHT), which is the closest station to the Shinmoedake crater (Iwoyama) at Kirishima volcano. Since eruptions have occurred at these craters during the study period, the Kirishima volcano is a suitable target region for evaluating the applicability of our single-satiation approach. After correcting the instrumental response of seismometers, we estimated the dominant source directions of Rayleigh waves every 30 minutes by using the polarization analysis method similar to that of Meza-Fajardo et al. (2015). At the V.KIRA station, Rayleigh waves propagating from the direction of the crater were predominant, especially in the 0.5-3 Hz band, during eruptions in January 2011, October 2017, and March 2018. During the period from the 2017 eruption to the 2018 eruption, Rayleigh waves propagating from the direction of the crater continued to be predominant. From February 2020 to December 2022, several periods of the predominance of Rayleigh waves arriving from the crater direction were identified in the 1-4 Hz band, even though no eruptions occurred. At the V.IYHT station, the predominance of Rayleigh waves arriving from the direction of the crater in the 1.5-3 Hz band has continued since the April 2018 eruption. Further validations should be performed, for example, by checking results at other neighboring stations. However, if the robustness of our approach is ensured, it will be helpful to understand the activities of various volcanoes, including those with sparse seismic networks.

Acknowledgments: We would like to thank the Japan Meteorological Agency for providing continuous seismograms.

Keywords: polarization analysis, Rayleigh waves, Kirishima volcano

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