Wave characteristics of harmonic tremor observed at Sakurajima volcano

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Harmonic tremor originating at Sakurajima, an andesitic volcano was analyzed to make clear wave characteristics. Data of analogue records, which were obtained at 4 boreholes and 1 ground based station with three component and 1Hz seismometers, are digitized with 200Hz sampling. Here, data of 10 minutes in 2 hours quasi-continuous occurrence in July 1990 were analyzed. Before analysis, amplitude of tremor was corrected to reduce the site effect at each station by using amplitude distribution of distant earthquakes.

It has a regular peaks of fundamental frequency of 1.6 Hz, which are relatively stable in the range of 1.2 - 1.7 Hz and their integer multiples at all stations. This suggests that the feature of the spectra was caused by effect of the sources.

Particle motion of 1.6 Hz component of the harmonic tremor was investigated. P-waves are identified at 3 stations near the crater. The particle motions are linearized in the direction to the crater. The P-waves were found in the initial part of wave packet of the harmonic tremor. The linearized particle orbit changed elliptical several seconds later. The rotation direction is retrograde at a grond-based station and prograde at borehole stations. This facts indicates that the waves were composed of Rayleigh waves. At further stations from the crater, only Rayleigh waves were identified. This suggest that the source of the harmonic tremor is shallow.

The spatial properties of the amplitude of harmonic tremor was analyzed concentrated in 1.6 Hz component. Two typical cases were found. At the initial part of the wave packet, the amplitudes were attenuated with epicentral distance. In the other case, the amplitude decay with distance, but increased at further station. In the first case of smooth decay of amplitude, the source may be isotropic, generating P-wave. But in the second case, Rayleigh waves are dominant at further stations. So the amplitudes did not decay smoothly.