Long-term change of volcanic fluid system beneath Aso volcano, Japan as inferred from seismological observations

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Long-period events observed around volcanoes are considered to be generated by the motion of volcanic fluids beneath the volcanoes, and elucidation of these signals is one of the critical keys to understand the dynamics of volcanic system. Recent studies on long-period seismic signals suggest the possibilities to infer the physical properties of volcanic fluids from observed complex frequency of the signals, and such analyses have been applied to long-period events at many volcanoes. These precedent studies, however, mainly concentrate on the analyses of signals observed during eruptive period of volcanoes, and not so much attention have been paid to the long-term change of properties of volcanic tremors.

In this study, we present a quantitative description of long-term change in long-period tremors observed at Aso volcano, Japan by analyzing analog and digital seismograms. The observed spectra of the tremor show gradual change over several years, and the trend of the temporal variation is well correlated with the level of surface activity and the observed emission rate of SO_2. At Aso volcano, from various geophysical observations, we have revealed the existence of a crack-like conduit just beneath craters. Based on the fluid-filled crack model, the temporal change in tremor spectra thus can be interpreted as the change in composition of volcanic fluid in the crack-like conduit. Our result suggests that the long-term trend in the state of volcanic fluid systems beneath active volcanoes may be monitored by seismological means.