3D-FDTD simulation of monotonic infrasound waves of the 2014-2015 eruption of Aso volcano

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At Aso volcano in Japan, 160-days lasting magmatic eruption occurred in 2014–2015 after a 20-years silence. This eruption was the first event that we could monitor well using our infrasound network deployed around the crater. During a whole period of this eruption, in both cases when ash or gas venting and Strombolian explosions occurred, monotonic infrasound waves were observed almost every day. Estimated source location of the signals by considering the topographic effect and atmospheric condition was highly stable at the active vent. The peak frequency of the signals 0.4–0.7 Hz was gliding with time, however, had no reasonable correlation with eruption style. Based on these facts, we speculate that these signals were related to resonant frequencies of a void in the conduit, uppermost part inside the vent. By a 3D-FDTD model (Kim and Lees, 2011, GRL; Kim et al., 2015, GRL) using a SfM data of the crater during the eruption (March 2015), we calculated the infrasound propagation from the conduit. Assuming that a shape of the conduit was a simple pipe, observed waveforms were well reproduced by the numerical calculation regardless of variations of the source time function: resonant oscillations in the later phase were due to a trapped wave inside the pipe. The peak frequency of the simulated waveforms was defined by the length of the pipe. These results indicated that we have a potential to track conduit parameters by observation; for example, a growth of the vent/conduit geometry, a depth of the magma head, and sound velocity inside the conduit. However, the time evolution of the peak frequency and the size of the eruptive vent both of which we successfully measured were not enough to constrain such conduit parameters. To estimate them correctly with time, further and additional analysis from another standpoint, e.g., trajectories, should be required.