

Spatio-temporal variation of the stress drop revealed the generation and migration process of the 2009 swarm activity at Hakone volcano

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Hakone volcano has been an active volcano which is started about 400 thousands years ago. In addition the volcanic activity has caused seismic swarm periodically. Since those swarm activity occasionally generate widely felt earthquake, it is important to elucidate the generation process of the activity for future disaster mitigation. Yukutake et al. (2011) performed precise relocation of 2009 Hakone swarm hypocenters and found that a clear migration of the hypocenters which is consistent with diffusion of pressurized thermal fluid. However, it is still unclear 1) how the fluid controls the initiation of the swarm, and 2) whether all earthquakes during the sequence occurred under the same generation process.

In this study, to address the questions, we estimated the stress drop of the earthquakes observed during the 2009 sequence using empirical Green's function deconvolution method. Obtained stress drop were generally low, ranging between 0.01 MPa to 0.1 MPa, indicating the pore pressure increase might get involved the activity. Furthermore, the result showed the clear spatio-temporal variation of the stress drop: The stress drop tends to be higher when it occurs earlier and closer to the hypocenter of the initial earthquake. It implies that the flow of highly pressurized fluid initiated the swarm and promoted at the initial stage of seismic activity. However, at the middle to last stage, earthquakes might be triggered by pore pressure increase and/or stress perturbation due to the occurrence of the events earlier.

Keywords: Hakone volcano, swarm earthquakes, empirical Green's function method, stress drop, invaginated the fluid