[EE] Evening Poster | S (Solid Earth Sciences) | S-SS Seismology

[S-SS03]Induced and triggered seismicity: case-studies, monitoring and modeling techniques

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Induced and triggered seismicity occurs in conjunction with human activities such as reservoir impoundments, mining operations, conventional and non-conventional hydrocarbon production, geothermal energy exploitation, wastewater disposal, CO2 sequestration and gas storage operations as well as volcanic and hydrogeological processes. The stability of faults is affected by external solicitations such as pore-pressure diffusion, relaxation effects and stress field perturbations related to mass and/or volume changes, dike intrusions and earthquake-earthquake interactions. A better understanding of the physical processes governing induced and triggered seismicity is thus important for assessing the risk of current and future industrial activities, including the geological disposal of nuclear waste.

The study of induced and triggered seismicity is inherently an interdisciplinary problem, which requires the combination of seismological, hydrogeological and geodetic data as well as a wide range of modeling approaches. This session covers the analysis and modeling of induced and triggered seismicity at different spatial scales and in different environments. We welcome contributions from earthquake and volcano seismology and geomechanics.

Relevant topics to be presented include - but are not limited to - new methods for microseismicity characterization (both natural and anthropogenic), spatio-temporal variations of physical parameters (including stress, pressure and temperature changes), spatio-temporal patterns of seismicity, modeling strategies and case-studies.

The goal of the session is to cover both observational, theoretical and experimental aspects on the topics summarized above.

[SSS03-P05]Temporal variation of waveforms of S-S scattered waves observed around the Moriyoshi-zan volcano in Akita prefecture, Tohoku District, Japan

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We examined temporal change in waveforms of S-S scattered waves observed around the Moriyoshi-zan volcano in Akita prefecture, Tohoku District, Japan. The seismicity around the volcano was triggered by the 2011 off the Pacific coast of Tohoku earthquake, and characterized by migration of hypocentral location. We observe clear scattered waves in the S-coda of the triggered earthquakes. In our previous study, we estimated the location of scatterers assuming S-S scattering at about 5 km to the north of the volcano and at a depth of about 13 km. Both the migration and scatterers suggest a contribution of geofluids. Thus, the analysis of temporal variation of scattered waveforms may provide a new

circumstantial evidence related to the existence and migration of geofluids.
In our analysis we used waveform data recorded at two temporal seismic stations we deployed at approximately 4 km to the NWN and 2 km to the SW of the most active cluster of triggered seismicity. We used hypocenteral parameters relocated by the hypoDD location technique.
We first selected events with similar waveforms by using a coherence value. We calculated coherence in a time window of 2.5 s that includes both P and S-waves, and averaged in a frequency range of 8 to 32 Hz. Next, we aligned seismograms with high coherence on the maximum amplitude of S-waves, and examined waveforms of coda wave part that is outside the window of coherence calculation. We found that waveforms about 0.1 s from S wave arrival are highly similar, however, waveforms in subsequent time window are less similar. The waveforms of scattered waves are similar but uneven in the alignment of each phase. These results affirm that temporal variation of S-S scattered waves is evident. The arrival time of scattered waves is perturbed in the range of about 0.2 s. During a short time period within a few days, the arrival time is advanced or delayed systematically about 0.1 s. In terms of longer period of a few months, they seem to perturb randomly. These changes may be attributed to a spatiotemporal change in the scatterer location, or velocity structure along the ray path of scattered waves. We also found that envelopes of scattered waves show temporal change. In particular, envelopes of many events show double peaks after 2013. This variation can be attributed to a change in both the number, and the location of scatterers. These changes are possible if scatterers are composed of fluid. However further examinations are required to get definite conclusion.