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

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

convener:Francesco Grigoli(ETH-Zurich, Swiss Seismological Service), Yosuke Aoki(Earthquake Research Institute, University of Tokyo), Bogdan Enescu(京都大学 大学院 理学研究科 地球惑星科学専攻 地球物理学教室, 共同), Luca Urpi(Swiss Seismological Service - ETH Zurich)
Wed. May 23, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)
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-P04]Numerical investigation of Reservoir Induced Seismcity: poroelastic response of a layered media

*Luca Urpi[1], Antonio Pio Rinaldi[1], Luigi Improta[2] (1.Swiss Seismological Service - ETH Zurich, Switzerland, 2.Istituto Nazionale di Geofisica e Vulcanologia, Seismology and Tectonophysics, Rome, Italy)
Keywords:RIS, poroelasticity, Induced seismicity, Layered crust, fault reactivation

Water level reservoir affects the underlying crust stress state through the poroelastic response to the weight of the water volume stored and by the consequent fluid movement. The perturbation of crustal stress state has been associated to seismic events with maximum magnitudes up to 6.3, as recorded in the largest confirmed case of Reservoir-Induced Seismicity (RIS), that took place at the Konya reservoir in India. In this work, we present results of forward numerical modeling (finite element), to evaluate the poroelastic effect on the possible triggering of induced events, especially considering the undrained and the drained response of a layered crustal model. The 3-dimensional model presented here allows inclusion of heterogeneous elastic and hydraulic properties. Stress and strain are calculated for a transient

evolution of the water level, and the calculation allows to compute dCFS (change in Coulomb failure stress) and to identify promotion of failure on different planes at different time of reservoir activities. The short-term undrained response strongly depends on the elastic properties and can be amplified in a heterogeneous layered elastic media, especially for a media being stiffer with increasing depth. The long-term response depends on the hydraulic properties and it can play a role even if the reservoir is hydraulically isolated from the underlying units.