Session Outlines

Session 1

Discriminating human-made and natural earthquakes

Most geo-technologies face the challenge of operating in an environment of natural seismicity while at the same time having the potential of inducing earthquakes. Especially in the case of a larger – and potentially damaging – earthquake close to a project site, the discrimination between a natural or an anthropogenic origin of the event is of paramount interest to all involved stakeholders. Simple and highly sophisticated methods have been proposed to address this issue. The questions to be answered do not only cover geoscience and engineering but also encompass the social and legal domain and reach to fundamental problems within the philosophy of science. We invite papers from mentioned fields that address and help to solve these challenges.

Session 2

Social aspects of induced seismicity

The success of geotechnical projects largely depends on their acceptance in society, which evolves from a fragile balance of stakeholder-perceived benefits and afflictions. To develop a risk governance strategy for this problem, we must analyse the totality of actors, rules, conventions, processes, and mechanisms concerned with how relevant risk information is collected, analysed, and communicated and how management decisions are taken. In this session, we invite papers that analyse the mentioned aspects for induced seismicity and propose strategies for future risk governance.

Session 3

Induced seismicity from gas extraction and post-extraction reuse

Since many years, large-scale gas production projects have been suspected (or proven) of inducing earthquakes causing damage to local infrastructure. In some regions, production rates had to be decreased dramatically to reduce induced seismicity. The long-term effectiveness of these remediation measures are largely unknown and post-extraction reuse of these reservoirs, for e.g., geothermal or gas-storage, has been discussed for many of these types of gas reservoirs. However, the assessment of potential hazards of such projects is very challenging due to the complex-depletion histories of the reservoirs. We invite papers illuminating these issues from scientific, licensing, and industry perspective either by case stories or through conceptual contributions.

Session 4

The Pohang M5.4 earthquake

The Pohang earthquake on 15 November 2017 occurred close to an EGS site that had performed three hydraulic stimulations between January 2016 and October 2017. The quake caused considerable damages in the city of Pohang - injuring more than 90 people and causing an estimated $52 million in property damage. Due to its vicinity to the EGS project, the event was monitored by a dense network of seismic and non-seismic instruments. We invite papers that investigate the M5.4 earthquake from seismological, geodetical, seismic-engineering, geological, social, and economic perspectives. We also invite papers that discuss the induced seismicity related to the three EGS stimulations.

Session 5

Case studies: geothermal / mining / dams / others

In this session, we ask for inputs discussing case stories of induced seismicity from all geo-technologies that have not been covered in Session 3. Multidisciplinary contributions looking beyond seismological aspects are much appreciated.

Session 6

Advances in monitoring induced seismicity

In recent years, several new technologies and methods have been developed to improve the detection and location of induced seismicity. Large-N arrays, fibre-optic and piezoelectric sensors, ambient-noise tomography, template matching, and machine learning are only a few examples. For a better understanding of induced seismicity, it is equally important to develop and improve multidisciplinary monitoring concepts to capture and quantify the geomechanical, hydrological, geothermal, and chemical parameters. We invite papers discussing developments and applications in these fields.

Session 7

Modelling induced seismicity

Numerical modelling is a challenging but essential part in advancing our understanding of induced seismicity. Predictions from modelling can be tested against real data and in this way contribute to the falsification or validation of scenarios. Recent challenges in numerical modelling of induced seismicity include the development of algorithms that accurately handle the complexity and coupling of the involved mechanisms. In addition, advanced traffic light systems rely on algorithms that can provide "good enough" results in near real-time. We invite papers that report on the application and advancement of numerical modelling of induced seismicity in all geotechnical settings.

Session 8

Physics of induced earthquakes

In this session, we want to focus on the physics of induced earthquakes: How do they start, propagate, and stop? What are the driving mechanisms? How do they scale with geotechnical parameters (e.g. injection/extraction volume, added/removed mass)? What is the role of aseismic slip? Are there precursory phenomena and how can we measure them? We invite papers from theoretical or experimental fields.

Session 9

Laboratory and deep underground lab experiments

Studying ruptures in the lab has two advantages: the experimental conditions as well as the density and the kind of monitoring can be largely controlled. In recent years, rock-lab experiments have also focused on induced seismicity. Current challenges still include to improve the monitoring equipment (e.g. non-linearity of AE sensors), to reach realistic environmental experiment conditions (e.g. temperature, confining pressure, rupture speeds), or to understand if and how results from the lab-scale transfer to the field-scale. A first step to solve the latter question – undertaken in various parts of the world – is the establishment of deep underground labs. We invite papers discussing result, challenges, and future directions of laboratory and deep-underground lab experiments.