The 3rd Shaoxing International Forum on Rock Mechanics and Engineering Geology

---IAEG XIV Congress Session 9: Technological Innovation in Engineering Geology

September 23-24, 2023
CHENGDU, CHINA

Session 1. Advanced Monitoring Technologies for Geoengineering

Convenor

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Brief Introduction

The field of geotechnical and geological engineering relies heavily on monitoring technologies to assess the performance and safety of infrastructures and risks of geo-hazards. The advent of advanced monitoring technologies and data analysis methods has revolutionized the way these structures and geohazards are monitored and managed. This session will focus on the latest advancements in monitoring technologies and their applications in geotechnical and geological engineering.

Advanced monitoring technologies play a critical role in the construction and service of geotechnical projects as well as the management of geohazards. During the last decade, there have been many advances in the development of monitoring technologies for geotechnical and geological engineering applications, including optical fiber sensors, MEMS, LiDAR, InSAR, UAVs, et al. Advanced data analysis methods, such as machine learning and artificial intelligence, are also becoming increasingly important for denoising, analysis, fusion, and interpretation of the monitoring data. These methods can help to identify patterns and anomalies in large datasets, making it easier to predict potential hazards and manage geo-risks. This session will explore the latest advances in monitoring technologies for geoengineering, including remote sensing and in-situ measurements as well as the implementation of advanced data analysis methods and algorithms in geoengineering monitoring. The session will feature presentations by experts in the field, who will discuss the challenges and opportunities associated with monitoring geoengineering projects.

The theme of this session is “Advanced monitoring technologies for geoengineering”. This session on advanced monitoring technologies for geoengineering will provide an opportunity for experts in the field to share their research and insights on the latest developments in this rapidly evolving area. Prominent scholars and experts will be invited to give speeches sharing their latest achievements in monitoring technologies, theories, methods, applications, as well as ideas on specific challenges. By bringing together experts in monitoring technologies and geoengineering, this session aims to foster collaboration and innovation, enabling the development of more effective and sustainable solutions to address the challenges of climate changes.

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Session 2. In-situ Geo-technology

Convenor

Zhongqi Quentin Yue
The University of Hong Kong

Michael Celia
Princeton University

Chun'an Tang
Dalian University of Technology

Yujie Wang
China Institute of Water Resources and hydropower Research

Hao Wang
Institute of Rock and Soil Mechanics, Chinese Academy of Sciences

A.P.S. Selvadurai
McGill University

Brief Introduction

This session is about the recent development and progress of in-situ geo-technology. The in-situ geo-technology is one of the most important subjects in Engineering Geology and the Environment and can be one important part of the Theme 09 entitled "New Technology in Engineering Geology-3rd Shaoxing International Forum". This session will provide a platform for researchers around the world to discuss and exchange their studies in in-situ geo-technology. Most importantly, in-situ technology of drilling process monitoring and/or measurement while drilling has been well developed and progressed in recent years. It can be an effective and environmental-friendly in-situ technology for a habitable earth.

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Session 3. New Laboratory Techniques and Their Applications in Engineering Geology

Convenor

Kaiwen Xia
China University of Geosciences (Beijing)

Sangho Cho
Chonbuk National University

Hongyuan Liu
University of Tasmania

Brief Introduction

Over the years, the development of engineering geology has always been accompanied by opportunities and challenges, and its research achievements hold significant importance for engineering construction, disaster assessment, and ecological environmental protection. As human engineering activities interact and influence the natural geological environment, new engineering geological problems gradually emerge. To address the conflicts and contradictions between human engineering activities and the natural geological environment, numerous pioneering theoretical explorations and technological innovations are continually being conducted. These studies provide fresh ideas and means for achieving harmony between human engineering activities and nature, leading to the correct utilization of geological conditions and rational solutions to geological problems in practical engineering.

This session focuses on the latest research findings related to a series of issues in the field of engineering geology, showcasing a large number of novel experimental theories, methods, and technologies. It also expands the application areas of relevant achievements, aiming to inspire engineering geologists' approaches, enrich existing research techniques, and optimize research systems. Furthermore, it aims to provide reliable scientific bases for the rational design, smooth construction, and normal operation of engineering projects. The symposium aims to promote the research and development of international engineering geology, contributing to the safety of major engineering projects and the socio-economic development. Addressing prominent issues in geological engineering is a crucial goal of this symposium.

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Session 4. Current Trends and Future Perspectives of Machine Learning Applications in Geoscience and Engineering Geology

Convenor

Efstratios Karantanellis
University of Michigan

Anika Braun
Technische Universität Berlin

Jie Dou
China University of Geosciences

Brief Introduction

Machine learning (ML) has been proven to be successful in different domains and the general development is surely furthered by openly accessible algorithms and datasets for the geocommunity to work with. ML first emerged from the field of Artificial Intelligence (AI) in which computers emulate human behavior. It enables a data analysis process to extract meaningful insights from raw datasets and provides accurate results based on algorithms. ML algorithms and techniques have been applied widely in the geoscience field with varied results. It is now incumbent for society to examine the two key issues of quality and value in the geo-applications. ML has also made its way into engineering geology, facilitating the analysis of increasing amounts of data and automatizing laborious tasks. Its benefit concerns the ability to exploit large datasets and identify patterns and trends that might not be apparent to a human cognition.

Examples of ML applications in engineering geology are:

- feature detection/object-based image classification to detect e.g.; landslides, rock fall deposits, faults, discontinuities, etc. in remotely sensed data at different scales, e.g., satellite or drone, optical images or digital elevation data, hyperspectral data;
- point cloud classification, e.g., for rock mass characterization;
- time series analysis/forecasting, e.g., for deformation monitoring or rainfall threshold estimation;
- landslide susceptibility and hazard assessment, e.g., for large areas.