Groundwater in a Geoenergy Context (G534)

Tutor(s)

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Overview

This course examines all aspects of groundwater – from the geological features that affect it, to how it relates to GeoEnergy Transition projects and the wider context of groundwater regulations and management. It is a useful introduction to help access other advanced courses. The course will include some tasks that relate to the practical application of knowledge and formative assessment will be used throughout to allow participants to reflect and manage their learning.

Duration and Logistics

Classroom version: A 1.5-day course comprising a mix of lectures, case studies and exercises. The manual will be provided in digital format and participants will be required to bring a laptop or tablet computer to follow the lectures and exercises.

Virtual version: Three 3.5-hour interactive online sessions presented over 3 days. Digital course notes and exercise materials will be distributed before the course. Some exercises may be completed by participants off-line and there will be links provided to useful additional and applied learning.

Level and Audience

Fundamental. The course is intended for sub-surface scientists, principally geoscientists, but some engineers will also find the course instructive. Participants should have a working knowledge of geoscience. However, the subject matter of this course, groundwater as it relates to GeoEnergy Transition projects, is covered from basic principles.

Objectives

You will learn to:

1. Explain key groundwater concepts.
2. Evaluate potential factors controlling groundwater in different geological settings.
3. Explain how groundwater is investigated and some of the limitations.
4. Explain how groundwater is relevant and, in many cases, critical to geoenergy projects.
5. Evaluate how different geological settings can affect the viability of different geoenergy projects.
6. Describe how and why groundwater is regulated.
7. Explain how risks to groundwater are assessed and managed.

Course Content

Course Details

Some graduate Earth science degrees do not include modules on groundwater, so this course commences with a session designed to bring all participants to the level required to access learning in the subsequent sessions. The first session provides required working knowledge relating to geological features that affect groundwater and how groundwater flow can be conceptualised. The second session provides a review of specific knowledge relating to groundwater and different GeoEnergy Transition projects, and the third considers the wider context of groundwater regulations and management, and how this relates to the development of GeoEnergy Transition projects.

Session 1: Groundwater

- Prior knowledge review
- Key concepts multiple choice quiz

Content

- Rudimentary hydrogeology, hydrology and groundwater systems
- How geological media affects flow
- Conceptualizing flow at different scales
- Chemical and physical behaviours of fluids and rock interaction
- Investigating, extracting and monitoring groundwater

Plenary/application of knowledge exercise

- Investigating groundwater on Mars

Session 2: Groundwater and the GeoEnergy Transition: reservoirs, resource and pathways

Prior knowledge review

- Inductive exercise

Content

- Mines and mineral extraction: dewatering, mine water as thermal resource and acidity
- Critical minerals and brines: geochemistry, exploitation and extraction
- Geothermal: groundwater as a thermal resource, open and closed loop systems, fractures, testing and modelling
- Carbon capture and storage: geochemistry and fluid phases, injection and reservoir permeability, storage capacity and leakage
- Nuclear waste/hydrogen storage: fluids, pathways and low flow

Plenary/application of knowledge exercise

- Resource potential assessment for investment case exercise

Session 3: Groundwater regulation, risk assessment and management in GeoEnergy Transition projects

Prior knowledge review

- What is wrong in this picture?

Content

- Groundwater as natural and economic capital
- Water quality and protection
- Policy, regulations and regulators
- Risk management in the project lifecycle
- Hazards from geoenergy projects
- Groundwater risk assessment
- Management and mitigation

Plenary/application of knowledge exercise

- You are the regulator exercise