Utrecht University

Faculty of Geosciences
Department of Earth Sciences

Utrecht Centre for Sustainable Subsurface Use

Integrating expertise on subsurface processes

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Subsurface use: a challenge on all scales

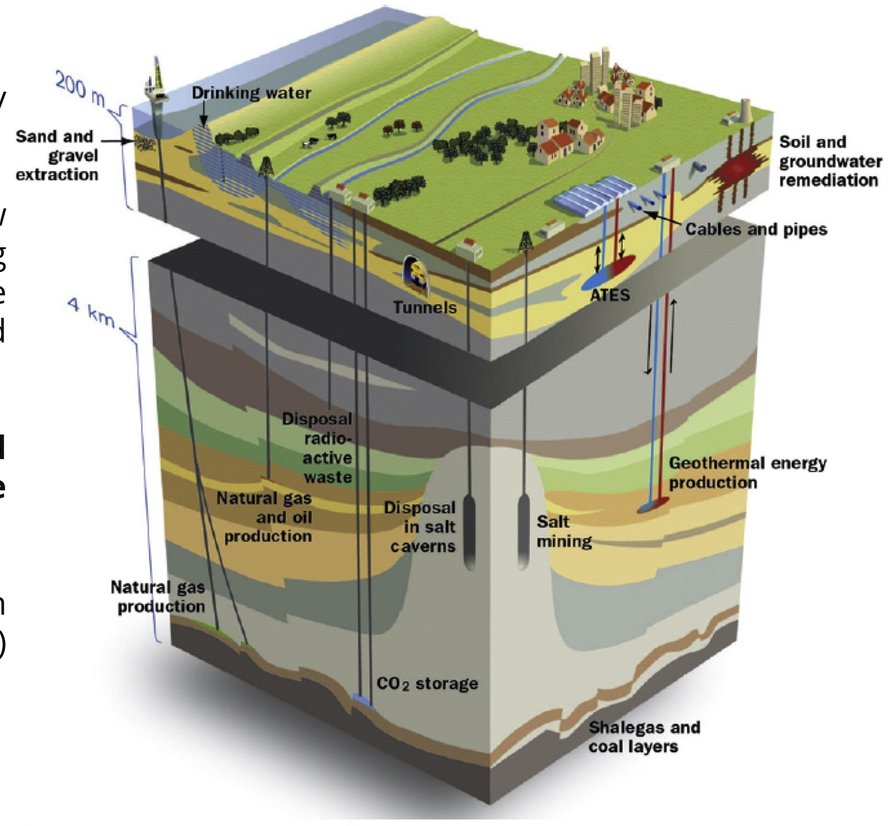
Increasing and evolving use of the subsurface is crucial for ensuring a stable supply of energy and drinking water in the short- and long-term future.

This subsurface use involves storage of energy, exploitation of geothermal energy, mining of raw critical materials, and groundwater extraction. Additionally, the subsurface is increasingly being used for urban infrastructure development, and subsurface solutions will be needed for the permanent disposal of radioactive waste, CO_2 sequestration, and remediation of contaminated soil and groundwater.

We provide a fundamental and multi-scale understanding of the the complex, coupled thermal, hydrological, mechanical and (bio-)chemical (THMC) processes involved in these subsurface activities, ensuring both current needs and future sustainability are addressed.

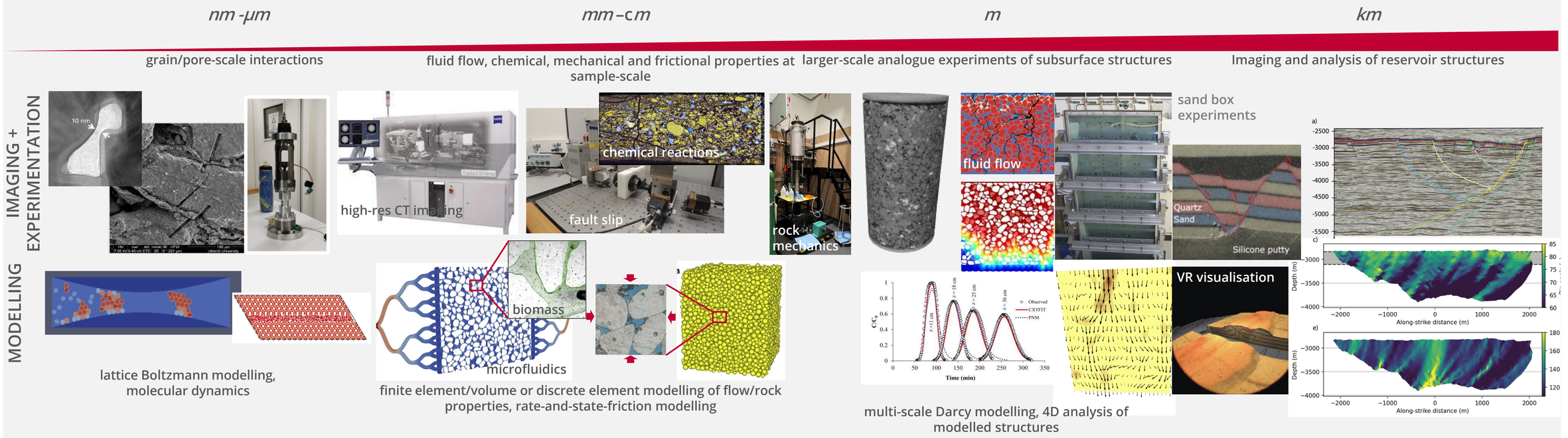
We conduct our research through involvement in large (inter)national research programmes, in collaboration with other universities (TU Delft, Tue, UT-ITC) and research institutes (e.g., TNO) and stakeholder companies (e.g., COVRA) through (student) research projects and internships.

Our state-of-the-art facilities[1] are accessible through the EPOS-NL[2] and Excite2 Network[3].



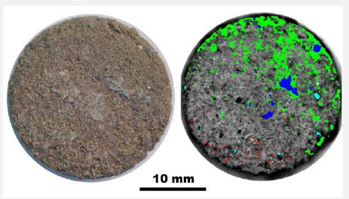
Examples of subsurface use in the Netherlands[4]

Imaging, experimental investigation and numerical simulation at the nano- to m-scale: THMC processes at pore- and grain-scale

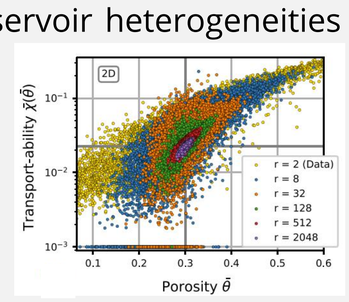


Upscaling to (heterogeneous) field-scale

Mineralogy and rock texture play a key role in controlling the impact of THMC processes. Upscaling lab observations should be based on true reservoir petrography (realistic grain size, mineralogy, porosity etc. distribution), relevant (bio)reactions and realistic flow dynamics, including reservoir heterogeneities and geostatistics.



Infrared Imaging Spectroscopy of reservoir core for scalable, efficient petrography (collab with UT).

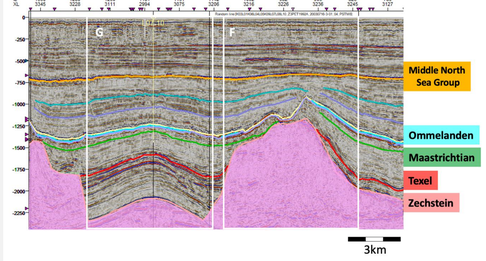


Upscaling of diffusive transport properties taking into account complex pore space geometries.

Site characterisation and assessment

Prospect evaluation is crucial to assess the storage potential of sites. We contribute to this through (student) projects, with visualisation and interpretation of geologically relevant data.

Evaluation of the Upper Cretaceous Chalk Fm (top L and K blocks) for CCS, through a student project within the DOCS framework.
Soon a second project will start focusing on the Early Cretaceous Bentheimer sandstone.

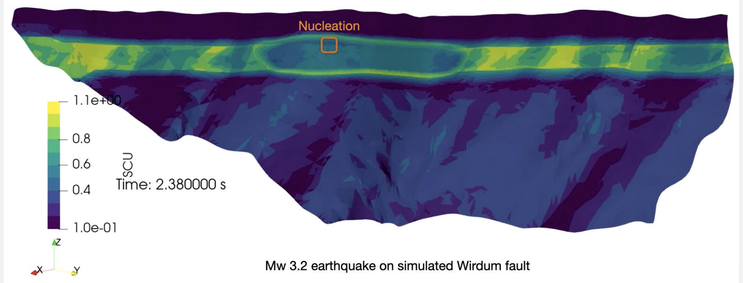


Integrated framework of the public geological database of the Dutch subsurface, for geological interpretation

Download via QR code (left): Petrel-based project integrating publicly available data of 10,599 2D seismic lines, 280 3D seismic cubes, 6,590 wells and 4,752 composite wells logs.

Hazard assessment of subsurface use

THMC processes resulting from subsurface use are key to predicting the impact of subsurface use in numerical models to extrapolate the nano- to m-scale observations in space and time.



Mw 3.2 earthquake on simulated Wirdum fault

Top: High-resolution model of the Wirdum fault in the Groningen gas field allowing for detailed THM assessment of the potential for fault slip due to gas production.

References

1. https://www.uu.nl/en/organisation/faculty-of-geosciences/research-facilities
2. https://epos-nl.nl/facilities/
3. https://excite-network.eu/
4. Griffioen et al. (2014) https://doi.org/10.1016/j.scitotenv.2014.02.114

uu.nl/en/research/department-of-earth-sciences

EPOS-NL EUROPEAN PLATE OBSERVING SYSTEM EPOS-Netherlands

Excite² Network