Numerical PhD position in Environmental Fluid Mechanics

We are looking for a candidate to join the team of the ERC-funded project MORPHOS. You will work on flow-induced morphology modifications in porous multiscale systems, with focus on fluid mechanics for environmental applications.

Job description

Are you fascinated by physics and interested in performing simulations to better understand how fluids shape environmental systems? We are looking for a PhD student to carry out state-of-the-art research on flows in porous media.

In many environmental and industrial systems involving fluids in porous media, local flow conditions may induce changes to the pores structure. Likewise, the flow is controlled by the geometry of the porous matrix. This is the case of snow: when ice crystals melt, water infiltrates through the interstitial space, melting neighbouring crystals or refreezing around them. A similar scenario occurs when carbon dioxide is injected in the subsurface with the aim of permanent storage: CO_2 reacts with the rocks, which may dissolve posing a risk on the structural integrity of the formation (see Fig. 1). The formation of sea ice is also a process of flow within a porous (mushy) layer that evolves in response to oceanic and atmospheric conditions. Predicting the dynamics of these systems is challenging due to the multiway coupling, multiscale nature and feedback mechanisms. Controlled laboratory experiments and high-resolution numerical simulations will be used to develop physical models to design, predict and control these flows.

You will work on numerical simulations of heat and mass transport systems in porous media with variable morphology. Simulations will be mainly performed with the finite-difference codes AFiD and AFiD-Darcy (see De Paoli et al., Comput. Phys. Comm., 312 (2025), 109579 for additional details). The morphology variations considered are produced by: (i) phase-changes (e.g., melting of snowpack and phase-change materials in latent heat thermal energy storage systems - PCM-LHTES), (ii) reactions (e.g., rock dissolution) and (iii) reactions and phase change (e.g., formation of sea ice).

Location

- Research group of Environmental Fluid Mechanics, P.I.: Marco De Paoli.
- Institute of Fluid Mechanics and Heat Transfer, TU Wien (Vienna, Austria).
- TU Wien is Austria's largest institution of research and higher education in the fields of technology and natural sciences. With over 26,000 students and more than 4000 scientists, research, teaching, and learning dedicated to the advancement of science and technology have been conducted here for more than 200 years, guided by the motto "Technology for People". As a driver of innovation, TU Wien fosters close collaboration with business and industry and contributes to the prosperity of society: A creative environment in one of the most liveable cities in the world.

Your profile

Required:

- Masters degree (or equivalent) in mechanical or chemical engineering, physics, or in a closely related discipline.
- Strong communication skills, including fluency in written and spoken English.

- Highly motivated to do a PhD.
- Ability to and interest in working in team and in supervising undergraduate students.
- Experience in fluid mechanics.

Desired:

- Experience with numerical simulations.

Our offer

- Desired starting date: as soon as possible.
- Duration: 3 years, expected to result in a doctoral thesis upon conclusion.
- Salary: 2,786.10 Euro/month (gross salary, 14 times/year).
- A range of attractive social benefits (see Fringe-Benefits).

How to apply

Potential applicants are encouraged to apply to Prof. Marco De Paoli (marco.de.paoli@tuwien.ac.at). Applications should include the following documents:

- A motivation letter describing why you want to apply for this position.
- Description of your research interests and previous experience.
- A detailed CV including research experience and any other relevant experience, a list of publications (if any), and technical skills.
- Academic transcripts from your Bachelor's and Master's degrees.
- Names and contact details of at least two references who are willing to send a letter of recommendation on your behalf (name, affiliation, relation to candidate, e-mail).
- An interview with a scientific presentation and a technical examination will be part of the selection process.

Incomplete applications will not be considered. The position will stay open until filled.

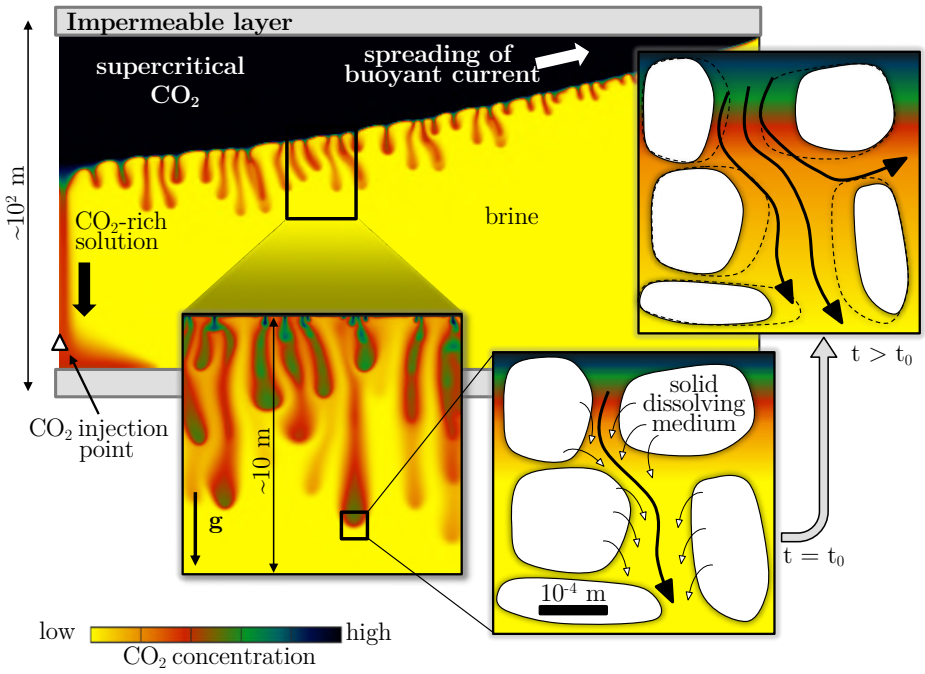

Figure 1: Schematic representation of the mixing process of CO_2 in the subsurface (see De Paoli, EPJ-E 46.12 (2023):129), with the rocks experiencing morphology variations.