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# Measuring and modelling multi-scale fluid distributions in heterogeneous rocks based on X-ray micro-computed tomography

*Wednesday, 2 June 2021 19:35 (15 minutes)*

Multiphase flow through heterogeneous reservoir rocks is commonly found in geoscience applications. The accurate characterization of the pore space topology and fluid flow mechanisms is crucial to predict reservoir performance. This can be studied by visualizing the pore space with micro-computed tomography, allowing to construct image-based models (Bultreys et al., 2016). However, the multi-scale nature of many reservoir rocks typically results in significant amounts of sub-resolution porosity in micro-computed tomography (micro-CT) experiments. The challenging nature of multiphase flow simulations in such pore geometries has spurred the development of multi-scale models, such as dual pore network models (Jiang et al., 2013; Bultreys et al., 2015) and Stokes-Brinkman solvers (Menke et al., 2019). However, these models depend strongly on input parameters and physical assumptions describing the microporosity. There is currently a lack of direct validation methods to reduce the associated uncertainties in such simulations.
In this presentation, we present a pore-scale validation workflow based on an unsteady-state drainage experiment on an Estaillades limestone sample, imaged with micro-CT. Contrast agent-based difference imaging (Ghous et al., 2014; Boone et al., 2014; Lin et al., 2017) was used to first generate a sub-resolution porosity map of the sample and to then map the sub-resolution fluid saturations at several capillary pressure steps during the drainage. To this end, the sample was first saturated with high concentration KI-doped brine solution (25 wt%), and then displaced by n-decane with gradually increased drainage pressure (8 kPa-400 kPa). The resulting experimental data shows a good agreement with the mercury intrusion capillary pressure (MICP) curve for Estaillades (Bultreys et al., 2015). Then, the sub-resolution porosity map was used to generate a multi-scale pore network model of the sample studied in the experiment. Drainage simulations on this network model were validated by comparison to the experimental saturation maps on a pore-by-pore basis. The method can be used to inform and validate multiphase flow simulation in complex rock types, which is crucial to extend the use of digital rock physics for complex reservoir rocks.

## Time Block Preference

Time Block B (14:00-17:00 CET)

## References

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