Two phase flow modelling on realistic discrete fracture models

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We analyze the waterflood performance using an outcrop-based model, representative of North Sea fractured chalk reservoirs. To this end, we consider published data on the fracture geometry of Lägerdorf quarry in northern Germany and create a two-dimensional Discrete Fracture-Matrix (DFM) outcrop-based model, popu- lated with the rock and fluid properties, typical for North Sea oil reservoirs. We conduct several DFM simulations to study the dependency of oil recovery factor with respect to water injection rate under uncertainty in fracture apertures and orientations, using both sea and low salinity water as injection fluids. Based on simulation results, we show that if there is a noticeable impact of fractures on the flow, the slower injection rates lead to higher recovery in terms of water pore volumes injected. The main factor influencing the recovery efficiency is whether there is a direct communication between the inflow and outflow boundaries via highly conductive fractures. However, if the fractures' apertures in the direct communication path are small enough, the capillary forces can counterbalance the viscous displacement in fractures thus leading to better recovery. We demonstrate that commonly used statistical measures of fractures orientation and connectivity cannot predict this type of behavior