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Simulating CO_2 storage in fluvial-channel structures of the Triassic Bunter Sandstone, Southern North Sea

Kate Thatcher, Simon Mathias, Jon Gluyas, and Richard Davies
Department of Earth Sciences, Durham University, Durham, United Kingdom (kate.thatcher@durham.ac.uk)

Saline aquifers and depleted gas reservoirs in the southern North Sea have been proposed as sites for CO_2 storage. A possible storage unit is the Bunter sandstone, a lower Triassic sandstone deposited in arid to semi-arid conditions, deposited in a series of coalescing alluvial fans, dissected by braided rivers. This sedimentary environment will lead to marked permeability contrasts between higher permeability channel deposits and lower permeability flood plain deposits. The channels would be shallow ($<$2 m) and 10s of meters wide and are not imaged on seismic data. A stochastic approach based on facies modelling within Petrel is taken to mapping the channel structures. Pattern matching of modern day arid alluvial fan environments coupled with analogue field evidence from southern England has been used to constrain the geometries of the stochastic models.

Numerical modelling (using ECLIPSE 100) of CO_2 injection into a saline aquifer with stochastically generated channel structures is performed to assess the effect of channel structures on the pressure wave propagation and injectivity. To address the problem of scale, a nest grid is used. A fine grid around the injection point is used to capture the channel geometries that contain the CO_2-brine interface during the CO_2 injection period. This is surrounded by a coarser grid to allow proper accounting of the pressure wave propagation, which can travel up to a hundred kilometres. We investigate the effect on injectivity estimation by replacing the detailed channel structures with a homogeneous but anisotropic permeability field.