Structural Validation and Fracture Modelling of the InSalah CO_2 Storage Site, Algeria

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The structure of the In Salah CO_2 storage site comprises a simple 20 x 8km long anticlinal structure with a 20m thick sandstone reservoir. Gas is produced from the structure using five production wells. The CO_2 from the In Salah gas fields (containing between 1 to 9% CO_2) is removed on site and stored in the saline aquifer down-flank from the Krechba gas field. The surface expression of the sub-surface pressure field related to CO_2 injection is being monitored using satellite (InSar) and tilt meters. Information from monitoring has been combined with 3D seismic data and modelling to create a picture of the sub-surface geometries and structures that are likely to influence CO_2 migration in the reservoir.

A workflow for the creation of a 3D structural model from the seismic data is presented along with models for the structural evolution of the anticline and associated faults. Detailed observations of the porosity and permeability of the reservoir sandstone from SEM analysis suggest that the reservoir sandstone is tight and the interconnectivity of open fractures may critically influence the sub-surface movement of CO_2. We have used our understanding of the structural evolution through time to restore, and then forward model, the present day structure to generate a series of fracture scenarios. The fracture scenarios are based on prediction of fracture sets associated with deformation of the reservoir unit during the structural evolution of the anticline and the inter-play with present and palaeo-stress regimes. Connectivity analysis of the fractures allows the modelled scenarios to be tested against injection and monitoring data to predict the critical pathways and potential distribution of CO_2 within the reservoir unit.