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3D geological model of potential CO2 reservoir for the Heletz test site

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In the framework of the EU-FP7 MUSTANG project, the Heletz site located at the Southern Mediterranean Coastal Plain of Israel had been chosen as a test site for a small-scale CO2 injection experiment. To assist the planning of the experiment, as well as to provide input for a general site characterization, a 3D geological model of the potential CO2 reservoir has been built. We present an overview of the model and the approach used to build it.

The Heletz structure is an anticline fold with a crest of about 2 km by 4 km with a vertical closure of 70 m. The structure is gently dipping to the east, truncated by a pinch-out line to the west and subdivided into a number of blocks by transversal normal faults with small displacements. The potential reservoir for CO2 storage consists of three Lower Cretaceous sand layers. The sands are separated by shales of various thickness. In the wells located in the central parts of the structure the sands are oil producing, whereas in several wells located at flanks of the structure the sands are saturated by salt water; one of such wells has been chosen for the injection experiment. The reservoir is overlain by a thick impermeable shale and marl section which probably served as a cap rock for oil accumulation.

The 3D model produced for the site describes the main geological features of the potential reservoir and cap rock layers. The model is based on the core and log analysis from about 40 wells located within the Heletz structure, providing a good overview and statistical basis of the properties of the layers. The spatial extension of the model is limited to the Heletz oil field ($\sim$4.0 km by 5.5 km) within the depth interval of -1300 to -1600 m. The model is represented by a set of maps and geological cross-sections describing the structural features (layers geometry, pinch-out lines, faults) and physical parameters (porosity, permeability, pressure, salinity) of the reservoir layers.

The model demonstrates that the sand reservoir is vertically limited by two surfaces, with its top at the depths of -1370 m to -1560 m and bottom at -1404 to -1587 m. The total reservoir thickness increases from 2.2 m near the pinch-out at the north-west to 20.6 m at the south-east. The average porosity within the sand layers varies between 13% and 25 %. The thickness of the cap rock increases from 23 m at the north to 54 m at the south. Uncertainties in the model parameters are related mainly to the problems of exact identification of the layers' boundaries due to a very limited set of geophysical logs in most wells, and to the problems of reliable estimation of porosity and permeability due to a very limited amount of core samples available for analysis.