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An overview of results from the CO2SINK 3D baseline seismic survey at Ketzin, Germany

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A 3D seismic survey was acquired at the CO2SINK project site over the Ketzin anticline in the fall of 2005. Main objectives of the survey were (1) to verify earlier geological interpretations of the structure based on vintage 2D seismic and borehole data, (2) to provide, if possible, an understanding of the structural geometry for flow pathways within the reservoir, (3) a baseline for later evaluation of the time evolution of rock properties as CO2 is injected into the reservoir, and (4) detailed sub-surface images near the injection borehole for planning of the drilling operations. Overlapping templates with 5 receiver lines containing 48 active channels in each template were used for the acquisition. In each template, 200 nominal source points were activated using an accelerated weight drop, giving a nominal fold of 25. Due to logistics, the number of actual source points in each template varied. In spite of the relatively low fold and the simple source used, data quality is generally good with the uppermost 1000 m being well imaged. Data processing results clearly show a fault system across the top of the Ketzin anticline that is termed the Central Graben Fault Zone (CGFZ). The fault zone consists of west-southwest−east-northeast- to east−west-trending normal faults bounding a 600−800 m wide graben. Within the Jurassic section, discrete faults are well developed, and the main graben-bounding faults have throws of up to 30 m. At shallower levels, the fault system appears to disappear in the Tertiary Rupelian clay. The main bounding faults of the CGFZ can be traced downwards to the top of the Weser Formation and possibly to the Stuttgart level, the target formation for CO2 injection. No faults were imaged near the injection site on the southern limb of the anticline. Remnant gas, cushion and residual gas from a previous natural gas storage facility at the site, is present near the top of the anticline in the depth interval of about 250–400 m and has a clear seismic signature. In addition to the standard processing and interpretation applied, attribute analysis, detailed shallow reflection seismic processing, tomographic inversion of first arrival times, and initial seismic modeling of the CO2 response have been performed. Attribute analysis of the target horizon using the continuous wavelet transform indicates that the injection site penetrates the target reservoir near the edge of a north-northwest−south-southeast striking channel.