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Technological laboratory for geologic CO2 storage in Hontomín (Spain): 2D-3C reflection imaging

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During 2010, a technological laboratory for geologic CO2 storage has been implemented in Hontomín (Spain), in order to investigate the different phases of CO2 subsurface injection at real scale and its long-term monitoring. As part of these multidisciplinary project a multi-seismic baseline study was carried on by means of innovative and non-standard seismic experiments including: 1) a 35 km2 of 3D seismic survey, 2) 2D survey with three-component receivers, 3) a Seismovie survey, 4) a Vertical Seismic Profile (VSP) survey and 4) a 30 passive-seismic network.

The 2D seismic reflection survey was acquired with new generation 3-component receivers DSU3·(Sercel). A total of 420 sensors with 25 m interval were deployed along 2 orthogonal lines centered next to the injection borehole. The seismic source was generated by 4 15-Tn M22 vibroseis trucks with a 16-sec sweep ($\sim$74% of the total area) and 450 gr of explosives for difficult access areas (26% of the total area). The distance between consecutive sources was 25 m. Data processing included static corrections, spherical divergence correction, airwave muting, deconvolution, band-pass filtering, stack and time migration. The multi-seismic baseline study has given details on the tectonic structure of the potential injection zone, the dome-geometry of the reservoir, and the physical and mechanical properties of the reservoir rock and seal layers. The first analysis of the vertical component data show two main features in 2D seismic sections. First, the loss of P-wave first arrival amplitudes at some 800-1000 m from the shot point, generating a shadow zone of $\sim$400 twts in average, which seem to be related to Upper Jurassic/Lower Cretaceous continental detritic deposits of the Purbeck and Weald formations, and eventually also to the Middle Cretaceous Escucha and Utrillas formations. And second, a high-amplitude reflection at the base of the shadow zone, identified continuously practically along the whole record section. This reflection is related to the high impedance contrast between the Purbeck formation and the Middle Jurassic carbonated marine deposits of the Dogger formation that corresponds to the top of the reservoir seal. Below this Purbeck-Dogger contact, the seismic sections shows a $\sim$100-twts thick package with high-amplitude reflections that are interpreted as the Lower Jurassic carbonate sequence of the Lias formation, between $\sim$1100-1500 m in depth, where the reservoir is located and the CO2 will be injected.