4D seismic monitoring at the Ketzin pilot site for CO_2 storage – plume imaging in the injection and post-injection phases

Alexandra Ivanova (1), Stefan Lüth (1), Peter Bergmann (1), Thomas Kempka (1), Christopher Juhlin (2), Fei Huang (2), Monika Ivandic (2), and Fenjiao Zhang (2)

(1) GFZ Potsdam, Germany, (2) Uppsala University, Sweden

The injection of CO_2 at the Ketzin pilot site started in June 2008 and ended in August 2013. A total amount of about 67 kt of CO_2 was injected into a saline aquifer. Aiming to investigate post-injection movement of the injected CO_2, a third repeat 3D seismic survey, serving as the first post-injection survey was acquired in 2015. Consistent with the previous two monitoring surveys, a predominantly WNW migration of the gaseous CO_2 plume in the up-dip direction within the reservoir is inferred in this first post-injection survey. There are no systematic anomalies detected through the reservoir overburden. The extent of the CO_2 plume west of the injection site is almost the same as that one found in the 2012 second repeat survey (after injection of 61 kt). But there is a significant decrease in its size east of the injection site. The percentage of detected CO_2 mass for the three seismic repeat surveys estimated using consistent input parameters shows a dramatically lower result for the third repeat than for the two surveys acquired during the injection period. Decrease in the size of the seismic anomaly may be explained as to be due to multiple factors, such as limited vertical resolution, CO_2 dissolution and CO_2 migration into thin layers, in addition to the effects of ambient noise. The assessments of various performance parameters comparing seismic monitoring and reservoir simulation results generally showed better conformance for the 2009 dataset than for the 2012 and 2015 datasets. The conformance assessment will be repeated with updated models after incorporating various new up-to-date monitoring data.