



The time lapse experiment in Al Wasse water pumping field in Saudi Arabia by an ultra-stable seismic source (ACROSS)

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We have developed the time lapse technology for EOR (enhanced oil recovery) and CCS (Carbon Capture and Storage) using a very stable and continuous seismic source called ACROSS (Accurately Controlled Routinely Operated Signal System) with multi-geophones. Since 2011, we have tested this technology in the context of carbonate rocks in Saudi Arabia. The Al Wasee water pumping site approximately 120 km east of Riyadh city has been selected as a trail-site. The intention is to observe the changes in aquifers induced by pumping operations. One ACROSS source unit was installed at the Al Wasee site in December 2011 and we are continuing the field test. The instrument has been operated from 10 to 50 Hz with 40 tons-f at 50 Hz. Using alternatively clockwise and counter-clockwise rotations we can synthesize vertical and horizontal forces, respectively. 31 3C-geophones in 2 km x 3 km area and four nearby 3Cgeophones have been used to monitor the seismic changes from pumping the water. The one and half month data between December 2012 and February 2013 show continuous and clear change of observed waveforms for all 31 stations while the source signature did not change. The change is closest and fastest at the station #42. The cause of continuous change with time is interpreted as pumping of water by 64 wells located in this field.