Geophysical Research Abstracts
Vol. 18, EGU2016-8216, 2016
EGU General Assembly 2016

Enhancement of CO_2 Trapping in Saline Aquifers Using a Water-Alternating-Gas Method

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Geological formations in general and saline aquifer in particular can be used to store considerable amount of CO_2. The efficiency and durability of the storage are not only defined by the formation hydro-geological properties but also by injection strategy employed. Previous studies have shown that certain injection strategies result in enhanced residual trapping and dissolution trapping that can noticeably increase CO_2 immobilization and the efficiency of the aquifer to store CO_2. One such enhancement method to increase the trapping mechanisms is water-alternating-gas (WAG) in which intermittent slugs of gas and water are injected. The injection rate, injection duration, the WAG ratio and the total volume of the injected components affect the efficiency of trapping. The objective of this study is to investigate different WAG injection schemes considering a heterogeneous field and find an optimized method to enhance the storage efficiency. The Heletz site in Israel, where CO_2 trapping will be quantified in a field injection experiment, is selected as an example for the optimization. We use the iTOUGH2-EOS7C code to simulate the trapping processes. The formation heterogeneity is considered; gas injection and migration are simulated in spatially correlated random permeability fields, which are generated based on currently available geological information and borehole data at Heletz.