Geophysical Research Abstracts
Vol. 20, EGU2018-5955-1, 2018
EGU General Assembly 2018

Enhancement of storage efficiency and pressure management with the brine drain in a fault-segmented small scale reservoir

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The storage efficiency in CO_2 geologic storage can be a very important factor in the case that large scale sedimentary basins are not distributed as in Korea. However, without any management, storage efficiency could be defined by given natural conditions. Therefore, recent research on the artificial storage efficiency enhancement method using the brine pumping method is proceeding robustly. Small reservoirs compartmentalized by faults are not suitable for geologic storage because of the high probability that the mechanical stability of the faults will be impaired due to the excessive pressure increase in the reservoir. In the small reservoir, even if the brine extraction is applied to control the pressure rise, it is difficult to utilize as a reservoir considering the leakage of injected CO_2 with extracted water. Brine extraction can make the migration of injected CO_2 toward the pumping well be accelerated. In this study, numerical modeling was carried out to investigate whether or not to increase the spatial storage efficiency and to extend the period of carbon dioxide injection by using the installation method of the brine drainage behind the fault. In the applied numerical modeling, the improvement of the storage efficiency was examined, including the sensitivity analysis of the permeability and the capillary entry pressure of the single layer. Numerical modeling results show that this method can suppress the excessive pressure increase in the reservoir and the storage efficiency can be improved from 12% up to 20% and the operation duration can be extended by $2 \sim 6$ years. In some cases, such that fault permeability is extremely low and brine drain well behind fault is not applicable, alternative approaches should be considered.