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INVESTIGATION OF THE POTENTIAL IMPACT OF LARGE-SCALE CO2 STORAGE IN SONGLIAOBASIN ON THE LOCAL GROUNDWATER SYSTEM

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Summary. The Songliao basin is located in the northeastern China. The China's largest oil field, Daqing oilfield, is at the center of the basin. In the past several decades, extensive explorative investigations and production of oil and gas have been carried out in this area. Relative abundant geologic knowledge of the area has been acquainted through these activities. The area hosts many heavy industries, which could be sources of the large stationary CO_2 emission. For these reasons, the area has been considered as a potential candidate site for CO_2 storage for China. Large-scale CO_2 storage in deep aquifers may cause considerable pressure perturbation and groundwater migration in both deep and shallow formations. In this study, we developed a numerical model to simulate a hypothetical storage of CO_2 in the Songliao Basin. The model will be used to investigate possible pressure build-up in the highly heterogeneous aquifers and change of groundwater flow system. The potential storage capability will also be investigated through the simulation. The model covers whole Songliao basin, which has an area about 260,000 km2 and is represented by more than 750,000 gridblocks and 2,300,000 connections. Thickness of the model layers ranges from a couple meters at the border of the basin to more than 2000 m in the depression areas. To solve the large-scale model efficiently, a parallel multiphase flow simulator, TOUGH2-MP/ECO2N, was adopted for the simulation. Models are run on Linux clusters with several tens to hundreds of processors. In the simulation, CO2 was injected into the Yaojia formation at the Central depression area from 10 wells with a total rate of 10 million tons/year for 100 years. Simulation results suggest that propagation of pressure is far reaching and large covering of the model domain is necessary, even though the CO2 plume is much smaller. The pressure change is sensitive to the injection amount and permeability of the confined layers. The simulation results demonstrate that even the permeability of cap rocks of the storage system is not fully impermeable, injected CO2 cannot escape from the site in several thousand years.