Numerical modeling of multiphase flow is an essential tool to ensure the viability of long-term and safe CO2 storage in geological formations. However, lack of knowledge of formation properties and heterogeneity of the formation, uncertainties need to be assessed in order to make simulation effective and useful. In this study, we investigated the impact of heterogeneous reservoir and cap distributions for CO2 geological storage in a deltaic environment using a Boolean approach. The Boolean method can be divide into two processes. The first defines the shapes of geological bodies according to some control parameters (eg. thickness, length and width). The second gets the overall reservoir and cap’s volume fraction from the drilled holed. Then, this arithmetic can generate the distribution of shale and cap formations. It is shown that this method is very effective and simple. Finally, in comparison to homogeneous model, the heterogeneous model has distinct difference in the spatical distribution of the CO2 and its partitioning between gas and liquid and breakthrough time.

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Key words: Heterogeneity, Reservoir and cap formations, Carbon dioxide, Boolean method

Fig. 1. (A), Realization of the distribution of reservoir and cap in 2D of one simulation domain of long 2,000m, width 2,000 m and height 110 m (Shape of control parameter is 50 meters in x-direction, 1 meter in y-direction and 5 meters in z-direction); (B), Gas saturation at 20 years, 0.1 kg/s (per metre in y-direction thickness).

Fig. 2. Realization of the distribution of reservoir and cap in a simulation domain of long 2,000m, width 2,000 m and height 110 m (Shape of control parameter is 100 meters in x-direction, 100 meter in y-direction and 5 meters in z-direction). (A), Plane graph of the simulation domain in x-y direction; (B), Three-dimensional map of the simulation domain; (C), Geological three bar graph; (D), Three-dimensional map of gas saturation in about 20 years.