CO_2 behavior simulation using large scale geological model

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Carbon Capture and Storage (CCS) is expected as a mitigation measure of climate change and global warming causing by the rise in atmospheric carbon dioxide (CO_2) concentration. CCS is a technology that can reduce the amount of CO_2 emissions from large point sources, such as electricity power plant, by separating and recovering CO_2 from atmosphere-releasing gas and storing it in the basement. Main items of reservoir evaluation are (1) evaluation of injection performance and (2) evaluation of storage capacity. In this research, the above two evaluation items were investigated by numerical analysis. Analysis module, TOUGH2-ECO2N which deals with multicomponent and multiphase fluid was used.

(1) Evaluation of injection performance
The influence of basic physical parameter (permeability and porosity) on the CO_2 injection performance of the reservoir layer was investigated. As a result, it has been found that permeability affects whole pressure level of the reservoir layer and porosity affects the slope of pressure rise. Furthermore, their influence on the long-term distribution range of pressure and CO_2 plume has been revealed clearly.

(2) Evaluation of storage capacity
The basic physical parameter of analysis model for the evaluation of the storage capacity was determined with history matching based on the monitoring and the prediction simulation of the pressure, which was conducted in the CCS project in Canada Quest. In order to reveal the factors affecting the storage capacity evaluation were carried out, case studies such as changing placement of injection wells, etc. It is expected that the findings from this study can contribute to the evaluation of the storage capacity, such as predicting pressure rise in the reservoir layer and distribution of CO_2 plume, and the helpful for enabling "reservoir management", such as arrangement of injection wells, number of wells, injection rate and time, and installation of a pressure relief well.

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