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Deep-learning-based surrogate model for brine extraction well placement for geological carbon storage

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In a geological carbon storage project, management of reservoir pressure buildup is essential for long-term safe carbon storage. A reservoir pressure buildup caused by CO₂ injection may lead to serious safety issues such as induced seismicity, caprock damage, and leakage of brine and CO₂. Brine extraction is a practical solution to mitigate the reservoir pressure buildup. In heterogeneous reservoirs, the performance of brine extraction is significantly affected by where to place a brine extraction well because the mitigation of pressure buildup and the arrival time of injected CO₂ to the brine extraction well are determined by the hydraulic connectivity map. The optimization of a brine extraction well location is computationally expensive because many reservoir simulation runs are required to seek optimal locations in potential well locations. We propose an efficient surrogate model that computes the optimality of a brine extraction well quickly using the fast marching method and a convolutional neural network. The arrival time map of a pressure pulse that the fast marching method provides rapidly can be used as a good representation of the hydraulic connectivity map for a brine extraction well location. The performance of our surrogate model is demonstrated in a CO₂ injection site in the Pohang basin. The computational cost of optimization of a brine extraction well is significantly saved using our accurate surrogate model compared to a normal optimization process.

Time Block Preference

Time Block A (09:00-12:00 CET)

References

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