Contribution ID: **1082** Type: **Poster Presentation**

Simulation of CO2 Injection and Development of Proxy Models for Svelvik CO2 Field Lab

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Svelvik CO2 Field Lab is a small-scale field laboratory located about 50 km southwest of Oslo in Norway. The test site occupies an inactive part of a sand and gravel quarry, located in a glaciofluvial –glaciomarine environment. It consists of an injection well surrounded by four monitoring wells covering an area of approximately 300m x 150m. The injection well facilitates water and CO2 injection at a depth of 64-65m. From September to November 2019, through the Pre-ACT project (Pressure control and conformance management for safe and efficient CO2 storage –Accelerating CCS Technologies), an injection campaign was performed. The data sets gathered from this campaign are geophysical monitoring of the CO2 plume (seismic and ERT), water and CO2 injection rates, and pressure at the depth of injection for the injection well and the monitoring wells. By using this data, numerical simulations of CO2 injection at Svelvik CO2 Field Lab were performed. To capture the CO2 plume movement, a fine grid geological model was used in the simulation study which takes seven hours to complete the Pre-ACT injection.

In this study, an initiative is proposed using proxy models to reduce the simulation time and to be used for the next injection design. A prediction scenario of two cycles with one week injection and one week shut-in is recommended for the proxy model development. By using the history-matched model, 18 different injection cases with different CO2 injection rates were simulated by using a numerical reservoir simulator. The results from the numerical reservoir simulator were used to train the proxy models. The proxy models used in this study are response surface proxy and universal kriging proxy with the input of first and second cycle CO2 injection rate. Several outputs are predicted using the proxy models, such as injection bottomhole pressure, average field pressure, field dissolved CO2 in water, and field CO2 in the gas phase. The validity of the proxy models is evaluated by percent error and correlation coefficient (R2).

The results of the response surface and universal kriging proxies show promising results for the evaluation and validation cases. All predicted results have R2 greater than 0.99, which means that the proxy models are highly correlated to the simulation results. The universal kriging proxy shows a better performance than the response surface due to the limitation of the response surface in following the polynomial regression model, while the universal kriging has the potential to minimize the error through the Gaussian process.

Overall, this study presents a success story of proxy model implementation in CO2 injection to replicate key results from the numerical simulations. Moreover, the proxy model can reduce the time required to complete a numerical reservoir simulation, which is an advantage in performing experiment design for the next injection in Svelvik CO2 Field Laboratory.

Participation

In-Person

References

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