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CO2 storage site characterization using variational autoencoders

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Characterization of geologic heterogeneity is crucial for reliable and cost-effective subsurface management operations, especially in problems that involve complex physics such as field-scale carbon storage and unconventional oil and gas operations. With recent advances in computational power and sensor technology, large-scale aquifer characterization using various types of measurements has been a promising approach to achieve high-resolution subsurface images. However, traditional large-scale inversion approaches require high, often prohibitive, computational costs associated with large-scale coupled numerical simulation runs and large dense matrix multiplications. As a result, traditional inversion techniques have limited utility for problems that require fine discretization of large domains and a large number of hydrogeophysical measurements to capture small-scale heterogeneity. In this presentation, we apply a deep-generative model-based Bayesian inversion method for large-scale carbon storage site characterization and forecast. To be specific, novel variational autoencoders are used to learn the approximate distribution from multipoint geostatistics-derived training images as a prior and accelerated stochastic inversion is performed on the low-dimensional latent space in a Bayesian framework. Numerical examples with synthetic 2D permeability fields with fluvial channels confirm that our proposed method provides promising subsurface site characterization with reliable uncertainty quantification.

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Time Block Preference

Time Block B (14:00-17:00 CET)

Participation

Online

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