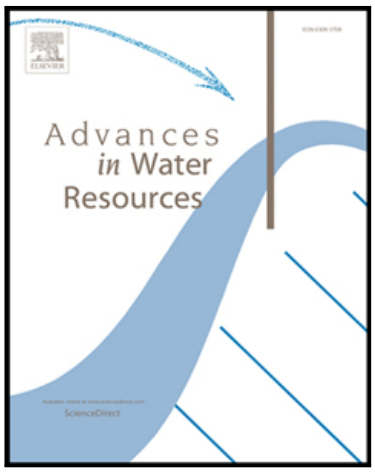

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Inversion using a new low-dimensional representation of complex binary geological media based on a deep neural network

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Abstract

Efficient and high-fidelity prior sampling and inversion for complex geological media is still a largely unsolved challenge. Here, we use a deep neural network of the variational autoencoder type to construct a parametric low-dimensional base model parameterization of complex binary geological media. For inversion purposes, it has the attractive feature that random draws from an uncorrelated standard normal distribution yield model realizations with spatial characteristics that are in agreement with the training set. In comparison with the most commonly used parametric representations in probabilistic inversion, we find that our dimensionality reduction (DR) approach outperforms principle component analysis (PCA), optimization-PCA (OPCA) and discrete cosine transform (DCT) DR techniques for unconditional geostatistical simulation of a channelized prior model. For the considered examples, important compression ratios (200 - 500) are achieved. Given that the con-

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