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Deep Learning-based inverse modeling of a tank model of a channelized aquifer

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Inverse modeling plays a fundamental role in the subsurface characterization of aquifers, given the scarcity of available data. Several techniques have been proposed in the literature and tested using synthetic examples. However, one of the big criticisms of these techniques is the lack of demonstrations in real cases. In this context, this study presents the application of two of the most advanced inverse modeling techniques: the Ensemble Smoother with Multiple Data Assimilation (ES-MDA) and Deep Learning-based inverse modeling (DL), for the characterization of the non-Gaussian hydraulic conductivity field of a 2D tank model of an aquifer. The experiment consisted of the release of a fluorescent solution from a point source on a horizontal flow field (constant head imposed to the left and right boundaries of the model). The physical model was built with glass beads of two sizes, forming a homogeneous low hydraulic conductivity matrix with sub-horizontal high conductivity channels embedded. The inverse problem pursued the identification of the hydraulic conductivity from measurements of the solute concentration at given locations and times. Prior field realizations were generated using multiple-point geostatistics to resemble the channel patterns observed on the physical model. The efficiency and accuracy of both techniques in terms of computational time and error/dispersion in hydraulic conductivity and solute concentration are evaluated.

Participation

In-Person

References

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Primary authors: Dr A. GODOY, Vanessa (Universitat Politecnica de Valencia); Dr TODARO, Valeria (Università degli Studi di Parma); Dr NAPA-GARCÍA, Gian F. (Universitat Politècnica de València); Prof. ZANINI, Andrea (Università degli Studi di Parma); Prof. GÓMEZ-HERNÁNDEZ, J. Jaime (Universitat Politècnica de València)

Presenter: Dr A. GODOY, Vanessa (Universitat Politecnica de Valencia)

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