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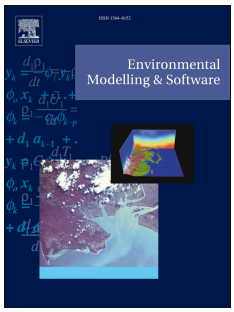

A model-independent iterative ensemble smoother for efficient history-matching and uncertainty quantification in very high dimensions

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A model-independent iterative ensemble smoother for efficient history-matching and uncertainty quantification in very high dimensions

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Abstract <150 words

An open-source, scalable and model-independent (non-intrusive) implementation of an iterative ensemble smoother has been developed to alleviate the computational burden associated with history-matching and uncertainty quantification of real-world-scale environmental models that have very high dimensional parameter spaces. The tool, named pestpp-ies, implements the ensemble-smoother form of the popular Gauss-Levenberg-Marquardt algorithm, uses the pest model-interface protocols and includes a built-in parallel run manager, multiple lambda testing and model run failure tolerance. As a demonstration of its capabilities, pestpp-ies is applied to a synthetic groundwater model with thousands of parameters and to a real-world groundwater flow and transport model with tens of thousands of parameters. pestpp-ies is shown to efficiently and effectively condition parameters in both cases and can provide means to estimate posterior forecast uncertainty when the forecasts depend on large numbers of parameters.

Keywords: modeling; uncertainty; iterative ensemble smoother; Gauss-Levenberg-Marquardt

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