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# Comparison of simulation-based algorithms for parameter estimation and state reconstruction in nonlinear state-space models

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## Résumé

In geosciences, data assimilation (DA) methods aim at reconstructing the state of a system by combining observations with a physical model. The most popular algorithms in the DA community are based on the Ensemble Kalman Filter and Smoother (EnKF/EnKS) and its extensions. DA is usually based on a state space model. The parameters of the model strongly impact the results of DA algorithms and they are usually unknown and may be difficult to specify. There is hence a need for an efficient method to estimate them. Expectation-Maximization (EM) is the most classical algorithm in the statistical literature to estimate the parameters in models with state variables. It consists in updating sequentially the parameters by maximizing a likelihood function where the state is approximated using a smoothing algorithm. In this paper, we propose to combine a Stochastic EM (SEM) algorithm with various smoothing algorithms and compare the results.

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