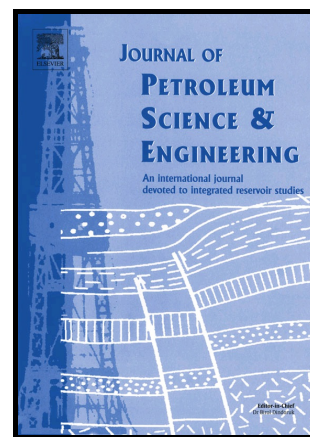


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Estimating Uncertainty Bounds in Field Production Using Ensemble-based Methods

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Abstract

Ensemble-based methods have been successfully applied in reservoir history-matching problems in the last decade. Among the advantages normally attributed to these methods, the fact that they generate multiple realizations of the model is one of the most important. By simulating these realizations, one can estimate the uncertainty in the production forecast for the field. However, because of limitations related to the use of relatively small ensembles, these methods often underestimate the posterior variance in the reservoir model parameters. Consequently, they tend to underestimate uncertainty in production forecasts. This paper introduces a simple procedure to evaluate the uncertainty bounds in the field production using ensemble-based data assimilation. The implementation of the proposed method is straightforward requiring very few modifications in a standard data assimilation code. The method was tested against the PUNQ-S3 case and a real field problem.

1 Introduction

Reservoir simulation plays an important role in the development and management of production in oil fields. Reservoir models allow engineers to evaluate the performance of the field under variate conditions. For example, they can test different well locations and design secondary recovery schemes. However, the actual properties of a reservoir are poorly known, which makes model-based forecasts inherently uncertain. In order to mitigate uncertainty, it is necessary to incorporate all relevant data about the reservoir in the models. The process of incorporating dynamic data into reservoir models is known in the petroleum literature as history matching. History matching has been subject of intense investigation in the last five decades; see (Oliver and Chen, 2011) for a review of the main methods and recent developments in history matching.

Modern history matching methods are typically grounded on Bayesian statistics, which allows to write the posterior probability density function (PDF) for unknown reservoir model

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