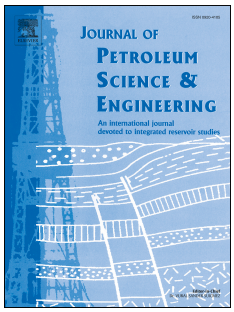
Accepted Manuscript



Applying a localization technique to Kalman Gain and assessing the influence on the variability of models in history matching

Ricardo Vasconcellos Soares, Célio Maschio, Denis José Schiozer

PII: S0920-4105(18)30453-4

DOI: 10.1016/j.petrol.2018.05.059

Reference: PETROL 4988

To appear in: *Journal of Petroleum Science and Engineering*

Received Date: 22 November 2017

Revised Date: 18 May 2018

Accepted Date: 18 May 2018

Please cite this article as: Soares, R.V., Maschio, Cé., Schiozer, Denis.José., Applying a localization technique to Kalman Gain and assessing the influence on the variability of models in history matching, *Journal of Petroleum Science and Engineering* (2018), doi: 10.1016/j.petrol.2018.05.059.

Applying a Localization Technique to Kalman Gain and Assessing the Influence on the Variability of Models in History Matching

Ricardo Vasconcellos Soares [(a)*], Célio Maschio [(a)], Denis José Schiozer [(a)]

(a) Department of Energy – Division of Petroleum Engineering – University of Campinas, PO Box 6122, Campinas, São Paulo, Brazil, 13083-970.

*Corresponding author (Email: rsoares@cepetro.unicamp.br)

ABSTRACT

History matching (HM) is an important process that considers dynamic data to reduce uncertainties of parameters. As an ill-posed inverse problem, different combinations of uncertainties can result in matched models and, as the real response is unknown, methodologies for HM must be capable of representing all possible answers in a certain search space, mitigating the risk of convergence to a local minimum that may not represent the real answer. This work presents a study of an ensemble-based method, derived from the Kalman Filter (KF), the Ensemble Smoother with Multiple Data Assimilation (ES-MDA), in conjunction with a localization technique applied to a benchmark model with a known response, seeking to evaluate the final variability of the models and potential exclusion of better models in a HM problem. We used three different approaches of the same model aiming to identify the main applications and limitations of the method: the first approach uses ES-MDA without localization and the other two use ES-MDA with localization under distinct approaches. Results showed that ES-MDA without localization generated an ensemble with excessive uncertainty reduction. The localization technique was able to deal with this issue. However, the different approaches with localization presented different answers, suggesting that careful analysis is required. In addition, key parameters, such as the number of models and iterations also influence the results.

Keywords: History Matching; Ensemble Kalman Filter; Ensemble Smoother with Multiple Data Assimilation; Localization.