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Hydrology and Earth System Sciences
Discussions

Interactive comment on "On the efficiency of the hybrid and the exact second-order sampling formulations of the EnKF: A reality-inspired 3D test case for estimating biodegradation rates of chlorinated hydrocarbons at the port of Rotterdam" *by* M. E. Gharamti et al.

Anonymous Referee #1

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In this case the title says it all, or almost... I was quite thrilled when I read the title and introduction since I was expecting to see an application of the EnKF to a realistic case (port-Rotterdam inspired), unfortunately the final outcome is a nicely written, quite interesting analysis of the efficiency of the hybrid and the exact second-order sampling formulations of the EnKF, but the application, although port-Rotterdam-inspired, is far from being realistic at all. And the authors fail to recognize it.

The authors make no comment about the statement in line 345ff "Modelling parameters

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Discussion paper

required for running the coupled FTR-Model, such as porosity, distribution coefficients and others are defined, based on real data and laboratory assessment, as 3D heterogeneous fields" (They forgot to mention explicitly hydraulic conductivity.)

This assumption means that all the uncertainty associated with the heterogeneous geological parameters is discarded, and that all the analysis has been performed assuming that porosity, conductivity, distribution coefficient, and other parameters are perfectly known. Once this is realized, one has to continue reading under the understanding that what follows is a purely academic exercise, poorly disguised as a realistic application.

The authors must be very clear from the very beginning on this "small" detail, and acknowledge it. Apart from that, I think the paper is well written, hard to follow at times, and provides an interesting discussion on how to deal with the specifics of the hybrid and the exact second-order sampling formulations of the EnKF.

Minor comments

line 129: What do you mean by "...the EnKF computes an approximation of the joint pdf..." Unless you mean the non-parametric joint pdf as implied by the raw set of ensemble values, the statement is incorrect. The EnKF is based on means and covariances, but this does not imply that by knowing them you know the joint pdf.

line 160. There is no Gaussian assumption in the derivation of the Kalman filter equations!! Those equations are solely based on means and covariances and there is no requirement that parameters or state variables are Gaussian to derive them. However, it is true that the EnKF is optimal for multiGaussian-based variables.

line 483. ... the "famous" steady-state Kalman filter... Please, watch your wording and avoid sensationalism.

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