Richards’equation solution computed by means of EnKF combined with Brownian bridges

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Here we present a new technique for assimilating water content measurements into Richards’equation. This technique is based on the ensemble Kalman filter ([4]), that is largely employed in the context of groundwater modeling (see for example [5]) and makes particularly sense whenever we have few observations in time, and a stiff evolutionary equation such as Richards’equation.

As a matter of facts, assuming to have frequent observations in time, even though Richards’equation is a stiff problem ([2,3,6]), a cheap explicit method can be used, because observations continuously “correct” the computed solution [1]. Conversely, if observations are sporadic in time, we can interpolate them in order to have a grid of fictitious observations: finally, the measurement error covariance matrix for these fictitious observations is estimated by means of Brownian bridges. In groundwater modeling, often we have the whole measurement matrix of water content. The technique presented has the advantage to take into account all these observations (since we interpolate them) and not only the observations of the state at current time, as in the classical formulations of Kalman filters.

References