Adjoint problem ensemble algorithms for inverse modeling of advection-diffusion-reaction processes

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The inverse problems for nonlinear advection-diffusion-reaction models with image-type and in situ measurement data are considered. The use of the sensitivity operators, constructed of the ensemble of adjoint problem solutions, allows transforming the inverse problems stated as the systems of nonlinear ODE or PDE to a family of operator equations depending on the given set of projection functions in the space of the measurement results [1,2]. The adjoint problems from the ensemble can be solved in parallel. In order to reduce the number of the ensemble members, the adaptive set of the projection functions is constructed. Newton-Kantorovich type methods are applied to the solution of the resulting ill-posed operator equations. The algorithms can be used for the solution of the data assimilation problems considered as the sequences of the linked inverse problems [3]. The algorithms are numerically evaluated on inverse problems of atmospheric chemistry.

References
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