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# Numerical solution of the inverse source problems for the chemical transformation models with image-type measurement data

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The inverse source problems for nonlinear chemical transformation models with image-type measurement data are considered. These inverse problems arise in the course of data assimilation of the atmospheric composition monitoring data obtained in the form of time series, vertical concentration profiles or satellite images of the concentration fields.
The use of the sensitivity operators constructed from the set of the adjoint problem solutions allow to transform the inverse problem stated as the system of nonlinear ODE or PDE to the family of operator equations depending on the given set of orthogonal functions in the space of the measurement results [1]. By the proper choice of the orthogonal functions the dimensionality of the problem can be reduced thus allowing for the efficient solution of the resulting operator equation with the relevant methods for nonlinear ill-posed operator equations (e.g. the methods based on the truncated SVD or Newton-type methods). This reduction of the dimensionality can be done by choosing the set of left singular vectors corresponding to the largest singular values of a sensitivity operator, constructed for the largest feasible (for the computer used) number of the orthogonal functions from some general basis (e.g. trigonometric) in the space of the measurement results. In the work the numerical methods are presented and tested on the atmospheric chemistry transformation models.

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References
[1] Penenko A.V. Consistent numerical schemes for solving nonlinear inverse source problems with the gradient-type algorithms and the Newton-Kantorovich methods. Numerical Analysis and Applications, 2018 (in press).