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term estimation with a simple weak-constraint inverse modeling scheme

It is well known that weak-constraint variational data assimilation (4D-Var) performs better than its strong-constraint counterpart by including model uncertainty terms in the cost function. However, model uncertainties have been rarely considered in the inverse modeling applications. In this study, a simple weak-constraint inverse modeling scheme is designed to include model uncertainties using NOAAâ⊠s HYSPLIT Lagrangian dispersion model. The Cross Appalachian Tracer Experiment (CAPTEX) data are used in the initial tests so that the results can be easily evaluated with the known release sources. In this simple scheme, model uncertainties are added to the observational covariance matrix. Before the model uncertainty terms are introduced, the inverse tests using concentration differences in the cost function results in severe underestimation while those using logarithm concentration differences in the cost function results in overestimation of the release rate. Adding model uncertainty terms improves results for both choices of the metric variables. This weak-constraint HYSPLIT inverse modeling system is further tested with the Fukushima nuclear accident case. In the tests, the daily average cesium-137 air concentration measurements around the globe are used to estimate the release of the radionuclide. The results are then compared with the results using a strong-constraint HYSPLIT inverse modeling system.

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