Atmos. Chem. Phys. Discuss., 3, S1846–S1847, 2003
www.atmos-chem-phys.org/acpd/3/S1846/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "An evolution strategy to estimate emission source distributions on a regional scale from atmospheric observations" *by* P. O'Brien et al.

P. O'Brien et al.

Received and published: 7 November 2003

The concerns expressed by the reviewers regarding the failure of SVD to find the global least square fit solution to the stated test problems are fully justified. A minor error has been found in the programming code, which generated the simulated time series. The result was that the SVD and ES methods while working on the same problem, were not working on the identical twin problem stated in the paper. The error introduced singularities into the data presented to SVD and the ES for solution, that otherwise would not have been present. Certain emission cell values to be determined were in effect multi-valued. This event afforded ES the opportunity to apparently rival SVD in its solutions to the test problems.

On correction of the error in the code, SVD solves the test problems at medium res-

Full Screen / Esc
Print Version
Interactive Discussion
Discussion Paper

olution perfectly, in the sense of achieving a correlation coefficient of 1.0. For the distributed source, the ES model does not approach the same value in reasonable computation time, and therefore does not rival the comparative SVD solution. The ES solution is not, however, a poor solution to the test problem. In fact the ES solution remains a better fit to the original test emission map as SVD presents significant negative emissions. Nevertheless, the solution which SVD presents is recognized to be just one of an infinite number of potential solutions which can be found by the linear combination of it and the null-space basis vectors, that SVD also generates. SVD also provides variance and covariance information regarding the solution, and it is likely that the application of post analysis constraints would yield acceptable positive solutions.

Some claims can still be made for the ES. It is easy to implement; readily amenable to applying constraints and different cost functions. The ES results are also easy to interpret. Each run of the ES presents new near-fit solutions to the problem. With multi-runs, data will be generated regarding the topography of the solution space, that is to say one will gain insight into the robustness of the near-fit solutions. The ES model may also have scope for application to real data, where, because of observational error, or actual emission variations, singular (or very nearly singular) data will be commonplace. As observed earlier, it was singularities, which led to the overestimation of the ES performance.

Our conclusions are therefore much mollified. The ES is an interesting technique, and shows promise for estimating emission source distributions. However, the authors recommend the exhaustion of more established methods before embarking on an ES strategy, particularly with regard to linear models.

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 1333, 2003.

ACPD

3, S1846–S1847, 2003

Interactive Comment