

We thank referee#2 for insightful comments and useful references. Our responses are following:

Problem 1.

Please open abbreviation "NIES".

Answer 1.

National Institute for Environmental Studies. We will add this in revised manuscript.

Problem 2.

As benefit of the proposed method against "traditional" regional inversion, I recommend highlighting the consistent way for definition of set of EOFs that capture "variability" of emissions.

Answer 2.

We thank the referee for the comment. We will add detailed description for definition procedure of EOFs in the revised manuscript. Also we would like to note that for singular value decomposition we used a standard procedure from Numerical Recipes in FORTRAN (The Art of Scientific Computing) Second Edition.

Problem 3.

Introduction. Some discussions on the variational adjoint methods for inversion of emissions can be added. (T. Kaminski, P. J. Rayner, M. Heimann, and I. G. Enting. On aggregation errors in atmospheric transport inversions. J.Geophys. Res. , 106:4703– 4715, 2001).

Answer 3.

We agreed with referee and will add this reference in manuscript.

Problem 4.

2. Methodology (or Method and Results). It would be better to insert sub-sections:

2.1 Determination of EOF; 2.2 Constraining EOF by data in NIES transport model; 2.3 Experiments with synthetic data, accuracy of inversion; 2.4 Observability of derived EOFs; 2.5 Comparison with regional inversions. I recommend to put a brief model description (with reference to Maksutov et al., 2008) in the context of 2.2 and eliminate Appendix A.

3.Conclusions. This section with discussions of Fig. 3 and 5 reminds me discussion of results. It would be better to state a major promise of the proposed approach and discuss the future plans for applications with different data sets.

Answer 4.

We thank the referee for the very appropriate suggestion. We applied these corrections to our manuscript.

Problem 5.

I would recommend to add results of so-called simulator experiments with synthetic CO₂ data and “prescribed” true emissions to illustrate the main attractive features of the EOF approach. These features are listed in the abstract and conclusions but they are not substantially illustrated in the manuscript. It is worthy to note that using different dimension of the synthetic data (from 75 stations to 1000 data points) this paper can easily address the question of observability of derived EOFs by the current and prospected surface networks of CO₂ observations.

Answer 5.

Thank you for this suggestion. We will perform this experiment and will describe the results in the revised manuscript.