

# Accounting for Representativeness Errors in the Inversion of Atmospheric Constituent Emissions: Application to the Retrieval of Regional Carbon Monoxide Fluxes

Mohammad Reza Koohkan<sup>a,b</sup> and Marc Bocquet<sup>a,b</sup>

<sup>a</sup> *Université Paris-Est, CERA joint laboratory École des Ponts ParisTech and EDF R&D, France*

<sup>b</sup> *INRIA, Paris Rocquencourt research center, France*

A four-dimensional variational data assimilation system (4D-Var) is developed to retrieve carbon monoxide (CO) fluxes at regional scale, using an air quality network. The air quality stations that monitor CO are proximity stations located close to industrial, urban or traffic sources. The mismatch between the coarsely discretized Eulerian transport model and the observations, inferred to be mainly due to representativeness errors in this context, lead to a bias (average simulated concentrations minus observed concentrations) of the order of magnitude of the concentrations. 4D-Var leads to a mild reduction of the bias because it does not adequately handle the representativeness issue. For this reason, a simple statistical subgrid model is introduced and is coupled to 4D-Var [1]. In addition to CO fluxes, the optimization seeks to jointly retrieve *influence coefficients*, which quantify each station's representativeness. The method leads to a much better representation of the CO concentration variability, with a significant improvement of statistical indicators. The resulting increase in the total inventory estimate is close to the one obtained from remote sensing data assimilation. This methodology and experiments suggest that information useful at coarse scales can be better extracted from atmospheric constituent observations strongly impacted by representativeness errors.

## References

[1] Koohkan, M. R. and Bocquet, M., "Accounting for representativeness errors in the inversion of atmospheric constituent emissions: Application to the retrieval of regional carbon monoxide fluxes.", *Tellus B*, 64, 19047, 2012.