

ABSTRACT

TITLE:

*Using High-Resolution Forward Model Simulations of Ideal Atmospheric tracers to Assess the Spatial Information Content of Inverse CO2 Flux Estimates *

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Attribution of observed atmospheric carbon concentrations to emissions on the country, state or city level is often inferred using "inversion" techniques. Such computations are often performed using advanced mathematical techniques, such as synthesis inversion or four-dimensional variational analysis, that invoke tracing observed atmospheric concentrations backwards through a transport model to a source region. It is, to date, not well understood how well such techniques can represent fine spatial (and temporal) structure in the inverted flux fields. This question is addressed using forward-model computations with idealized tracers emitted at the surface in a large number of grid boxes over selected regions and examining how distinctly these emitted tracers can be detected downstream. Initial results show that tracers emitted in half-degree grid boxes over a large region of the Eastern USA cannot be distinguished from each other, even at short distances over the Atlantic Ocean, when they are emitted in grid boxes separated by less than five degrees of latitude - especially when only total-column observations are available. A large number of forward model simulations, with varying meteorological conditions, are used to assess how distinctly three types of observations (total column, upper tropospheric column, and surface mixing ratio) can separate emissions from different sources. Inferences for inverse modeling and source attribution will be drawn.

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