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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