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Atmospheric Measurement Techniques Discussions

Interactive comment on "The potential of satellite spectro-imagery for monitoring CO_2 emissions from large cities" *by* Grégoire Broquet et al.

Anonymous Referee #3

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The authors report an observation simulation study of uncertainty reductions obtained using simulated CarbonSat observations of fossil fuel co2 emissions from the Paris, France urban area. In the absense of correlated (bias) errors, the authors estimate that a 50% reduction in uncertainty relative to the assumed prior uncertainty is obtained. The authors also includeÂădetailed estimates of the effect of bias errors.

General comments:

The problem is reasonably well conceived, the methods are sufficient to provide useful information. The results are useful in showing that use of CarbonSat data in regional CO2 inversions would reduce uncertainty in urban fossil fuel emissions. The paper would be useful contribution to AMT and could be published with revisions.

That said, the paper covers a lot of material and lacks clarity in some of the figures and description.

In particular, authors might add separate figures showing: 1) the predicted fossil and NEE signals within the modeling domain for one of the OSSE configurations 2) the pattern of sampling for each of the different OSSE configurations (TH-CS, TH-LS, SIM-CS from Table 1.)

The figures showing model results need better captions that describe that each panel shows points representing results for each of the 20 model days included in the OSSE (assuming I understand the figures correctly).

The assumption of relatively weak positive NEE for the October period doesn't allow consideration of other seasons. For example, strong NEE uptake in the growing season would result in potentially uncertain drawdown in XCO2 that could mask the fossil signal. This mentioned and potentially estimated numerically to provide a better sense of the seasonal cycle in CO2 sensing.

The methods description of systematic biases is so terse as to be unclear how large are the resulting signal (ppm) biases It would be helpful to have some additional figure or table to illustrate this before launching into results.

Last, I have not assessed the accuracy of the bias simulations so cannot comment on those results.

Specific comments:

abstract: The abstract should state the assumed prior model uncertainties (50% on all fluxes) before stating the uncertainty reductions provided by the observations.

page 7, Eq (1) & (2): The OSSE is estimating scaling factors for hourly (in a band of 6 hours) fossil fuel and NEE using maps of XCO2 covering the entire model domain. This effectively assumes that prior modeled fluxes do not contain significant correlated spatial errors. This should be identified as a limitation of the study and perhaps addressed

by comparing with modeled XCO2 signals obtained from a different prior model for emission (e.g., spatially uniform fluxes or a different flux models like EDGAR, GEIA, etc.).

page 11, line 23: What is the justification for assuming prior uncertainties for all fossil fuel and NEE sectors are equal to 50% ? This seems a rather weak constraint relative to uncertainties typically assumed for fossil fuel emissions, though perhaps not so far off for NEE.

Fig. 1: The figure axes or caption need to indicate units (degrees?)

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