

Interactive comment on “A local to national-scale inverse modeling system to assess the potential of spaceborne CO₂ measurements for the monitoring of anthropogenic emissions” by Diego Santaren et al.

Anonymous Referee #1

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The authors do a good job of explaining a regional tool that can be used to evaluate observing systems. Much of this detail has already been covered in Broquet et al (2018), but they add some to the analysis presented there and extend to a more comprehensive state vector that includes the larger region, as well as exploring the impacts of satellite data precision and resolution on the inversions.

Everything as described is correct mathematically, and the results from the point of view of a linear least squares optimization are useful. I find the analysis related to the independence of various sources particularly interesting, as distinguishing from

C1

neighboring sources is critical for the mission of CO2M.

As the authors highlight their exploration of the observational precision, it behooves me to point out that we have no reason to believe the assumption they make about independence of the errors in retrievals that are spatially near each other. In fact, work by Kulawik et al and Worden et al would suggest that the correlation length scales would be something more like 50km-100km for XCO₂. The assumption that errors scale by \sqrt{N} is particularly poor. I can appreciate that handling systematic errors in a classical uncertainty reduction framework is not straightforward, but handling correlated observation errors should be doable. This consideration is particularly important for small scale sources/sinks of the sort that the authors are claiming to constrain.

I think the paper is worthy of publication, but I do think that it will have more impact with this one extra factor considered.

I also recommend a bit more rigorous grammar and spelling check, as I noticed typographical errors and grammatical errors as I read the manuscript.

I don't have specific comments, as the presentation is straightforward, and the figures are self-explanatory.

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C2