Interactive
comment

Interactive comment on "Geostatistical inverse modeling with very large datasets: an example from the OCO-2 satellite" *by* Scot M. Miller et al.

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This paper describes some strategies for solving geostatistical inverse problems in tracer sources and sinks. As the authors note, these approaches form an important alternative to the more common classical Bayesian approach and have been widely and successfully used. These methods have thus far not often been scaled to deal with the large data sets and control vectors becoming usual in tracer inverse studies now. This paper describes some strategies for doing this. It is thus certainly within scope for GMD.

The paper is well-written and sound and makes a useful contribution for those wishing to follow such methods but held back by computational aspects. I have one comment

about such papers in general and two requests for the authors.

My first question concerns the code. This is likely to be a significant part of the contribution of the paper, at least for those who use MATLAB. Yet most people are not solving exactly the same problem as the authors. So the question arises how to make such code more generally useful, and from the journal's viewpoint, how to have its utility reviewed. I wonder if a short appendix to the paper or a document attached to the code describing any particular problems the authors had to overcome to implement the method and the approaches they took might be more generally useful than learning this from the code directly.

My other question concerns section 5.2. The general finding here is that the reduced rank approximation will overestimate posterior uncertainty since it reduces the size of the update made via the Sherman\-Morrison\-Woodbury matrix lemma. I agree with that but doesn't it also reduce the generalised variance of the prior by, for example, limiting the number of eigen-values in the decomposition? If that is correct do we have any sense of how this balance plays out?

Beyond these questions (neither of which need much work I think) I recommend the paper for publication.

Interactive comment on Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2019-185, 2019.