

Interactive comment on “A sparse reconstruction method for the estimation of multiresolution emission fields via atmospheric inversion” by J. Ray et al.

Anonymous Referee #2

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The paper describes an innovative method to estimate fossil fuel CO₂ emissions. It is an important addition to classical atmospheric inversion methods (e.g., variational inversion, ensemble Kalman filter methods). The performance of the method is demonstrated with synthetic observation experiments. The paper is well written. I recommend publishing the paper. I only have two comments in the following.

1. The summary of section 2 states that “mutual incoherence may offer analytical insight into the quality of observations and uniqueness of solutions”. But in the text, I could not find a proof of this point. It would be very useful for the community if the authors could add examples to illustrate how this method can detect bad quality observations, and show the uniqueness of flux solutions. 2. The purpose of the proposed

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method is to estimate fossil fuel CO₂ emissions. As stated in the conclusion, the fossil fuel CO₂ emission is not the only type of emission in nature. I would like to see an example of estimating fossil fuel emissions with this method in the presence of inaccurate biosphere fluxes. It is possible that this method could not work over the entire year, but could possibly work in some months of the year (e.g., January). The authors could then discuss the challenges of estimating fossil fuel emissions in a more realistic scenario.

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