

Interactive comment on “A multiresolution spatial parameterization for the estimation of fossil-fuel carbon dioxide emissions via atmospheric inversions” by J. Ray et al.

Anonymous Referee #2

Received and published: 14 April 2014

This paper is a useful contribution to the literature on this topic. The manuscript is at times, difficult to follow, as it navigates the line between a very technical treatment and the scientific import of the technical formulation and results. Though not an expert on the specific methodological treatment employed here, the approach is promising as an alternative in portions of the planet where detailed bottom-up style inventories are not available or highly questioned. However, as the authors note, the challenge of a real application in which observational limitation (location/siting and biosphere interference) is significant, remain. It would be useful to see this technique applied to the globe starting with a nightlights-based global fossil fuel CO₂ emissions inventory. The use of nightlights versus BUA needs some more detail. The authors indicate that

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BUA uses nightlights and hence these are not independent, though land-cover maps are also used. Perhaps some further comment on whether or not that makes much difference would help. I worry that these are essentially the same thing and/or what differences do exist are hard to interpret via the results presented here. This effort seems well-suited to explore questions of measurement siting. What network of CO₂ measurements might be more fossil-sensitive? This is independent of radiocarbon. . . there are perhaps locations where the fossil signal from Vulcan is well represented by the treatment here? That would offer some practical guidance to future network expansion or interpretation of OCO₂ measurements. I don't expect the addition of these tests to the manuscript but some comment at the end would be a very useful addition to those readers pondering the practical utility of the approach. Specific comments: Page 1280, line 21: I think a key reason why there have been fewer attempts at inverting for the fossil component of the carbon fluxes is the difficulty of observationally separating the fossil component in observed atmospheric CO₂. Other than ¹⁴C, expensive and not comprehensively observed, there are few tracers that can offer much constraint. I agree that part of the problem is the underlying spatiotemporal variability but this is only half the problem. Page 1288, line 15: be wary of CARMA – not a peer-reviewed dataset and has many problems. Page 1296, line 4: Am I understanding c correctly in that it represents an aggregate total? If so, the aggregate totals in EDGAR aren't really EDGAR values but probably IEA country totals.

Interactive comment on Geosci. Model Dev. Discuss., 7, 1277, 2014.

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