

Interactive comment on “Can a regional-scale reduction of atmospheric CO₂ during the COVID-19 pandemic be detected from space? A case study for East China using satellite XCO₂ retrievals” by Michael Buchwitz et al.

Anonymous Referee #2

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This paper endeavors to characterize the impacts of COVID-19 pandemic on atmospheric CO₂ by estimating the fossil fuel emission from satellite observations (OCO-2 and GOSAT). This is an inverse estimation, so a model is needed to establish the relation between observation and model variables (Fossil fuel emissions (FF)). The authors did not use a physical model, but use the posterior CO₂ field and input fossil fuel emissions from CarbonTracker – a inverse model of atmospheric CO₂, to construct a linear regression model, to calculate FF emissions from the change of XCO₂, and this relationship was then used to estimate emissions from satellite XCO₂ observations. The

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authors did get an estimation of a small change in fossil fuel emissions, but the change is so small comparing to its uncertainty and possible variations caused by other factors.

Even so, this referee suggests that manuscript should be published after major revision, as suggested below.

Major comments:

1. The paper is too long comparing to its contents. For example, the lengthy abstract, and a couple of paragraphs (part of) quoted from other documents, and other redundant description and analysis.
2. Reduction algorithm is the core of the method using in the paper, and in the same time the authors did not get a significant change as a result of COVID-19 pandemic. Therefore, if we need to justify the result of this research, the authors should assess the consequence of a possible signal lost of the original observations as a result of the reduction algorithm used, and this could be the most important contribution of this paper to our research community.

Minor comments:

The abstract is way too long.

Line 138-139: “assimilates...as well as...”. Does the model assimilate emissions?

Line 142-149: Is it necessary to quote a whole paragraph to describe CT?

Line 154: “The DAM method is essentially identical with the” and Line 159: “Our approach is very similar”. If you think “essentially identical” and “very similar” are identical, then “very similar” in Line 159 is redundant.

Line 156-159: Hakkarainen et al., 2019, explain their method as follows: “...”. Is it necessary?

Line 163: How about change “but” to “and”? you already have a “but” in line 162.

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Line 164: how about remove “as contained”?

Line 167: What is “very similar”?

Line 168: what is “The good agreement”?

Line 208: ΔXCO_2^{FF} is misleading. It is FF estimated from ΔXCO_2 , and $FF^{\Delta XCO_2}$ could be more intuitive.

Line 361: “This single observations uncertainty”. Is “This single uncertainty of observations” better?