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Discussions

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Interactive comment on "A methodology to constrain carbon dioxide emissions from coal-fired power plants using satellite observations of co-emitted nitrogen dioxide" *by* Fei Liu et al.

Anonymous Referee #1

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General comments

The manuscript presents a methodology to derive CO2 emissions using satellite-based NO2 retrievals from OMI instrument. The topic is very interesting as not many studies have successfully attempted space-based CO2 emission estimation (while much more common is the top-down emission estimation for short-lived gases such as NO2) and most of the previous studies only derive emissions for a few sites in the world. The results could be a good addition to the existing literature on the subject but I feel this work still does not dramatically improve what was achieved in previous studies in terms

of emission estimation from CO2 point sources. The methodology is reasonable but more effort should be put in proving how this approach could be extended to more than the 8 point sources analysed in the manuscript.

Therefore I would suggest to provide some sort of recommendations (or criteria) on how to apply the same approach to other point sources depending on the characteristics of the power plants. One possibility could be to test the approach on a few other cases outside US in addition to Matimba in order to illustrate the potential differences.

The manuscript can be published after addressing this issue and the following comments.

Specific comments

1. P2 L33 -> There is a recent update to this paper where the anomalies are calculated on global scale and also TROPOMI data are used for comparison on local scale. You might want to add this as well in your intro: Hakkarainen, J.; Ialongo, I.; Maksyutov, S.; Crisp, D. Analysis of Four Years of Global XCO2 Anomalies as Seen by Orbiting Carbon Observatory-2. Remote Sens. 2019, 11, 850.

Here also another work it might be worth mentioning: Wang, S., Zhang, Y., Hakkarainen, J., Ju, W., Liu, Y., Jiang, F., & He, W. (2018). Distinguishing anthropogenic CO2 emissions from different energy intensive industrial sources using OCOâĂŘ2 observations: A case study in northern China. Journal of Geophysical Research: Atmospheres, 123, 9462– 9473. https://doi.org/10.1029/2018JD029005

2. P7 L19-20 "We assume the NOx to CO2 emission ratio of Matimba is on the upper end of the US values, considering that it is not equipped with any NOx control devices, even low-NOx burners which are widely installed in US power plants" This step is quite critical if you think about extending the method to other sources. You are basically saying that you have to know already something on the source before applying the method. . . how do you expect to make this choice for other sources? Please comment.

3. Fig. 8 How do your emission estimates for Matimba compare with Reuter 2019 estimate?

4. P11 L25 This paper in now published: Reuter, M., Buchwitz, M., Schneising, O., Krautwurst, S., O'Dell, C. W., Richter, A., Bovensmann, H., and Burrows, J. P.: Towards monitoring localized CO2 emissions from space: co-located regional CO2 and NO2 enhancements observed by the OCO-2 and S5P satellites, Atmos. Chem. Phys., 19, 9371-9383, https://doi.org/10.5194/acp-19-9371-2019, 2019.

5. Sect. 2.2 Is there any other dataset in addition to EPA's CEMS you could verify these ratio with?

Technical comments

P3 L20 "...plants.As discussed" there is a space missing here

P7 L11 I would change the title with "Application to Matimba power plant" or something like that more specific

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2019-521, 2019.