

Interactive comment on “Neural Network Based Estimation of Regional Scale Anthropogenic CO₂ Emissions Using OCO-2 Dataset Over East and West Asia” by Mustafa et al.

Anonymous Reviewer

August 30, 2021

1 General comments

In this study, the authors proposed a method to estimate the regional scale anthropogenic CO₂ emissions with OCO-2 XCO₂ retrievals over East and West Asia. The topic fits well to the aims and scopes of AMT. Concerning critical requirement for quantitative estimates of carbon emissions and the rapid development of machine learning techniques, this study would be certainly interesting to the community. However, the current version of the manuscript, in my opinion, cannot be recommended for publication. I do have some major concerns that need to be responded if the authors consider to submit the revised manuscript.

First of all, I see little scientific significance in this paper, actually after I read the paper by Yang et al. (2019) <https://www.mdpi.com/1424-8220/19/5/1118>, I surprisingly found out there are many similarities in both papers, even though the old one has been cited by the authors. For example, Section 2.2 is quite similar to Section 2.3 on Yang et al. (2019), including all equations and Figures 1 and 2. I am not saying that the methodology (algorithms, processing steps) should not be reused especially when its performance has been justified in previous studies. But the authors claimed in the manuscript that “we proposed a method to estimate the regional scale anthropogenic CO₂ emissions”, which can be misleading to readers. The only differences between these two papers seem to be that Mustafa et al. used OCO-2 data and extended the study region to West Asia. Therefore, if possible, I would suggest the authors to highlight the differences in both estimation methods, if not, please completely revise the manuscript for readers to better understand the objective of this paper.

Second, significant technical details are missing in Sections 2 and 3:

- Although this study directly used the XCO₂ product, it would be important for readers to know essential information of the retrieval algorithm, as the authors claimed in Section 3.2 that compared to previous studies, this study obtained a better result

due to the improvements in the XCO₂ retrieval algorithm. Therefore, in Section 2.1.1, please add more relevant details.

- Information about training, testing, validation of the GRNN should be given, e.g., what are input parameters, only OCO-2 data? How did you organize the training, testing, and validation datasets?

2 Specific comments

- Line 46: Seriously, I don't think your own paper is proper for this statement "Satellites provide the most effective way to monitor atmospheric CO₂ with great spatiotemporal resolutions". Satellite remote sensing has been utilized to measure greenhouse gases for over 20 years, and it is widely known that this technology can provide high-resolution CO₂ observations.
- Line 48: The references for satellite CO₂ measurements can be largely improved. For instance, there have been a number of new studies available for TanSAT CO₂ retrievals, which cannot be simply overlooked, e.g., Bao et al. (2020); Yang et al. (2018); Hong et al. (2021). In addition, it would be nicer to have journal papers instead of a conference abstract.
- Section 2.1.1: What is the spatial resolution of OCO-2? How good is the data quality of the employed XCO₂ retrieval product?
- Section 2.1.2: Where do you acquire ODIAC dataset? Is it publicly available? Please specify it.
- Line 216: Both "tons" and "Mt" are not SI base or SI-accepted units. Please check information at <https://www.bipm.org/documents/20126/41483022/SI-Brochure-9-EN.pdf/2d2b50bf-f2b4-9661-f402-5f9d66e4b507?version=1.9&download=true>.
- Line 217: What are the "improvements in the XCO₂ retrieval algorithm"? Again, does this sentence just prove that this study USED the method proposed in (Yang et al., 2019), but with a different dataset?
- Page 9–13: Many references do not have the standard format, journal names are missing in many cases.
- Figure 3: Please correct the subfigure index in the caption.

References

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- S. Yang, L. Lei, Z. Zeng, Z. He, and H. Zhong. An assessment of anthropogenic CO₂ emissions by satellite-based observations in China. *Sensors*, 19(5), 2019. doi: 10.3390/s19051118. 1118.