

Interactive comment on “Carbon dioxide emissions in Northern China based on atmospheric observations from 2005 to 2009” by Archana Dayalu et al.

Anonymous Referee #1

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The article by Dayalu et al focuses on CO₂ emissions and atmospheric observations for 2005-2009 in Northern China. They analyse and evaluate 3 anthropogenic inventories for the studied region, two that are subsets of global inventories (EDGAR, CDIAC) and a China specific one (ZHAO). The results highlight the importance of improving emission estimates for China in order to accurately track changes in CO₂ emission reductions.

In general, the paper is scientifically sound; however, it is not what the title and the start of the Abstract promises. The authors highlight interesting plans in terms of improving/optimizing emissions over China but then focus a large portion of the writing

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on defending and justifying why they weren't able to accomplish them. Based on the current text it seems like the authors are also aware that the results are a subject to a large number of limitations, and try to justify these things throughout the paper. I understand that this is work in progress and the authors were restricted by the available data resources; however, the way the authors framed the whole work, my overall take home message is that the results are just not robust enough. Overall the work should be published; however, in the current format maybe ACP is not the best choice. Having in mind that the authors stated that at this stage there are no other available observations and it is not possible to perform optimization of the emissions I see two potential pathways to go ahead with the publication of this work: 1) Re-frame the writing/aim of the work and highlight more and focus more on what you did and what information you can get from the available data (with high certainty) and not what you weren't able to do 2) Extend the work/analysis by including additional methods to evaluate and constrain regional CO₂ emissions and additional inventories that potentially became available since the start of this research.

General comments:

1. Lots of focus on justifications/limitations early on in the Abstract. I suggest shortening the Abstract, more specifically the part where the authors discuss that they only have one site. Try to re-frame it so that you highlight and emphasize what you have and what you did, and not what you don't have and can't do. Moreover, the limitation of only 1 site is discussed too many times in the text, no need to repeat it over and over again.
2. I would also suggest to merge the caveats section with the conclusions. I understand that including the caveats of this study is quite important to justify the results/work/effort; however, currently the focus on the caveats puts the results in the second plan.
3. The whole text could be condensed. There are a number of places where the

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authors repeat the same thing. An example: Introduction lines ~115 where describing the measurements is the same as the beginning of the CO₂ observations section. No need to have all the details on both places.

4. The writing needs modification and improvement, hence the paper needs a careful reading/checking. There are a number of sentences (or parts of sentences) that are hard to follow and requires few re-reading in order for the reader to understand the message. I suggest the authors to re-write and clarify the sentences under the Specific Comments.

Specific Comments:

1. Sentences that could use some rephrasing or dividing into multiple sentences:

Line 22: Comparison of CO₂ observations to CO₂ predicted from accounting for global background concentration and atmospheric mixing of emissions suggests potential biases in the inventories.

Line 39: Additionally, we note that averaged over the study time period, the unscaled China-specific inventory has substantially larger annual emissions for China as a whole (20% higher) and the northern China evaluation region (30%) than the unscaled global inventories.

Line 42: lend support the rates

Line 180: Winter wheat emergence in the spring and corn emergence in later summer shift the seasonal patterns such that regional seasons are more appropriately represented when months of year are grouped as January, February, March (JFM/Winter); April, May, June (AMJ/Spring); July, August, September (JAS/Summer); and October, November, December (OND/Fall), respectively.

Line 285: This is not intended as an exhaustive sampling of inventory approaches; however, it is sufficient to demonstrate the utility of continuous high-accuracy observations as a top-down constraint for evaluating emissions estimates.

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Line 468: As noted in Sect. 3, the regional growing season does not have a typical pattern in that peak uptake occurs around July/August with the onset of the corn growing season.

2. Also few wording that needs re-phrasing:

Line 45: import

Line 80: exhaustive

Line 95: judge

Line 110: while the others do not

3. More details needed:

Abstract Line 21: "CO₂ inventories" – list which ones.

Line 285: "This is not intended" - this as what, the study? Clarify.

Line 320: "Applying the weekly and diurnal Nassar et al. (2013) scaling factors did not generate differences that were statistically significant, suggesting that a more rigorous set of temporal scaling factors need to be developed for China. " Is this based on work from the authors or Nassar or? Clarify.

4. Line 145: "it is not possible to evaluate any error in spatial allocation of emissions. However, we note that the same transport model is applied to all the emission fields. Unresolved transport error undoubtedly contributes to scatter in the model-data comparison but is unlikely to generate consistent biases among the inventories." - could you please explain this better.

5. Line 170: "Average annual data coverage" – was this calculated based on hourly, daily data? Just add some brief details how was it quantified.

6. Line 189: "filtered to include only non-missing observations" – a little bit unclear, does this means that only days are used when we have measurement for each hour

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between 11 and 16?

7. Line 190: “background criteria” – if possible, briefly mention what it is in the main text also or additionally refer to section 3.5.

8. Methods section – when describing why the 11-16 measurements are used, please add a discussion of why the authors didn't use night time data and how much this affects the results. Although this is briefly mentioned at the end of section 3.3. it would be good to extended it in the Methods section also.

9. Figure 2: It would be good to add another sentence on what the different percentile regions represent/describe. This could be added around Line 235.

10. Line 259: “which has been noted previously as major uncertainty in Chinese emission inventories” – add reference.

Technical comments:

1. Feel free to remove the word respectively from everywhere in the text. It is already automatically assumed that the order is respectively.

2. Line 160 rephrase ‘made’ → “measured’

3. Table 1. – define what the abbreviations are (if used for the first time in the text). And just to clarify, these are the 2005-2009 averages? Add in the caption.

4. Line 820: (in press), 2018 – still in press?

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