

## ***Interactive comment on “Evaluating China’s fossil-fuel CO<sub>2</sub> emissions from a comprehensive dataset of nine inventories” by Pengfei Han et al.***

### **Anonymous Referee #1**

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Reducing uncertainty in China’s CO<sub>2</sub> emissions and understanding its trends is very relevant of course. The presented attempt of a thorough comparison of nine inventories can be useful but in the current form I find it unconvincing. Some sections are not written clearly and do not present clear findings or conclusions. I find the balance between disusing the CO<sub>2</sub> emission sources and strengths and the spatial distribution of CO<sub>2</sub> is not right, the latter receives most of the attention while I think it should be the other way around, or in fact the discussion of emission and trends (section 4.1 is only 1 page) should be expanded. I believe, the paper needs a major revision but most of that should be deeper analysis and better characterization/discussion of reasons for differences and what does it mean for the future, ie., how can we do better. Still, I believe this work shall be published and with all the material collected and already

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evaluated to some extent, the manuscript can be revised successfully.

Here are more specific comments that shall help to understand why I made the above statement.

Abstract: Line 31: Bearing in mind uncertainties, using 'about/around' rather than a precise 28% might be more appropriate. Line 37: Suggest adding a unit for the emission factors. Additionally (and this is something more important for the section discussing emission factors), there are some good reasons for variability in CO<sub>2</sub> EF for coal as well as change over time (this is something that is not discussed enough in the paper) and so the authors could potentially revisit this statement later after revision.

Introduction: I recommend a closer look at the whole introduction and consider rewriting it. I find it lack structure and order; it contains lots of information and references but all of it appears to be arranged in a bit chaotic way. A clear separation of discussion of total emissions and trends from spatial distribution would help for example, now these are mixed in different paragraphs (see for example 2nd para).

Also, please check Reference style as in the text references use of 'single names' as authors while many of those are papers with many authors as given in the Reference section. The CO<sub>2</sub> emission inventories are uncertain everywhere, highlighting why Chinese are possible more uncertain and why it matters would be important.

Line 49-50: suggest adding a reference to IPCC AR5 too

2.Emission data As shown in Table 1, the evaluated inventories are covering various periods but overlap. I'd expect that after reading this section (line 107-113) one would know for which years the evaluation will be performed. In fact, even in the method section (3), this is not evident.

I see that in the SI, there is an extended version of Table 1. I was wondering if adding a row with EFs for cement industry across inventories would be also useful.

I think it would be useful to add a short paragraph explaining why it is important to

evaluate spatial distribution of CO<sub>2</sub> emissions. It is certainly obvious for the authors and many but not for all. Not sure if this is the best place but (could be also in the introduction or method).

3. Methods I am struggling a little to understand the significance of the Figure 1 as the concept for the evaluation method. The figure does not show anything beyond obvious and sources of data or sectors are listed in further text anyway. In general, I find this whole section is not written very well or informative yet; in fact, beyond the 2nd para where there is some information about spatial analysis I do not see here much of a concept or method explained. I think, this needs further work and clear statement why and how certain things are done and why priority is given to X or Y. Additionally, some of the assumptions about the considered sectors for comparison could be briefly discussed here as inventories do not have the same sources included [some of that is mentioned in the Discussion section but I believe it should be already brought in here] and for a comparison it would be sensible to assure apples are compared to apples as much as possible.

Line 125: Is “nearest neighbor algorithm” a standard used name and most will be familiar with it?

4. Results I think section 4.1 needs some clearer writing and add discussion as to why the range and uncertainties grow with time. I find the discussion of total (and also sectoral) emissions and trends deserves a lot more space and I find it more important than spatial distribution.

Line 146: ref to point 1); the EFs were the same for all sectors? Are these country averages? Were they changing over time in these or other inventories? I think it might be useful to add this discussion.

Line 149: What are “differences in emission definitions”? Do you mean sources? If so, then it might be important to try to bring it to a common denominator and if not possible then say why and what implications it has rather than saying they are different.

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Line 153: MEIC EF lower than EDGAR? Both average over all sectors for coal, or all fuels? In what units? How did change over time if inventories consider this (I think MEIC does).

Line 155: “minor difference” Is this good? Sensible? Or the match seems fine but maybe for wrong reason? As mentioned earlier the whole 4.1 misses actual discussion.

Line 184: “could be attributed”; If information is available and assume it is, then maybe one shall be more certain about it and say “is attributed” stating that this was identified as a reason.

Line 188: editorial “ODIAC was lack”

Fig3. The scale/ranges selected are a bit odd, changing  $\times 10/\times 2.5/\times 2/\times 5/\times 2$  and so it makes interpretation of differences a bit more challenging.

Line 200-2002: Why is this important for cumulative total? I assumed that the spatial distribution comes after emissions are calculated?

Line 206: I believe somewhere in Discussion section there is mention of issues/completeness of CARMA (and a reference to the paper evaluating it) but it would be useful to mention this also here I think

Line 241-244: Isn't it obvious? Anything different would be strange, wouldn't it?

Fig 5: Editorial: The numbers are actually not always ‘under’ so it might be better to say that the numbers simply refer to the green bars

5. Discussion Suggest to revisit the whole 5.1 to improve clarity. I am struggling to understand several statements here.

Line 256: “Artificial factors” – what is meant here?

Line 257-259: I have difficulty to understand what is suggested here.

Line 265: First sentence; what does it mean? It hints that possibly the comparison is

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not really addressing the same sources and that in some inventories some are missing? If so, then I think this should be mentioned much earlier and then statements about which specific sectors are of concern and if the other (common) sectors compare reasonably.

Section 5.2 could benefit from additional discussion of: - % of CO<sub>2</sub> from coal use vs. cement production vs. liquid fuels (transport, etc) - Differences between coals used in different sectors; where such info exists and how important it could be - Change in EFs (especially for coal) over time owing to potentially declining or improving fuel quality in specific sectors

Section 5.4 – I think the title should really explicitly refer to ‘area sources and line sources’. In fact, I thought that one can have one section 5.3 for “spatial distribution” and then sub sections on point sources and area sources.

Table S1: I find this table very difficult to read. One should consider reformatting and to show included source-sectors in each inventory I’d suggest to make a row for each sector and then ‘tick’ the ones that are covered in specific inventory. It would make reading of the table much easier.

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