Open Access
Earth System
Science
Data
Discussions

Interactive comment on "Global anthropogenic CO$_2$ emissions and uncertainties as prior for Earth system modelling and data assimilation" by Margarita Choulga et al.

Anonymous Referee #1

Received and published: 29 April 2020

1 General comments

The atmospheric inverse modeling community has long been waiting for an uncertainty estimate in emission inventories. The lack of such an estimate obligated to make arbitrary assumptions of the uncertainties used in inversions. Since the attribution of emissions to certain regions or processes is highly dependent on the a priori uncertainty assumed, this could lead to wrong results. Therefore, this study is very relevant and an important step into solving this problem and should be published.

However, I find the text and format can be confusing and difficult to read in certain

sections (mainly in sections 1, 2, 3 and 5). I would recommend major reformatting of the text to make it more clear. My main advise would be to view each paragraph as an independent unit of information. The first sentence should give the main take home message of the paragraph. The following sentences should provide supporting information.

2 Specific comments

- In the introduction there is a lot of information but there should be more focus on what is the problem, why is it important and what solution is proposed.

- Why the EDGAR sector uncertainty is not purely additive? Please expand on the exemptions.

- On what basis where fuel type assumed, e.g. source or citation? Could you add the assumed fuel type for each sector in a table?

- Emissions from Energy_A, Energy_B and manufacturing are assumed to decrease in the summer. However, data from the US Energy Information Agency suggests that for example natural gas consumption has two seasonal peaks, with consumption patterns predominantly driven by weather. The largest peak occurs during the winter, when cold weather increases the demand for natural gas space heating in the residential and commercial sectors. A second, smaller peak occurs in the summer when air conditioning use increases demand for electric power, which can be provided by natural gas, coal or petroleum-fired generators (Bradley S., 2015 and Comstock O, 2020).

3 Technical corrections

- line 41: Since the early 2002s -> 2000s

- line 86: Presence of observations may should better say availability of observations and emission information.

- line 150: lower case S in Savannah

- line 159: What is an autoproducer? Is this an automobile manufacturer?

- line 235: You repeat "per activity" several times

- Table 3 and table 7- why are lower bounds with larger uncertainty than upper bounds

- Better description of ensuring log-normal distribution

- Table S5: why '*', which indicates for residential sector only according to the table caption, on fuel types aviation fuel, motor gasoline, etc?

- I find too many acronyms difficult to follow, make text confusing: AD, NIR, TFI, EF, LDS, WDS, GLB, L, U etc.

- Figures 1 and 2 have text over background images and color of boxes make it difficult to read especially if printed in gray scale, much of it should be rather explained in the text.

- Indenting or centering of equations to distinguish them better from normal text.

- Could section 4.1 be largely substituted by a table and map?

- Please consider adding section S3 to main text as it makes the log-normal distribution more clear.

C3

4 References

Bradley, S, 2015, Natural gas use features two seasonal peaks per year, https://www.eia.gov/todayinenergy/detail.php?id=22892

Comstock, O., 2020, U.S. natural gas consumption has both winter and summer peaks, https://www.eia.gov/todayinenergy/detail.php?id=42815

C4