Dear authors of the manuscript, and the handling editor,

This study developed a global high-resolution (spatial and temporal) emission dataset for CO2 and co-emitted species emissions from power plants. The authors have collected and utilized a wide variety of data, including reported data, publicly available data, and commercial data to gather relevant underlying information, such as location, facility profiles, etc. The authors gap filled where needed in order to construct a global database. The dataset was compared to existing datasets that are somewhat old and outdated and thus the assessment did not give us validation.

I have no doubt that this type of data would be useful for improving the representation of emissions in spatially explicit inventories as well as analyses of point source emissions. However, the usefulness is not objectively highlighted in a scientific/objective way, in my opinion. The dataset does, as the authors acknowledged in the manuscript, have a list of limitations. What are the subsequent impacts on the modeling? Given the limitations, users need to assess and decide if they should use this database (or not) for their own research objectives. I do feel this manuscript in the current form would not be helping users. That's the significance of ESSD papers and that distinguishes random reports from high-standard ESSD papers. Some of the underlying data are shared by the outdated datasets that the authors attempted to use as a reference to measure their improvement/advancement they made. The emission calculation is reasonable. Thus, my comments would be just for presentation and uncertainty analysis. Ensuring the following of proper guidelines should be done prior to the review stage.

As an author for ESSD, I assume you've familiarized yourself with the paper preparation guidelines including things we discussed in the ESSD guidelines published as Carlson and Oda (2018). What I discuss in this review aligns with the ESSD guidelines, not based on my own personal opinion. If you ever wonder and need clarification, the guidelines should be able to help you. Thus, I try to keep my review short by not repeating the guidelines. The purpose/hope for the guidelines was not to repeat this type of instruction at the review stage. What I've discussed so fare are something taken care of before the manuscript appeared on ESSD discussion. Ensuring the following of journal guidelines should be done prior to the review stage. As we all know, it is VERY important for ESSD.

Ultimately, I will let the handling editor decide, but should data journals like ESSD publish the datasets just because reviewers think they are useful? What is the real point/value of publishing a paper in ESSD? Why should we/experts in the community review a manuscript for ESSD? The utility and advancement needs to be shown. Otherwise, should we publish all the useful data like a free pass? I hope ESSD continues tackling and addressing this type of challenge and remain as more than a collection of "useful" data. I thank the handling editor for the opportunity to review this manuscript. Reviewing a manuscript for ESSD is always a challenge for us/reviewers because of ESSD's unique nature and the quality it needs to strive for. I would appreciate if you could provide a little more guidance and support to ESSD authors before sending their manuscript for review.

Sincerely,
Tomohiro Oda (toda@usra.edu)

Manuscript format/contents for ESSD
This should have been suggested in an earlier stage of the submission process before sending this to reviewers. Several things need to be fixed and/or improved, including:

- Data table - the data format table is often a key component of ESSD papers. You should be able to construct a useful informative table based on the description in Section 2.
- Limitation sections should be there - This might be a preference, but the limitation should stand by itself. It is great to see the list of limitations that the authors have recognized. But some of them seem to deserve a little bit of investigation
- Data section - Any update description of data? Unit? The title is not the same as presented. Future update plan, and how do you do version control, etc.

I hesitate to pick previously published studies as a good example (which we did not do in the 2018 guidelines), but you should be able to find one.

Title
Database? High-resolution? Where is the spatial resolution? What is the resolution for spatial scale? This is a point source catalog as I understand. A bit strange to me.

Evaluation of the dataset
This is often a difficult part for ESSD manuscripts, especially for a study like this. The authors essentially mentioned that there is no suitable perfect database to compare. I agreed. But it does not mean no evaluation is justified. As ESSD is a science journal, we have to give it a try. Especially, the dataset's skill/utility and the authors' claims need to be supported objectively. Here are several points to be discussed and improved with potential suggested approaches:

- Location error (geolocation error) - Location uncertainty, Oda et al. (2019). Uncertainty is a function of spatial resolution. Given the potential use of this dataset, this is so important to highlight the unique value of this dataset. If this is incorporated into modeling, what would be the impact?
- Location error (relevant to emission data and/or atmospheric modeling) - The modeling is not happening at point source level. Does the CAMS model run at a 1km spatial resolution globally by any chance? What are the impacts then in concentration? If the model spatial resolutions are > 0.1 degree, the comparison to any 0.1 degree resolution dataset does provide meaningful practical insights. The changes the users would expect can be shown. The paper needs to self-stand and help users to decide if they should use that paper for the analysis or not. This paper is currently not helping such decisions by providing guidance. Depending on the focus of evaluation, the seemingly not usable datasets can be used for meaningful evaluation. Further, some existing datasets could also be useful as the authors provided a list of reasons not to compare to them. Other power plant databases, such as this (https://www.nature.com/articles/s41893-017-0003-y)?
- Impact of the methodological/data differences - CARMA? Methodological differences. How is that? The CARMA did have text and we are aware of how they built the database. Even quantitative. Differences cause differences. If so, what are driving the differences then? At least characterize them. Users need to understand the difference to decide if they use this data w/ adequate understanding.
- Injection height - Especially, the vertical injection height section is something that could be more quantitative. How about the sensitivity of the height to the modeling results? What are the

potential impacts? Regional difference? How can we determine if we should use your data? Would the inclusion of the injection height be a worth a try given the improvement we could potential get? Of course, there won't be a single answer given there are many study applications. However, even one single example of the potential use cases should help the potential users, and more importantly, should support the "usefulness (and degree/level of the usefulness)" that the authors claim objectively.

- Temporal error – Is Crippa et al. (2022) high temporal? How are those two different (or similar) and what are the potential impacts we see in modeling applications? It is for 2015, but we could easily imagine that many users would have to use the temporal profiles for different years. In inventory research and applications, it is easy to imagine a situation to use the 2015 seasonality to other non-COVID times. Thus, regardless of the 2015 vs. 2018 base year difference, the comparison should provide practical information to guide the future users of this database.
- Errors across different species – This is not just CO_2, but other species. This study should evaluate location in space and time (as mentioned earlier), and also the different errors over different species. It is hard to imagine that we can use the same error/uncertainty estimates for non-CO_2 other than location errors. Are they the same?

Potential conflict of interest

The main author and the handling editor are working in the same working group under the Global Emission Initiative (GEIA). It is totally understandable that finding a right handling editor is a challenge for ESSD. However, the potential conflict of interest should've been clearly indicated, even if it is very minor, in order to protect the scientific integrity that the authors and the handling editor have maintained.

Line by line comments

P2, L45: inadequate – this depends on your purpose/application. Need elaboration. If the authors claim that this dataset is more "adequate," you need to objectively demonstrate the skill and utility. You also have limitations. Where are the impacts of the limitations in terms of potential errors and uncertainties? These could be discussed in the database space and also in an applications space (e.g. composition simulations)

P2, L49: 0.1 deg – this is a statement for EDGAR? Relating to the comment above. The uncertainty should depend on the spatial resolution.

P2, L50: if so, you could use the 0.1 degree database to compare to the database presented in this manuscript.

P2, L60: not perfectly – as far as I understood.

P3, L71: where are those datasets available?

2.1 Create a table? Base year 2018 reasonable? What are the uncertainties associated with that?

L5, L126: Another assumption here. What is the potential impact of this?

2.2 how many of them were done by manual search?

P13, Figure 4 , maybe by region/country?
You should try to examine the utility of the gap filling of any approach by using the existent data,

3.2 spatial errors

P20, L405, not always. See Oda et al. 2019

P21, L414, R2 0.8 is concerning if at plant level. Is it adequate?
P21, L428, if CO2 is this bad, other compounds could be way worse.
P21, L442, CH4 needs to be evaluated.

P22, L443, why?

L26, L504. ESSD paper should stand by itself. Describe what the system does for the temporal modeling.

Figure 11, What are the uncertainties around the temporal estimates?

4 data Name is different. What is the readme? That's what we need here, too.

5.1 limitation should be before the conclusion and discussed in more detail. Some of them could be examined in this study.

P34, L675 not just for inverse modeling. This is a huge limitation for the potential users of this product.

Supplemental information

Figure 2. The correlation should be high. The high correlation does not really tell us any practical information regarding the performance of the dataset. How about using RMSE for location and emission intensity as a metric for potential improvements brought by this dataset?

References:
- Carlson and Oda (2018) https://essd.copernicus.org/articles/10/2275/2018/
- Oda et al. (2019) https://link.springer.com/article/10.1007/s11027-019-09877-2
- Crippa et al. (2022) https://www.nature.com/articles/s41597-020-0462-2