

Dear Anonymous Referee #1

First of all, we appreciate your comments and suggestions. Our responses are inlined.

This paper outlines a major update and improvement to the well documented ODIAC emissions inventory data set. With the withdrawal of funding for CDIAC, this data set becomes increasingly important. The fact that this new version makes use of collaborative efforts with CDIAC combines many features of the CDIAC data set that was not formerly a part of the CDIAC emissions inventory is a huge bonus. Of course, there are some minor issues that need to be cleared up, but they are minor. In general the presentation is excellent and a few phrasings are particularly nice.

Thank you for your comment and time you spent for this review.

One difficulty is that CDIAC is/was a whole center and has multiple products. In this paper it is sometimes difficult to distinguish between the data products from CDIAC. It would be nice to settle on a standardized way of representing each, perhaps CDIAC_EI for the emissions inventory (?) and something else for the other data.

It is a great idea to introduce a standardized way of addressing CDIAC and its research products. We have tried, but so far we have not been able to come up with a reasonable solution for this. At very least, to avoid the confusion, we propose to specifically add words such as “gridded” or “emission estimates”, and “global”, “national” or “monthly” where appropriate. We address CDIAC (lab) as CDIAC/ORNL. We hope this would improve the readability.

As the authors know, uncertainty is a big issue and has yet to be incorporated in an appropriate fashion into these inventories. However there is progress and this paper does a better job than most in outlining where its faults lie. There are still some challenges, such as the mysterious global scaling, but I can see ODIAC getting a handle of the uncertainty in the next few years by putting together that various pieces that are already in the literature and cited in this document.

As we discussed in the manuscript, the evaluation of uncertainty in gridded emission data products are challenging primarily because of the lack of physical measurements, especially at an aggregated spatial resolution. As you mentioned, with new data and modeling capability, we are trying to work on uncertainties with a hope of distributing future ODIAC emission products with reasonable uncertainty estimates. We expect the use of VIIRS nightlight data, as described in the manuscript, also will allow us to conduct a rigorous uncertainty analysis. Although it would only address an uncertainty that is specific to ODIAC model structure, we believe it would be a tiny, but significant progress from the current DMSP-based ODIAC. Later in this response, we will discuss the global scaling we implemented in ODIAC2016.

A few technical issues:

1. *There are a number of places with missing or incorrect articles ("the", "a"). I think it would be fairly quick for one of the authors to run through the paper with that in mind and do a quick correction. There is not a difficulty with understanding the intent, it would just be a bit smoother.*

Thank you for your suggestion. Please see the revised manuscript. Hope we improve the readability.

2. *Page 3, line 41. The upgrades to the CDAIC data are never outlined. It might be nice to revisit this at the end to summarize the differences. The following sentence on line 43 needs to be reworded for clarity.*

We propose to remove the word “upgrade”, as the word “extend” is more appropriate to describe our use of CDIAC data (e.g. the combined use of global and national emission estimates, emission seasonality and international bunker).

We propose to rephrase the sentence on L43

“As our ODIAC data product is based CDIAC emission data, our emission data production capability is significant given the expected discontinuity of future CDIAC emission data. ”

as

“Given the expected discontinuity of future, updated CDIAC emission data, we believe our emission data production capability of producing an extended product of the CDIAC emission data is significant.”

3. *Page 4, line 14. "adopt" should be singular.*

Fixed.

4. *Page 4, line 24. Sentence beginning here is awkward and needs rephrasing.*

We propose to rephrased the sentence at Page 4, Line 24

“Given recent most of atmospheric CO₂ inversion studies focused on years after 2000, we put a priority to develop emission data for years after 2000 and deliver to the science community in a timely manner.”

as

“Atmospheric CO₂ inversion studies recently published (e.g. Maksyutov et al. 2013)and operational assimilation systems such as NOAA’s CarbonTracker (<https://www.esrl.noaa.gov/gmd/ccgg/carbontracker/>) often focus on time periods after 2000. We thus put a priority to produce emission data after year 2000 with regular update upon the availability of updated emission and fuel statistical data and deliver the emission product to the science community,

instead of developing a longer term emission data product.”

5. Page 6, line 9-10. This really needs better explanation and resolution. This is kind of a big issue since the world total is simply "scale" to compensate. It sounds like you are doing something "fishy" and rather than actually fixing the issue, that you are just assuming it doesn't matter. It does matter and may be a source, for some countries, of significant error. My suspicion is that a simple scaling may not reflect the proper distribution of those emissions.

We would like to make it clear that we do not claim that applying a scaling factor is an ultimate solution to reconcile two different estimates. As described in the manuscript, global emissions and the sum of national totals do not match because of the differences in the emission estimation methodologies (e.g. Andres et al. 2012), although theoretically/conceptually those two should match. Those two are independent estimates. The difference is not due to something like errors in calculations and unlikely to go away completely. We consider the difference is a manifestation of the resolution/precision of global emission estimates, rather than an issue in emission calculation. Defining the difference as an issue and seek an ultimate solution is out of scope of this particular manuscript, although it is very important.

What we think more problematic is that different, inconsistent fossil fuel emissions are used in the scientific community to infer carbon fluxes (for example, GCP and atmospheric inversion). The global scaling is not physical, but we still decided to do it as we believe it should be useful for atmospheric inversion perspective because data users can impose their inverse models with the same global fossil fuel emission estimates (= add the same amount of fossil fuel C as other carbon budget studies like GCP, to their models). The difference is mainly due to the inconsistency in underlying statistical data which seems to be nearly impossible to reduce to zero, although some significant effort of improving statistical data collection system might reduce the difference. We also did not claim the 3% correction does not matter. Given the size of the national total uncertainties (4-20% at national level according to Andres et al. 2014), the scaling adjustment can be done within the uncertainty range. We decided to stick to the global total by sacrificing the accuracy of national emission estimates. The simple global scaling is also easily removed. To us, the few percent is also the uncertainty we need to accept in the analysis of carbon budget analyst (representation error). We propose to add a table for the correction factor we used. Then users can remove the correction if they prefer. We would like to see how many people would remove the scaling factor from the emissions.

Table A2. A table for the global scaling factor for 2000-2013.

Year	Scaling factor
2000	0.999
2001	1.016
2002	1.008

2003	1.014
2004	1.012
2005	1.022
2006	1.022
2007	1.016
2008	1.023
2009	1.024
2010	1.015
2011	1.017
2012	1.017
2013	1.025

6. on page 7, you outline the use of spatial data of power plants but wait until much later to explain the source of that data. It would be good to reference eGrid here as well. You might also investigate the use of other EPA data products to supplement the eGrid data. If you are planning to eventually pull out concrete production, you might as well get other major industrial sources as well.

Thank you for catching this. Our power plant information in ODIAC is primarily based on CARMA, which are partially based on eGRID. We would like to add a reference for CARMA (Wheeler and Ummel, 2008) to the main text also to the Appendix A. We are also working on an EPA data-based emission map and plan to include some of the outcome from the study to future versions of ODIAC. We would like to document the effort in a separate, future manuscript. Thank you for your suggestion for the cement production emissions. The future plan was briefly discussed in the uncertainty section.

7. Several places, such as on page 7, line 38, you explain the use of a data product without citing it. Another place, you cite a paper that also references the data product but not the product itself. The name of the data product should be cited, as well as a paper that might provide an explanation.

We added citations as suggested. Please see the revised manuscript. As mentioned at P4, L19-21, all the data used in the ODIAC emission development and associated citations and data sources are also summarized in Appendix A.

8. Page 17, line 25-27. the "/" is awkward and should easily be reworded.

We propose to fix the sentence

“...it would be useful to note/discuss issues/limitations and caveats in our emission data as well as modeling framework. Some of the issues/limitations are specific to our study, however the majority of them are often shared by existing other gridded emission data and or emission models.”

as

“... it would be useful for the users of the ODIAC emission data product to note and discuss issues, limitations and caveats in our emission data that the authors aware. Some of the issues and limitations are specific to our study, however the majority of them are shared by other existing gridded emission data and emission models.”

9. The summary has some awkward tense issues. The authors should discuss what should be past tense and what should be present tense. It is this reviewers opinion that anything that the paper does should be present tense and that work done in the past should be past tense.

Thank you for your suggestion. Please see the revised manuscript. Hope we improve the readability.

Overall this is a well written and important paper. Clearing up the few technical issues should be done quickly so that the paper can be officially published.

In addition to the reviewer's suggestions, we propose to add some text to describe the updated year 2017 versions of the ODIAC emission data product (ODIAC2017, 2000-2017). We also made minor editorial modifications to the main text to improve the readability. Please see the revised manuscript.

Thank you so much for your comments and suggestions.