

Review of the manuscript “PAPILA dataset: a regional emission inventory of reactive gases for South America based on the combination of local and global information” by Castesana et al. ESSDD, 2021.

The paper describes the development of a comprehensive inventory of anthropogenic emissions of different gases for South America called PAPILA, taking as baseline the global database CAMS-GLOB-ANT v4.1 and enriching it with local information available for Argentina, Chile and Colombia, for the period 2014-2016. Differences at local and regional scales are analyzed and discussed for various geographical areas and emission sectors/categories. The work also provides a flowchart of a general methodology so that any relevant new or updated information can be easily added to the dataset in a standardized and consistent way. In addition, the paper compares the performance of the PAPILA and CAMS-GLOB-ANT v4.1 inventories by means of Air Quality simulations performed with WRF-chem model. They evaluate model results against in situ observations for Buenos Aires (Argentina) in summer and winter 2015, where PAPILA-based simulations showed slight improvements, mainly for the winter period. The authors have done a thorough and careful job in merging different information that has not been previously reported for South America, which is presented as a starting point of an international collaboration that represents a breakthrough for this community. The annual database provided is complete for the years 2014-2016, is accessible to download, and is organized in a user-friendly format. Based on this, I believe the paper could be published in ESSD after the following issues (mostly linguistic, but also technical and regarding conclusions) are revised.

Main Comments:

1) Language editing needs further investment. I am aware that this is mainly because English is not the native language of the authors, but in many places the writing style complicates comprehension and compromises the quality of the document. In addition, mostly within the Methods section, it is evident that different authors have contributed individually, and the text (and equations used) would benefit of using unified style. See specific comments below.

2) I understand that the local information from Colombia used in this study considers only a subset of species and categories in comparison with those from Argentina and Chile (Fig. 1). However, it would still be interesting to see a high-resolution comparison within an urban/industrial domain centered in Colombia into Table 2, to at least evaluate the impact

of using the proposed methodology which is similar but not identical to the one applied for Chile. Including a simplified description of the similarities and differences between Eq. 2 and Eq. 3 would also be useful.

3) Even though the results discussion is mostly focused on comparing the different contribution from the individual sectors for each species (Section 3.1), I found a bit disproportioned the number of main Figures + Tables (2+1) comparing PAPILA and CAMS emissions in contrast to the Figures + Tables (also 2+1) focused on WRF-Chem air quality results. Note that the main focus of the paper is the development of the regional PAPILA inventory, and not a regional Air Quality study. Indeed, Section 3.1 compares emissions results within many different urban/industrial local domains within Argentina and Chile (Table 2), but the WRF-Chem analysis is centered only over Buenos Aires. Thus, the WRF-Chem simulation in MABA should be explicitly presented as a single case study analysis, and explicitly mention that the improvements with respect of considering CAMS emissions might not be applicable to the other selected urban/industrial areas within Argentina, Chile and Colombia (which otherwise would require a much larger description and evaluation of the WRF-Chem setup).

4) Section 5 (Conclusions) is a bit vague, it includes several adjectives that are not commonly used in scientific works (enormous, promising, auspicious, etc.) and focus on highlighting the cooperative effort of a South American community to develop emissions inventories and air quality research. However, the authors do not provide neither arguments supporting the main differences, strengths and/or weaknesses among PAPILA and CAMS, nor suggestions for future improvements of the PAPILA dataset. In other words, I would also expect to summarize in the conclusions the main methodological approaches used in the development of the PAPILA inventory, as well as the most important results of considering an improved inventory with local and high-resolution data. The current conclusion section seems to belong to another paper, or to the main benefits of a research proposal.

5) Finally, I would like to make a personal suggestion (not mandatory but that might increase the usefulness of the PAPILA inventory as input for air quality models): Could you include aerosol information (i.e., PM10 emissions), either from local or global inventories, into the PAPILA dataset? Following the methodology described in this paper, I believe it should be possible. Indeed, you have done so to perform the WRF-Chem simulations in this study based on EDGAR and CAMS. Having said this, I understand this might not be possible at

present time (due to data availability or even due to time dedicated to this project) and might be included into the 2<sup>nd</sup> version of the PAPILA dataset. In addition, a comparison between the PAPILA inventory and satellite information would also be interesting for future (or the current) work.

Minor comments:

1. L11: I found no need to explicitly mentioning the DOI for the PAPILA dataset on the Abstract. Also, I suggest using evaluation instead of assessment when the comparison between PAPILA and CAMS is mentioned.
2. L39: Please check if a more updated reference than 2002 is available on this topic. Country restrictions may have changed in the last 18 years.
3. L102: Figure 2 is quoted in the text before Figure 1 (L130). I suggest avoiding pointing at a Figure within the introduction.
4. L161: I do not understand why the trends for Chile and Colombia are specified within the Argentina section.
5. L202: Please add a reference for this statement
6. Table1: Consider restructuring this table, I found it quite difficult to read.
7. L211: Make reference to the results of section 3.1 where this topic is discussed
8. L263: Specify the version of WRF-Chem used as well as whether you used any spin up time in the simulation.
9. L289: Since PM data is mentioned as existing, why is it not further used for the model validation?
10. L288: Is there any reference that used this iterative method or any previous study that contains a description of a similar methodology? Was the iterative method applied only to WRF-Chem simulations based on PAPILA or also when CAMS was used? In case you applied to both, did you get similar results?
11. Figure 3: The description of the abbreviations is found much further back in the text (pg 4 and 6), it might be useful reinserting it in the caption of this figure together with a clarification of the sectors included in "Others" for easier interpretation of the figure.
12. L345: Please refer to the database used. If the SHIP-INTs for B. Blanca do not appear in CAMS, from which global estimate were they extracted? It is not clear.
13. L437: Clarify the meaning of the abbreviation "S-emitting", not mentioned above.
14. Figure 5: I would recommend placing a dot with the average value of each time series aside from the median that is already in the plot.

15. L464: Add the pollutants to which the hourly concentrations correspond to, for more clarity in the sentence.
16. L572: The document mentions several times “transparency”, but never really specifies what it actually entails.
17. The "regions" variable of the netcdf files is not described in the metadata nor in the general description of the readme.txt, intuitively we would say that they are time zones but it is not so, please clarify it.

Language editing comments:

19. L19: Change “relative to” by “in comparison to” or “in relation to”
20. L42: the word wood is repeated twice.
21. L79: PAPILA acronym is used in the introduction before it is defined.
22. L90: What is LAC?
23. L156: The sentence is confusing, please rephrase it.
24. L170: Equation indexes and styles for the Argentine emissions are not the same as the one used for Chile and Colombia. Please unify.
25. L 189: The sentence is too long, break it down into shorter, more specific segments.
26. L204: Check punctuation marks, the sentence is too long.
27. L213: Please rephrase
28. L220: Throughout the text, sometimes the term sectors is used and in some other you refer to categories. Please unify and, in case there is any difference among them, it should be explicitly mentioned.
29. L227: This sentence could be written in a more concise way.
30. L235: This sentence could be written in a more concise way.
31. L237: The word "such" is redundant.
32. L257: MABA is the City of Buenos Aires? Please define.
33. L427: The whole paragraph contains very long and repetitive sentences.
34. L460: I recommend the use of a more technical language to present the results e.g.: "errors in PAPILA results decreased in winter".
35. L483: Please rephrase.
36. L496: change “often resorted to” by “often used”
37. 559: The sentence is complex, please rephrase
38. Figure A2: change sites by “monitoring sites”