

Comment on **essd-2021-182**

Anonymous Referee #1

Referee comment on "Historical reconstruction of background air pollution over France for 2000–2015" by Elsa Real et al., Earth Syst. Sci. Data Discuss.,
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Historical reconstruction of air pollution is important for understanding the long-term trends of air pollution and is useful for health studies of air pollution. This paper reconstructs the background air pollution over France for 2000–2015. This work is important. However, the major issue of the paper is lack of novelty. And the methodology used in this paper has not been compared with other models. Besides, the manuscript appears messy a little bit. I cannot stand the terrible typesetting.

- This paper used a kriging method. Currently, there are many cutting-edge statistical models used for historical reconstruction of air pollution, including many machine learning algorithms. From the results of this paper, the performance of the kriging method is not satisfactory (except for O₃). I recommend the authors compare different models and select a model which performs best.
- I don't think it is appropriate to add a reference in the abstract (i.e., Real et al., 2021). (Line 18, P1)
- There have been many studies about the historical reconstruction of air pollution. They should conduct a thorough literature review in the introduction section.
- Line 26, P1 – Line 13, P2: It is not necessary to describe the trends of air pollution trends coming from ground observations in detail in the Introduction section. These contents have little to do with the purpose of the historical reconstruction of air pollution in France. These contents can be moved to the Results and Discussion section. They can compare their results of the trends using the reconstruction data and the results from previous studies using ground observations.
- Line 22, P3. They exclude industrial and traffic stations. In this case, the reconstruction maps of air pollutants will miss many pollution hot spots. I know that they want to reconstruct the background air pollution. However, without these hot spots, the reconstruction of air pollution is not that useful. I think another reason they exclude these stations is that the kriging method cannot deal with these stations with higher pollution levels well, because these stations are much less than urban and rural stations. However, the machine learning algorithms with land use information as covariates can capture the high pollution hot spots. Of course, they also need to incorporate meteorological variables in the models.
- Table 1, P3. Why the number of the stations of PM_{2.5} in 2007 are much fewer than that

in 2006 and 2008?

- Line 14, P5. Move "(particles with a radius < 10 μm)" and "(particles with a radius < 2.5 μm)" to the places where PM2.5 and PM10 first appear.
- P6, "3. Data validation". I think the leave-one-station-out CV cannot capture the model overfitting issues well. Typically, 10-fold spatially CV (leave-10%-station-out CV) is commonly used in such kind of studies.
- The chapter and section numbers are messy: " Data validation"->" 3.1.4. PM10"->" 3.1.5. PM2.5"->" 3.1.6. O3"->" 3.1.7. NO2"->" 4. Results"->" 4.1 Concentration maps and trends"->" 3.1.1. PM10"->" 3.1.2. PM2.5"->" 3.1.3. Ozone"->" 3.1.8. NO2"->" 4.2 Exposure trends"->" 4. Data availability".
- The words in the figure are too small. (e.g., Figure 9, etc.)
- Change "4. Results" to " 4. Results and Discussion"
- Incorporate the section "4 Data availability" into "Conclusion" section.
- The figures and tables can be better-looking.