



EGUsphere, referee comment RC2  
<https://doi.org/10.5194/egusphere-2022-1412-RC2>, 2023  
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## **Comment on egusphere-2022-1412**

Anonymous Referee #1

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Referee comment on "Global impact of the COVID-19 lockdown on surface concentration and health risk of atmospheric benzene" by Chaohao Ling et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-1412-RC2>, 2023

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Ling et al. used GEOS-Chem coupled with machine-learning models to predict the ambient benzene level before and after COVID-19 lockdown. Many studies have analyzed the impacts of COVID-related anthropogenic emission on regional air quality. It is a really interesting topic since there are few studies looking at the responses of global atmospheric benzene to COVID-19 lockdown. However, the manuscript still showed some major flaws especially in the model test and discussion, which should be addressed first.

The abstract includes too many results rather than the important findings. Thus, the important implications should be condensed in the abstract. I suggest the authors should reorganize the abstract.

There are numerous studies focusing on modelling surface air pollutants like PM and polluted gases using machine learning models (especially those adopted in the current study) globally or regionally. Thus, the authors are suggested to summarize related studies in the Introduction.

Line 58: How about the global or regional (like in China) O<sub>3</sub> and aerosol precursors (e.g., SO<sub>2</sub>, CO) changes during the COVID-19? The authors are also suggested to discuss since only PM and NO<sub>2</sub> mentioned here.

Line 60-67: Some field measurement of ambient benzene in China or Europe during COVID-19 period should be introduced. There should be several studies that have analyzed the temporal variation of ambient benzene in Chinese cities before and after lockdown.

Line 82-85: Why do you use the GEOS-Chem coupled with machine-learning models to decouple the emission and meteorology contributions? The GEOS-Chem model could also distinguish the emission and meteorology contributions. Are there any differences or advantages? Please clarify.

The specific lockdown time in different regions (e.g., China, India, and United States) should be introduced in the methods.

Line 103-104: How about the data quality in India? The authors should add some data quality assurance about benzene dataset in India. Besides, the data assurance in other regions should be also added.

Why do you use the ensemble model to predict benzene level? Please compare and show the advantage of the ensemble model compared with individual one.

Line 178: Why do you use 5-fold CV test instead of 10-fold test? The later one is the most commonly used one.

The monitoring sites only located in Europe, India, and the United States, but no site is available in China. This could lead to larger uncertainties in China. How did the authors resolve this issue?

Section 3.1: The authors must add the spatial transferability test in this part to confirm the robustness of the ensemble model.

Line 250: What does out-of-bag  $R^2$  mean? In fact, out-of-bag refers to out-of-sample. Do you mean out-of-station/site?

Line 356-357: Too many decimal places are meaningless.

Section 3.2: The discussion is too general and more detailed reasons for benzene change in different cities should be introduced.

Line 353-360: the paragraph is too simple. The impact of each meteorological parameter should be discussed in this paragraph.

The environmental implications of this study should be condensed in the conclusions. How can we control the ambient benzene pollution around the world?

There are many grammar errors and thus the English throughout the manuscript should be further edited carefully.