

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2021-369

Anonymous Referee #2

Referee comment on "Response of atmospheric composition to COVID-19 lockdown measures during Spring in the Paris region (France)" by Jean-Eudes Petit et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-369-RC2>, 2021

The manuscript by Petit et al. firstly reports the responses of aerosol and gaseous composition to COVID-19 lockdown by an innovative methodology "Application for Air Quality". Their results provide a comprehensive understanding on the impacts of traffic-related reduction on primary and secondary species. I suggest that major revision is needed for the manuscript prior to be published in this journal.

Major comments:

- The impacts of lockdown on aerosol chemistry were evaluated using Analog Application for Air Quality (A³Q) approach. Please give a detail discussion on the reliability and uncertainty (or limitation) of the method. I suppose that the method of comparing with reference period could be moved to the supplementary material because the focus should be on A³
- Please elaborate how to calculate the absolute and relative changes of aerosol and gaseous species due to lockdown.
- The Aerosol Chemical Speciation Monitor (ACSM) were used to measure aerosol composition. Since there are two versions of ACSMs nowadays, i.e., quadruple and Time-of-Flight ACSM, the author should clarify this in the Method. A composition dependent CE or a constant CE is used in this study?
- For Sec. 2.2, the POA-constrained PMF (or ME-2) was performed on OA matrix to resolve three OA factors (i.e., HOA, BBOA, OOA) during January-May 2020. The source apportionment results during June 2011- March 2018 were obtained from previous studies. It is unclear whether similar PMF method and OA components were used between the two periods. Please specify it.
- The elemental ratio and oxidation degree of SOA were calculated using I-A method. Which fragments or m/z were used for O:C and H:C calculation? Considering that ACSM detect species with unit mass resolution, I am afraid that the absolute values of element ratios were questionable to some extent.
- Figure 3, the scatter plots of simulated versus observed species contain two markers, i.e., small dots and six solid dots. Please explain it in the figure caption. Compared to the secondary inorganic aerosol, both POA factors and OOA showed much lower R during the evaluation period (Table 4). Did this mean that the organics might not be

well reproduced by this model? If this, the quantification of OA changes during 2020 lockdown might also be affected.

- The time periods used for calculation and discussion were a bit confused. In line 205-210, the author said that “the study period covers 92 days from March 1st –May 31st 2020”. However, January-February 2020 was chosen for model performance evaluation. Why only January-February 2020 was used? Which period was referred to as “lockdown” through the study? Please declare it in the Method.
- In line 390-400, is there other evidence that NO₃ formed from long-range transportation? The total changes of NO₃ can be quantitatively apportioned into regional decrease and advected contribution? Please elaborate the estimation method.

Minor comments:

- Please define BC_{ff} and BC_{wb} when first mentioned.
- The table caption should be placed on the top to table instead of the bottom.
- Although this is not a final publication version of ACP, the author should carefully check the output styles of the references as ACP recommended. For example, complete and abbreviated journal names
- The abstract could be more simplified, particularly for the descriptions before A³Q method.