

Comment on acp-2021-534

Anonymous Referee #1

Referee comment on "Air quality impacts of COVID-19 lockdown measures detected from space using high spatial resolution observations of multiple trace gases from Sentinel-5P/TROPOMI" by Pieterneel F. Levelt et al., Atmos. Chem. Phys. Discuss.,
<https://doi.org/10.5194/acp-2021-534-RC1>, 2021

This paper presents the observed changes in the atmospheric column amounts of five trace gases (NO₂, SO₂, CO, HCHO and CHOCHO) detected by TROPOMI to investigate the reductions of anthropogenic emissions due to COVID-19 lockdown measures in 2020. It aims to provide guidance to data users on how to best interpret and analyze TROPOMI trace gas data not only for lockdown-driven emission changes but also for other event-driven changes. I would suggest small revisions before the publication.

General comments:

- The authors used different quality assurance values (qa_value) for different species. Are the definition of qa_value consistent among species? If not, a small summary is appreciated. Otherwise, it is very confusing for readers.
- The authors used different approaches to consider the contributions from natural sources and meteorology for different species. I would appreciate a table or graph to summary the approaches.

Specific comments:

- Table 1. Are power plants primary sources of CO? Please confirm.
- Line 187. "In future studies, the averaging kernels could be used for inversion

modelling of emissions thus eliminating this error completely." It is not clear to me how the error can be eliminated completely. Please clarify.

- Line 204. Please clarify what are changes driven by mechanisms.
- Line 230. Please add reference for the magnitude of 20-60%.
- Line 265. Please add reference for the error.
- Line 327. What is the term of novel applied to? The algorithm?
- Line 338. Operational products instead of operations products.
- Line 346. Please define "box-air mass factors" before use.
- Figure 6 & 9. The data for June-Dec, 2020 is already available. Is there any specific reason to exclude them from the figures?
- Line 746. Is there any other evidences/reports from literatures to support the explanation for the enhanced CO?
- Figure D2. The font size is too small to read.