Comment on acp-2020-1199

Anonymous Referee #1

Referee comment on "Substantial changes in gaseous pollutants and chemical compositions in fine particles in the North China Plain during the COVID-19 lockdown period: anthropogenic vs. meteorological influences" by Rui Li et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-1199-RC1, 2021

Review of ACP-"Substantial changes of gaseous pollutants 1 and chemical compositions in fine particles in North China Plain during COVID-19 lockdown period: anthropogenic vs meteorological influences"

This paper analyzed changes of gaseous air pollutants as well as chemical compositions of $PM_{2.5}$ based on the observational data in Tangshan in the North China Plain. A random forest model was applied to investigate the contributions of meteorology and anthropogenic emissions to the changes of air quality during COVID-19 period. PMF was further applied to determine changes of source contributions before and during the lockdown. The topic is interesting, however, there are several major concerns to be addressed before it can be considered for publication:

(1) the most important data used in this study is the observation data based on a supersite in Tangshan whereas the title is "North China Plain". NCP covers large area with different topographical and meteorological conditions. Presenting the observation data at a single site is far enough to draw conclusion for a large and heterogeneous region. So the first limitation of this study whether this site is representative of the whole NCP region.

(2) Nine trace elements observed by Xact 625 are used in this study; however, Xact 625 can observe more than 20 species. Why did the authors only present 9 trace elements? What about the others?

(3) The authors used RF to quantify the influences from meteorology and emissions on air

quality. Why do the authors use RF instead of other machine learning techniques? This should be clarified. In addition, how can the model results be evaluated, or in orther words, how do the authors demonstrate the robustness of their model results?

(4) When performing source apportionment with PMF, the major input data does not even include major chemical components like OC/EC. How will this influence the results?

Specific comments:

- Abstract should be rewritten; the major findings/answers to the question raised in the title should be present in the abstract. In addition, it is misleading to present results like Cr (-201%) and Fe (-154%). The decrease of more than 100 % of a pollutant is misleading.
- The NH3 measurement is made by GAC-IC, while Hg is observed with Xact 625. Quality assurance and quality control procedures and results should be well documented and provided at least as supporting information.
- In "Section 2.2 Deweathered model development", the authors mainly described random forest; however, the deweathered technique with RF is not described. This should be clearly described in detail here. How are the meteorological conditions isolated by RF? How can the results be evaluated?
- Sulfate and NOx concentration decreased substantially after lockdown, while nitrate and ammonium increased. The authors explained that this might be due to the adverse meteorological conditions. This explanation is very weak. NO2 has been reduced by 62.8% while nitrate increased by 2.17%; is this attributable to the adverse meteorology? How did meteorological parameters change before and after the lockdown? Are there any changes in chemical reactions that are responsible?
- Some elements like Pb, Ca, Cr, Cu, Fe and Zn has been reduced by 7.44~91.5% while Hg, K, Ni increased by 20%, 0.08% and 1.17%, respectively. What's the reason? The authors also mentioned that the slight increase of K might be linked with the unfavorable meteorological conditions. This explanation is still very weak and not convincible. The authors should give detailed data analysis regarding the changes of meteorological parameters to support their explanation.
- Line 194-196, the deweathered Hg concentration still kept stable increase by 18%, which is opposite to other trace elements. What's the reason?
- Line 207, the deweathered Ca concentration decreased by more than 100%, it is hard to believe. Again, in Line 346, the Pb(-147%), Zn (-219%). This kind of description should be well clarified.
- Fig5 (C) some bars are not well shown, like Cr, Fe, Zn.
- Fig6-8 It does not make any sense to indicate DOY/Year is important or not in the prediction of gaseous pollutants using RF.
- There are many English grammar errors. The language should be polished thoroughly. For example, Line 130-131, "…were input into the model" there is grammar error in this sentence. Line 252, "both of " should be "both".