Dear editor,

Here we submitted our updated manuscript for consideration to be published on **Atmospheric Chemistry and Physics**

The further information about our manuscript is as follows:

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

Type of Manuscript: article

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 # Reviewer 1:

The authors have resolved most of the questions raised, and the overall quality has been improved. However, there are still several issues to be addressed:

Comment 1: The RF is used to differentiate the influence of meteorology and emission reduction, the RF model prediction results with R^2 value lower than 0.5 were treated as unreliable results, and only the species with R^2 larger than 0.5 were selected to assess the respective contributions of emission and meteorology to ambient concentrations. Did the authors delete those data with R^2 lower than 0.5? In Fig.S1~S4, did the authors only show data with R^2 higher than 0.5? This methodology may have large uncertainties. Conducting model validation is to understand the robustness of the method proposed, so that improvement can be further done to improve the results, but the authors just delete those data with lower prediction accuracy, which may raise large uncertainties.

Response: Thank for reviewer's suggestions. We have added the predictive performances of other species on Figure S5, which generally showed the worse accuracy based on RF model. Actually, the RF model showed the better predictive accuracy for most species, indicating the robust performance in distinguishing the contributions of emission and meteorology. Indeed, some species such as As, Cd, Mg^{2+}, and Ca^{2+} cannot be accurately predicted by RF model because the selected input variables

were not very appropriate. In our study, only time predictors (year, day of year (DOY), day of week (DOW), hour) served as key factors associated with COVID-19 lockdown. Although these time factors might be suitable to simulate the concentrations of NO_2, Pb, and Zn, they cannot accurately reflect the concentration variations of As, Cd, Mg^{2+}, and Ca^{2+}. Especially for the elements (Mg^{2+} and Ca^{2+}) closely associated with natural emission, the time predictors might be not very appropriate. In general, the hourly emissions of these elements might be more suitable to predict the pollutant concentrations. Unfortunately, the high-resolution data were unavailable. Overall, the RF model showed strong predictive ability, while it was significantly restricted to the independent variables. Therefore, in the future work, we should try our best to obtain high time-resolution emission inventories for many species to predict the concentrations of air pollutants, thereby distinguishing the emission and meteorology contributions.

Comment 2: Looking at Table S4, there maybe some problems when the authors ran PMF, the summary is not 100%. The authors need to carefully check the PMF model configurations and the source apportionment results.

Response: Thank for reviewer's suggestions. We have carefully checked the PMF model configurations and the source apportionment results. The least object function Q was estimated when the gik must be a positive-definite matrix. Besides, BS, DISP, and BS-DISP methods have been applied to assess the uncertainties. As shown in Table S4, BS run reached 100% and the summary of BS-DISP reached 97%. In fact, the model can be considered to be robust when the summary of BS-DISP was close to 100%. Based on the review of many previous studies (Cui et al., 2019; Chang et al., 2018), the summary in these studies also cannot reach 100%. Thus, we believed that the model is robust based on various validation.

Comment 3: Line 202, "result" should be "results"

Response: I agree with reviewer's suggestions. "result" has been changed into "results" (Line 199).

Comment 4: Line 330, "NO_2 emission" should be "NO_x emission", most of the primary NO_x emission is NO instead of NO_2.

Response: I agree with reviewer's suggestions. "NO_2" has been replaced by "NO_x" (Line 330)

Comment 5: Line 386-387, "The contribution ratios of SF for … increased from…" this sentence is not complete.

Response: Thank for reviewer's suggestions. The sentence has been changed into "Since COVID-

19 lockdown, the contribution ratios of SF to SO_4^{2-}, NO_3^-, and NH_4^+ increased from 35%, 33%, and 41% to 48%, 44%, and 52%, respectively (Line 386-387).

Comment 6: Figure 1, the sampling site is not clearly shown in fig 1(b).

Response: Thank for reviewer's suggestions. The Fig. 1b has been redrawn. The pink pentagram denotes the sampling site.

Comment 7: Figure S1~S4, in the title, "observe" should be "observed".

Response: Thank for reviewer's suggestions. "observe" has been changed into "observed" (Fig. S1-S5).