Reviewer #1

The outbreak of the 2019 novel coronavirus (COVID-19) has brought tremendous impact on human health and social economy. Sharp declines in primary pollution provided a unique chance to examine the relationships between anthropogenic emissions and air quality. The author investigated the vertical structure of pollutants by the highest meteorological tower in ShenZhen City. They found that O_3 concentrations were not sensitive to NO_x concentrations during lockdown, which implies that O_3 levels during the lockdown are more representative of the regional background. They deduced that reductions of anthropogenic emissions are effective to decline $PM_{2.5}$ and O_3 pollutant levels in the Pearl River Delta. Minor revisions are required before acceptance. Comments:

Thanks for your positive comments. The responses to your comments are listed as below:

1. How are the instruments on the tower calibrated and maintained on the meteorological tower to ensure data quality. The methods need to be explained in the second section?

The instruments on the tower are maintained by professional service providers and are routinely exchanged for calibration once every 3 months.

2. In Figure 5, why are the concentrations of $PM_{2.5}$, O_3 and NO_x higher up than at the surface?

The pollutants concentrations on the ground are from an atmospheric environmental observation station lying at the bottom of the SZMGT. The height of the sampling port of the ground station is lower than that of the surrounding forest top, which can absorb the pollutants transported from the sources beyond the forest and lead to lower concentration values than on the tower.

3. In Figure 9 and 10, how about the local photochemistry in different periods?

Fig. 9 compares the correlation between the $PM_{2.5}$ and NO_x concentrations before and during the lockdown, while Fig. 10 displays the correlation between the O_3 and NO_x concentrations before and during the lockdown. During the pre-lockdown period, the photochemical reaction generating the $PM_{2.5}$ must be very active, and the NO_x from traffic provided rich precursors for the photochemical reaction. Some recent studies pointed out that NO_3- is an important component of water-soluble aerosols in this region (Wu et al., 2020; Yang et al., 2021), which is quite accordant to the results shown in Fig. 9. At the same time the titration effect was also very obvious during the pre-lockdown period. While during the lockdown period, the photochemical reactions generating $PM_{2.5}$ were quite inactive, and the titration effect was no more obvious since the emission of NO_x had been reduced greatly.

References:

Yang, H., Zhang, Y., Li, L., et al. Characteristics of aerosol pollution under different visibility conditions in winter in a coastal mega-city in China. Journal Tropical Meteorology,, 26(2): 231-238. 2020.

Wu,L., Wang,Y., Li,L., Zhang,G.. Acidity and inorganic ion formation in $PM_{2.5}$ based on continuous online observations in a South China megacity. Atmospheric Pollution Research, 11: 1339-1350.2020.

4. It is suggested to add motor vehicle data in the article, to explain the change of emission from pre-lockdown to lockdown.

Though for the limitation of the data source, it is difficult to get exactly accurate vehicle data, the traffic data can still be estimated in light of the public new report. A nationally popular navigation service provider announced that during lockdown period, the traffic flow was about 14.1% of the normal situation,

which means there were around 282,000 vehicles running in the whole city of Shenzhen with territory of 2000 km^2, while the normal average number is around 2000,000 vehicles everyday.