**Anonymous Referee #1**

The manuscript describes a comprehensive observational dataset including atmospheric $O_3$, PAN, particulate matter, VOCs, NOx, and other trace gases to evaluate the effectiveness of emission control measures on reducing pollutant concentrations before, during, and after G20. It's very reasonable to demonstrate the effect of meteorological conditions by using WRF-Chem model. Further, an explicit OBM model was used to identify the predominant VOCs precursors and key chemical processes in PAN and $O_3$ formation and to further appoint the corresponding VOCs sources before, during, and after G20 by using PMF model. The manuscript is clearly written and for matted very well. Thus, after considering several comments below as minor revisions, I recommend the publication of this manuscript in ACP.

**Response:** Thanks so much for your positive comments and kind work on our manuscript. As you suggested, we made the corrections point by point in the revised manuscript.

1. The authors mentioned emission control measures contributed 63.5%, 44.1% and 31.2% to the reductions of $PM_{2.5,}$ $SO_2$ and $NO_2$ in DG20 II relative to BG20. And meteorological conditions made negative contributions. What are the other factors contributing to the reduction of the observed pollutants?

**Response:** Your question is quite important. Normally, the pollutant concentration is determined by the strength of emission source, chemical processes, and physical processes (meteorological conditions). In our study, we assumed that no significant change occurred in the chemical processes affecting the concentrations of these primary pollutants from BG20 to AG20. To some extent, the key factors affecting the photochemical reactions such as the intensity of solar irradiation could be indirectly reflected by the meteorological condition. Indeed, we assumed no significant change in the other reactive gases involved in the chemical reactions with these pollutants from BG20 to AG20. Therefore, the variation of the observed pollutants could be roughly attributed to the net contribution of emission control measures and meteorological conditions. In the revised manuscript, we have added "Here we assumed no significant change in chemical processes (specifically the other reactive gases involved in the chemical reactions with these pollutants) from BG20 to AG20." before the estimation.

2. What are the contribution of emission control measure and meteorological conditions to $O_3$ concentration?

**Response:** According to the calculation method as depicted in the manuscript, the contribution of meteorological conditions to the increased $O_3$ concentration was estimated to be 16.4% in this study. For the contribution of emission control measures, it was quite complex and should be separate discussed in different periods. During the period from BG20 to DG20I, the control measures on reducing the emission of VOCs sources except fuel combustion were really effective in alleviating $O_3$ pollution, which is confirmed by the decreased OFP. Unfortunately, during this period the unfavorable meteorological conditions such as the enhanced intensity of solar irradiation and regional transport both aggravated the $O_3$ pollution. In DG20 II, significant reduction of $NO_x$ due to the additional vehicle controls might lead to the increase in $O_3$ concentration during G20. It was not only because this region was under the VOC-limited regime in Hangzhou revealed by the results of OBM, but also due to the decreased titration effect of NO on $O_3$ in the morning and evening traffic rush hour during this period. These effects significantly worsen the effectiveness of control measures in vehicle exhaust on reducing OFP. Thus, the final contribution of emission control measures to the increased $O_3$ concentration was estimated to be 21.5% in this study.

3. I don't understand the variation of CO concentration during different stages. The authors mentioned fuel combustions should be the reason. Is there any evidence? Why did fuel combustion increase during G20?
**Response:** As we know, atmospheric CO is normally derived from human activities including fuel combustion (coal combustion, farming, residual usage, etc.). As illustrated in the Section 3.4 in the manuscript, industrial process with coal combustion and vehicle exhaust were strictly limited throughout the whole G20 period. In addition, straw combustion was excluded according to the decrease in the number of fire spots in the same time period from BG20 to AG20. On the contrary, to ensure the clean energy used in 2016 G20, local government accelerated the supply of liquid natural gas and liquid petroleum gas (ZPSY, 2016, 2017). The consequent CO was more produced from the incomplete combustion of these fuels during G20 relative to BG20. The emission control measures might be poorly effective on CO reduction, specifically on fuel combustion. Also in our study, ethylene, as a representative tracer of fuel combustion, showed continuous increase from BG20 to DG20, further confirming the ineffectiveness of control measures in this source. Therefore, CO showed a gradual increase. This phenomenon was also found in another research conducted during G20 in 2016 (Zhao et al., 2017).
*Reference:*
*Zhao, J. P., Luo, L., Zheng, Y. J., Liu, H. H.: Analysis on air quality characteristics and meteorological conditions in Hangzhou during the G20 summit, Acta Scientiae Circumstantiae, 37(10), 3885-3893, 2017. (In Chinese)*

4. Other minor errors:
Line 61-62: no need to mention "which are dominant compounds of fine particulate matter". Delete it
Accept

Line 69-70 the complexity of mitigating secondary photochemical pollution is also highly related with intricately photochemical reactions. Thus add the phase "in addition to intricate photochemical reactions".
Accept

Line 207-210: This section belongs to the description of emission control measures.

Thus suggest moving it in Introduction.
Accept.

Line 429-459 The Conclusion is a bit long. The authors are encouraged to shorten this Section.

**Response:** Accept. According to your suggestion, we shorten the Conclusion as "In this study, ground-based concentrations of atmospheric trace gases and particulate matter, together with meteorological parameters, were measured at a NRCS site in urban Hangzhou before, during, and after G20. We found significant decreases in atmospheric VOCs, $PM_{2.5}$, $NO_x$, and $SO_2$ in DG20 relative to BG20 and AG20, respectively, under the unfavorable meteorological conditions (e.g., stable weather pattern and regional transport). This evidence well indicated that the powerful control measures have taken effect in their emissions in Hangzhou. On the contrary, observed DMA8 $O_3$ increased from BG20 to DG20 I, which was attributed to the regional transport from the northern provinces and the enhanced solar radiation intensity, and then decreased from DG20 II to AG20. The decreases in the peak concentration of daily $O_3$ and the OFP estimated from various VOCs sources both suggested the effectiveness of stringent control measures on reducing atmospheric $O_3$ concentrations. Unlike $O_3$, PAN exhibited gradual decrease from BG20 to DG20. With the OBM model, we found acetaldehyde and methyl glyoxal (MGLY) to be the most important second-generation precursors of PAN, accounting for 37.3-51.6% and 22.8%-29.5% of the total production rates. Furthermore, we confirmed that the production of PAN was sensitive to anthropogenic and biogenic VOCs (isoprene) throughout the whole period, specifically aromatics in BG20 and DG20 I but alkenes in AG20. Similarly, the sensitivity of ozone formation was also under VOC-limited regime throughout G20 period. These findings suggest that reducing emissions of alkanes, alkenes, and aromatics would mitigate photochemical smog including PAN and $O_3$ formation. Furthermore, traffic (vehicle exhaust and gasoline evaporation) and industrial sources (solvent utilization, industrial manufacturing, and chemical feedstock) were found to be the major VOCs sources before G20, accounting for ca. 50.0% and 31.7% of the total, respectively, with the ozone formation potential (OFP) of 14.4 ppbv and 16.1 ppbv. Large decreases were found in the sources and OFPs of solvent utilization (74.1% and 17.3%), followed by vehicle exhaust (57.4% and 77.2%) and industrial manufacturing (56.0% and 40.3%) response to the stringent control measures during G20. We also appeal to pay attention on controlling fuel combustion and biogenic emission especially when anthropogenic VOCs were substantially reduced following the process of control measures.” in the revised manuscript.