Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC2
https://doi.org/10.5194/acp-2022-493-RC2, 2022


# Comment on acp-2022-493

Anonymous Referee #2

Referee comment on "Examining the implications of photochemical indicators for $O_3$–$NO_x$–VOC sensitivity and control strategies: a case study in the Yangtze River Delta (YRD), China" by Xun Li et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-493-RC2, 2022

**Comments to Li et al.**

This paper presented the examination of different indicators for O3-NOx-VOC sensitivity based on the chemical transport model CMAQ results. Four indicators were tested, i.e. the ratio of the production rates of H2O2 and HNO3 (PH2O2/PHNO3), HCHO/NO2, HCHO/NOy, and reactive nitrogen concentrations (NOy) for the YRD region. This work determined and evaluated the threshold values of these indicators. Besides, the uncertainty caused by the method was also analyzed. Generally, the manuscript is well-written with a clear structure, and the analysis and discussion are scientifically sound. I recommend publication once the comments below have been addressed.

**General comments:**

- The determination of NOx-limited and VOC-limited is changes of O3 by more than 5 ppbv if NOx and VOC emission reduction by 35% relative to the base run. This criterion is adopted from Sillman et al. (1998). However, the original analysis mainly focused on an ozone episode at the Nashville and vicinity area with relatively high O3 concentration (>80 ppbv). As indicate in Figure 2(a), the O3 concentration could match this criterion for the south part of YRD but not the North part. The relatively low O3 in the north part leads to relative low absolute change of O3 concentration when NOx or VOC emission reduce by 35%. In this case, the north part can still be attributed to

NOx/VOC limited regime. It's not clear to me how the determination of threshold for different indicators depends on this classification.

- In section 3.4, the $P_{H2O2}/P_{HNO3}$ is used for an example but also suggest to add similar discussion on $HCHO/NO_2$ or HCHO/NOy to address the statement that "By comparing with the $O_3$ isopleths, it was found that $HCHO/NO_2$ and HCHO/NOy showed the most consistency".
- The overall accuracy values of NOy in some cases are higher than other photochemical indicators as shown in Fig.4, however in the section 3.3, the indicator was not recommended. Please explain the discrepancy between the result mentioned above.

**Specific comments:**

- The language needs improved. For example, the tense of one paragraph should be consistent. I only list a few and suggest the authors to carefully go through the paper. Line 14: examines à examined; Line 49: is VOC-limited à was VOC-limited …
- Line 48: Explain "NOz" when it appeared for the first time.
- Line 50: If the threshold for an indicator is varying, it seems contradict to "robust",
- Please Briefly introduce HDDM in the section of "Methods".
- The introduction of OA expression in Table 4 was incomplete
- Please elaborate the determinization of thresholds for different photochemical indicators in Fig.3.
- Delete the extra brackets in Fig.3(a).
- Please elaborate the approach to distinguish the O3 formation regime with shading colors as shown in Fig.5.

Reference:

Sillman, S., He, D., Pippin, M. R., Daum, P. H., Imre, D. G., Kleinman, L. I., Lee, J. H., and Weinstein-Lloyd, J.: Model correlations for ozone, reactive nitrogen, and peroxides for Nashville in comparison with measurements: Implications for O3-NO x -hydrocarbon chemistry, 103, 22629-22644, https://doi.org/10.1029/98JD00349, 1998.