This study analyzed the effects of different typhoon tracks on the ozone concentrations through chemical formation, dispersive condition, horizontal and vertical transport using ground-based observations, reanalysis data, and atmospheric chemistry simulation. The analyses and interpretation are sound and reasonable. I only have minor comments.

1. I did not find a data availability section. There are many data included in this study. It would be better to list their public availability.

Response:

Thank you very much for your comment.

In the section 3 of the manuscript, all the sources and URLs of the data are listed in detail. Except for the ozone ground observation data which is not made public, all other data are publicly available.

2. Line 338-339: when the typhoon is distant from the target area, how can the local ozone concentrations be attributed to distant typhoon instead of local generation?

Response:

Thank you very much for your comment. It is extremely important to us.

The colored dots represent the corresponding ozone concentrations at Guangdong sites along the typhoon tracks. They do not necessarily indicate the high ozone events, represented by red colors, are attributed to typhoons' influence directly.

The red points in Figure 1 at the large distances, such as those in the far north as 60° N, might not indicate persuasive correlation between high ozone in Guangdong and the long-range transport. Instead, it arose from a statistical artifact caused by the temporal overlap of two typhoons, which led to the misattribution of the high ozone values to the latter part of the first typhoon's trajectory. As illustrated in the figure below, Typhoon TRAMI occurred from September 20 to October 3, 2018, while Typhoon KONG-REY spanned from September 28 to October 7, 2018. The former (TRAMI) did not cause ozone pollution in Guangdong Province, whereas the latter (KONG-REY), as it approached the Chinese mainland, triggered severe ozone pollution in Guangdong. However, due to the temporal overlap between September 28 and October 3, the high ozone values were statistically assigned to the later segment of the first typhoon's path. As shown in Figure 9 of the manuscript, the circulation of a typhoon can still induce long-range transport of ozone even when the typhoon is near 35°N. Therefore, we focus primarily on the latitudinal range of 15 – 40°N. To avoid ambiguity, we have revised the manuscript to clarify the relationship between TYPE2 typhoons and ozone pollution in Guangdong Province.

Line 337-340: Typhoons of Type2 can affect the ozone concentration in Guangdong Province from a relatively distant location from the mainland. The paths of typhoons causing ozone pollution mainly fall within the range of 130-150°E and 15-40°N.

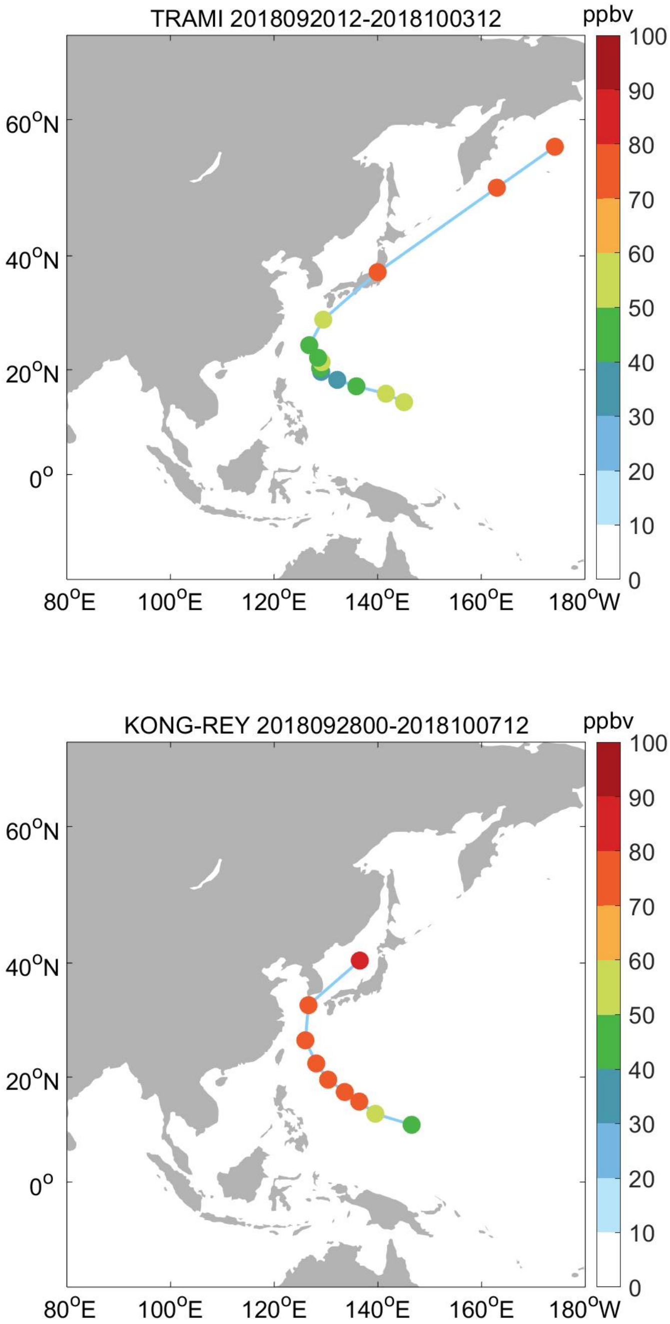

Figure. The paths of Typhoons TRAMI (upper) and KONG-REG (bottom) and the corresponding ozone concentrations in Guangdong Province

3. Line 368-370: how would the seasonal biases of meteorological data be eliminated for the comparison between typhoon days and non-typhoon days?

Response:

We appreciate the comment and acknowledge that utilizing non-typhoon days from the entire year for meteorological comparison introduces significant seasonal biases. To address this, we conducted the following analyses:

1. The analysis was conducted in the summer and autumn seasons when the frequency of typhoons was higher and the ozone concentration was also higher. The differences in meteorological characteristics between the periods of June to November (JJA & SON), June to August (JJA), and September to November (SON) were compared respectively.

2. Compare the results in 1 with those before the modification, and analyze which meteorological factors have undergone significant changes after the modification.

And the following conclusions are drawn:

1. Regardless of using the period from June to November (JJA & SON), the period from June to August (JJA), or the period from September to November (SON) to compare typhoon and non-typhoon weather, the results obtained do not conflict with the results using the entire year. The meteorological characteristics of typhoon days are all high temperatures, low cloud cover, high radiation, low precipitation, low humidity, high boundary layer height, low wind speed, and stable weather.

2. There are indeed differences in the numerical values of meteorological factors in summer and autumn, but the overall situation is very similar. To avoid making the article overly lengthy, we decided to use the period from June to November to compare the meteorological differences. Corresponding modifications have also been made in the manuscript, as detailed in Line 372-374 and Line 391-397.

3. By comparing the meteorological conditions before the modification (Before) and after the modification (AFTER), we found that the factors that changed significantly are: temperature (24.8 -> 29.8), radiation (0.19 -> 0.21), precipitation (0.05 -> 0.12), and relative humidity (70.62 -> 71.93).

Figure The changes in meteorological factor values before and after the modification

Table Characteristics of meteorological factors based on different statistical methods

	Vars	Type1	Type2	Type3	Non-typhoon
Before: Annual	Temperature (℃)	30.60	31.69	32.41	24.80
	Total cloud cover	0.56	0.40	0.47	0.75
	UV radiation (MJ/m^2)	0.24	0.26	0.28	0.19
	Precipitation (mm)	0.04	0.06	0.08	0.05
	Relative humidity (%)	63.97	63.88	65.44	70.62
	Boundary layer height (km)	1.01	1.02	1.03	0.82
	Wind speed (m/s)	2.92	2.32	2.09	3.22
	Vertical velocity (pa/s)	0.00	0.01	-0.02	-0.03
After: JJA&SON	Temperature (℃)	30.97	32.12	32.41	29.80
	Total cloud cover	0.56	0.39	0.47	0.75
	UV radiation (MJ/m^2)	0.24	0.26	0.29	0.21

	Precipitation (mm)	0.04	0.06	0.08	0.12
	Relative humidity (%)	64.20	63.88	65.33	71.93
	Boundary layer height (km)	1.03	1.02	1.03	0.85
	Wind speed (m/s)	2.92	2.32	2.09	3.21
	Vertical velocity (pa/s)	0.00	0.01	-0.02	-0.04
JJA	Temperature (℃)	32.95	33.00	33.19	31.45
	Total cloud cover	0.63	0.78	0.55	0.92
	UV radiation (MJ/m^2)	0.29	0.29	0.30	0.26
	Precipitation (mm)	0.11	0.17	0.09	0.40
	Relative humidity (%)	65.63	65.26	66.23	75.08
	Boundary layer height (km)	0.96	0.93	1.03	0.86
	Wind speed (m/s)	2.66	2.22	1.98	3.60
	Vertical velocity (pa/s)	-0.03	-0.03	-0.02	-0.05
SON	Temperature (℃)	29.30	30.41	30.68	26.87
	Total cloud cover	0.41	0.27	0.30	0.56
	UV radiation (MJ/m^2)	0.23	0.25	0.26	0.18
	Precipitation (mm)	0.01	0.01	0.02	0.03
	Relative humidity (%)	62.17	59.77	59.98	68.45
	Boundary layer height (km)	1.09	1.14	1.06	0.84
	Wind speed (m/s)	3.05	2.47	2.30	2.85
	Vertical velocity (pa/s)	0.00	0.02	0.02	-0.02

4. Line 373-374: Why does 14:00 local time be chosen specifically?

Response:

Thank you very much for your comment.

14:00 local time is the period when photochemical reactions are the most intense in a day. We believe that comparing the meteorological conditions at 14:00 is more representative than using the daily average.

5. Line 490-491: How can the selection of June to November help to eliminate the seasonal biases? There are still large variations from summer to fall.

Response:

Thank you very much for your comment.

To eliminate seasonal influences, the anomaly in ozone concentrations between typhoon days and non-typhoon days was first calculated on a monthly basis, after which the different types of statistics were conducted. The results after reanalysis are qualitatively similar to before, confirming that Types 2 and 3 cause the most notable ozone increases. The specific values have been adjusted, and the revisions are reflected in the manuscript.

Line 504-515: To further investigate typhoon-induced ozone variations, spatial ozone concentration differences between typhoon conditions and non-typhoon conditions were calculated (Fig.6). To eliminate seasonal influences, the anomaly in ozone concentrations between typhoon days and non-typhoon days was first calculated on a monthly basis, after which the different types of statistics were conducted. The results indicate that northward-moving typhoons (Type 2 and Type 3) can significantly increase the ozone concentration at altitudes ranging from 250 to 900hPa (Fig. 6b,c). Within this altitude range, the variation of ozone concentration at the center point (113.23 °E, 23.16°N) changes ranged between 2.5-14.0 ppbv (Type 2) and 0.3-14.5 ppbv (Type 3). In contrast, Type 1 did not cause significant high-altitude ozone increases, with central point ozone concentration changes ranging from -3.5 to 2.5 ppbv.

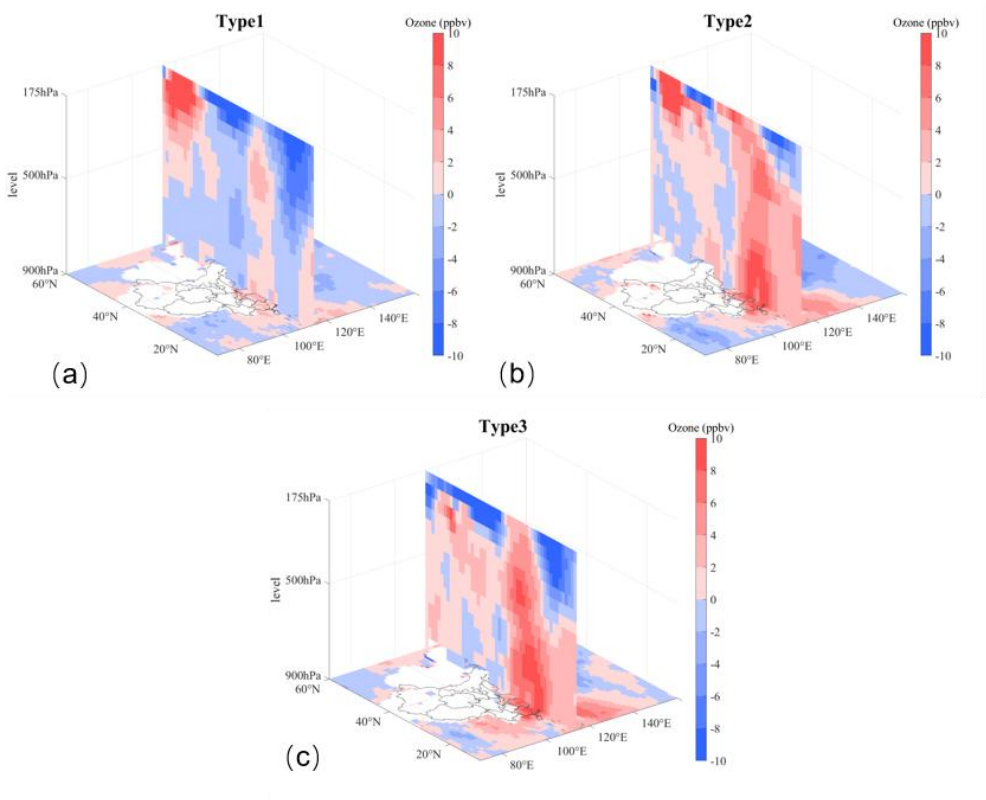

Figure 6. Ozone concentration changes induced by different typhoon types (a-c: horizontal distribution changes at 900 hPa and vertical cross-section changes along 114°E for each typhoon track type respectively).

6. Line 635-636: By the dominance of photochemical reactions, is it dominated by the promoted reaction rates or the promoted precursor concentrations? Generally, how would regional transport of precursor promote the generation of ozone at the target area?

Response:

Thank you very much for your comment.

The IPR analysis in CMAQ can be used to calculate the influence of different atmospheric processes on the values of pollutants, and to quantify the importance of each process in the evolution of the pollutant value. It can only quantify the importance of photochemical reactions, but it cannot distinguish whether it is the increase in the rate of photochemical reactions or the change in the concentration of the precursors that is involved.

Wang et al (2022) combined on-site and satellite observation results with model simulations to find that as the typhoon approached, the cross-regional transport of ozone precursors increased, and under the active photochemical reaction, the ozone formation efficiency increased by more than twice.

Wang, N., Huang, X., Xu, J., Wang, T., Tan, Z. M., and Ding, A.: Typhoon-boosted biogenic emission aggravates cross-regional ozone pollution in China, Sci. Adv., 8, https://doi.org/10.1126/sciadv.abl6166, 2022.