

Atmos. Chem. Phys. Discuss., referee comment RC4
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Comment on acp-2022-60

Anonymous Referee #4

Referee comment on "Transport of substantial stratospheric ozone to the surface by a dying typhoon and shallow convection" by Zhixiong Chen et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-60-RC4>, 2022

This paper discussed the downward transport of stratospheric ozone to the troposphere as well as down to the surface through a combined effect of a dying typhoon In-fa and shallow local mesoscale convective system (MCS). They analyzed the ozone and CO concentration, meteorological reanalysis data, radiosonde data, and FLEXPART-WRF simulation. The downward transport of stratospheric ozone-rich air to the surface will degrade surface air quality and affect human health. Overall, the paper is good. It studied an important topic, used various observations. However, it still has some major weak points.

General comments:

- Because the downward transport was caused by typhoon In-fa, it would be nice to have a brief introduction of typhoon In-fa in section 2. Please include a plot showing the development of the typhoon In-fa (e.g., radar reflectivity for different times), and a plot showing the path of the typhoon In-fa. This will help the reader to understand the discussion of the second part.
- Lightning-generated NO_x could also increase downwind ozone level. The paper did not prove that the ozone increase is not caused by LNO_x generated by previous storms.
- In the paper, they calculate the 10-day mean O₃/CO as the baseline. However, the 10-day mean included the days affected by typhoon In-fa. Therefore, it is hard to tell what's the normal condition. It might be better to use the 10-day mean before the typhoon period as the baseline.
- In this paper, they run WRF with tracer instead of using WRF-Chem. However, LNO_x and other ozone precursors could also affect the results. Please explain why you choose not to use WRF-Chem or other chemistry models. The ozone production is not significant in the first few hours, however, previous studies found that there would be a great ozone increase in the downwind side on the next day. If you insist to use WRF with tracers, you need to convince the reader that your results would not be affected by any ozone chemistry reactions.

Specific comments:

- Line 44, here are some references for deep convective transport of surface pollution and ozone precursors to upper troposphere:

Dickerson, et al. (1987). Thunderstorms: an important mechanism in the transport of air pollutants, *Science*.

Pickering, et al. (1991). Photochemical ozone production in tropical squall line convection during NASA Global Tropospheric Experiment/Amazon Boundary Layer Experiment 2A. *J. Geophys. Res.*

Pickering, et al. (1992). Ozone production potential following convective redistribution of biomass burning emissions. *J Atmos Chem*.

Li, et al. (2017). Evaluation of deep convective transport in storms from different convective regimes during the DC3 field campaign using WRF-Chem with lightning data assimilation. *J. Geophys. Res. Atmos.*

- Line 110, it would be nice to have a brief introduction of typhoon In-fa in section 2. Please include a plot showing the development of the typhoon In-fa (e.g., radar reflectivity for different times), and a plot showing the path of the typhoon In-fa. This will help the reader to understand the discussion of the second part.
- Line 166, please include the reference for WRF.
- Line 167, please add a figure showing the location of each domain in supporting information.
- Line 185, why do you choose WRF instead of WRF-Chem? See general comments 4.
- Figure 2, see general comments 3.
- Figure 2, please add a map showing the storm location during the ozone surge period.
- Line 226, CO is also an important tracer for deep convective transport. Please include references here. "CO is often...(add references)"
- Line 250, please mention the ozone exceedance level, and compare the observed ozone level to the ozone exceedance level. Otherwise, you cannot conclude that "which can pose great threats to human health..."
- Line 268, please explain more about "no influence from ozone precursors from biomass burning or LNOx". See general comments 2.
- Figure 5, please label time in each plot.
- Line 400, could you add a forward trajectory experiment of stratosphere tracers?