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## **Comment on acp-2022-60**

Anonymous Referee #5

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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-RC5>, 2022

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### Review of **Transport of large stratospheric ozone to the surface by a dying typhoon and shallow convection**

By Zhixiong Chen, Jane Liu, Xiushu Qie, Xugeng Cheng, Yukun Shen, Mengmiao Yang, and Xiangke Liu

This is an interesting paper, addressing an important topic, and appropriate for publication in ACP. At times the description of the dynamics is hard to follow, and so I suggest some attention be given to making the arguments simple and clear.

The paper mainly falls down, I think, in presenting the meteorology of the convective system that is alleged to be responsible for bringing the ozone down to the surface. This may simply be because the authors are meteorologists by training, and forget that most ACP readers are not. Please explain more! A prime example is Figure 11, which purports to demonstrate the downward transport: "We performed cross-section analyses of the bow-echo MCS (Fig. 11b-c), and the results clearly show a rearward pathway through which the stratospheric ozone-rich air mass was transported to the surface by the rear inflows descending from stratiform clouds to the leading convective line." Maybe they clearly show that to the authors, but unfortunately not to this reader. Is the salient point that the "tracers" are now mostly below 3.6 km? Or that some of the wind vectors are pointing down? Is the reader supposed to be able to see "the rear inflows descending from stratiform clouds to the leading convective line"? Remember that many of your readers won't know where the "leading convective line" is found.

Minor points:

The presentation and grammar need some good editing. It is sometimes difficult to understand what the authors are trying to say.

Abstract: This is a bit long, and some of it reads like an introduction to the paper, rather than a brief summary of new results. At the least, the last sentences of each paragraph (lines 20-21 and 30-32) should be moved or deleted.

Lines 66, 449, 450: "...wrapped around the anvil". An "anvil" is a block of iron that a blacksmith hammers upon. "Rearward anvil" and "forward anvil" are meteorologist's slang. Most readers will know that an anvil-shaped cloud is often associated with a thunderstorm, but no more. Please be clear about what you are describing, and why.

Lines 111-116: The instrumentation should be identified, and/or the uncertainty and detection limits cited.

Lines 189-190: I think this is saying that FLEXPART-WRF used the 3-km resolution output of WRF-ARW, but it isn't really clear.

Lines 208-201: "It is a common practice to use 25th percentile of ozone concentration distributions as a background value (e.g., Parrington et al., 2013), which yields an even severer ozone enhancement in the surface." I think the authors are trying to suggest that the ozone amount is more significant because it is all transported from elsewhere, and so could be measured against some "background" value (arbitrarily defined). This is a dubious comparison that will only serve to confuse the reader. Delete.

Line 226: After "...not reduced in Qingdao and Weihai" I suggest adding "...which were outside of the path of influence of the MCS, as noted in the preceding paragraph."

Line 230: I suggest referring to Figure 1 here.

Line 281: Bohai Bay is not indicated in Figure 1.

Lines 287-288: Is that the blue areas? In other words, does a positive vertical velocity in Pa imply downward motion? This is not clear.

Line 307, Figure 6: Why use dewpoint depression? This metric will be unfamiliar to those

without meteorological training (most ACP readers!).

Line 344: The term "bow-echo MCS" is used here without definition. The description appears later, beginning on line 362. Please move it ahead of this.

Line 363: "produce"? Perhaps "are associated with" would be better. The radar echoes don't cause the winds.

Line 367: Perhaps they should be shown? I find the evidence of descent unconvincing at present, and this is an important part of the paper. Also, a few lines below, you claim that "...strong radar reflectivities were confined below 6 km altitude (480 hPa, -9 °C) suggesting limited vertical extension of convective storms." It would be helpful to see those data.

Lines 388-394: This plot and description give me no useful information with which to evaluate the model performance. What exactly is being simulated? What observations are being compared? Does a POD of 0.8 mean we have 80% perfect agreement, or 80% chance of seeing something similar within 20 km? What does the SR of 20-80% mean, and what is a frequency bias (FR)?

In contrast, I do get some information from comparing Figures 8 and 9. Perhaps instead of S9 you could simply describe the agreement between these figures. It looks to me like WRF is simulating a system of similar size and strength in pretty much the same place.

Lines 442-448: This description and Figure 11 are quite confusing to me, as noted above. I'm not at all sure what the lines labelled "tracers" represent. Are they contours of particle counts? At 3.6 km?

Figures 2, 3 & 4: I find the times on the X-axis hard to read.