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## Response to Reviewer #1

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Li et al. present observations of VOCs measured on top of a 450 m tower. As stated in prior review, these measurements are of value to better understand how VOCs behave at higher levels in the boundary layer, as there have been minimal constraints.

The authors have done a great job in addressing all the comments from both reviewers. The new analysis and figures have greatly improved the overall manuscript and makes it of value to the ACP community.

**Reply:** We appreciate the reviewer for the valuable comments.

However, one minor aspect should be addressed with the new information provided by the authors. Looking at their S1 figure, which is greatly appreciated and useful in understanding the set-up, there is concern about the location of the inlet. From the figure, it looks like there is a large amount of roofing between the inlet and the edge of the building. Thus, two potential aspects that maybe biasing the results I believe should be mentioned:

(1) How much could off-gassing from the roof impact the measurements?

**Reply:** We appreciate the reviewer for the valuable comments and suggestions. In the last version of the SI file, some of the bottom parts of Figure S1(f) were covered to show the window of the observation room (Figure S1(g)), resulting in an illusion that there is a large amount of roofing between the inlet and the edge of the building. We have provided a clearer picture in Figure S1 to show the location of the sampling port in the revised SI file. Actually, the “roofing” is the orbit of the Bubble Tram on the 450 m platform (Figures R1 and S1(d)). The orbit of the Bubble Tram is located on the open hollow steel structure of the Canton Tower and is ~10 m higher when passing over the sampling inlet. Therefore, the off-gassing from the Bubble Tram could be largely attributed to emissions from visitor-related sources and had

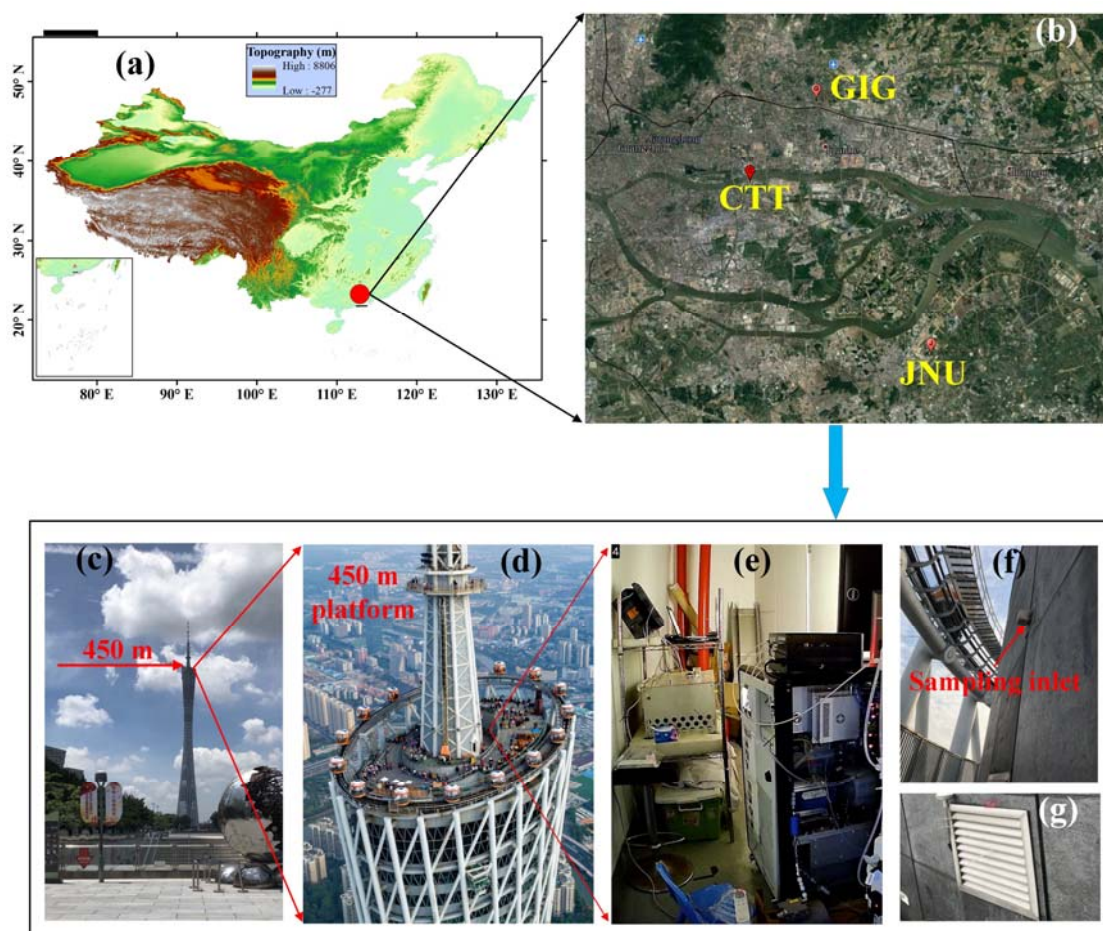
weaker impacts on the VOCs measurements in comparison to those from visitors on the 450 m platform.



**Figure R1.** Picture showing the orbit of the Bubble Tram on the 450 m Look Out platform. The picture was obtained from the official website of the Canton Tower: <https://www.cantontower.com/en/sightseeing/ferriswheel/>.

(2) How could local eddies being created by that roof and thus potentially sampling more local VOCs than urban background impact the measurements?

**Reply:** We appreciate the reviewer for the valuable comments and suggestions. As shown in Figures R1 and S1(d), the orbit of the Bubble Tram is quite narrow (~1 m) and is built on the open hollow steel structure of the Canton Tower. Under these circumstances, the Bubble Tram is unlikely to create eddies significantly affecting the VOCs measurements at the sampling port.



*Figure S1. in the revised SI file.*

Another minor comment from what the authors included in their comments. I like how the authors addressed the concerns about the visitors PMF in that it is a local source and would not be typical of the upper boundary layer measurements. It may be of value, in text, to state that and when comparing concentrations and reactivity, to have with and without the visitors PMF to better reflect how this factor may not be important for typical upper boundary layer VOCs.

**Reply:** We appreciate the reviewer for the valuable comments and suggestions. As suggested by the reviewer, we have provided discussions in the revised manuscript to highlight the local characteristics of the visitor-related source in PMF analysis. [see P: 16; L: 396-398] We agree with the reviewer's opinion that contributions of the visitor-related source should be excluded when highlighting contributions of other typical sources to the VOCs measurements or sources of typical VOC species in the

upper boundary layer. Therefore, contributions of the visitor-related source were considered when discussing contributions of the VCP-dominated source in TVOC mixing ratios [see P: 16; L: 405-411] and sources of the ethanol measurements [see P: 19; L: 478-489] in the manuscript. Contributions of the visitor-related source were not excluded in most discussions of the paper as we believe that it is also a significant contributor to ambient VOCs concentrations at ground level (particularly during the outbreak of the COVID-19 pandemic) and should be given more concern in future studies.

*“It should be noted that visitor-related emissions belonged to highly local sources on the 450 m platform and were not typical of the VOCs measurements in the upper boundary layer.”*