

Dear Editor,

We appreciate the prompt reviews and thanks a lot for your constructive suggestions on our manuscript entitled “Characteristics of fine particle matters at the top of Shanghai Tower” (MS No.: egosphere-2022-782). We have carefully considered all comments and suggestions. Listed below are our point-by-point responses (Your points in black, our responses in blue).

Thank you for your thorough and comprehensive response to the referee comments. I find that the manuscript is significantly approved and am pleased to accept it for publication following attention to the minor comments outlined below. Line numbers refer to the track changes version of the manuscript unless otherwise noted.

**Response:**

Thank you again for your valuable comments, which have been carefully addressed during revision. Please find our point-to-point response below and highlighted changes in the revised manuscript. Line numbers refer to the track changes version of the manuscript.

1. Lines 109-112: Please add a note saying that a composition dependent collection efficiency was investigated and resulted in no significant changes – something along the response that was included to the referee’s question.

**Response:**

Thanks for your suggestion. Add accordingly. Please see lines 112-113.

2. Line 182: I am confused about where and when the MARGA

measurements were made. Please elaborate on these.

**Response:**

The MARGA measurements were operational at PEMC site, but not available for public access. The MARGA and SHT NO<sub>3</sub> data were compared for the exact same period. Please see lines 192-193.

3. Section 3.23: I think the organization and presentation of information in this section should be modified to improve readability. In particular, after reading the first paragraph in the section, I was confused by the statement that “the lowest RPC in winter could be attributed to the shallowest PBL height.” It is lowest because all the RPC values are negative and thus even though it is the lowest, it represents the largest change between aloft and surface measurements. If both measurements are within the PBL, I would expect a shallower PBL to lead to a shallower gradient. It is clarified in the second paragraph though that the result is really driven by the differences between day and night. I think harmonizing these two discussions to make this clear would benefit the reader.

**Response:**

Thank you for your suggestion. In the first paragraph of Section 3.2.3, we speculate that lower PM<sub>2.5</sub> observed at SHT than SUR in winter would be partially attributed to the relatively weak vertical diffusion of PM<sub>2.5</sub> from surface to high latitude in addition to the differences between day and night. However, we agree your comments to avoid possible confusion. Therefore, we just present the RPC results in the first paragraph. The confusing statement was removed. Please lines 253-254, and 271.

4. Lines 370-372 and Figure 8: I don't agree with the statement that the

“diurnal cycle of NOR kept roughly stable” since the magnitude the max-min change for NOR, particularly in winter and spring, is  $\sim 0.04$  while for SOR it is  $\sim 0.06$ . These numbers are not that different. I think it is more the fact that the variation in NOR is not reproducible between the seasons and is not as straightforward to interpret the variation as the SOR is. I think adding some clarifying text about the subtlety of this point would be helpful to the reader. I also suggest adding shading indicating the standard deviations as well as a comment in the figure caption indicating what quantity is plotted (mean, median, etc.). It could be once variability is included that there really isn't variation in NOR, but with the information presented, the reader is not able to judge that.

**Response:**

Thanks for your suggestion. According to the definition of NOR ( $[\text{NO}_3]/([\text{NO}_3]+[\text{NO}_2])$ ), the increase of  $\text{NO}_2$  would lead to the decrease of NOR. However, the NOR at SHT did not see notable decrease from 8:00 to 12:00, when  $\text{NO}_2$  increased significantly by 21.8-61.4%. Apparently, the statement “diurnal cycle of NOR kept roughly stable” brought confusion. Therefore, the statement and Figure 8 (Figure AR1) were revised as suggested. Please see lines 354, 377-386.

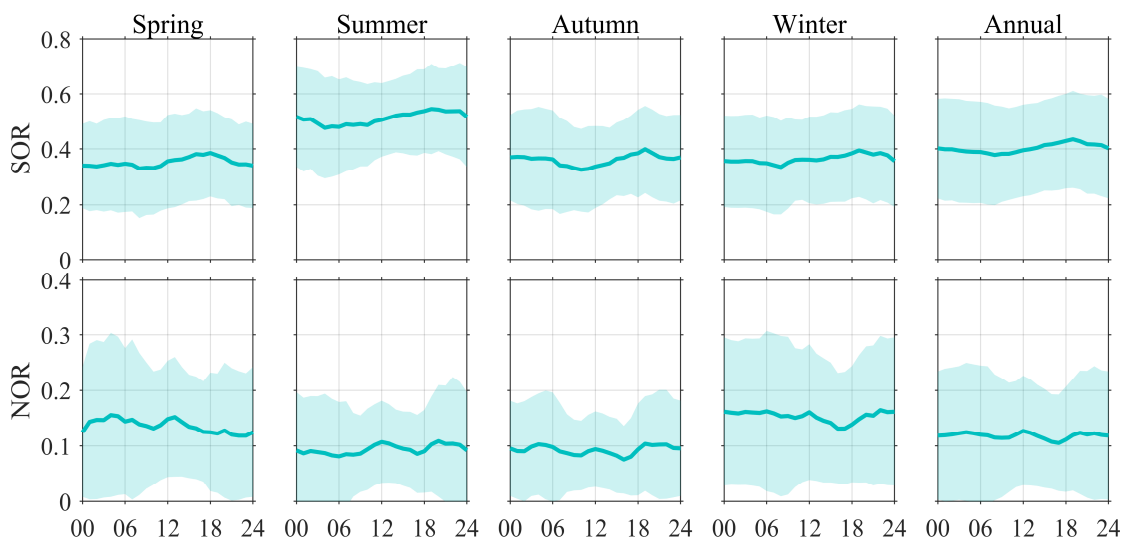


Figure AR1: Diurnal variations of SOR and NOR observed at SHT (blue line) in four seasons and the entire observation period. The line stands for the mean values. The shaded area represents the standard deviation.

5. Lines 471-476: I think this discussion should be moved much earlier in the manuscript as it is an important point for the reader to keep in mind when thinking about the results. I recommend including it at the beginning of Section 3 (before Sect. 3.1) as an overall comment on the interpretation used throughout the section. I think it would also be useful to include the discussion and the figures regarding the back trajectory analysis that were provided in the response to referee document. Placing these added figures and discussion in the supporting information is appropriate.

**Response:**

Thanks a lot for your suggestion. The discussion was moved, and the back trajectory analysis was included. Please see lines 159-165, and 482-486.

Technical:

1. Please consider placing Fig. S1 in the main text so that the reader can follow along more easily with the discussion surrounding the HOA and OOA attribution.

**Response:**

Thanks for noting. Revised.

2. "m/z" should be italicized throughout the text

**Response:**

Thanks for pointing out. Revised accordingly.

3. Line 178: Table S1 is missing from the supporting information. Please add it to the document.

**Response:**

Thanks for noting. Table S1 was added in supporting information.

4. Line 364: vegetables --> vegetation

**Response:**

Thanks for noting. Revised.