In this manuscript, the authors gave a very detailed analysis of observed one year continuous PM2.5 and its chemical components at the top of 632 m high Shanghai Tower (SHT). The data collected were precious, and the topic is of great interest in recognizing vertical PM2.5 characteristics and its formation processes related to emission, chemical production and boundary layer (BL) etc. The analysis is mostly sound, but some details need clarification. I recommend a minor revision and my specific comments listed below.

Specific comments:

- My primary concern is that the study address the PM2.5 and its chemical components at SHT dominating by vertical mixing from surface (most in daytime) and chemical production therein from surface precursors, while omitted the PM originating from transport outside Shanghai. The seasonal winds induced by Asia monsoon are quite different in upstream (ocean or land, most natural or anthropogenic in background) and could impact much at SHT than on the surface. I suggest the authors should refer to this factor or indicating for future research.
- Nitrate (NO3-) and sulfate (SO42-) should be correctly present in the manuscript.
- In line 69, Shanghai is not only one of the most densely populated megacities in China, but also in the world.
- In this study, the heights of BL were important. Please give a brief introduction of BLHs in different season and day and night in Shanghai.
- In line 176-178, the inference is not very exact. The seasonal variations of BLH could be key factor for the similar monthly variations of PM2.5 at SHT and SUR, and related to regional transport, vertical diffusions etc. And I am happy to find you mentioned of regional transport, while did not raise this in conclusion, abstract and other paragraphs.
- In 188-190, the anomalies may reflect the seasonal variations of BLHs.
- In 210-211, "completely" is not very exact because in some synoptic conditions, the mass and energy exchange between free troposphere and within the BL could occur.
- What were the definitions of POA, OOA, and HOA, and their chemical components in this study?
In figure 5, why there was the largest difference of PM2.5 between SHT&SUR in summer, while the largest difference of NOR in winter and spring in figure 7?

In line 370, latitude should be altitude.

In line 374, “since the SO2 level was relatively lower than the other seasons.”, or also because the favorable diffusion and wet scavenging condition of atmosphere in summer.