

Review of “**Mixing-layer-height-referenced ozone vertical distribution in the lower troposphere of Chinese megacities: Stratification, classification, meteorological, and photochemical mechanisms**” by Liao et al.

In this paper, Liao and the co-authors presented a new way to investigate vertical ozone variation in lower troposphere below ~5 km, which is to scale the ozone vertical profile by the mixing layer height (H). In this way, the authors separate the ozone profiles into two parts: in the mixing layer (ML) and free troposphere (FL), taking ozonesonde observation in Beijing and Hong Kong from 2000-2022. Therefore, the authors are able to obtain some new understanding of ozone vertical variation in the two layers, in the interface of the two layers, and at the surface. Otherwise, such understanding may be lost if the conventional height scale is used. Using the H-referenced scale, the authors further characterized three types of vertical ozone profiles in the lower troposphere: FL-ozone dominated, ML-ozone dominated, and uniform distribution. Through meteorological and photochemical interpretations, the authors attempted to explain the vertical ozone variations in the three types of profiles.

Understanding vertical ozone variation is of importance to ozone pollution management at the surface. This paper provides some new understanding in this regard. The topic is also suitable to this journal. The paper overall read well. I recommend acceptance of this paper and provide the authors with the following suggestions for them to consider when revising their paper.

The authors did a good job in the first part of their paper (Figs. 1-7). The second part is also well-written, but a more in-depth investigation is necessary. For example, the meteorological interpretations for the three types of vertical profiles (Fig. 7) also contain signals of the seasonal variations in the meteorological variables. In addition, it is unclear how the Asian monsoon and associated large scale vertical motions impact the H-referred ozone profiles in different seasons. In the end, the mechanisms for the three kinds of ozone vertical profiles are not clearly articulated.

Minor points:

Fig.8, please explain the numbers at the top of each panel in the caption.

L501, Surface ozone, not lower tropospheric ozone, is autumn-high/summer low in Hong Kong. Ozone in the lower troposphere below 5 km is also high in spring in Hong Kong.