

Interactive comment on “Significant impact of the East Asia monsoon on ozone seasonal behavior in the boundary layer of Eastern China and the west Pacific region” by Y. J. He et al.

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We would like to appreciate the Reviewer 2 for the appropriate and constructive comments. We have carefully considered the comments, and made a revision and also added some necessary contents into the manuscript by taking account of all the comments given by the two reviewers. Below we will address the comments point by point.

(1) The fact that the authors have used 3yr time averaged calculations prevents any insight into the development and decay of the East Asian summer monsoon system.

The summer monsoon over East Asia usually is strongest in June, July, or August, and may vary from year to year. At present, however, most studies of the monsoon index are calculated based on the average of the mean values of June, July, and August of

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some meteorological factors for the summer monsoon. The seasonal information is not available from these defined monsoon indexes. The dynamical normalized seasonality monsoon index (DNMI) used in this study, which was developed by Li and Zeng (2002, 2003), is computed based on the grid-by-grid and season-by-season calculations of the climatological wind field. Though the DNMI could characterize the monsoon seasonal variations, we still slightly suspect that it could completely depict the small difference of the monsoon among the different months, particularly for June, July, and August. Therefore, we used 3yr averaged calculations to reduce and avoid the potential deviations during the computation of monsoon index. Based on our calculations, we cannot find any obvious development or decay of the summer monsoon during the three year from the DNMI.

(2) The authors should discuss a little bit about the modeling results and observational data in this study and identify the causes of the discrepancies.

We will add a brief discussion about the comparison between the modeled and observed data into the text.

(3) The impact of a strong or a weak monsoon penetration on the bimodal seasonal patterns of ozone should be compared in the study.

In this study, we applied the dynamical normalized seasonality monsoon index to depict the typical temporal and spatial patterns of East Asia monsoon. It should be noted that the monsoon index can only characterize the main and common features of the monsoon, but not in details, as addressed in answer (1). On the other side, the research of monsoon usually is based on the point of climatological view, and the causes which affect the O₃ variations are quite complicated. Therefore, it is hard to discuss the annual variations of monsoon and ozone for only three years. Actually, during our research period, there seems no clear relationship between the monsoon index and ozone for the annual variations, and it is also hard to separate a strong or weak monsoon year only from the monsoon index. We believe that the regular relationship between the

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variations of monsoon and ozone for the annual variations could become much clearer if covering a longer period, such as 10yr or even more. In this study, we only want to detect the common features between the seasonal patterns of monsoon and ozone. As for the annual variations, we will prepare it for next step.

(4) The authors could further explain the ozone variation by using the atmospheric stability during different monsoon periods (such as pre-onset, onset, active and break, retreat).

To avoid the effect of the inhomogeneous vertical distribution and vertical convection, we used the averaged values of the lower boundary layer (0-1 km) to discuss the O₃ variations and the impact of East Asia summer monsoon. As illustrated in Figure 3 and 4, the main conclusions of this study are based on the boundary layer mean data. Therefore, the influence of the atmospheric stability on the ozone seasonal patterns should be quite small. During the data pre-process, we have already compared the ozone seasonal patterns between the different layers and the surface level among the boundary layer, and also analyzed the distribution patterns of the ozone vertical profile, but not found any obvious features which could be favorable for the analysis of ozone seasonal variations.

We believe that the effect of the atmospheric stability on ozone variations should be different during the different monsoon periods. Our calculations of 3yr average and the boundary layer mean may conceal the difference. As addressed in Reply (3), the monsoon index is a climatological concept, which is not suitable for the detailed discussions, neither in temporal and spatial distributions. In this study, we want to investigate the general features of the impact of East Asia summer monsoon on ozone seasonal variations by the application of monsoon index. It is hard to discuss the monsoon impact on ozone variations too detailed for the temporal and spatial distributions, and it is also not our purpose.

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