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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Lower tropospheric distributions of O_3 and aerosol over Raoyang, a rural site in the North China Plain" *by* Rui Wang et al.

Anonymous Referee #1

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The authors present measurements of vertical profiles of O3 and aerosol by unmanned aerial vehicle, balloon, and LIDAR over a rural site in the North China Plain (NCP) region. The distributions of O3, aerosol number density, and aerosol scattering property in the mixed layer and residual layer are examined. This new vertical profile data is compared against the previous MOZIAC measurements over the Beijing area to assess the increase in the boundary layer O3 over the NCP region. Overall, the observations are valuable and the interpretation is convincing. The manuscript is clearly organized and well written. I would like to recommend that the paper can be accepted for publication after the following specific comments being addressed.

Specific comments:

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Discussion paper

1. Page 1, Line 17: change “still quite limited” to “still limited”.

2. Page 1, Line 30: In-Service. . .

3. Page 2, Line 5: impacts on human health. . .

4. Page 2, Lines 9-10: “actual vertical distribution of O3 is fundamental. . .” is strange. Please rephrase this sentence.

5. Page 2, Line 18: the authors use “Atmospheric boundary layer (ABL)” throughout the manuscript. In the reviewer’s opinion, “planetary boundary layer (PBL)” should be more familiar for the community and readers. The authors should consider to replace the “ABL” by “PBL”.

6. Page 4, Line 17, “some other reactive gases”: please state what species were measured.

7. Section 2: the authors used a set of miniature analyzers including O3 and aerosol number size distribution monitors for the UAV measurements. Did the authors inter-compare these equipment against the more reliable instruments deployed for the ground-based observations? What’s the design of the sampling inlet of the UAV to avoid interference? It would be better if the authors could provide such information, maybe in the supporting materials.

8. Page 5, Line 15 and elsewhere: “vertical profile” instead of “profile”.

9. Page 6, Section 3.1: this section consists of only one paragraph which just documents the measurement data with little interpretation. This seems to be not enough as a section. The authors may need to consider either strengthen the discussion of data or combine this paragraph with other sections.

10. Page 7, Line 23: after sunrise. . .

11. Page 10, Line 20: Heilongjiang

12. Section 3.5: the authors discussed the increasing trend of O3 concentrations over the NCP region, especially in the northern part. A recent study reported a significant increase of O3 at a mountain site (Mt. Tai) in the central part of the NCP region. Moreover, this study presents another non-surface measurement effort in this region, and is hence relevant to the present study. The authors may consider to compare their results with this previous effort.

Sun, L., Xue, L. K., Wang, T., Gao, J., Ding, A. J., Cooper, O. R., Lin, M. Y., Xu, P. J., Wang, Z., Wang, X. F., Wen, L., Zhu, Y. H., Chen, T. S., Yang, L. X., Wang, Y., Chen, J. M., and Wang, W. X. Significant increase of summertime ozone at Mount.Tai in Central Eastern China, Atmos. Chem. Phys., 16, 10637-10650, 2016.

13. Page 13, Line 11: the enhancement of 20-41.6 ppbv in O3 concentrations from 2004-2014 points to the rate of 2.0-4.1 ppbv/year of O3 increase. It would be helpful if the authors compare this magnitude of O3 increase with other previous results.

14. Table 1: I presume all the time given here is local time. Please specify.

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