Atmos. Chem. Phys. Discuss., 15, C2081–C2083, 2015
www.atmos-chem-phys-discuss.net/15/C2081/2015/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Observation of ozone enhancement in the lower troposphere over East Asia from a space-borne ultraviolet spectrometer" *by* S. Hayashida et al.

S. Hayashida et al.

sachiko@ics.nara-wu.ac.jp

Received and published: 30 April 2015

Reply to Anonymous Referee #1

Thank you for your positive evaluation and recognition of our study. We have revised our manuscript in accordance with your comments. The most significant revision was the merging of the Results and Discussion sections into one section, as suggested by both reviewers. Discussion on OCRB was also merged into Section 3.3 with the discussion of annual variation.

Detailed responses to the comments are as follows.

In that paper the authors had reservations about separating boundary layer ozone from free tropospheric using UV spectra measured by OMI. In addition to poor vertical resolution there are uncertainties related to surface albedo, aerosols, and calibration. The analysis of the rows and columns of the Averaging Kernels provides a basis for the ability to detect ozone in the boundary, however the physical limitation remain. Although enhanced ozone in the boundary layer may overcome some of these problems the authors should directly address how.

In our study, the vertical sensitivity for detecting ozone enhancement in the lower troposphere is slightly worse than in Liu et al. (2010a) owing to the assumption of a measurement error of $\geq$0.2%. It is true that the vertical sensitivity to lower tropospheric ozone from UV is limited owing to reduced photon penetration to the lower troposphere and a large smoothing error (i.e., physical limitation), and is further reduced owing to uncertainties related to surface albedo, aerosols, and calibration (Liu et al., 2010a); there is still weak sensitivity to ozone at layer 24 in the retrieval, as shown in the averaging kernels in Figure 4. When the actual ozone enhancement increases, the retrievable signal also increases and can be larger than the ozone retrieval error for that layer, meaning that it can be detected. In the revised manuscript, a discussion on AKs and sensitivity has been added to Section 3.1.4 after merging the Results and Discussion sections.

Some reorganization will make the manuscript more logical and easier to read. For example Section 3.2 should be integrated into Section 4.6. Also suggest that Section 3.1.2 be integrated with Section 4.1 particularly since some of the content is repeated.

We have merged Sections 3 and 4 in the original manuscript into a combined Results and Discussion section (Section 3), and have deleted redundant expressions. We believe this revision has made the manuscript more logical and easier to follow.

At the end of the Section 4.3, the authors claim that the ozone enhancements observed in the Mount Tai Experiment field campaign were roughly consistent with OMI results.

ACPD
15, C2081–C2083, 2015

To further support this claim, it would be beneficial to show that data.

This claim represents ongoing research, and so we have deleted the sentence on the consistency of ozone values between the in situ measurements and the satellite data.

Other minor corrections:

Page 9, line 14: “80” has been revised to “80%”. Page 14, line 7: “two layers at 23 and 24” in the original manuscript has been revised to “the summation of ΔO3 (OMI) of the three layers from 22nd layer throgh the 24th layer.” Figure 3, panel (c3): Title of the y-axis was corrected to “ΔO3 22nd, 23rd and 24th(OMI) [DU]”. (Figure is as before)

Inappropriate references have been removed: Aires, F., et al., J. Geophys. Res., 117, D18304, doi:10.1029/2011JD017188, 2012. Safieddine, S., et al., J. Geophys. Res. Atmos., 118, 10,555-10,566, doi:10.1002/jgrd.50669, 2013. Yan, X., et al., Atmos. Environ., 40, 5262–5273, doi:10.1016/j.atmosenv.2006.04.040, 2006. Some references have been added: Bhartia, P. K. et al., J. Geophys. Res., 101(D13), 18,793–18,806, doi:10.1029/96jd01165, 1996. Chin, M. et al., J. Atmos. Sci., 59, 461– 483, 2002. Martin, R. V. et al., J. Geophys. Res., 108(D3), 4097, doi:10.1029/2002JD002622, 2003.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 2013, 2015.