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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Detection and Classification of Laminae in Balloon-borne Ozonesonde Profiles: Application to the Long Term Record from Boulder, Colorado" *by* Kenneth Minschwaner et al.

Anonymous Referee #2

Received and published: 31 October 2018

General comments:

This manuscript proposed a new algorithm to detect an ozone lamina in the upper troposphere and lower stratosphere (UTLS). Although many previous studies applied different detection methods to ozone vertical profiles in UTLS, most of them suffered from false detection of ozone lamina around the tropopause. The method proposed in this manuscript significantly reduces the false detection of ozone lamina around the tropopause and enables the study of ozone lamina in the whole UTLS region. This method was applied to the massive ozonesonde data at Boulder and provided

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seasonal and height variations of ozone lamina and characteristics of its generation mechanisms. In addition, this method can be applied to the gravity wave study near the tropopause, so that it has wide applications. Thus this method has the possibility to provide significant benefit for the atmospheric community. The manuscript is well written and well organized. The topic dealt in this manuscript is suitable for ACP. Description of the method and its evaluation based on the application to the ozonesonde data look convincing in most parts. Thus I recommend a publication of this manuscript after addressing a few specific comments given below.

Specific comments:

The authors tested the application of the method to tropical and midlatitude ozonesonde data. I would like to mention two points to be considered when applying this method to the Antarctic.

- In austral spring, ozone concentration inside the Antarctic ozone hole becomes nearly zero, so that the ozone lamina definition based on a relative amplitude of ozone perturbation will cause false detection of many small-amplitude laminae. Inside the ozone hole, ozone-enhanced layers have been studied as a measure of cross-vortex mixing (e.g., Moustaoui et al., 2003; Tomikawa and Sato, 2010). In order to apply this method to the Antarctic, the ozone lamina definition based on the absolute amplitude of ozone perturbation could be required.

- Thermal tropopause cannot be definitely defined over the Antarctic in winter, because temperature decreases with altitude even in the stratosphere. In this case, it may not be appropriate to use the thermal tropopause as a tropopause definition. On the other hand, ozone tropopause can be clearly defined even in the Antarctic winter (Tomikawa et al., 2009), so that its usage for the tropopause definition could be better.

The authors reported that the GW lamina maximized around the tropopause. Is there a possibility that it was caused by false detection of ozone and potential temperature lamina around the tropopause? It should be discussed in the manuscript.

Is there a plan to disclose “RIO SOL” to the research community? If yes, please mention it in the text.

p.9, l.4

Please put “-“ between January and February.

p.11, l.15

“Krizan et al (2016)” should be replaced by “Krizan et al. (2015)”.

p.13, l.11

Please put “2011” at the end of this reference.

p.13-16

Isotta et al. (2008), Schmidt et al. (2008), and Thompson et al. (2010) are not cited in the text.

p.17, l.3

“fight” should be replaced by “right”.

References:

Moustaoui, M., H. Teitelbaum, and F. P. J. Valero, Ozone laminae inside the Antarctic vortex produced by poleward filaments, Quart. J. Roy. Meteor. Soc., 129, 3121–3136, 2003.

Tomikawa, Y., Y. Nishimura, and T. Yamanouchi, Characteristics of tropopause and tropopause inversion layer in the polar region, SOLA, 5, 141–144, 2009.

Tomikawa, Y., and K. Sato, Ozone enhanced layers in the 2003 Antarctic ozone hole, J. Meteorol. Soc. Japan, 88, 1–14, 2010.

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