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Atmospheric Measurement Techniques Discussions

Interactive comment on "Interference of sulphur dioxide to balloon-borne ECC ozone sensors over the Valley of Mexico" *by* I. Kanda et al.

Anonymous Referee #2

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Kanda et al. investigate the potential interference of SO2 in O3 concentrations measured by electrochemical cells used in ozone-sondes. They observed drastic drops in the signal of these cells during a number of ozone-sonde launches over Mexico City and assumed that the cause was large plumes of SO2 emitted by a nearby volcano and a large industrial complex. They used the WRF and FLEXPART models to test their hypothesis, as well as conducted lab experiments to evaluate the SO2 interference in the electrochemical cells.

The ozone-sondes observations presented here were accidental and limited to a small number (5). However, they might provide valuable information for future studies suggesting the use of SO2 filters for measurements in polluted atmospheres. This will only be true if the authors give a right proportion to their observations. The electrochemical

cells have been used for decades to measure O3 (Komhyr, 1969). The interferences caused by other trace gases are also well known (e.g. Barnes et al., 1985) and have been also used to detect SO2 plumes at high altitudes (e.g. Morris et al., 2010; Flentje et al., 2010; as cited in this manuscript). Similarly, the SO2 emissions from the Popocateptl volcano and the Tula industrial complex, and their impact in the atmosphere of Mexico City have been extensively studied (e.g. Grutter at al., 2008; de Foy et al., 2009; Almanza et al., 2012, 2013).

Our recommendation in the preliminary review is still valid. The material presented here is more suitable for a technical note rather than for a research article. It is not clear if the manuscript fills the scope of Atm. Meas. Tech. No new measuring/analysis techniques are introduced and the topic has been extensively studied and reported in previous articles.

If the authors decide to continue with the article's submission, they need to consider the following comments:

1) The manuscript needs to be read and corrected by a native English speaker. Some sections are obscure due to grammatical errors.

2) This corrected version of the manuscript is shorter than the original, but is still long. Some paragraphs do not provide enough information and others are repetitive.

3) There is a lack of references in some sections. A better literature review is needed.

4) All acronyms need to be defined the first time they appear (e.g. DOAS, GPS, LST, WRF, FLEXPART, NCEP, WSM, ATI, TLI, CONCAWE, etc.).

5) The number of observations is insufficient to provide conclusive findings. The ozone drops at 5,500 m observed in four ozone-sonde launches may be related with the Popocateptl volcano plume, as suggested and discussed by the authors. But it is difficult to associate (scientifically) the failures in the electrochemical cells with the emissions from the Tula industrial complex using as reference only one observation. In

addition, studies designed specifically to investigate the Tula's impact in the air quality of Mexico City, have found that Tula's plume reach only the city during particular meteorological conditions and operational circumstances of the refinery and/or power plant located there. Similarly, studies conducted by the local environmental authority (RAMA, as defined in the article) have concluded that some industries in the north of the city are still illegally burning dirty fuels, particularly during night-time. Reason why is not uncommon to see high SO2 concentrations in the north of the city during nights and following mornings.

Minor comments:

P294, L24. Which standards (e.g. Mexican standards, USA-EPA, etc.)?

P294-P295. Introduction. Consider that readers of AMT are familiar with the ozone pollution details. Better provide information about the use and history of electrochemical cells to measure ozone and their limitations caused by interferences with other trace gases.

P295, L 11. . . . and destruction. Add reference.

P296, L19-27. More precise objectives are needed. Explain what you are trying to demonstrate/investigate in this particular study, and not the in the main field campaign.

P297, L10-14. Add reference.

P299, L3. SO2 emission sources?

P299, L9-10. INEM2008, reference missing.

P299, L12. For the Federal District emissions indicate the base-year of the inventory.

P300, L6. With the aim of unravelling the life cycle of O3 in MCMA? The O3 problem in the Valley of Mexico has been well documented in the peer-reviewed literature (e.g. http://mce2.org/en/publications).

P300, L15. Do you mean "ascending speed" by "rate of climb"?

P303, L22-26. It would be helpful to indicate the location of the balloon when it reached the 5,500 m height in figure 5b.

P303, L27. How was the thermal ascent of the volcano plume estimated?

P304, L9. Remove this section. See comment #5.

P306, L24-26. What about the month of November? Your study is based on measurements conducted on this month.

P307, L1. Remove this section. See comment #5.

P311, Fig. 1. Define all acronyms. Readers may not go to the main text to find their meanings.

P312, Fig. 2. The light and dark blue and green traces are not easy to distinguish. Better use markers or lines+markers.

P313, Fig. 3. Units? Why is a logarithmic function needed?

P314, Fig. 4. Why not presenting the ozone concentrations in units of ppb?

P315, Fig.5 Use an additional panel to show the wind direction profiles.

P316, Fig. 6. Vertical distribution of O3 concentration and equivalent potential temperature . . ..

P317, Fig. 7. PED SO2 data before 6 am?

P319, Fig. 9. What does OCENTRAL mean at the top of each panel? Instead of using numbers to indicate the months analysed in each panel, write the months' names.

References

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Barnes, R. A., Bandy, A. R., and Torres, A. L.: Electrochemical concentration cell ozonosonde accuracy and precision, J. Geophys. Res., 90, 7881–7887, 1985.

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Interactive comment on Atmos. Meas. Tech. Discuss., 7, 293, 2014.