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Atmospheric Measurement Techniques Discussions

Interactive comment on "A novel Whole Air Sample Profiler (WASP) for the quantification of volatile organic compounds in the boundary layer" *by* J. E. Mak et al.

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The boundary layer is an area of high interest for atmospheric research. Here, reactive emissions from the surface are mixed with long-lived trace gases, and photooxidation takes place. Hence, the examination of this area is important to understand regional chemistry and dynamics, and its influence on air quality and climate. One challenge is the inaccessibility of the air masses between 300-1500 m. Mak et al. (2013) present a novel concept to overcome this challenge using a new sampling method – the WASP. This airborne based sampling system is used to collect vertical profiles from the surface to the top of the atmospheric boundary layer. The concept is introduced, extensive tests

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are presented and first measurement results are discussed.

The manuscript should be published after discussion and inclusion of the following aspects:

1)Due to the novelty of the concept, the experimental description of WASP needs to be very precise and clear. The current manuscript is well written and explains the concept in detail. However, reading through the Title, Abstract, Introduction and the first part of the Experimental Methods, I found it difficult to get to know the concept of WASP. To better introduce the new technique to the reader, the authors should carefully define the basic concept and use at the beginning of the manuscript. Especially, in Section 2.1 the authors should consider to restructure the text in order to present the idea of their new sampling system right from the start of the manuscript. E.g. the description starting from p.4157, l.17 could be used as first paragraph of this section. Like that, the reader has an image of the aircraft, the location of WASP and its operation principal. Also, very important to note is that the WASP is a sampling device, and the analysis is done offline in the laboratory. Details, how to "mark" the air sample, calculate sample altitudes, and prepare the 150 m tubing could be part of a second paragraph in Section 2.1. Additionally, it would be nice to have a photograph of the set-up used.

2)The following paragraphs in Section 2 treat in detail possible interferences or sampling artifacts. The withdrawal flow direction seems to be the major problem, which is presented in Figure 6. Comparing the text with this Figure, I find inconsistencies. The text says that for the reverse withdrawal direction peak heights decrease as function of the sampling time. But in the graph the red peaks are pictured to increase with the sampling time. Could you please clarify here in which direction the air is drawn and for which occasion a decrease (or increase) of peaks is observed?

3)In order to understand the presented first results, a description of uncertainties is necessary. Certainly, both the PTR-TOF-MS and the WASP have uncertainties and influence the overall detection limit. Could you please provide these values?

AMTD
6, C1371–C1373, 2013

4)Did you test the WASP for the possibility of losses of VOCs? Are reactions on the surface of the stainless steel tubing possible? Why was this material chosen, and not Teflon tubing, or a Teflon coating?

5)How was the calibration of the PTR-TOF-MS performed? Was the WASP included in the calibration?

6)First results are presented in Section 3 and discussed. The diurnal variation of isoprene and MVK&MACR are shown in Figure 11 as well as the temperature and relative humidity profiles of the day. In order to get a better view on the processes that are important for the observed profiles, it would be good to include the height of the top of the boundary layer during the day. Possibly, you could include potential temperature or additional measurements?

7)One important point is missing in your presentation of results: Is it possible to include a comparison to parallel observations during the campaign which are provided by commonly used and established techniques? Or if this is not possible can you compare your results to the literature and expected values? Or use a boundary layer model to estimate the magnitude of the presented VOCs?

8)A question of general interest: What is the advantage of the WASP in comparison to available online measurement methods?

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 4153, 2013.