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Comment

Interactive comment on “A horizontal mobile measuring system for atmospheric quantities” by J. Hübner et al.

J. Hübner et al.

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Dear Sir or Madam,

we are very grateful for your comments made with the aim of enhancing our paper for AMT. Before we answer the comments in particular, we want to say some words in general. We haven't discussed the measurement results in section 3.4 in more detail, since the paper was aimed at the technical description of the newly developed Horizontal Mobile Measuring System (HMMS). To discuss the variations, especially in the quantities (temperature, humidity and trace gases) influenced by turbulent exchange processes, would make investigations of several further measuring systems necessary, which we deliberately decided not to show in this paper for the following reasons:

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(i) further documentation would result in an overly large paper and would miss the main topic of the paper and the journal and (ii) detailed investigations of the HMMS' results and the linkage with other measuring systems is reserved for another planned publication. We hope you will understand our reasons, but nevertheless we will improve our paper with your comments and want to address now the individual comments.

Yours sincerely,
Jörg Hübner (First author)

1. *4554-line 23: Maybe a short explanation of what is meant by “quasi-stationary secondary circulation” and the relation to measuring horizontal gradients would be useful here.*

Answer:

We will add a short definition of secondary circulations at the end of 4554-line 24. A detailed description can be found in Glickman (2000), and for site specific conditions Eder et al. (2013).

Additionally we will add a short linkage between secondary circulations and the horizontal structures measured with the HMMS in the introduction (see next answer). We installed the HMMS in order to find sinks and sources in the horizontal structures that would allow the drawing of conclusions on secondary circulations and other specific effects found near a forest edge. For a detailed discussion about this topic, we have to refer to planned publications.

2. *4555-line 3: Maybe I missed it, but why exactly do you measure O₃ concentration? A little more background information would be helpful here.*

Answer:

Foken et al. (2012) have shown that trace gas fluxes/concentrations, especially of O₃, constitutes a good tracer for coherent structures and is therefore a good tracer for exchange processes. So we decided to also equip the HMMS, in addition to some O₃ flux tower measurements, with a O₃ flux monitor to measure

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concentrations along the transect. We will add some more background information at 4555-line 3.

3. *4570-line 7: In figure 6(g) there are marked changes in nighttime CO₂ concentration within the forest as well as in the clearing. Although this is a technical paper, I miss a more detailed discussion/interpretation of these changes.*

Answer:

Foken et al. (2012) and Serafimovich et al. (2011) have shown that there will be a concentration accumulation during uncoupled situations between free atmosphere and near-ground atmosphere. This is often present under stable conditions during nighttime. The variations/lower concentrations around 21:00 CET are caused by a change in the wind direction from northerly to easterly winds and the import of colder/CO₂ depleted air. We have added some more words about this.

4. *4570-line 12: I also miss a little more discussion about the increase in O₃ concentration in the afternoon. Where does this increase derive from? (point 2)*

Answer:

The significant gradient between forest and clearing is certainly the result of the good weather conditions during this day (28 June 2011), as the ozone formation is mainly a sun-induced photochemical reaction: $\text{NO}_2 + \text{O}_2 + h\nu \rightarrow \text{NO} + \text{O}_3$. We have also added here some more interpretation of the increase.

5. *4572-line 4: I would start the conclusion just here. The previous sentences should be put to the methods or to the discussion.*

Answer:

Thanks for the advice, but we differ here in our opinion, as the first parts of the conclusion contains a summary of the technical practicability/implementation of the used components.

Glickman, T. S. (Editor) (2000). Glossary of meteorology, 2nd edn. Am. Meteorol. Soc., Boston, MA, p. 855.

Eder, F. et al. (2013). Coherent structures at a forest edge: Properties, coupling and impact of secondary circulations. Bound.-Lay. Meteorol., 148 (2), pp. 285-308. DOI: 10.1007/s10546-013-9815-0

Foken, T. et al. (2012). Coupling processes and exchange of energy and reactive and non-reactive trace gases at a forest site – results of the EGER experiment. Atmos. Chem. Phys., 12 (4), pp. 1923-1950. DOI: 10.5194/acp-12-1923-2012

Serafimovich, A., Thomas, C., and Foken, T. (2011). Vertical and horizontal transport of energy and matter by coherent motions in a tall spruce canopy. Bound.-Lay. Meteorol., 140, pp. 429–451. DOI: 10.1007/s10546-011-9619-z.

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