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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Eddy covariance VOC emission and deposition fluxes above grassland using PTR-TOF" *by* T. M. Ruuskanen et al.

T. M. Ruuskanen et al.

taina.ruuskanen@helsinki.fi

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The authors thank the referee for the thorough review, constructive comments and suggested corrections. We have carefully gone through them and improved the manuscript. Here are our responses to the individual comments, the page, line etc numbering refers to the manuscript in ACPD.

Comment 1: As the referee pointed out, this was not intended a long term study, and we clarified that this was a short term case study and wrote: "Here we present an 8 day case study of fluxes for three sunny periods from August 2009..:" The performance of the PTR-TOF for flux measurements and their consistency with well established PTR-MS DEC flux measurements at this site has been shown by Müller et al., 2010 for the case of methanol as referenced e.g in the intro and methods. The introduction was

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carefully read trough, but we could not cut it in half. The intro reflects the focus of the ms, a study of the biosphere-atmosphere exchange of a wide range of volatile organic compounds that are involved in several atmospheric processes.

Comment 2: The air exchange rate including the exchange in sample lines and the instrument was longer than the data acquisition rate, but sufficient to catch the sub second changes in the concentrations of the measured VOCs. We clarified our methods: “Any time shift between the vertical wind velocity and the VOC concentrations, which were smoothed and de-trended to this end, due to the residence time of the air in the tube and differences in computer clocks was determined by the maximum covariance method in a ± 2 s time window and removed (note that negative time shifts may occur if the clock of the sonic anemometer computer lags behind the PTR TOF computer more than the tube lag time).” We changed the “true lag time”, that was a misleading term, to ”calculated lag time” that we hope to represent the lag time that was calculated after we combined the wind and VOC concentration datasets where we took into account the time delay caused to the VOC concentration from the air sampling and exchange in instrument.

Comment 3: as the referee pointed out, the forbs and graminoids, that grown in the measured field, are not in general monoterpene emitting species, with the exception of clover that was also found to emit terpenes in the plant screening study for isoprene and monoterpene emission by Hewitt and Street (1992). Clover is one of the dominant forbs that grow in the Stubai field (Wohlfahrt et al., 2008) and the species found to emit both mono- and sesquiterpenes. We added to the text: “Laboratory PTR-TOF and adsorbent sample GC-MS measurements confirmed that mono- and sesquiterpenes are emitted during drying of clover, one of the forb species growing at the field site (Brilli et al., in preparation). Also Hewitt and Street (1992) reported that clover can emit monoterpenes, but not isoprene, and did not screen for other VOC emissions.”

The monoterpene deposition was also puzzling for us and we found that understanding it required a detailed analysis to understand how often and why this type of deposition

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occurred – this analysis is presented in detail in a dedicated paper covering both the 2008 and 2009 growing seasons that has been recently submitted by Bamberger et al. In order to convey the basic message of the story behind the monoterpene deposition necessary to comprehend the data presented in this paper we have added the following text to section: "However, the deposition of terpenoids comes as a surprise, since this group of compounds is typically associated with emission only (Kesselmeier and Staudt, 1999), although Noe et al. (2008) observed deposition of monoterpenes to non-emitting species in a laboratory experiment and Himanen et al. (2010) suggested that non-emitting plants may be protected by deposited semivolatiles from neighboring sesquiterpene emitters. As shown in detail in Bamberger et al. (submitted), monoterpene deposition occurred during a period of approximately five weeks following a hail storm which triggered large monoterpene emissions from damaged coniferous trees surrounding the study site on the valley slopes. Following the hail storm, ambient monoterpene concentrations were significantly elevated, which represents the presumed cause for the observed deposition to the site which otherwise exhibits close to zero monoterpene fluxes (Bamberger et al., submitted)."

Comment 4: a reference to Custer and Schade (2007) was added to the text.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 21077, 2010.