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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.

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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 on Section 2.2, line 6: we used the planar fit method and corrected the text to:" ..applied a coordinate rotation of the wind data according to the planar fit method (Wilczak et al., 2001)..."

Comment on Section 2.2, line 6: we smoothed the de-trended VOC concentration, clarified the text to: "Any time shift between the vertical wind velocity and the VOC

concentrations, which were smoothed and de-trended to this end,..."

Comment Section 2.2, line 8-10, refresh rate of the measurements, negative delay or lag time: 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 $\pm$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 on Section 2.2, first paragraph: We acknowledge the importance of frequency correction for EC measurements, which has been lacking from the field of VOC flux measurements since it requires higher frequency measurements the ones used in DEC method for spectral analysis. The frequency corrections should be done separately for neutral, unstable and stable conditions (e.g. Massmann, 2000) and the correction terms may be compound specific; since tube damping, tube and instrument delay etc effects depend on the species properties. In addition the ecosystem CO_2 and energy flux corrections are sufficiently large dataset e.g. on annual basis and should be done for a longer than an 8 day dataset presented in this ms. The need for uniform spectral corrections has been acknowledged for the long term CO_2 and energy exchange studies (workshop summary by Massmann Lee, 2002) and proper frequency corrections of VOC fluxes, is indeed an important topic that should be address in a detailed study in the future. We added to paragraph 2.3 "High- and low pass filtering of

signals occurs due to a finite averaging interval (30 min), signal de trending, damping and phase shift due to effects such as sampling through a tube, imperfect sensor time response, sensor separation, etc., leading to an underestimation of fluxes (Massman, 2000). Proper correction for these effects requires a detailed co spectral analysis of a larger data sample (e.g. Wohlfahrt et al., 2005) than available from the 8 day study period and thus we decided not to correct for high and low pass filtering effects."

Comment on Section 3.1: Changes in air density due to fluctuations of air temperature and/or humidity do not affect VOC concentrations measured with PTR technology and thus the so called WPL correction (Webb et al., 1980) was not applied – we have added a corresponding sentence to section 2.3.

Comment on Section 3.3, line 25: removed repetition.

Comment on Fig. 5: corrected to the wrong day in figure caption.

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