

Interactive comment on “Flux measurements of biogenic VOCs during ECHO 2003” by C. Spirig et al.

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GENERAL COMMENTS

The paper is well written and the experiment as well as the data analysis is conducted and described very carefully. The results give us valuable information on the canopy scale emissions of biogenic VOCs, which can be used to assess the up-scaling of leaf-level emission measurements and as input to BVOC emission inventories and models. However, there exist a couple of issues, which should be taken care of, before publication in the ACP.

SPECIFIC COMMENTS

The major shortcoming of the paper lies in the so-called “expansion” of a VOC concentration data. This data processing method involving the expansion of each VOC

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concentration measurement, originally conducted with integration time of 0.2 seconds to fill the whole 3 second sampling cycle, leads to un-necessary reduction of the systems ability of measuring the high-frequency contribution of the eddy flux. This leads to the loss of information on the flux at frequencies higher than 0.17 Hz, which is the Nyquist frequency derived from 3 second measurement cycle. If the measurement systems are capable of measurements of VOC concentrations at response time of 0.2 seconds, there are no real advantages in the data “expansion” method described here, as the measurement system would be capable of measuring the turbulent fluxes up to the frequency of 2.5 Hz. I would therefore suggest calculating the fluxes as the covariance of real 0.2 second data of wind and concentrations at least for the fast PTR-MS on the west tower.

On page 6609 the time resolution of the VOC concentration measurement is discussed. However, it seems that there is some confusion between time resolution and the measurement response time. The time resolution of these measurements is defined by the measurement interval whereas the response time is a feature of the instrumentation and defines how quickly the instrument responds to a change in the concentration. The response time of the instrument is the factor that defines the high frequency response of the flux measurement system rather than the time resolution. The response time of the system can be determined by feeding a step change into the input of the system. If the VOC pulse, whose measurements are shown in Figure 3 has a step change, it seems that the response time of the system would more than one second. The authors do not mention which of the instruments this data is from. Is this instrument the fast response PTR-MS, or the older type with the response time about one and half seconds? It would be interesting to see also similar figure using the data from the other instrument with different response time.

The method for calculation of covariances in spectral space should be described more clearly. Also it is not clear if the described method, requiring transformation to spectral space and back, is more efficient than direct calculation of covariance? As this effi-

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ciency comes at the expense of direct measurement of high frequency contribution of the fluxes, calculation of the fluxes in real space with original fast response data would result in a more direct flux measurements with less empirical corrections needed.

For the calculation of night time fluxes the mean time lag could be used. In this way a flux value could be obtained during the times when detecting the maximum covariance is not possible, even though the uncertainty would be larger than the flux.

From the ogive shown in the figure 6 it seems that there is no flux signal of mass 69 at frequencies higher than 0.07 Hz. This is quite much lower than the theoretical high frequency of 0.17 Hz. What could be the reason for this difference? From which instrument this data is from? Apart from ogives, it would be interesting to see or hear if the power spectra and co-spectra obey the $-2/3$ and $-4/3$ laws, respectively.

On page 6624 normalized emission fluxes are given. These are calculated using mean fraction of oaks around the measurement tower. Should each half-hourly flux value be weighed by the relative contribution of oaks in the footprint before calculating the standard emission factor?

P. 6620 line 1: Normally two times standard deviation is used as error-bar. Is there a specific reason to use three times standard deviation?

P. 6621 line 24 and p. 6622 line 15: The procedure of expanding the PTR-MS data results the loss of flux above the frequency of 0.17 Hz, which is the Nyquist frequency, not 0.3 Hz.

TECHNICAL CORRECTIONS

P 6619 line 1: ...mid Europe. should be ...Central Europe. line 16: ...isoprene oxidation MVK... should be ...isoprene oxidation product MVK... line 23: ...half hours. should be ...half hour periods. line 25: ...validated fluxes... would be better understandable as ...fluxes that pass the quality criteria...

P 6629 Reference to Kaimal, 1972 seems incomplete.

P 6633 Figure 1 is not very informative as the color coding is not fully explained. Please include more detailed description of color coding.

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