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Interactive Comment

Interactive comment on "Calculations of automatic chamber flux measurements of methane and carbon dioxide using short time series of concentrations" *by* N. Pirk et al.

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Some nuances regarding trace gas units should be clarified in this manuscript before its final publication, in order to describe a proper and useful methodology to perform chamber flux measurements.

First, the authors should specify the exact meaning of "concentration" when this word is used within the manuscript, since density, molar fraction or mixing ratio are all measurements of concentration with different physical definitions. In this sense, it is important to realize that molar fraction should correspond to the molar ratio of carbon dioxide with reference to dry rather than moist air, to avoid erroneous flux estimates.

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Processes such as heat conduction, compression-expansion, or dilution can alter the quantity of the measured trace gas if we use density or molar fraction referred to moist air (Kowalski and Serrano, 2008). This fact is crucial when we confine a specific air volume to monitor the rate of change of a trace gas quantity in order to measure plant or soil gas exchange fluxes. Water vapor molecules are emitted by leaf and soil pores via transpiration and evaporation processes, respectively. This addition of water vapor molecules to the confined air dilutes the trace gas we intend to measure, causing a decrease in both the trace gas density and molar fraction referred to moist air, and also can cause spectral cross-sensitivity due to absorption band broadening and inherent instrument cross-sensitivity. There are a number of means to correct for the dilution error: one can desiccate air prior to its sampling by the infrared gas analyzer (IRGA), utilize an IRGA that measures molar fraction referred to dry air (this is not the case for those mentioned in the manuscript), or convert trace gas units after data acquisition as explained by Pérez-Priego et al. (2015). The latter two options require accounting for humidity in some way, which does not appear to be possible with the instrumentation used by Pirk et al.

The flux community should be careful when using IRGAs that do not directly measure pressure and temperature, since both variables are necessary to transform the gas density derived from infrared absorption (what the IRGA measures) into molar fraction.

References

Kowalski, A. and Serrano-Ortiz, P.: On the relationship between the eddy covariance, the turbulent flux, and surface exchange for a trace gas such as CO2, Boundary-Layer Meteorology, 124, 129-141, 2007.

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