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Atmospheric Measurement Techniques Discussions

Interactive comment on "Photoacoustic measurement may significantly overestimate NH_3 emissions from cattle houses due to VOC interferences" *by* Dezhao Liu et al.

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We were always surprised how confident researchers have been in trace gas instruments using broadband light sources for the determination of gaseous emissions from agriculture. The present paper focuses on interferences occurring in ammonia concentration determination by INNOVA instruments. It convincingly shows the severe limitations of this measurement technology and documents the strong influence of other gases on the readout of these devices. Reliable concentration measurements need in addition the determination of a large variety of compounds in order to perform the suggested correction algorithms. This is a paradoxical situation, as such measurements

need complex and costly instrumentation that will make the use of broadband filter-based instruments redundant. In some cases cheaper NH3 passive samplers or liquid impingers can be used as a robust and reliable alternative, if high time resolution is not required. Innova-based NH3 concentration measurements are likely influenced by compensating errors. The positive interferences discussed in this paper focus on the detection side, but in parallel there are potential losses of NH3 in the inlet tubing/lines and switching valves, especially in multiport systems. Within livestock production systems rather high dew points are present that facilitate absorption onto most types of surfaces. Often low flow rates are used, tubing is not heated, and some inlet filters are put in place to protect the analyzer from dust ingress, which all exacerbate the adsorption/desorption problem.

It is also striking that in many peer-reviewed articles reporting emission data based on Innova or similar instruments, detailed information on the sampling and analytical system are missing, which prevents a critical re-evaluation of such data. Consequently, emission factors based on these instruments should be taken with great caution.

Fifteen years ago, we investigated in detail the dependence of the concentration output, for a large range of CO2-CH4-N2O-H2O mixtures, of three different Innova's (1312, 1314) as a function of the cell temperature and the water vapor (dew point). An overview of the measurements is given in the supplement. These analyses are the base of the evaluation algorithm developed by Flechard et al. (2005) for the determination of N2O concentrations, which showed the large influence of CO2, water vapour and temperature. Another striking result was the large influence of the water content and the cell temperature on the CH4 concentration. The contribution of H2O to the CH4 raw signal depends on the ratio of the two gases. It will e.g. be less important in cow stable, compared to our INNOVA experiment where CH4 was only a couple of ppm.

Only in case Innova devices are operated in a temperature-controlled environment, with the dew point being kept constant, can reliable CH4 measurements be made.

Reference Flechard, C. R., Neftel, A., Jocher, M., Ammann, C., and Fuhrer, J.: Bidirectional soil-atmosphere N2O exchange over two mown grassland systems with contrasting management practices, Glob. Change Biol., 11, 2114–2127, 2005.

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Please also note the supplement to this comment:
https://www.atmos-meas-tech-discuss.net/amt-2018-412/amt-2018-412-SC2-supplement.pdf

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