2 case studies of N_2O measurements by eddy covariance during field campaigns: data analysis and uncertainty sources.

Agnès Grossel [a], Jordan Bureau [a], Benjamin Loubet [b], Patricia Laville [b], Raia Massad [b], and Catherine Hénault [a]

[a]INRA, UR 0272 Science du sol, Centre de recherche d'Orléans, CS 40001 Ardon, 45075 Orléans cedex (France)

[b]INRA, UMR EcoSys, F- 78850 Thiverval-Grignon (France).

Evaluations of N_2O fluxes by the eddy covariance method remain challenging because of the high sensitivity and high frequency required in N_2O concentration measurements. Two datasets from different field campaigns with the same QCL gas analyzer measuring N_2O, H_2O and CH_4 by absorption spectroscopy (Aerodyne Research Inc.) were compared with the focus on signal quality control and flux error analysis. The first dataset was recorded from 6 to 27 June 2013 with a 2 m high mast over fertilized grasslands, during the inter-comparison INGOS campaign for N_2O flux measurements at Easter Bush (Edinburgh, UK). The second dataset was recorded from 1 April to 18 May 2015 with a 15 m high mast within a cropped area mainly dedicated to cereals and rapeseed crops in Centre France. Both campaigns enabled to capture emissions following fertilizations. Offset drifts on the raw N_2O mixing ratio signal were observed during the second campaign probably because the gas analyzer was housed in a simple vented box which could not fully dampen temperature variations. Oppositely no drift was observed during the first campaign. We used a recursive running mean filter on raw signal (Mamarella et al. 2010) and the time constant needed for the filter was determined using Allan variance analysis. By this way, the artificial fluctuations of the estimated flux due to raw signal drift were successfully eliminated.

Mammarella, I., Werle, P., Pihlatie, M., Eugster, W., Haapanala, S., Kiese, R., ... & Vesala, T. (2010). *Biogeosciences*, *7*(2), 427-440.