

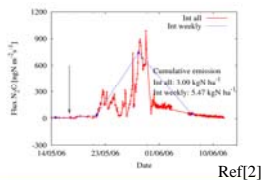
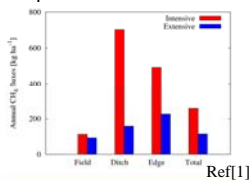
Eddy covariance observations of CH₄ and N₂O Towards more accurate emission estimates

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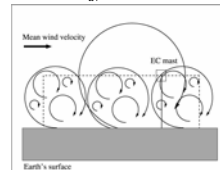
Introduction

The uncertainty in annual estimates of CH₄ and N₂O over agricultural fields is almost always 50% or higher when chamber measurements are used due to a combination of spatial and temporal variation of the emissions.



Eddy covariance method provides a good alternative to determine emission estimates on a hectare scale that also have continuous coverage in time.

$$EC_{wc} = \frac{1}{T_{av}} \int w'(t)C'(t)dt$$



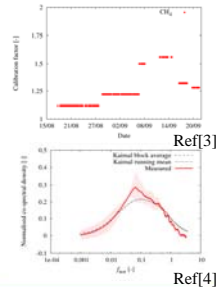
Systematic errors in EC flux measurements

$$EC_{wc} = EC_{wc}^{meas}$$

↓

$$EC_{wc} = \chi_{cal} \chi_{low} \chi_{high} EC_{wc}^{meas} + \chi_{cal} \chi_{Webb}$$

After corrections, the 30 min EC fluxes can increase by even more than 100%.

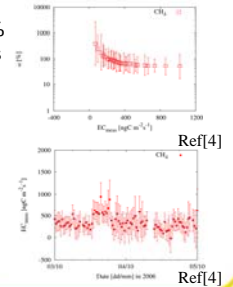


Uncertainty in 30 min EC flux measurements

$u(EC_{wc})$ can be much larger than 100% for a 30 min EC flux. This uncertainty is mainly caused by $u(EC_{wc}^{meas})$ which is assumed to be equal to the random one-point uncertainty.

$$u_{op} = \frac{2}{M} \sigma_{w'c'} = \frac{20z}{\sqrt{T_{av} U}} \sqrt{(w'c')^2 - (\overline{w'c'})^2}$$

$$= a EC_{wc}^{meas}$$

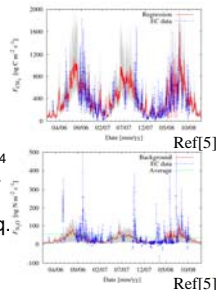


Annual CH₄ and N₂O balance

The field emissions were derived by

$$F_{wc} = \int_0^h \frac{\partial C}{\partial t} dz + \overline{w'c'}|_{z=h}$$

and the average annual field CH₄ and N₂O emissions were 165 (±13%) kg CH₄ ha⁻¹ yr⁻¹ and 20 (±34%) kg N₂O ha⁻¹ yr⁻¹. The total field greenhouse gas balance was estimated at 15 Mg ha⁻¹ yr⁻¹ CO₂-eq. with contributions of 33, 26 and 41% by CO₂, CH₄ and N₂O, respectively.



Conclusions

- The annual emission estimates of peat areas are very uncertain.
- Corrections should be applied for systematic errors in EC flux measurements.
- The uncertainty in a 30 min EC flux is mainly caused by one-point uncertainty and can be larger than 100%.
- Assuming 100% data coverage, the uncertainty of a monthly EC flux average can be even smaller than 10%.

References: 1. Schrier-Uijl et al., BGD, 2008; 2. Kroon et al., Nutr. Cycl. Agorecosyst., 2008; 3. Kroon et al., BG, 2007; 4. Kroon et al., AFM, submitted; 5. Kroon et al., Eur. J. Soil Sci., submitted.