**1. Methodology**

**Experimental set up**

- **Ecosystem:** Production crop - sugar beet (2016)
- **Measurements:**
  - Wind velocity (Gill HS-50)
  - N₂O mixing ratio (Aerodyne Research Inc. QCLaser)
  - Meteorological and soil conditions (half-hourly monitoring)

**Data treatment**

- Use of EddyPro® Software (LI-COR) to process data
- Time series quality was assessed following Vickers & Mahrt, 1997
  - The test for skewness and kurtosis was discarded due to excessive flagging of N₂O time series.
- Timelag correction was based on covariance maximum with a default value
  - The automatic procedure of timelag optimization implemented by EddyPro® gave unrealistic results and was thus discarded.

**Spectral corrections**

- Comparison of two methods for spectral correction factors (SCF)
  - EddyPro approach: Fratini et al. (2012) for tube attenuation and Horst & Lenschow (2009) for sensor separation → SCF_{EddyPro} = SCF_{H&L09} x SCF_{FR12}
  - Global approach: one transfer function (adapted Lorentzian) based on ensemble cospectra of N₂O and sensible heat → SCF_{Global}

Based on high quality (co)spectra in the dataset, the step of Fratini et al. (2012) and the global approach perform a linear regression between SCF and wind speed. This regression is then applied to half-hours of poorer quality.

**2. Flux analysis**

**Influence of farming practices and weather**

- A 6% difference in cumulated corrected fluxes between methods was found.
- Higher differences between methods were observed for stable conditions at low wind speed, which was attributed to SCF_{H&L09}
- The global approach gave different SCF depending on whether the intercept was set to 1 or not (7% difference in cumulated corrected fluxes).

- Cumulated emissions from fertilization to harvest: 5800 µmol N₂O m⁻² (to be refined)
  - This represents a 1.2% loss of N inputs via N₂O emissions, which is in agreement with IPCC 2006 estimates of emission factor for managed soils.
  - When converted to CO₂-eq, it corresponds to about 20% of the mean annual GHG budget of the experimental site.

- Precipitation (and consequently SWC in the top soil) and some farming practices were the main drivers, with the specific following observations:
  1. Triggered by mineral fertilization and rainfall, an emission burst occurred (30% of total N₂O emissions)
  2. The emission burst was inhibited after sowing
  3. When vegetation development begins, no more important peaks are observed.

**Daily variability of N₂O fluxes**

- Cyclical variations of N₂O fluxes are observed at a daily scale.
- These oscillations are more in phase with the surface temperature (Tsurface) than with the soil and air temperatures (Tsoil and Tair).

**3. Take-home message**

- Cumulated N₂O emissions reached 5800 µmol m⁻², corresponding to 20% of mean annual GHG budget
- 30% of N₂O was emitted between the first fertilization and sowing
- No emission burst was observed after crop development
- Emission peaks interrupted at sowing
- Flux oscillations in phase with surface temperature
- Spectral correction methods should be further investigated

**Acknowledgments**

This research is funded by the Fonds de la Recherche Scientifique – FNRS (Belgium)
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