N_2O flux short-term response to meteorological solicitations and farming practices in a fertilized crop

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EXPERIMENTAL SET-UP

Ecosystem :

- Production crop - Sugar beet (2016)

Measurements :

- Wind velocity (Gill HS-50)
- N_2O mixing ratio (Aerodyne Research Inc. QCLaser)
- Meteorological and soil conditions (half-hourly monitoring)

EC data processed with EddyPro® (LI-COR software)

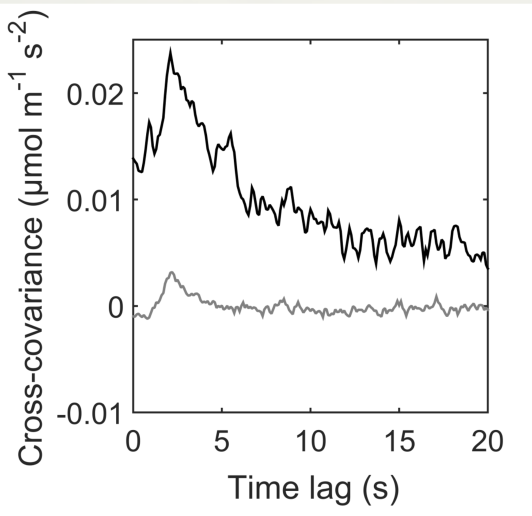
EC DATA TREATMENT / N_2O specifics

➢ **Quality of timeseries following Vickers & Mahrt, 1997**

⇨ Test parameters were adjusted specifically for N_2O timeseries

➢ **Timelags assessed by searching for covariance maximum**

⇨ Method suitable during peaks (black) *and* periods of background flux (grey)



➢ **Stationarity and turbulence by Foken & Wishura (1996)**

⇨ Quality classes (Mauder & Foken, 2004), level 2 discarded

➢ **Influence of friction velocity**

⇨ Selection of data to minimize the influence of N_2O flux drivers (fertlization, SWC,…)

⇨ Still, difficult to untie the influence of u* and temperature

⇨ Use of CO_2 fluxes to assess the u* threshold.

EVALUATION OF UNCERTAINTIES

➢ **Random Error (RE)**

⇨ Estimated by the RMSD from zero of the covariance function at a far away lag (e.g. 200 s) following Langford et al., 2015..

➢ **Sensitivity to spectral correction (SC)**

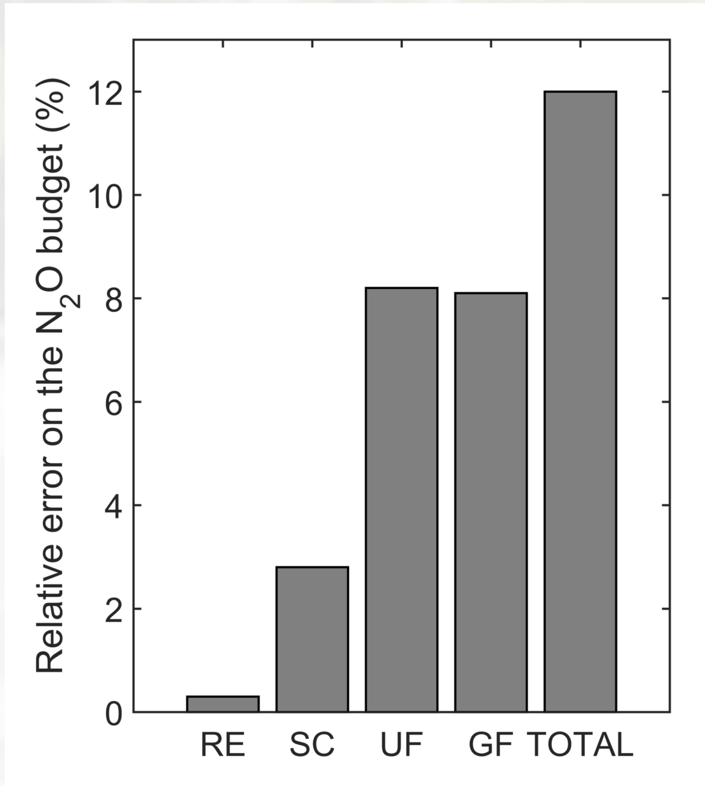
⇨ Uncertainty approximated via the 99%-confident interval of the regression between correction factor and wind speed

➢ **Sensitivity to u* filtering (UF)**

⇨ Lowest and highest reasonable thresholds determined with normalized CO_2 fluxes

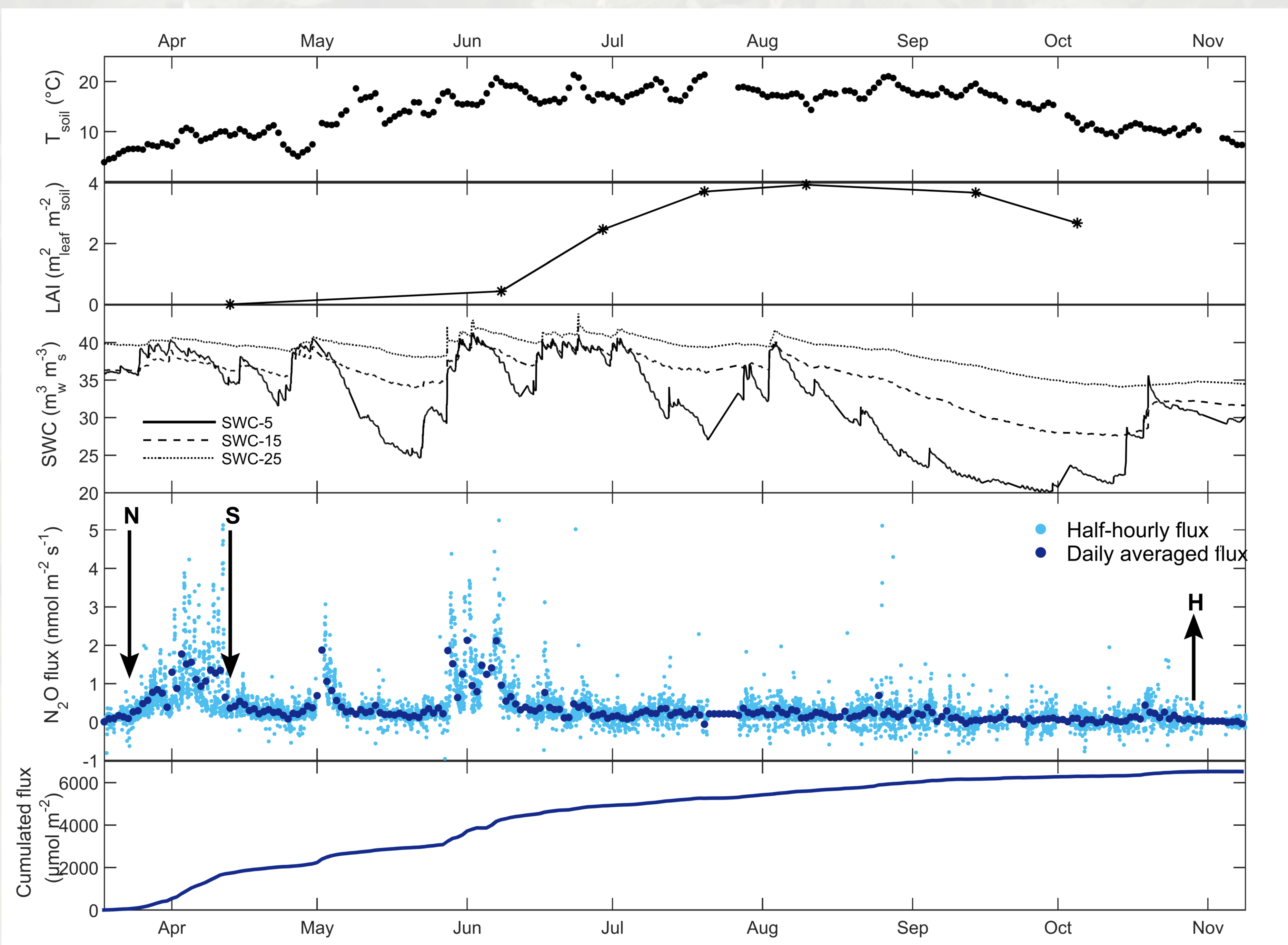
➢ **Sensitivity to gap-filling (GF)**

⇨ Uncertainty calculated daily as 1.96*SD of daily mean or of a rectangular moving average if less than 18 half-hours available in a day.



Uncertainty on the N_2O budget	12 %
Uncertainty on the GHG budget (N_2O + CO_2)	3 %

RESULTS – Dynamics from fertilization (F) to harvest (H)



➢ **N_2O emissions from fertilization to harvest : 6520 (±775) µmol N_2O m^{-2}.**

⇨ This represents a **1.3% loss of N inputs** via N_2O emissions, slightly above IPCC 2006 estimates of emission factor for managed soils (1%).

➢ **When converted to CO_2-eq, it weighed for 22% of the net GHG balance of the experimental site (Buysse et al., 2017).**

⇨ Importance of including N_2O when measuring gas exchanges and doing so at high temporal resolution for improved estimates.

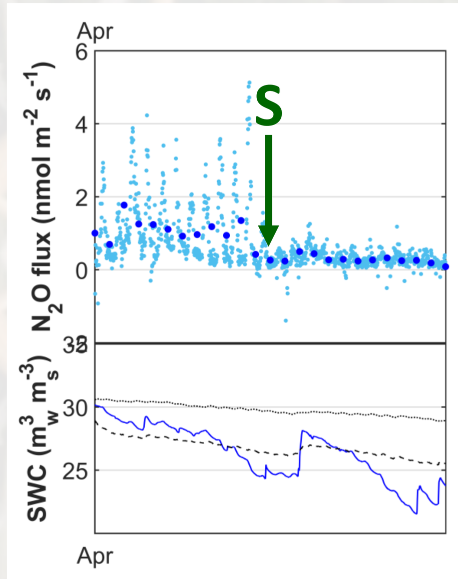
Influence of weather and farming practices

➢ **30 % of N_2O fluxes were emitted between fertilizer and sowing (S)**

⇨ Favorable conditions for N_2O production with fertilization (136.5 kg N ha^{-1}) and precipitation (SWC ~ 40%)

➢ **The first emission burst was inhibited after sowing (significant decrease of 70%)**

⇨ This suggest that the preparation of seedbed, by disturbing the top soil layer, relocated active micro-organisms at a greater depth which decreased N_2O production.



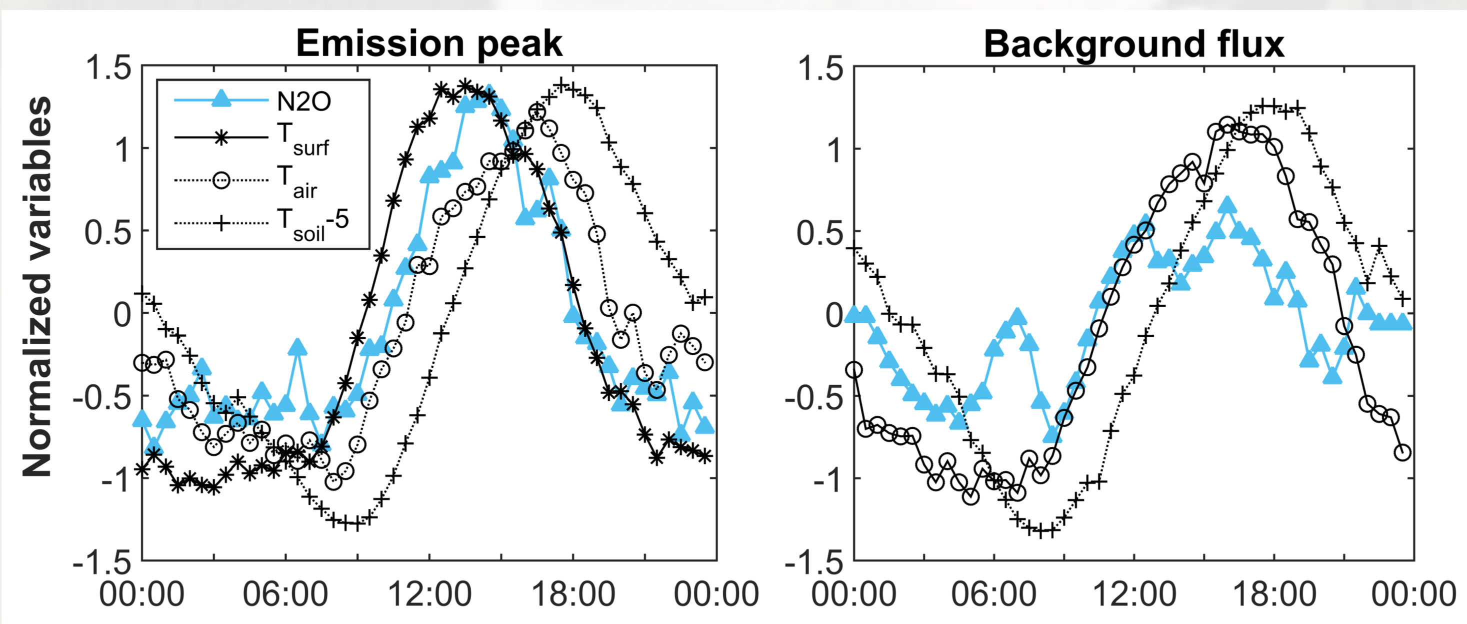
Daily variability of N_2O fluxes

➢ **The three episodes of emission peak show different daily patterns :**

❶ During the first emission burst, **correlation between N_2O and CO_2 fluxes** (R^2 = 0.53) and clear **diurnal pattern.**

❷ During the second peak, no correlation with CO_2 fluxes and a **less distinct** diurnal pattern**.**

❸ During the third peak, **important emissions during the day *and* during the night**.



➢ **During the background period, night fluxes significantly lower.**