TEMPORAL VARIABILITY OF N_2O FLUXES FROM A FERTILIZED GRASSLAND: PRELIMINARY RESULTS FROM DYNAMIC CLOSED CHAMBERS

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1. Objectives and scope

- **Measuring N_2O fluxes** from a pasture grazed by the Belgian Blue breed of cattle using dynamic closed chambers.
- Part of a project funded by the public service of Wallonia (SPW-DGARNE), aiming to make a carbon/CO_2 balance of the grassland (Jérome *et al.,* 2013) and to quantify CH_4 (Dumortier *et al.*, 2013) and N_2O fluxes.

2. Materials and Methods

- The site is located in **Dorinne**, Belgium. It is a permanent grassland of ca. 4.2 ha with a moderate slope of 1 to 2 %.
- Two cylindrical **chambers** of 19,2 cm diameter and 11,5 cm height were placed inside a protected area around a micro-meteorological station (**Figure 1**).
  A **Thermofischer 46i** was used to determine N_2O concentrations.

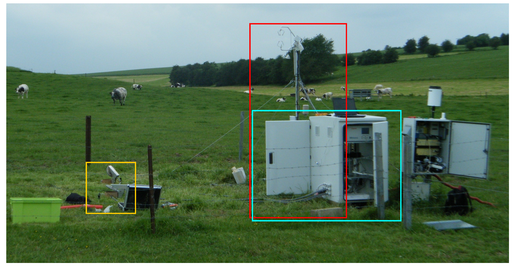

Figure 1: Experimental setup showing the meteorological station (back), the instrument box (front) and the chambers (left).

- Additional measurements: **soil volumetric moisture** and **temperature** (θprobe ML2x and PT-1000) at 3cm depth, see **Figure 2**.
- The **monitoring phase** took place during June and July 2012. The chambers were installed in the field and N_2O fluxes were followed without manipulation.
- The **experimental phase** took place in November 2012: two different fertilizer treatments were applied to the chambers. Doses of 100 and 200 kg N/ha of ammonium nitrate were sprayed respectively in chamber 1 and 2 (equivalent to a 8mm precipitation). The system was then subject to atmospheric conditions, including rain events.

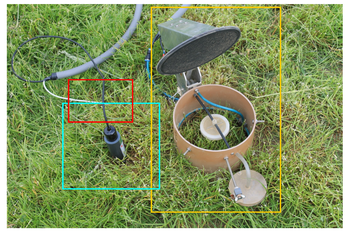

Figure 2: Measurement chamber (center) with on the left side the moisture sensor (black cable) and the temperature sensor (white cable).

References:

Dumortier *et al.,* Geophysical Research Abstracts, Vol. 15, EGU2013-2083-1, 2013
Jérome *et al.*, Geophysical Research Abstracts Vol. 15, EGU2013-6989, 2013

Acknowledgments:

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3. Results and Discussion

Results from the **experimental and monitoring phase** are shown respectively in **Figures 3 and 4**.

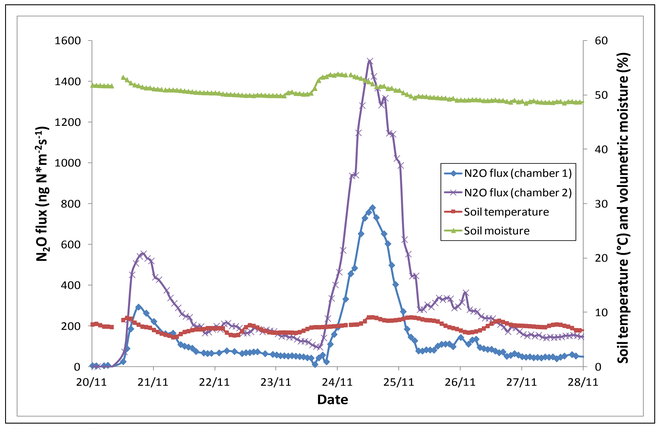

Figure 3: Temporal evolution of N_2O fluxes, soil temperature and soil moisture for the experimental phase in 2012.

-> Experimental phase

- The experimental phase focused on the interaction of soil humidification and available mineral nitrogen.
- **N_2O production peaked** shortly after rain events, in a magnitude that could be explained both by anoxic conditions and a lack of competition for mineral nitrogen between microorganisms and vegetation.
- N_2O fluxes from chamber 2 were roughly **twice as high** as for chamber 1, corresponding to the ratio of fertiliser dose.

-> Monitoring phase

- For the monitoring phase, N_2O fluxes were **separated** into **base** fluxes (background) and **peak** fluxes, using a threshold.
- N_2O **background fluxes** were found to correlate positively with **soil temperature**, but did not seem to be correlated with soil moisture.
- **Peak fluxes**, however, showed a significant positive correlation for **soil moisture** as well as for **soil temperature**.
- The **cumulative N_2O fluxes** were found to be **equal** between the base and peak fluxes, indicating the need for measuring fluxes at a high temporal resolution in order to account for the whole N_2O dynamics.

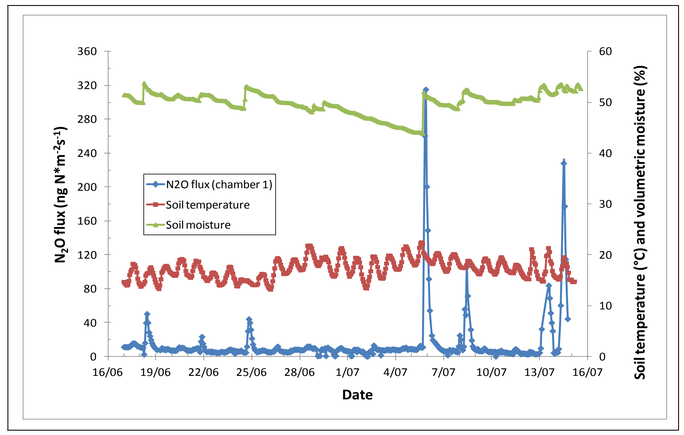

Figure 4: Temporal evolution of N_2O fluxes, soil temperature and soil moisture for the monitoring phase in 2012 (chamber n° 1).

4. Conclusions

- **N_2O fluxes tend to peak after a humidification event**
- **Impact of soil moisture levels on N_2O base fluxes: no clear trend**
- **Soil temperature enhances N_2O production from soils**
- **Fertilizer dose influences N_2O production**

5. Future developments

- An **additionnal experiment** will be conducted on site, involving adding fixed amounts of water and fertilizer to eight chambers.
- Aim: quantify the impact of **fertilizing and humectation** on soil N_2O fluxes.

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