Time integrated nitrous oxide and methane flux measurements using automated chambers across Europe

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Introduction

Measurements of soil –atmosphere fluxes of N_2O and CH_4 from different ecosystems are essential in order to gain a true budget of both gases due to the significant temporal fluctuations. Monitoring gas fluxes has been labour intensive with either manual chambers, automatic chambers with online gas chromatography or laser based gas analysers such as the tunable diode laser systems. The application of all these methods can only work in areas with good infrastructure and easy access.

The NitroEurope project facilitated the development of the System for Inert Gas Monitoring by Accumulation (SIGMA), which is particularly suitable for stand-alone observations of inert soil trace gas fluxes in remote locations with limited infrastructure (Ambus *et al*. 2010).

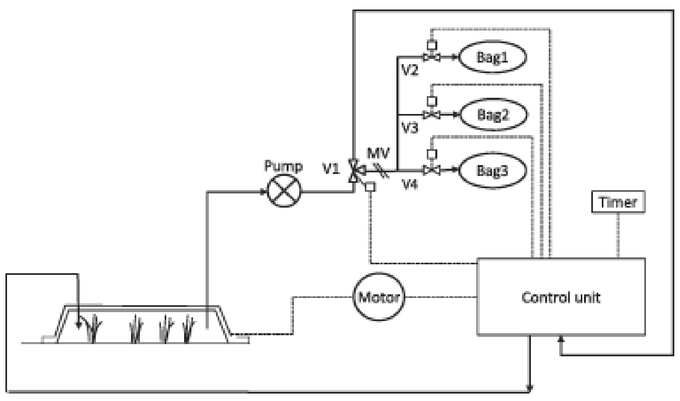

Figure 1 Schematic diagram of the SIGMA autochamber (Ambus *et al*. 2010) Chamber air is accumulated into the same storage bags over 2-4 week periods.

Method

The SIGMA system provides an integrated measure of N_2O and CH_4 flux over several weeks. The measurement frequency is high, but sample analysis is reduced to 9 samples every 2-4 weeks.

The SIGMA chamber is basically an automatic static chamber (Ambus *et al.* 2010). The chamber consisted of a stainless steel collar inserted into the soil which has a PVC unvented cover box (Fig 1). During chamber closure, 3 samples of the headspace are taken at different points in time. Each sample is collected in one of 3 FlexFoil bags. Chamber closure time lasted between 1 -2 hours, with 3 or 4 closures per day. Samples are accumulated in the same 3 FlexFoil bags for 2-4 weeks and analysed by gas chromatography for N_2O and CH_4.

During the Nitroeurope IP the auto chambers were placed at 7 field sites across Europe, for approximately 6 to 18 months, with 3 auto chambers at each site (See Table 1).

Table 1 Locations of SIGMA autochambers

Field site	Country	Ecosystem
Majadas	Spain	Open savannah with Holm Oak
Fyodorovskyoe	Russia	Forest
Griffin	United Kingdom	Forest
Petrodolinskoye	Ukraine	Arable
Monte Bondone	Italy	Grassland
Roccarespampani	Italy	Forest
Rzecin	Poland	Wetland

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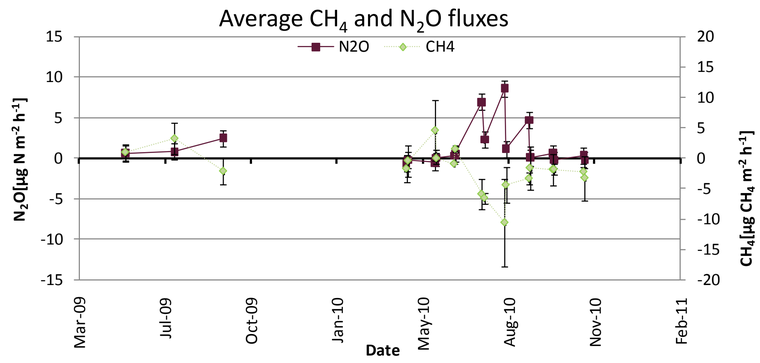
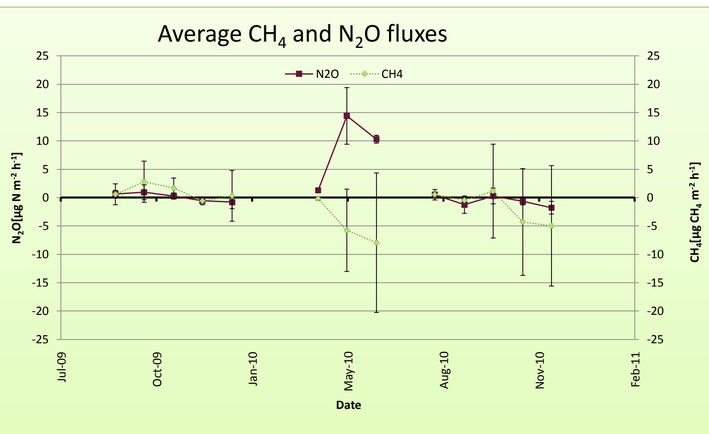
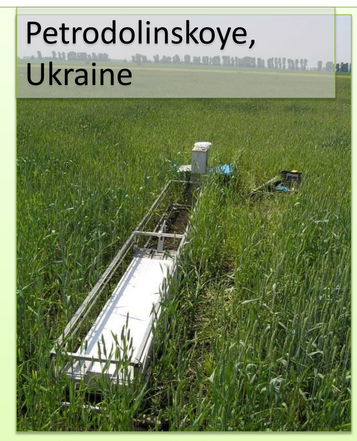
Results & Discussion

The SIGMA chambers were successfully operated. Below are examples of the N_2O and CH_4 results from selected sites.

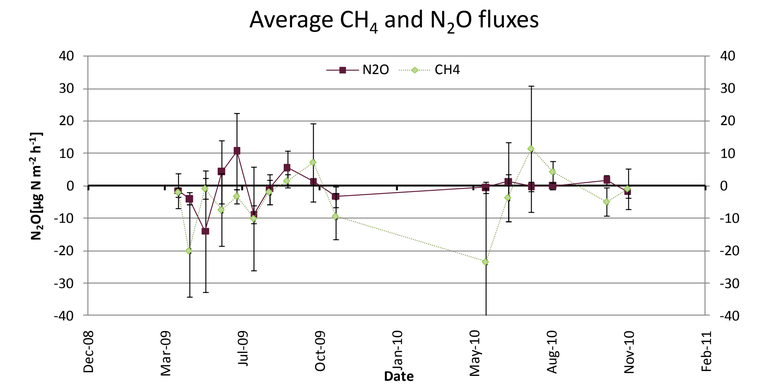


Fyodorovskoye, Russia : The period June to August 2010, was the hottest summer at Fyodorovskoye (boreal forest), in 100 years , which resulted in high N_2O emissions.

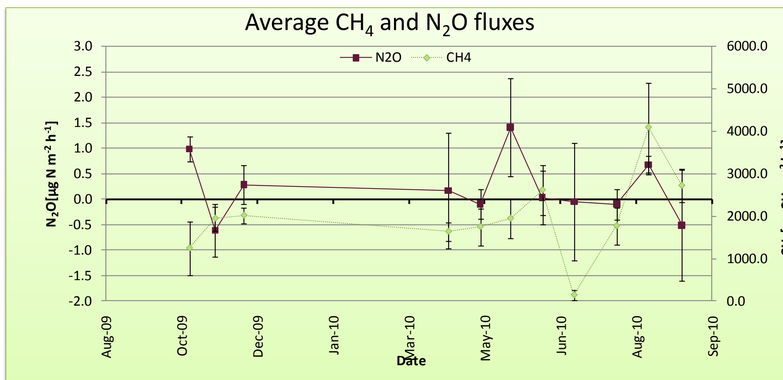




Petrodolinskoye , Ukraine : As expected large N_2O fluxes followed fertilisation events in March and April 2010 at Petrodolinskoye. (see Medinets *et al*. (2011) for more details).



Majadas, Spain: This is a relatively dry site and as a result small fluxes of CH_4 and N_2O were observed.



Rzecin, Poland : Large CH_4 emissions were measured at the only wetland site in the network of SIGMA chambers.

References: Ambus, P. Skiba, U. Drewer, J. Jones, S. K. Carter, M. S. Albert, K. R. Sutton, M. A. 2010. Development of an accumulation-based system fo cost-effective chamber measurements of inert trace gases. *European Journal of Soil Science.* **61** 785 – 792.

Medinets, S. Skiba, U. Kotogura, S. Medinets, V. Drewer, J. Pitsyk, V. 2011. N_2O and CH_4 Flux Measurements Using SIGMA Autochambers on the Arable Site "Petrodolinskoye", Ukraine. Poster at the Nitrogen and Global Change conference, Edinburgh, *April 11 -14th 2011.*

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