Application Note

GREENHOUSE GAS FLUX MONITORING IN SOIL SCIENCE

Farming practices like tillage or fertilization have a strong impact on the intensity of greenhouse gas emissions from cultivated soils. Many research studies aim at characterizing the soil gas fluxes to identify the best practices. Trace gas monitoring inside flux chamber is a standard and cost-effective measurement method used globally

The Challenge

To quantify soil emissions and study various land management practices, soil scientists require gas monitors featuring advanced measurement specifications and easy-to-deploy, in-field conditions.

Agriculture activity is a major contributor of greenhouse gas (GHG) emissions, representing an estimated 13% of global anthropogenic (resulting from human activities) emissions.

In order to refine the emission factor databases used in global GHG emission inventories, researchers in Soil Science have a need in rapid, precise and reproducible GHG flux monitoring methods in order to assess and compare various cropping systems. Their works also serve as a basis for determination of best practices (in particular for fertilization) and future land management strategies.

Our INNOVA photoacoustic multi-gas monitors offer a unique combination of measurement performances and operational features to meet their needs.

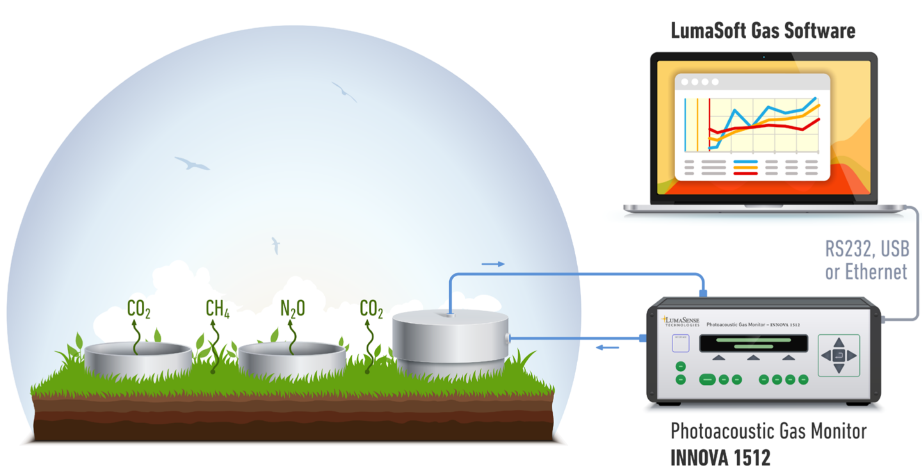
Monitoring Needs

Greenhouse gas emissions studied in soil science are linked with carbon and nitrogen cycles. Soil respiration and biomass degradation produce CO_2 (carbon dioxide) and CH_4 (methane). Nitrogen inputs from fertilizers lead to emission of N_2O (nitrous oxide) and NH_3 (ammonia).

The most widely used and least expensive method for measuring GHG fluxes in agricultural fields involves periodic gas sampling from static flux-chambers: the emission rate (or efflux) is derived from the concentration increase rate in the closed chamber volume.

Best experimental practices recommend a high number of temporal and spatial replications in order to correctly account for the inherent variability of the soil emissions in the highly heterogeneous conditions that are

The INNOVA 1512 monitor has a direct measurement capability with its embedded sampling pump. It integrates easily in a closed loop configuration with any flux chamber design. Featuring superior portability, ease of use, and very-limited maintenance, it is a practical and cost-effective solution for studies with large replication rates. It can be operated either in standalone mode or remote-controlled with the LumaSoft gas software for online monitoring.



INNOVA 1512
Photoacoustic Gas Monitor.

Our Solution

Once pre-configured with the appropriate set of optical filters, the Photoacoustic Gas Monitor 1512 can be easily and rapidly deployed at the various flux chamber locations. It is typically integrated in a closed-loop system with a chamber and enables the parallel reading of up to 5 gas concentrations (+ water vapor).

Simple by design, the standalone instrument is extremely easy to use even by non-experts in gas analysis: all it takes is a start/stop button.

Measurement logs of extended research campaign are conveniently stored in the internal memory and can be easily analyzed using the user-friendly LumaSoft Application Software, then exported into spreadsheet format for further processing.

Measurement Specifications

Leveraging the photoacoustic spectroscopy technique, the Innova 1512 differentiates significantly from the competition with a very low volume measurement cell. Consequently, a 1:1000 ratio is easily obtained between the cell volume and the static flux chamber for typical bucket-size (~ 10L) chambers. It helps minimizing the disturbances inside the chamber and possible artifacts on the readings.

When measuring with active cross-compensation (from IR spectroscopic interferences), the following detection limits can be obtained after proper filter configuration and instrument calibration:

Compound	Formula	Optical Filter	Detection limit (ppm)
Carbon Dioxide	CO_2	UA0983	5
Methane	CH_4	UA0987	0.1
Nitrous Oxide	N_2O	UA0985	0.03
Ammonia	NH_3	UA0976	0.2

Your Benefits

- ✓ **Field deployable standalone monitor**
- ✓ **In-situ direct multi-gas monitoring**
- ✓ **Low volume gas sample cell**
- ✓ **Stable, reliable, "zero" maintenance**
- ✓ **Scalability of measurement campaigns at high replication rate without extra cost (no carrier gas, no consumables)**

Advanced Energy

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