SOIL FLUX ANALYSIS WITH LGR-ICOS ANALYZERS

Dear Colleagues and Partners,

Greenhouse gases (GHGs) such as CO_2, CH_4 or N_2O released from various soils in the atmosphere, or from plants or livestock manures play an important role in climate change. The ABB LGR-ICOS analyzers allow to perform real-time measurement of GHGs of biogenic origin released from different locations. Those measurements provide critical information to environmental scientists as they quantify GHG emissions and assess the impact of the nature of various soils on the environment.

The soil flux measurements can be performed in a laboratory after extracting soil flux samples from the survey site, *e.g.* with syringes. However the preferred approach is to perform direct *in-situ* analysis. The flux is collected through an open-bottom chamber placed on the ground or around plants, crops or livestock manure, and connected to a gas concentration analyzer in closed-loop mode. The analyzer measures the evolution over time of the GHGs concentration in the chamber headspace.

ABB LGR-ICOS series 915, 918 and 919 field portable analyzers are perfectly suited for *in-situ* soil flux analysis, even in the most challenging environments. They can be easily interfaced to the most current types of soil flux chambers.

Exact configuration for *in-situ* soil flux measurement is case-dependent but will typically include:

- ABB LGR-ICOS analyzer.
- Soil flux chamber(s) (3rd party, lead suppliers: Eosense, Lica United, LI-COR).
- Multiplexer if several chambers are monitored (ABB 8-port or 16-port multiport inlet unit, or 3rd party). Note that a second ABB multiport inlet unit can be used for sample return to the chamber.
- Data logger (ABB or 3rd party)

The soil flux measurement packages based on ABB LGR-ICOS instruments provide some unique benefits to scientists, in particular:

- Streamlined field installation as LGR-ICOS analyzers are pre-calibrated, highly sensitive and stable.
- Reliable flux data as the LGR-ICOS instruments are robust against cross-interference and matrix effects.
- Highly cost-effective solution: no consumables are required.
- Proven robustness of LGR-ICOS instrument design enables *in-situ* soil flux measurements in most extreme conditions and harsh environments.
- Compact portable LGR-ICOS analyzers facilitate surveys in remote locations.
- The LGR-ICOS analyzers can be multiplexed over several soil flux chambers.
- Field-serviceability of the LGR-ICOS instruments enables on-site maintenance and cavity cleaning operations without requiring expensive and time-consuming factory repair.

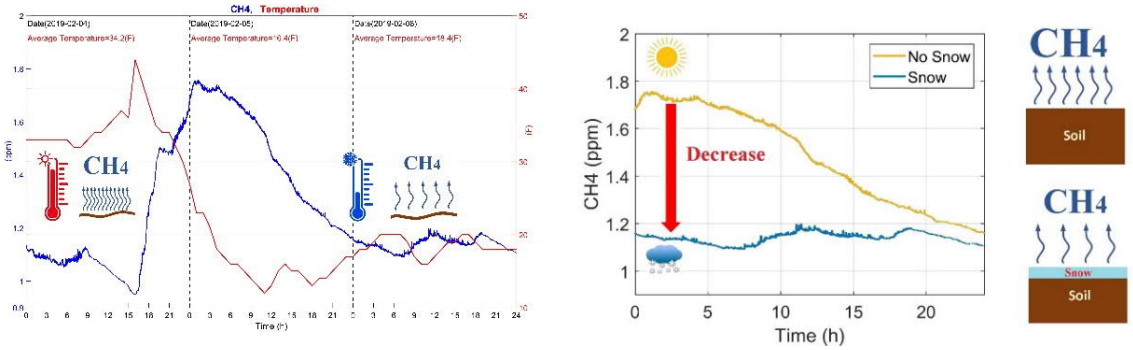
Application examples of LGR-ICOS instruments for soil flux applications. Left: in Amazonia (Courtesy Wanderlei Bieluczyk, USP-CENA), right: in Chinese forest (Courtesy Lica United)

Overall, the LGR-ICOS are widely used by scientists on all continents, and they are regularly referred to and acclaimed in numerous scientific papers. An example of use of the LGR-ICOS Ultraportable

Greenhouse Gas Analyzer (U-GGA-915) for a soil flux application is outlined in a video prepared by young scientists from the University of Michigan in the framework of a competition organized by the Institute of Electrical and Electronics Engineers (IEEE) for promotion of innovative thinking to address geophysical challenges in polar region. In this work, the scientists monitored methane and other global warming gas concentration and their relation to the permafrost and sea ice:

https://vimeo.com/317048636/31b6ae4237

The authors studied the impact of temperature, snow and field localisation (latitude) on the methane emission rate from thawing soil.



Impact of temperature (left) and snow (right) on methane emissions from soil (Wang *et al.*)

This work nicely illustrates the ease of implementation and sensitivity of the U-GGA-915 for field experiments, as well at its robustness and fitness for use even in challenging environment.