Measuring CH_4 and CO_2 with New Generation High-Precision Low-Power Low-Maintenance Closed-Path Analyzers: Lab and Field Results

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Introduction

Global CO_2 and CH_4 monitoring requires instruments that must meet the stringent requirements for:

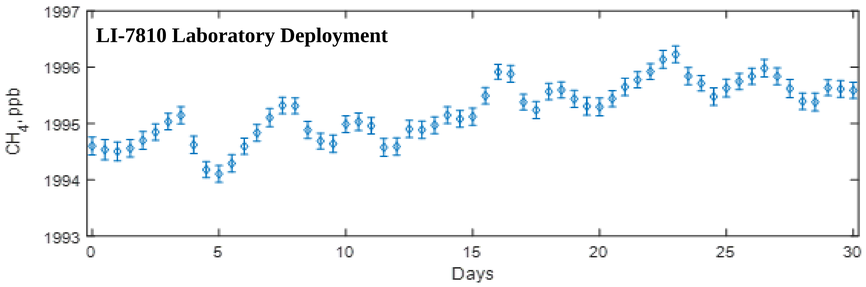
- ❑ Accuracy, precision and stability
- ❑ Low power consumption, field portability, and limited maintenance

Two new field portable analyzers were designed to address these requirements:

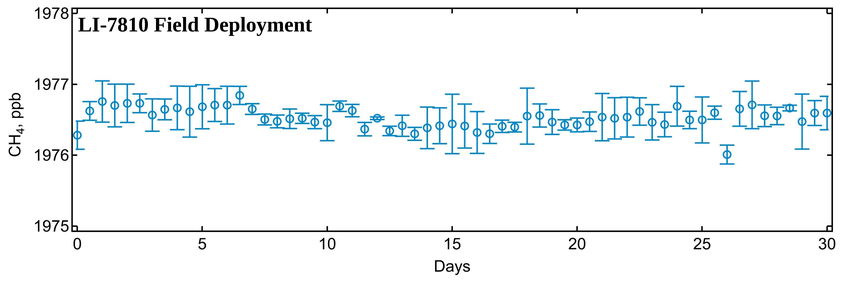
- ❑ LI-7810 $CH_4/CO_2/H_2O$
- ❑ LI-7815 CO_2/H_2O

We report on the laboratory and field performance validation of both analyzers.

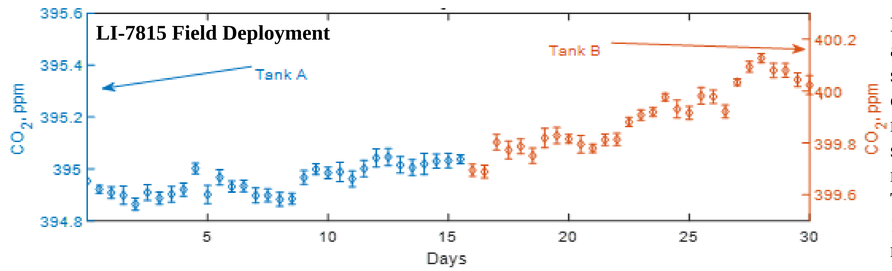
Laboratory and Field Validation



The analyzer measured ambient air between stability checks. During stability checks, the analyzer was flushed for 10 minutes with tank gas** and a time series data set was subsequently recorded for 10 minutes every 12 hours. The figure shows the mean value of the 10-minute measurements. Error bars represent a 1σ confidence interval (68%).



Located in an enclosed shelter, the analyzer measured ambient air between stability checks. During stability checks, the analyzer was flushed for 10 minutes with tank gas** and a time series data set was subsequently recorded for 10 minutes every 12 hours. The figure shows the mean value of the 10-minute measurements. Error bars represent a 1σ confidence interval (68%).



Located in an enclosed shelter, the analyzer measured ambient air between stability checks. During stability checks, the analyzer was flushed for 10 minutes with tank gas** and a time series data set was subsequently recorded for 10 minutes every 12 hours. The figure shows the mean value of the 10-minute measurements. Error bars represent a 1σ confidence interval (68%).

***Tank gas: 2 ppm CH_4, 400 ppm CO_2 mixed in air balance, 1% nominal concentration accuracy*

LI-7810 Stability and Precision

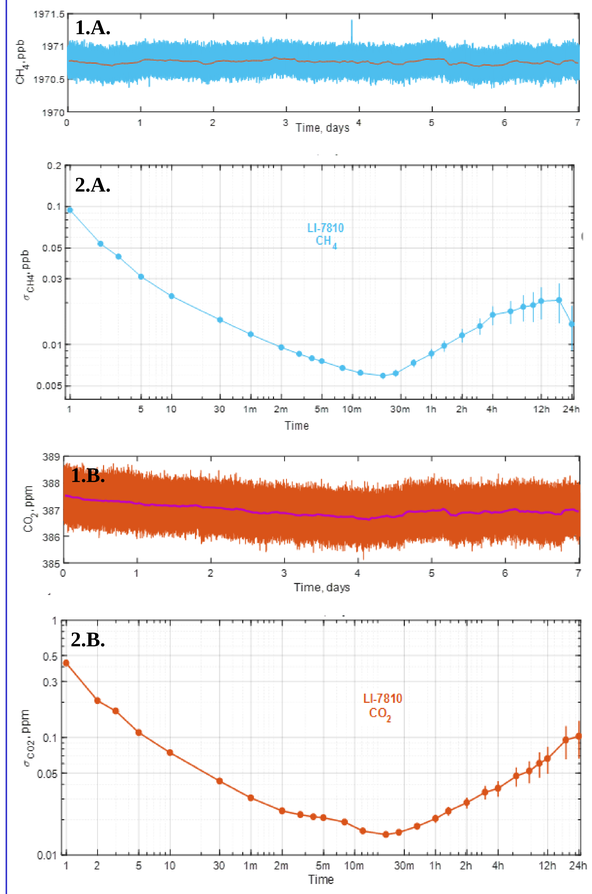


Chart 1: The instrument was operated continuously over a 7-day period with a continuous flow of tank gas. The blue line shows 1-second measurements; the orange line shows a 50 minute block average. Chart 1.A. reflects the high precision CH4 data set, with chart 1.B. providing the CO2 data from the same instrument. The LI-7810 provides high precision CH4 measurements, with CO2 data similar to other IRGAs available.

Chart 2: Allan deviation plots for the LI-7810 Analyzer. The plot shows precision at 1-second signal averaging, with improved precision as averaging time increases. Error bars represent 68% (±1σ) confidence intervals based on number of averaged time series available at each τ. Chart 2.A. reflects the high precision CH4 data set, with chart 2.B. providing the CO2 data from the same instrument.

LI-7815 Stability and Precision

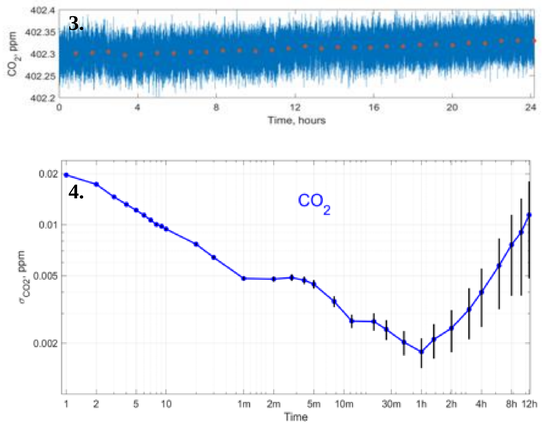
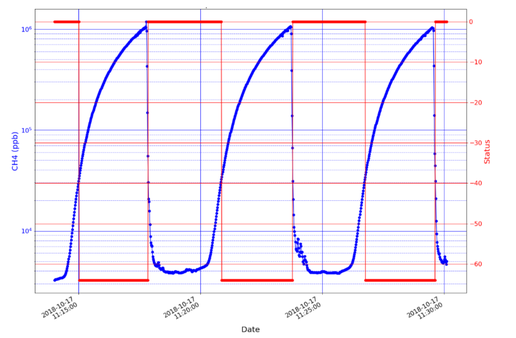


Chart 3: The instrument was operated continuously over a 24-hour period with a continuous flow of tank gas. The blue line shows 1-second measurements; the orange line shows a 50 minute block average.

Chart 4: Allan deviation plots for the LI-7815 Analyzer. The plot shows precision at 1-second signal averaging, with improved precision as averaging time increases. Error bars represent 68% (±1σ) confidence intervals based on number of averaged time series available at each τ.

Dynamic Range Tests



The LI-7810 was tested against higher concentrations of CH_4. The instrument responded and continued to measure, however, specifications are not guaranteed outside of the 0 – 50 ppm range for CH_4. This is reflected in the status codes given at higher concentration measurements.

Acknowledgements

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