

Off-Axis integrated cavity output spectroscopy (OA-ICOS)

Los Gatos Research (LGR)



Triple isotope water analyzer benefits scientific research

Measurement made easy

Off-Axis integrated cavity output spectroscopy (OA-ICOS)

Introduction

Los Gatos Research (www.LGRinc.com), recently acquired by ABB, Inc., announced that its patented spectroscopic analyzers have proven highly useful for the scientific understanding of the water cycle, atmospheric convection, and climate modelling, and other applications requiring ultra-precise measurements of water isotope ratios.

The specific analyzer technology, called Off-Axis Integrated Cavity Output Spectroscopy (OA-ICOS), accurately measures the three stable isotopes of water (liquid and vapor). Unlike previous techniques, it requires no sample conversion with toxic reagents and is simple to operate.

The researchers who collect the samples can make the measurements.

For more information

Further details of ABB Measurement & Analytics products are available for free download from: www.abb.com/measurement

or by scanning this code:



Precision and accuracy

As documented in a recent Analytical Chemistry Journal article (Anal. Chem., 2013, 85 (21), pp 10392-10398), repeated high-throughput measurements of the international isotopic reference water standard– Greenland Ice Sheet Precipitation – have demonstrated the precision and accuracy of this Triple Isotope Water Analyzer. Its ability to accurately measure liquid water isotopes inexpensively and without sample conversion should vastly increase application of these analyzers to hydrological and climate research.

Douglas Baer, Ph.D., president of Los Gatos Research, says that these analyzers provide new opportunities for scientific research. “They combine relatively small size, low power consumption, and fast response. Most importantly, they offer high absolute accuracy, rugged reliability, and automated operation,” he says. “We expect these analyzers to benefit budget-constrained research applications including climatological, hydrological and medical studies.”

Los Gatos Research (LGR)

Los Gatos Research adds innovative analytical measurement and enhanced laser capabilities to expand ABB’s measurement products and services in oil and gas, electric power and other industrial sectors. LGR brings a new line of high-performance gas analyzers to ABB’s leading measurement products business.

The company provides analyzers and services to a wide range of customers (on all seven continents) who need real-time measurement of trace gases and isotopes for research, environmental monitoring and industrial process measurements. Its novel and innovative laser-based measurement strategies allow for non-destructive analysis of gases and liquids continuously and in real time.

ABB Measurement Products

ABB’s Measurement Products business unit (www.abb.com/measurement) is among the world’s leading manufacturers and suppliers of instrumentation and analyzers. With thousands of experts around the world and high-performance technology,

ABB’s team is dedicated to making measurement easy for its customers. ABB (www.abb.com) is a leader in power and automation technologies that enable utility and industry customers to improve their performance while lowering environmental impact. The ABB Group of companies operates in around 100 countries and employs about 150,000 people.

High resolution absorption spectra recorded by independently tuning a pair of telecommunications grade diode lasers continuously over multiple lineshapes of selected water isotopologues (labeled above corresponding lineshape) – see Figure 1.

These spectra, reported to the user in real time, enable direct measurements of $\delta^2\text{H}$, $\delta^{17}\text{O}$, $\delta^{18}\text{O}$, ^2H -excess and ^{17}O -excess in water.

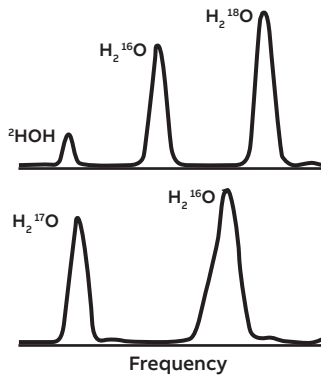


Figure 1 High resolution absorption spectra

Measurement accuracy for ^{17}O -excess_{VMSOW-SLAP} demonstrated by measurements of GISP and four commercially available USGS isotopic reference waters by LGR’s Analyzer (OA-ICOS) and two independent IRMS laboratories. Error bars represent one standard error of the mean – see Figure 2.

The excellent agreement obtained using different technologies operated in different laboratories demonstrates the inherent accuracy of OA-ICOS and the results.

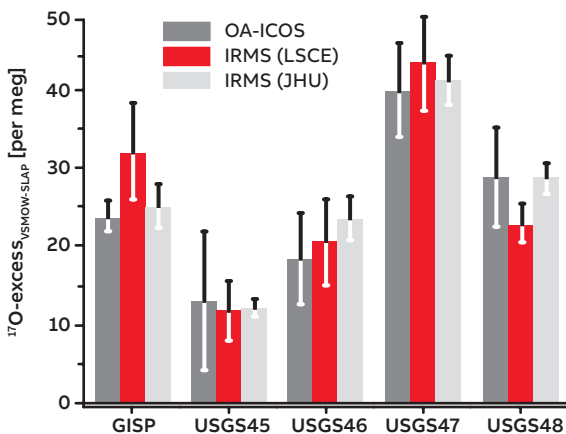


Figure 2 Measurement accuracy for ^{17}O -excess_{VMSOW-SLAP}

Figure 3 (Allan deviation plot) indicates how the precision improves as the number of measurements averaged increases. The solid line represents perfect averaging of white noise.

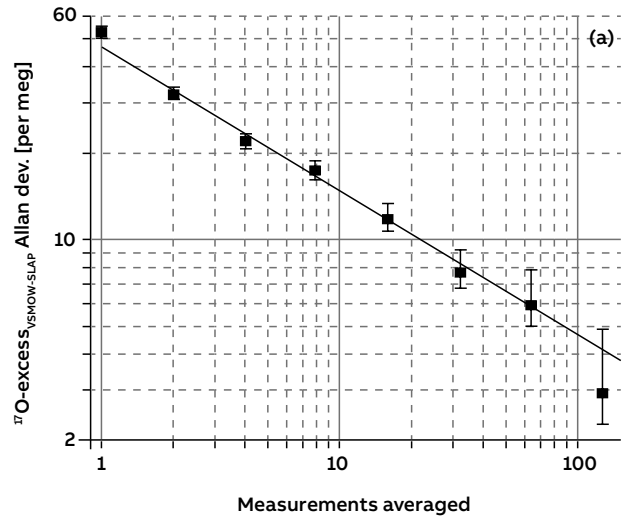


Figure 3 Allan deviation plot showing precision as a function of number of measurements averaged.

Figure 4 shows a histogram with normal distribution fit for high-precision measurements of ^{17}O -excess of GISP calibrated against ^{17}O -excess_{VMSOW2-SLAP2}. The average and standard deviation of the measured values are noted, along with a published average value.

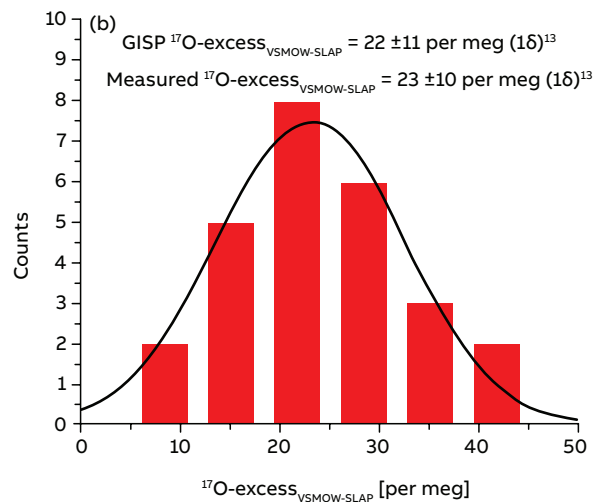


Figure 4 Histogram with overlaid normal distribution fit for high precision measurements of ^{17}O -excess of GISP calibrated against ^{17}O -excess_{VMSOW2-SLAP2}

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