AN021

No Compromise High Throughput $\delta^{18}O$ and δD Measurements

Picarro water isotope analyzers provide optional high speed measurements with minimal impact on memory and precision and no impact on drift compared to high precision operation.

Keywords:

Material: Water samples, reproducibility, low drift
Process: Stable isotopes, $\delta^{18}O$ and δD, delta-18O, delta-D

Summary and Relevance:

The ability to measure the $\delta^{18}O$ and δD isotopic content of water has long relied on cumbersome methods that require well-equipped laboratories, highly qualified technicians and frequently calibrated instruments. The advent of commercial analyzers based on Wavelength Scanned Cavity Ringdown Spectroscopy (WS-CRDS) for isotopic water measurements has opened up new possibilities for mobile laboratory and field deployable isotopic instruments. In addition, for many of these laboratories, sample throughput has been a major bottleneck. For example, the real-time sampling of stream flow during meteorological events requires multiple samples per hour. Alternatively, the number of discrete samples gathered during a hydrology or oceanography campaign can be a daunting challenge. It is a common occurrence that a huge sample set must be analyzed within a short period of time to avoid sample spoiling. In these and other applications, the required isotopic 'resolution' requires a high precision, drift-free analyzer with a high throughput mode.

The solution is a Picarro water isotope analyzer which gives users the capability of 360 sample injections per day. This high throughput method comes with minimal impact on the precision and memory and absolutely no impact on the drift characteristics of the analyzer. The results shown in this study clearly confirm that the precision of the Picarro system is very high and the memory and drift characteristics are exceptional, even with a high data acquisition rate.

Picarro Analyzer Used:

L1102-*i* equipped with autosampler option

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Process:

The samples used for this study were pipetted into 2 mL vials and arranged in a standard autosampler tray. High precision mode was selected by simply by clicking on an icon. The data in this mode of operation were collected at a rate of 360 sample injections per day.

Results:

As shown in Figure 1, the precision of the high throughput method is outstanding, measuring 0.09 permil $\delta^{18}O$, and 0.4 permil δD. The standard deviation was calculated from consecutive sets of 12 injections throughout the run. That suite of standard deviation values was then averaged to provide the final value. This method decouples the precision calculation from any instrument drift.

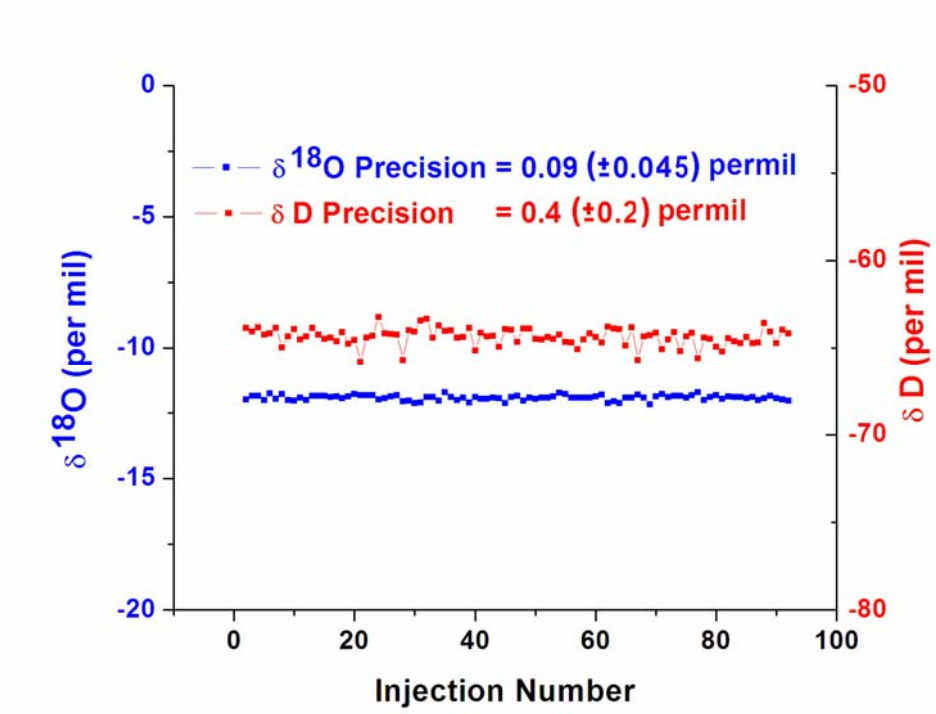

Figure 1. Both $\delta^{18}O$ (0.09 permil) and, δD (0.4 permil) measured on this instrument, at 360 sample injections per day, are within the guaranteed performance specifications for the analyzer in high precision mode. To further demonstrate the robustness of both the analyzer and the method, no drift correction or calibration was performed at any time.

Furthermore, a review of the memory from the high throughput method shows that there is little compromise associated with the high precision method. (Figure 2).

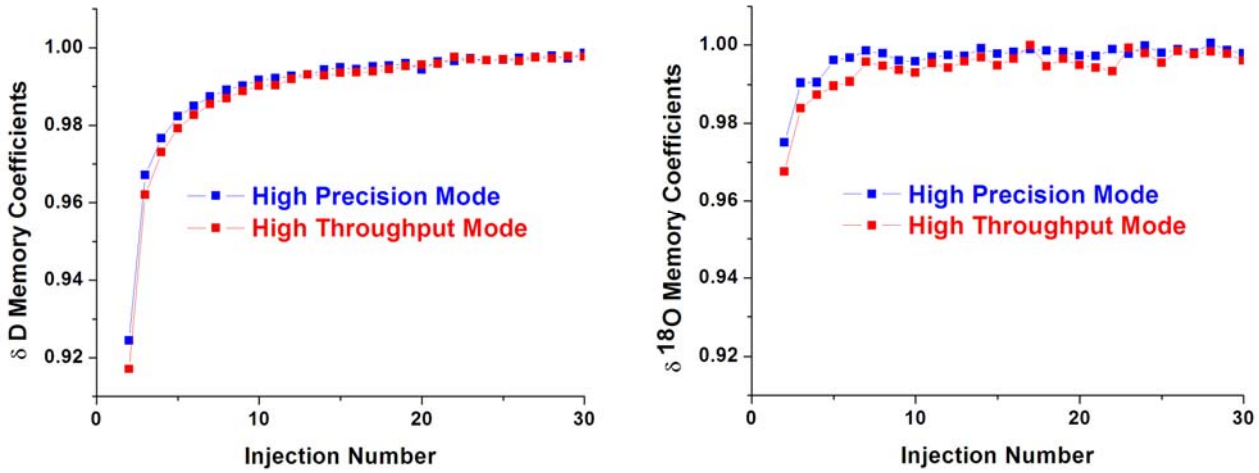

Figure 2. δD (left) and $\delta^{18}O$ memory coefficients (right) are virtually identical for high precision and high throughput modes.

In addition, the drift of the system is incredibly low. Picarro guarantees the drift performance of all analyzers, and the drift for the 18-hour period falls well within the guaranteed performance characteristics.

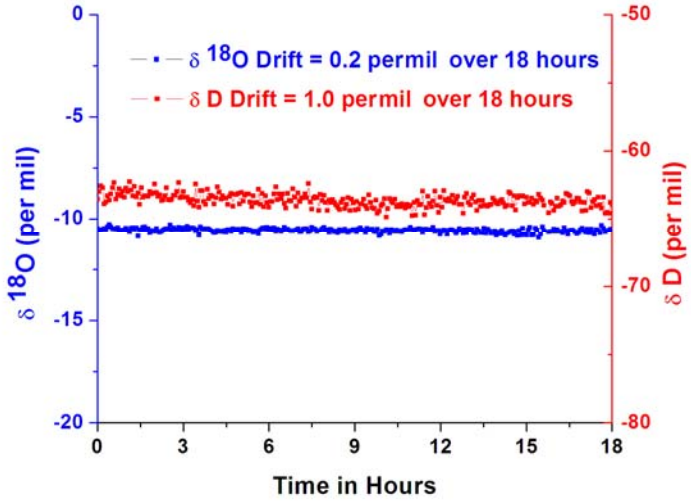

Figure. 3. Drift data using high throughput mode is well within the instrument's guaranteed performance.

Comments:

Picarro's water isotope analyzers provide the flexibility to select between high throughput and ultra-high precision measurements. The new high throughput mode, combined with the ease-of-use characteristics of the Picarro analyzers, is expanding the reach of isotopic measurements to field environments. The ability to place these devices on ships and boats makes it possible to provide real-time ecological measurements.