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Performance data of an infrared laser spectroscopic system for water stable isotope analysis

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Stable isotopes of hydrogen and oxygen in natural waters are effective tracers for the origin and movement of waters on earth. Their use as routine tool in water resources investigations worldwide has been limited so far by the necessary relative high operational skills and cost of mass spectrometers used for measuring isotope abundance ratios. Less expensive and easy-to-use spectroscopic methods using lasers have been developed for some time but have lacked the ability to provide results with sufficient precision necessary for hydrological applications. Here, we report data on extensive testing of a liquid water stable isotope analyzer based on infrared laser high-resolution direct absorption spectroscopy at our laboratory. The technique uses a cavity with high-reflectivity mirrors to generate path lengths of several kilometres. A number of secondary standards calibrated on the VSMOW scale were used for the tests as well as natural water samples. Results show that stable isotope abundance ratios can be measured expressed on delta scales with a precision of 1.5 per mill for δ^2H and 0.3 per mill for δ^{18}O. Data on the performed tests, the dependence of performance on external parameters and the efficient data evaluation will be presented.