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Tests and validation of two instruments using wavelength-scanned cavity ring-down spectroscopy (WS-CRDS) technology in laboratory. A way to assess the isotopic composition measurement of water vapor.

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Water stable isotopes constitute a useful tool to reconstruct past climate variability and to study water cycle. Isotopic measurements of precipitation (oxygen18 and deuterium) are commonly used to better constrain climate-isotopes relationship which is still poorly understood in tropical regions. The new wavelength-scanned cavity ring-down spectroscopy (WS-CRDS) technology should provide us unseen isotopic measurements in the tropical water vapor soon. It would help to better constrain isotopic fractionation processes, especially at the vapor-liquid condensation, and to improve their representation in general circulation models.
We present here different tests performed on two WS-CRDS instruments during one year in our laboratory. A consistent check of the correct running of this instrument is needed before set it up on the field. We are elaborating protocols that especially offer a reliable method for calibration by liquid standards or vapor. We tested different configurations: auto-sampler and manual injections. The comparisons of WS-CRDS instrument's measurements with the well-validated cold trap technique were made. We observed a constant calibration's slope stability with time. Nevertheless the instrument is very sensitive to temperature variability and humidity concentration. We took great care to checked the instrument's autonomy and to reach the better precision with an eye to possible analysis of deuterium excess parameter (d=deltaD-8*deltaO18). Therefore we show that this instrument is able to measure with a precision of ± 1 per mil for deltaD and ± 0.2 per mil for deltaO18 for a 30s acquisition time and for a 4000-20,000 ppm H2O concentration range, provided that temperature is regulated.