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Characterization of a customized calibration unit for continuous measurements of the isotopic composition of water vapor

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The objective of this work is the development, standardization and creation of a method to carry out continuous measurement of oxygen and hydrogen isotopic composition of the atmospheric water vapor using a wavelength-scanned cavity ring down spectroscopy (WS-CRDS) instrument produced by Picarro, L1102-i model.
Some technical improvements of the standard instrument configuration have been made to create three different inlet gas lines: a "standard" line, a calibration line and a line connected with the external sampler.
The calibration line is composed of a syringe-pump that continuously injects standard water into a steel tee heated at the temperature of 170°C and flushed with dry nitrogen gas. In this way, instantaneous and complete vaporization of the standard water takes place. The resulting steam is characterized by a well-defined composition in δD e δ^{18}O values.
To allow comparison with other international data, we have characterized the individual instrumental response to variation of the isotopic composition of the water vapor. Several humidity-isotope response functions (6000-26000 ppmv) have been estimated with three different internal standards (0.35‰ -8.75‰ -29.11‰ and -40.28‰ for δ^{18}O; 2.31‰ -58.91‰ -222.19‰ and -317.78‰ for δD).
Moreover, we have measured the instrumental drift at regular time intervals to apply the opportune corrections to instrument data.
The setup has been tested using a 3.5 day continuous measurements carried out with the Picarro sampling the water vapor outside our campus in Venice and parallel sampling using the classical cryogenic trapping procedure, obtaining excellent results. Furthermore, our analysis technique has given good results for the standards with values which are similar to those obtained with the isotope ratio mass spectrometry (IRMS) technique.