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Atmospheric Measurement Techniques Discussions

Interactive comment on "Measuring variations of δ^{18}O and δ^{2}H in atmospheric water vapour using laser spectroscopy: an instrument characterisation study" *by* F. Aemisegger et al.

Anonymous Referee #1

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General comments

The present paper "Measuring variations of δ^{18}O and δ^{2}H in atmospheric water vapour using laser spectroscopy: an instrument characterisation study" by Aemisegger et al. present results of a comparison of commercial laser spectrometers to measure isotope ratios in water vapour. The paper is generally well written, it could have however be written more precise and shorter ocacionally. Specific comments are given for the printer-friendly version of the manuscript.

Specific comments

Full Screen / Esc
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Interactive Discussion
Discussion Paper

P. 1600 L. 13: The research instruments by Webster and Heymsfield, Science **302**, 1742 (2003, see also refs therein), and Dyroff et al., Appl. Phys. B **98**, 537 (2010) should be included in the list of references for completeness.

P. 1602 L. 17: change infrared to near infrared.

P 1603 L. 6: You state that "In both systems, the sample gas is drawn through a high finesse optical cavity,..". Isn't it that the finesse (F) of the WVIA cavity is actually low since the free spectral range (FSR) is made small by exciting the cavity with a beam that is coupled in off axis? ($F = FSR/FWHM$)

P 1603 L 10: change astigmatised to astigmatic.

P 1603 L 11: change introduced to coupled into the cavity.

P 1603 L 12: you state that the cavity 'àppears to be always resonant". Isn't it that the cavity is becoming rather non resonant due to the much lower FSR? Consider to refer to the Sayres 2009 paper you cited earlier.

P 1603 L 15: You state "Laser light is injected in alignment with the mirror and the cavity mode structure requires frequency modulation of the electromagnetic signal using a piezoelectric actuator." Please rephrase to make clear what is done. Is the length of the cavity adjusted by a Piezo electric transducer to keep the cavity modes at constant wavelengths?

P 1603 L 21: Pressure and temperature control are not limited by the flow rate for any flow rate on the order of a few standard liters per minute! This is no technical problem.

P 1603 L 28: As far as I am aware, ringdown times are measured after the end of every laser scan in the LGR instruments. Tis would be a ringdown measurement at only one wavelength. The cited paper is an early work. I suggest getting back to the manufacturer to check this issue.

P 1608 L 7: What is a dry cell?

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5, C357–C359, 2012

Interactive Comment

P 1612 L 22: You state “In the calibration experiment ten laboratory working standards of stable water isotopes were measured and calibrated with the two laser systems as well as with IRMS.” You calibrated your working standards with the laser spectrometers? Was it not the purpose of your experiments to characterize the instruments with known standards? Please clarify.

P 1613 L 2: I am puzzled.. Would it not be a good idea to use the SAME standard range to calibrate instruments that one wants to intercompare? Also here: mention again that you used WS11 and WS12 to calibrate the IRMS. Otherwise it takes a while to find it on Page 1607.

P 1618 L 7: I assume you refer to the spectral baseline?

P 1618 L 29: It is technically not difficult to dry ambient air to humidity < 5 ppmv using molecular sieve. Why is the residual humidity here so much higher?

P 1620 L 6: Change “...minimum, which is the optimum averaging time ($\tau_0 = 10^3$ s) and then...” to “...minimum, which is at the optimum averaging time ($\tau_0 = 10^3$ s), and then...”.

P 1620 L 10: The word “perfect” is misleading. Noise is never perfect as it is never wanted. Please rephrase to something like: “This indicates statistically independent measurements with a white frequency spectrum.”

P 1620 L 25: Are 5 s averages not too long for flux measurements?

P 1621 L 19: Remove “, which are considered for the bias correction.”

P 1623 L 5: Please state the humidity for which these precision values are valid (Fig. 6).

P 1627 L 11: Rephrase “precision and accuracy in terms of short and long-term stability” to something like “the short and long-term precision and accuracy”.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 1597, 2012.