Atmos. Meas. Tech. Discuss., 5, C1689–C1692, 2012
www.atmos-meas-tech-discuss.net/5/C1689/2012/
© Author(s) 2012. This work is distributed under
the Creative Commons Attribute 3.0 License.

Atmospheric Measurement Techniques Discussions

Interactive comment on "Evaluation of continuous water vapor δD and δ^{18}O measurements by off-axis integrated cavity output spectroscopy" *by* N. Kurita et al.

N. Kurita et al.

nkurita@jamstec.go.jp

Received and published: 30 July 2012

I'm glad to listen your positive reply to our manuscript. Here I describe my replies to your comments.

Q1) Page 2824, line 2, refer to the Griffith paper amongst other references as a laser technique, the Griffith paper discusses an FTIR method so uses a broadband source rather than a laser. Suggest changing ". . . :utilises laser based. . . " to ". . . utilise instruments based on optical spectroscopy. . . " (Page 2823 line 26)

A) We have modified this sentence following your suggestion.

Q2) Page 2824, line 14, suggest changing ". . . laser instrument . . . " to ". . . in-situ instrument . . . " See comment above.

A) This sentence also has been modified following your suggestion.

Q3) Page 2825, line 5, what is the time frame of long-term stability?

A) In the previous studies, the period of in-situ measurement was less than a month, therefore our mentioned "long-term" means the period, which is longer than a month. In this revised manuscript, to clearly mention our target period, we have modified as follows: "long-term water vapor isotope monitoring test across the several seasons has not been reported yet."

Q4) Page 2825, line 18, what changes were made in the software update?

A) The software was upgraded to optimize the performance of the WVIA. We have added this phrase in the revised manuscript.

Q5) Page 2826, line 1, 10 s should be 10_s

A) This was an error during the PDF conversion. We have modified this error.

Q6) Page 2827, line 17, how stable is the cavity temperature?

A) Even though standard gas comes out from heated chamber, the temperature in the cavity was steady even when the valve switched from the ambient air inlet to the standard gas line. We have added this sentence in the last paragraph of the Section 2.2.

Q7) Page 2827, line 17, I suggest adding the cavity volume to illustrate the exchange rate for the cavity.

A) We have added the cavity volume (830ml) and calculated exchange time in the first paragraph of the Section 2.2.

Q8) Page 2830, line17, it is not obvious what is meant by analytical uncertainty.

AMTD

5, C1689–C1692, 2012

A) This analytical uncertainty is equal to measurement precision for liquid water samples. In this revised manuscript, we have replaced “analytical uncertainty” to “analytical error”.

Q9) Page 2831, line 5, can a concentration dependence be ruled out as the source of the enrichment for the raw _D values retrieved by the WVIA?

A) Although dD values at 3000 ppm are slightly heavier than those at the other humidity concentration, there is no significant isotopic difference from the others. According to the spec, required operating humidity level is more than 3000 ppm. So that variability in the WVIA measured isotopic values becomes large toward lower humidity concentration. Because of this relatively larger variability in dD during vapor trapping, we cannot discuss this bias in detail.

Q10) Page 2831, line 15, but your uncertainty for your cold trap _18O collected at 10000ppm and shown in figure 2 appears larger than 0.15‰ so I don’t think it is possible to rule out the variability in the cold trap values as a significant contributor to the scatter in figure 3b rather than it being attributed to just the WVISS.

A) Moisture trapping in the WVISS generated air was repeated 16 times at 10000 ppm, and those variation in d18O were shown in Figure 2. The average H2O concentration during vapor trapping was not constant among each experiment, but was varied ranging from 9500 ppm to 10700 ppm. Interestingly, the d18O values of trapped water show significant negative linear relationship with H2O concentration (R2=0.31). The lowest (highest) H2O concentration corresponds to the most enriched (depleted) d18O value (-10.6 permil and -11.6 permil). Because the large spread of d18O in Figure 2 is closely related to the variation in the H2O concentration, we can think that the influence of the variability in the cold trap samples may be minor. In this revised manuscript, we have added this explanation in Section 3.1.

Q11) Page 2832, line 5, inefficient evaporation in vaporisers tends to lead to increased variability in the H2O concentrations and isotopic values. The noise arises from liquid

AMTD

5, C1689–C1692, 2012

CC BY

being deposited on the hot surfaces of the vaporisation chamber which then evaporate. This is observed as spikes in the H2O concentration and the isotopes. Inefficient evaporation therefore tends not to produce biases when collecting water vapour samples over the time period the cold trap samples were collected (2-6hrs). For there to be a bias due to inefficient evaporation, the liquid must build up in the vaporisation chamber and not re-evaporate. It is therefore unlikely inefficient evaporation in the WVISS would be a source of the biases for the cold trap isotopic values. Although the authors discount inefficient evaporation as the source of the cold trap biases, it is unlikely to produce negative biases as they suggest.

A) At first, identification of the source of this bias and large spread shown in Figure 2 is beyond the scope of this paper. We have added this sentence in the revised text. As you mentioned, all features cannot be explained only by inefficient evaporation. In addition, above mentioned gradual decreasing in dO of trapped water with H2O concentration at 10000 ppm is opposite from the obtained concentration bias. Thus, we have removed discussion as for inefficient evaporation effect.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 2821, 2012.