Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2019-295-RC1, 2019

Atmospheric Measurement Techniques Discussions

Interactive comment on "Evaluation of a field-deployable Nafion-based air drying system for collecting whole air samples and its application to stable isotope measurements of CO_2" *by* Dipayan Paul et al.

Anonymous Referee #1

Received and published: 15 October 2019

Scientific Significance: 1 The authors have prepared an important discussion paper examining the drying of air sampled into flasks packages that fits well within the scope of AMT papers. This Nafion-based air sample Dryer (NAD) method provides an efficient, effective and logistically practical, method to dry air samples without effecting either the mole fractions or the stable isotopic composition of the air sampled.

Scientific quality: 1 The authors examine parameters required to insure the integrity of the samples, and then a NAD develop a drying system that meets these requirements based on multi-tube Nafion driers. The methods used are sound with a structure to the

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Discussion paper

examination of the drying system that provides confidence that the authors are fully aware of effects that exist with other drying systems. The examination of both mole fractions and isotopic composition in a very controlled manner with techniques that are proven ensures that their results are sound. The assessment of the NAD system under conditions that closely match the real sampling environments additionally provides confidence that the experimental results are meaningful. While the assessment of the isotopic composition in section 3.3 was at a reduced flow rate compared to both normal operation and the assessment in section 3.4, the authors indicate that the lower flow rate will impact more heavily as the residence time is greater. The authors may wish to discuss the results from section 3.3 and the case 5 results from section 3.4 which are similar tests at different flow rates to demonstrate that their assertion is correct.

Presentation quality: 2 The authors provide experiments that demonstrate the ability of the NAD to sample air with minimal alteration, they compare their results to the WMO GAW compatibility goals. It should be noted that while the flask sampling on aircraft takes place in Brazil the compatibility goal for CO2 should be 0.05 ppm for the Southern Hemisphere.

In section 2.1 the authors describe the use of a G2301 cavity ring down spectrometer which measure CO2, CH4 and H2O. They do not provide a measurement precision for H2O, but rather for carbon monoxide which is not measured by the instrument.

A molecular sieve type 3A is employed to dry the backflush air for the Nafion, the authors may wish to provide manufacturer and grade details in section 2.2 line 140.

The authors have prepared a well structured and readable manuscript. There are several typographical errors that if resolved would improve the paper. Some examples of these are: Page 2 ln35, missing word after that. “We estimated that least 8 flasks . . .” Page 9 ln 223, A comma is required after “each” in the text. “24-inch Perma Pure PD-Series gas dryers containing 200 Nafion tubes each in a stainless steel tube shell”

The GAW report 242 should include the names of the editors in the reference.

Figure 2. The scale for H2O % needs some attention between 0.1 and 1 as the decimal place is not present.

Figure 5. The authors refer to the excess flow line within the text and state that the CRDS instrument and the hygrometer are both attached to this line. In the Figure 5 this is depicted as two separate lines. The authors may wish to clarify either the text or the figure to indicate clearly the configuration used.

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