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Atmospheric Measurement Techniques Discussions

Interactive comment on "Site selective real-time measurements of atmospheric N_2O isotopomers by laser spectroscopy" *by* J. Mohn et al.

Anonymous Referee #3

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This paper describes the evolution of a previously demonstrated instrument based on pulsed infrared QC laser-based absorption spectroscopy (QCLAS), and the application of this instrument to the field (grassland) measurements of relative abundances of the three main stable nitrous oxide isotopomers including alpha and beta forms. The autonomous instrument comprises this previously developed (yet improved) spectrometer combined with a preconcentration system. The primary advancement for the spectrometer is higher sensitivity and the real-time operation of the instrument in the field, which includes protocol to successfully interface with the sampling system. The instrument is used to characterize isotope ratios for the aforementioned species. The analysis is thorough and the 0.2permil performance is impressive.

In general, I would classify this as more of an evolutionary paper, with results of likely

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interest to the community as optical methods are crossing new performance barriers that make them competitive with, or, in some cases, superior to mass spectrometers. This work highlights this capability. I would recommend publication after the following minor revisions, which I believe will enhance the manuscript.

1.) I would add an off-axis ICOS reference (specifically, Los Gatos instrument) to the introduction as those instruments are relevant in the context of the discussion of Mid-IR nitrous oxide sensors that are capable of doing isotopic measurements. Additionally, I would recommend comparing the performance of those sensors (and perhaps others) to the results derived with this instrument in the discussion section 3 (a mention of typical per-mil specs).

The LGR instruments are capable of extremely low per-mil specs-likely best in the industry, and I believe they now have a commercial instrument that is capable of real-time isotopomer analysis of nitrous oxide for at least ambient air samples. It too could likely be interfaced with a preconcentration unit and achieve similar or better performance to that presented here.

2.)In Section 2.2.2 it would be useful to quantify the improvement in the new spectrometer compared to the previous embodiment, perhaps as equivalent absorption sensitivity per cm or otherwise for both systems.

3.) The equivalent absorption sensitivity should be mentioned independently if not in the above when the spectrometer is the limiting factor- for example, in the 1permil/hz1/2 spec is this the spectrometer precision or the other, e.g. sampling limited value.

4.) what is the precision of the 8kPa pressure measurement, and is the cell stabilized and if so to what precision?

5.) In Section 2.4, there is a mention of a laser intensity anomaly leading to 2% "bad" data that is a bit unclear to me, even after having read it several times. There is no value of this discussion unless the problem is more thoroughly described and the connection

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to mixing ratio corrections made clear. Overall, I think it is not germane to the paper and could probably just be omitted. If it is kept, the connection between the "moreover" clause to the prior information regarding the isotope mixing ratios is what needs work.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 813, 2012.