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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 #2

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General comments:

This manuscript presents a novel and highly interesting technique to analyze with high precision in real-time and under field conditions the site-specific isotopic composition of the greenhouse gas N2O at ambient mixing ratios. Information about site-specific isotopic composition of N2O is a valuable tool to improve the mechanistic understanding of soil microbial processes underlying the N2O exchange between soil surface and atmosphere. The novel technique is based on a coupling of a mid-infrared quantum cascade laser with an automated and liquid nitrogen-free pre-concentration device. The authors, furthermore, present convincing results of a field application of this novel technique at a grassland site over three weeks of continuous measurement. From my point of view the analytical technique and the results as presented in the manuscript

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are of great interest to a broad readership of ATM and ready to be published. However, the discussion of the results in its current form is too simplistic and requires reconsideration in a couple of points (see specific comments).

Specific comments:

Page 824, lines 4-9: The authors assume for the inorganic soil nitrogen pool, which may serve as substrate for the microbial N2O formation, a δ15N value of 5‰ and refer to one reference from the literature (Makarov et al., 2010). However, from the literature there is ample evidence available that soil nitrate and ammonium δ15N values are highly variable in time and space and thus, cannot be simplified ascribed with one δ15N value of 5‰Ė.g. Durka et al. (1994, Nature 373: 765-767) found for nitrate from forest soils a range of δ15N values from -6 to +6‰Ẇrage et al. (2004, Rapid Commun. Mass Spectrom. 18: 1201-1207) found even a wider range for nitrate δ15N values from grassland soils spanning from about -20 to +5‰Ṫhus, I urgently recommend a more careful consideration of the potential variability of δ15N values in the soil inorganic nitrogen pool when calculating net isotope effects.

Page 824, lines 11-16: Microbial denitrification and nitrification are widely considered as processes involved in soil N2O emission, though nitrification has already been shown to be probably of very minor importance under natural conditions (see Tilsner et al. (2003) Biogeochemistry 63: 249-267 and Wrage et al. (2004) Rapid Commun. Mass Spectrom. 18: 1201-1207). Of probably much greater importance for soil N2O emissions than nitrification is a microbial process that came just since recently in a major focus, namely nitrifier denitrificantion (see e.g. Wrage et al. (2001) Soil Biol. Biochem. 33: 1723-1732 and Kool et al. (2011) Soil Biol. Biochem. 43: 174-178). I recommend considering the latter process in the manuscript.

Page 825, lines 9-13: Please note that N2O consumption in soils is not only driven by soil nitrate availability, but also by soil water content (Goldberg & Gebauer (2009) Global Change Biology 15: 850-860) and soil temperature regime (Goldberg et al.

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(2010) Biogeochemistry 97: 21-30). These aspects should be discussed.

Technical corrections:

I have no suggestions for any technical corrections. The manuscript is formally prepared in a perfect manner.

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