General comments:

The paper aims to quantify N_2O and N_2 production process in grassland soils and its dependence on compaction. N_2O and N_2 emissions and their isotopic signature have been monitored over a period of 12 days after amendment of KNO_3. The presented laboratory studies simplify the complex soil pore system into macro and micropores and uses four stages in a rather narrow range of 70 to 95% "mean" WFPS.
The experimental setup is described in detail. The results agree with the expected values, i.e. domination of bacterial denitrification processes for the higher water content and an increasing share of other contribution for when part of the pores is dry. The measurement of the isotopic signature allows to distinguish different production processes and their dependence on the water status of the macro and micropores.

I had difficulties to follow the argumentation and get quickly lost in too many in details. I also miss a discussion of the significance of the presented findings for the characterization of the emissions of N-species for real grassland systems, although in the introduction (e.g. lines 62 and 63) the study is set in this context.

The used soil stem from a long-term permanent grassland. But the preparation of the samples (a necessary step for the laboratory study) destroys the specific characterization of a grassland soil. Roots and the organization of the aggregates are removed and there is no plant growth that greatly influence the distribution and availability of N substrate as well as the oxygen supply. It should also be mentioned that a large share of N-input in agricultural system occurs in reduced N-form (excrement's, urea or ammonium nitrate). In grazed system, spatial heterogeneity is related to the urine patches with a very high N-input on a very limited area. Also, compaction (trampling by animal, tractor tracks) is spatially very heterogeneous and likely uncoupled to N-substrate input.

The results from the present study shows for N_2O as well as (N_2O and N_2) emission a remarkably low variability among the four treatment, much lower as typically experienced in field measurements.

Below are given specific comments as a guideline to improve the manuscript

Abstract:

Lines 16 and 17: The soil emitted N_2O is predominantly derived from denitrification and to a smaller extent, nitrification in soils,

This is a too crude generalization. There are many ways to produce N_2O and the share between them depends in a complex manner from the main driver, such as oxygen content, substrate availability, etc.

Lines 20 and 21: Soil water content expressed as water filled pore space (WFPS) is a major controlling factor of emissions and its interaction with compaction, has not been studied at the micropore scale.

This is slightly misleading as the experimental setup can only measure net fluxes across the surface of the entire soil samples and naturally does not allow to determine N_2O production/consumption in and out of the micropores.

Introduction

Lines 210 and 211: concentration) for 24 h, or until the system and the soils atmosphere were emitting low background levels of both N_2 and N_2O (N_2 can get down to levels of 280 ppm much smaller than atmospheric values).

Please indicate these „background" values.

Lines 222 and 223: Flushing was carried out with He for half an hour before the solution was required for application to the soil cores and continued during the application process to avoid atmospheric N2 contamination (a total of one and a half hours).

How this affects the oxygen availability?

Lines 304 and 305: We accepted these as unavoidable features of the experimental set-up, but we suggest that the main response of the gaseous emissions occurred under the initial conditions, prior to the loss of water over subsequent days.

"We suggest" is a strange formulation, either the time coarse of the emissions clearly shows this, or it is an assumption.

Results

Lines 311 UNSAT/halfsat (50-100 N kg- dry soil)

Unit of NO_3^- seems incorrect. Also, the header of Table 2 is wrong (twice UNSAT/SAT)

Lines 349 to 351: The results showed that the total N emission (N_2O+N_2) (Table 3) had a consistent decreasing trend, with decreasing soil moisture i.e. from 63.4 for SAT/sat (100% WFPS) to 34.1 kg N ha-1 (71%
351 WFPS) for UNSAT/halfsat.

I don't see a consistent decreasing trend. Only the driest treatment shows a lower emission.

It also would make more sense to use the same reference for the mineral N content as well as the cumulative gaseous emissions (e.g. per g soil).

Lines 351 and 352: The maximum cumulative N_2O occurred at around 80% WFPS as Fig. 2 shows.

This is an overinterpretation. There are four values and a fit with three unknown is applied.

Noticeable emissions of N_2O and N_2 occur in all four treatment only up to day four. Bacterial denitrification is identified as the main production pathway. This is due to the experimental setup with a combined amendment of KNO_3 and glucose, a setup that produce good conditions for denitrification irrespective of the specific treatment.