

Interactive comment on “Spatial variability and hotspots of soil N₂O fluxes from intensively grazed grassland” by N. J. Cowan et al.

Anonymous Referee #1

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The manuscript by Cowan et al. is a research paper to investigate the spatial variability and hotspots of soil N₂O emissions from intensively grazed grassland in Scotland. In this study, they employed a high resolution dynamic chamber method to monitor N₂O fluxes from 100 random points across a 6.78 ha grazed grassland during three days. They also collected 55 soil samples out of 100 measurement locations to evaluate the relationship between soil physic-chemical characteristics and N₂O emission. An interesting and innovative point is that several hotspots of N₂O production were included when they established this study. This could help us to understand the spatial variation of N₂O fluxes from naturally inhomogeneous soils and the contribution of hotspots as N₂O sources to the total emissions. Overall, the manuscript can be given full consideration for publication after revision.

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I have two major comments as follows: (1) The context of section 3.3 about N₂O fluxes from drainage stream should be rewritten concisely because of its less importance. (2) The authors have discussed more about the correlations between soil properties and N₂O fluxes, and also indicated that the soil conditions is more conducive for the occurrence of nitrification and thus higher concentrations of NO₃⁻. However, the authors suggested that denitrification may be the primary process for N₂O emissions solely according to the lack of correlation between NH₄⁺ and N₂O fluxes, this conclusion assumed seems to be speculative and misleading. The process of nitrifier denitrification as a significant source of N₂O production under certain soil environmental conditions is increasingly highlighted in various soils, and should be incorporated into the discussion of the current manuscript.

Specific comments P15330 L14-16, what is the exact time for gas measurement? P15333 L18, the unit for KCl should be 1 mol L⁻¹. P15334 L11, “Fifty measurements were...”, this should be checked again throughout the manuscript. P15334 L10-13, this section is in contrast to the first paragraph in the later 3.5 section, and should be rewritten. P15334 L17, “, respectively”, as well as in other places in this manuscript. P15337 L5, “between the height...”. P15338 L21-22, this sentence is unclear. P15338 L22-23, the range of soil bulk density needs to be clear. P15339 L13-14, concentrations of NO₃⁻ should also be correlated strongly with both total nitrogen and WFPS%.

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