

# ***Interactive comment on “Revisiting the relationship between soil moisture and N<sub>2</sub>O production pathways by measuring <sup>15</sup>N<sub>2</sub>O isotopomers” by Kate A. Congreves et al.***

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Anonymous Referee #2

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Overall the data set is very interesting and will be of interest to readers.

1) The title uses the word 'revisiting'. While the introductory text notes the relationship between nitrification and denitrification processes with respect to soil moisture there is no prior evidence/studies introduced with respect to isotopomers and soil moisture. Thus the title may require suitable amendment or the introduction requires some addi-

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tional information.

Authors: Text has been added to the introduction to make reference to earlier studies that have evaluated the relationship between moisture and N<sub>2</sub>O, and which have used <sup>15</sup>N tracer techniques. No previous studies that we are aware of have used isotopomers to look at this relationship. We have modified the title to better convey our meaning:

“A new look at an old concept: Using <sup>15</sup>N<sub>2</sub>O isotopomers to understand the relationship between soil moisture and N<sub>2</sub>O production pathways”.

2) The introduction is nicely succinct and clear with respect to the problems associated with emissions of N<sub>2</sub>O, the role of soil moisture as a driver of N<sub>2</sub>O emissions, and the basics of isotopomers of N<sub>2</sub>O as linked to nitrification and denitrification. A reference for terminology used would be good.

Authors: we added a citation after the terminology reference, see page 3/line 8 (Ostrom and Ostrom 2012).

3) In the materials and methods sections: - were the soils sieved? I assume so seeing as they were placed in Petri dishes, thus what was the mesh size? - what was the randomised block design? There are 3 soils and 4 replicates but how many water treatments (WFPS treatments) and what were they? It appears looking at Fig 2 that there are about 16 WFPS treatments

Authors: yes the soils were sieved using a 2-mm mesh screen; this information has been added to the revised text (page 4/line 5). The final moisture range (40 to 105% WFPS) was based on data collected during a preliminary test in which soil moisture was varied from 10% to 105%. A lack of N<sub>2</sub>O production when WFPS was <40% led us to limit the moisture range for the final study. The number of moisture treatments within the overall range varied depending on soil texture (21 for the Sutherland soil; 17 for the Asquith soil; and 16 for the Bradwell soil). We can add this information to the

text, or add a supplemental table that lists the individual moisture treatments for each soil (i.e., gravimetric soil water content and WFPS).

The soil microcosms were arranged using a completely randomized design (CRD) with four replicates. This information was added at page 4/line 5.

4) Note how N<sub>2</sub>O fluxes were determined. Assume it was just the one gas sample used, so there are I assume assumptions about linearity.

Authors: We apologize for the miscommunication. We did not measure N<sub>2</sub>O fluxes; rather, we measured the total amount of N<sub>2</sub>O produced during the 24-h incubation. The text has been revised (Section 3.1) to reflect this fact. We have changed the y-axis title in Figure 2 from “ng g<sup>-1</sup> d<sup>-1</sup>” to “ng g<sup>-1</sup> 24-h<sup>-1</sup>”; and have changed “N<sub>2</sub>O flux” to “N<sub>2</sub>O production” throughout the manuscript.

5) For the Picarro CRDS is there a maximum/minimum N<sub>2</sub>O concentration? Were SP effects constant over a range of concentration?

Authors: The minimum detectable N<sub>2</sub>O concentration of the G5131-i (ca. 0.05 ppb) is well below any of the concentrations we measured during the study (the minimum concentrations being at ambient levels). The maximum concentration we can measure without difficulty is about 1000 ppb; consequently, any sample determined to exceed this concentration (based on the GC analyses) was diluted with ultra-pure zero-air to a concentration of approximately 300 ppb for 15N<sub>2</sub>O isotopomer analysis. As well, during earlier testing of the instrument performance it was determined that site preference was independent of gas concentration. (Note: instrument performance is being described in a separate manuscript that is still in the works.)

6) The results and discussion are well considered and it is good the authors have considered N<sub>2</sub>O reduction effects on SP and interpreted results accordingly. For clarity, in the figure captions please state if the data presented are means or single points etc.

Authors: The data presented in Fig 2 are the means (n = 4) means and bars represent

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the standard error of the mean. This information has been added to the figure caption (page 6). Likewise, the data presented in Fig. 3 are the mean site preference values; this information has been added to the figure caption (page 9).

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