

## ***Interactive comment on “Denitrification in soil as a function of oxygen supply and demand at the microscale” by Lena Rohe et al.***

**Anonymous Referee #3**

Received and published: 8 September 2020

This study aimed to explore the controlling factors (soil organic matter, aggregate size, water saturation) of the denitrification process ( $\text{N}_2\text{O}/\text{N}_2$ ) at microscopic scale using new approaches of X-ray computed tomography and  $^{15}\text{N}$  tracer incubation. They found that  $\text{N}_2\text{O}/\text{N}_2$  fluxes could be well predicted by anaerobic soil volume fraction (ansvf,  $\text{O}_2$  supply) and  $\text{CO}_2$  release ( $\text{O}_2$  demand). This findings would expand our understanding of how the  $\text{N}_2\text{O}$  and  $\text{N}_2$  are formed in soils. In general, the experimental design is clear, and the manuscript is well written. However, there are some concerns about the methodology and data interpretation. Major comments 1. The authors selected two types of soils with contrasting soil properties, including soil organic matter contents, soil texture, soil pH and etc., so it is unclear why the authors concluded the differences in denitrification ( $\text{N}_2\text{O}$  and  $\text{N}_2\text{O}+\text{N}_2$  fluxes) between two investigated soils were

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triggered by different respiration rates due to different SOM content rather than other properties. 2. In the results section, the authors displayed the averages for the whole incubation, I feel it is better to show their results with incubation time. And of course, I also think it is not so reasonable to correlated average gas fluxes to the X-ray CT data of a specific incubation time, because the fluxes are not constant during incubation, neither for anaerobic soil volume fraction. 3. From the detailed information showed in supplementary file, the variation between three replicates is very large (eg. Figure S1), the reasons for this large variation as well as the effects on the data reliability need to be clarify. 4. And of course it would have been of interest to see the variations in denitrifying communities at microscopic scale. Minor comments: L125: The soil depth of topsoil should be define, 0-20 cm? L141: How much soil is used for each column? How about the soil depth of the repacked soil cores? How to control the compactness of filling? L150-151: Why spray additional nitrate solution in 83% and 95% WHC treatments but not in 70% WHC?

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Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2020-221>, 2020.

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