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Discussions

Interactive comment on "Nitrous oxide emissions from soil of an African rain forest in Ghana" *by* S. Castaldi et al.

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Answer to comments by Anonymous Referee #2

Referee: However, the method used for N2O as well as CO2 measurements in the study may have defects. Several authors (Zhang et al., Journal of Environmental Sciences, 2013, 25(3): 547-553; Zheng et al., Plant and Soil, 2008, 311(1-2): 211-234) recently have recognized strong influence of CO2 concentration on N2O measurements by using high purity N2 as carrier gas for the GC-ECD method, and N2O flux would greatly overestimated by using the static chamber in comparison with high pre-

cision methods (DN-CO2 method, DN-Ascarite method and AM method). Therefore, the reviewer suggests the authors to discuss a little bit about the quality of the data referring to the two references.

Authors: The analytical method applied to determine CO2 and N2O concentration refers to the set up described in Lotfield et al. In our long term experience on GHG determination in natural and non natural ecosystems we have had many occasions to check possible interference between the two gases. The referee suggests that based on Zhang results high concentrations of CO2 should enhance the peak area of N2O. We never had evidence of such behavior. We have several examples in environments where N2O production was strongly limited (low N or low water) but CO2 conc was increasing inside the chamber over time. We never observed in such cases any increase of N2O over atmospheric concentration. Also we measured GHG emissions from volcanic areas and despite the wide range of CO2 conc observed in the samples, N2O was always at atmospheric concentration without any variation which was relevant (higher than the error associated to the measure). This should be already a good evidence of non significant interaction with our set up. However, given the suggestion we also wanted to test the GC thus we used standards at two N2O concentrations (0.32ppm and 5 ppm) which were, each of them, mixed with pure CO2 so to reach different CO2 concentrations (4 different CO2 conc per each N2O conc.). We did not observe any significant increase of N2O for rising CO2 concentration, which is a result coherent with all our previous observations. We always used the same trademark of GC, TRACE GC ULTRA, THERMO SCIENTIFIC, which was not the one tested by Zheng. We used a Porapak Q column. The peaks of CO2 and N2O separate perfectly at the analysed concentrations so that it is easy to determine the areas for both molecules. So although we clearly accept the scientific evidence by Zhang, we do not have any clear scientific evidence that the same phenomenon occurs with our GC set up.

Referee: Line 19-21, the conclusion lack of evidence, because the authors didn't pro-

vide comparison with other fields.

Author: Yes, we will delete the sentences which are based only on speculation.

Referee: Results, the very large negative values of N2O fluxes obtained by the study may be due to the large uncertainty of the method used by the authors; Considering the standard deviation of the GC-ECD for measuring N2O, the small fluxes (less than 0.103mg/m3/d derived from their standard deviation) presented in line 15-16 (page 16571) were meaningless

Author: It is written few lines above 11-12,: Single chamber N2O fluxes varied between -0.15 and 29.13mgN2Om-2 d-1 in the upland and -0.53 and 16.62mgN2Om-2 d-1 in the lowland. So the minimum flux is indeed higher than 0.103 mg/m2/d, which was close to the value we used as technique limit. The value the referees is referring to in lines 15-16 is the MEAN of several values, so it is a number which derives from a mathematical calculation and not from a direct measure. For example if you have 3 point which flux value is: 0, 0 and 0.2, the mathematical mean is 0.06.

Referee: Page 16571, line 23-24, I don't know the meaning of the sentence.

Author: The sentence mean that to calculate the amount of N2O emissions between two days of measured fluxes we calculate the integral of the area which is delimited by the two measured flux points. You do it for every interval delimited by two measured points. Each consecutive couple of points have as coordinates their respective x(julian day) and y(value of measured flux). Using geometric coordinates the area of the trapezium can be calculated.

Referee:line 1-3, I don't think that the comparable annual N2O fluxes in the three African sites mean similar key driving mechanisms of N2O production.

Author: It is difficult to answer to this comment, as it sounds as an opinion and I don't have a specific scientific statement to which I can answer. We have tried to give our view in the discussion.

Referee: Page 16575, line 10-13, are you sure the WFPS (37-78%) in the lowland is close to saturation?

Author: We did not use in line 10-13 the wording "close to saturation". We observed that the distribution of fluxes for WFPS classes in the two sites is quite different, the lowland being distributed between 37-78%. A higher number of fluxes hence compared to the lowland will occur above 50-60%. With increasing water content the occurrence of anaerobic hotspots increases, where denitrification occurs (Smith 1990). The exact threshold at which this occurs varies also depending on respisration rates, and it is then influences by ecosystem type, C content, C quality, soil temperature, etc. 60% WFPS in a cold and C poor soil might have a different effect of development of anaerobic microsites compared with the same WFPS in warm tropical forests.

Interactive comment on Biogeosciences Discuss., 9, 16565, 2012.