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comment**

Interactive comment on "Tropospheric NO$_2$ concentrations over West Africa are influenced by climate zone and soil moisture variability" *by* Ajoke R. Onojeghuo et al.

Anonymous Referee #1

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Review on manuscript acp-2016-1128

"Tropospheric NO2 concentrations over West Africa are influenced by climate zone and soil moisture variability " by A.R. Onojeghuo, H. Balzter and P. Monks

The objective of this article is to highlight the links between NO2 colums in the troposphere and soil water content, by using satellite data and statistical analysis, on different climate zones classified from arid to humid depending on their latitudinal position in West Africa. The topic is very interesting, and the tools used for the analysis give attractive figures. However the discussion lacks of in-depth interpretation and does not go far enough in the meaning of the results. I would recommend rejecting the paper at that stage of the work, but I would also recommend re-submitting it after careful proof

reading of the English language and thorough interpretation of the results which would give certainly very interesting conclusions. In that purpose, I give general and specific comments to improve the manuscript and consider a new submission.

General comments:

In the discussion part, the text remains very descriptive, and more interpretation of the results are needed. The conclusion does not reflect the title.

English language needs careful proof reading (sentences beginning by "with" should be written in another way).

Soil Water Index is deduced from satellite data, and is mentioned as soil moisture in the text, whereas figures mention SWI. Please choose one denomination only and homogenize throughout the text.

The land cover classes in Figure 2 are not exploited enough in the interpretation. Furthermore, the influence of anthropogenic emissions, biomass burning or natural emissions are discussed, but without any clear basis. Emission inventories would be needed to explain NO2 tropospheric columns, or at least information from literature.

The acronyms should be detailed the first time they are used.

Specific comments:

Abstract: mention the period used for this study. Line 22: emissions of NO2 do not exist. Should be emissions of NO or concentrations of NO2.

Introduction: Paragraph from lines 19 to 32 page 2 should be placed before paragraph from lines 6 to 17. Page 3, Figure 1: The Köppen Geiger climate classes mention a "tropical savanna" class. This class is never mentioned again in the text. Please use the same denominations to determine the climatic classes used in figure 1, in the text (especially page 4 lines 3 to 14) and in figure 2. Page 3 line 10: "relatively constant" is not precise enough. Please quantify and explain on which basis you give

this statement. Page 4 line 19: the sentence is too long and the same thing is repeated twice.

Methods: page 6 line 9: may be you could explain in a few words the role of each R package.

Page 7 line 16-17: "GC test... ". I do not understand this sentence.

Results and discussion page 8 This part should be reorganized and results could be discussed according to the vegetation types and the N emissions found in each climatic zone. Urban and traffic emissions are mentioned for Lagos et Abuja, what about flaring, which is mentioned later on in the manuscript?

Page 8 line 5: what are "soil moisture emissions"?

Page 9: Figure 4 needs a better analysis. What information does it bring compared to the other figures? The information seems to be given but should be better organized to help the reader follow the discussion. Paragraph from lines 17 to 21 is redundant with the preceding.

Page 10 line 20 "arid steppe zone" is repeated twice.

Page 11 line 10: sentence is not correct. Line 24: can you explain in more details why "the increasing soil moisture can cause an increase in the abundance of OH radical?" What about NO2 deposition onto vegetation? It also a key loss process of NO2, depending on the type of vegetation in presence. Line 32 to 35: the sentences are not correct.

Page 12: A lot of description of figure 6 is given but no reasons why NO2 columns decrease when SWI increases in JJA and SON. NO2 concentrations depend not only on NO emissions from soils or anthropogenic sources, but also on NO2 deposition (and on the type of vegetation). The information is in the paper, but is not analyzed correctly.

Page 13 line 1: Feig et al. refers to Water Filled Pore Space, and not on soil moisture

or SWI. These are different ways of representing the soil water content and a direct comparison is not possible. Line 11, F should be 10.22 instead of 72.50 in the case of arid desert as mentioned in table 1. No interpretation is given in reference to this Granger causality test results, this is frustrating for the reader. Sentence line 15 is not correct.

Page 14 line 14: you mention "global effect of climate change induced soil moisture variability" but no explanation is given. What influences these flooding of the Niger Delta do have on NO2 columns?

Page 15 line 2: the Green wall initiative is mentioned: do you mean that this project has increased NO2 concentrations in the troposphere due to the input of fertilizers? In that case this has nothing to do with soil moisture variability? How do you cross this statement with previous results of figures 3, 4, 5, 6, 7? Same comment for NO2 decline and the decrease in gas flaring: what is the link with soil moisture?

Page 16: Conclusion. The text does not allow to conclude that "soil moisture plays a vital role in reducing atmospheric NO2". It is difficult to understand why.

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