Response to anonymous referee #2

The authors greatly thank the reviewer for the interesting and constructive comments on the manuscript. We will try below to answer the questions and propose solutions. The reviewer's question is in italic, while the author's answer is below. Line numbers where modifications are made are relative to the new version of the manuscript.

General comments:

While I believe the methodologies associated with atmospheric and gas flux measurements are sound, I am concerned with the soil sampling protocol and subsequent characterization, especially as it relates to mineral-N. It is not clear if the authors took 3-4 replicates for each landscape element each day, or a total of 3-4 replicates over the course of the campaign for each landscape element (lines 243-244).

The authors took a total of 3-4 replicates over the course of the campaign. On one particular day, samples were collected at the 4 different ecosystems. For example, on July 19th and 28th, samples were collected in bare soil, grassland, forest and maize field, whereas the forest site was not sampled on July 9th, and maize field was not sampled on July 6th.
Moreover, the first collection date for grassland should be July 6th (instead of 7th). This will be corrected.
Line 246, the sentence has been modified in
Samples were collected at the four different land cover types, three to four times during the campaign

Soil C should not change (to the extent reported) over the course of 3 days (Bare Soil: 06/07-09/07) and can only be attributed to environmental heterogeneity

Actually samples were collected in the same area, but not exactly at the same place (another hole was dug, close to the first one). Therefore, the spatial heterogeneity of samples may explain de different results of organic carbon.

While I am sure location and resources had much to do with this, air-drying may result in large changes to ammonium concentrations. Additionally, significant changes in the amounts of ammonium can take place over prolonged storage at room temperature, even if soils are dried. It seems that the authors are aware of this issue and attempted to justify their method by citing a meta-analysis of warming experiments on N-cycle activity. (Bai et al. 2013). However, this meta-analysis found that warming and moisture reduction had no significant effect on mineralization (Bai et al, 2013: Table 1), indicating even in dried samples, pools of inorganic-N may change over time. To remedy this, the authors could have compared their ammonium concentrations to similar studies from this region; however, this was not included in the results/discussion.

The authors are aware of this particular problem of NH_3 volatilization. The analyses have been made as soon as possible after the field campaign. A direct analysis was not possible, due to missing infrastructure. Freezing the samples would have been the best solution, but considering the difficulty of organizing the campaign in a place where the minimum material was installed, we could not afford to bring a freezer.
Some authors have also published results of ammonium concentrations measured in soils that were dried in ambient air (Bai et al., 2010, Dick et al., 2006, Cassity-Duffrey et al., 2015).

Moreover, very few values are available in the literature, it is therefore very difficult to compare. The results presented in section 3.3 are consistent with Massad et al. (2010) which may provide a certain confidence in analysis. Dick et al. (2006) have also found NH_4^+ concentrations between 2 and 8 $mgN.kg^{-1}$ in Senegalese soils, which is very close from our results. Vanlauwe et al. (2002) have found values between 0.8 and 1.4 $mgN.kg^{-1}$ in West African moist savanna soils (in Togo and Nigeria).

Line 255, new references have been added in the text:
Some authors have also published results of ammonium concentrations measured in soils that were dried in ambient air (Bai et al., 2010, Dick et al., 2006, Cassity-Duffrey et al., 2015).

Line 360, the following references have been added:
Dick et al. (2006) have found NH_4^+ concentrations between 2 and 8 $mgN.kg^{-1}$ in Senegalese soils, which is very close from our results. Vanlauwe et al. (2002) have found values between 0.8 and 1.4 $mgN.kg^{-1}$ in West African moist savanna soils (in Togo and Nigeria)..

In regards to the tables and figures, the authors should strongly consider merging Figures 2-5. As they currently sit, there is a large amount of redundancy.

As reviewer #1 asked to add NO and NH_3 concentrations in the figures, we chose not to merge figures 2 to 5, it would have been impossible to read.

References

Bai Junhong, Haifeng Gao, Wei Deng, Zhifeng Yang, Baoshan Cui, Rong Xiao, Nitrification potential of marsh soils from two natural saline–alkaline wetlands, Biol Fertil Soils (2010) 46:525–529.

Cassity-Duffey Kate, Miguel Cabrera, John Rema, Ammonia Volatilization from Broiler Litter: Effect of Soil Water Content and Humidity, Soil Sci. Soc. Am. J. 79:543–550, 2014.

Dick Jan, Ute Skiba, Robert Munro and Douglas Deans, Effect of N-fixing and non N-fixing trees and crops on NO and N2O emissions from Senegalese soils, Journal of Biogeography (J. Biogeogr.) (2006) 33, 416–423.

Vanlauwe B., J. Diels, O. Lyasse, K. Aihou, E.N.O. Iwuafor, N. Sanginga, R. Merckx & J. Deckers, Fertility status of soils of the derived savanna and northern guinea savanna and response to major plant nutrients, as influenced by soil type and land use management, Nutrient Cycling in Agroecosystems 62: 139–150, 2002.