On behalf of all co authors, I would like to thank anonymous referees for their positive comments on this study. We have tried to address all comments and to bring some new information to the paper, in order to improve its structure and its readability.
Each point raised by the referee (in italic) is given an answer.

I am struggling with the organization of the paper, with only minimal information provided in the introduction (e.g. what are driving hypotheses for studying these sites and multi-years) :

The following text was added in the introduction, to fix the ideas on the link between seasonal meteorological cycle and impact on emission and deposition processes:
"In West Africa, meteorological variations are determined by those of the West African Monsoon (WAM). The ITCZ (InterTropical Convergence Zone) is the primary factor controlling directly the rainfall over West Africa. In boreal winter, the continent is dry (the ITCZ is around 5° N). It reaches its northernmost position (between 10 and 12° N) in August before retreating to the south (Lebel et al., 2009). The resulting typical rainfall cycle involves a 3 to 6 months rainy season, depending on the latitudinal position. In theory, more rain will allow an increase in the vegetation available for grazing, i.e. a better quality and higher quantity of food for animals, which will induce more N in animal manure, more NH_3 from volatilization and NO emission from soils, and therefore more wet and dry deposition of Nitrogen compounds. The volatilization of NH_3 and other species will be retrieved in the rains, and scavenged by the wet deposition, which will further increase the NH_4^+ availability in soils, and again the NH_3 volatilization and NO emission from soils"….
…"The present work allows a comparison between two different nitrogen emitting ecosystems, for different years and different points at the local scale. The interannual approach (compared to the single year approach made for 2006) helps to study the reproducibility of nitrogen emission and deposition fluxes linked to the WAM cycle, and to compare the eventual impact of the WAM variability from year to year, with the natural variability of local sources."
…
"The approach is mostly based on modelling (only nitrogen concentrations in gas and rains are measured), leading to large uncertainties and to results difficult to check, but with the idea to give an insight on rather known processes occurring in little known regions with specific environmental conditions".

The material and method part (some tables summarizing site characteristics, used models, approaches to assess uncertainty and assumptions taken to finally derive flux estimates) are needed.

The material and method part has been completed with portions of text that were not at the right place in the result discussion. Some tables have been added to present the different sites in terms of type of soil and vegetation, geographical location, mean annual precipitation and temperature, min and max LAI, livestock and human population, land use and fertilisation. Table 4 summarizes methods or models used to calculate the different contributions of emission and deposition fluxes, and Table 5 summarizes how uncertainties have been estimated.

Table 1. Presentation of the measurement sites. Mean annual precipitation is calculated from TRMM (see text for details) and local measurements. WS=Wet Season. DS=Dry Season.

Name	location	Country (region)	Climate	Annual Precip. mm (simul/meas.)	Annual Temp. °C
Agoufou	15.3° N, 1.5° W	Mali (Mopti)	Sahelian WS: June-September DS: October-May	482/366	30
Banizoumbou	13.3° N, 2.4° E	Niger (Dosso)	Sahelian WS: June-September DS: October-May	664/463	30
Katibougou	12.5° N, 7.3° W	Mali (Koulikoro)	Soudano-Sahelian WS: June-September DS: October-May	720/765	28
Djougou	9.7° N, 1.7° E	Benin (Atakora)	Soudano-Guinean WS: April-October DS: November-March	1115/1250	27
Lamto	6.1° N, 5° W	Ivory Coast ()	Guinean WS: April-October DS: November-March	1100/1300	28

Table 2. Presentation of the measurement sites: Soil and vegetation types.

Name	Vegetation classification	Dominant vegetation type	Min-max LAI ($m^2.m^{-2}$)	Soil types
Agoufou	Dry savanna	Open woody savanna *Cenchrus biflorus, Aristida Mutabilis* *Zornia Glochidiata, Tragus Berteronianus*	0-1.8	Fixed dunes Sandy plains
Banizoumbou	Dry savanna	Tiger bush - fallow bush *Zornia Glochidiata, Guiera Senegalensis* *Cenchrus prieurii*	0-1.7	Sandy soils
Katibougou	Dry savanna	Deciduous shrubs	0.3-2	Sandy soils
Djougou	Wet savanna	Deciduous shrubland with sparse trees *Hyparrhenia involucrata, Andropogon fatigiatus*	0.5-2.5	Sandy soils
Lamto	Wet savanna	Gallery forest mosaic *Hyparrhenia diplandra, Andropogon schirensis*	2.5-4	Ferrugineous soils

Table 3. Presentation of the measurement sites: Land use and population. C=Cattle, S=Sheep, G=Goats. IPR= Institut Polytechnique Rural

Name	Land use	Fertilisation	Livestock head.km^{-2}	Human population Nb people.km^{-2}
Agoufou	Main rain-fed crop: millet	Organic	C:24, S:16, G:19 Close to a wet point High grazing pressure	16.7
Banizoumbou	Rain-fed crop: Millet, Sorghum	Organic	C:22, S:21, G:27 Close to a wet point High grazing pressure	45
Katibougou	Rain-fed crop: Millet, Sorghum	Organic	C:11, S:7, G:10 IPR High grazing pressure	30
Djougou	Cultivated crops and fallow Yam, tec, karite	Organic	C:8.5, S:5, G:6 Low grazing pressure	18
Lamto	Pineapple, coffee, cacao V Baoule shape	Synthetic	C:7, S:8, G:6 Low grazing pressure	20

Table 4. Methods and models used for the calculation of emission and deposition fluxes.

Flux	Method description	Model (or calculation) used
Biogenic NO	SVAT Model	ISBA
Biomass burning fires	Satellites	SPOT-VGT vegetation satellite and Global Land Cover (GLC) vegetation map
Biofuel fires	Existing Database	Emission factors inventory for biofuels
Ammonia volatilization	Existing Database	Livestock population and N release from manure
Dry deposition Velocity	SVAT model	ISBA
Gas concentrations	In situ measurements	Passive samplers
Dry deposition flux	Inferential method	dry deposition velocity * concentration
Wet deposition flux	In situ measurements	Precipitation collector

What I missed to see is time series of the measurements of wet deposition and air concentrations of Nr/ O3 etc. on which all the modelling was based.

Concentrations in gas in monthly means have been reported and described in Adon et al. (2010). A new line has been added in figure 3, showing NH_3 concentrations at the 5 sites. Considering that NH_3 has the prominent place in the budget, concentrations of NO_2 and HNO_3 have not been added to keep the figures readable. Figure 2 now concerns only oxidized N compounds, figure 3 concerns reduced N compounds + NH_3 concentration. The referee is kindly asked to refer to response to referee#2 to have a look at figure 3.
Concentrations in rain are calculated at the monthly scale, but are usually used in publications at the yearly scale. A new paper by Laouali et al. (2011) will be published soon in Atmospheric Environment (it has been accepted with revision), and concerns concentrations in rain for the three IDAF dry savanna sites. (Long term monitoring of the chemical composition of precipitation and wet deposition fluxes over three Sahelian savannas, Laouali et al. (2011)). Concentrations in rain for wet savanna sites have been reported by Yoboué et al. (2005) for Lamto, and a publication is in preparation for Djougou.

As an example of monthly time series for wet deposition, measured at the three dry savanna sites (Agoufou, Banizoumbou and Katibougou), the following figure has been extracted from laouali et al. (2011), but NOT included in the present paper.
This figure shows the evolution of NH_4^+ and NO_3^- concentrations in rain, and corresponding wet deposition fluxes. Three years of measurements are available in Agoufou, 16 years in Banizoumbou, and 13 years in Katibougou.

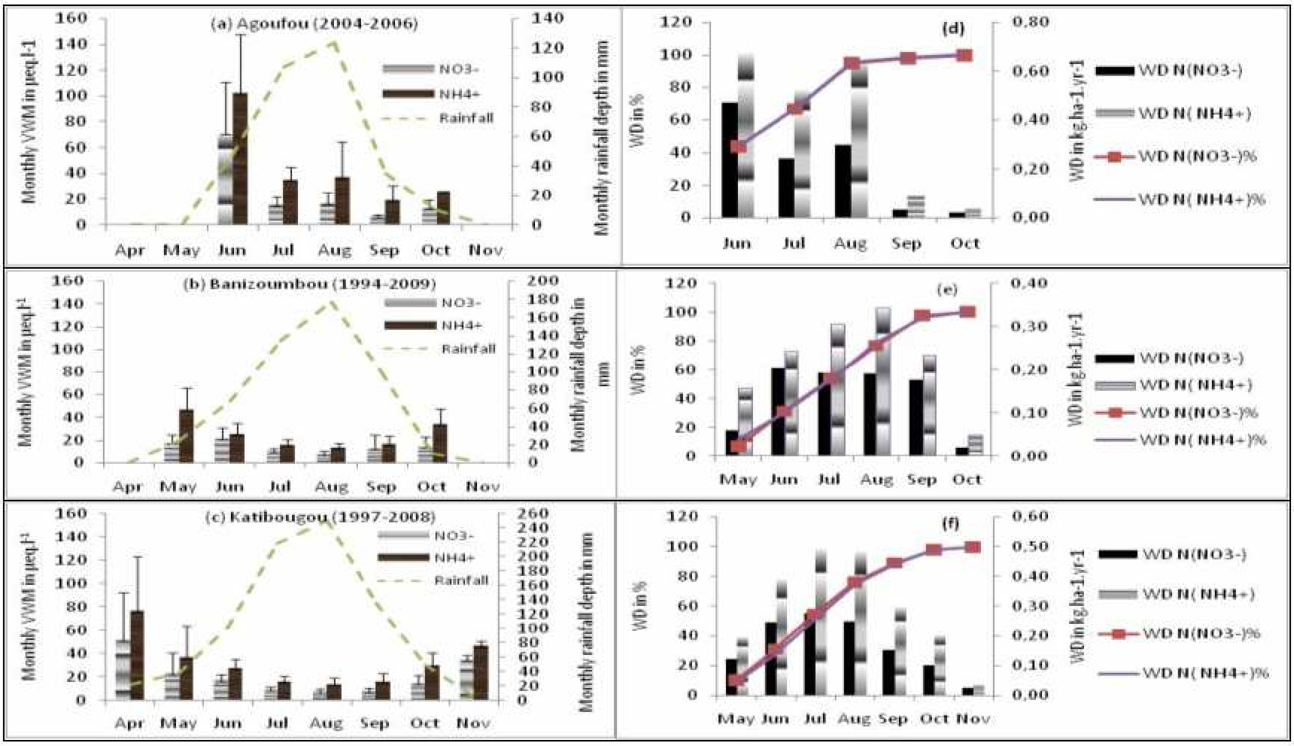

Figure 5(a-c): Mean monthly VWM concentrations of NO3- and NH4+ in µeq.l-1 and wet deposition in % at the three dry savanna sites. Vertical bars represent the standard deviation around each monthly mean.
Figure 5(d-f): Wet deposition flux in % calculated from the monthly mean over the measuring years.

This figure shows the rather high concentrations in rain at the beginning of the wet season, and also at the end for Banizoumbou and Katibougou, probably due to later rains in the season occurring after a pause in precipitations.

N must be lost from the system in form of N2 or N2O (marginal most likely as N2O5) but a rough estimate of biological N2 fixation as driver of N cycling in these systems would be useful.

In the introduction, the following text has been added:
"The vast majority of N in the atmosphere is N_2, which is biologically unavailable to most organisms. N must be converted from N_2 to reactive N (Nr) (Chen et al., 2010). Most biological N fixation (BNF) in terrestrial systems occurs in tropical regions (Galloway et al., 2008), and the response of these systems to additional N inputs could result in rapid N losses to air and water (Matson et al., 1999). Chen et al. (2010) have estimated that the mean BNF rate in savannas was 18.6 $kgNha^{-1}yr^{-1}$."
N_2, N_2O and N_2O_5 fluxes have not been our budget for several reasons: our study focuses on reactive N, measurements on sites do not include those compounds, and emission fluxes are low on very dry soils.
The following text has been added at the end of the introduction:
"This budget is not exhaustive, because measurements do not include all N compounds. Non reactive N compounds (N_2, N_2O, N_2O_5) are not included in the budget (we only consider the atmospheric reactive N compounds). N_2O emissions from savanna soils account for 16% of the global production of N_2O (Brummer et al., 2008), but NO has a higher chance than N_2O to escape from sandier soils (Meixner and Yang, 2004), especially if Water Filled Pore Space (WFPS) is inferior to 50% (Bouwman et al., 2002), which is the case of most of the sites studied in this work. For N_2, it is relatively well established that emissions are favoured by a WFPS superior to 70% and for loam and clay loam soils (Loubet et al., 2011). The contribution of N_2, N_2O, and N_2O_5 can therefore be considered as negligible in semi arid and sandy sites with low soil humidity, whereas in other parts of West Africa it will introduce a gap in the budget if not quantified."

Page 7224, line 1 foll. A rough estimate of the contribution of tropical regions to Nr production would be helpful. I think that Galloway et al. 2008 provides some ideas to get to such numbers.

This is partly answered in the introduction (see comment just above).

Page 7224, line 11 following It is clear that the work of Delon et al was expanded to two more sites and a longer time period. But at this point it would be interesting to know what are you hypothesizing: due to the limited interannual variability of rainfall Nr fluxes are rather constant across years? Are dry or wet savanna systems exhibit larger Nr fluxes? Some reasoning on current understanding underpinning hypotheses would be helpful too.

When I have started this study, I would have hypothesized that the interannual variability in rain intensity would have a significant effect on emission and deposition fluxes. But this hypothesis has not been verified on deposition fluxes, whatever the site. No significant tendency could have been isolated, and the study is more focused on the seasonal variations of fluxes (linked to the African Monsoon cycle and to natural variations of sources) in two different ecosystems rather than their interannual variability. I have tried to give the main

driving ideas in the introduction, and actually wet and dry savannas present the same amount of Nr fluxes, but the contributions of different sources are not equivalent.
I expect that these ideas have been better exposed in the new version of the manuscript.

Page 7225 Though it may be repetitive more site information is needed. Specifically climate information, dominating vegetation, land use at the site and the region, possibly information about management (livestock raising, fertilizer use, crop management, frequency and intensity of biomass burning events) to get a bit of an idea how comparable sites are, or how they differ. To say this has been reported is not fair for any reader, at least some rough information is needed (e.g. in form of a Table.)

As mentioned above, several tables give some more information on sites. This list is of course not exhaustive, and a lot more is probably available in other references.

Page 7226, line 14 How was the 54% uncertainty determined? Also in the following just say shortly how uncertainty values were derived.
Table 5 is a bit more descriptive on uncertainties calculations than the previous text. It gives the sources of uncertainties. Furthermore, uncertainties on NO biogenic fluxes have been more precisely assessed. Some uncertainties are not quantified, as the one linked to the compensation concept, not accounted for in this work. The fact that this study is mostly based on modelling adds a non quantifiable uncertainty… In the table, only quantifiable uncertainties are given, as a lowest estimate.

Table 5. Uncertainties linked to the calculation of emission and deposition fluxes. A=Agoufou, B=Banizoumbou, K=Katibougou, D=Djougou, L=Lamto. EF=Emission Factor.

Flux	Sources of Uncertainties	References
Biogenic NO	Non linear function on soil temperature and moisture A: 3-42%, B: 4-42%, K: 7-68%, D: 2-46% L: 3-90%	Delon et al. (2010)
Biomass burning	Burnt areas: 20%, Burning efficiency: 25% Biomass dendity: 30%, Emission factor: 31%, Total: 54%	Liousse et al. (2010)
Biofuel	Wood and charcoal consumption: 50%, EF: 31% Total: 60%	Junker and Liousse (2008) Assamoi and Liousse (2010)
Ammonia volatilization	Animal population: 10%, N release: 50% Total: 51%	Bouwman et al. (1997), FAO
Dry deposition Velocity	Wind forcing, rugosity: NO_2:13%, HNO_3: 19%, NH_3: 15% Chemical reactions: NO_2:35% Monthly integration (missing conv) :NO_2:20%, HNO_3 and NH_3: 10%	De Arellano and Duynkerke (1992) Matt and Meyers (1993)
Gas concentrations	Covariance of duplicate samples: NO_2:9.8% HNO_3: 20%, NH_3: 14.3%	Adon et al. (2010)
Dry deposition flux	Total: NO_2:70%, HNO_3: 38%, NH_3: 31%	
Wet deposition flux	Rain gauge measurements: 10% for all species	Galy-Lacaux and Modi (1998)

Page 7226, line 24 should not be excluded? Does this means that it was considered? And how was it considered?

Text was changed in “Biomass burning influence from the southern hemisphere is indirectly taken into account in wet deposition fluxes”

Page 7232, line 22 The following paragraph is very well suited for the introduction section but not for the results.

The paragraph has been moved to the introduction.

Page 7234, line 1 follow. Also this paragraph I would rather see in the Material and Methods section (site description) as to be found in the result section.

The paragraph has been moved to the Material and methods section.

Page 7234, line 27 FAPAR curves: let us assume that not all readers are insiders.

The following text has been added:
"Furthermore, dry savanna ecosystems are characterized by a strong annual vegetation cycle, as stated by FAPAR (Fraction of Absorbed Photosynthetically Active Radiation) curves given for the Sahel region in Galy-Lacaux et al. (2009), and showing the level of vegetation photosynthetic activity, which signifies the amount, state and health of vegetation canopies."

Chapter 3.1.2 Since estimates of soil NO emissions are modeled and not measured I find this section extremely speculative. From my perspective the discussion of the modeling results should focus on the likeliness of magnitudes, seasonal patterns and site differences (e.g. due to differences in soil, vegetation or management) and not so much if nitrification or denitrification or both are contributing to simulated emissions.

This chapter has been deeply modified, and comparisons with unpublished and literature data have been added. A lot has been moved to introduction or site description, and the following text and table have been added:
"Very few measurements have been done in these regions, and some have not been published. During the AMMA program, several field campaigns have been performed in Agoufou (in 2004) and Djougou (in 2005 and 2006), giving an order of magnitude for biogenic NO fluxes at different seasons. These results are presented in Table 7, together with literature data from Lamto and Banizoumbou. Measurements performed in dry savanna (Agoufou and Banizoumbou) give higher averages than those from wet savannas (Djougou and Lamto). Dry savanna modelled fluxes are in accordance with measurements, whereas in wet savanna, modelled fluxes overestimate measurements."

Table 7. Mean NO biogenic fluxes from unpublished data and from literature

Site	NO flux ($kgN\,ha^{-1}yr^{-1}$)	Period of meas.	Reference
Lamto	0.17±0.07	Wet season, 1992	Leroux at al. (1995)
Lamto	0.41±0.12	Wet season, 1992	Leroux at al. (1995)
Lamto	0.12±0.04	Wet season, 1992	Leroux at al. (1995)
Lamto	0.09±0.02	Wet season, 1992	Leroux at al. (1995)
Banizoumbou	1.92±0.83	Wet season, 1992	Leroux at al. (1995)
Lamto	0.03±0.01	Dry season, before fire, 1992	Serça et al. (1998)
Lamto	0.20±0.10	Dry season, after fire, 1992	Serça et al. (1998)
Agoufou	2.58±3.86	Wet season, 2004	Delon et al. (2007)
Agoufou	0.81±0.51	Wet season, 2005	Unpublished
Djougou	0.43±1.34	Wet season, 2005	Unpublished
Djougou	0.62±0.42	Dry season, 2006	Unpublished

Some more corrections have been added in response to referee #2, and the structure of the paper has been modified to clarify and separate material/method, results, and discussion parts.

A new version of the manuscript is already available: all modifications could not be mentioned in this response to referee.