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.

The N budgets presented are very uncertain and the data are therefore somewhat over-interpreted, bearing in mind that so much is based purely on model simulations (eg biogenic NO emission), or very crude assumptions (eg a flat emission factor of 30% for NH_3 from organic fertilisation).

The speculative aspect of this study raised by the referee comes effectively from the fact that results are mostly based on modelling. As stated in the introduction, "the idea is to give an insight on rather known processes occurring in little known regions with specific environmental conditions". Concentrations in gas and rain are measured, and modelling result interpretation strongly relies on these measurements, from which all this study starts.
Of course these results can not be verified as a whole, but they corroborate the measurements, and help to understand the contributions of sources, in a rather large range of uncertainty.

The flat emission factor of 30% has been deduced from literature. Including a seasonal variation for this factor would have introduced a supplementary uncertainty. The following text was added:
"This rate of 30% has been deduced from other studies: Bouwman et al. (1997), Bouwman and Van Der Hoek (1997) and Bouwman et al.(2002) have found that the fraction of the N excretion that is lost as NH_3 ranges from 10 to 36%, depending on animal-waste management and animal category."

However, key messages are difficult to extract, the structure of the paper is a little confusing, with results being shown in the materials and methods section, while this section actually devotes very little space to the description of sites, measurement protocols and models used. Even if the 'present paper is a continuation of Delon et al. (2010)' it would be useful to provide a little more background information in an M&M section, while shifting the actual results to a different section.

Description of sites has been developed through tables, as asked as well by referee #1.
Three tables have been added. Table1: Presentation of the measurement sites. Mean annual precipitation is calculated from TRMM (see text for details) and local measurements. Table2: Presentation of the measurement sites: Soil and vegetation types. Table3: Presentation of the measurement sites: Land use and population.
Referee #2 is kindly asked to have a look to response to referee #1 where tables are given.

The structure of the paper has been deeply modified, all text concerning material and methods has been moved to the right section, and results included in the "Material and method" section have been moved to the "results and discussion" part.

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

Concerning dry deposition,… Thus the error bars attributed to NH3 dry deposition (Fig. 4) are undoubtedly much too small… Basically, there is no way to tell whether the ecosystem

is a net source or sink until some sort of validation using actual flux measurements is done. Since this was clearly outside the scope of the study, this paper should make it clear that the uncertainties associated with dry deposition are much larger than currently shown.

Concerning NH_3 and NO_2 dry deposition, it is difficult to quantify the uncertainty we do when non applying the compensation point. However, we have tried to advertise the reader that, effectively, the quantified uncertainty is incomplete and underestimated.
The following text has been added in the "Results and discussion" part: "However, NH_3 concentrations can be large in savanna areas, as shown in Adon et al. (2010), and non evaluating the compensation point effect will inevitably involve a supplementary source of uncertainty on NH_3 net flux, rather difficult to assess."
At the end of this paragraph, before the conclusion, the following text was included: "The uncertainty applied on deposition fluxes (25%), has been calculated only from quantifiable assumptions. In reality, dry deposition fluxes of NH_3 do not take into account the compensation point concept, and an important additional uncertainty (not quantified in this work) should be applied on this contribution of the budget."

I hold the same to be true for biogenic NO emissions as predicted by the model, unless there have been flux measurements in the past at some of these sites, that are not mentioned in the current manuscript.

Concerning NO emissions from soils, results from literature and from unpublished data have been added in Table 7, and discussed in comparison to modelling results, in the "Results" section, "Biogenic emission from soils".

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

"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. This could be due to a too pronounced response of the model when soil moisture remains high, like in wet savanna ecosystems, leading to higher modelled fluxes than measured."

p7225, section 2.1: add Table summarising the main characteristics of the 5 sites: annual T, P; maximum grazing density; min-max LAI; main vegetation species; etc

Three tables have been added, and presented in response to referee#1.

p7230, l15-16: there are of course also very large seasonal changes in vegetation in European (temperate) conditions, which I don't see as being any less drastic than at the savanna sites. Annual crops (wheat, potatoes, maize, etc) grow from a leaf area index of 0 to 4-6 m2/m2 within a few months, before harvest, from canopy height z=0 to z=1- 3 m, etc. Deciduous trees leaf out in spring and photosynthesize during the summer, before leaves drop in the autumn. Thus stomatal conductance and roughness length, which control dry deposition, thus also undergo large seasonal changes in Europe, not more, not less than in Africa.

The text in the manuscript was actually targeting on soil moisture drastic changes, not so much on vegetation. As vegetation is directly linked to soil moisture, confusion was made in the original sentence.

"Vegetation" in the sentence was changed in "soil moisture", which leads to "soil moisture in European sites is less subject to such drastic seasonal changes."

p7230, l5-l27: it would be helpful to provide the mean or median Vd for all sites (only the range is provided at present).

Mean annual Vd have been added in the text:

"Monthly mean values of deposition velocities for HNO_3 range from 0.40 to 1.00 cm/s (average: 0.63±0.13cm/s) in Agoufou, 0.42 to 1.11cm/s(average: 0.72±0.15cm/s) in Banizoumbou, 0.49 to 1.13 cm/s (average: 0.73±0.13cm/s) in Katibougou, 0.43 to 0.91 cm/s (average: 0.65±0.11cm/s) in Djougou and 0.52 to 0.85 cm/s (average: 0.69±0.08cm/s) in Lamto.

NO_2 deposition velocities range from 0.13 to 0.35cm/s (average: 0.20±0.06cm/s) in Agoufou, 0.14 to 0.39cm/s (average: 0.23±0.07cm/s) in Banizoumbou, 0.14 to 0.43cm/s (average: 0.23±0.08cm/s) in Katibougou, 0.18 to 0.46cm/s(average: 0.31±0.08cm/s) in Djougou, and 0.21 to 0.46cm/s (average: 0.35±0.06cm/s) in Lamto.

NH_3 deposition velocities range from 0.14 to 0.41cm/s (average: 0.23±0.07cm/s) in Agoufou, 0.16 to 0.49cm/s (average: 0.27±0.10cm/s) in Banizoumbou, 0.16 to 0.53cm/s (average: 0.28±0.10cm/s) in Katibougou, 0.22 to 0.52cm/s (average: 0.37±0.10cm/s) in Djougou, and 0.26 to 0.54cm/s(average: 0.42±0.07cm/s) in Lamto.

p7231, l1-8: as said above in general comments, I would not be so quick to rule out a compensation point, in the foliage and probably more importantly in the leaf litter on the soil surface, since warm and wet conditions favour a rapid decay, mineralization and turnover of plant material, releasing NH4+ which can either be nitrified, but also be lost to the atmosphere directly by volatilisation. It seems to me that this pathway of NH_3 emission is not accounted for in the emission inventory described in Section 2.2.4 (with only dung and urine contributing with a 30% emission factor?

The referee is right, the emission of NH_3 from soil is not quantified in the emission budget. Indeed, no direct emission flux has been measured on sites, and the budget is estimated through calculations only. However, NH_3 deposition and emission fluxes show an increase at the beginning of the rain season (as shown in figure 3 by fluxes and concentrations), which in my opinion indirectly retransmits the emission from soils, flooded in the volatilization from manure.

Concerning the evaluation of the compensation point, further work is planned to include the compensation point in the model and correctly calculate ammonia deposition velocity. This work will hopefully be done in the near future.

p7231, l9-13: this belongs to materials and methods, but much of the text that has come before was results. There should be a clearer split between methods and results.

The text was shifted at the right place.

p7231, l18-19: these uncertainties are certainly much higher

As explained above, these uncertainties have not been quantified; however, the reader is informed that the results are presented with uncertainties at their lowest estimate.
Concerning NO emissions from soils, the following sentences have been added in the "Material and Methods" section:
"Actually, this uncertainty is invevitably underestimated, because it is based on simulated soil moisture and temperature, which own uncertainties increase the resultant uncertainty on fluxes. Furthermore, pH, sand percentages, and fertilisation rates are taken from global or hand made databases, which further increases the flux uncertainty. The total uncertainty is hard to quantify. Therefore, a 20% annual mean uncertainty for all sites will be applied as a lowest estimate, except in Lamto, where a 50% uncertainty is applied.

p7231, l20-21: are these wet-only collectors?

Yes.

p7232, l1-2: dissolved organic nitrogen can contribute a significant fraction (20-30%) of total wet N deposition in Europe; how about Africa?

As far as the authors know, very few references are available on the subject. References have been found for the United States (Hille et al., 2005, Whitall et al., 2002), stating that DON could represent 20% of the total wet deposition N flux, and a reference in Eastern Mediterranean states that " Water-soluble organic N was found to contribute ~17% and ~26% of the total water-soluble N in rain and aerosols, respectively." (Mace et al., 2003).
These references have been added in the text.

p7232, l7-8, what is TRMM3B42 for the layman?

Following text was added: "In Table 1, mean annual rainfall is calculated from TRMM (Tropical Rainfall Measurement Mission)-3B42 data in mm, from 2002 to 2007, and compared to local site measurements. The TRMM rainfall estimates are based on combined calibrated microwave and infrared precipitation estimates with a rescaling to monthly gauge data (Boone et al., 2009)."

p7232, section 3.1: much of this section actually describes how the models work. It is important to draw the line between describing how a model responds to input data, and inferring mechanisms of emission and deposition from actual (flux) obervations, which are not available here. Thus it must be clear that the whole discussion on nitrification / denitrification, soil turnover, biogenic emissions, etc, is a reflection of mechanisms encoded in the model, and is not measurement-based, to avoid the danger of overinterpreting the actual observations.

This paragraph has been divided in two parts, first part has been moved in the introduction to avoid speculation on modelling results, and second part has been kept in the results section as a description of figures 2 and 3.

Figures: The quality of figures 2, 3 and 5 should be improved by increasing font sizes; the values, axes, legends are barely legible.

Font sizes have been enlarged for these figures.

Figure 2: in caption, replace 'compounds' by 'fluxes' after 'oxidised N' and 'reduced N'. It would be useful to indicate for each site whether dry or wet savanna. It would also be helpful to show the measured concentrations alongside the simulated fluxes, at least for NH3, which dominates dry deposition, in order to assess how much of the variability in fluxes is due to meteorology (through the model), as opposed to driven by seasonal and interannual variations in concentrations.

Concentrations are shown in figure 3. Figure 2 has been divided in 2 figures, Figure 2 concerns now only the oxidized N compounds variation, Figure 3 concerns the reduced N compounds. NH3 concentrations have been added in figure 3, showing a close evolution to NH3 deposition fluxes. This highlights the idea that sources local variations have a stronger impact on fluxes than inter annual meteorological variations ((meteorological variations have an impact on deposition velocities, and therefore on deposition fluxes, which would not, in that case, follow the concentration evolution).

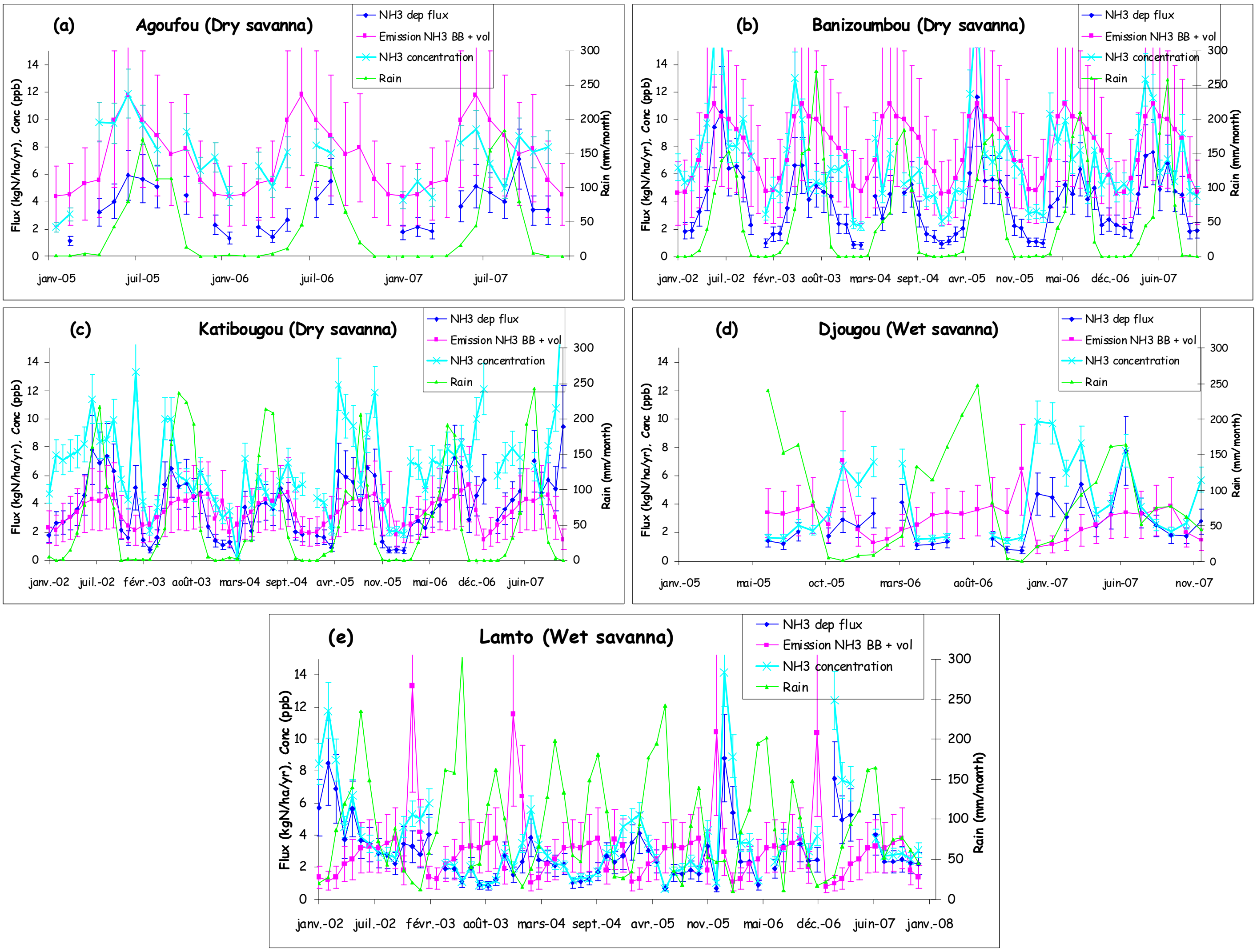


Figure 3: Interannual evolution of reduced N fluxes NH_3 volatilization + NH_3 emission from biomass burning in pink, NH_3 dry deposition in blue, NH_3 concentration in light blue, rainfall in green, in Agoufou (a), Banizoumbou (b), Katibougou (c), Djougou (d), and Lamto (e).

Figure 3, caption: indicate 'Total GASEOUS dry deposition flux: : :'. 'Total' is slightly misleading as aerosols and organics were not included.

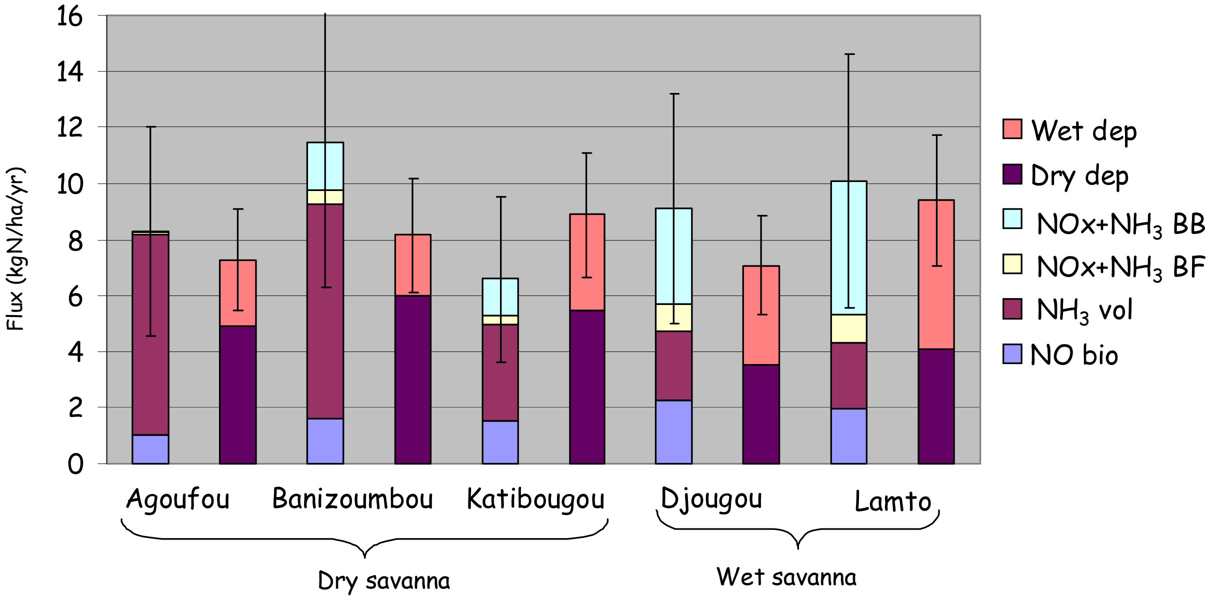
OK.

Figure 4, legend of (b), change to 'NO3- wd' and 'NH4+ wd'

OK.

Figure 5: a pie chart should represent additive quantities, whereas emissions and deposition of Nr have opposite signs. Fig 5 and Fig.6 should be combined, with for each site the total N_dep and N_em fluxes shown as stacked bars of different colours for the different contributions.

Figure 6 is now a combination of ex-figures 5 and 6, showing at the same time the contribution of each source and the comparison between emission and deposition fluxes.



16
14
12
10
8
6
4
2
0
Flux (kgN/ha/yr)
Wet dep
Dry dep
NOx+NH3 BB
NOx+NH3 BF
NH3 vol
NO bio
Agoufou
Banizoumbou
Katibougou
Djougou
Lamto
Dry savanna
Wet savanna