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Emission and deposition of Nitrogen compounds in West Africa

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The atmospheric nitrogen budget depends on emission and deposition fluxes both as reduced and oxidized compounds. In West African ecosystems, data are scarce, and establishing a N budget is not an easy task.
This work aims at linking data from diverse origins (surface, aircraft measurements, satellite data, modelling) to estimate emissions and deposition of N compounds in dry and wet savannas of West Africa, and to study their impact on atmospheric chemistry.
In remote areas like in the Sahel, N oxidised compounds emissions are dominated by NO biogenic emissions from soils. N emissions from anthropogenic sources (biomass burning, domestic fires, fossil fuel) are less important, due to the low quantity of vegetation, and to the remoteness of big cities. N reduced compounds emissions are dominated by the release of NH3 from cattle dung.
Biogenic NO emissions from soils have a direct impact on NOX and ozone concentration increase in the lower troposphere, as shown by results from aircraft and surface measurements, and from modelling (coupled dynamics/chemistry MESONH-C model, with on line emission derived from a neural network algorithm, where the NO flux is dependent on water field pore space, surface and deep soil temperature, sand percentage, pH, fertilization rate and wind speed), in the area of Niamey (Niger) in August 2006.
In a second part of this work, estimated emissions of both oxidised and reduced N compounds are compared to estimate dry and wet deposition fluxes for the year 2006 in the Sahel region. The dry deposition flux is the product of modelled dry deposition velocity and the measured concentration. Concentrations have been measured in 3 stations located in dry savanna ecosystem) within the IDAF (IGAC/DEBITS/Africa) network, and dry deposition velocities have been modelled with the surface model ISBA. A first tentative of budget has been calculated for the year 2006, trying to integrate all potentially known sources and sinks in the region.
Finally, the study has been extended in time and space; emissions from soils and fires have been calculated for the years 2002 to 2007, dry deposition velocities have been calculated within the same period in the 3 stations of dry savanna, plus 2 stations in wet savanna.
The results show that the interannual variability in rainfall is responsible for changes in emission (both biogenic and anthropogenic) and deposition (dry and wet) fluxes, due to changes in soil moisture and temperature, LAI, and turbulence, linked to meteorological conditions.
This study uses original and unique data from remote and hardly-ever-explored regions.
The main conclusion of this work is that while often underestimated, savannas and seasonally dry ecosystems of the African continent play a significant role in the global nitrogen budget, and have a direct impact on the chemistry of the troposphere.