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Interannual variability of Nitrogen compounds emission and deposition in West and Central Africa

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The atmospheric nitrogen budget depends on emission and deposition fluxes both as reduced and oxidized compounds. In this study, a first attempt at estimating the interannual variability of the nitrogen emission and deposition fluxes for the years 2002 to 2007 is made, through measurements and simulations at seven stations of the IDAF (IGAC-DEBITS-Africa) network situated in dry savanna, wet savanna and forest ecosystems.
The purpose of this study is to estimate the impact of the interannual variability in precipitations on the interannual variability in emission and deposition of nitrogen compounds. The interannual variability of rains between 2002 and 2007 is responsible for changes in emission and deposition fluxes, due to changes in soil moisture and temperature, LAI, and turbulence, linked to meteorological conditions.
Dry and wet deposition fluxes are presented in a companion paper (Adon et al., this session) They are calculated from measurements of NO2, HNO3 and NH3 concentrations (from passive samplers) and simulated deposition velocities, and wet deposition is calculated from NH4+ and NO3- concentration in samples of rain. This budget does not take into account organic nitrogen species.
Emission fluxes are evaluated including NO biogenic emission from soils, emissions of NOx and NH3 from domestic and biomass fires, and volatilization of NH3 from animal excreta. Biogenic NO fluxes from soils are simulated in a SVAT model (ISBA), where an algorithm derived from an Artificial Neural Network has been inserted. Meteorological conditions are provided by the forcing, derived from satellite data, and developed in ALMIP (AMMA Land surface Model Intercomparison Project).
Emissions of NOx and NH3 from domestic fires and biomass burning are calculated from satellite data, and volatilization of NH3 is calculated from the release of N input from animal excreta, and from the animal population in each country.
This study uses original and unique data from remote and hardly-ever-explored regions. In dry savanna ecosystems, the monthly evolution of oxidized N compounds shows that the fluxes increase at the beginning of the rainy season, because of large emissions of biogenic NO (pulse events). Emission of oxidized compounds is dominated by biogenic emission from soils in dry savanna ecosystems, whereas domestic fires and biomass burning emission of oxidized compounds are more important in wet savanna and forest sites. In dry savannas, emission of NH3 is dominated by the process of volatilization from animal excreta, whereas it is dominated by emissions from domestic fires and biomass burning in wet savanna and forests.