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Nitrogen Cycling in a Sahelian West African Savanna: a Tentative Budget

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Continuous wet and dry deposition measurements have been performed at a field station near the Agoufou village (15°20.394N, 1°28.766W), in the Gourma region of Mali since July, 2004. These measurements are part of the IDAF network which also includes aerosol chemical characterization and mean monthly concentration of a variety of gases measured with passive samplers. Additional NO flux measurements were performed during the wet season (June to August) of 2004, 2005, and 2006 as part of the AMMA (African Monsoon Multidisciplinary Analyses) program. This work presents a tentative budget of nitrogen cycling in this semi-arid ecosystem. In the case studies herein, the calculation is made for the reference year 2006. Wet atmospheric deposition is calculated for NH4+ and NO3- from concentrations measured by ionic chromatography in each whole rain sample collected with an automatic rain sampler. Dry deposition of NO2, HNO3, NH3 is calculated from mean monthly concentrations determined in situ with passive samplers, and set deposition velocity specific for each gas. Similar results are obtained in Agoufou and for two other IDAF sites (one in Mali and one in Niger), showing that the spatial scale covered here is typically of a thousand kilometres for a latitudinal stripe of a few hundred kilometres width. Nitrogen emissions under the form of NO are calculated using an approach combining an Artificial Neural Network (ANN) algorithm coupled with the Soil-Vegetation-Atmosphere-Transfer-SVAT model ISBA (Interactions between the Soil Biosphere and Atmosphere). The ANN algorithm takes into account the influence of

7 determining parameters (surface temperature and WFPS, deep soil temperature, pH, sand percentage, fertilisation rate, and wind speed). Note that the spatial distribution of land surface moisture is a critical point that has to be addressed in order to correctly represent the NO fluxes from the soil, especially during the wet season. Realistic soil moisture patterns, obtained from a realistic dynamic large scale forcing (derived from EPSAT satellite observations) have been used here. An inventory of NO emission at 0.5° spatial and monthly temporal resolution for West Africa has been obtained with ISBA. This inventory and the deposition budget of nitrogen will be compared for the Sahelian region covered by IDAF with a first focus on the wet season, while the annual budget, needing the nitrogen inputs from biomass burning, will be provided in a second step.