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Dry and wet deposition of inorganic nitrogen compounds to a tropical pasture site (Rondônia, Brazil)

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Abstract. The input of nitrogen (N) to ecosystems has increased dramatically over the past decades. While total (wet + dry) N deposition has been extensively determined in temperate regions, only very few data sets of N wet deposition exist for tropical ecosystems, and moreover, reliable experimental information about N dry deposition in tropical environments is lacking. In this study we estimate dry and wet deposition of inorganic N for a remote pasture site in the Amazon Basin based on in-situ measurements. The measurements covered the late dry (biomass burning) season, a transition period and the onset of the wet season (clean conditions) (12 September to 14 November 2002) and were a part of the LBA-SMOCC (Large-Scale Biosphere-Atmosphere Experiment in Amazonia – Smoke, Aerosols, Clouds, Rainfall, and Climate) 2002 campaign. Ammonia (NH_3), nitric acid (HNO_3), nitrous acid (HONO), nitrogen dioxide (NO_2), nitric oxide (NO), ozone (O_3), aerosol ammonium (NH_4^+) and aerosol nitrate (NO_3^-) were measured in real-time, accompanied by simultaneous meteorological measurements. Dry deposition fluxes of NO_2 and HNO_3 are inferred using the ''big leaf multiple resistance approach'' and particle deposition fluxes are derived using an established empirical parameterization. Bi-directional surface-atmosphere exchange fluxes of NH_3 and HONO are estimated by applying a ''canopy compensation point model''. N dry and wet deposition is dominated by NH_3 and NH_4^+, which is largely the consequence of biomass burning during the dry season. The grass surface appeared to have a strong potential for daytime NH_3 emission, owing to high canopy compensation points, which are related to high surface temperatures and to direct NH_3 emissions from cattle excreta. NO_2 also significantly accounted for N dry deposition, whereas HNO_3,

HONO and N-containing aerosol species were only minor contributors. Ignoring NH_3 emission from the vegetation surface, the annual net N deposition rate is estimated to be about −11 kgN ha^{-1} yr^{-1}. If on the other hand, surface-atmosphere exchange of NH_3 is considered to be bi-directional, the annual net N budget at the pasture site is estimated to range from −2.15 to −4.25 kgN ha^{-1} yr^{-1}.

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