



Reactive nitrogen deposition to South East Asian rainforest

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The supply of reactive nitrogen (N) to global terrestrial ecosystems has doubled since the 1960s as a consequence of human activities, such as fertilizer application and production of nitrogen oxides by fossil-fuel burning. The deposition of atmospheric N species constitutes a major nutrient input to the biosphere. Tropical forests have been undergoing a radical land use change by increasing cultivation of sugar cane and oil palms and the remaining forests are increasingly affected by anthropogenic activities. Yet, quantifications of atmospheric nitrogen deposition to tropical forests, and nitrogen cycling under near-pristine and polluted conditions are rare. The OP3 project (“Oxidant and Particle Photochemical Processes above a Southeast Asian Tropical Rainforest”) was conceived to study how emissions of reactive trace gases from a tropical rain forest mediate the regional scale production and processing of oxidants and particles, and to better understand the impact of these processes on local, regional and global scale atmospheric composition, chemistry and climate. As part of this study we have measured reactive, nitrogen containing trace gas (ammonia, nitric acid) and the associated aerosol components (ammonium, nitrate) at monthly time resolution using a simple filter / denuder for 16 months. These measurements were made at the Bukit Atur Global Atmospheric Watch tower near Danum Valley in the Malaysian state of Sabah, Borneo. In addition, the same compounds were measured at hourly time-resolution during an intensive measurement period, with a combination of a wet-chemistry system based on denuders and steam jet aerosol collectors and an aerosol mass spectrometer (HR-ToF-AMS), providing additional information on the temporal controls. During this period, concentrations and fluxes of NO, NO₂ and N₂O were also measured. The measurements are used for inferential dry deposition modelling and combined with wet deposition data from the South East Asian Acid Deposition Network to estimate the total annual atmospheric reactive nitrogen deposition to this tropical forest ecosystem and to quantify the relative contribution of the different chemical compounds.