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N_2O and NO emissions from tropical rainforest ecosystems: Measurements, driving forces and up scaling

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In view of global climate change the accurate determination of the sources and sinks of primary (CO_2, N_2O and CH_4) and secondary (NO) greenhouse gases for natural, agricultural and forest ecosystems is getting more and more important. Though tropical rainforest soils are one of the major sources for atmospheric N_2O and can also emit high amounts of NO, their source strength for these N-trace gases is still not well constrained. In order to further clarify the role of tropical forest ecosystems as sources for N_2O and NO and to characterize the underlying driving forces determining the magnitude of emissions we carried out numerous long term continuous measurements of N-trace gas emissions in different Australian and Kenyan rainforest ecosystems. The magnitude of N_2O and NO emissions were highly variable in space and time and were strongly influenced by environmental and climatic conditions, like soil texture, substrate availability and changes in soil moisture and temperature. N_2O-emissions showed a pronounced seasonal pattern, with highest rates in the wet season ($>$ 500 μg N m^{-2} h^{-1}) and significant lower rates during dry season (mostly $<$10 μg N m^{-2} h^{-1}). Beside the interannual variation, N_2O emission showed also a pronounced difference between years (1 to 7 kg N ha^{-1} yr^{-1}) depending on the respective climatic conditions. NO emissions were measured during an intensive field campaign at a Australian lowland rainforest site during the transition period between dry and wet season and showed also a pronounced temporal variability (1- $>$ 700 μg N m^{-2} h^{-1}) which was mainly triggered by changes in soil moisture and nutrient availability.

Based on these field and also accompanying laboratory measurements the process

oriented biogeochemical model PnET-N-DNDC was further developed and validated in order to simulate C- and N-cycling and associated N-trace gas emissions for tropical forest ecosystems. Finally, the model was linked to a GIS database in order to calculate an inventory of N_2O-emissions for the Wet Tropics, Queensland, Australia an area of 9000 km^2 mainly covered with tropical rainforest.