Tropentag, October 5-7, 2011, Bonn

"Development on the margin"

N-oxides Fluxes, N_2O Sources, and Soil-profile N_2O Concentrations of Tropical Forests after Chronic N Addition

Juvia Sueta, Marife Corre

Georg-August-Universität Göttingen, Soil Science of Tropical and Subtropical Ecosystems, Germany

Abstract

N deposition is projected to increase in tropical region and emissions of climate-relevant N-oxide (NO and N_2O) gases are expected to rise. However, few studies quantify long-term impact of increased N availability on these gases and on the processes responsible for their production. We used N addition experiments to achieve N-enriched conditions in contrasting montane (3–4-yr N addition) and lowland (11–12-yr N addition) forests in Panama. Control and N-addition (receiving 125 kg urea-N ha^{-1} yr^{-1}) treatments were represented by four (40 m × 40 m) replicate plots each. We wanted to 1) quantify changes in surface N-oxide fluxes during N addition in tropical montane and lowland forests and 2) assess the contribution of denitrification and nitrification to the surface N_2O fluxes and deduce which process might be dominant at lower depths.

In the montane forest, N-oxide fluxes from N-addition plots were higher than the control. During the two-year measurement period (2008–2009), a two-fold increase in annual N_2O fluxes was observed while annual NO fluxes decreased from the N addition plots. Nitrification contributed ≥60 % to the N_2O flux from both treatment plots while ≤40 % was attributed to denitrification. In the lowland forest, N-oxide fluxes from N-addition plots were also higher than the control. Annual N_2O and NO fluxes from the N-addition plots remained comparable. Denitrification appeared to be the dominant process producing N_2O in N-addition plots during both dry and wet seasons. In the control plots, nitrification accounted for 70 % of the total flux during the wet season. At both sites, soil-profile N_2O concentrations in the N-addition plots were significantly higher than the control, starting at about 40-cm depth. High water-filled pore space (≥80 %) at these depths suggests that denitrification might be the dominant process contributing to the measured N_2O concentrations.

Keywords: Chronic N-addition, denitrification and nitrification, N-oxides, tropical forest

Contact Address: Juvia Sueta, Georg-August-Universität Göttingen, Soil Science of Tropical and Subtropical Ecosystems, Buesgenweg 2, 37077 Goettingen, Germany, e-mail: jsueta@gwdg.de