The effect of termite biomass and anthropogenic disturbance on the CH4 budgets of tropical forests in Cameroon and Borneo

Abstract

The exchange of CH4 between tropical forests and the atmosphere was determined by simultaneously measuring the net CH4 flux at the soil surface and assessing the flux contribution from soil-feeding termite biomass, both within the soil profile and in mounds. In Cameroon the flux of CH4 ranged from a net emission of 40.7 ng m(-2) s(-1) to a net CH4 oxidation of -53.0 ng m(-2) s(-1). Soil-inhabiting termite biomass was significantly correlated with CH4 flux. Termite mounds emitted up to 2000 ng s(-1) mound(-1). Termite-derived CH4 emission reduced the soil sink strength by up to 28%. Disturbance also had a strong effect on the soil sink strength, with the average rate of CH4 oxidation, at -17.5 ng m(-2) s(-1), being significantly smaller (approximate to 36%) at the secondary forest site than the -27.2 ng m(-2) s(-1), observed at the primary forest site. CH4 budgets calculated for each site indicated that both forests were net sinks for CH4 at -6.1 kg ha(-1) y(-1) in the near-primary forest and -3.1 kg ha(-1) y(-1) in the secondary forest.

In Borneo, three forest sites representing a disturbance gradient were examined. CH4 oxidation rates ranged from 0 to -32.1 ng m(-2) s(-1) and a significant correlation between the net flux and termite biomass was observed only in an undisturbed primary forest, although the biomass was insufficient to cause net emission of CH4. Rates of CH4 oxidation were not significantly different across the disturbance gradient but were, however, larger in the primary forest (averaging -15.4 ng m(-2) s(-1)) than in an old-growth secondary forest (-13.9 ng m(-2) s(-1)) and a young secondary re-growth (-10.8 ng m(-2) s(-1)). CH4 flux from termite mounds ranged from net oxidation in an abandoned mound to a maximum emission of 468 ng s(-1) mound(-1). CH4 budgets calculated for each site indicated that CH4 flux from termite mounds had an insignificant effect on the budget of CH4 at the regional scale at all three forest sites. Annual oxidation rates were -4.8, -4.2 and - 3.4 kg ha(-1) y(-1) in the primary, secondary and young secondary forests, respectively.