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Tropical forest CH₄ budget: the importance of local hotspots

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Methane (CH₄) is one of the most important anthropogenic greenhouse gases. Despite its importance, natural sources of methane, such as tropical wetlands and termites, are still not well understood and a large source of uncertainty in the tropical CH₄ budget. The Amazon rainforest is a key region for the (global) CH₄ budget but, due to its remote location, local CH₄ concentration and flux measurements are still rare.

Fieldsite ZF2 (60 km NW of Manaus, Brazil) is located in pristine tropical rain forest. At this fieldsite, a Spectronus FTIR-analyzer (measuring CO₂, CO, CH₄, N₂O & δ¹³CO₂) was installed at the foot of the K34 tower, set up to measure different heights above and below the canopy continuously. In addition, by use of a Los Gatos portable analyzer (measuring CO₂ & CH₄), additional semi-continuous concentration measurements were performed at the valley tower (studying the nighttime build up of valley CH₄), above the igarapé (capturing the CH₄ ebullition bubbles leaving the water surface), and on the plateau (studying the spatial horizontal heterogeneity of CH₄ concentrations within the canopy). Furthermore, the portable analyzer was used for soil, water, termite mound, and termites flux measurements.

By combining tower and flux chamber measurements, the role and magnitude of different ecosystem sources could be assessed. We observed that, while soils in the valley are a small source of CH₄ (0.1 to 0.2 nmol CH₄ m⁻² s⁻¹), overall the soils of this ecosystem are expected to be a net CH₄ sink (-0.3 to -0.5 nmol m⁻² s⁻¹). Estimated total ecosystem CH₄ flux, based on nighttime concentration analyses of the tower data, indicate that the ecosystem is a net CH₄ source (~1 to 2 nmol CH₄ m⁻² s⁻¹). We propose that the net CH₄ emission of the ecosystem is driven by local

emitting hotspots, such as the valley stream and standing water, termites and termite mounds (~ 1 nmol CH₄ m⁻² s⁻¹), anoxic soil spots and decaying dead wood.