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Halogenated organic species over the tropical South American rainforest

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Abstract. Airborne measurements of the halogenated trace gases methyl chloride, methyl bromide and chloroform were conducted over the Atlantic Ocean and about 1000 km of pristine tropical rainforest in Suriname and French Guyana (3–6° N, 51–59° W) in October 2005. In the boundary layer (0–1.4 km), maritime air masses, advected over the forest by southeasterly trade winds, were measured at various distances from the coast. Since the organohalogens presented here have relatively long atmospheric lifetimes (0.4–1.0 years) in comparison to the advection times from the coast (1–2 days), emissions will accumulate in air traversing the rainforest. The distributions of methyl chloride, methyl bromide and chloroform were analyzed as a function of time the air spent over land and the respective relationship used to determine net fluxes from the rainforest for one week within the long dry season.

Net fluxes from the rainforest ecosystem have been calculated for methyl chloride and chloroform as 9.5 (±3.8 2σ) and 0.35 (±0.15 2σ)µg m^{-2} h^{-1}, respectively. No significant flux was observed for methyl bromide within the limits of these measurements.

The global budget of methyl chloride contains large uncertainties, in particular with regard to a possible source from tropical vegetation. Our measurements are used in a large-scale approach to determine the net flux from a tropical ecosystem to the planetary boundary layer. The obtained global net flux of 1.5 (±0.6 2σ) Tg yr^{-1} for methyl chloride is at the lower end of current estimates for tropical vegetation sources, which helps to constrain the range of tropical sources and sinks (0.82 to 8.2 Tg yr^{-1} from tropical plants, 0.03 to 2.5 Tg yr^{-1} from senescent/dead leaves and a sink of 0.1 to 1.6 Tg yr^{-1} by soil uptake). Nevertheless, these results show that the contribution of the rainforest ecosystem is the major source in the global budget of methyl chloride.

For chloroform, the extrapolated global net flux from tropical ecosystems is 56 (±23 2σ) Gg yr^{-1}, which is of minor importance compared to the total global sources and might be already contained in the soil emission term.

◻ Final Revised Paper (PDF, 1598 KB)   ◻ Discussion Paper (ACPD)

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