Vertical profiling and determination of landscape fluxes of biogenic nonmethane hydrocarbons within the planetary boundary layer in the Peruvian Amazon

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RESUMEN:

Vertical profiles of volatile organic compounds (VOCs) within the convective boundary layer (CBL) were measured at a tropical forest site in the Peruvian Amazon during July 1996 from a tethered balloon sampling platform. A profiling technique based on the collection of VOCs onto solid adsorbent cartridges was used to take samples at altitudes up to 1600 m above ground. VOC analysis was performed by thermal desorption with gas chromatographic separation and mass spectrometric and flame ionization detection. A total of 26 VOCs were structurally identified. VOCs were dominated by biogenic compounds. Highest concentrations were observed for isoprene, followed by α-pinene, p-cymene, and β-pinene. Combined, all monoterpenes accounted for approximately 15-20% of the total carbon from biogenic VOCs (BVOCs). The isoprene oxidation products methacrolein (MAC), methylvinylketone (MVK), and 3-methylfuran were observed throughout the CBL. Besides the ubiquitous chlorofluorocarbons, anthropogenic VOC concentrations were at the lower end of concentration ranges observed in rural air. From the vertical profiles, BVOC surface flux estimates were derived. Emission rates were estimated from five vertical profiles using the mixed-layer gradient and CBL budget methods. Emission estimates varied depending on method and choice of statistics, but were within 3000-8200 μg compound m−2 h−1 for isoprene, 120-370 μg m−2 h−1 for α-pinene, 40-75 μg m−2 h−1 for β-pinene, about 16 μg m−2 h−1 for p-cymene, and 40-50 μg m−2 h−1 for camphene. The changes in the ratios of MAC and MVK to isoprene with altitude were utilized to estimate the mixing times between the surface layer, mixed layer and lower troposphere.

Key words:

Biogenic emission; convective boundary layer; hydrocarbon; tropical forest; vertical profile; volatile organic compound.