Isotopic composition of methane in an upland forest: Preliminary data set from an Amazon tropical forest

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Introduction

As one of the biggest wetland areas in the world, the Amazon region has an important role in current greenhouse scenario since recent estimates indicate that CH_4 flux in the Amazon basin is approximately 22 TgC yr^{-1} (Melack et al., 2004). However, not only flooded areas but also upland forests in the Amazon may contribute as a source of CH_4, as pointed out by Frankenberg et al. (2005), Keller et al. (2005), and Carmo et al. (2006). The main objective of this work is identify possible sources of CH_4 in upland forest by using stable isotopic techniques. Here we present preliminary results of the stable isotopic composition of CH_4 in tropical upland forest.

Material and methods

Sampling

This first campaign was done during the end of the dry season (Jan/06) at Flona do Tapajós tower site (km67), in Santarém-Para, where a set of tubes were placed and inlets for sampling allowed us to pull atmospheric air samples in a vertical profile (0.2, 7, 22, 35, and 45m) in different times of the day (16, 22, 24 and 04h) during 2 days. The air samples were pulled through the tubes by a battery-operated pump and then stored into glass flasks (Fig 01).

Fig. 01 – Tower site (km67) and sampling approach

Analyses

The $\delta^{13}C\text{-}CH_4$ was determined in a Carlo Erba NA 1600 elemental analyzer equipped with a Finnigan MAT Conflo interface at the Laboratory of Marine Science (University of North Carolina) (Fig 02).

Fig. 02 – Mass Spectrometer

References

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Preliminary Results

The $\delta^{13}C\text{-}CH_4$ varied from -47.1‰ to -48.2‰ and overall mean value found was equal to -47.7 ±0.3‰; it is in the range for values found for atmospheric methane. Although we did not find any difference among the times along the day, the midnight samples were the lightest group we found. Significant difference was found among the different heights, the lowest height (0.2m) showed the lightest values of $\delta^{13}C\text{-}CH_4$.

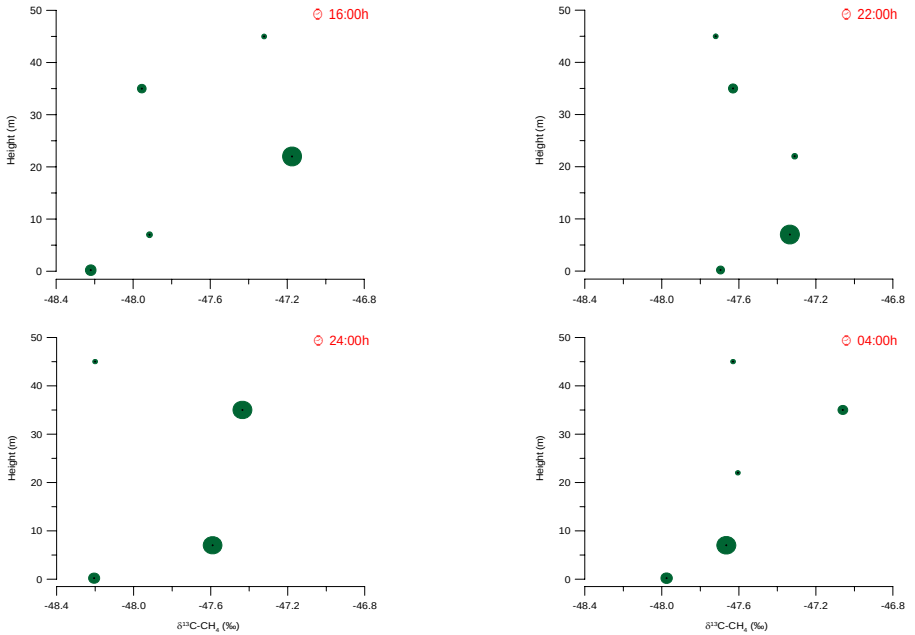

Fig. 03 – Isotopic composition of CH_4. Values represent the average between the two days of sampling and the size of the symbols is related to the standard deviation of the means

Discussions

The CH_4 produced during nighttime ours tends to be more depleted in ^{13}C than that produced during daytime hours, indicating that microbial production within the canopy may be an important source of this gas. The lightly heavier and much more variable values observed at the intermediate heights, in comparison to those ones observed near the ground, suggest that sources with different origins could co-exist at these heights and could contribute differently to the isotopic composition of the CH_4 released to the atmosphere.

Next steps

(1) Keep sampling and extend campaigns to the wet and intermediate seasons in order to see the existence of seasonal variation; (2) Provide measurements in other regions (forest and pasture) of the Amazon looking for spatial variation; (3) Measure the isotopic composition of CH_4 released from at the interface ground-air of forest and pasture; (4) Provide a better resolution on the data set increasing the number of sampling point through out the tower profile.

Acknowledgments

FAPESP LBA Cena 40 anos IEB MOORE FOUNDATION