Amazon Basin: an important source of Methane?

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18th WMO/IAEA Meeting on Carbon Dioxide, Other Greenhouse Gases, and Related Measurement Techniques (GGMT-2015), September 13-17, 2015, La Jolla, California

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INTRODUCTION

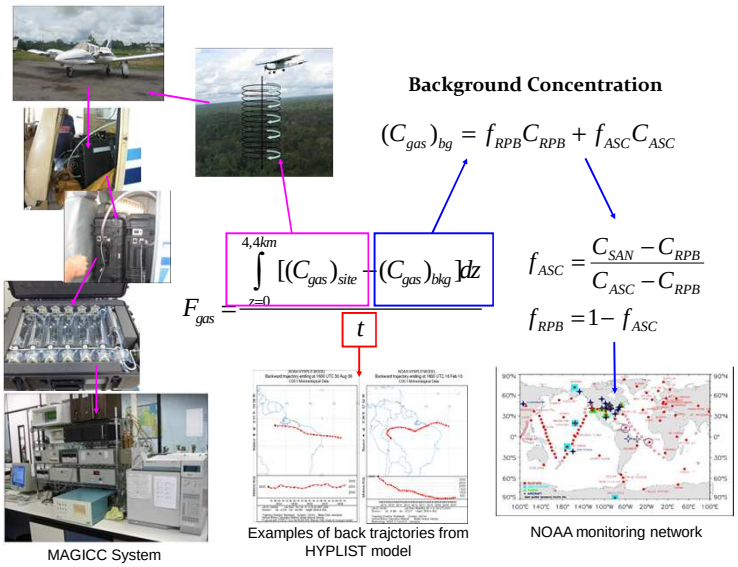
Tropical land regions have until recently been poorly observed with large-scale integrating in-situ observations. Considering that the Amazon Basin represents 50% of the world tropical rainforest and Methane (CH_4) is the second most important anthropogenic greenhouse gases, contributing with around 18% to radiative forcing, and in 2012 the CH_4 mixing ratio increases of 5ppb in comparison with the previous year, reaching 1819ppb, is important understand the behavior of the Amazon Basin in relation to this greenhouse gas. Then, observing the global importance of CH_4 and uncertainties in the emission of this greenhouse gases this study aimed to determine CH_4 emission in the Amazon Basin.

METHODOLOGY

Were used regular vertical profiles in 4 sites distributed over the basin from east to west, Alta Floresta (ALF; 8.80ºS, 56.75ºW), Rio Branco (RBA; 9.38ºS, 67.62ºW), Santarem (SAN; 2.86ºS; 54.95ºW) and Tabatinga (TAB; 5.96ºS, 70.06ºW). Since 2010 samples are collected, fortnightly, aboard light aircraft between 300m and 4.4km. From the flux estimates we calculated basin wide budgets with some differentiation of underlying processes based on carbon monoxide from fires.

Four study sites in the Amazon Basin.

Column Integration Technique

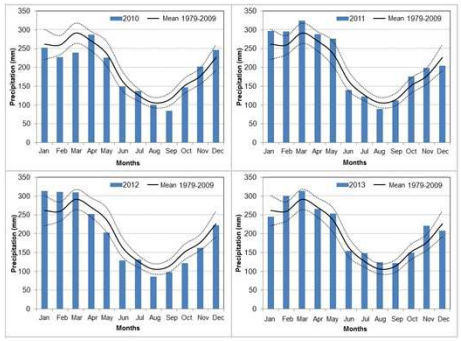


MAGICC System

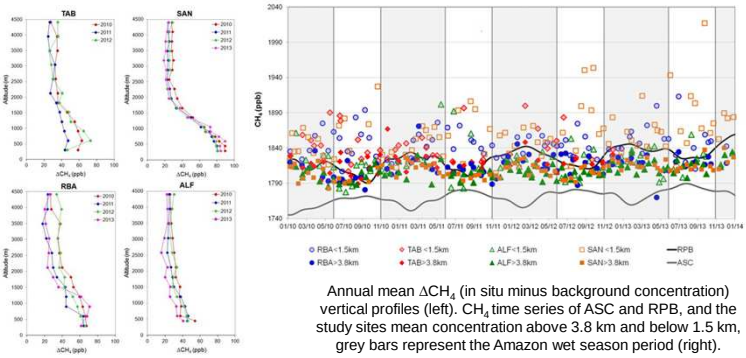
Examples of back trajctories from HYPLIST model

NOAA monitoring network

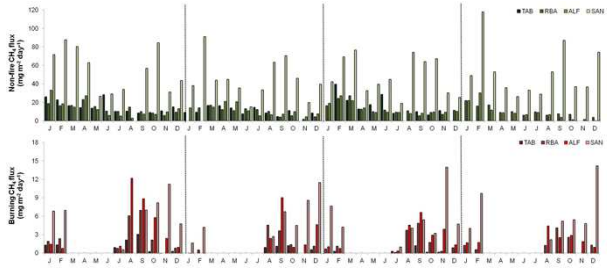
RESULTS



TRMM precipitation data for Amazon Basin.



Annual mean ΔCH_4 (in situ minus background concentration) vertical profiles (left). CH_4 time series of ASC and RPB, and the study sites mean concentration above 3.8 km and below 1.5 km, grey bars represent the Amazon wet season period (right).



Monthly mean CH_4 fluxes for each study site from biomass burning and the non-fire fluxes.

Annual mean CH_4 fluxes for each study site

Total flux ($mgCH_4\ m^{-2}\ day^{-1}$)	2010	2011	2012	2013
ALF	15.8 ± 2.2	12.8 ± 1.5	14.6 ± 1.6	10.4 ± 1.5
RBA	14.9 ± 1.5	10.5 ± 1.3	14.0 ± 1.7	11.2 ± 1.6
TAB	16.2 ± 1.8	11.1 ± 1.1	17.6 ± 3.5	-
SAN	59.5 ± 7.3	48.5 ± 6.0	52.6 ± 5.7	56.5 ± 8.6
Non-fire flux ($mgCH_4\ m^{-2}\ day^{-1}$)	**2010**	**2011**	**2012**	**2013**
ALF	13.0 ± 2.6	11.1 ± 1.7	12.8 ± 1.7	9.1 ± 1.8
RBA	13.2 ± 1.4	9.5 ± 1.3	12.8 ± 1.8	10.3 ± 1.6
TAB	15.4 ± 1.9	10.8 ± 1.1	17.3 ± 3.5	-
SAN	55.4 ± 7.0	45.2 ± 5.9	48.9 ± 5.6	52.8 ± 7.6
Fire flux ($mgCH_4\ m^{-2}\ day^{-1}$)	**2010**	**2011**	**2012**	**2013**
ALF	2.8 ± 1.1	1.7 ± 0.8	1.8 ± 0.6	1.4 ± 0.6
RBA	1.8 ± 0.7	1.0 ± 0.5	1.1 ± 0.4	1.0 ± 0.4
TAB	0.8 ± 0.3	0.4 ± 0.1	0.3 ± 0.1	-
SAN	4.2 ± 1.2	3.3 ± 1.0	3.7 ± 1.1	3.8 ± 1.3
Percentage of fire emissions in total flux	**2010**	**2011**	**2012**	**2013**
ALF	18%	13%	12%	13%
RBA	12%	10%	8%	9%
TAB	5%	3%	1%	-
SAN	7%	7%	7%	7%

Annual CH_4 emission Brazilian , precipitation and temperature for Amazon area

Amazon area (4.2 million km^2)			
year	CH_4 Emission ($Tg\ CH_4\ yr^{-1}$)	Precipitation (mm)	Temperature (ºC)
2010	29	1755	26.5
2011	21	2018	26.2
2012	28	1722	26.5
2013	24	1951	26.7

CONCLUSIONS

The results showed that the Amazon Basin was a source of CH_4 during the study period, but the CH_4 emission variable in the different regions and variability with the years, these can be related with the climatological variations, 2010 and 2012 was driers years and 2011 and 2013 was wet years. With these results is possible to observe the importance of conducting studies on a regional scale to elucidate the behavior of the entire Amazon Basin. And the importance of long-term studies due the variation in emissions year by year, so that the results can be assumed to average behavior a long time series is necessary to take into account the methane balance from the Amazon Basin.

ACKNOWLEDGEMENTS