LONG TERM CH_4 MEASUREMENTS IN AMAZON AND BRAZILIAN COAST

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1. Introduction

Methane is the second most important anthropogenic greenhouse gas, with natural and anthropogenic sources[1]. After a period of CH_4 growth rate was near zero, since 2007 the atmospheric CH_4 has been increasing again. Until now are not completed understand what factors is causing this increase, but one of possible reasons is an increase in wetlands emissions in tropical areas, like Amazon, due anomalies in precipitation during La Niña events[2,3]. To improve the understand of the Amazon CH_4 balance and the climatic variation effect on this balance, we developed a scientific strategy of GHG measures involving different scales, since local until regional scales, using measures in flasks and small aircrafts to perform vertical profiles.

2. Methodology

The LaGEE (Laboratory of Greenhouse Gases located at National Institute for Space Research/INPE, Brazil) activities starting in 2003, constructing a replica of NOAA/ESRL/GMD GHG Laboratory and installing in Brazil in 2004. Since this time the places studied and the types of measures taken have grown to reach our goal. CH_4 atmospheric measurements were started with vertical profiles using small aircrafts, since 2000 in Santarém (SAN; 2.86ºS; 54.95ºW), 2010 in Rio Branco (RBA; 9.38ºS, 67.62ºW), Alta Floresta (ALF; 8.80ºS, 56.75ºW), Tabatinga (TAB; 5.96ºS, 70.06ºW) and Tefé (TEF; 3.31ºS 65.8°W, which started in 2013 to replace TAB, results from these sites will be named TAB_TEF), all these sites located in Brazilian Amazon. In 2006, we started flasks measurements at Arembepe (ABP; 12,75°S, 38,15°W; between 2006-2009) located at the Brazilian Atlantic coast and since 2010 in more two locations in Brazilian coast, Salinópolis (SAL; 0.60°S, 47.37°W, between 2010-2017) and Natal (NAT; 5.48°S, 35.26°W). In 2014 started another Brazilian coast site, Camocim (CAM; 2.51°S, 40.51°W).

The samples from the Brazilian coast were collected weekly by using a pair of glass flasks (2.5L) and a portable sampler. At Amazon sites samples from vertical profiles were collected, generally fortnightly, using a semi-automatic sampling system, which consists of separate compressor and flask units, developed by ESRL/NOAA.

3. Results and Discussion

We are presenting in this study results of 688 vertical profiles distributed in four sites in Brazilian Amazon, between 2000 and 2018 and a total of 1700 samples from four sites located at Brazilian Northeast coast between 2006 to 2018.

Figure 2 shows the results obtained during 2000 until 2018 in SAN region (Northeast of Brazilian Amazon), and the CH_4 mean mole fractions from the south and north hemisphere, respectively, for this period from NOAA database. It was observed that mole fractions from SAN are between the observed in North and south hemisphere and follow the global increase.

Figure 3 shows a comparison between the four sites located at Brazilian Amazon during 2010 and 2018 and the CH_4 mean mole fractions from the south and north hemisphere, respectively, for this period. It was observed that mole fractions from all Amazon sites are similar and between the observed in north and south hemisphere, following the global increase.

Analysing the results from Brazilian coast sites (Figure 3), can be observed that ABP, NAT and CAM mole fractions area similar to the south hemisphere mean, while SAL results have a clear seasonality throughout the year, indicating that part time is influenced by north hemisphere (with higher mole fractions), when ITCZ (Intertropical Convergence Zone) is above this region.

4. Conclusions

Results of this long-term measurements showed that all sites had a continuous increase in CH_4 concentrations, with an annual growth ratio between 7.2 and 7.6 ppb/year (2010-2018), that is lower than the global increase in this period (7.8 ppb/year using the NOAA data).

Considering only the SAN measurements (2000-2018) the annual growth ratio is 5.8 ppb/year, higher than the observed for the global mean concentration during this period (4.9ppb/year), suggesting higher emissions in this area. Analyzing this long time series of SAN is evident the stable period of CH_4 concentrations until 2005 and a clear increase in the concentrations after the middle of 2006, following the CH_4 global concentration increase.

Acknowledgments

FAPESP (2016/02018-2, 2008/58120-3, 2011/51841-0, 2018/14006-4), NASA, ERC (GEOCARBON, Horizon 2020/ASICA), NERC (NE/F005806/1), CNPq (480713/2013-8).

References

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Figure 1. Sample sites located in Brazilian Amazon and NOAA stations

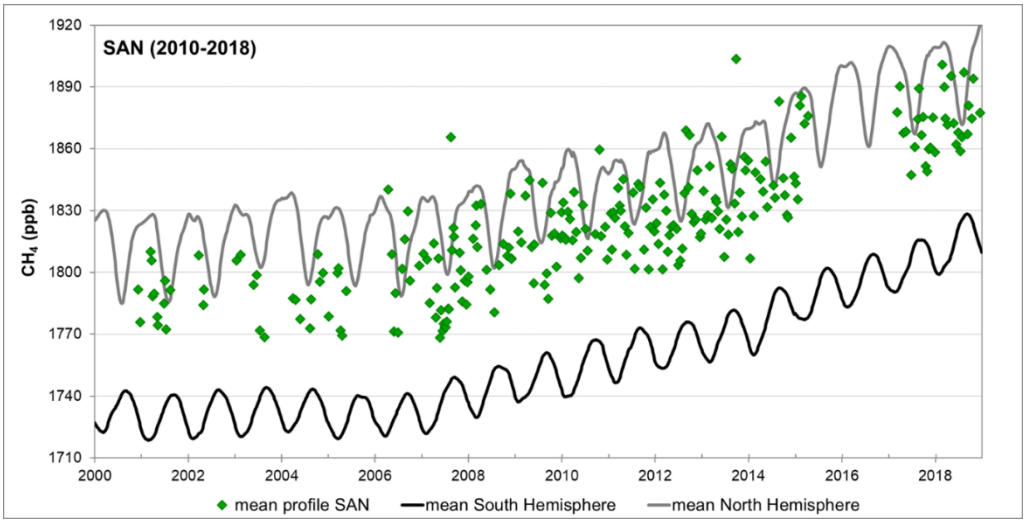

Figure 2. CH_4 Temporal series for SAN region (green) and CH_4 mean mole fractions of south hemisphere (black line) and north hemisphere (grey line) from NOAA, between 2000-2018

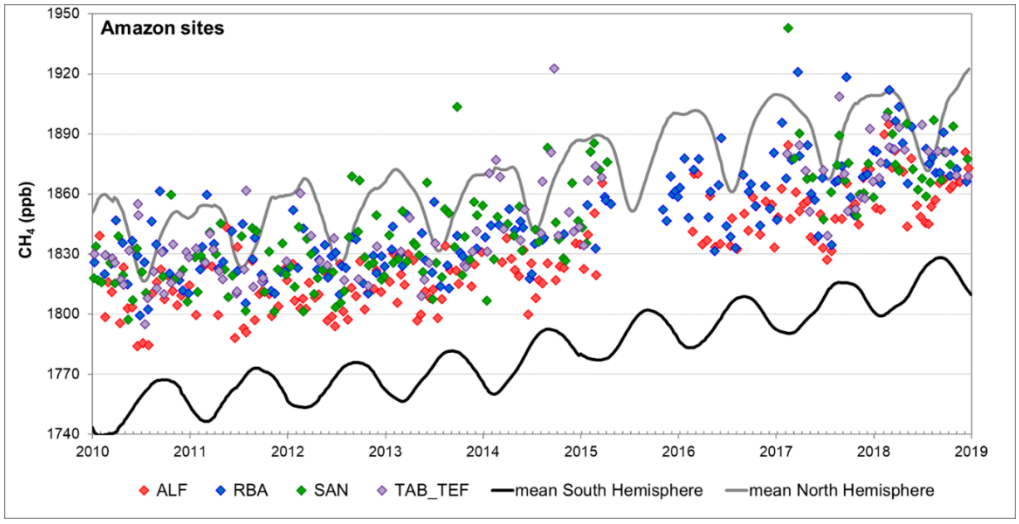

Figure 3. CH_4 Temporal series of CH_4 for Amazon sites (ALF, RBA, SAN, TAB_TEF) and CH_4 mean mole fractions of south hemisphere (black line) and north hemisphere (grey line) from NOAA, between 2010-2018

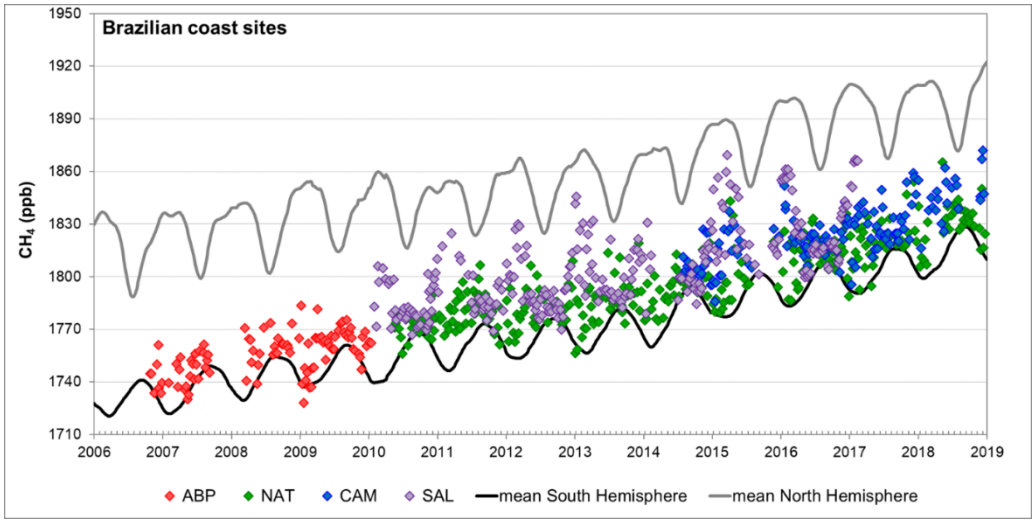

Figure 4. CH_4 temporal series for Brazilian Northeast coast sites (ABP, NAT, CAM, SAL) and CH_4 mean mole fractions of south hemisphere (black line) and north hemisphere (grey line) from NOAA, between 2006-2018