BACKGROUND CONCENTRATIONS OF CO_2, CO AND N_2O IN BRAZILIAN COAST

*L. Marani[1]; V.F. Borges[2]; L. V. Gatti[1,2]; L.G. Domingues[1,2]; C.S.C. Correia[1,2]; L.S. Basso[1]; R.S. dos Santos[1,2]; S.P Crispim[1], R.A.L. Neves[1], M. Gloor[3]; J.B. Miller[4]
[1]Earth System Science Center (CCST), National Institute for Space Research (INPE), São José dos Campos, Brazil
[2]Nuclear and Energy Research Institute (IPEN), SP, Brazil
[3]School of Geography, University of Leeds, Leeds, UK
[4]Global Monitoring Division, Earth System Research Laboratory, National Oceanic and Atmospheric Administration (NOAA), Boulder, USA
*E-mail: lmarani@gmail.com

1. Introduction

There are fell measures on background greenhouse gases (GHG) in the tropical areas, mainly in the Atlantic Ocean coast, so these areas are underrepresented in the actual global greenhouse gases (GHG) monitoring network. Understand the characteristic GHG concentrations in Tropical Global range on Atlantic Ocean is an important task for many studies to determine GHG balances and the contribution of Amazon area to the regional and global budget. The Amazon Forest represent around 50% of the world's rainforest (Gloor et al., 2012). In this work, we present the observations of CO_2, N_2O and CO at four coastal stations located on North and Northeast Brazilian Coast in the period of 2006 to 2018.

1.1 Scientific reasons for Coastal GHG measurement

A better understand of the typical GHG background for the Amazon analysing the air masses that arrived on North and Northeast Brazilian coast, come from the Atlantic Ocean in the period 2006 to 2018 is the motivation of this study.

2. Geographic, material and methods considerations

The GHG background measurements on Brazilian Coast start in Arembepe (ABP: 12º45’46.79”S; 38º10’08.39”W, 15 meters above sea-level) in 2006 and goes to 2010. From 2010 up to 2017, air samples were collected on Salinopolis (SAL: 00º36’15.03”S; 47º22’25.02”W, 10 m a.s.l). Since 2010, samples are collected at Natal (NAT: 05º29’21.83”S; 35º15’39.42”W, 15 m a.s.l. from 2010 to 2015 and 05º47’43.12”S; 35º11’07.27”W, 87 m a.s.l. since 2015). In 2014, the sampling starts in Camocim (CAM: 02º51’47.00”S; 40º51’36.70”W, 21.5 m a.s.l.).

The samples were collected weekly by using a pair of glass flasks (2.5L) and a portable sampler, totalling 1700 samples. The air samples were analysed to quantify carbon dioxide (CO_2), nitrous oxide (N_2O) and carbon monoxide (CO) on the Greenhouse Gas Laboratory (at IPEN until April 2015 and later at LaGEE/CCST/INPE).

Backward trajectories of air masses that arrived at the sites were simulated by HYSPLIT model (DRAXLER, R.R. and ROLPH, G.D. HYSPLIT- HYbrid Single-Particle Lagrangian Integrated Trajectory <http://ready.arl.noaa.gov/hypub-bin/trajtype.pl?runtype=archive>) for each sample by using the location and altitude of the sample point and 240h retroceding, to determine the origin and seasonality of air masses for all sites (Figure 1).

3. Results and discussion

The GHG results showed on Figures 2, 3 and 4 evidence that each study site presented seasonality when compared to the WMO GHG Monitoring Global Stations of Ascension Island (ASC: 07º96'67.00"S; 14º0'00.00"W, South Atlantic Ocean) and Ragged Point Barbados (RPB: 13º16'50.00"N, 59º43'20.00"W, North Atlantic Ocean). The stations of SAL and CAM showed highest GHG concentrations between January and May, a behaviour similar to RPB, when the air masses come from North Hemisphere, while in the rest of the year the concentrations were similar to that observed in ASC, when the simulations track their origin in the south hemisphere. In ABP and NAT the concentrations were lowest and more homogeneous throughout the all year, more similar to ASC, and their origin were tracked only to the south hemisphere. The influence of the displacement of the Intertropical Convergence Zone (ITCZ) on the GHG concentrations at SAL and CAM was confirmed by backward trajectories simulations by HYSPLIT model (using 240 hours) of the air masses (Souza et al., 2009; Rolph, 2017). Mean GHG concentrations for 2018 obtained from CAM and NAT sites (Table 1) increased over 2016 values following the global growth rate, with exception for CO concentrations, which showed a decrease during the period of this study. The trends of increase of all GHG concentrations in the Brazilian coast stations showed a similar behaviour of the global average concentrations during the period of this study.

References

Gloor, M., et al., 2012: The carbon balance of South America: a review of the status, decadal trends and main determinants. *Biogeosciences*, 9, 5407-5430.

Rolph, G.D., 2017: Real-time Environmental Applications and Display system (READY) Website (http://www.ready.noaa.gov). NOAA Air Resources Laboratory, College Park.

Souza, P., et al., 2009: Atmospheric centres of action associated with the Atlantic ITCZ position. *International Journal of Climatology*, 29, 2091–2105.

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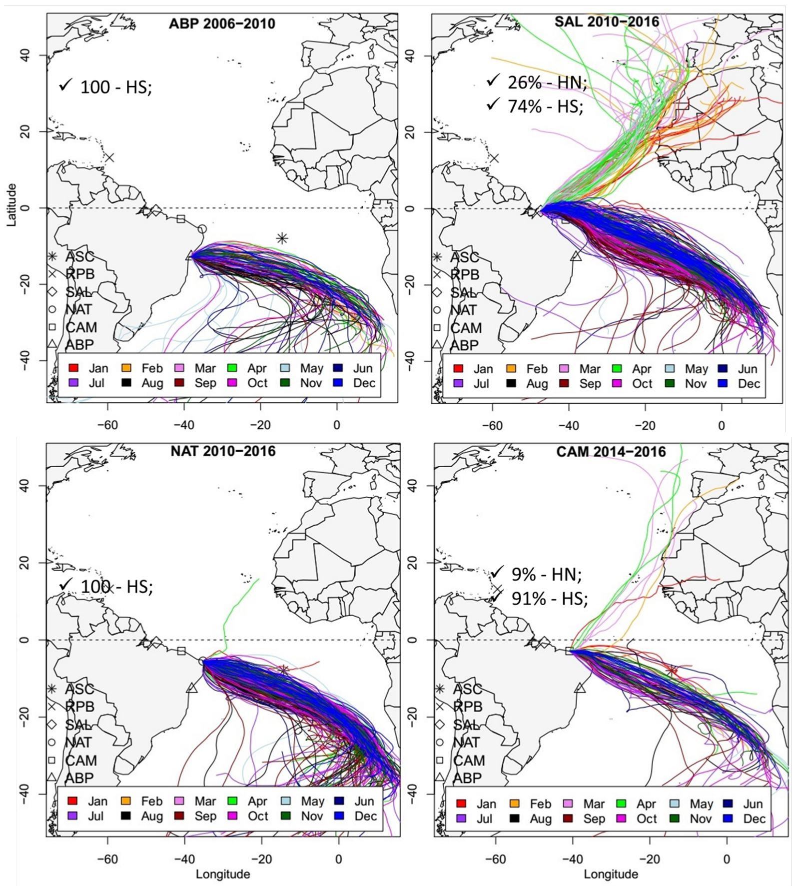

Figure 1. Backward trajectories of air masses that arrived in ABP, SAL, NAT and CAM simulated by HYSPLIT model. The percentage of air masses from north (HN) and south (HS) hemispheres are highlighted.

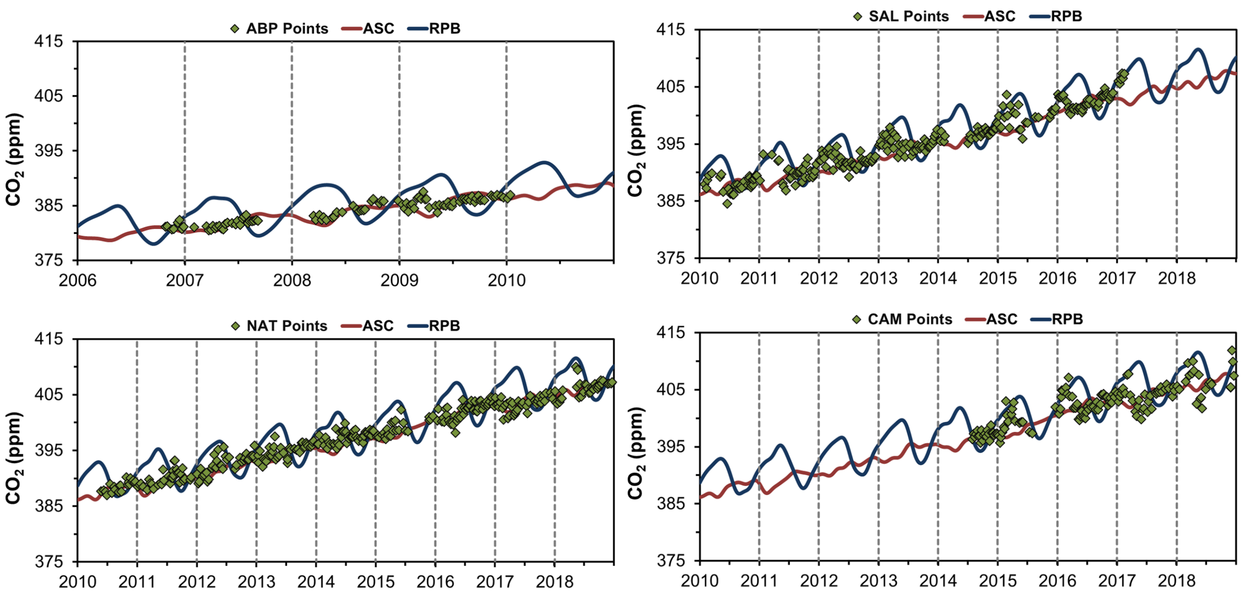

Figure 2. Time series in ABP, SAL, NAT and CAM for CO_2 and the CO_2 background for the WMO GHG Monitoring Global Stations of ASC and RPB

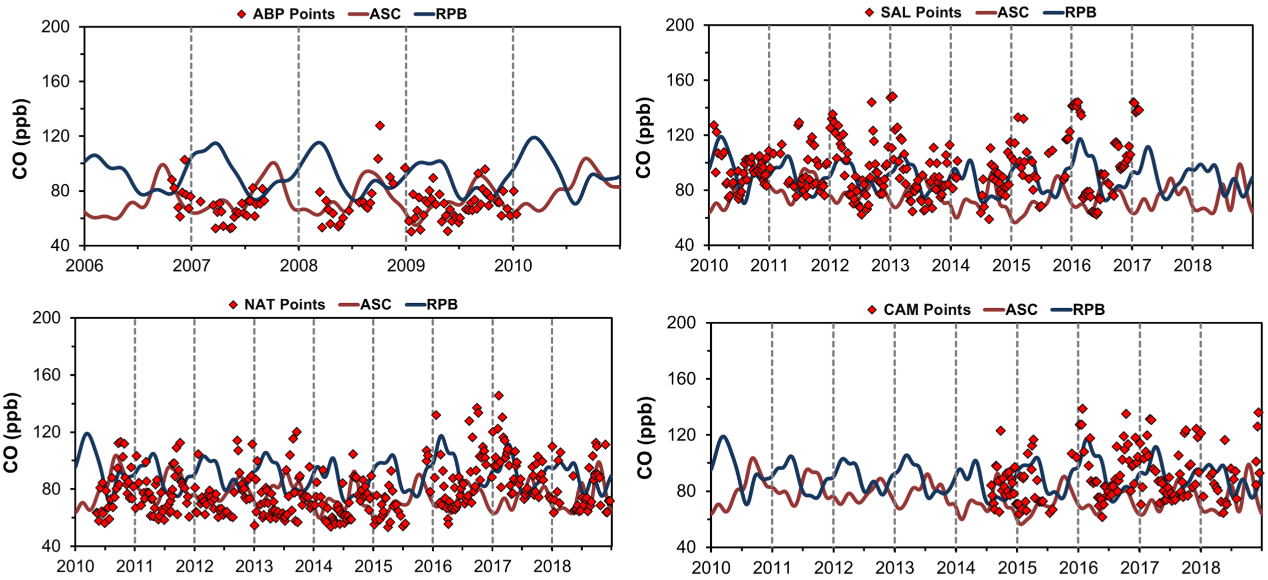

Figure 3. Time series in ABP, SAL, NAT and CAM for CO and the CO background for the WMO GHG Monitoring Global Stations of ASC and RPB

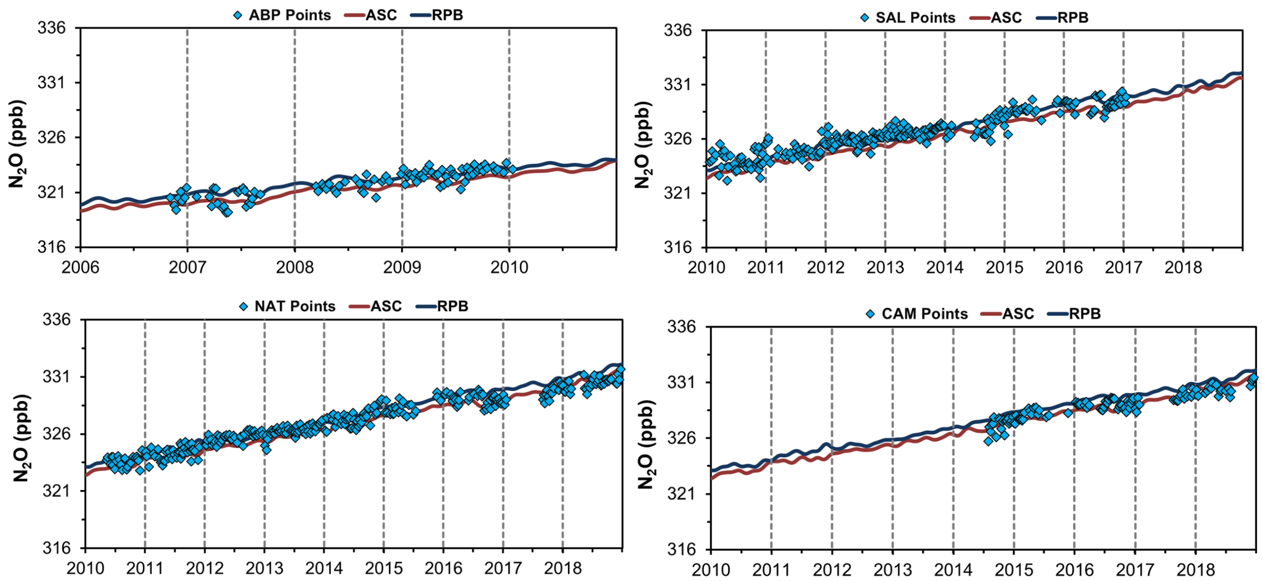

Figure 4. Time series in ABP, SAL, NAT and CAM for N_2O and the N_2O background for the WMO GHG Monitoring Global Stations of ASC and RPB

Table 1. Mean concentration of CO_2, CO and N_2O for CAM and NAT in 2016 and 2018

		Mean GHG Concentration					
		CO_2 (ppm)		***CO (ppb)***		***N_2O (ppb)***	
Site	**Code**	**2016**	**2018**	**2016**	**2018**	**2016**	**2018**
Camocim	**CAM**	402.63	406.49	94.27	91.43	329.02	329.11
Natal	**NAT**	402.14	406.17	86.69	80.46	328.67	330.45