

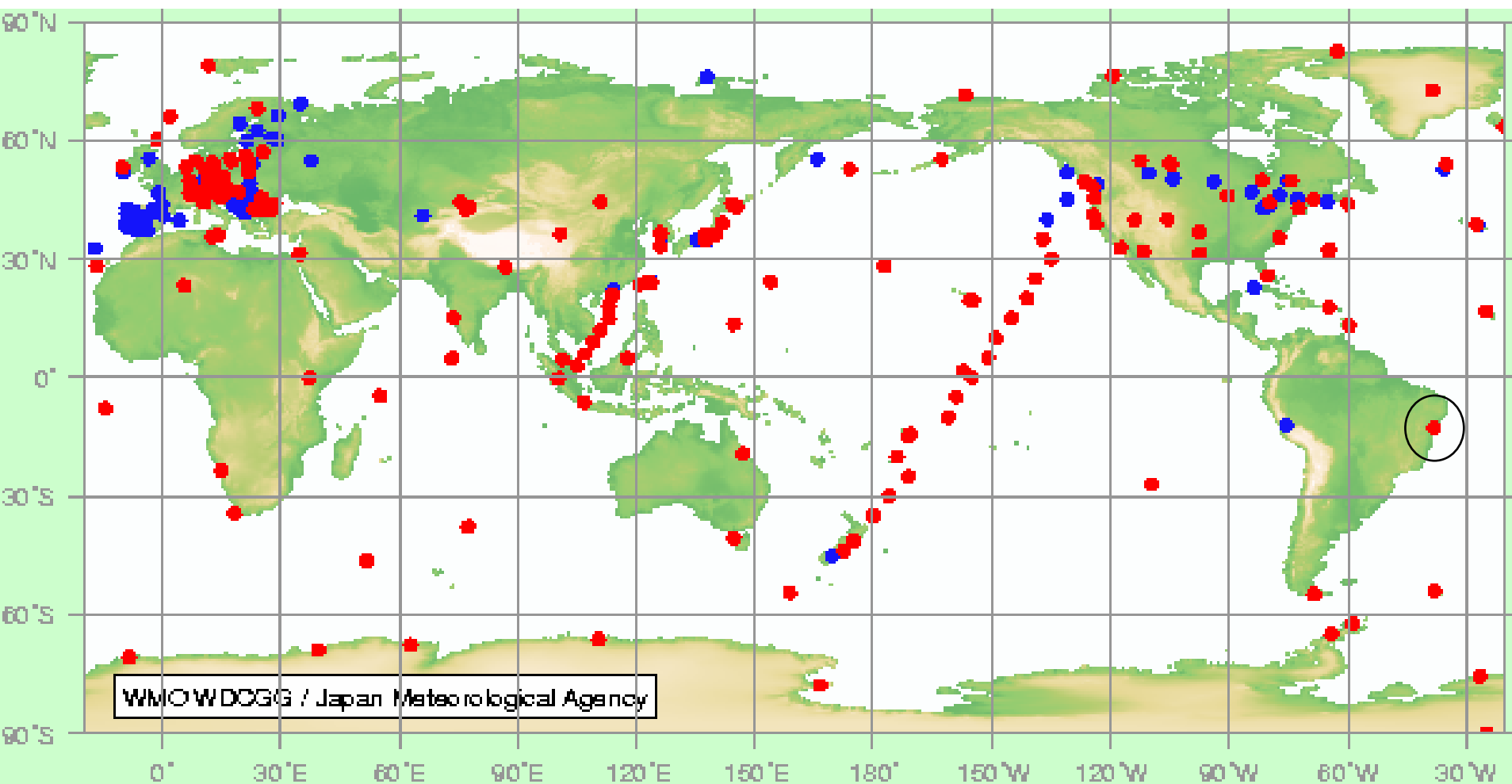


GHG Intercomparison NOAA/IPEN and Efforts in to start a GHG Network in Brazil

Luciana V. Gatti, Monica T. S. D'Amelio, John B. Miller, Andrew Crotwell, Ed Dlugokencky, Thomas Conway, Luana S. Basso, Alexandre Martinewski, Pieter Tans

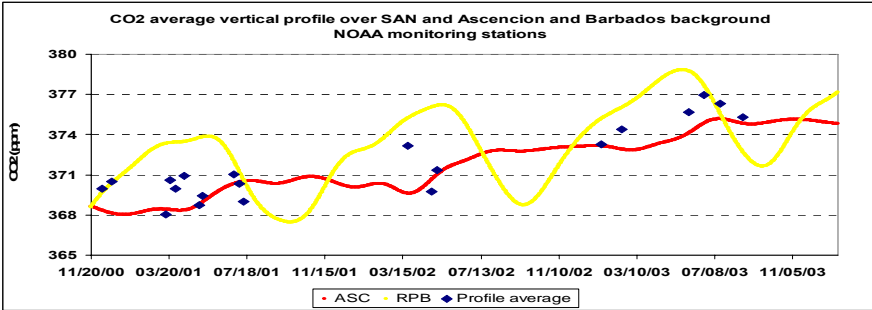
Atmospheric Chemistry Laboratory – IPEN

NOAA - Earth System Research Laboratory - Global Monitoring Division

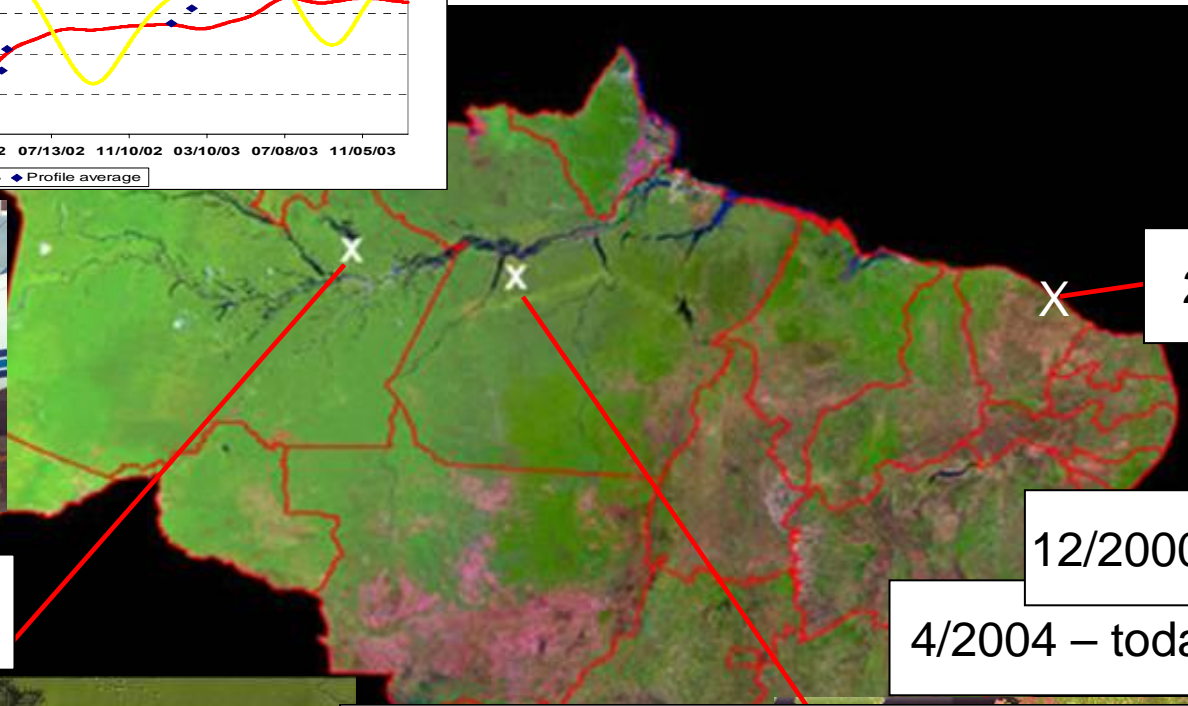


Vertical profiles of carbon dioxide and other trace gas species over the Amazon basin using small aircraft – LBA-ECO,

Principal Investigator: P.S. Bakwin (NOAA/CMDL); Co-investigators: John Miller, P. Tans (NOAA/CMDL), and J.W.C. White (CU/INSTAAR),
Brazilian Collaborators: L. V. Gatti (IPEN), 2003-



12/2004 – 12/2007



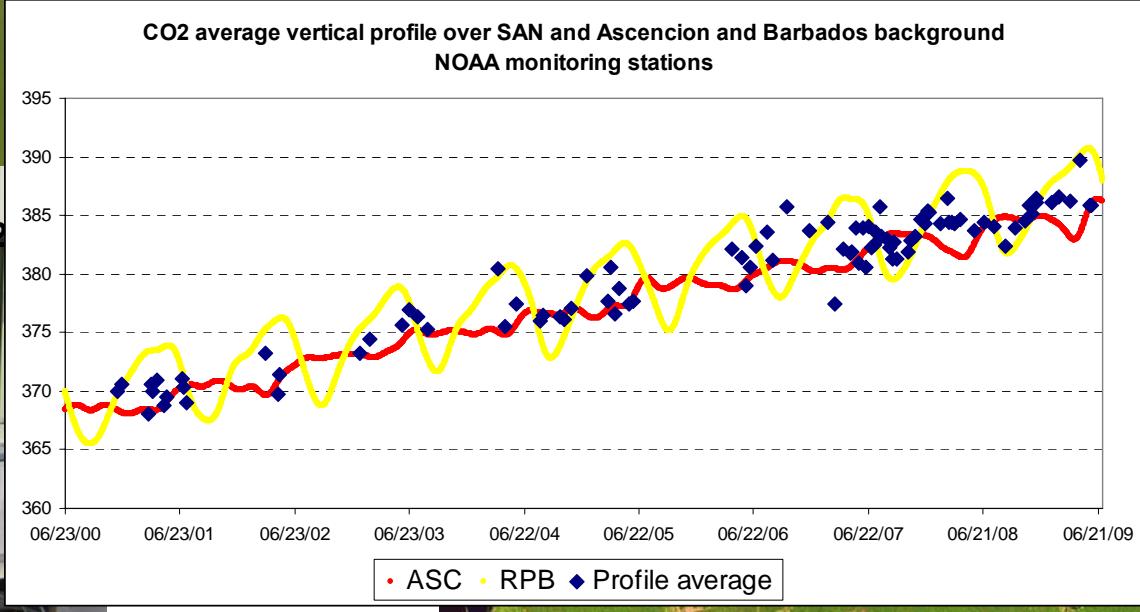
2001 – 2003

12/2000 – 2003

4/2004 – today + 4 years



CO₂, CH₄, N₂O, CO, SF₆ and H₂



Comparison between MAGICC system on GMD/NOAA and IPEN/Brazil for Precision and stability and the difference showed in inter-comparison in Arembepe Station

Species	Repeatability of MAGICC/GMD NOAA	Repeatability of MAGICC/IPEN LQA	%	Reprodu- cibility*	Instrument Information
CO ₂	0.05 ppm	0.04 ppm	0.01	0.03 ppm	CO ₂ Analyzer (LI-COR)
CH ₄	< 1 ppb	3 ppb	0.14	1.0 ppb	FID Chromatograph (HP)
N ₂ O	0.2 ppb	0.3 ppb	0.10	0.1 ppb	ECD Chromatograph (HP)
SF ₆	0.03 ppt	0.02 ppt	0.69	0.02 ppt	ECD Chromatograph (HP)
CO	0.5 ppb	1.0 ppb	0.71	0.8 ppb	CO Monitor (Peak Laboratories)
H ₂	0.5 ppb	2 ppb	0.25	2 ppb	CO Monitor (Peak Laboratories)

*Defined as the standard deviation found for the same high pressure cylinder measured for all gases an average of one/two times per month, since the system was installed.

CO Analyzer

N₂O and SF₆

CG/ECD

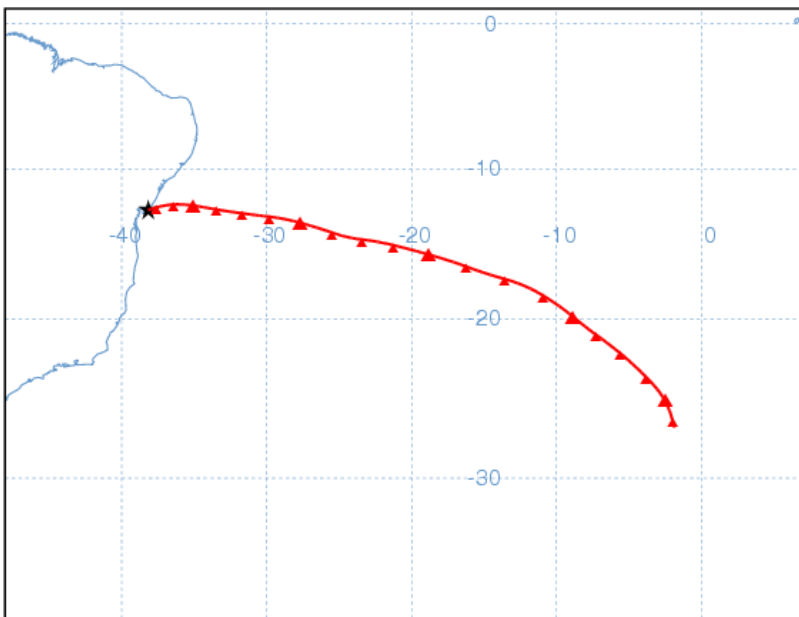


- 2005 – CO₂ Expert meeting
Tom Conway (NOAA) and Len Barry
- start Arembepe GHG measurements at oct 2006

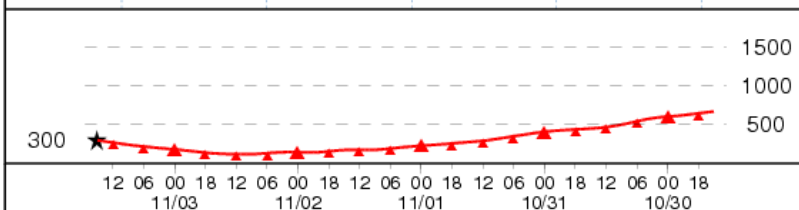


NOAA HYSPLIT MODEL
 Backward trajectory ending at 1500 UTC 03 Nov 06
 CDC1 Meteorological Data

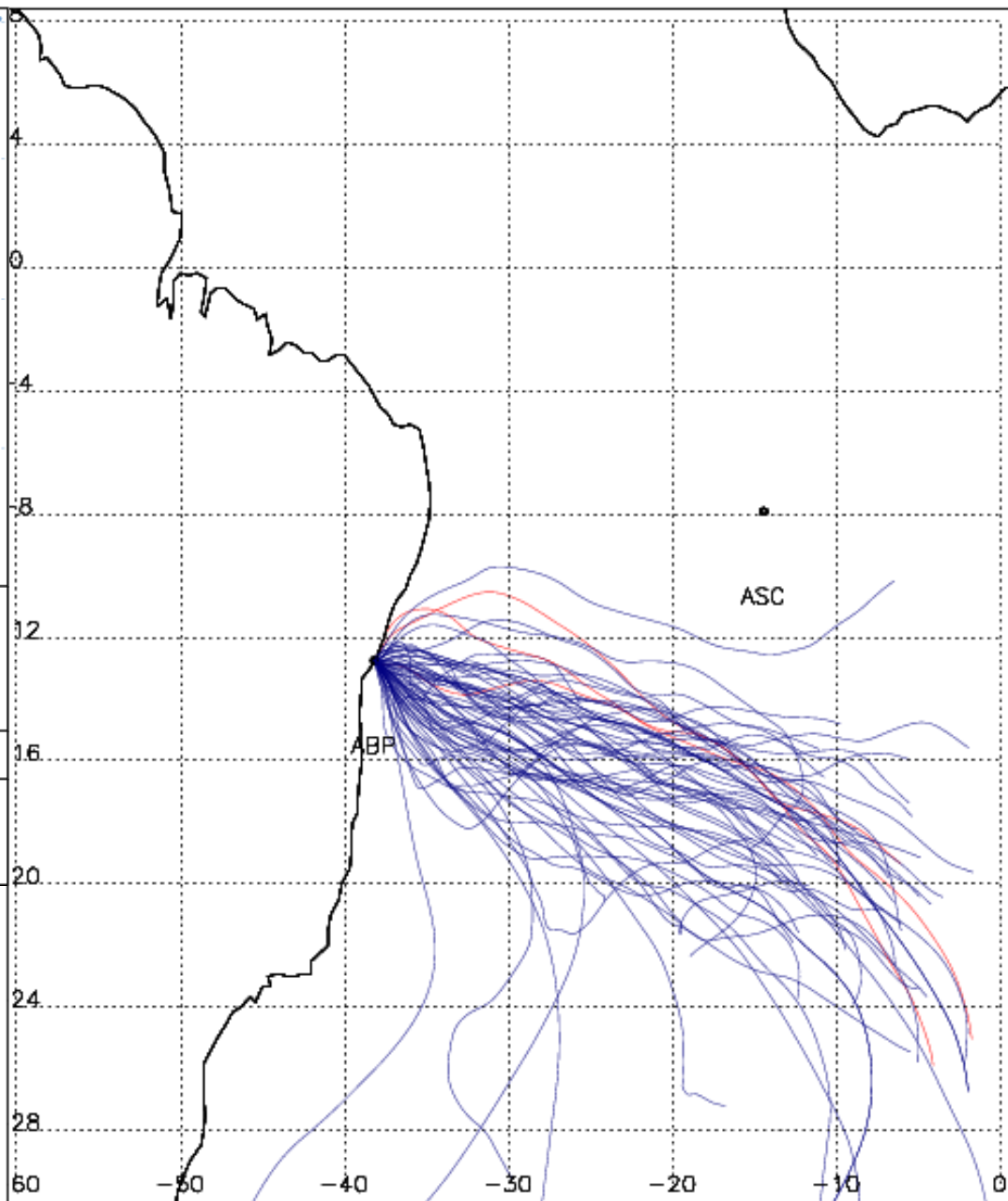
Source ★ at 12.76 S 38.17 W



Meters AGL

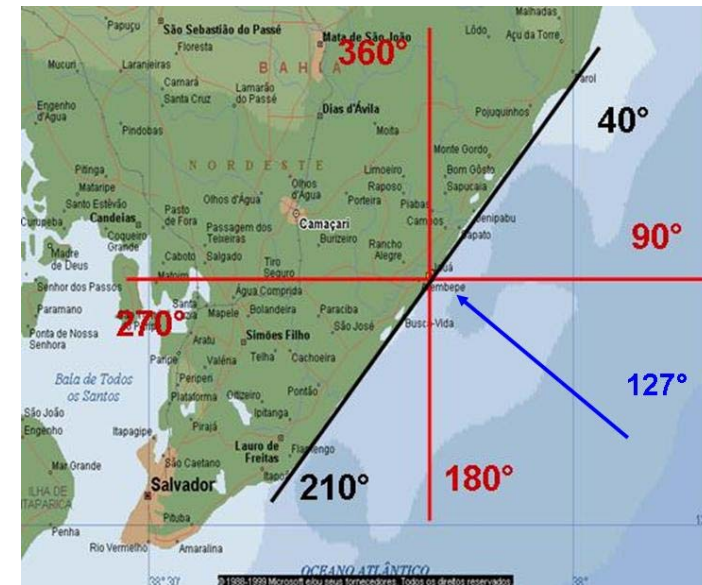


Job ID: 391415 Job Start: Wed Aug 26 12:50:45 GMT 2009
 Source 1 lat.: -12.7627 lon.: -38.169 height: 300 m AGL
 Trajectory Direction: Backward Duration: 120 hrs Meteo Data: reanalysis
 Vertical Motion Calculation Method: Model Vertical Velocity
 Produced with HYSPLIT from the NOAA ARL Website (<http://www.arl.noaa.gov/ready/>)

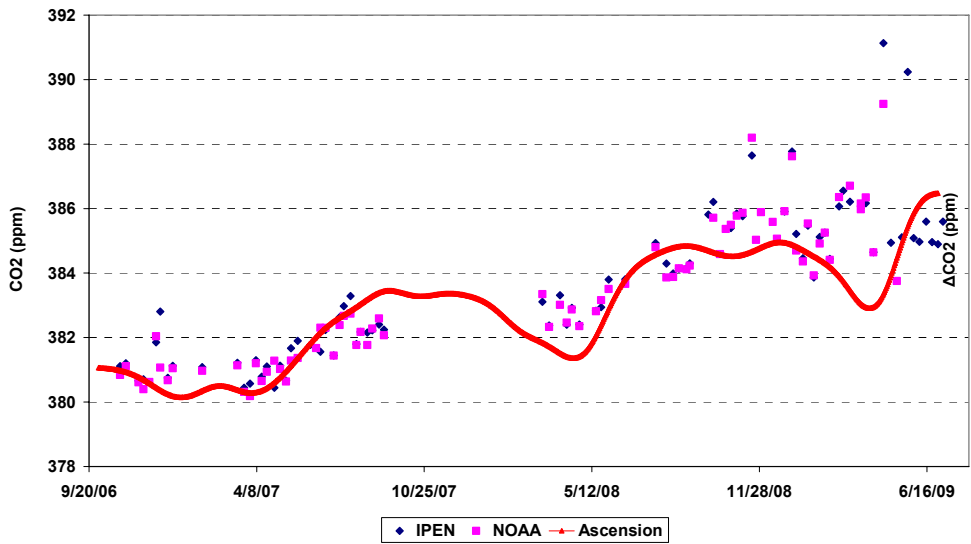


Intercomparison

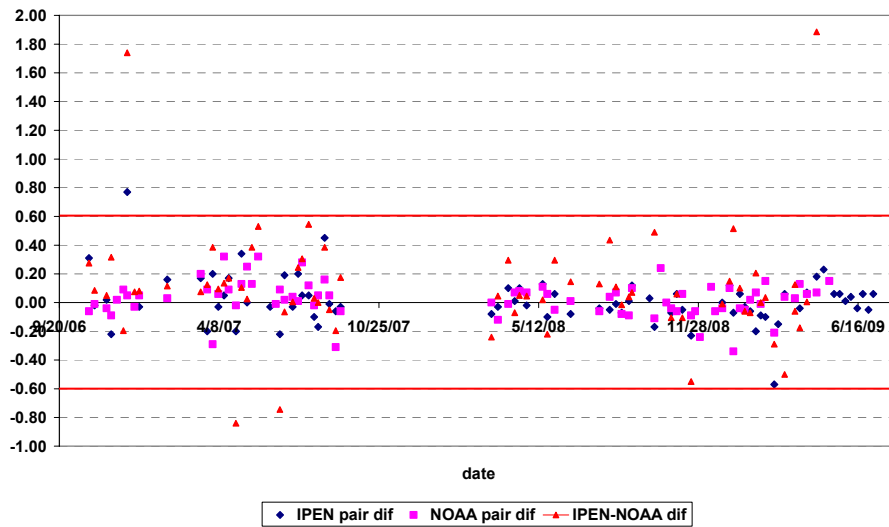
- Same sampler
- Pair is sampled to IPEN and NOAA in sequence
- Average time between samples is 17min (13 to 42min)
- Sample conditions $>4\text{m/s}$,
- WD $70 - 140^\circ$
- 11:30 as 13:30Hs (local time)
- (14:30 - 16:30Hs GMT)



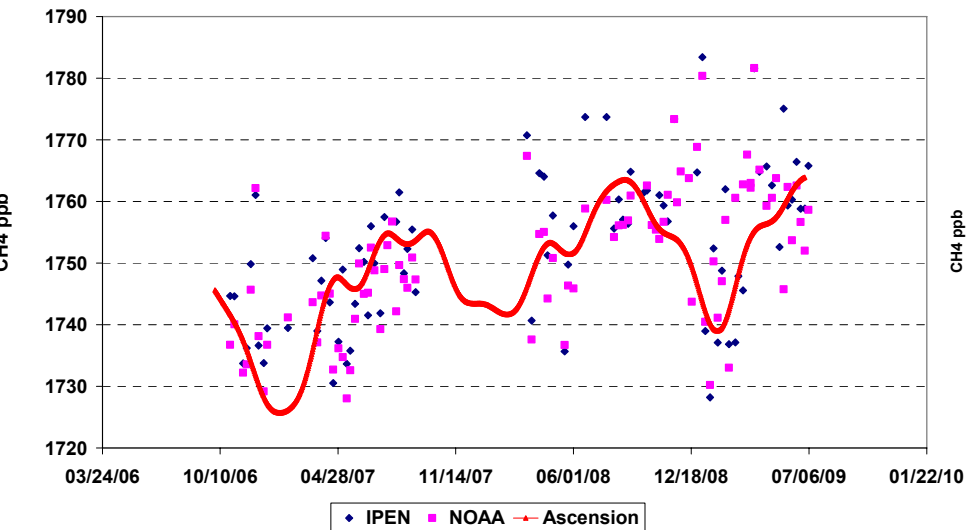
CO2 Arembepe IPEN, NOAA, Ascension



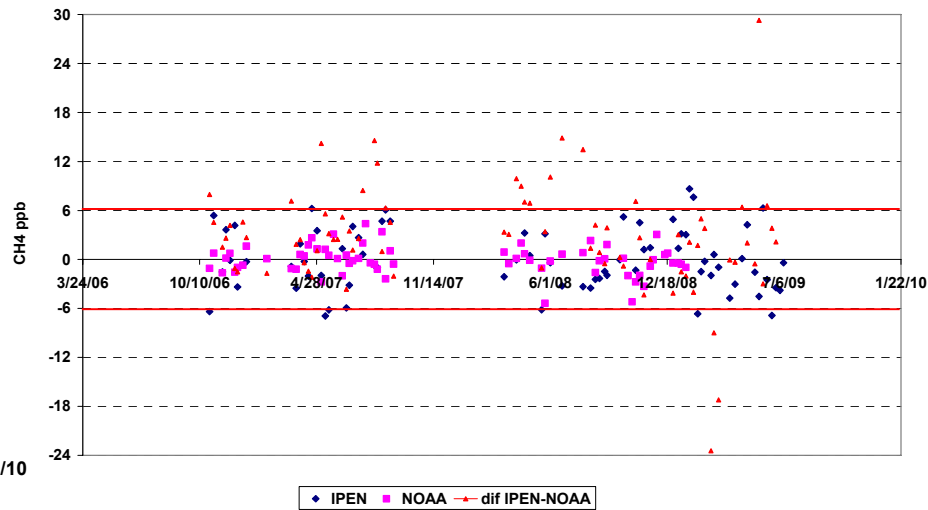
Intercomparition CO2 Arembepe measurements between IPEN and NOAA



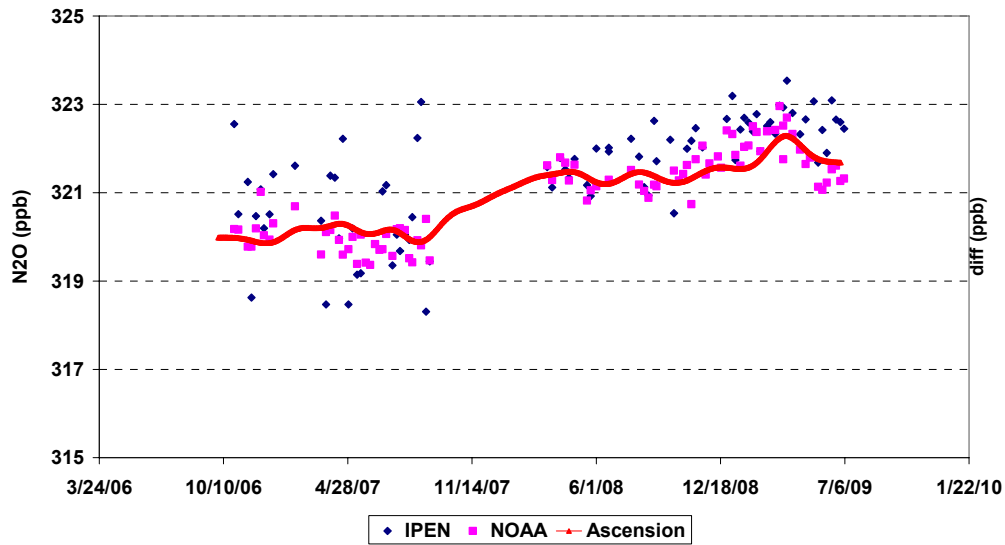
CH4 Arembepe IPEN, NOAA, Ascension



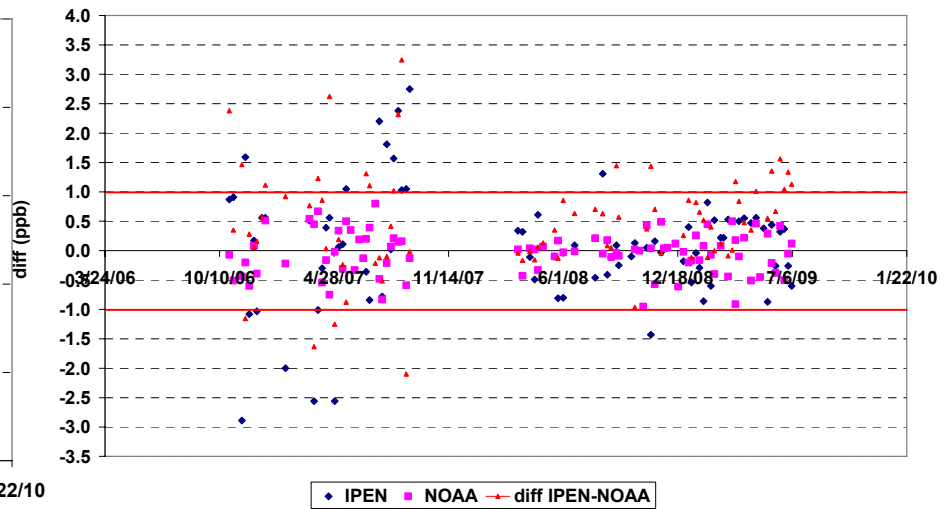
Intercomparition CH4 Arembepe measurements between IPEN and NOAA



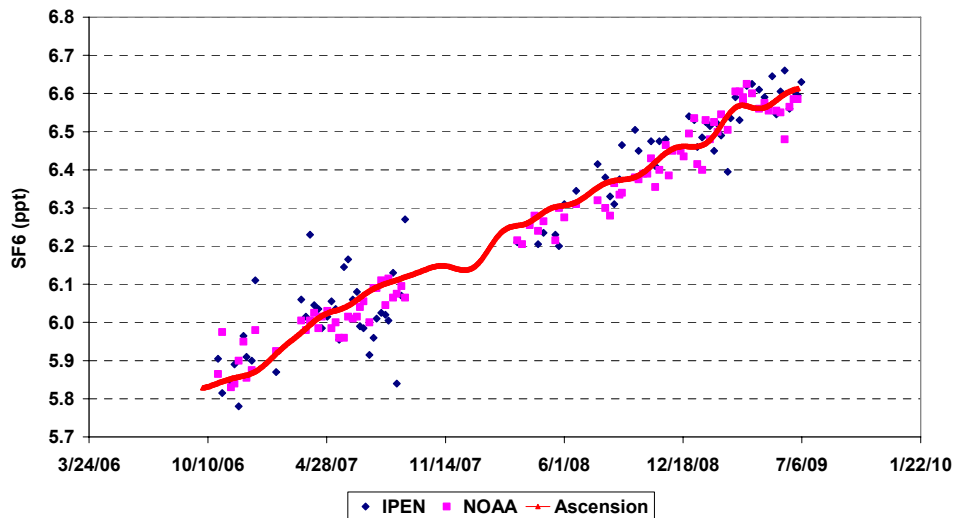
N2O Areambepe IPEN, NOAA, Ascension



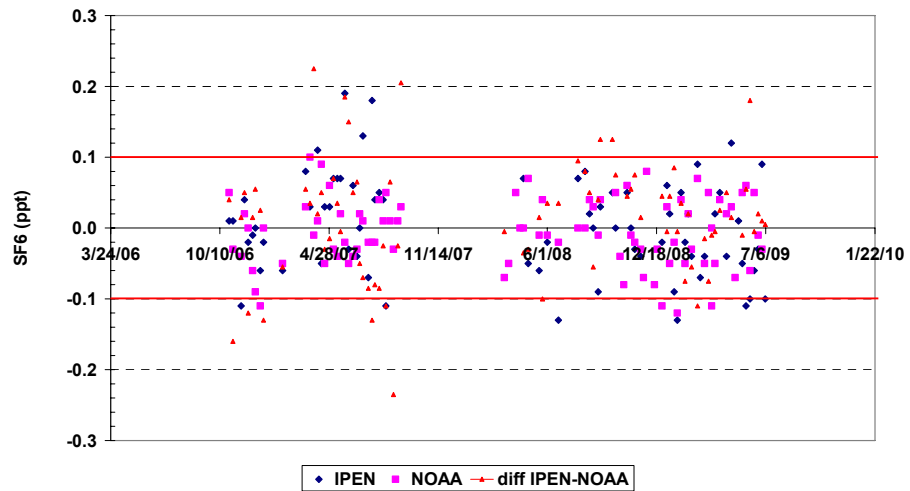
Intercomparison N2O Areambepe measurements between IPEN and NOAA



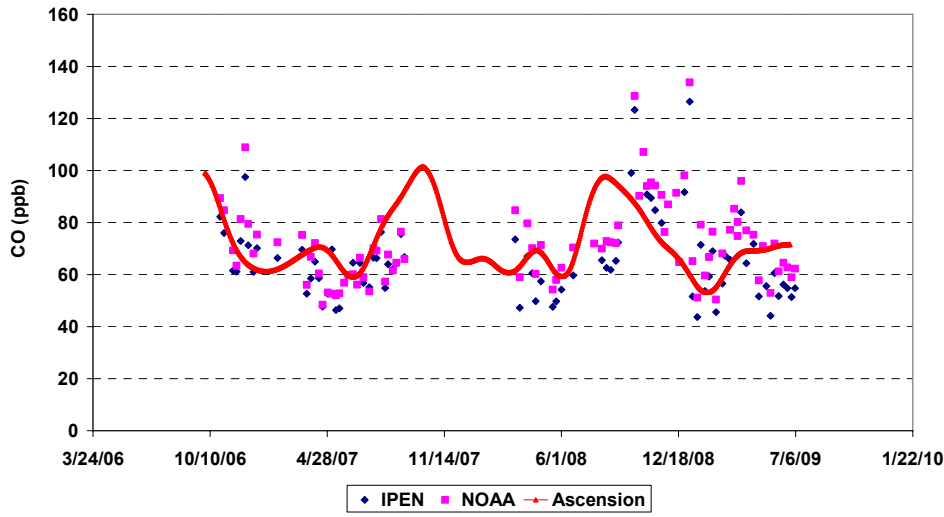
SF6 Areambepe IPEN, NOAA, Ascension



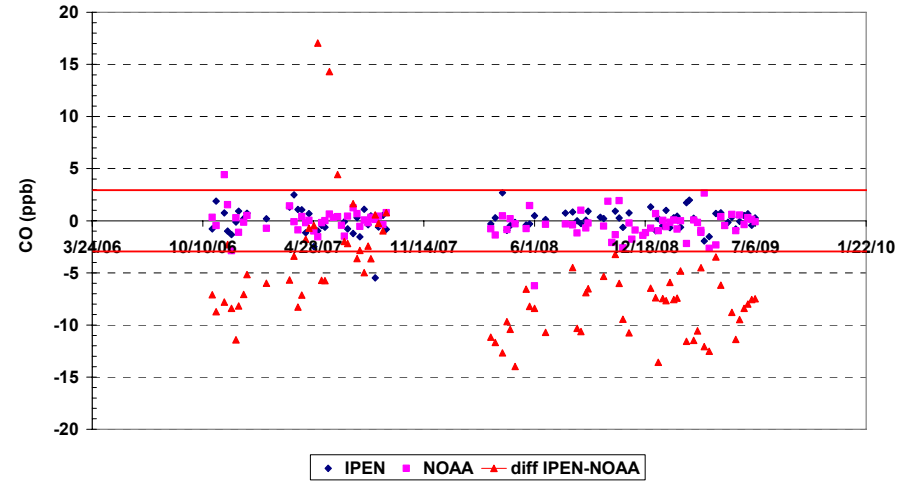
Intercomparison SF6 Areambepe measurements between IPEN and NOAA



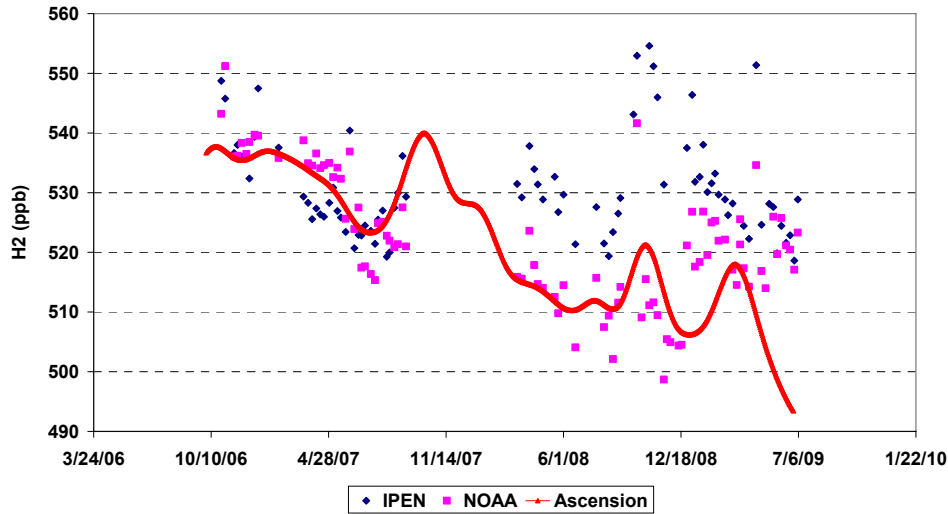
CO Arembepe IPEN, NOAA, Ascension



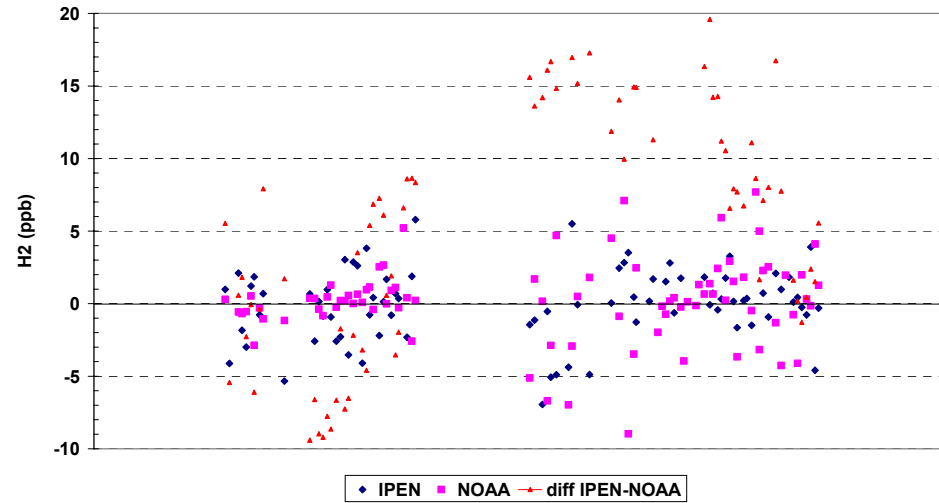
Intercomparition CO Arembepe measurements between IPEN and NOAA

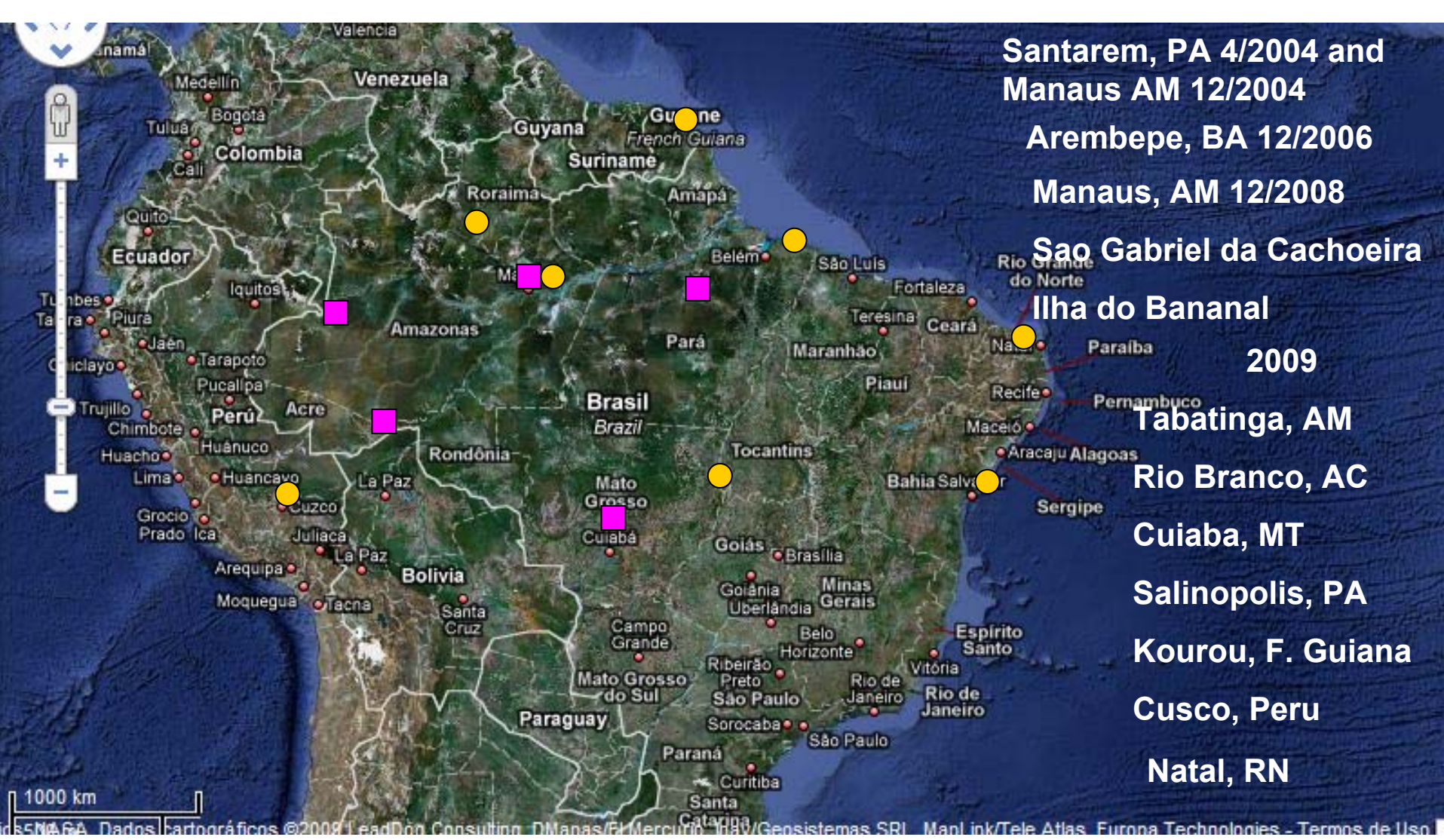


H2 Arembepe IPEN, NOAA, Ascension



H2 Arembepe IPEN, NOAA, Ascension



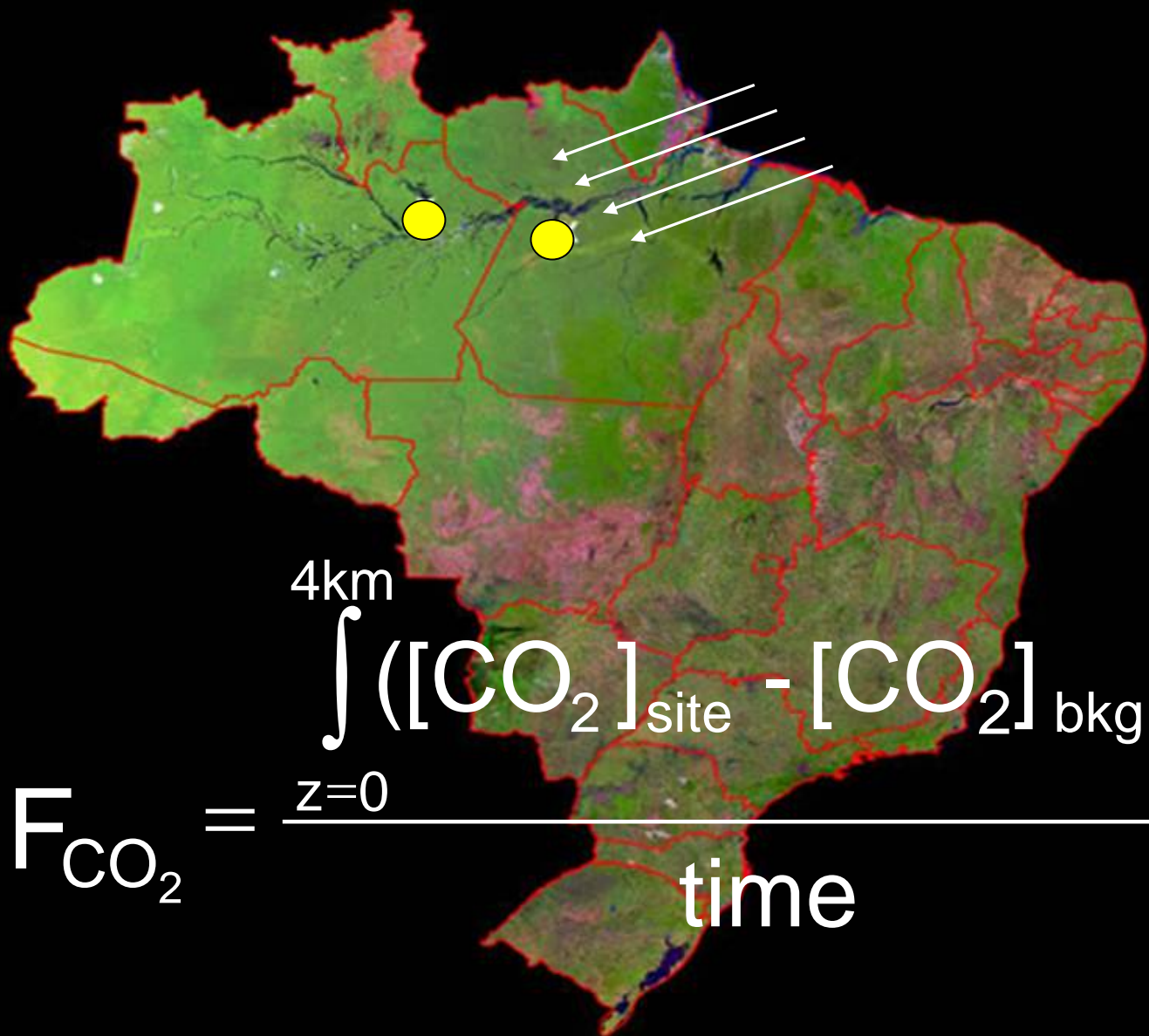


● Flask site

■ Airplane site

● Barbados
(RPB)

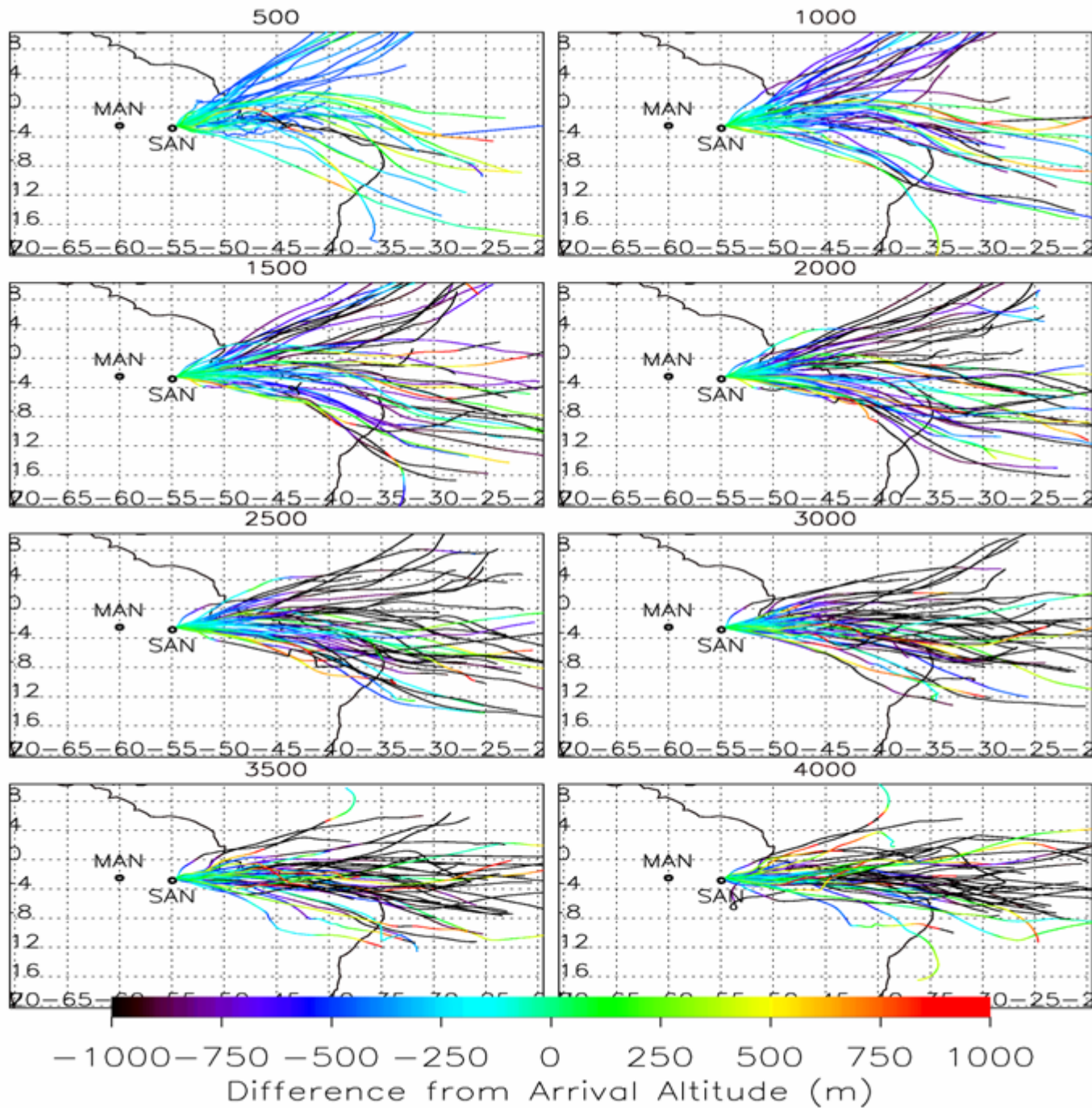
● Ascension
(ASC)



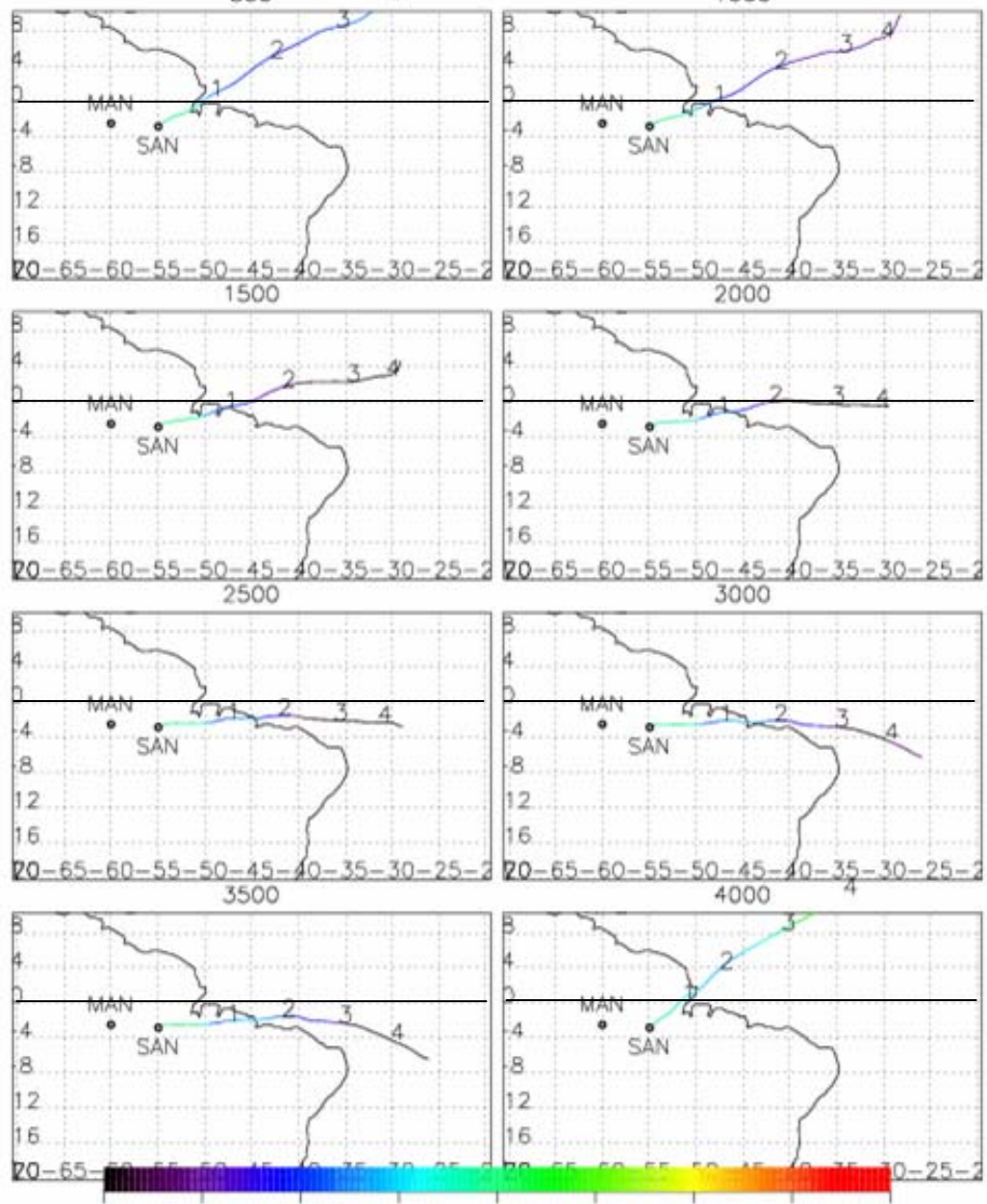
$$\int_{z=0}^{4\text{km}} ([\text{CO}_2]_{\text{site}} - [\text{CO}_2]_{\text{bkg}}) dz$$

$F_{\text{CO}_2} =$

time

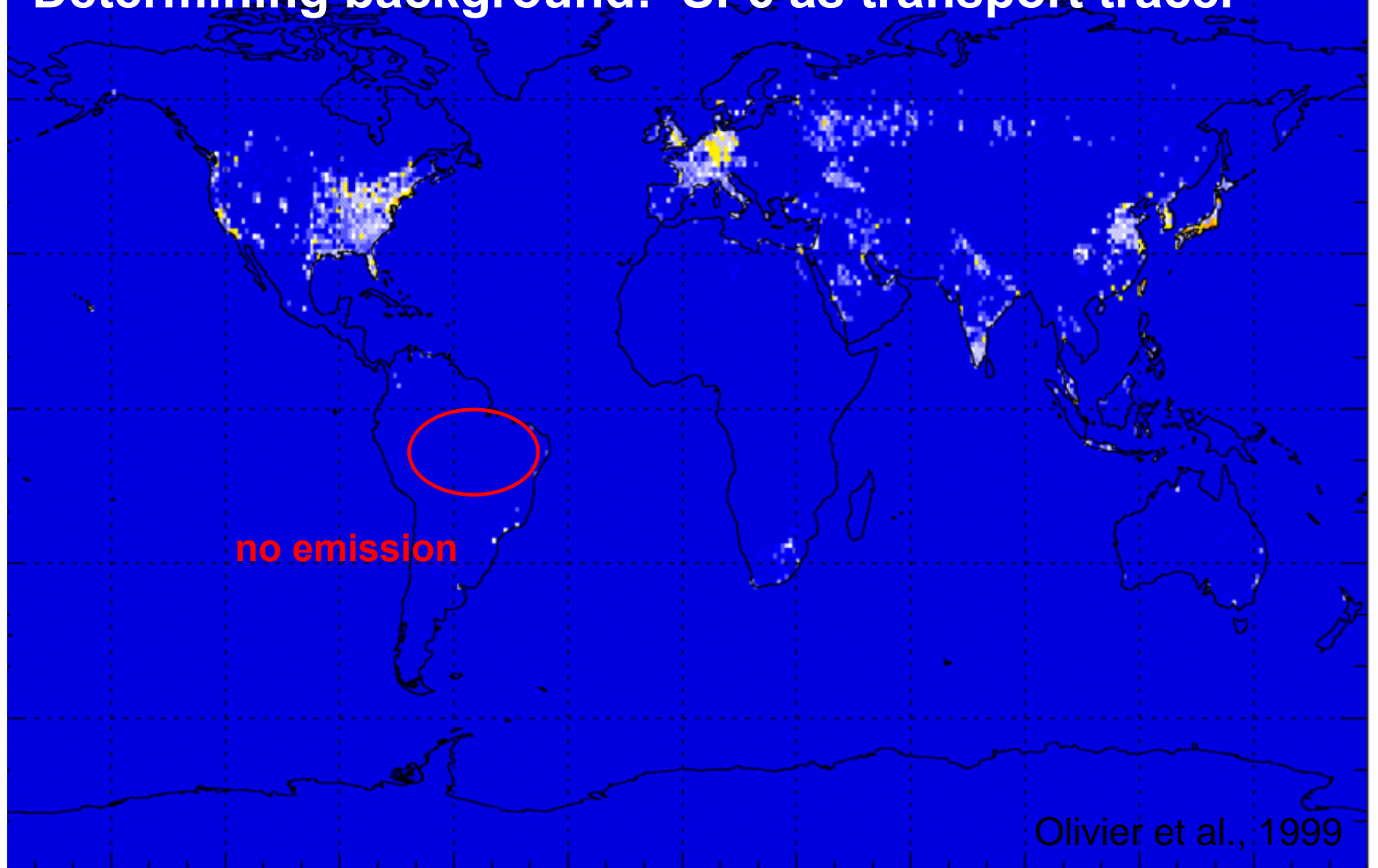


2006_04_14

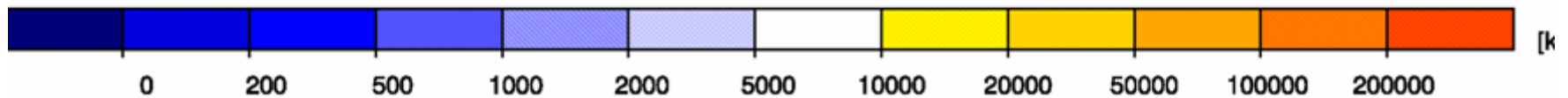


-1000 -750 -500 -250 0 250 500 750 1000
Difference from Arrival Altitude (m)

Determining background: SF6 as transport tracer

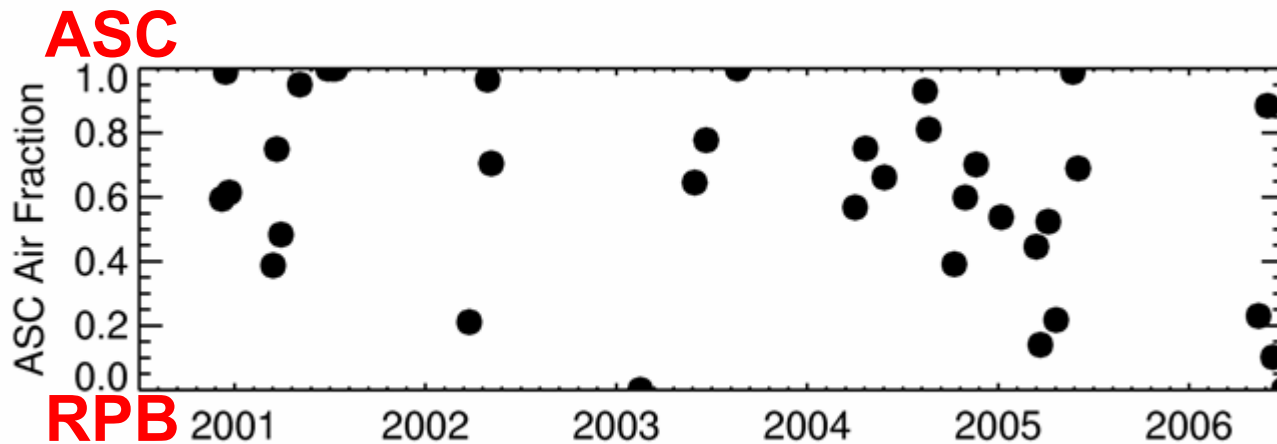
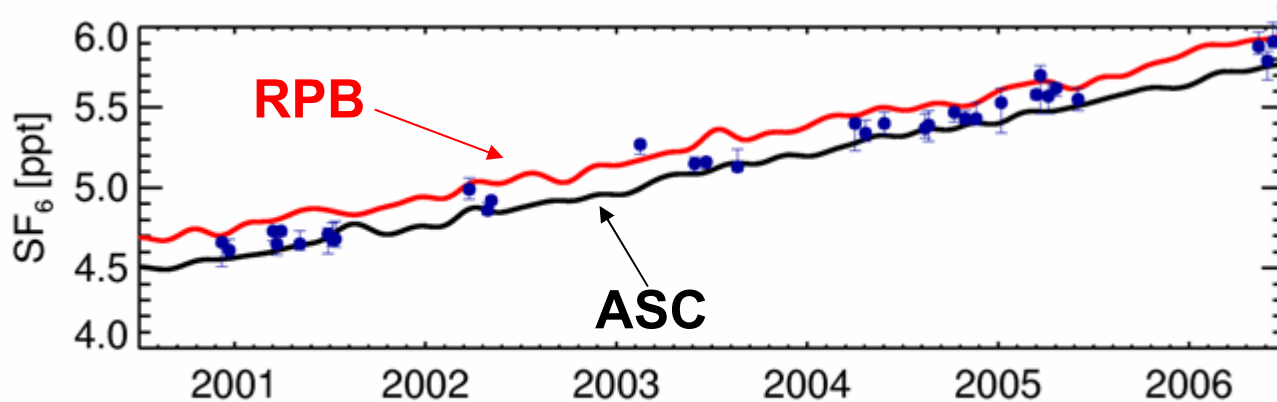


W 150W 120W 90W 60W 30W 0E 30E 60E 90E 120E 150E 180E
longitude (deg)

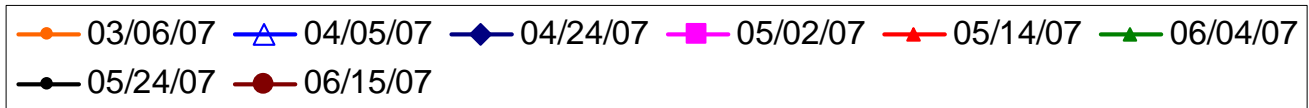
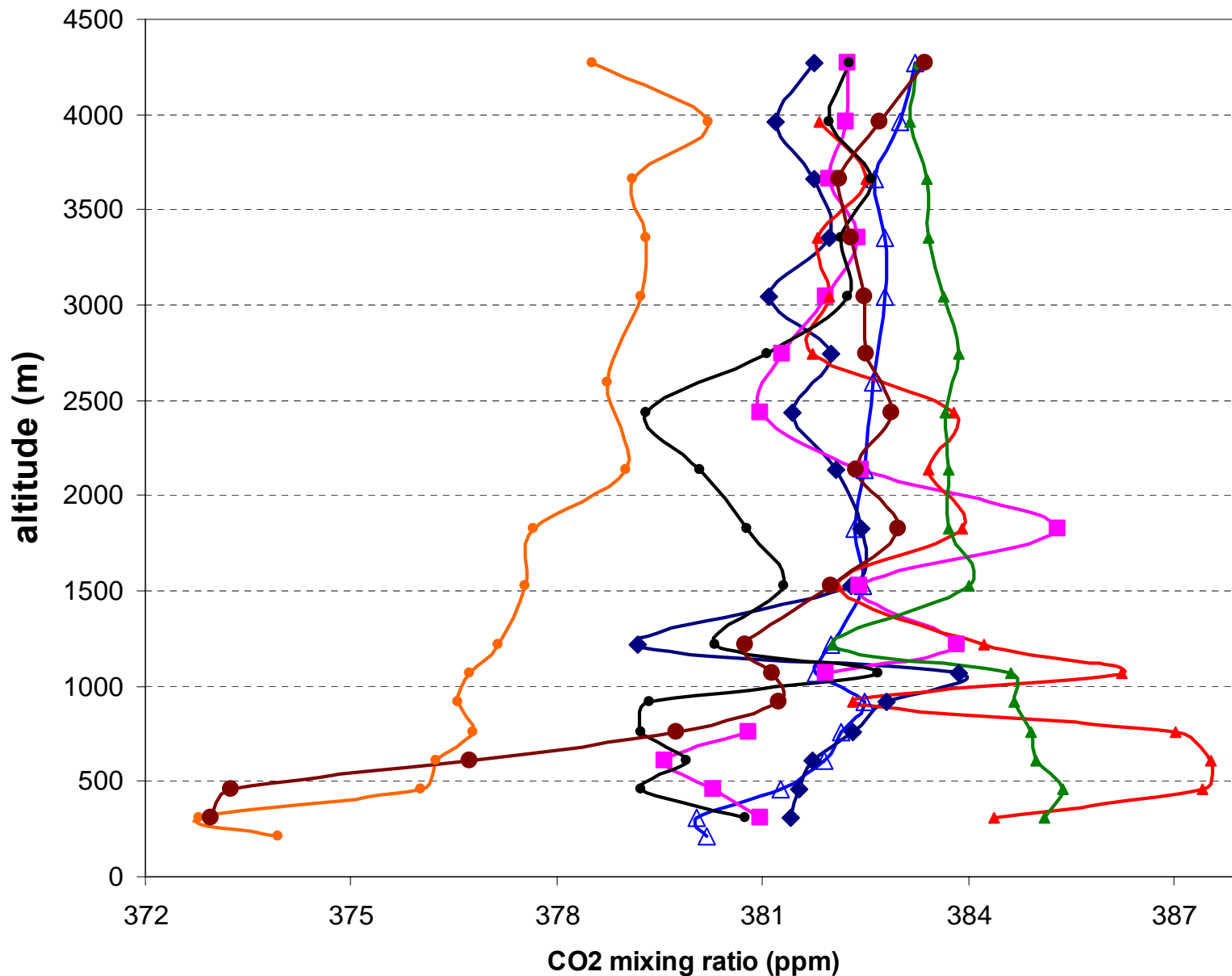


Determining background: fractions of NH and SH Air

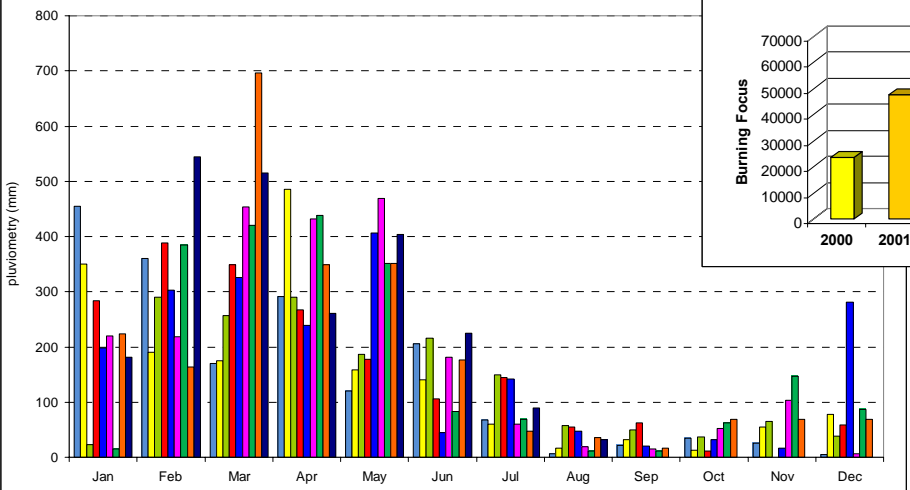
$$\text{ASC FRAC} = (\text{SAN} - \text{RPB}) / [(\text{SAN} - \text{RPB}) - (\text{SAN} - \text{ASC})]$$



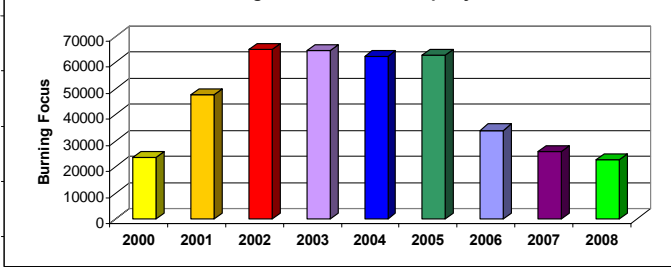
CO2 over Flona Tapajos



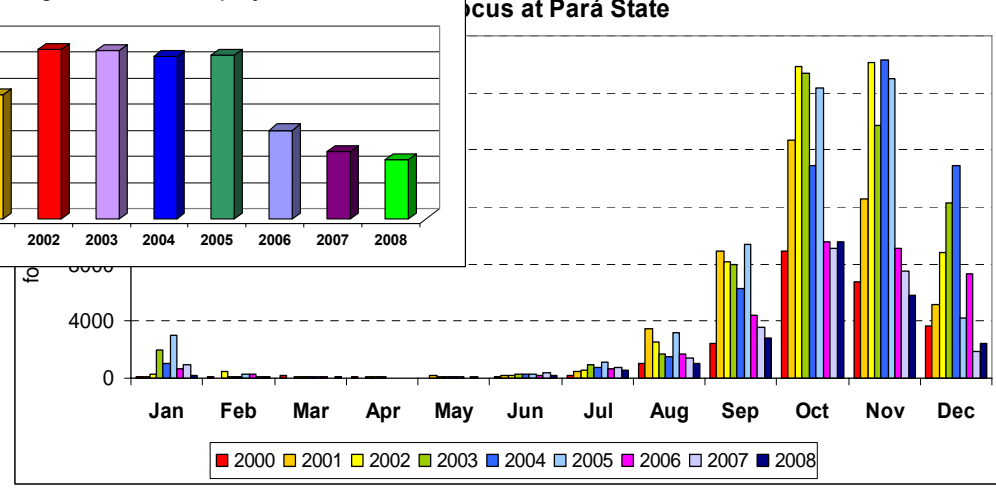
Pluviometry near Floresta Nacional do Tapajós (SAN)



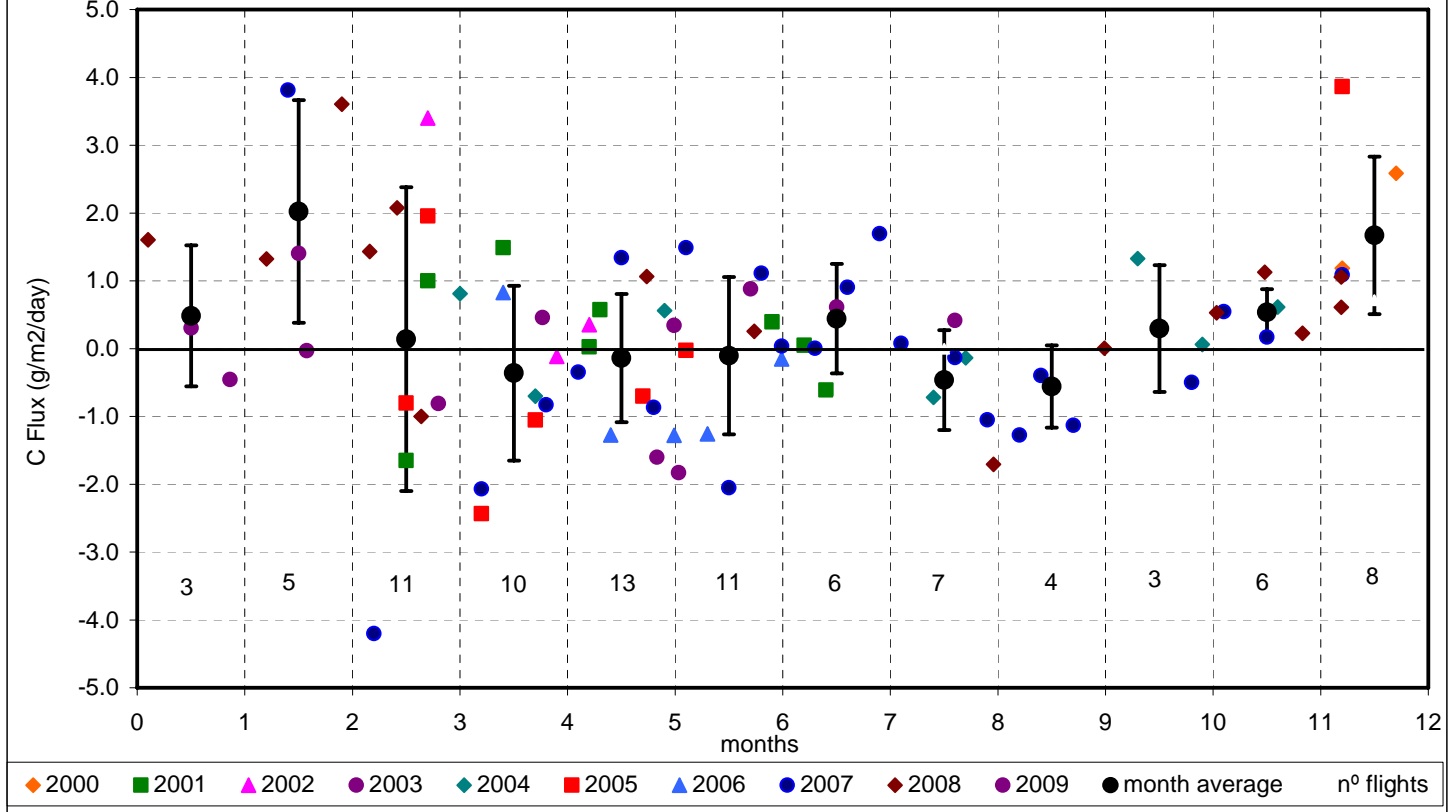
Burning Focus at Pará State per year



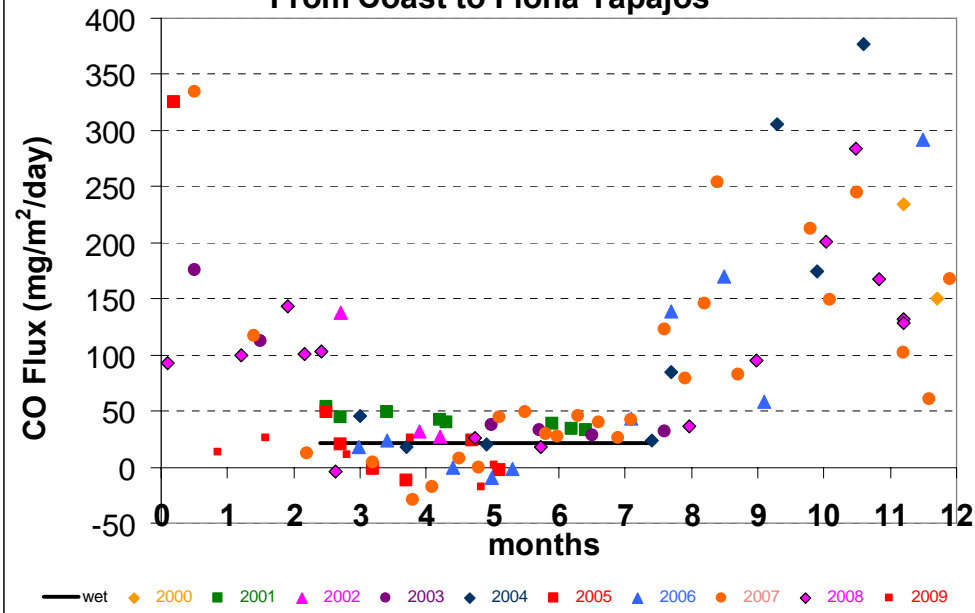
Burning Focus at Pará State



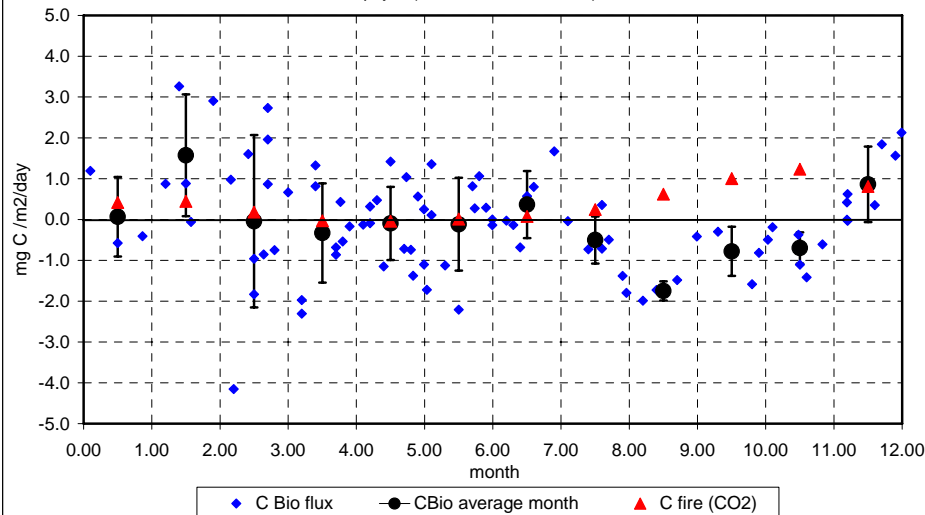
All flights 2000 - 2009 and month average gC/m²/day from Coast to Flona Tapajós



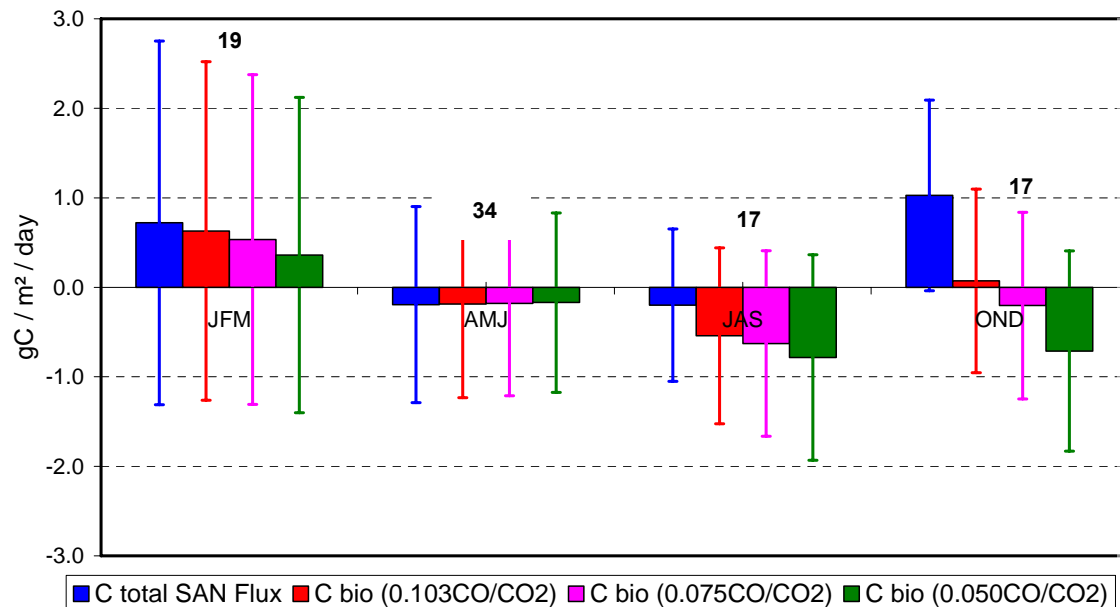
From Coast to Flona Tapajós



Time Series Total and Bio Carbon Flux per profile 2000 - 2009
from ocean until Flona Tapajós (central Amazon basin) 0.075 CO/CO₂



Trimester C Flux average Dec 2000-Jul 2009 from coast to Santarem
(85 Vertical Profiles)



Trimester Carbon Flux average 2000-2009
(85 SAN profiles) Total C and biogenic
flux using 3 relations:

- *0.050 CO/CO₂ - Chou, W. W., Wofsy, S. C., et al, J. Geoph. Res. : 107 (D22), 4614.*
- *0.075 CO/CO₂ - This study (average relation by 10 profiles with burning plumes.*
- *- 0.103 CO/CO₂ - Andreae, M.O. and Merlet, P; Global Biogeochem. Cy., 15 (4), 955-966, 2001*

Conclusions

- **Wet season flux: $0.36 \pm 1.3 \text{ g C.m}^{-2}.\text{day}^{-1}$**
- **Dry season flux: $0.30 \pm 0.76 \text{ gC. m}^{-2}.\text{day}^{-1}$**
- **The annual average $0.33 \pm 0.80 \text{ gC. m}^{-2}.\text{day}^{-1}$**
- **Extrapolating to Amazon forest (5 million km²) = $0.60 \text{ Pg C year}^{-1}$,**
- **Ometto J. et al (2005) review about 28 research studies in Amazon Basin: - 3.0 to $0.75 \text{ Pg C year}^{-1}$ from.**
- **Our measurements suggest a nearly neutral source/sink**
- **removing biomass burning influence using CO measurements (relation of $0.075\text{CO}/\text{CO}_2$ determinate in this study), showed the biological absorption during dry season of $-0.57 \pm 1.1 \text{ g C.m}^{-2}.\text{day}^{-1}$.**
- **This approach greatly reduces dry season CO₂ emissions and possibly indicates a regional sink of CO₂ for whole year, except to December.**
- **Extrapolating for Amazon forest (5 million km²) the absorption is $1.0 \text{ Pg C year}^{-1}$.**

Thank you