TG-06 Vertical Profiles of Trace Gases Above Santarem and Fortaleza

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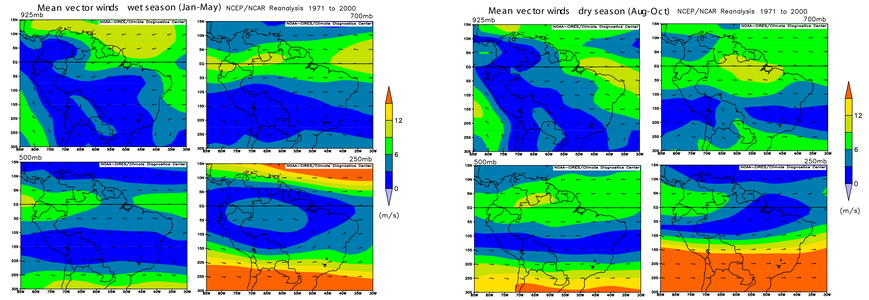
1. Introduction

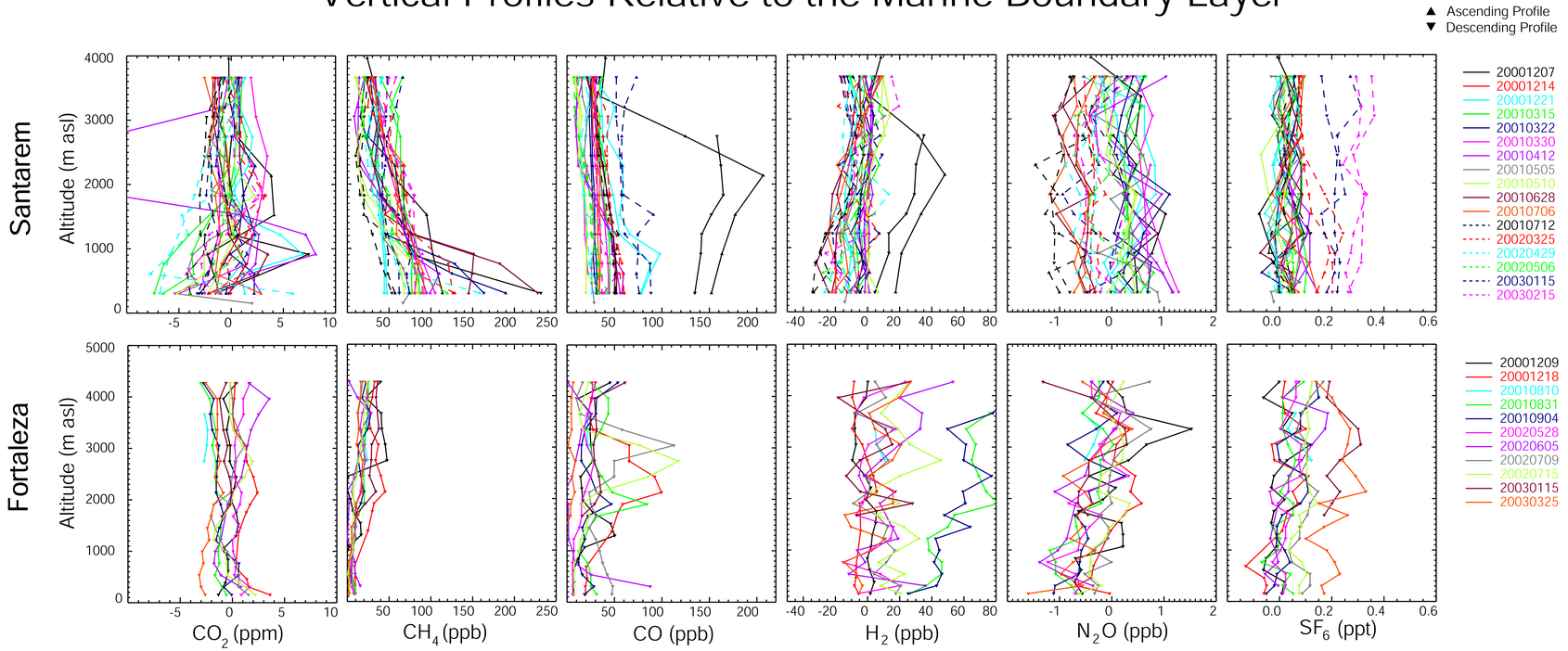
Our main motivation for making regular airborne trace gas measurements above Santarem and Fortaleza has been to better understand the regional carbon balance of the Amazon basin. By comparing profiles of CO_2 when air enters the continent and at Santarem, we hope to be able to see indications of source and sink activity. This idea extends to all the other gases we measure: CH_4, CO, H_2, N_2O and SF_6. From the global point of view, the CO2 fluxes from the tropics are the most uncertain. Scott Denning has shown that the addition of these two vertical profile sites to a global network of CO_2 observations could dramatically decrease the uncertainty both in Amazonia and in other regions as well.

Unfortunately, our planned sampling activities have been plagued with import and export problems resulting in a highly irregular sampling frequency that hampers our interpretation of the data. Our new plan focuses on transferring our analysis technology to Brazil to avoid the shipping delays that have affected us. A new analysis system has been tested and built and will begin operation at IPEN in January, 2004. During 2004, we will also transfer the technology necessary to make highly precise measurements of the carbon and oxygen isotopic ratios of CO_2. We plan to have this system operational at CENA/USP by January, 2005. Our new strategy will enable us to greatly increase the frequency of our measurements, which should translate into an enhanced understanding of Amazon basin trace-gas fluxes.

2. Mean Winds by Season and Atltitude



3. Vertical Profiles Relative to the Marine Boundary Layer



4. Data Analysis

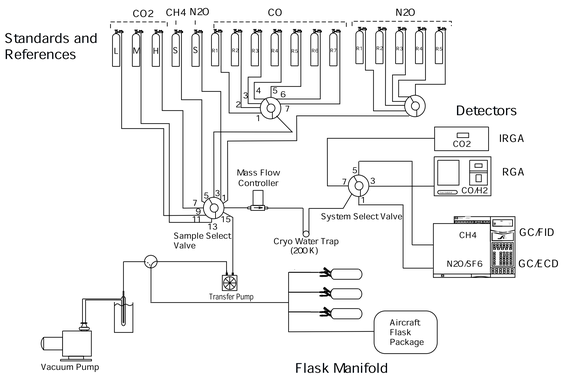
1. We see no clear evidence of net CO2 uptake between the Atlantic coast and Santarem. While the variability of CO2 at Santarem is much greater than at Fortaleza, when compared to the marine boundary layer (MBL), the mean of our measurements at both sites is close to the MBL value.

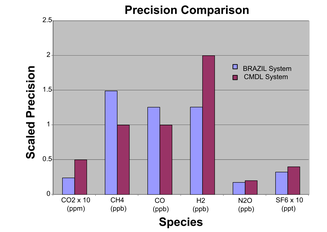
2. For CO2 and all gases, however, we note that our measurements have been taken mainly during the wet season at Santarem; our data provide an incomplete picture even in an average sense.

3. We see strong indication of CH4 and CO fluxes, with high CO fluxes presumably associated with biomass burning. We see evidence of H2 uptake by soils and only one clear instance of H2 release due to burning. We do not see significant vertical gradients of N2O, but the column means do differ significantly from the MBL, indicating flux activity somewhere between the ocean and Santarem. As expected, SF6 shows little vertical structure and is similar to the MBL.

4. Because our samples our not dried, our 13C and 18O measurements seem to have been compromised, especially at Santarem. New versions of our sampling unit will include a drier.

5. New Analysis System





6. Future Goals

Our goals for the remainder of our project are:

1. Establish weekly sampling at Fortaleza and Santarem with measurements of non-isotopic species made in Brazil.

2. Establish a sample inter-comparison project with the IPEN lab using small sample flasks.

3. Begin to measure isotopic ratios on our samples in Brazil by January, 2005.

4. Establish a new vertical profile site at Manaus or further west.