Vertical Profiles of CO_2, CH_4 and Other Trace Gases Above the Brazilian Amazon

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Since 2004, the NOAA ESRL Global Monitoring Division (GMD) has engaged in a very active collaboration with the IPEN Atmospheric Chemistry Laboratory focused on analyzing air samples collected above the Brazilian Amazon. The Amazon basin is both one of the most poorly sampled regions of the globe and at the same time one of the most critical to understand present day global greenhouse gas budgets and future climate feedbacks. In order to better study Amazonian greenhouse gas budgets, a copy of the GMD high precision, well-calibrated greenhouse gas analysis system (MAGICC) was built and installed at IPEN in April 2004. Between 2004 and 2008, more than 1500 samples have been collected above two sites in eastern and central Amazonia. These samples have been analyzed for CO_2, CH_4, CO, H_2, N_2O and SF_6 mole fractions. Our primary method of analysis has been to calculate the difference between the continental mole fractions and those measured in the tropical Atlantic by GMD at Ascension Island and Barbados. Using a simplified conception of atmospheric transport, we have calculated net surface fluxes between the coast and our sites. As can be seen in Figure 1, we see large enhancements of methane that translate to much larger fluxes than previously believed. In addition to the simplified flux calculations, we have also used regional and global inverse models to calculate surface fluxes. A flux calculation for CO_2 using the CarbonTracker inverse model is shown in Figure 2. The addition of the Amazonian observations substantially changes both the shape of the seasonal cycle and the annual net carbon flux, relative to the standard CarbonTracker results. The collaboration between NOAA and IPEN has proved very fruitful and has provided a unique dataset with which to analyze Amazonian greenhouse gas budgets.

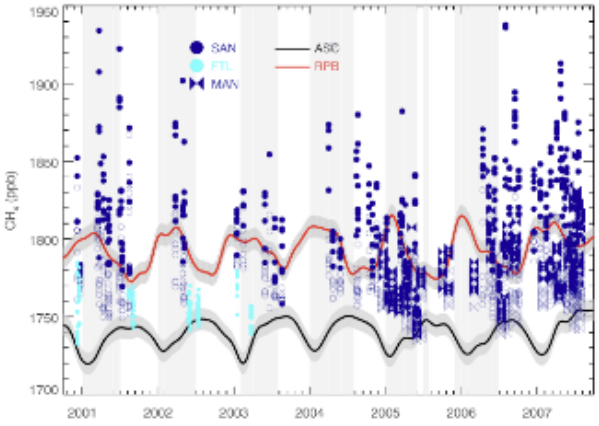

Figure 1. CH_4 above Amazonian sites (blue symbols) compared to Atlantic background sites (black and red lines, with gray uncertainty bands). Vertical gray bars indicate wet season months near Santarem (SAN). Filled and empty symbols are those below and above 1500m, respectively.

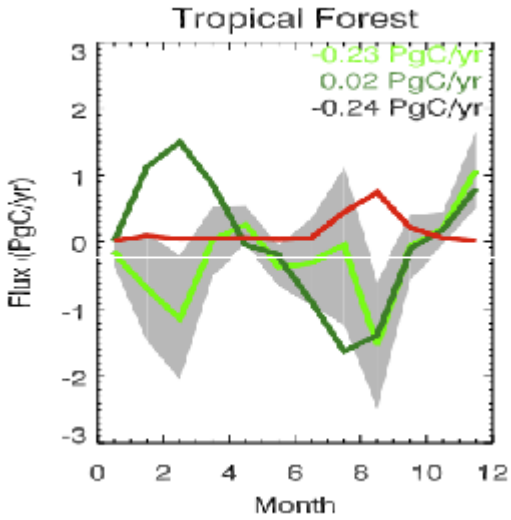

Figure 2. Net CO_2 flux in CarbonTracker's South America Tropical Forest region, before (dark green) and after (light green) including data from SAN (for 2007). The red curve is the unoptimized biomass burning flux, and the gray error band represents statistical uncertainty of the flux result.