AGU 100 FALL MEETING
San Francisco, CA | 9–13 December 2019

B33D-04 - Amazon Carbon Balance and its Sensitivity to climate and human-driven changes

Wednesday, 11 December 2019

14:25 - 14:40

Moscone West - 3007, L3

Swirl Topics

Climate - SWIRL

Abstract

The Amazon accounts for 50% of Earth's tropical rainforests hosting the largest live carbon pools in vegetation and soils (~200 PgC). The net carbon exchange between tropical land and the atmosphere is critically important, because the stability of carbon in forests and soils can be disrupted on short time-scales. The main processes releasing C to the atmosphere are deforestation, fires and changes in growing conditions due to increased temperatures and droughts. Such changes may thus cause feedbacks on global climate. In the last 40 years, the Amazon mean temperature has increased by 1.1°C. Annual mean precipitation has also decreased by 51 mm during this same 40 year period. The precipitation reduction occurred mainly in the dry season, and the dry season has lengthened, exacerbating vegetation water stress with consequences for carbon balance.

To better understand its C budget, starting in 2010 we established a regionally representative greenhouse gas monitoring program across Amazonia. The program aims to quantify gas concentrations (CO_2, CH_4, N_2O, CO, and SF_6) based on extensive collection of air from light aircraft vertical profiles. The atmosphere is profiled from the ground up to 4.5 km height at four sites along the main air-stream over the Amazon Basin on a twice-monthly basis. Here we will report what these new data tell us about the carbon balance and its controls from 2010-2017. During this period we performed 513 vertical profiles over four strategic regions that represent fluxes over much of Amazonia. The observed variability of carbon fluxes during these 8 years is correlated with climate-related (temperature, precipitation, soil water storage from GRACE satellite) and anthropogenic (fire counts) variables. The correlations were performed inside the upwind area for each profiling site.

During our study period, the Amazon was a consistent source of 0.4 ± 0.2 PgC/year on average, extrapolating to the entire Amazon Basin area of 7.2 million km^2. Fire emission is the main source of carbon to the atmosphere, which is not compensated by the C removal from old-growth Amazon forest. Moreover, the drought years of 2010, 2015 and 2016 are playing an outsized role in the eight-year mean. Removing those years from the mean, the net source is reduced from 0.4 ± 0.2 PgC/year to 0.2 ± 0.2 PgC/year.

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