Fluxes of CO₂, CH₄, CO, BVOCs, NOₓ, and O₃, in an old growth Amazonian forest

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Tropical forests hold a large store of carbon that is rapidly exchanging with the atmosphere through prolific photosynthesis and respiration. Tropical forest vegetation is very large source of biogenic hydrocarbons and tropical soils have high emissions of nitrogen oxides. Agricultural and urban development with its associated biomass burning further add to the emission of reactive trace gases. The close coupling of carbon cycling and atmospheric chemistry give this region critical influence on the global environment. Carbon flux measurements have been made at a site in the Tapajos National Forest near Santarem (the Tapajos km67 site) since 2002. In order to provide an upwind complement to the intensive atmospheric chemistry and aerosol measurements sited near Manaus we are continuing the carbon flux measurements and adding new observations of key atmospheric trace gas concentrations and fluxes. Our new measurement suite includes; NOy concentrations and eddy fluxes, NO/NO₂, O₃, CH₄, and SO₂ concentration profiles. During intensive campaigns scheduled for when the instruments are not needed for IOP in Manaus we will install PTRMS for hydrocarbon measurements.

The electrical supply to the site was rebuilt in the past year to repair some safety and reliability issues caused by storms and aging. Work included repair of the existing system to operate the CO₂ flux and profile measurements. The site infrastructure was rebuilt to provide clean space for new instruments such as the PTRMS and to provide an in situ space for sample and data analysis. The instrument package with NOy and NO/NO₂ analyzers together with data acquisition/control system and sample flow handling has been integrated and tested. It was shipped to Brazil and has now cleared customs and scheduled for delivery in Santarem. We will begin installation at the km67 site the week of April 14, and anticipate having valid measurements available in early May. These will run continuously thereafter.

Analysis of the CO₂ flux data indicate the Tapajos km67 stand has been a net carbon source for 2009-2011, despite a lack of a significant disturbance in the recently preceding years. Variations in carbon exchange over the 7.5 years of observation can be are well predicted by simple empirical relationships to radiation inputs and the duration of wet and dry seasons. Anomalies from this relationship such as the net CO₂ emission in 2002 when the model predicted carbon neutral or a small carbon sink can identify ecological perturbations such as a large-scale disturbance.