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Seasonal variation of reactive trace gas profiles in an Amazonian rainforest

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In 2011, an 80 m high walk up tower for atmospheric research was erected at the ATTO (Amazon Tall Tower Observatory) site (02°08'38.8"S, 58°59'59.5"W) in the remote Amazonian rainforest. The nearly pristine environment allows biosphere-atmosphere studies within an ecosystem far away from large anthropogenic emission sources. Since April 2012 vertical mixing ratio profiles of H_2O, CO_2 and O_3 were measured at 8 different heights between 0.05 m and 79.3 m. During five intensive campaigns (Oct-Dec 2012, Oct-Nov 2013, Mar 2014, Aug-Sep 2014, Oct-Dec 2015) nitric oxide (NO) and nitrogen dioxide (NO_2) were also measured.

Ozone values exhibit a clear seasonal cycle with lower values in the wet season (Jan-Apr) and higher values the drier seasons (Aug-Nov). The last months of 2015 were strongly influenced by a strong El Niño signal in the Pacific region, leading to much drier conditions and enhanced biomass burning in the Amazon also resulting in an extended period of higher O_3 mixing ratios. Back trajectories were used to identify the influence of biomass burning on the formation of O_3 at the ATTO site. The burning events were additionally confirmed by aerosol and VOC measurements. By correlating these different measurements we could identify clear seasonal differences regarding sources and sinks of aerosols and trace gases, whereas different regimes of O_3 production and destruction within and above the canopy could be detected. NO peaks above canopy in the morning were related to export of below-canopy air that was enriched in NO_x and CO_2 and depleted in O_3.

Additional to the detailed concentration measurements, there have also been, O_3 flux measurements during this campaign allowing a more detailed analysis of the O_3 exchange between atmosphere and the canopy as well as the role of various mechanisms involved in atmosphere-biosphere exchange at the ATTO site.