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Four years of ozone measurements in the Central Amazon – Effects of increasing deforestation rates and different meteorological conditions on near surface concentrations

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The ATTO (Amazon Tall Tower Observatory) site (02°08'38.8"S, 58°59'59.5"W) is located in the remote Amazon rainforest, allowing atmospheric and forest studies away from nearby anthropogenic emission sources. Starting with continuous measurements of vertical mixing ratio profiles of H_2O, CO_2 and O_3 in April 2012 at 8 heights between 0.05 m and 80 m above ground, the longest continuous record of near surface O_3 in the Amazon rainforest was established. Black carbon (BC), CO and micrometeorological measurements are available for the same period. During intensive campaigns, NO_x was measured as well using the same profile system, and, therefore several month of simultaneous NO_x measurements are available. During a period of about four months also direct flux measurements of O_3 are available. Here, we analyze the long term and seasonal variability of near surface O_3 mixing ratios with respect to air pollution, deposition and transport.

The Central Amazon is characterized by a clear seasonal precipitation pattern (ca. 350 mm around March and ca. 80 mm around September), correlating strongly with ozone mixing ratios. Since 2012 deforestation rates have increased again in the Amazon, leading to higher air pollution especially during the drier season in the last years. For several strong pollution events we compared the effects of long and short distance biomass burning on O_3 and NO_x mixing ratios using back trajectories and satellite data. By comparing O_3 mixing ratios with solar radiation, Bowen ratio, several trace gases and aerosol loads (Volatile Organic Compounds, CO and BC), different correlation patterns throughout the year that are linked to the sources (transport of O_3 and precursors) and sinks (stomatal uptake and chemical reactions) are investigated. For example, the last months of 2015 were strongly influenced by an extraordinary El Niño phenomenon, leading to much drier conditions and enhanced biomass burning in the Amazon, which prolonged the period of increased O_3 values. These exceptional dry conditions and a slight La Niña in 2016 have influenced the water availability, which in turn may have affected the O_3 deposition.