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Analyses of relevant processes determining surface O_3 concentrations (2013-2017) in the Central Amazon rainforest at the ATTO site

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The pristine Amazon acts as a sink for ozone (O_3), mainly due to deposition processes, which occur inside the canopy. Loss pathways are stomatal and surface deposition, reactions with terpenes and NO_x. Sources of O_3 are biomass burning especially during the drier season due to the emission of O_3 precursors (VOC and NO_x). O_3 levels are expected to increase with ongoing deforestation: first, through release of O_3 precursors from biomass burning and secondly by reduced deposition as forest canopies (esp. tropical forest), which efficiently remove O_3, are replaced by grassland or crops. Apart from that, the entrainment of free tropospheric O_3 contributes to boundary layer concentrations especially in the wet season.
The ATTO (Amazon Tall Tower Observatory) site in the Central Amazon (02°08'38.8"S, 58°59'59.5"W), comprises a 325 meter and two 80 meter towers and acts as an ideal location to perform comprehensive long-term studies regarding forest-atmosphere interactions. During the wet months (350 mm precipitation in March), the air quality shows almost pristine conditions, whereas very strong pollution from biomass prevails in the drier season (ca. 80 mm precipitation in September). Since 2012 vertical mixing ratio profiles of H_2O, CO_2 and O_3 have been continuously measured at multiple heights between 0.05 and 80 m, and since 2016 until 325 meters. Ozone fluxes have been determined by means of flux-gradient methods and eddy covariance.
These unique long-term measurements allow detailed comparisons with previous campaigns in the Amazon basin. Monthly median O_3 values show very good agreement for all measurements north of Manaus. In the south, where the influence of biomass burning is much stronger, values are much higher in the dryer season. Therefore, we use trajectory weighted fire counts together with proxy data (CO and BC) for studying the effects of biomass burning on the local O_3 concentrations. For quantifying the different contributions, the boundary layer budget of O_3 will be analyzed.