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Air-borne measurements of CH_2O, $C_2H_2O_2$ and $C_3H_4O_2^*$ over the Amazon and their biomass burning emission ratios with respect to CO

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Abstract

We report on simultaneous air-borne measurements of CO, CH_2O, $C_2H_2O_2$, and $C_3H_4O_2^*$ (i) taken over the Amazon from aboard the HALO (High Altitude and LOng range) aircraft during the ACRIDICON-CHUVA field campaign in September 2014 (Wendisch et al., 2016). In-situ CO was measured using the AMTEX instrument, and CH_2O, $C_2H_2O_2$, and $C_3H_4O_2^*$ were inferred from the limb observations of the mini-DOAS (Differential optical absorption Spectroscopy) instrument (Hueneke et al., 2017). The measurements allow us to distinguish between background tropical air, where the concentrations of the measured species are primarily due to the oxidation of biogenically emitted VOCs (mostly isoprene), and moderately to strongly polluted air masses affected by directly emitted or secondarily formed CH_2O, $C_2H_2O_2$, and $C_3H_4O_2^*$, and CO directly emitted by biomass burning and urban emissions, and/or formed in their plumes. From collocated visual imagery and the measurements performed near the ground, biomass burning plumes are identified and the normalized excess mixing ratio (NEMR) for the targeted species with respect to CO in the plumes are inferred, and compared with previous studies.

The paper reports on the first measurements of these bicarbonyls over a prominent, though mostly natural source region of VOCs, and the relative contributions from local as well as regional pollution sources.

(i) Here $C_3H_4O_2^*$ is denoted by $C_3H_4O_2$ (methylglyoxal) and other substituted bicarbonyls with visible absorption spectra similar to those of $C_3H_4O_2$.