Geophysical Research Abstracts
Vol. 19, EGU2017-15013-1, 2017
EGU General Assembly 2017

Biomass Burning observed during IAGOS – CARIBIC

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Since May 2005 the CARIBIC passenger aircraft (Civil Aircraft for the Regular Investigation of the atmosphere Based on an Instrument Container – Lufthansa, Airbus 340-600) measures ∼100 trace gases and aerosol components in the UTLS (9-12 km altitude) on 4-6 consecutive long-distance flights per month. Volatile Organic Compounds (VOCs) are measured with a Proton-Transfer-Reaction Mass Spectrometer (PTR-MS). In 2017 the current instrument will be replaced by an improved version, similar to the one operated by our group onboard the HALO research aircraft.

Worldwide ∼1.3 Tg/y of acetonitrile (CH_3CN) is emitted into the atmosphere almost exclusively from biomass burning (BB) together with other VOCs (e.g. ketones, aldehydes, aromatics), CO, CO_2, NO_x and aerosol particles. Therefore, and due to its rather long tropospheric lifetime of ∼6 months, acetonitrile constitutes a reliable BB tracer.

Based on the signal of acetonitrile and CO, we analyzed the IAGOS-CARIBIC data set with respect to signatures of BB. The most intense but relatively rare BB signals (up to ∼1200 pptV acetonitrile, i.e. ∼8 times the tropospheric background) were sampled ∼3 km above the thermal tropopause over North America and Greenland in boreal summer. However, the largest contribution of BB signatures (∼40%) was observed over the tropics in autumn and winter. In the tropics ECMWF back trajectory calculations show that the upward transport is driven by convection and we found hints for secondary O_3 production in BB affected air masses leading to an enhancement of ∼25 ppb O_3 relative to the tropospheric background. Based on our applied detection algorithm, ∼8% of the IAGOS-CARIBIC data were identified to be affected by BB.