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Biomass Burning observed during IAGOS – CARIBIC

Marco Neumaier (1), Garlich Fischbeck (1), Markus Hermann (2), Dieter Scharffe (3), Layal Safadi (1), and Andreas Zahn (1)

(1) Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany (marco.neumaier@kit.edu), (2) Leibniz Institute for Tropospheric Research, Leipzig, Germany , (3) Max-Planck-Institut for Chemistry (MPI-C), Mainz, Germany

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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). Worldwide ∼1.3 Tg/y of acetonitrile (CH3CN) 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 checked several algorithms to detect BB plumes in the IAGOS-CARIBIC data set. It turned out that the most intense BB plumes were sampled during summer over North America and during autumn over South America. The results will also be discussed with respect to biases due to flight statistics (i.e. destination, flight season, sampling of tropospheric and stratospheric air, etc.).
Two flights that took place during the strong ENSO (El Niño/Southern Oscillation) event in July 2015 between Munich (MUC) and Los Angeles (LAX) will be discussed in more detail by taking into account other VOCs and aerosol particles. Here acetonitrile mixing ratios of up to ∼1100 pptv were sampled over Greenland ∼0.5 km above the tropopause. It is shown that the sampled air originated from Northern America / Canada where strong wildfires took place. During the flight from LAX to MUC the boundary layer air entered the upper troposphere by isentropic quasi-horizontal mixing and not by fast convective transport. The correlation of some VOCs (i.e. acetone, methanol and acetonitrile) with CO will be discussed and contrasted to findings from the literature. It is shown that in BB affected air masses a good correlation between VOCs and CO is found and that the ΔVOC / ΔCO correlation slopes are significantly smaller compared to correlation slopes measured in the free troposphere.