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Primary VOC emissions from Commercial Aircraft Jet Engines

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Air traffic is growing continuously [1]. The increasing number of airplanes leads to an increase of aviation emissions giving rise to environmental concerns globally by high altitude emissions and, locally on air quality at the ground level [2]. The overall impact of aviation emissions on the environment is likely to increase when the growing air transportation trend [2] is considered.
The Aviation Particle Regulatory Instrumentation Demonstration Experiment (APRIDE)-5 campaign took place at Zurich Airport in 2013. In this campaign, aircraft exhaust is sampled during engine acceptance tests after engine overhaul at the facilities of SR Technics. Direct sampling from the engine core is made possible due to the unique fixed installation of a retractable sampling probe and the use of a standardized sampling system designed for the new particulate matter regulation in development for aircraft engines. Many of the gas-phase aircraft emissions, e.g. CO_2, NOX, CO, SO_2, hydrocarbons, and volatile organic compounds (VOC) were detected by the instruments in use. This study, part of the APRIDE-5 campaign, focuses on the primary VOC emissions in order to produce emission factors of VOC species for varying engine operating conditions which are the surrogates for the flight cycles.
Previously, aircraft plumes were sampled in order to quantify VOCs by a proton transfer reaction quadrupole mass spectrometer (PTR-MS) [3]. This earlier study provided a preliminary knowledge on the emission of species such as methanol, acetaldehyde, acetone, benzene and toluene by varying engine thrust levels. The new setup was (i) designed to sample from the diluted engine exhaust and the new tool and (ii) used a high resolution time of flight PTR-MS with higher accuracy for many new species, therefore providing a more detailed and accurate inventory. We will present the emission factors for species that were quantified previously, as well as for many additional VOCs detected during the campaign.

References
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