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A new off-line instrumentation for airborne measurements of Volatile Organic Compounds

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Primary Volatile Organic Compounds and their oxidation products (VOCs) play a key role in atmospheric chemical processes at different levels. On a local scale, they alter air quality and some of them show high toxicity and harmful effects on human health (ex: benzene). On a regional and continental scale, they contribute to the formation of pollution plumes loaded with ozone and many other secondary pollutants. In particular, gaseous secondary organics comprise a broad range of high molecular weight polar species responsible for Secondary Organic Aerosols (SOA) production. SOA are known to modify atmospheric radiative forcing. Regarding the effects of primary and secondary VOCs, it is essential to characterise the spatial and temporal distribution of their concentrations in order to get to a better statement of their impacts. To do so, new instrumentations, and airborne techniques in particular, need to be developed.

The LISA has developed a new offline instrumentation based on a sampling step aboard, followed by chromatographic analysis at the laboratory. AMOVOC (Airborne Measurement Of Volatile Organic Compounds) is an automatic and continuous air sampler divided in two parts: one devoted to primary VOCs and the other to carbonyl compounds of primary and secondary origin. The primary VOCs are nonmethane hydrocarbons (NMHC from C_4 to C_{10}), principal tracers of anthropogenic and biogenic emissions. NMHC are collected on cartridges of solid adsorbents and then analyzed by a thermodesorption/GC-MS system (Gas Chromatography coupled with Mass Spectrometry). Detection limits vary between 10 and 20 ppt according to the compound. Carbonyls are trapped on a diffusion tube where they are derivatized in a DNPH solution and then analyzed by HPLC-UV (High Performance Liquid Chromatography coupled with a UV detector).

AMOVOC is available in three prototypes. It is a compact and removable instrument, which can be deployed simultaneously on airborne and ground-based platforms. At least, 30 samples can be collected aboard. The sampling time is 10 minutes and is adjustable according to the environmental conditions. The whole measuring chain is now operational and was deployed for the first time during the international AMMA campaign (African Monsoon Multidisciplinary Analysis) in Western Africa in 2006. One of the scientific interests was the evaluation of the impact of tropical deep convection on the free troposphere chemistry. During AMMA, AMOVOC was installed on the two French aircrafts to get a complete exploration of the tropospheric column.

The communication will present for the first time the new developed instrumentation and its performances through some key results of the AMMA campaign.