



1 Fast airborne chemical analysis of biomass burning organic aerosol by CHARON PTR-ToF-MS

Felix Piel (1,2), Markus Müller (2), Tomas Mikoviny (3), Armin Wisthaler (2,3)

(1) Ionicon Analytik GmbH, Innsbruck, Austria (felix.piel@ionicon.com), (2) Institute for Ion Physics and Applied Physics, University of Innsbruck, Innsbruck, Austria, (3) Department of Chemistry, University of Oslo, Oslo, Norway

Biomass burning (BB) emissions contain a myriad of organic compounds in the gas and the particulate phase. Many of the emitted compounds undergo rapid photochemical transformations after their release into the atmosphere. A detailed chemical characterization of organic aerosol that is primarily emitted or secondarily formed from BB is an important but challenging analytical task. This task becomes even more difficult if sampling takes place from a rapidly moving platform such as an aircraft. Over the past decade, the aerosol mass spectrometer (AMS) has been deployed on many research aircraft for chemical particle measurements. In the AMS, most organic analytes do, however, decompose prior to their mass spectrometric detection. In the newly developed CHARON-PTR-ToF-MS instrument, vaporization and ionization of organic analytes occurs under much softer energetic conditions. The technique has been successfully deployed on the ground, but no airborne measurements have hitherto been reported. We herein present the first successful airborne deployment of a CHARON-PTR-ToF-MS instrument onboard the NASA DC-8 Airborne Science Laboratory during the Student Airborne Research Program (SARP) in summer 2018. On the 25th of June 2018, the DC-8 intercepted the plume emanating from the Lions Fire in the Sierra National Forest. The data obtained during the interception demonstrates that the chemical particle analyzer responds sufficiently fast (< 10 s) and that it delivers an elementally resolved analysis of a large fraction ($> 80\%$) of the total sub-micrometer particulate organic mass. 230 peaks were resolved: 65% of the detected organic mass was associated with $C_xH_yO_z^+$ ions, 7% with $C_xH_y^+$ ions and 9% with $C_xH_yN_z^+$ ions. The remaining peaks were not elementally resolved. We were able to assign the 20 highest peaks to compounds that are commonly found in fire-emitted particles (*e.g.*, vanillin, vanillic acid and levoglucosan). Levoglucosan was the most abundant organic species ($\sim 17\%$ of the total organic mass). The smallest peaks in the mass spectrum derived from unidentified organic compounds in the single digit ng/m^3 concentration range.

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