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First Airborne PTR-ToF-MS Measurements of VOCs in a Biomass Burning Plume: Primary Emissions and Aging

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The NASA DISCOVER-AQ mission saw the first airborne deployment of a Proton-Transfer-Reaction Time-of-Flight Mass Spectrometer (PTR-ToF-MS). The newly developed instrument records full mass spectra at 10 Hz and resolves pure hydrocarbons from their oxygenated isobars (e.g. isoprene and furan). Airborne measurements of volatile organic compounds (VOCs) at high spatio-temporal resolution (0.1 s or 10 m) improve our capabilities in characterizing primary emissions from fires and in studying chemical transformations in aging plumes.
A biomass-burning plume from a forest understory fire was intercepted by the NASA P-3B near Dublin, GA, USA on September 29, 2013. VOCs were measured at high time resolution along with CO, CO_2, NO_x, O_3, HCHO, aerosols and other air quality and meteorological parameters. Repeated measurements in the immediate proximity of the fire were used to determine VOC emission ratios and their temporal variations. Repeated longitudinal and transversal plume transects were carried out to study plume aging within the first hour of emission. We will discuss the observed OH-NO_x-VOC chemistry (including O_3 formation), the observed changes in the elemental composition of VOCs (e.g. O:C ratios) and the observed formation of SOA.