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A technique for the measurement of the stable carbon isotope ratios of isoprene, methacrolein, and methyl vinyl ketone from ambient air samples

R. Iannone (1,2), R. Koppmann (2), and J. Rudolph (1,2)

(1) Centre for Atmospheric Chemistry, Department of Chemistry, York University, Toronto, Ontario, Canada (2) Institut für Chemie und Dynamik der Geosphäre, ICG-II: Troposphäre, Forschungszentrum Jülich, Germany (riannone@yorku.ca / Phone: +1 416 736-5410)

Isoprene is the chief volatile organic compound (VOC) emitted by forest species such as oak, poplar and eucalyptus and a key VOC in tropospheric chemistry on both regional and global scales. Isoprene is predominantly emitted during daylight hours and its atmospheric oxidation via both OH radicals and ozone leads to the formation of the major reaction products methacrolein (MACR) and methyl vinyl ketone (MVK). Upon their production, MACR and MVK are also removed from the troposphere through their reactions with OH radicals and ozone.

The determination of the stable carbon isotope ratios of tropospheric VOCs is a recent technique; such measurements have served to further the understanding of atmospheric processes. For example, isotope ratios can be used to quantify the extent of photochemical processing a particular compound has undergone since emission to the atmosphere. This allows for the characterization of sources impacting a given site, the investigation of atmospheric mixing and transport, and the identification and quantification of the impact of chemical reactions on atmospheric VOCs.

Presented here are measurements of the stable-carbon isotope ratios of isoprene, MACR and MVK from ambient air samples taken in Jülich, Germany during May-August, 2005. A cryofocussing system allowed for the collection and preconcentration of 100-140 L of ambient air. A gas-chromatography combustion isotope-ratio mass spectrometry (GCC-IRMS) system was used to separate the VOCs, quantitatively convert all separated compounds to CO_2 gas, and concurrently measure their mixing ratios and isotope ratios using an isotope ratio mass spectrometer.