

Development of a Fast GC-MS System for Aircraft-based Analysis of VOCs

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Abstract

Volatile Organic Compounds (VOCs) are an essential component in many atmospheric chemical cycles and result in the formation of secondary pollutants such as tropospheric ozone and secondary organic aerosols. Many VOCs also negatively impact human health. Gas Chromatography - Mass Spectrometry (GC-MS) is an effective tool for monitoring these VOCs, and the relatively new concept of airborne, in-situ GC-MS systems has allowed for rapid and accurate measurements at the point source. The Trace Halogenated Organics Analyser (THOr) is a new, state-of-the-art gas chromatography-time of flight mass spectrometry system which can provide high resolution data on a broad array of VOCs with time resolution of just one minute, comparing favourably with other similar instruments. The swift sampling and analysis is achieved by operating two separate thermal desorption (TD) GCs in an alternating fashion and feeding both into a single Time of flight mass spectrometry (ToFMS) detector. The TD component makes use of cryogen-free preconcentration, rapid desorption and fast chromatography to maintain ppt sensitivity whilst using only small sample volumes. THOr will be commissioned on the FAAM BAE-146 research aircraft in 2025, and the rapid sampling capabilities of the instrument will be used to garner detailed information about the behaviour, lifetimes, and reactivity of VOC species. The archive collated by THOr can be reassessed in light of future developments in the area of emerging pollutants. It is expected that over 100 VOC species will be identifiable and quantifiable by THOr, including halogenated species, extending the aircraft's capability to stratospheric chemistry processes.

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