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GC/TOF-MS as a new method for halocarbon observation in the atmosphere

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The need for halocarbon measurements in the atmosphere arose with the anthropogenic emission of CFCs beginning in the 1950s and the discovery of their ozone depleting potential in the 1980s. CFCs were replaced by HCFCs and are nowadays replaced by HFCs, with new compounds continuously being developed and introduced to the atmosphere. While not being harmful to the ozone layer, HFCs are still greenhouse gases and many tend to be hazardous to human health at high concentration. They can also serve as tracers to study atmospheric transport at low concentration, making high precision measurement interesting to atmospheric studies.

Gas chromatography coupled with time-of-flight mass spectrometry (GC/TOF-MS) is still a new method in the field of atmospheric halocarbon measurement compared to the well-established GC/QP(quadrupole)-MS. The QP-MS is indeed a very stable and easy-to-operate instrument but also limited by mass resolution and either mass range or sensitivity.

We will present the general applicability of GC/TOF-MS to regular halocarbon observation by a time series of halocarbon measurements from the Taunus Observatory (Kleiner Feldberg, Germany) and the implementation of a second, high-resolution (max. R=4000) TOF-MS system. Both GC/TOF-MS systems are characterized with respect to reproducibility, non-linearity and limits of detection (LOD). Furthermore, the advantages of a higher mass resolution are demonstrated with respect to LOD, substance identification and substance quantification.