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Atmos. Chem. Phys., 8, 5143-5149, 2008
www.atmos-chem-phys.net/8/5143/2008/

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First atmospheric observations of three chlorofluorocarbons

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Abstract. We report the first atmospheric observations of the Chlorofluorocarbons (CFCs) trifluorochloroethene, 3-chloropentafluoropropene and 4,4-dichlorohexafluoro-1-butene by means of Gas Chromatography with Electron Capture and Mass Spectrometric detection (GC-ECD-MS) in air samples taken at the Taunus Observatory operated by the University of Frankfurt (Main) and the Jungfrauoch High Altitude Research Station in Switzerland. These substances belong to a class of CFCs containing a double bond and are suspected to originate from the production and thermal degradation of widely used fluoropolymers like polychlorotrifluoroethene (PCTFE). Their atmospheric lifetimes are expected to be rather short. A quantitative calibration could only be derived for trifluorochloroethene but not for the other species by now. Thus, we use a relative sensitivity method to get a first indication of the observed atmospheric abundances. Identification was possible because of an air plume containing high concentrations of these substances. We suggest that the abundances found on this occasion originated from a local source. However, we have also observed the novel CFCs in air masses representative of background conditions, though with much lower concentrations. These species and some of their degradation products are toxic and could also be relevant for stratospheric and tropospheric ozone depletion.

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Citation: Laube, J. C. and Engel, A.: First atmospheric observations of three chlorofluorocarbons, Atmos. Chem. Phys., 8, 5143-5149, 2008. [Bibtex](#) [EndNote](#) [Reference Manager](#)



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