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First retrievals of HCFC-142b from ground-based high-resolution FTIR solar observations: application to high-altitude Jungfraujoch spectra

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Hydrofluorocarbons (HCFCs) are the first substitutes to the long-lived ozone depleting halocarbons, in particular the chlorofluorocarbons (CFCs). Given the complete ban of the CFCs by the Montreal Protocol, its Amendments and Adjustments, HCFCs are on the rise, with current rates of increase substantially larger than at the beginning of the 21^{st} century. HCFC-142b (CH_3CClF_2) is presently the second most abundant HCFCs, after HCFC-22 ($CHClF_2$). It is used in a wide range of applications, including as a blowing foam agent, in refrigeration and air-conditioning. Its concentration will soon reach 25 ppt in the northern hemisphere, with mixing ratios increasing at about 1.1 ppt/yr [Montzka et al., 2011]. The HCFC-142b lifetime is estimated at 18 years. With a global warming potential of 2310 on a 100-yr horizon, this species is also a potent greenhouse gas [Forster et al., 2007].

First space-based retrievals of HCFC-142b have been reported by Dufour et al. [2005]. 17 occultations recorded in 2004 by the Canadian ACE-FTS instrument (Atmospheric Chemistry Experiment – Fourier Transform Spectrometer, onboard SCISAT-1) were analyzed, using two microwindows (1132.5–1135.5 and 1191.5–1195.5 cm^{-1}). In 2009, Rinsland et al. determined the HCFC-142b trend near the tropopause, from the analysis of ACE-FTS observations recorded over the 2004–2008 time period. The spectral region used in this study extended from 903 to 905.5 cm^{-1}.

In this contribution, we will present the first HCFC-142b measurements from ground-based high-resolution Fourier Transform Infrared (FTIR) solar spectra. We use observations recorded at the high altitude station of the Jungfraujoch (46.5°N, 8°E, 3580 m asl), with a Bruker 120HR instrument, in the framework of the Network for the Detection of Atmospheric Composition Change (NDACC, visit http://www.ndacc.org). The retrieval of HCFC-142b is very challenging, with simulations indicating only weak absorptions, lower than 1% for low sun spectra and current concentrations. Among the four microwindows tested, the region extending from 900 to 906 cm^{-1} proved to be the most appropriate, with limited interferences, in particular from water vapor. A total column time series spanning the 2004-2012 time period will be presented, analyzed and critically discussed. After conversion of our total columns to concentrations, we will compare our results with *in situ* measurements performed in the northern hemisphere by the AGAGE network.

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References

Dufour, G., C.D. Boone, and P.F. Bernath, First measurements of CFC-113 and HCFC-142b from space using ACE-FTS infrared spectra, *Geophys. Res. Lett.*, *32*, L15S09, doi:10.1029/2005GL022422, 2005.

Forster, P., V. Ramaswamy, P. Artaxo, T. Berntsen, R. Betts, D.W. Fahey, J. Haywood, J. Lean, D.C. Lowe, G. Myhre, J. Nganga, R. Prinn, G. Raga, M. Schulz and R. Van Dorland, 2007: Changes in Atmospheric Constituents and in Radiative Forcing. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group

I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Montzka, S.A., S. Reimann, A. Engel, K. Krüger, S. O'Doherty, W.T. Sturges, D. Blake, M. Dirf, P. Fraser, L. Froidevaux, K. Jucks, K. Kreher, M.J. Kurylo, A. Mellouki, J. Miller, O.-J. Nielsen, V.L. Orkin, R.G. Prinn, R. Shew, M.L. Santee, A. Stohl, and D. Verdonik, Ozone-Depleting Substances (ODSs) and Related Chemicals, Chapter 1 in *Scientific Assessment of Ozone Depletion: 2010*, Global Ozone Research and Monitoring Project-Report No. 52, 516 pp., World Meteorological Organization, Geneva, Switzerland, 2011.

Rinsland, C.P., L.S. Chiou, C.D. Boone, P.F. Bernath, and E. Mahieu, First Measurements of the HCFC-142b trend from Atmospheric Chemistry Experiment (ACE) Solar Occultation Spectra, *J. Quant. Spectrosc. Radiat. Transfer*, *110*, 2127-2134, 2009.