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CO measurements from the ACE-FTS satellite instrument: data analysis and validation using ground-based, airborne and spaceborne observations

C. Clerbaux[1], M. George[1], S. Turquety[1], K. A. Walker[2,3], B. Barret[4], P. Bernath[2,5], C. Boone[2], T. Borsdorff[6], J. P. Cammas[4], V. Catoire[7], M. Coffey[8], P.-F. Coheur[9], M. Deeter[8], M. De Mazière[10], J. Drummond[11], P. Duchatelet[12], E. Dupuy[2], R. de Zafra[13], F. Eddounia[1], D. P. Edwards[8], L. Emmons[8], B. Funke[14], J. Gille[8], D. W. T. Griffith[15], J. Hannigan[8], F. Hase[16], M. Höpfner[16], N. Jones[15], A. Kagawa[17], Y. Kasai[18], I. Kramer[16], E. Le Flochmoën[4], N. J. Livesey[19], M. López-Puertas[14], M. Luo[20], E. Mahieu[12], D. Murtagh[21], P. Nédélec[4], A. Pazmino[1], H. Pumphrey[22], P. Ricaud[4], C. P. Rinsland[23], C. Robert[7], M. Schneider[16], C. Senten[10], G. Stiller[16], A. Strandberg[21], K. Strong[3], R. Sussmann[6], V. Thouret[4], J. Urban[21], and A. Wiacek[3]

[1]Université Paris 6, CNRS, Service d'Aéronomie/IPSL, Paris, France
[2]Department of Chemistry, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1, Canada
[3]Department of Physics, University of Toronto, Toronto, Ontario, Canada M5S 1A7, Canada
[4]Laboratoire d'Aérologie UMR 5560, Observatoire Midi-Pyrénées, Toulouse, France
[5]Department of Chemistry, University of York, Heslington, York YO10 5DD, UK
[6]Forschungszentrum Karlsruhe, IMK-IFU, Garmisch-Partenkirchen, Germany
[7]Laboratoire de Physique et Chimie de l'Environnement, CNRS, Université d'Orléans, Orléans, France
[8]National Center for Atmospheric Research, Boulder, CO, USA
[9]Spectroscopie de l'atmosphère, Chimie Quantique et Photophysique, Université Libre de Bruxelles (U.L.B.), Brussels, Belgium. P.-F. Coheur is Research associate with the FRS-F.N.R.S, Belgium
[10]Belgian Institute for Space Aeronomy, Brussels, Belgium
[11]Department of Physics & Atmospheric Science, Dalhousie University, Halifax, Canada
[12]Université de Liège ULg, Institute of Astrophysics and Geophysics, Liège, Belgium
[13]Department of Physics and Astronomy, State Univ. of New York at Stony Brook, USA
[14]Instituto de Astrofísica, Andalucía (CSIC), Granada, Spain
[15]Department of Chemistry, University of Wollongong, Wollongong, New South Wales, Australia
[16]Institut für Meteorologie und Klimaforschung, Forschungszentrum Karlsruhe, Germany
[17]Fujitsu FIP Corporation, Tokyo, Japan
[18]National Institute of Information and Communications Technology, Tokyo, Japan
[19]Microwave Atmospheric Science Team, Jet Propulsion Laboratory, CA, USA
[20]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California, USA
[21]Chalmers University of Technology, Göteborg, Sweden
[22]School of GeoSciences, Edinburgh, Scotland
[23]NASA Langley Research Center, Hampton, Virginia, USA

Abstract. The Atmospheric Chemistry Experiment (ACE) mission was launched in August 2003 to sound the atmosphere by solar occultation.

Carbon monoxide (CO), a good tracer of pollution plumes and atmospheric dynamics, is one of the key species provided by the primary instrument, the ACE-Fourier Transform Spectrometer (ACE-FTS). This instrument performs measurements in both the CO 1-0 and 2-0 ro-vibrational bands, from which vertically resolved CO concentration profiles are retrieved, from the mid-troposphere to the thermosphere. This paper presents an updated description of the ACE-FTS version 2.2 CO data product, along with a comprehensive validation of these profiles using available observations (February 2004 to December 2006). We have compared the CO partial columns with ground-based measurements using Fourier transform infrared spectroscopy and millimeter wave radiometry, and the volume mixing ratio profiles with airborne (both high-altitude balloon flight and airplane) observations. CO satellite observations provided by nadir-looking instruments (MOPITT and TES) as well as limb-viewing remote sensors (MIPAS, SMR and MLS) were also compared with the ACE-FTS CO products. We show that the ACE-FTS measurements provide CO profiles with small retrieval errors (better than 5% from the upper troposphere to 40 km, and better than 10% above). These observations agree well with the correlative measurements, considering the rather loose coincidence criteria in some cases. Based on the validation exercise we assess the following uncertainties to the ACE-FTS measurement data: better than 15% in the upper troposphere (8–12 km), than 30% in the lower stratosphere (12–30 km), and than 25% from 30 to 100 km.

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