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Atmospheric carbon gases retrieved from SCIAMACHY by WFM-DOAS: version 0.5 CO and CH₄ and impact of calibration improvements on CO₂ retrieval

M. Buchwitz¹, R. de Beek¹, S. Noël¹, J. P. Burrows¹, H. Bovensmann¹, O. Schneising¹, I. Khlystova¹, M. Bruns¹, H. Bremer¹, P. Bergamaschi², S. Körner³, and M. Heimann³

¹Institute of Environmental Physics (IUP), University of Bremen FB1, Bremen, Germany

²Institute for Environment and Sustainability, Joint Research Centre (EC-JRC-IES), Ispra, Italy

³Max Planck Institute for Biogeochemistry (MPI-BGC), Jena, Germany

Abstract. The three carbon gases carbon monoxide (CO), carbon dioxide (CO₂), and methane (CH₄) are important atmospheric constituents affecting air quality and climate. The near-infrared nadir spectra measured by SCIAMACHY on ENVISAT contain information on the vertical columns of these gases which we retrieve using a modified DOAS algorithm (WFM-DOAS or WFMD). Our main data products are CO vertical columns and dry-air column averaged mixing ratios of methane (CH₄) and CO₂ (denoted XCH₄ and XCO₂). For CO and CH₄ we present new results for the year 2003 obtained with an improved version of WFM-DOAS (WFMDv0.5) retrieved from Level 1 version 4 (Lv1v4) spectra. This data set has recently been compared with a network of ground based FTIR stations. Here we describe the WFMDv0.5 algorithm, present global and regional maps, and comparisons with global reference data. We show that major problems of the previous versions (v0.4 and v0.41) related to the varying ice-layer on the SCIAMACHY channel 8 detector have been solved. Compared to MOPITT the SCIAMACHY CO columns are on average higher by about 10–20%. Regionally, however, especially over central South America, differences can be much larger. For methane we present global and regional maps which are compared to TM5 model simulations performed using standard methane emission inventories. We show that methane source regions can be clearly detected with SCIAMACHY. We also show that the methane data product can be significantly further improved using Lv1v5 spectra with improved calibration. For CO₂ we present three years of SCIAMACHY CO₂ measurements over Park Falls, Wisconsin, USA, retrieved from Lv1v5. We show that the quality of CO₂ retrieved from these spectra is significantly higher compared to WFMDv0.4 XCO₂ retrieved from Lv1v4.

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