Uniform formaldehyde retrieval applied to SCIAMACHY, OMI, and GOME-2 (A and B) data from 2003 to 2016

Leonardo M. A. Alvarado (1), Andreas Richter (1), Andreas Hilboll (1), Mihalis Vrekoussis (1,2), John P. Burrows (1), Nikos Daskalakis (1), Stelios Myriokefalitakis (3), and Maria Kanakidou (4)

(1) University of Bremen, Institute of Environmental Physics, Bremen, Germany (lalvarado@iup.physik.uni-bremen.de), (2) Energy, Environment and Water Research Center (EEWRC), The Cyprus Institute, Cyprus, (3) Institute for Marine and Atmospheric Research (IMAU), Utrecht University, Utrecht, The Netherlands, (4) Environmental Chemical Processes Laboratory, Department of Chemistry, University of Crete, Greece

Formaldehyde is an intermediate product in the oxidation process of volatile organic compounds (VOC) but has also primary emissions in the troposphere, both from anthropogenic and natural sources; with a significant contribution from wildfire emissions.

Formaldehyde is important for tropospheric chemistry as a radical source and is also often used as a proxy for VOC emissions. Therefore, the number of retrievals of formaldehyde abundances from observations by space-borne remote sensing instruments using the Differential Optical Absorption Spectroscopy (DOAS) method has significantly increased the last decades. Recently, effort is put on improving the retrieval of formaldehyde from different satellite measurements in order to reduce the uncertainties in formaldehyde column abundance and in the subsequently derived estimation of VOC emissions.

Here we present a new uniform formaldehyde product using air mass factors computed based on vertical profiles simulated with the TM4-ECPL chemistry transport model. This retrieval algorithm is applied to data from (a) SCIAMACHY, (b) OMI, and (c) the two GOME-2 instruments (on MetOp-A and -B), allowing for unprecedented consistency in formaldehyde levels observed by the four instruments .

Overall, the retrieved formaldehyde column amounts using the uniform retrieval algorithm show similar seasonal behavior among the instruments over selected hot-spot regions. In addition, the combination of four instruments provides more than 14 years of measurements, which are used for the investigation of the temporal variability of formaldehyde on regional and global scales.