Geophysical Research Abstracts
Vol. 20, EGU2018-16478, 2018
EGU General Assembly 2018

First formaldehyde TROPOMI validation using NDACC harmonized total columns obtained within the FTIR network

Corinne Vigouroux (1), Bavo Langerock (1), Isabelle De Smedt (1), Cesar Guarin (2), Frank Hase (3), Nicholas Jones (4), Rigel Kivi (5), Erik Lutsch (6), Maria Makarova (7), Ivan Ortega (8), Mathias Palm (9), Markus Rettinger (10), Dan Smale (11), Yao Té (12), Geoffrey Toon (13), and the other FTIR PI's & co-workers

(1) BIRA-IASB, Brussels, Belgium (corinne.vigouroux@aeronomie.be), (2) Centro de Ciencias de la Atmósfera, Universidad Nacional Autónoma de México (UNAM), 04510 Mexico City, México, (3) Karlsruhe Institute of Technology (KIT), Institute of Meteorology and Climate Research (IMK-ASF), Karlsruhe, Germany, (4) Centre for Atmospheric Chemistry, University of Wollongong, Wollongong, Australia, (5) Finnish Meteorological Institute (FMI), Sodankyl\"a, Finland, (6) Department of Physics, University of Toronto, Toronto, Canada, (7) Saint Petersburg State University, Atmospheric Physics Department, St. Petersburg, Russia, (8) Atmospheric Chemistry, Observations \& Modeling, National Center for Atmospheric Research (NCAR), Boulder, CO, USA, (9) Institute of Environmental Physics, University of Bremen, Bremen, Germany, (10) Karlsruhe Institute of Technology, IMK-IFU, Garmisch-Partenkirchen, Germany, (11) National Institute of Water and Atmospheric Research Ltd (NIWA), Lauder, New Zealand, (12) LERMA-IPSL, Sorbonne Universit\'e, CNRS, PSL Research University, Observatoire de Paris, 75005 Paris, France, (13) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California, USA

The ground-based FTIR (Fourier Transform infrared) measurements performed within the Network for the Detection of Atmospheric Composition Change (NDACC) can provide accurate and precise formaldehyde (HCHO) total columns. Until very recently, only a few stations have provided HCHO total columns time-series (Paton-Walsh et al., JGR, 2005; Jones et al., ACP, 2009; Vigouroux et al., ACP, 2009; Viatte et al., AMT, 2014; Franco et al., AMT, 2015). The spatial coverage was not optimal for providing good diagnostic for satellite validation. Furthermore, these past studies used different retrieval settings, and biases as large as 50% can be observed in the HCHO total columns depending on these retrieval choices, which is also a weakness for validation studies combining data from different ground-based stations.

For the present work, the HCHO retrieval settings have been optimized and applied consistently at 21 FTIR stations (Vigouroux et al., in preparation for AMT). This unprecedented harmonized formaldehyde data set will be presented by showing the long past time-series, and the seasonal and diurnal cycles at all sites. The network is covering nicely different concentration levels of formaldehyde, from very clean levels at the limit of detection (a few 1E13 molec/cm^2) to high polluted levels (7E16 molec/cm^2). The FTIR products will be characterized by their averaging kernels and uncertainty budget. Depending on the station, the systematic and random uncertainties of an individual HCHO total column measurement lie between 11 and 31%; and between 1 and 11E14 molec/cm^2, respectively, with median values among all stations of 14% and 2.6E14 molec/cm^2.

We will show the very first results of HCHO TROPOMI validation using this FTIR data set. The TROPOMI HCHO retrieval algorithm has been successfully implemented operationally (De Smedt et al., AMTD, 2017). The first assessment of the TROPOMI HCHO tropospheric columns is promising. The uncertainty on the columns reach the previsions of the pre-flight instrument specifications. Furthermore, the TROPOMI spatial resolution already shows a more precise view of the HCHO distribution and of the non-methane volatile organic compound sources. The operational HCHO product is mature for validation, the only limitation being the reduced number of days that can be used for now. The validation methodology will take into account the averaging kernels of both satellite and ground-based FTIR data sets. Differences in a priori will be eliminated according to Rodgers and Connor (JGR, 2003). Furthermore, the horizontal displacement due to measurement geometry of the FTIR instruments is used in the co-location method.