



Validation of the first complete year of TROPOMI/S5P HCHO measurements using FTIR and UV-Vis DOAS ground-based networks

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As part of the S5P Validation Team, we will present the results of the NIDFORVal project (S5P Nitrogen Dioxide and Formaldehyde Validation using NDACC and complementary FTIR and UV-Vis DOAS ground-based remote sensing data), focusing on the formaldehyde (HCHO) S5P products.

Fourier Transform Infrared (FTIR) and Multi-Axis Differential Optical Absorption Spectroscopy (MAXDOAS) ground-based HCHO measurements at a few stations have been used in the past for satellite validation. In the NIDFORVal project, about 20 FTIR and 40 MAXDOAS stations are involved providing data corresponding to a wide range of observation conditions including high, mid, and low latitudes, as well as remote, sub-urban, and urban polluted sites. The HCHO retrieval settings have been optimized recently and applied consistently at the FTIR stations that are, for most of them, part of the Network for the Detection of Atmospheric Composition Change (NDACC), creating a unique harmonized data set ensuring a quasi-globally consistent validation of the satellite product. For the MAXDOAS stations, a best-effort basis harmonized dataset is used so far, which will be improved and enlarged within a Fiducial Reference Measurements (FRM) ESA program (FRM4DOAS).

Data from 16 FTIR sites and 10 MAXDOAS stations were already used for the preliminary validation of the HCHO S5P columns (S5P commissioning and pre-operational phases). The comparison results showed usually negative biases (TROPOMI being smaller) that were well within the accuracy requirements (40-80%). While the standard deviations were within the precision requirements for clean sites (1.2×10^{16} molec/cm² for a single pixel), polluted sites showed larger deviations attributed to higher spatial/temporal variability. This preliminary validation exercise needed further investigation, which has now become possible with the availability of more TROPOMI measurements.

While only four to six months of data were available for the preliminary S5P HCHO validation, we will show in this presentation the validation results of one complete year of measurements, allowing the seasonal cycles to be compared at more than 30 sites around the globe. We will also be able to compare validation results where both FTIR and MAXDOAS techniques are available, such as at the polluted site of Mexico City, or at the clean station Maïdo, Reunion Island.