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On the use of harmonized HCHO and NO_2 MAXDOAS measurements for the validation of GOME-2 and OMI satellite sensors

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During the last decade, the MAXDOAS technique has been increasingly recognized as a source of Fiducial Reference Measurements (FRM) suitable for the validation of satellite nadir observations of species relevant for climate and air quality like NO_2 and HCHO. As part of the EU FP7 QA4ECV (Quality Assurance for Essential Climate Variables; see http://www.qa4ecv.eu/) project, efforts have been recently made to harmonize a network of a dozen of MAXDOAS spectrometers in view of their use to assess the quality of satellite climate data records generated within the same project.

Harmonization tasks have addressed both retrieval steps involved in MAXDOAS retrievals, i.e. the DOAS spectral fit providing the differential slant column densities (DSCDs) and the conversion of the retrieved DSCDs into vertical profiles and/or vertical column densities (VCDs). In this work, we illustrate the successive harmonization steps and present the resulting QA4ECV MAXDOAS database v2. The approach adopted for the conversion of slant to vertical columns is based on a simplified look-up-table approach. The strength and limitation of this approach are discussed using reference data retrieved using an optimal estimation scheme.

The QA4ECV MAXDOAS database is then used to validate satellite data sets of NO_2 and HCHO columns derived from the Aura/OMI and MetOp/GOME-2 sensors. The methodology of comparison, which is also a subject of the QA4ECV project, is reviewed with respect to co-location criteria, impact of vertical and horizontal smoothing and representativeness of validation sites. We conclude by assessing the current strengths and limitations of the existing MAXDOAS datasets for NO_2 and HCHO satellite validation.