Tropospheric HCHO retrieved from OMI, GOME(-2), and SCIAMACHY within the Quality Assurance For Essential Climate Variables (QA4ECV) project

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One of the main goals of the QA4ECV project is to define community best-practices for the generation of multi-decadal ECV data records from satellite instruments. QA4ECV will develop retrieval algorithms for the Land ECVs surface albedo, leaf area index (LAI), and fraction of active photosynthetic radiation (fAPAR), as well as for the Atmosphere ECV ozone and aerosol precursors nitrogen dioxide (NO_2), formaldehyde (HCHO), and carbon monoxide (CO).

We present the results of the reprocessing of the OMI and GOME-2 databases using the QA4ECV HCHO retrieval algorithm that has been developed and consolidated during the first years of the project. Comparisons with the previous BIRA-IASB HCHO products distributed on the TEMIS website are presented, as well as validation results using ground-based observations of HCHO, also under development within the QA4ECV project.

Each retrieval step and the corresponding code has been intercompared within the group, allowing for a consolidation of the algorithms. The main improvements of the QA4ECV HCHO retrieval baseline are (1) the use of a large fitting window for OMI and GOME-2, allowed by improved quality of the recorded spectra, (2) refinement of the wavelength calibration procedure, (3) the use of a mean background radiance as DOAS reference spectrum allowing for a stabilization of the retrievals (the selection of reference spectra is line-of-sight dependent for all instruments), (4) a reduction of the East/West polarization biases in the GOME-2 retrieval, (5) an updated background correction based on the reference sector method has been implemented, with a significant impact over Tropical regions. As for NO_2, HCHO profiles from the TM5 model are used as a priori in the AMF calculation. These are provided on a $1°x1°$ latitude-longitude grid, allowing for an improvement of the spatial resolution of the final product.

Each step of the retrieval algorithm is documented via traceability chains, providing detailed information on the algorithm settings and auxiliary data sources. An uncertainty budget is also provided for each important retrieval parameter. This can be used for quality assurance and validation purposes.