

SETTING UP AN OPERATIONAL VALIDATION FACILITY FOR GOME-2 NO₂ COLUMN DATA

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Introduction

In the framework of EUMETSAT's Satellite Application Facility on Ozone and Atmospheric Chemistry Monitoring (O3M-SAF), operational nitrogen dioxide (NO₂) total and tropospheric column data products are generated from MetOp-A GOME-2 measurements in near real time.

To ensure meaningful and continuous quality assessment of GOME-2 NO₂ data products, BIRA-IASB, DLR and RMI have developed an **end-to-end validation approach**, which consists in performing the verification and validation of critical individual components of the level-1-to-2 retrieval chain. This approach uses other established retrieval facilities, a set of correlative observations performed by complementary ground-based instruments, measurements from other satellites, and modelling support.

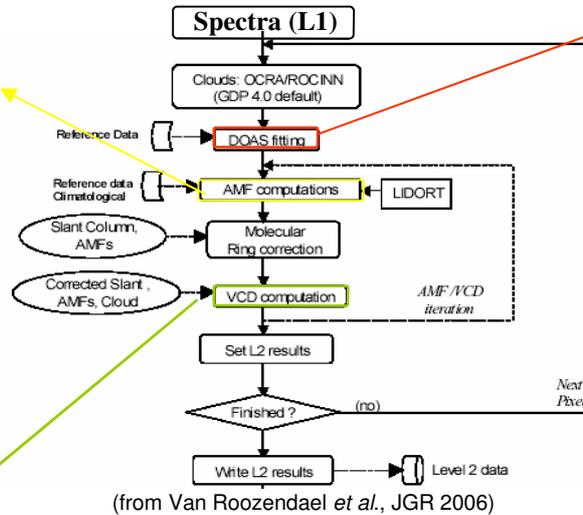
Why an end-to-end validation

Validation of components is recommended by Reference Protocols and Guidelines

- Center for Devices and Radiological Health, "General Principles of Software Validation, Version 1.1, dated June 9, 1997"
- Data Quality Guidelines for Satellite Sensor Observations Relevant to GEOS, Recommendations by CEOS/WGCV to the CEOS Task Force, 2004.
- Lambert, J.-C., P. Skarlas, and M. Van Roozendael, Earthwatch GMES Service Element - Atmospheric Monitoring Services: Service Validation Protocol, Version 1/ Issue 0.2, pp. 27, November 2006.

In order to avoid cascade of uncertainties and hidden compensating errors and to characterize the information provided by the system.

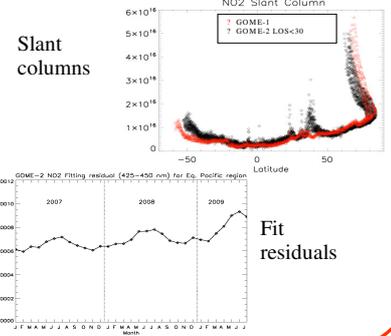
GDP 4 level-1-to-2 retrieval



(from Van Roozendael et al., JGR 2006)

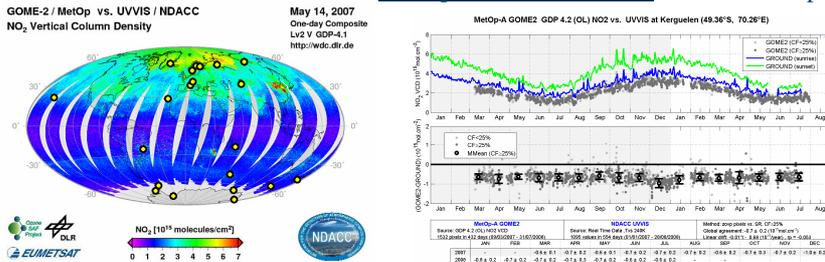
Assessment of the quality of the slant column densities

- testing the operational slant column algorithm on GOME and GOME2 datasets
- comparing this algorithm to other state-of-the-art scientific algorithms: GDOAS

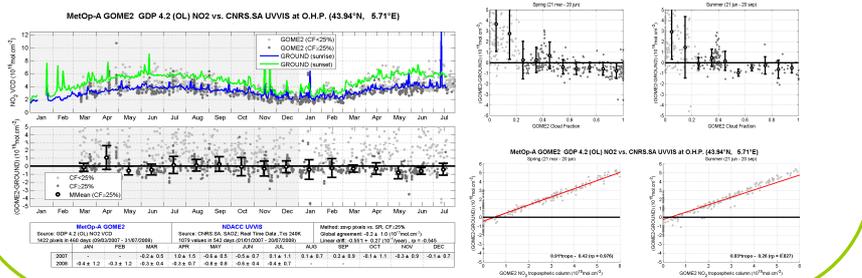


Assessment of the validity of the total columns Comparison with NDACC

1) Unpolluted conditions: total = stratospheric

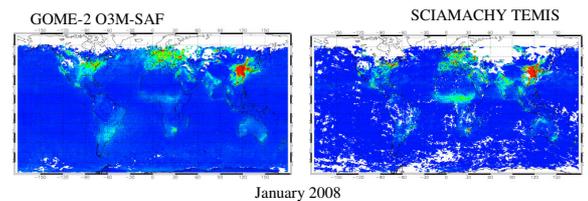


2) Polluted conditions: total = strato + tropo => separated evaluation



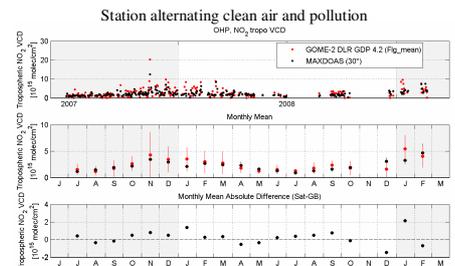
Assessment of the validity of the tropospheric columns

1) Direct comparison with satellite data:



2) Direct comparison with MAXDOAS data:

Pilot study at OHP



Conclusion:

- GDP 4.2 DOAS fit results match requirements. Evolution of fit residuals over Pacific region is an indicator of degradation effects.
- Pole to pole validation vs NDACC UVVIS network showed a good agreement with ground-based NDACC observations in the Northern Hemisphere, where GOME-2 data meet target requirements, and a systematic underestimation by about $0.6 \cdot 10^{15}$ molec/cm² at the Southern middle latitudes.
- Comparison with SCIAMACHY present a good qualitative agreement with similar spatial variations and enhanced tropospheric NO₂ over anthropogenic and natural emission regions, but quantitative differences mainly due to difference in retrieval methods.
- First tentative of GOME-2 tropospheric NO₂ "direct" validation at OHP vs MAXDOAS is very encouraging. However, the extension to more polluted regions (ex, BIRA-IASB MAXDOAS in Beijing) is much more challenging.

