OVERVIEW OF THE O3M-SAF VALIDATION FACILITY FOR OPERATIONAL GOME-2 NO_2 COLUMN DATA

G. Pinardi[1], J.C. Lambert[1], J. Granville[1], M. Van Roozendael[1], A. Delcloo[2], H. De Backer[2], P. Valks[3], N. Hao[3]
(1)Belgian Institute for Space Aeronomy (IASB-BIRA),(2) Royal Meteorological Institute of Belgium (RMI), Brussels, Belgium, (3) German Aerospace Center (DLR), Wessling, Germany

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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 (NO_2) 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 NO_2 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.

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Ozone and Atmospheric Chemistry Monitoring

How

From the quality assessment of every step to the geophysical validation.

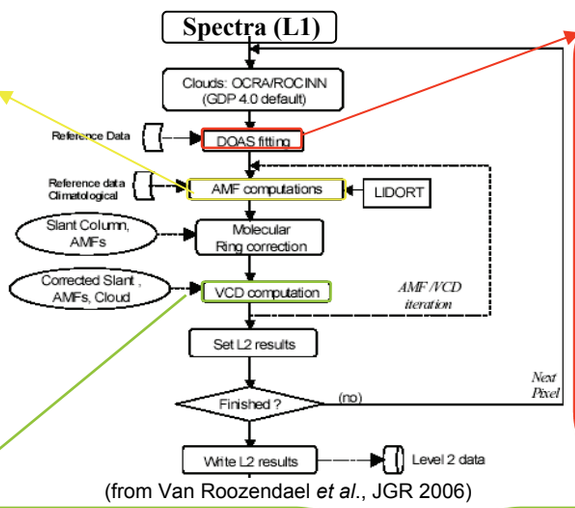
Why an end-to-end validation

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 GEOSS, 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.

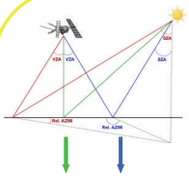
GDP 4 level-1-to-2 retrieval



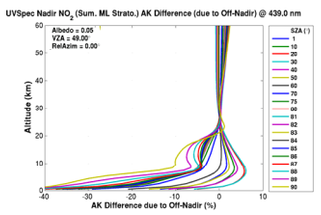
(from Van Roozendael *et al.*, JGR 2006)

Assessment of AMF accuracy

with independent processor



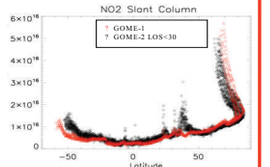
AMF differences:

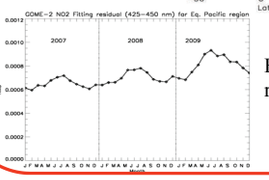


Assessment of the quality of the slant column densities

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

Slant columns



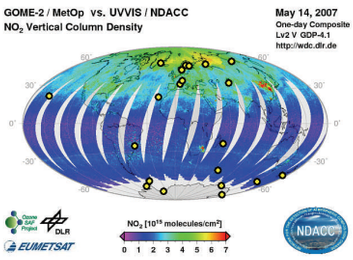


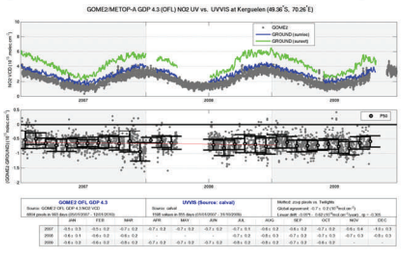
Fit residuals

Assessment of the validity of the total columns

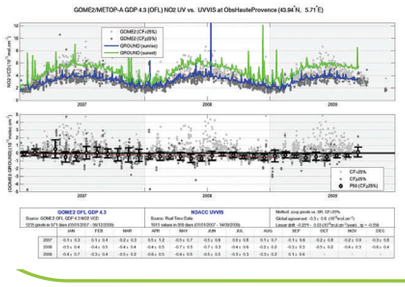
Comparison with NDACC

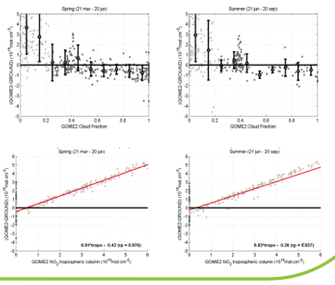
1) Unpolluted conditions: total = stratospheric





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

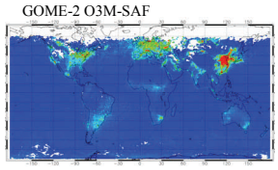




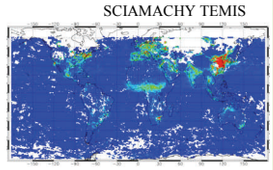
Assessment of the validity of the tropospheric columns

1) Direct comparison with satellite data:

GOME-2 O3M-SAF



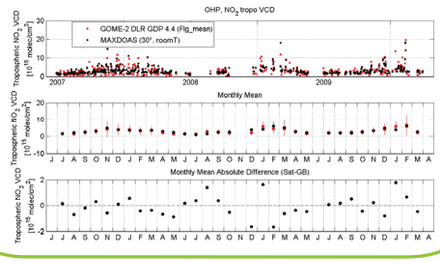
SCIAMACHY TEMIS



January 2008

2) Direct comparison with MAXDOAS data: Pilot study at OHP

Station alternating clean air and pollution



Conclusion:

- GDP 4.4 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 10^{15} molec/cm^2 at the Southern middle latitudes.
- Comparison with SCIAMACHY present a good qualitative agreement with similar spatial variations and enhanced tropospheric NO_2 over anthropogenic and natural emission regions, but quantitative differences mainly due to difference in retrieval methods.
- First tentative of GOME-2 tropospheric NO_2 "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.

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