INTEGRATED TRACE GAS VALIDATION AND QUALITY ASSESSMENT SYSTEM FOR THE EUMETSAT POLAR SYSTEM

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Outline

- Presentation of the CDOP-2 project in the O3M-SAF context and the heritage from CDOP-1.

- Validation activities:
    - Illustrations for NO_2, BrO, H_2CO
    - BIRA stations + satellite vs satellite (and operational vs scientific product)

- Conclusions and perspectives:
    - extensions to CHOCHO, BrO tropo, OClO, IASI products (SO_2 and HNO_3),
    - Validation and quality assessment web portal

CDOP-2 project

- The second phase of the **Continuous Development and Operations Project** (CDOP-2):
  - framework of EUMETSAT's Satellite Application Facility on Ozone and Atmospheric Chemistry Monitoring (**O3M-SAF**),
  - started in **March 2012** with the aim to deliver operational GOME-2 and IASI data products of well characterized precision, accuracy and stability. →**pres. of S. Hassinen**

- **BIRA-IASB** is involved in the trace gas products development/ maintenance in support to DLR and **coordinates the validation and Quality Assessment** activities for **minor trace gases.**
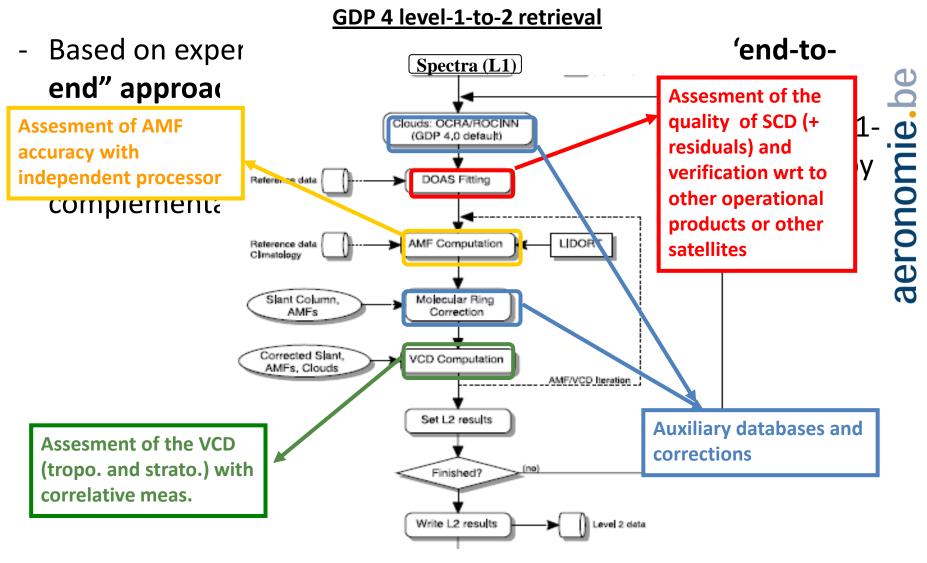
Validation: full validation exercise for new products before reaching operational status (e.g., new gases and Metop-B products)

Quality Assesment (QA): regular online monitoring of operational products, in order to ensure their stability → internal verification by the developer Institutes + regular comparisons to correlative datasets, performed by the validation groups.

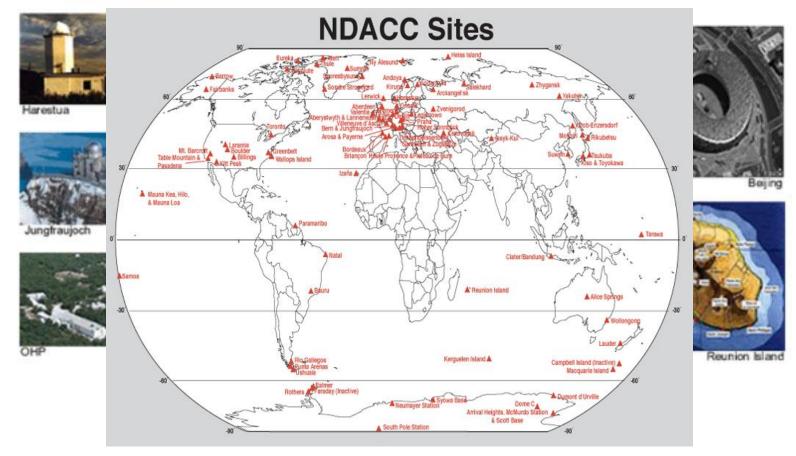**A validation web portal will be set up**

CDOP-2 project

GDP 4 level-1-to-2 retrieval

- Based on exper... **'end-to-end" approac...** 1-

complementa...

Assesment of AMF accuracy with independent processor

Assesment of the quality of SCD (+ residuals) and verification wrt to other operational products or other satellites

Spectra (L1)

Clouds: OCRA/ROCINN (GDP 4,0 default)

Reference data → DOAS Fitting

Reference data Climatology → AMF Computation ← LIDORT

Slant Column, AMFs → Molecular Ring Correction

Corrected Slant, AMFs, Clouds → VCD Computation

AMF/VCD Iteration

Set L2 results

Finished? (no)

Write L2 results → Level 2 data

Assesment of the VCD (tropo. and strato.) with correlative meas.

Auxiliary databases and corrections

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

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- Correlative data:
  - <u>satellite-to-satellite</u> comparisons (GOME, SCIAMACHY and OMI instruments),
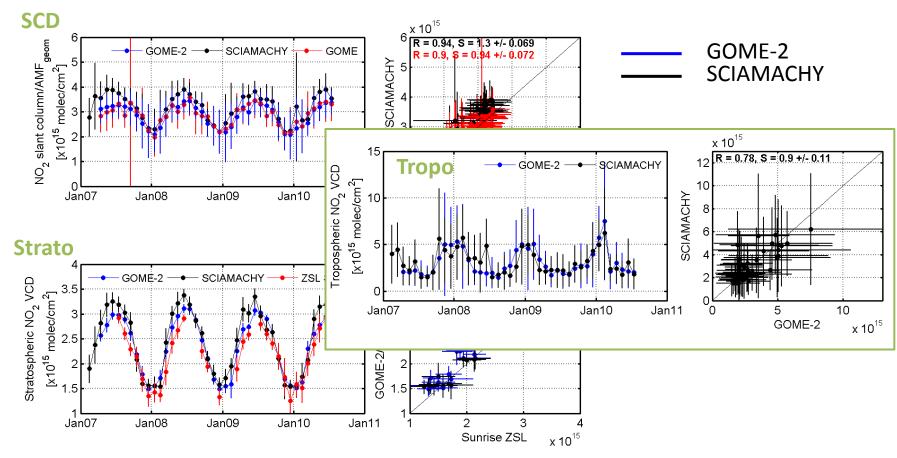
- End-to-end method illustrated above OHP (Valks et al. 2011, AMT).

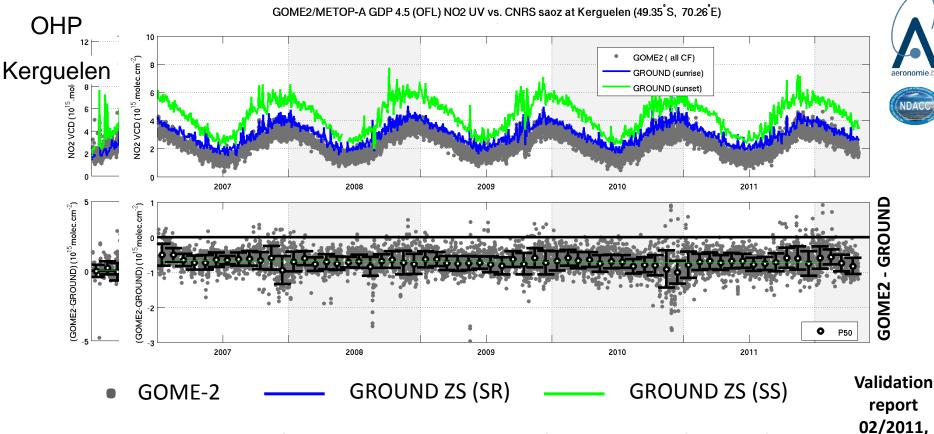**End-to-end comparison with other NO$_2$ satellite dataset above OHP**

validation activities: NO$_2$

- End-to-end method illustrated above OHP (Valks et al. 2011, AMT).
- Independent comparison with NDACC ground-based instrum.

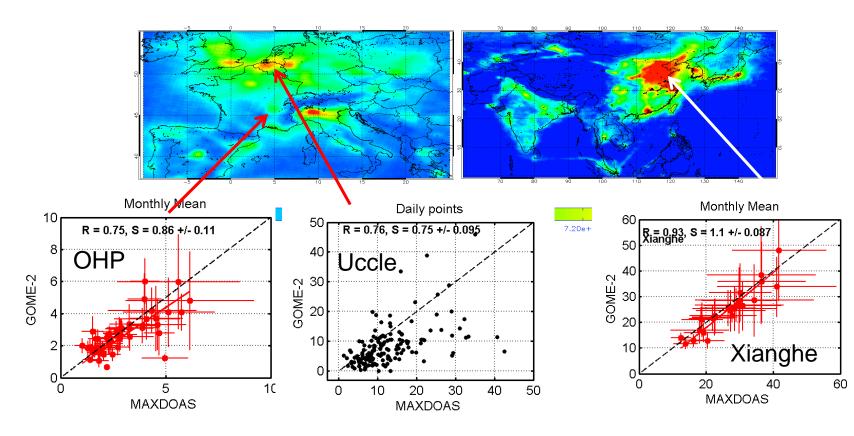GOME2/METOP-A GDP 4.5 (OFL) NO2 UV vs. CNRS saoz at Kerguelen (49.35°S, 70.26°E)

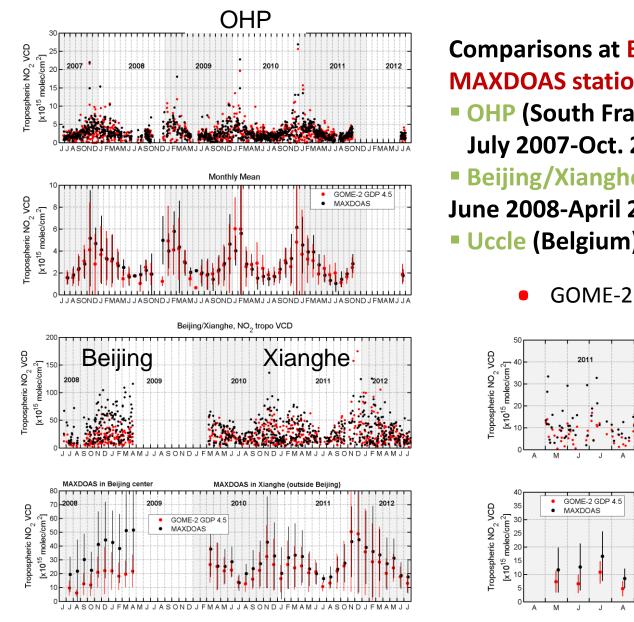Comparison at the NDACC stations: examples at OHP and Kerguelen

- End-to-end method illustrated above OHP (Valks et al. 2011, AMT).
- Independent comparison with NDACC ground-based instrum.
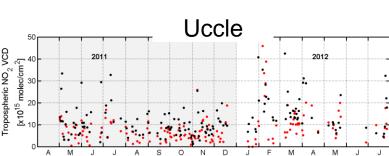- **Independent comparison with BIRA ground-based MAXDOASes**

validation activities: NO$_2$

OHP

Monthly Mean

Beijing/Xianghe, NO$_2$ tropo VCD

Beijing   Xianghe

MAXDOAS in Beijing center   MAXDOAS in Xianghe (outside Beijing)

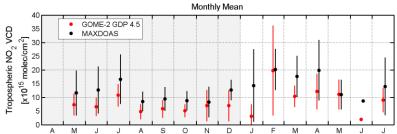**Comparisons at BIRA ground-based MAXDOAS stations:**

- **OHP** (South France):
  July 2007-Oct. 2011, and July 2012-now
- **Beijing/Xianghe** (China):
  June 2008-April 2009 and March 2011-now
- **Uccle** (Belgium): May 2011- now

● GOME-2   ● MAXDOAS
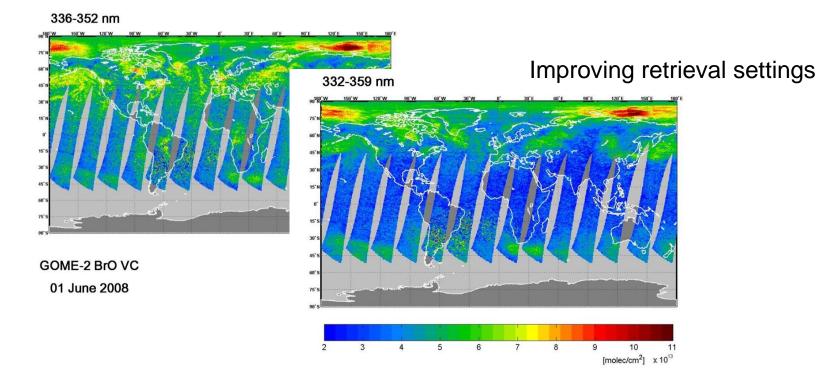
Uccle

Monthly Mean

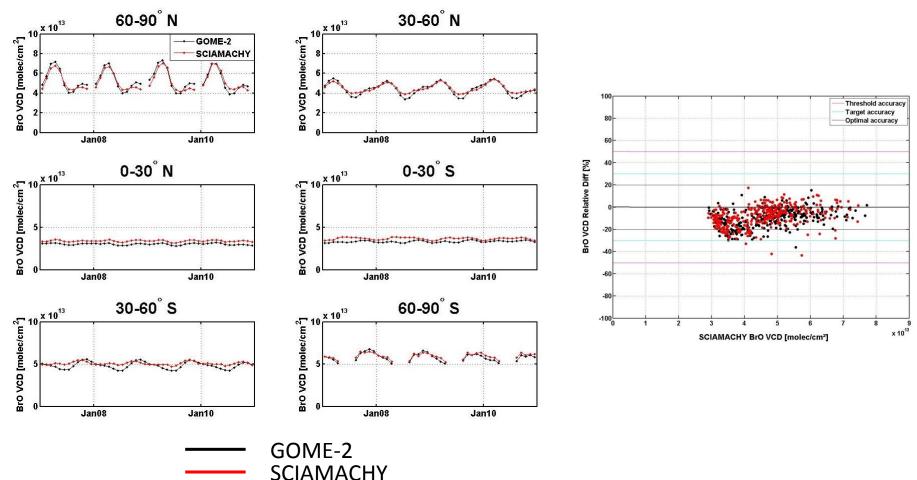aeronomie.be

validation activities: BrO

- Validation of total BrO columns of GOME-2:
  First report (2009) showed a fairly good agreement with SCIAMACHY (GOME-2 generally lower at high latitude sites of both hemispheres and with a slightly different seasonal pattern).

- Improvement of total columns (Theys et al., 2011):

336-352 nm

332-359 nm

Improving retrieval settings

GOME-2 BrO VC

01 June 2008

2   3   4   5   6   7   8   9   10   11

[molec/cm^2]   x 10^{13}

validation activities: BrO

- Validation of the <u>improved</u> total BrO columns of GOME-2:
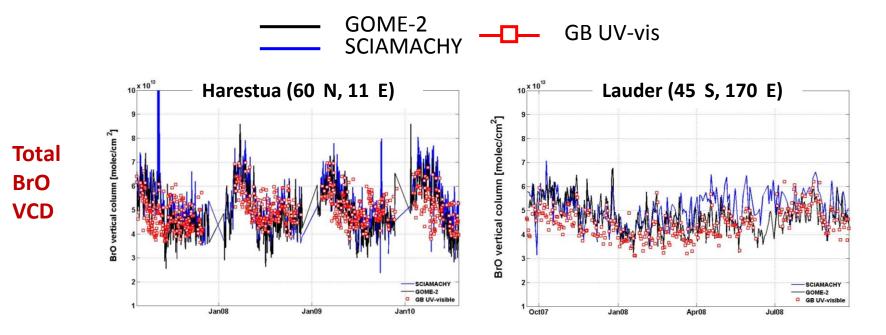 **comparisons showed good comparisons with SCIAMACHY**

GOME-2
SCIAMACHY

validation activities: BrO

- Validation of the <u>improved</u> total BrO columns of GOME-2:
  comparisons showed good comparisons with SCIAMACHY and ground-based data.
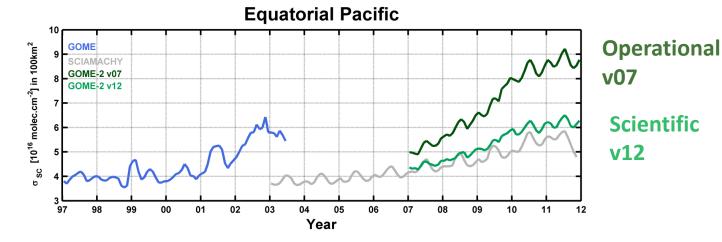

Total BrO VCD

→ Upon availability of correlative data, these comparisons will be included in the verification/quality assessment webportal.

validation activities: H₂CO

- Validation of H$_2$CO columns of GOME-2: **First report (2009) showed that most of the differences between the scientific and operational products are due to different auxiliary databases (albedo and clouds).**

- Improvement of the GOME-2 columns (De Smedt et al., 2012)

Equatorial Pacific
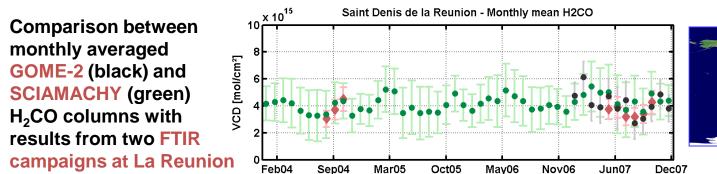
Operational v07

Scientific v12

DOAS settings implemented in the <u>operational product</u> (v 07): based on settings developed for GOME, SCIAMACHY and GOME-2 during TEMIS and PROMOTE projects (De Smedt et al., 2008)

v 12: Improved DOAS settings from the <u>scientific product</u> (extended fitting interval and pre-fit of BrO) that <u>will be implemented during CDOP-2</u>

validation activities: H₂CO
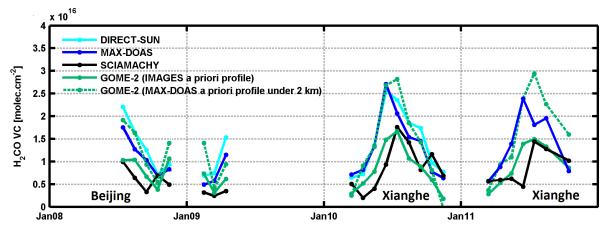
- Validation with ground-based measurements: La Reunion & China

Comparison between monthly averaged GOME-2 (black) and SCIAMACHY (green) H₂CO columns with results from two FTIR campaigns at La Reunion

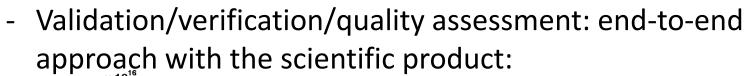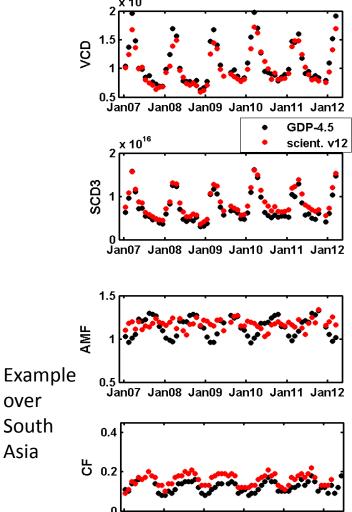Comparison between monthly averaged GOME-2 and SCIAMACHY H₂CO columns with MAX-DOAS and Direct-Sun measurements in Beijing/Xianghe

Scientific GOME-2 H₂CO product from BIRA/IASB.

- Validation/verification/quality assessment: end-to-end approach with the scientific product:

Example over South Asia
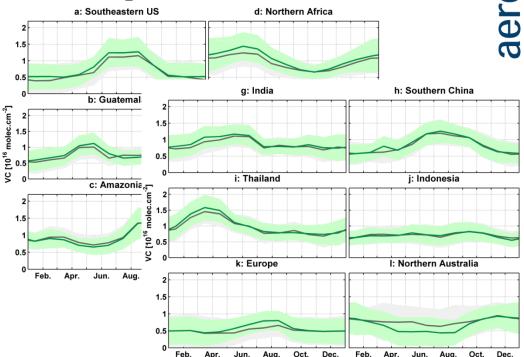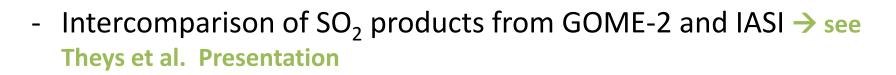
For the quality assurance (website):

- SCIAMACHY has been lost (2003-March 2012)

- OMI H$_2$CO columns are degrading

- Intercomparison of SO_2 products from GOME-2 and IASI → **see Theys et al. Presentation**

- Next years, extension to other trace gasbres measured by the GOME-2 and IASI sensors: tropospheric BrO, glyoxal, HNO3 and OClO

- The trace gas validation system will largely benefit from harmonization and automatization of the ground-based remote-sensing data within the NORS project (Demonstration **N**etwork **O**f ground-based **R**emote **S**ensing Observations in support of the GMES Atmospheric Service)

Conclusion

- In CDOP-2, BIRA-IASB is coordinating the minor trace gases validation and quality assessment for the O3M-SAF.

- Based on the heritage/experience from CDOP-1 several gases are already continuously validated (NO_2, BrO, H_2CO, …) and the a system is on development for the extension to others gases for GOME-2 and IASI on Metop-A and on Metop-B (as glyoxal, SO_2, HNO_3 and OClO).

- The results will be regularly updated and presented on a validation and QA web portal.

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… validation and QA web portal which is currently being developed…

CDOP-DEV

O3M SAF CONTINUOUS DEVELOPMENT & OPERATIONS PHASE 2

· HOME · TRACE GASES · VALIDATION · QUALITY ASSESSMENT · LINKS · INTERNAL DOC

···> Home ▶ Validation

Validation

During CDOP-1 BIRA-IASB was involved in the validation of the following trace gases:

- NO2 (total and tropospheric) from GOME-2
- BrO from GOME-2
- SO2 from GOME-2 and IASI
- HCHO from GOME-2

Thank you for you attention!

This includes:

Trace Gas	Validation	Quality Assessment
GOME-2 Metop-A and -B		
NO2 (total and tropospheric)	Metop-B	x
BrO (total and tropospheric)	Metop-B and tropopsheric prodcut	x
SO2	Metop-B	x
HCHO	Metop-B	x
CHOCHO	Metop-A and Metop-B	x
OClO	Metop-B (depending on the product quality)	depending on the quality of the data with Metop-B
IASI on Metop-A and -B		
HNO$_3$		

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