SCIAMACHY Ozone Column Validation
ACVT - MA

Henk Eskes
Royal Netherlands Meteorological Institute

Antje Dethof
European Centre for Medium-Range Weather Forecasts

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Part I:
Sciamachy retrievals
(ESA operational, KNMI Tosomi)
validation reference set
monitored with GOME assimilation based on
Togomi (KNMI) total ozone retrievals
Aug - Oct 2002
Validation reference set, Aug-Oct 2002

Coverage
validation
reference set

Split ozone hole!
Scia operational vs assimilated GOME: latitude dep.

OmF vs latitude
Scia oper. minus assimilated GOME (in Dobson units)

Concl:
• overall bias OmF < 1%
• std OmF 3%
Tosomi vs assimilated GOME: latitude dependence

OmF vs latitude
Tosomi minus assimilated GOME (in Dobson units)

Concl:
• overall bias OmF < 1%
• std OmF 3%
• more consistent in NH
• SH: split ozone hole
Scia operational vs assimilated GOME: viewing angle

**OmF vs VZA**
Scia oper. minus assimilated GOME (in Dobson units)

**Concl:**
- increasing O3 with vza: 2%
- backscan lower for vza>0
- backscan higher for vza<0
(also for Tosomi)

![Graph showing the relationship between OmF and viewing angle (VZA) for East-West direction with data points indicating state-id 6,7 F(*) and 6,7 B.](image)
Scia operational vs assimilated GOME: cloud fraction dep.

OmF vs cloud fraction
Scia oper. minus
assimilated GOME
(in Dobson units)

Concl:
increasing O3 with
cloud fraction: 2-3%
Tosomi vs assimilated GOME: cloud fraction dep.

OmF vs cloud fraction
Tosomi minus
assimilated GOME
(in Dobson units)

Concl:
increasing O3 with
cloud fraction: especially
for cfr = 1.0
Related to Fresco?
Scia operational, Tosomi vs assimilated GOME
(validation reference set, Aug-Oct 2002)

Conclusions:
• **Overall bias** between (assimilated) GOME-TOGOMI, SCIA-operational and TOSOMI is small, < 1% - improvement wrt ACVE-1
  Note: TOSOMI about 1.5% low compared to Brewer/Dobson (E. Brinksma)
• **STD** TOSOMI, SCIA oper versus assimilated GOME = 3%: good result!
• Tosomi is somewhat more consistent with assimilated GOME, except for a bias near the South Pole
• **Viewing angle** dependence: 2% difference East-West for SCIA-oper.
• **Cloud fraction** dependent bias, both for TOSOMI and SCIA-oper:
  2 - 2.5% ozone difference between cfr=0 and cfr=1
• Validation reference states not ideal for validation with assimilation
Part II:
Direct comparison
Sciamachy operational total ozone vs
Tosomi total ozone
Scia vs Tosomi O3 column
Latitude > 60 S
Validation reference states
(85% pixels)

Concl:
Good correspondence
Bias: 1.7 DU (0.5%)
Std: 6 DU (2%)
Scia vs Tosomi

Scia vs Tosomi O3 column
Latitude < 60 S (South pole)
Validation reference states
(15% pixels)

Concl:
Large differences for the large ozone column values

Note: exceptional year, split vortex
Scia vs Tosomi vs latitude
Validation reference states
State id: 7, 6, 5, 4, 3, 2

Concl:
Bias < 4% [ 50S, 50N ]
Bias up to 10% for larger SZA's, latitudes especially SH
Scia vs Tosomi

Scia – Tosomi vs latitude
Slant column
Validation reference states
State id: 7, 6, 5, 4, 3, 2

Difference in treatment of rotational Raman scattering.

Different ozone cross sections
Conclusions:
• Good comparison between Scia oper and Tosomi at low- and mid-latitudes: latitude dependent bias less than 4% [50S, 50N], overall bias 0.5% (surprising, given differences between algorithms).
• Considerable differences at high latitudes, especially south of 60S: bias up to 5% (NH), 10% (SH); note: special conditions, vortex split.
• Differences in slant column reflect differences in treatment of rotational Raman and cross sections.
• Angles need to be checked again (especially VZA).
Part III:
Monitoring Sci_RV__2P and Tosomi,
year 2004
(ECMWF)
Monitoring of Sciamachy NRT column ozone at ECMWF

• ESA’s SCI_RC__2P product (NRT total column ozone) monitored at ECMWF since February 2003

• KNMI’s TOSOMI NRT total column ozone data monitored at ECMWF since 21 March 2004
Problems in March 2004:
inadequate leakage current calibration, wrong initialisation file
April 2004: Scia NRT vs Tosomi

**Scia NRT, Tosomi**

Conclusion: Scia NRT shows large negative bias (40-60DU) in April 2004
ESN NRT L2 product, April 2004

KNMI NRT L2 tosomi product

fg-departures [%]

Observations [DU]
Summary 2004 monitoring

• ESA product normally relatively stable, but problems in March, April 2003
• Negative bias of SCI_RV__2P data, bias worse after 28 March 2004 (– 60 DU in global mean)
• TOSOMI product agrees better with ECMWF ozone analyses
• Data gap between about 90-150E: data from ftp-pde.envisat.esa.in not available in NRT, too late for analysis
• Geolocation information (e.g. FOV, SZA) still not included in SCI_RV__2P data.
• Quality of SCI_RV__2P currently not good enough to assimilate the data at ECMWF
Summary: Sciamachy total ozone

**SCIA operational product** (val.reference set, Aug-Oct 2002)
- Improved: overall bias wrt GOME-Togomi assimilation < 1%; bias 0-4% for [50S,50N] wrt Tosomi, up to 10% for large sza; bias O3 vs vza, cloud fraction ± 1%, cloud fraction consistent with Fresco
- OmF std 3% - good results.
- Upgrade of processor needed (following GOME developments)

**KNMI Tosomi product** (Jan 2003 to present)
- Operational, NRT within 18h: http://www.temis.nl
- Stable product - not sensitive to L1 updates
- Small bias < 1% vs GOME-Togomi, 1.5% low vs ground-based

**2004 monitoring**
- ESA product shows problems in March, April 2003, not good enough for assimilation; Tosomi agrees better with ECMWF
- Data gap between about 90-150E; Geolocation information missing; data not in time for ECMWF analysis
Tosomi vs Brewer, Dobson …

Worldwide validation for 1 year of SCIA-Tosomi ozone columns

Ellen Brinksma,
(see poster)

Main conclusions:
• Tosomi 1.5% lower than ground based
• RMS 4.9%
• No clear geographical location dependence
Scia Operational, Tosomi vs assimilated GOME

OmF
SCIA operational validation reference set minus assimilated GOME (in Dobson units)

Aug-Oct 2002
Scia, Tosomi vs assimilated GOME

OmF
Tosomi minus assim GOME
(in Dobson units)
Scia, Tosomi vs assimilated GOME

OmF vs time
GOME minus assimilated GOME (in Dobson units)

Concl:
• bias 0 %
• rms 3%
Scia, Tosomi vs assimilated GOME

**OmF vs time**
Scia oper. minus assimilated GOME (in Dobson units)

Concl:
- bias < 1%
- rms 3%
Scia, Tosomi vs assimilated GOME

**OmF vs time**
Tosomi minus assimilated GOME (in Dobson units)

Concl:
- bias < 1%
- rms 3%
Scia vs Tosomi

Scia – Tosomi cloud fraction
Validation reference states

Conclusion:
Very good agreement between the two cloud retrievals, except for cfr = 1.0
Scia vs Tosomi

Scia – Tosomi
cloud top pressure
Validation reference states

Conclusion:
Agreement OK
• Fresco - cloud pressure retrieval
• OCRA - climatology
Scia – Tosomi
Viewing angle (TOA)
Validation reference states

Conclusion:
There is still a mismatch that needs to be resolved
Global mean SCI_RV__2P data, 19 Jan - 18 Apr 2004

- Negative bias of SCIA data, -30/-60 DU in global mean
- Problems in March 2004: inadequate leakage current calibration, wrong initialisation file
- Further change around 28 March -> worse agreement with ECMWF
ESA NRT vs. KNMI Tosomi

Timeseries of global means, 21 Mar - 18 Apr 2004
Validation activities

Retrievals:
- Sciamachy operational (ESA)
- Tosomi (KNMI)
- GDOAS (BIRA-IASB)

Validation:
- Sciamachy retrievals (validation reference states) monitored with GOME assimilation (Togomi)
- Direct comparison Scia-oper vs Tosomi
- Monitoring Sci_RV__2P and Tosomi in 2004 (ECMWF)