

SCIAMACHY Ozone Column Validation ACVT - MA

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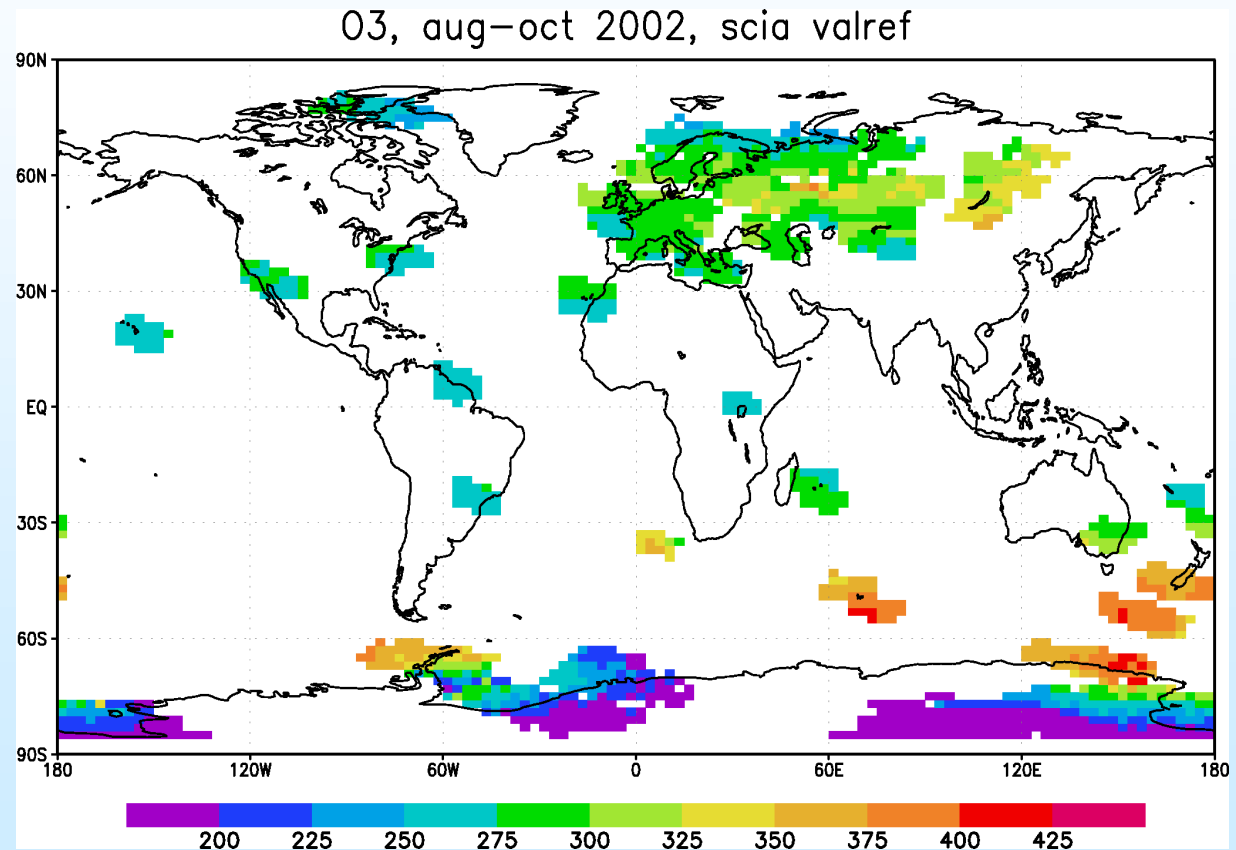
**Acknowledgements: Ankie Pitters, Jan Fokke Meirink,
Ronald van der A, Ellen Brinksma (KNMI)**

**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 !



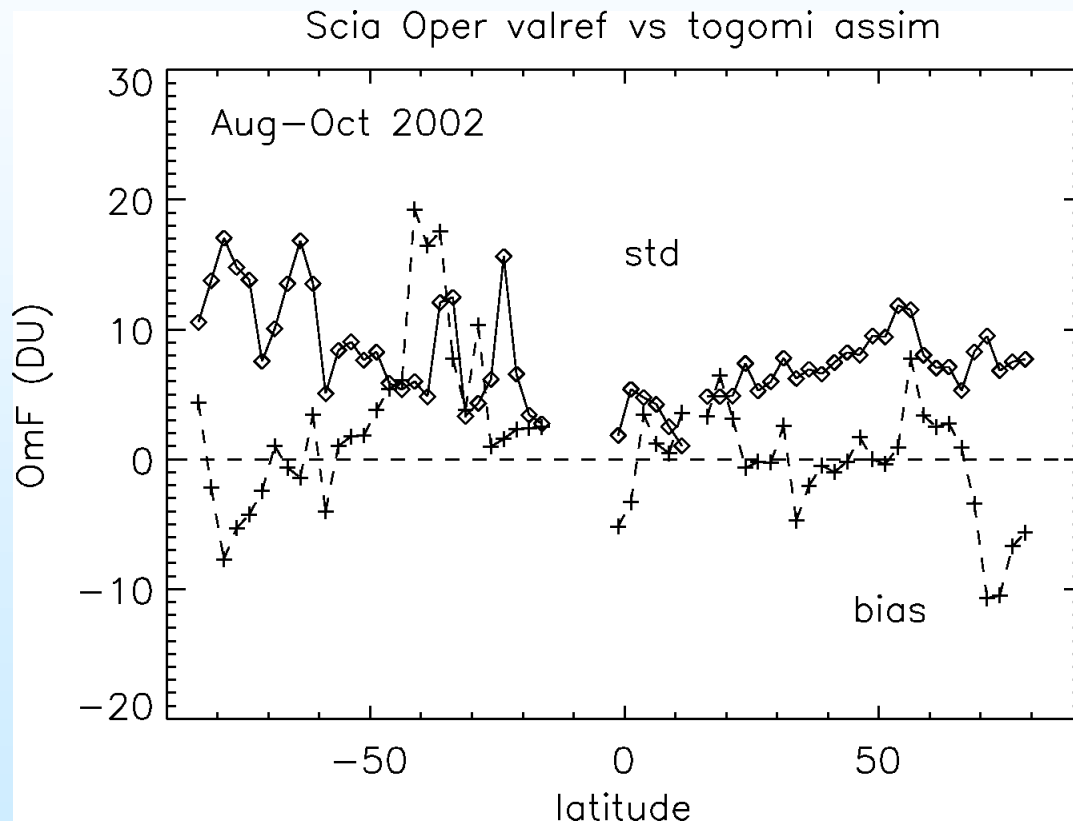
Scia operational vs assimilated GOME: latitude dep.

OmF vs latitude

Scia oper. minus
assimilated GOME
(in Dobson units)

Concl:

- overall bias OmF < 1%
- std OmF 3%



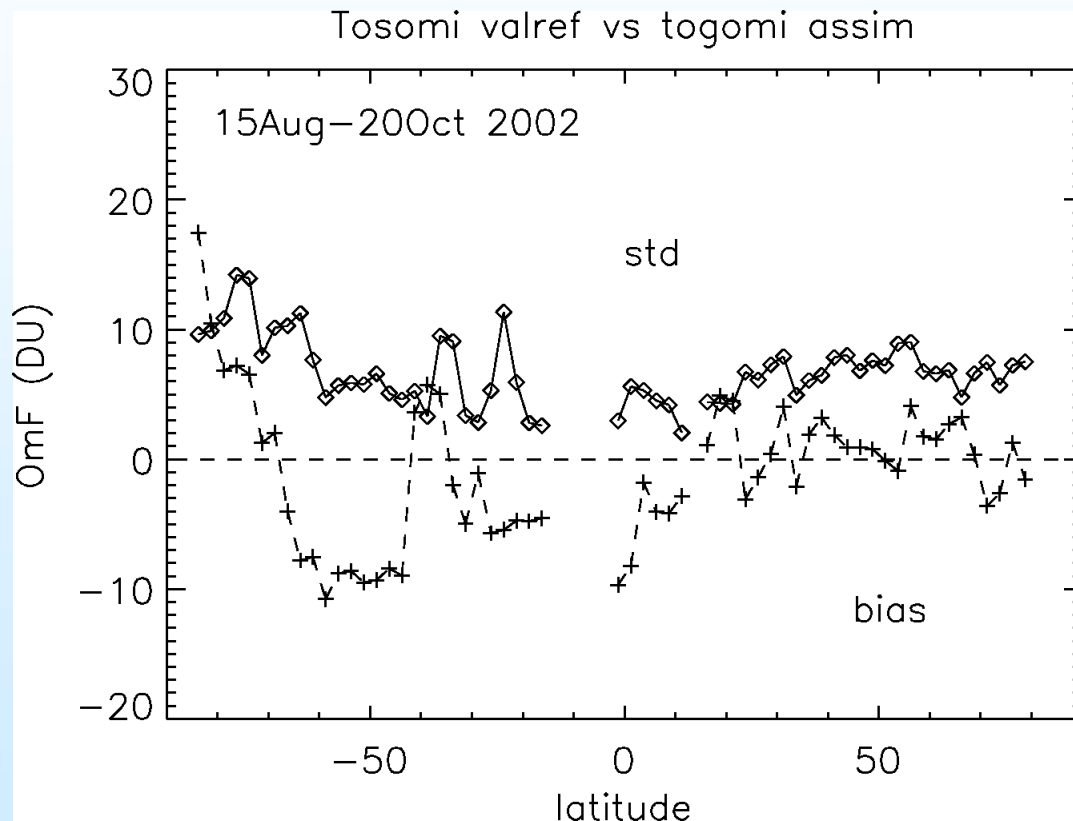
Tosomi vs assimilated GOME: latitude dependence

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



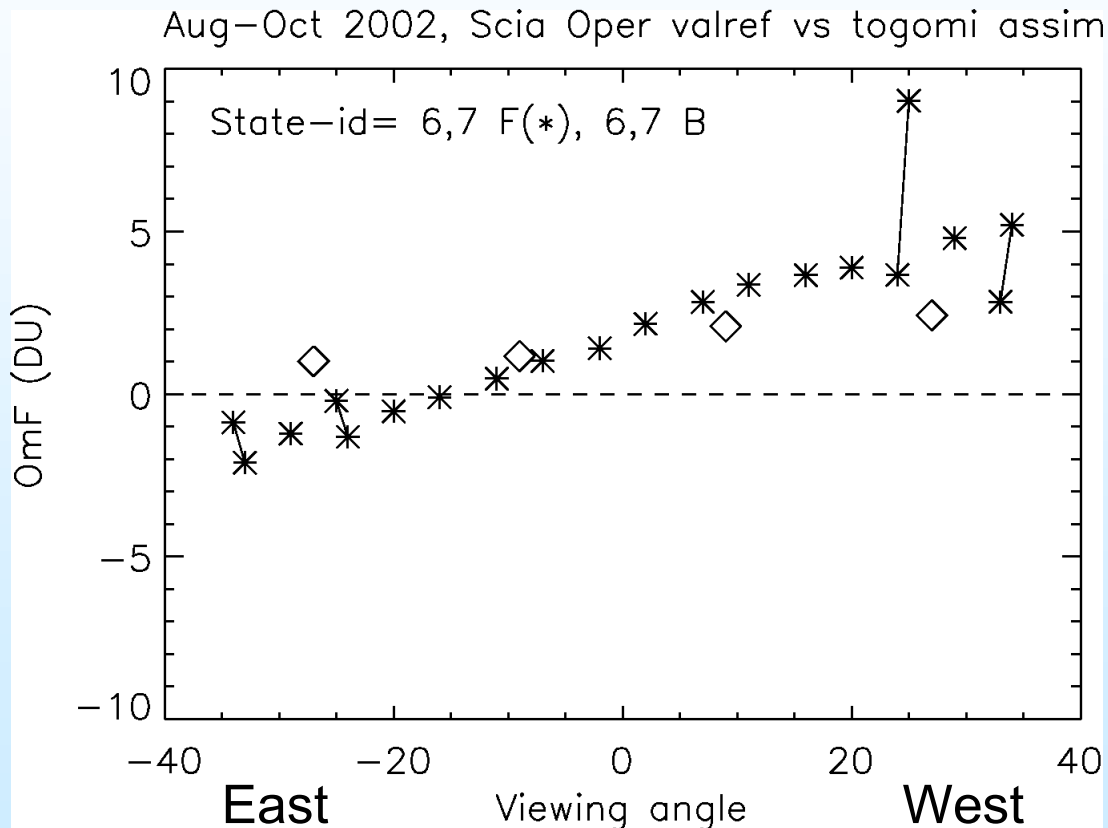
Scia operational vs assimilated GOME: viewing angle

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)

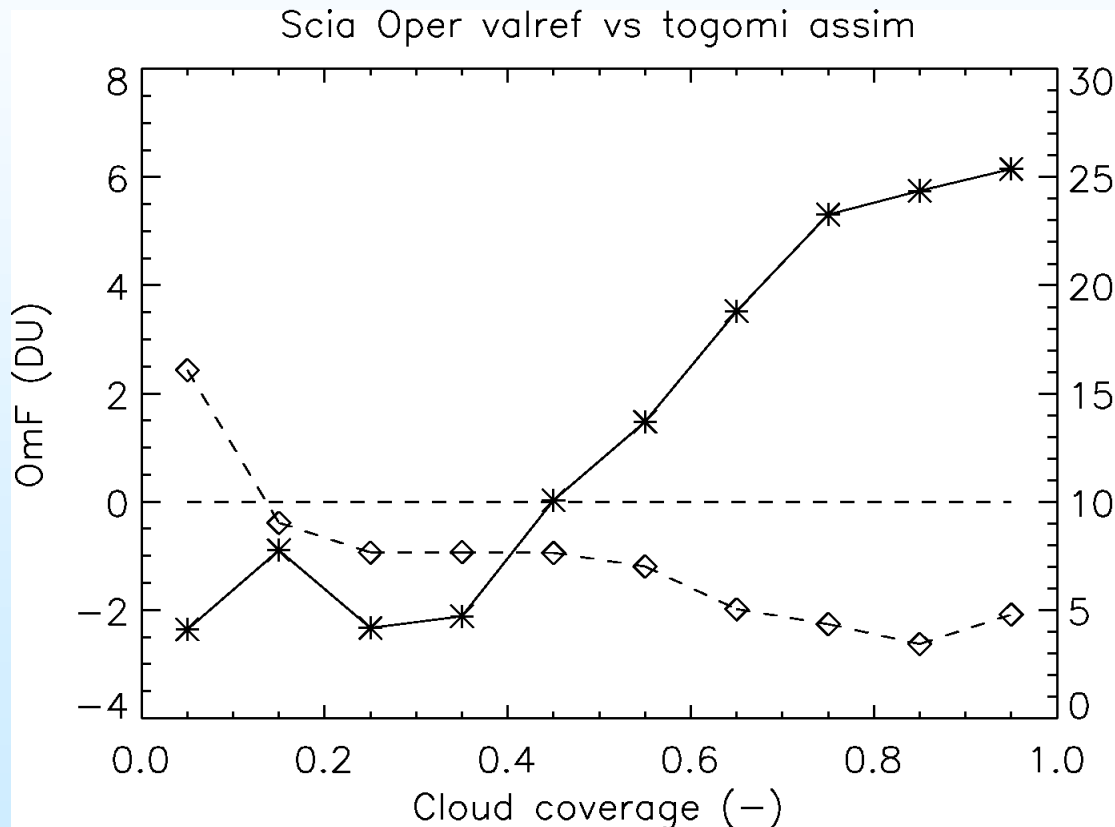


Scia operational vs assimilated GOME: cloud fraction dep.

OmF vs cloud fraction

Scia oper. minus
assimilated GOME
(in Dobson units)

Concl:
increasing O3 with
cloud fraction: 2-3%

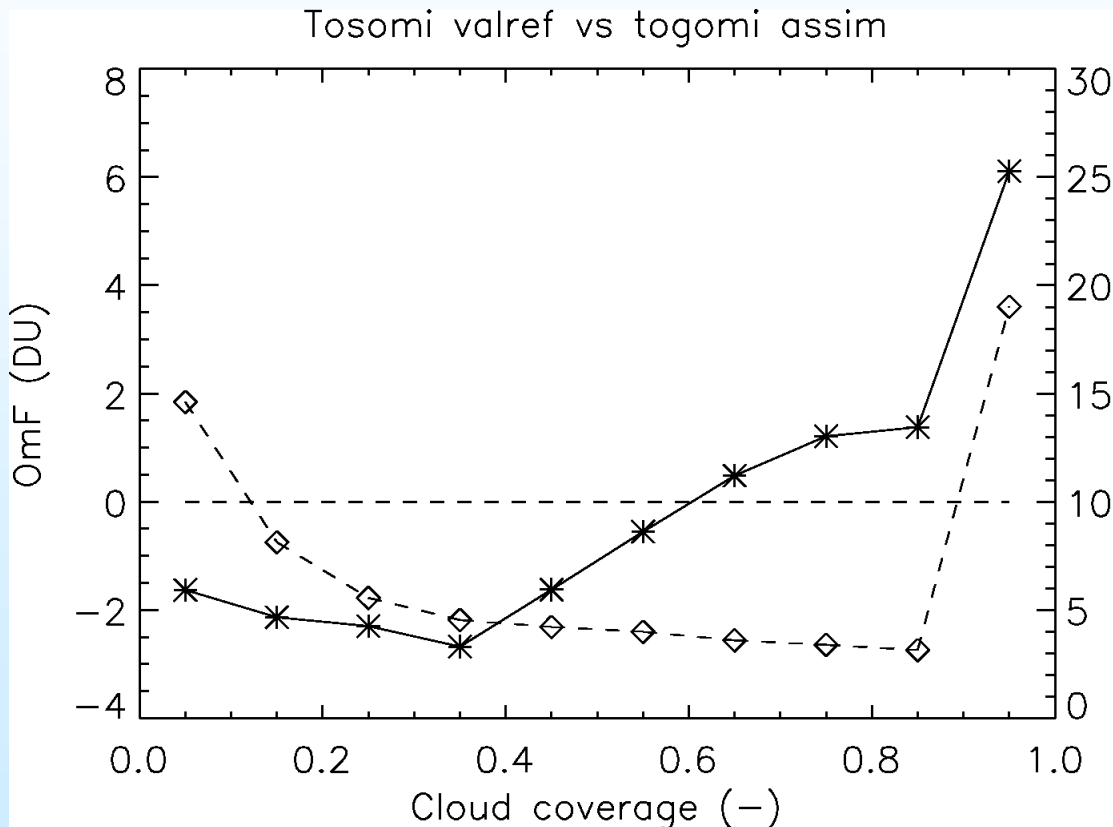


Tosomi vs assimilated GOME: cloud fraction dep.

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

Scia vs Tosomi O3 column

Latitude > 60 S

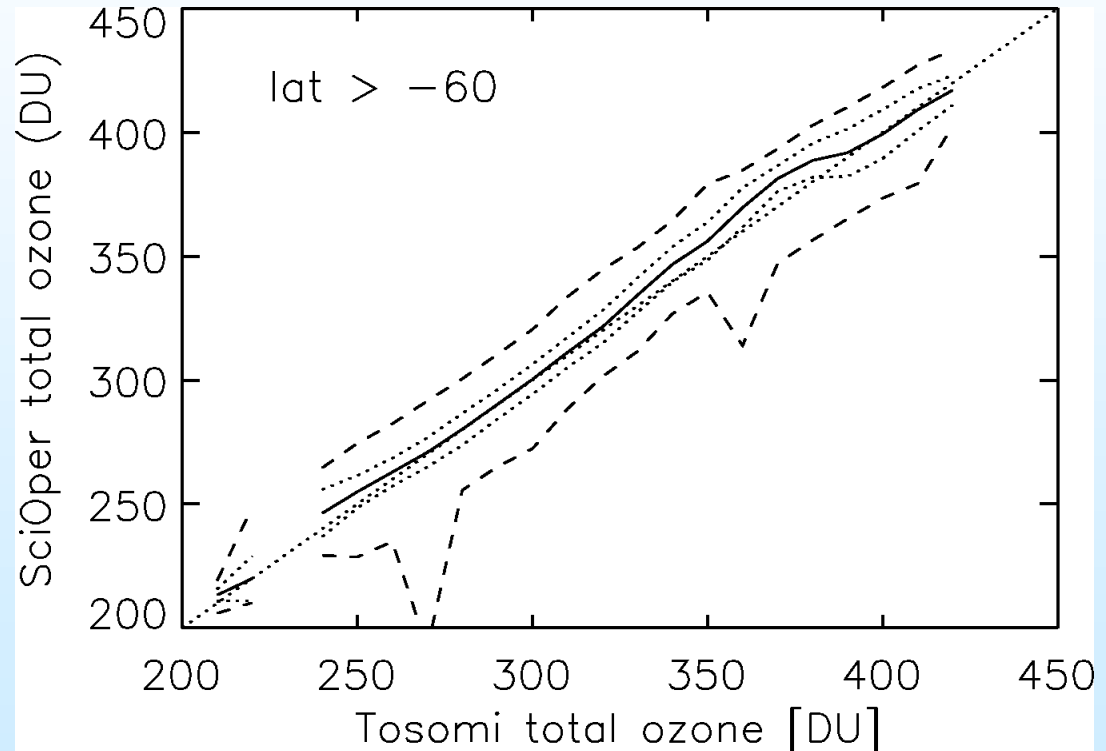
Validation reference states
(85% pixels)

Concl:

Good correspondence

Bias: 1.7 DU (0.5%)

Std: 6 DU (2%)



Scia vs Tosomi

Scia vs Tosomi O3 column

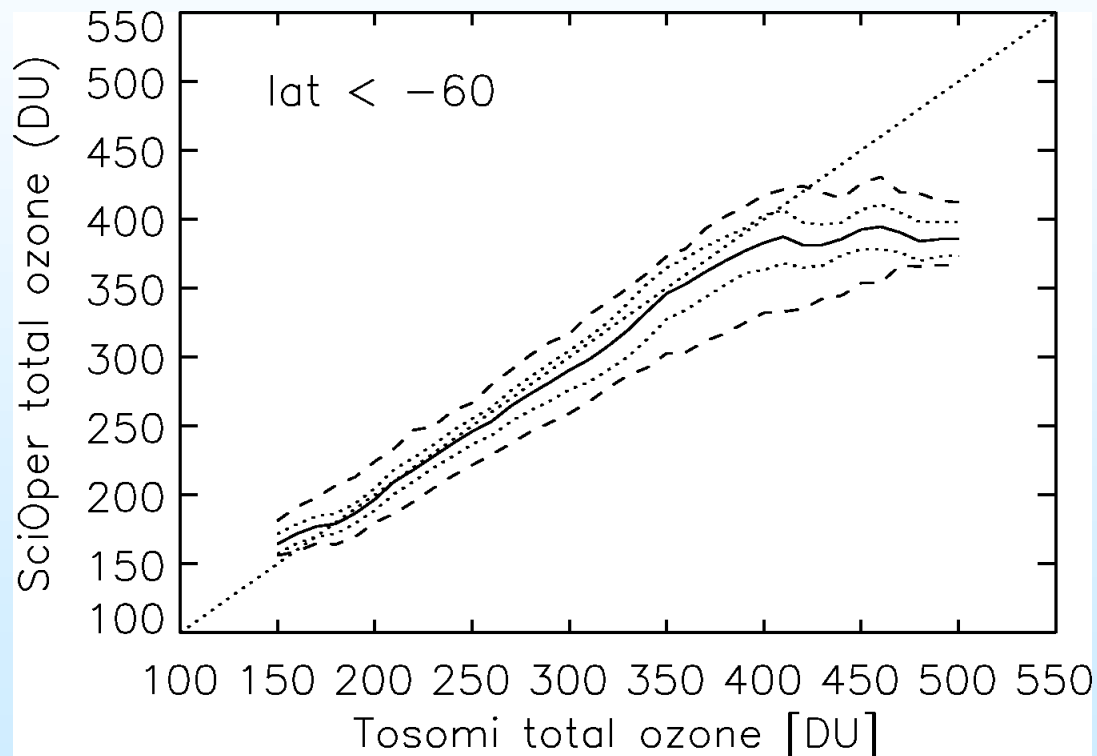
Latitude < 60 S (South pole)

Validation reference states
(15% pixels)

Concl:

Large differences for the
large ozone column values

Note: exceptional year,
split vortex



Scia vs Tosomi

Scia – Tosomi vs latitude

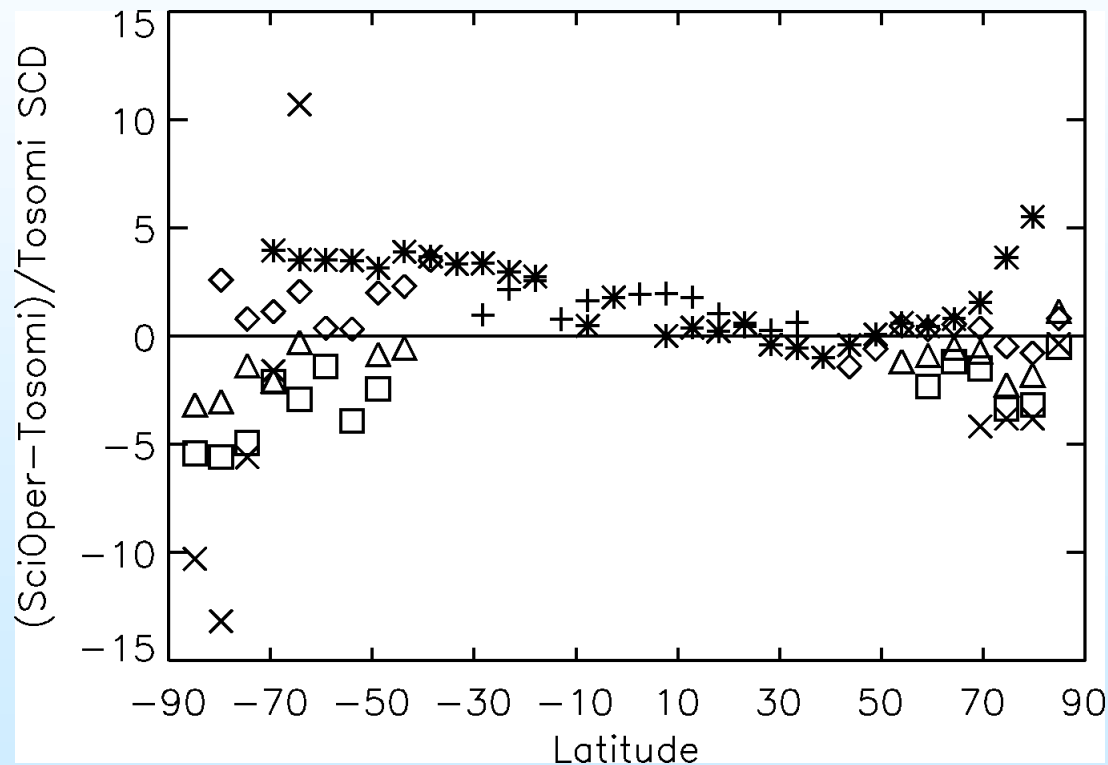
Validation reference states

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

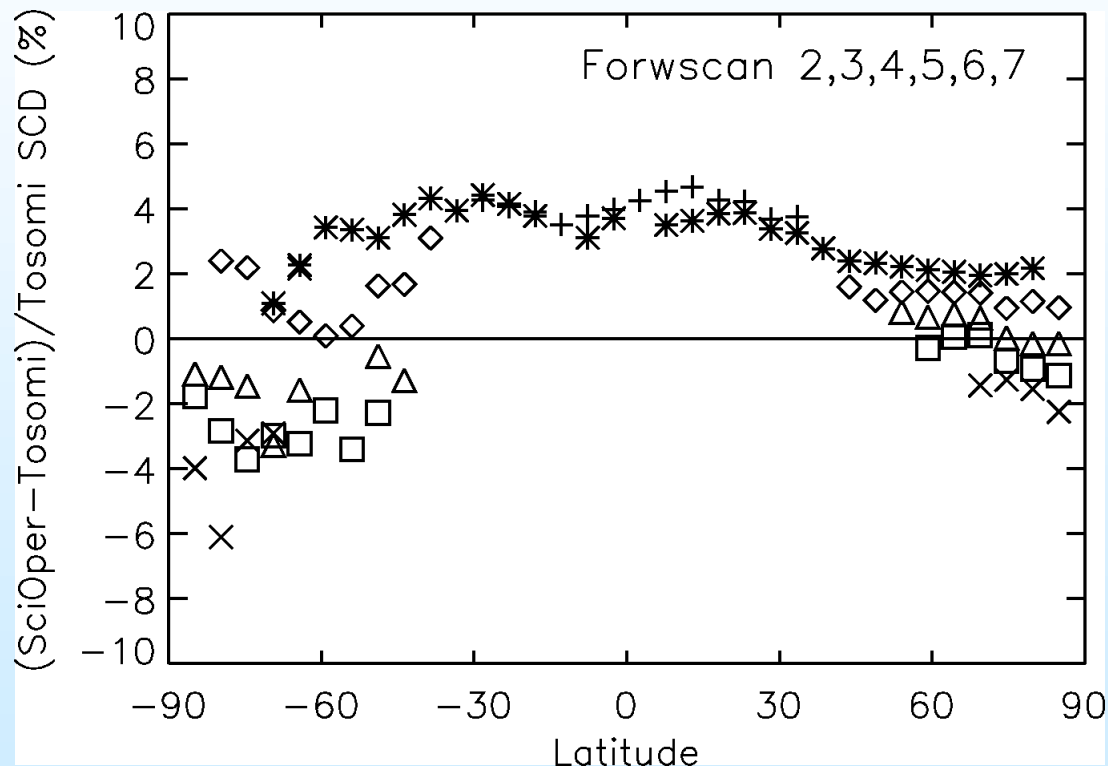
Scia – Tosomi vs latitude Slant column

Validation reference states

State id: 7, 6, 5, 4, 3, 2

Difference in treatment
of rotational Raman
scattering.

Different ozone
cross sections



Scia vs Tosomi

Conclusions:

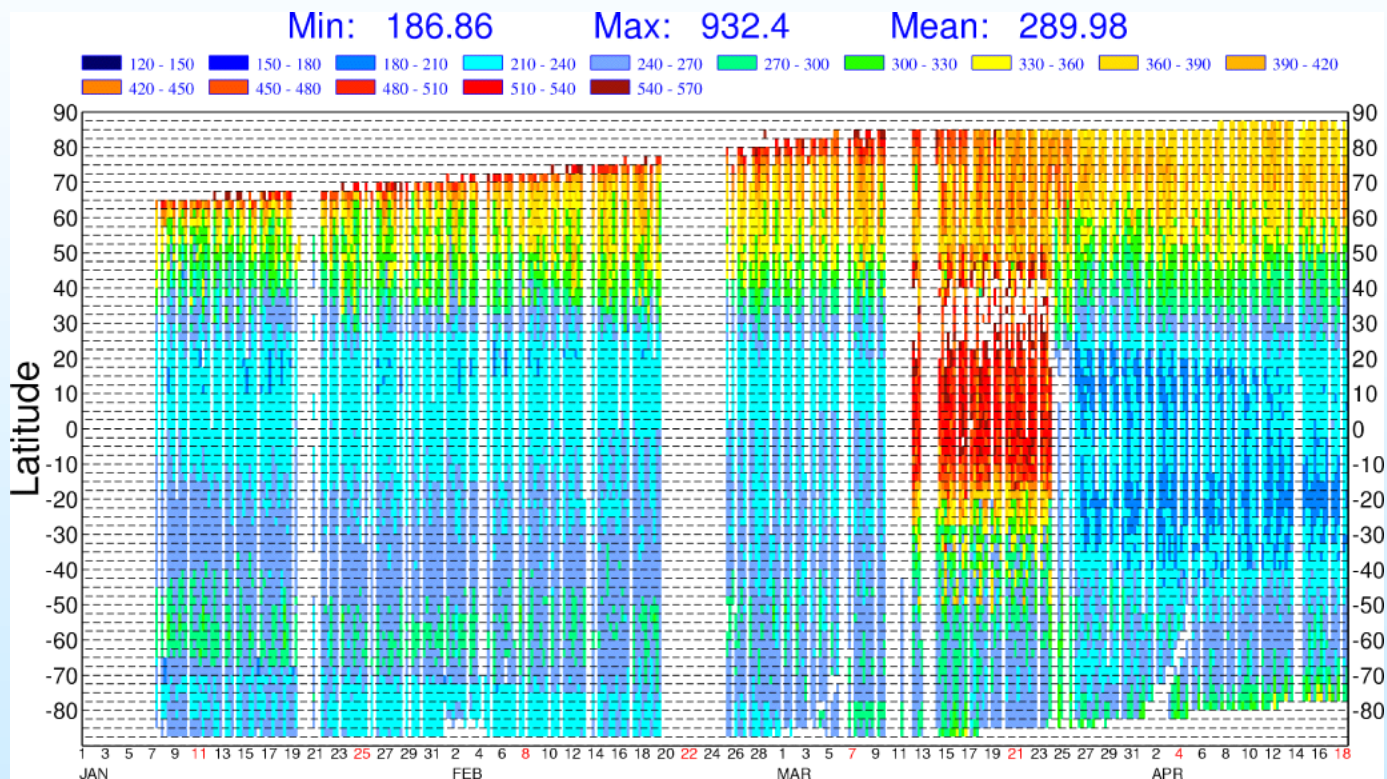
- Good comparison between Scia oper and Tosomi at **low- and mid-latitudes**: latitude dependent bias less than 4% [50S, 50N], overall bias 0.5% (surprising, given differences between algorithms)
- Considerable differences at **high latitudes**, especially south of 60S: bias up to 5% (NH), 10% (SH); 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

Zonal mean SCI_RV__2P data, 1 Jan - 18 Apr 2004



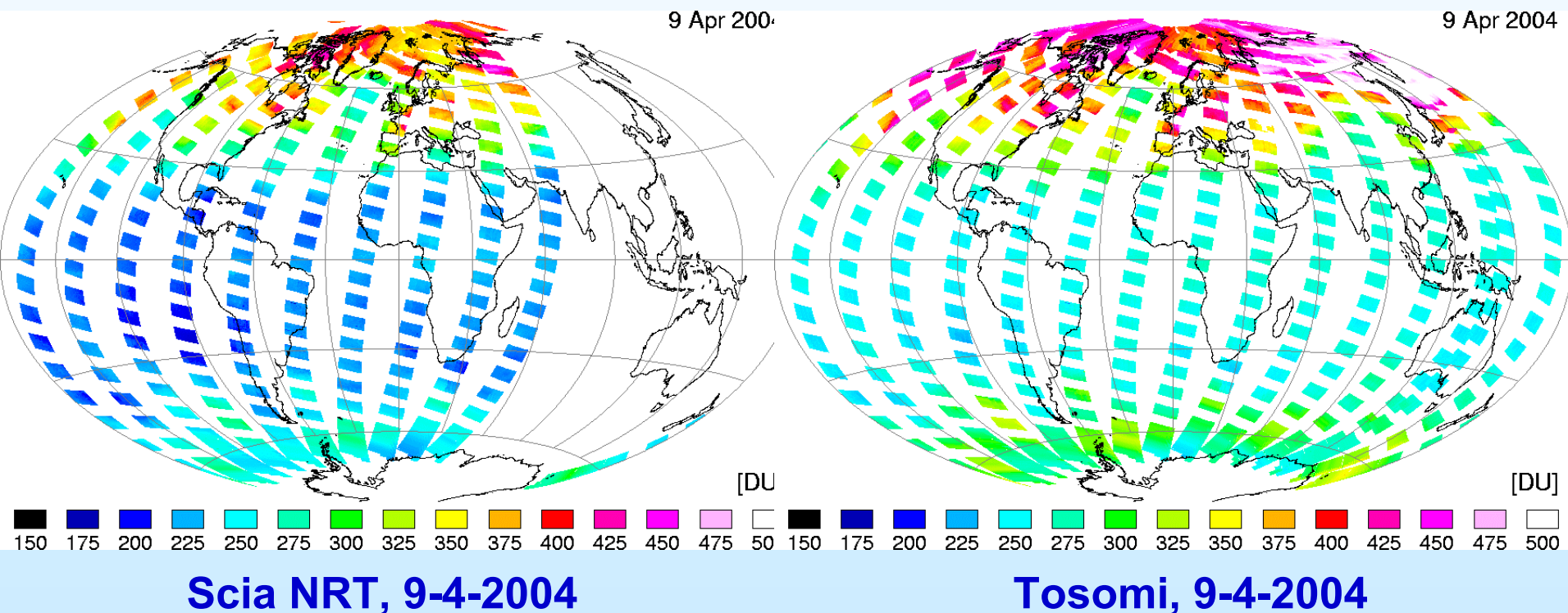
Problems in March 2004:

inadequate leakage current calibration, wrong initialisation file

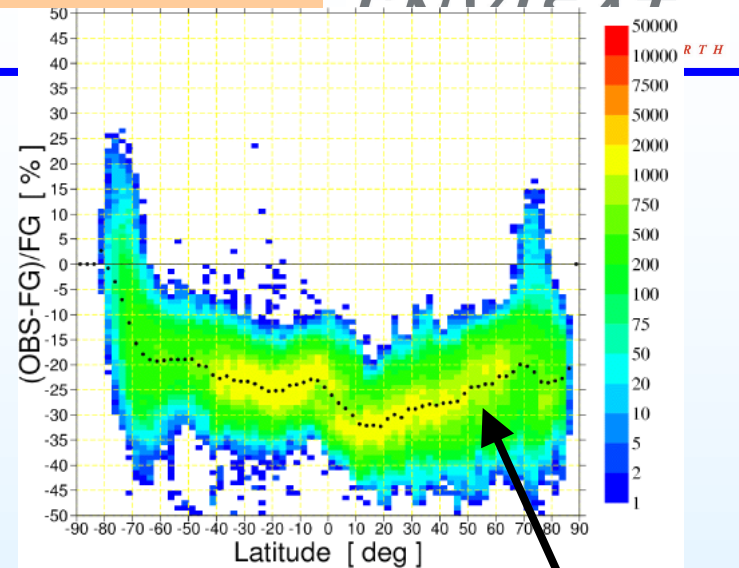
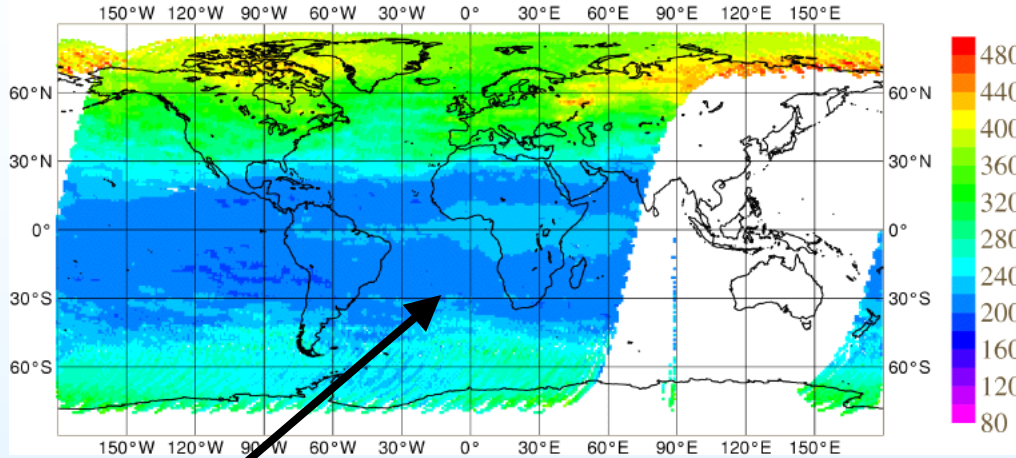
April 2004: Scia NRT vs Tosomi

Scia NRT, Tosomi

Conclusion: Scia NRT shows large neagive bias (40-60DU) in April 2004



Min: 189.53 Max: 490.6 Mean: 262.45

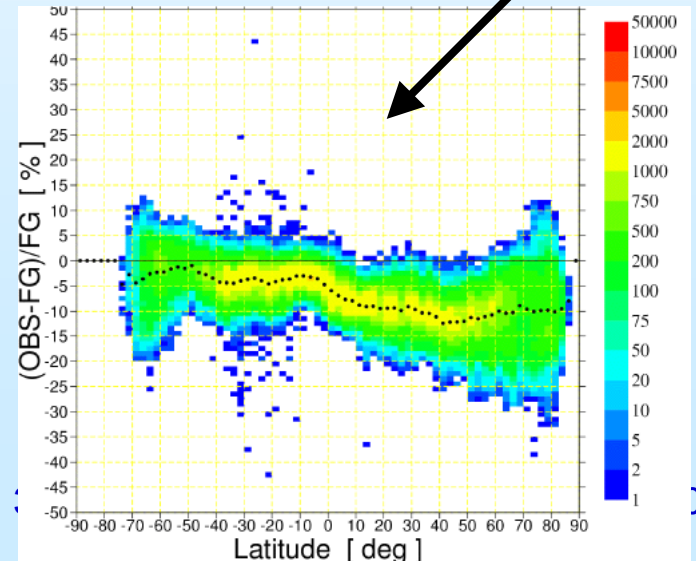
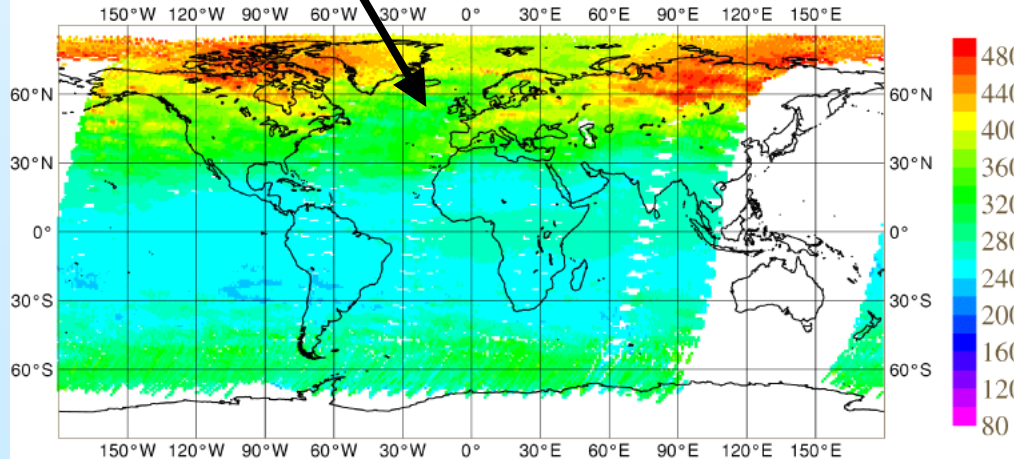


Observations [DU]

KNMI NRT L2 tosomi product

fg-departures [%]

Min: 226.7 Max: 525.5 Mean: 302.37



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 $\pm 1\%$, 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

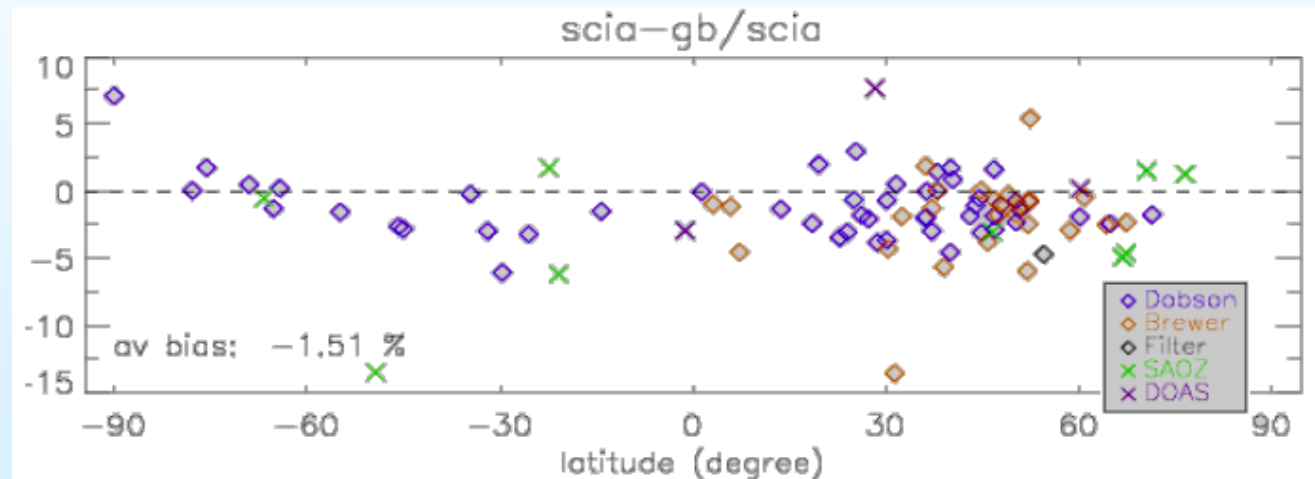
2004 monitoring

- 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:

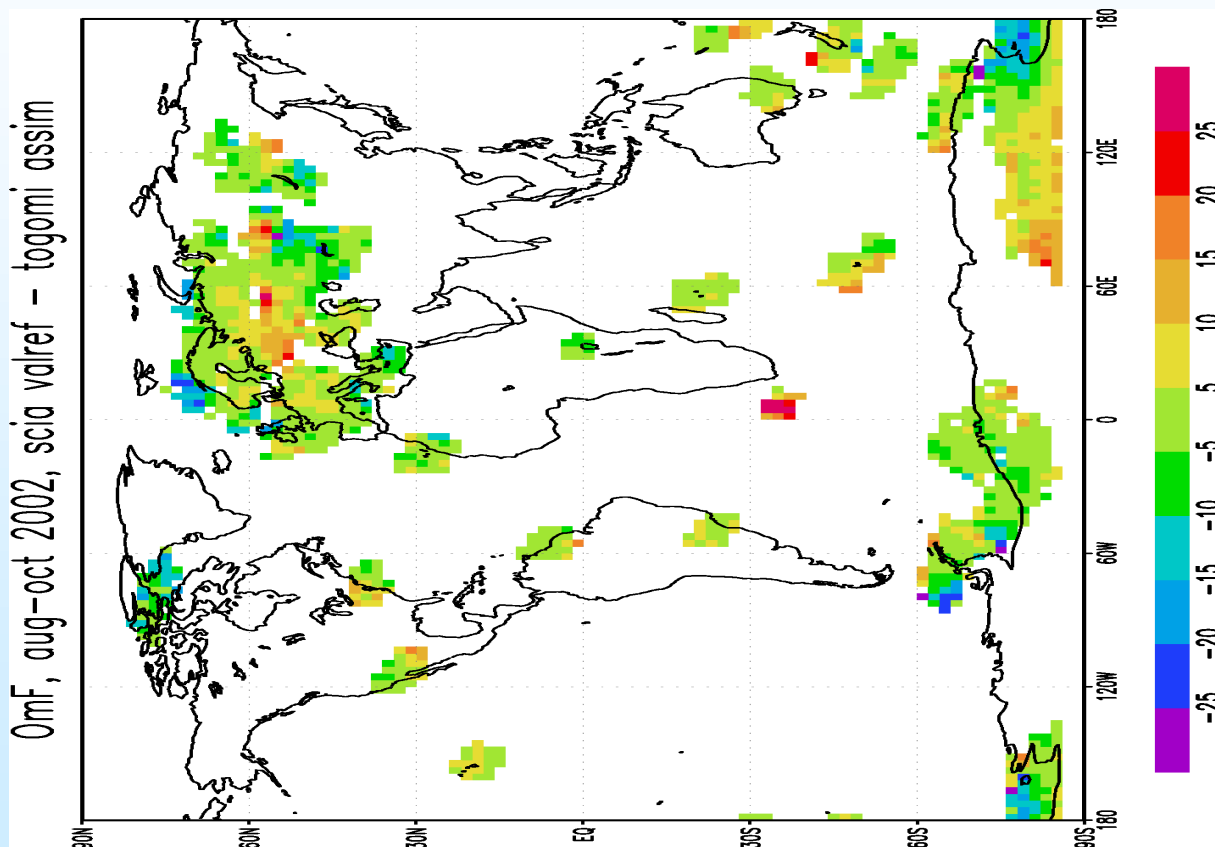
- Tosomi 1.5% lower than ground based
- RMS 4.9%
- No clear geographical location dependence

Scia Operational, Tosomi vs assimilated GOME

OmF

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

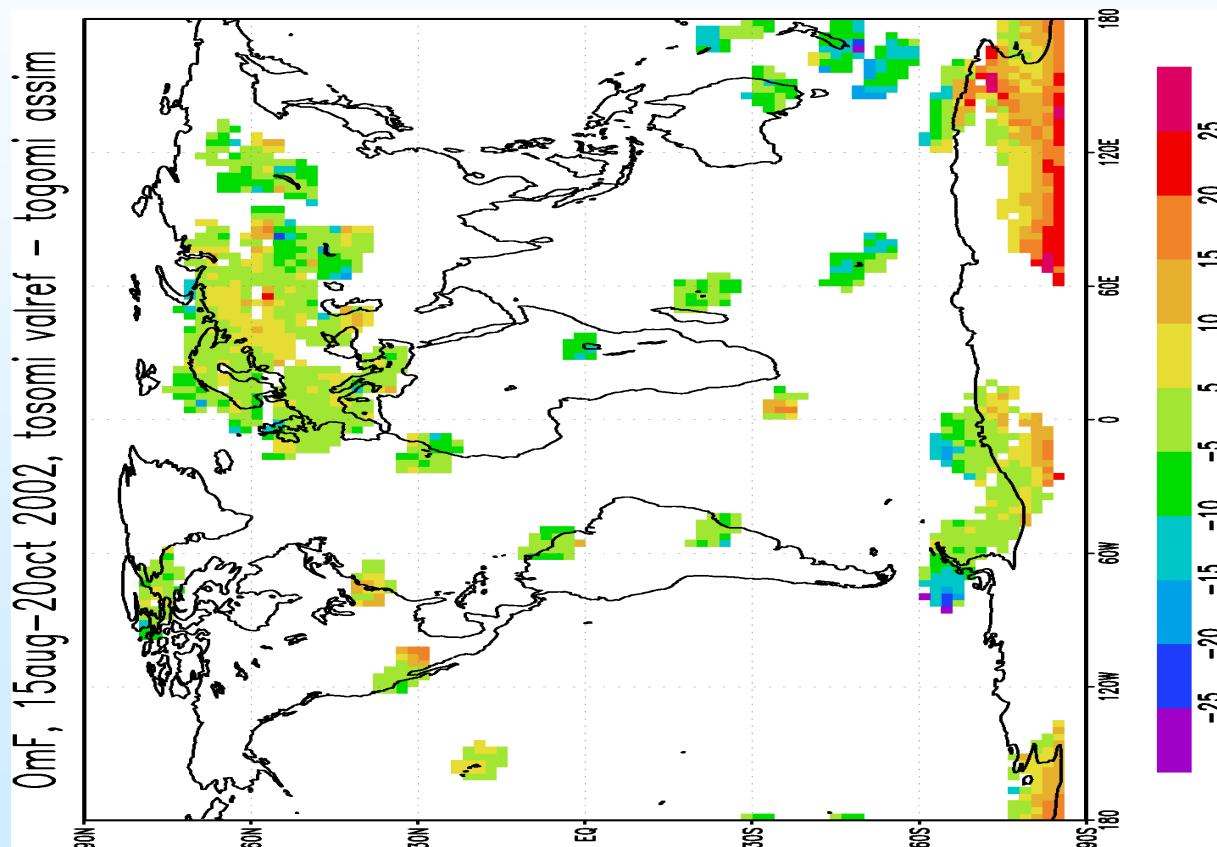
Aug-Oct 2002



Scia, Tosomi vs assimilated GOME

OmF

Tosomi minus
assim GOME
(in Dobson units)

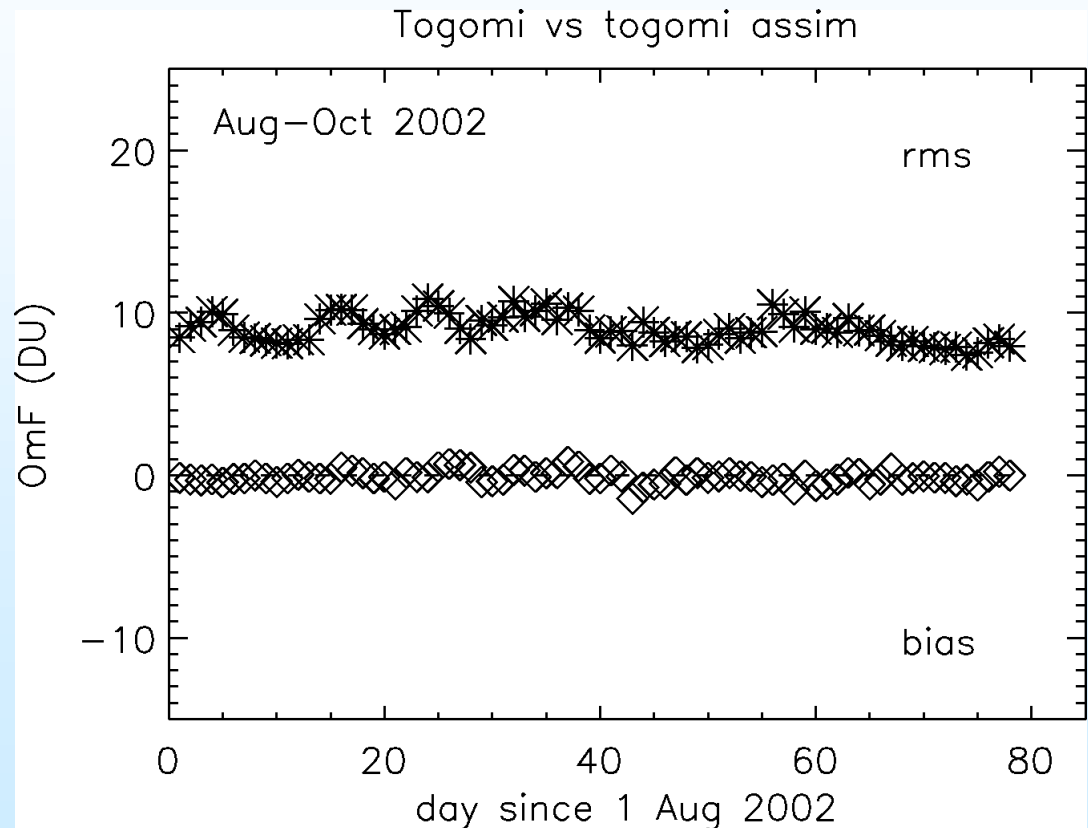


Scia, Tosomi vs assimilated GOME

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

Concl:

- bias 0 %
- rms 3%



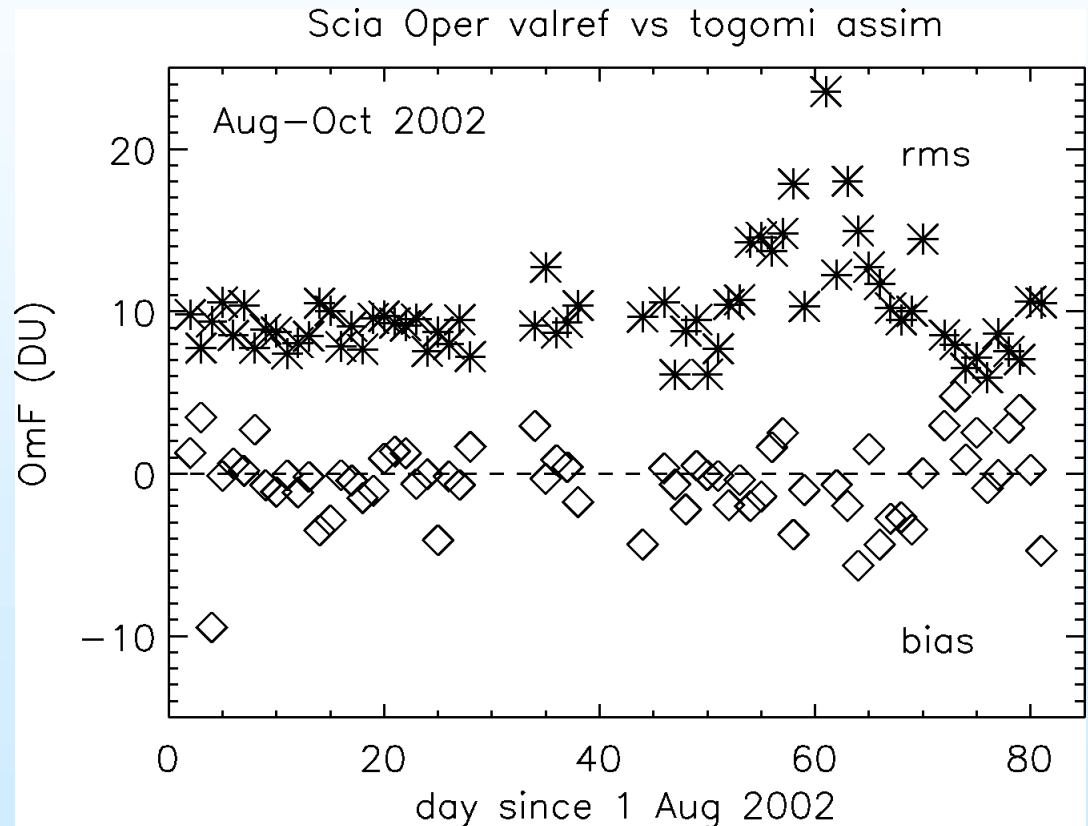
Scia, Tosomi vs assimilated GOME

OmF vs time

Scia oper. minus
assimilated GOME
(in Dobson units)

Concl:

- bias < 1%
- rms 3%



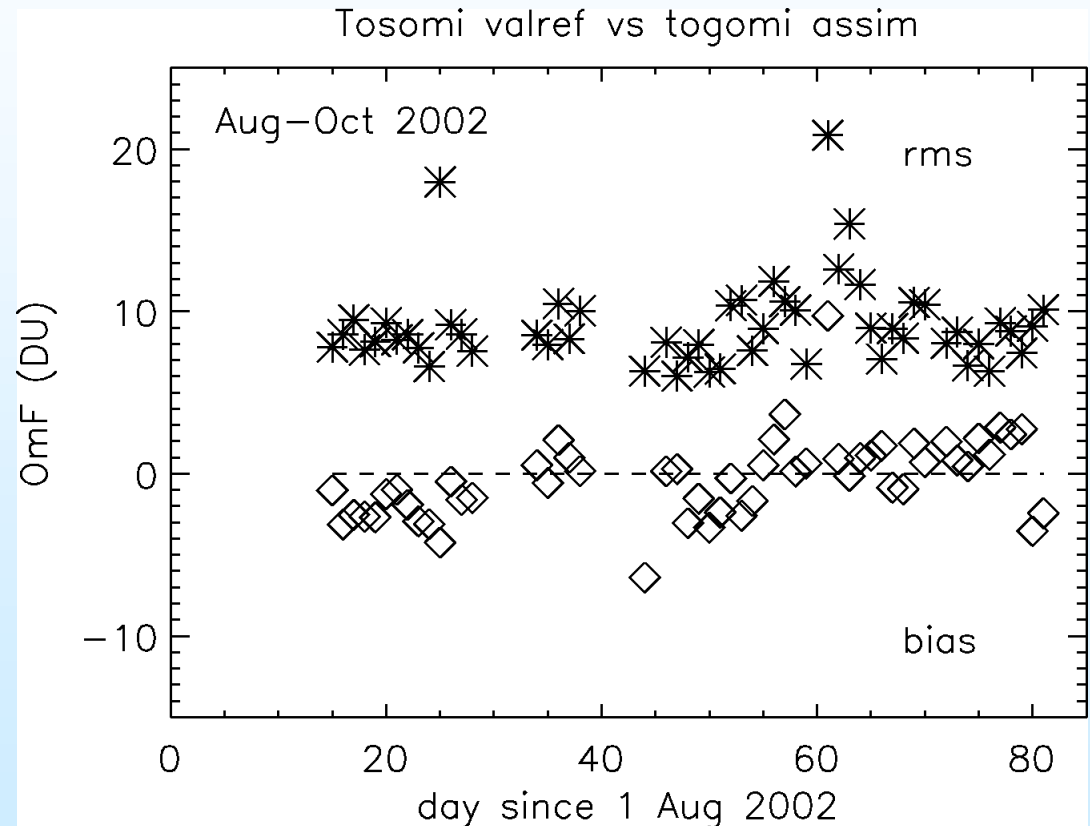
Scia, Tosomi vs assimilated GOME

OmF vs time

Tosomi minus
assimilated GOME
(in Dobson units)

Concl:

- bias < 1%
- rms 3%



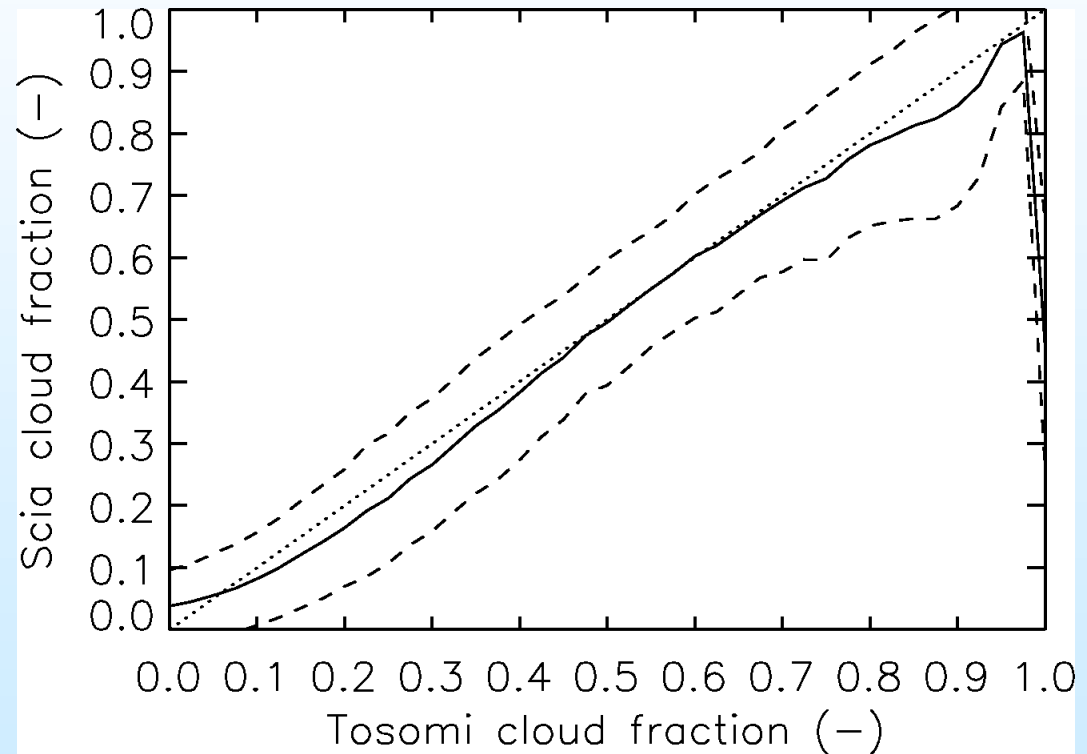
Scia vs Tosomi

Scia – Tosomi cloud fraction

Validation reference states

Conclusion:

Very good agreement
between the two cloud
retrievals, except for
cfr = 1.0



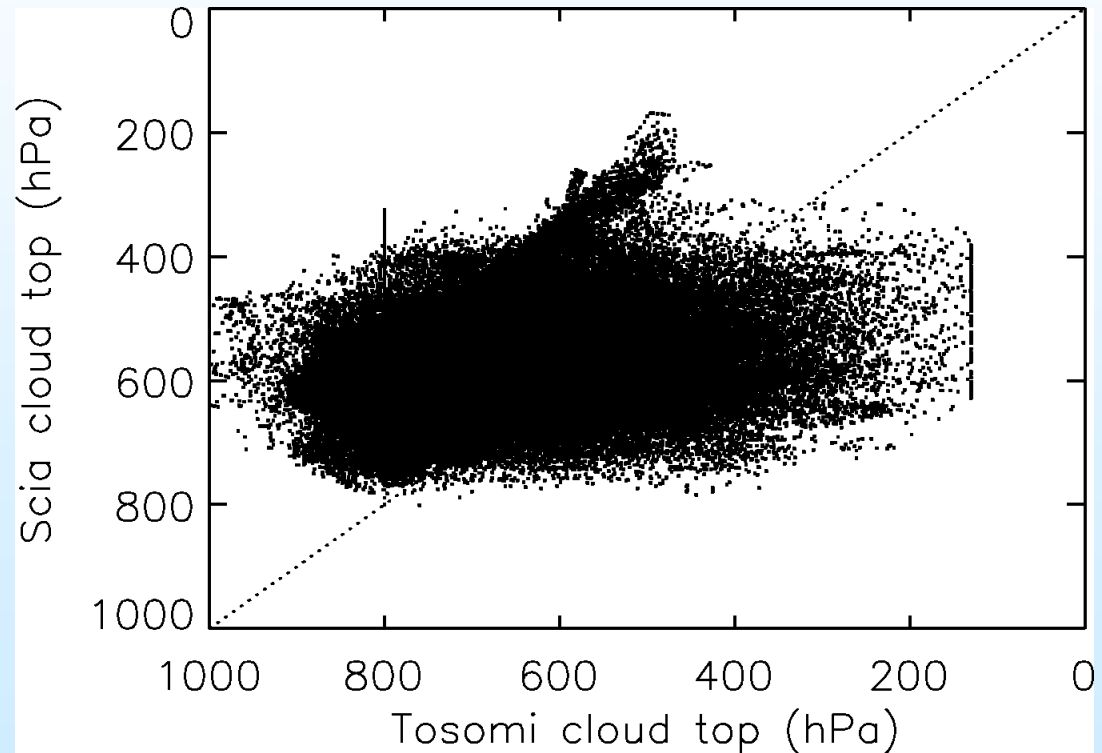
Scia vs Tosomi

Scia – Tosomi
cloud top pressure
Validation reference states

Conclusion:

Agreement OK

- Fresco - cloud pressure retrieval
- OCRA - climatology



Scia vs Tosomi

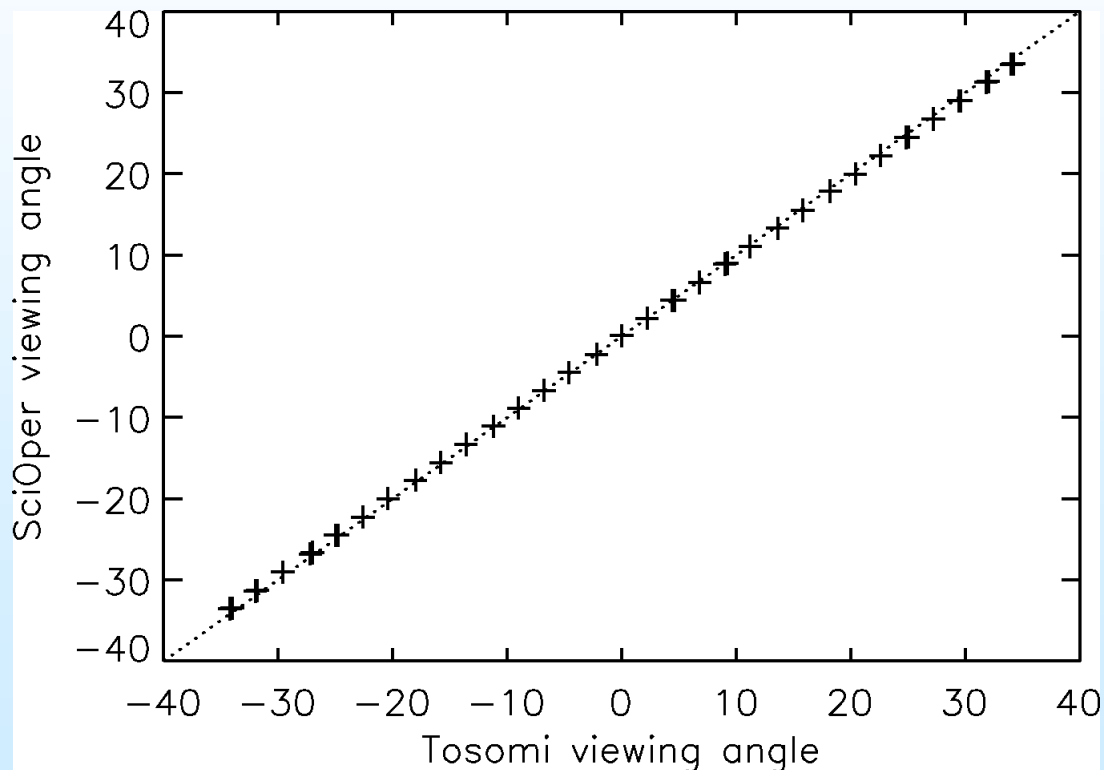
Scia – Tosomi

Viewing angle (TOA)

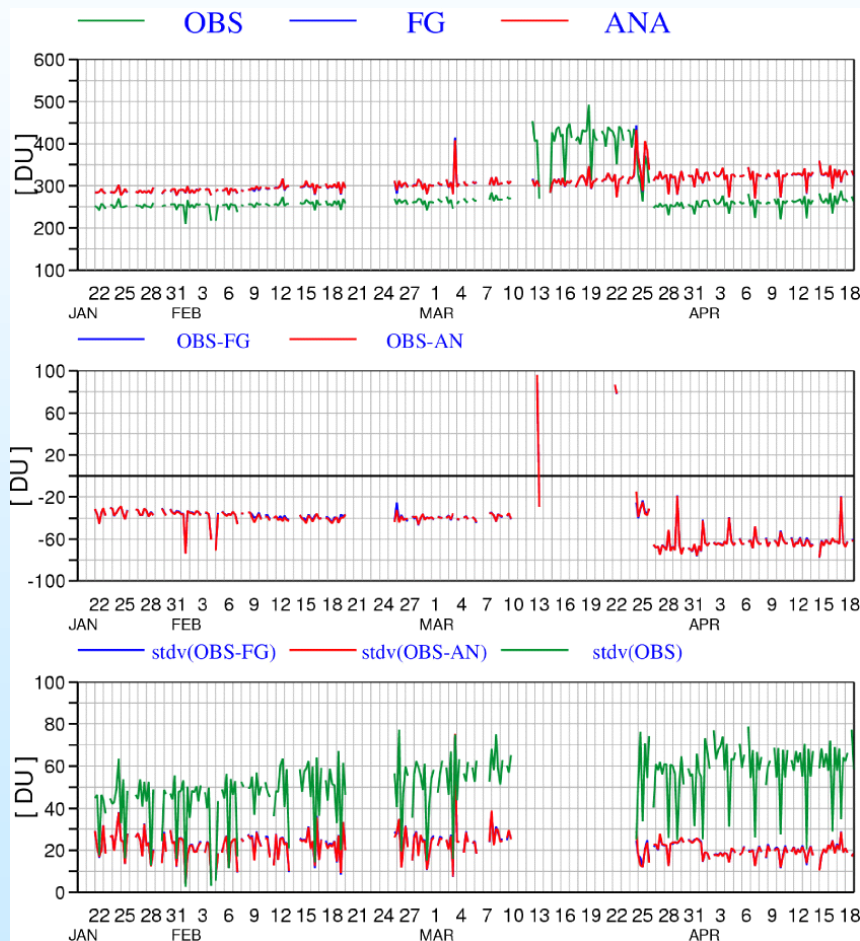
Validation reference states

Conclusion:

There is still a mismatch
that needs to be resolved



Global mean SCI_RV__2P data, 19 Jan - 18 Apr 2004

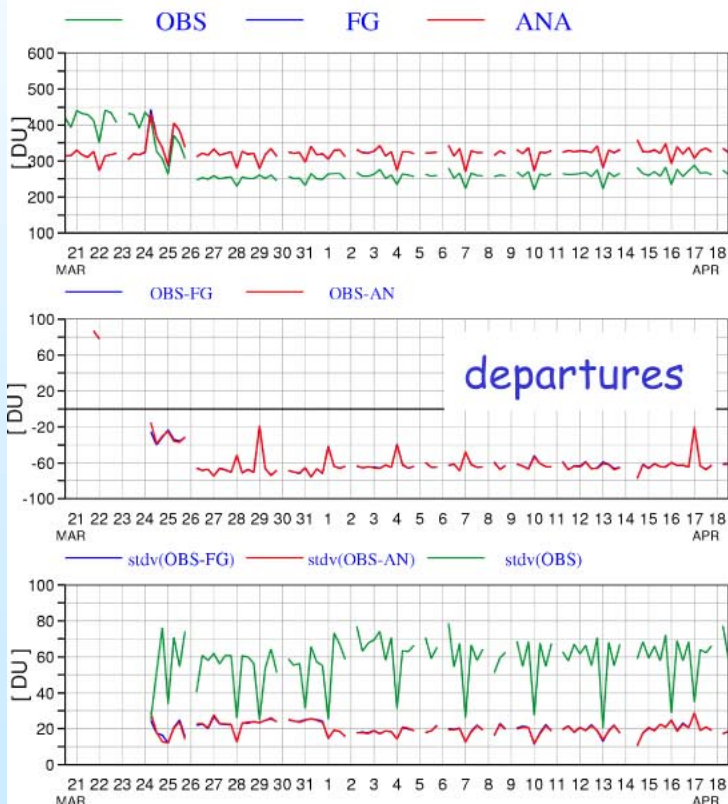


- Negative bias of SCIA data, -30/-60 DU in global mean
- Problems in March 2004: inadequate leakage current calibration, wrong initialisation file
- Further change around 28 March -> worse agreement with ECMWF

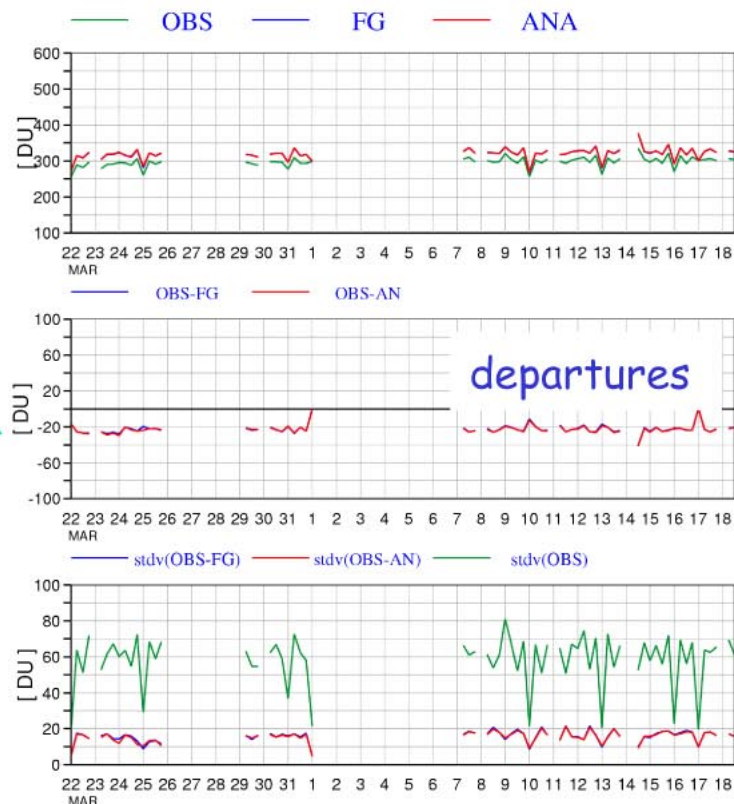
ESA NRT vs. KNMI Tosomi

Timeseries of global means, 21 Mar - 18 Apr 2004

ESA NRT L2 product



KNMI NRT L2 tosomi product



-20DU

-60DU

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)