

Validation of SCIAMACHY trace gas data products by comparison with measurements from other satellite sensors (VIRTIS Level-2: FKZ 50 EE 0025)

Astrid Bracher

L. Amekudzi, K. Bramstedt, J. Meyer, A. Richter, G. Rohen, A. Rozanov, C. v. Savigny, M. Sinnhuber, M. Weber, J. P. Burrows

Institute of Environmental Physics (IUP/IFE), University of Bremen

presented at GSVT Final Presentation at SCIAMACHY Validation Workshop, Bremen, Germany, 7 Dec 2003

Studies within VIRTIS Level-2 project (I)

Tools for determining coincident measurements, incl. dynamical aspects:

Global comparisons of total O₃ of GOME, TOMS, Dobson (Bramstedt et al. ACP 2003)

„ „ of GOME and SAGE II O₃-profiles incl. dynamics (Bracher et al. JGR 2004)

Satellite validation of operational SCIAMACHY O₃ and NO₂ products:

Columns with GOME 3.0 & IUP, TOMS (Bracher et al. Val. WS 2002, ACVE-2 2004;

Hilsenrath et al. ACVE 2004, Lambert et al. ACVE 2004, to be subm. to ACP)

Profiles with HALOE, SAGE-II (Bracher et al. ACVE-2 2004; Brinksma et al. ACVE-2 2004;

von Savigny et al. ACVE-2 2004)

Studies within VIRTIS Level-2 project (II)

Satellite validation of scientific SCIAMACHY IUP-O₃ and NO₂ profiles:

[Stratos. limb NO₂ with HALOE & SAGE](#) (Bracher et al. ACPD 2004; Rozanov et al. ASR subm.)

[Stratos. limb O₃ with HALOE, SAGE, POAM III](#) (Rozanov et al. TOPOZ 2003;
Brinksma et al. ACVE 2004)

[Mesospheric limb O₃ with HALOE](#) (Rohen et al. ASR subm.)

[Solar occultation O₃ & NO₂ with HALOE, SAGE, POAM](#) (Meyer et al. ACP subm.)

[Lunar occultation O₃ & NO₂ with HALOE](#) (Amekudzi et al. ASR subm.)

Cross validation of scientific SCIA-IUP with other ENVISAT O₃ and NO₂ products:

[Stratos. limb O₃- & NO₂ with MIPAS-IMK](#) (Milz et al. AMIL2DA 2003; Bracher et al. ASR subm.)

[Stratos. limb O₃- & NO₂ with GOMOS](#) (Bracher et al. QOS 2004, ENV-SYMP 2004, ASR subm.)

[Stratos. limb O₃- & NO₂ with MIPAS](#) (Bracher et al. QOS 2004, ENV-SYMP 2004)

[Mesospheric limb O₃- & NO₂ with MIPAS](#) (Rohen et al. ASR subm.)

[Lunar occultation O₃ & NO₂ with MIPAS and GOMOS](#) (Amekudzi et al. ASR subm.)

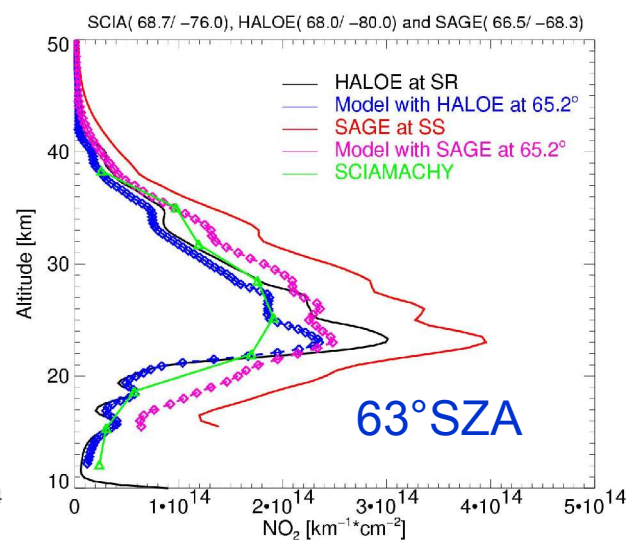
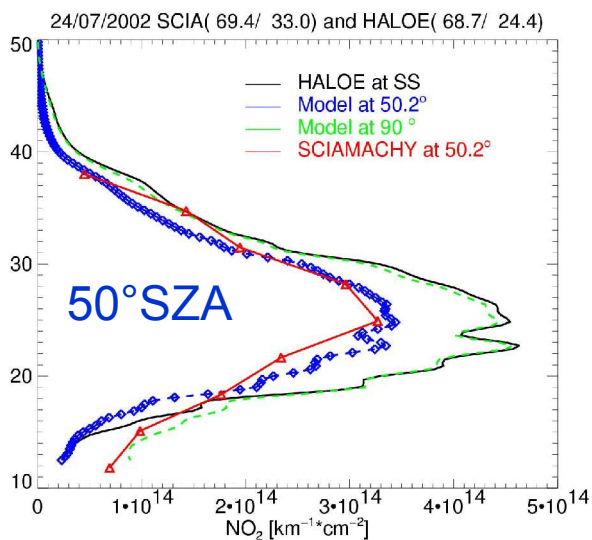
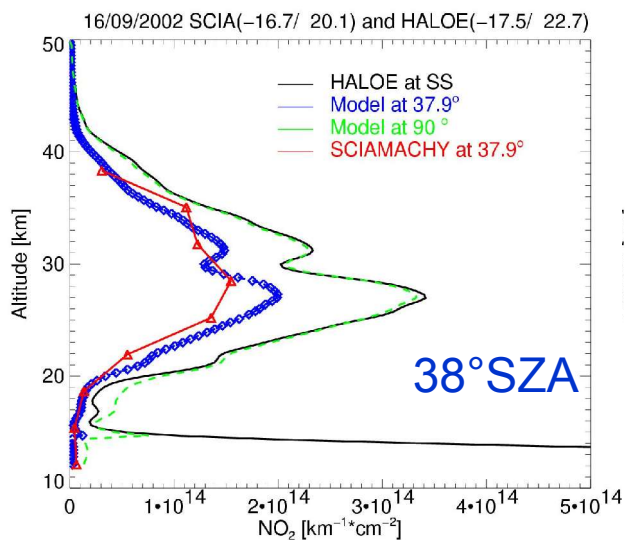
Stratospheric limb NO₂ profiles with HALOE & SAGE

SCIAMACHY NO₂ profiles from Rozanov et al. (2004), HALOE V19, SAGE v6.2

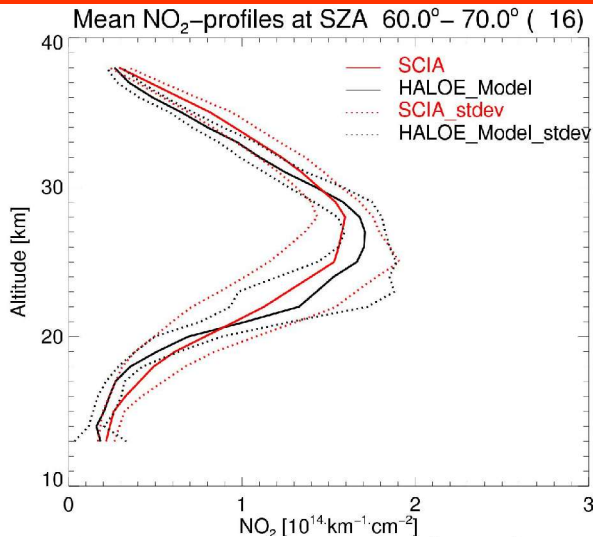
HALOE and SAGE II within 500 km and same day of SCIAMACHY measurement

with HALOE 37 matches for 24.7.-15.10.2002 at SCIA SZA from 30° to <70°:
>60°N (16), 40°N - 60°N (9), tropics/subtropics (3), 40°N - 60°N (3), >60°S (6)

with SAGE II 26 matches for 24.7.-15.10.02 all >60°N and >60° SCIA SZA

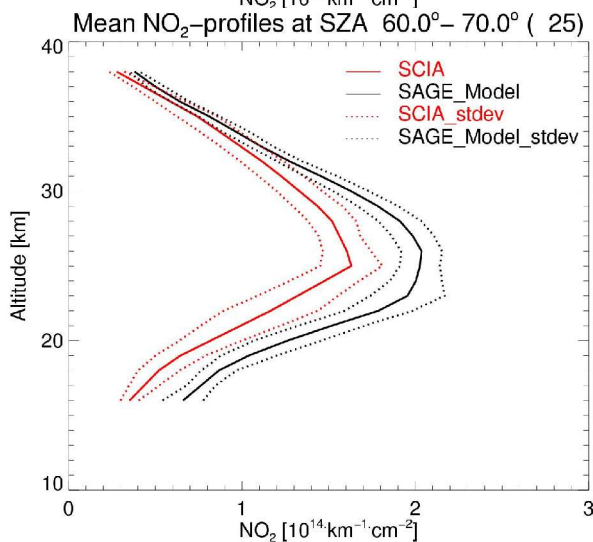
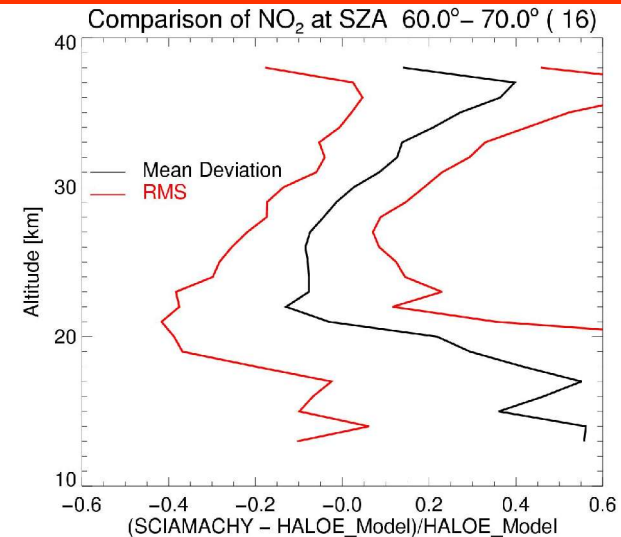


Stratospheric limb NO₂ profiles with HALOE & SAGE

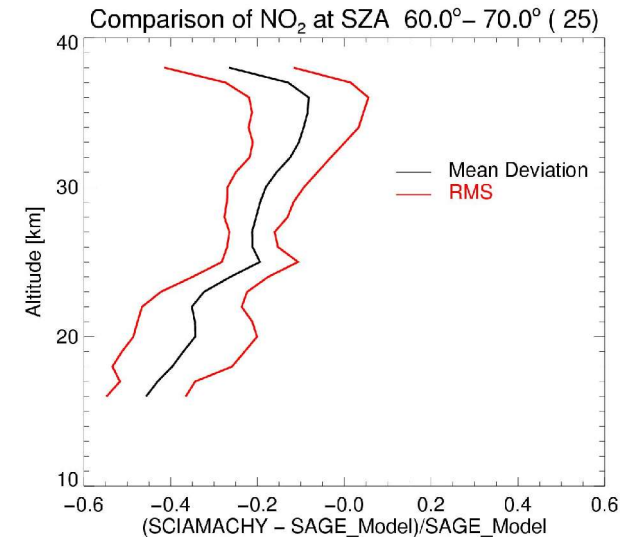


SCIAMACHY NO₂

to HALOE_Model
at 18 – 33 km:
+/- 12% (+/-15 – 30%)

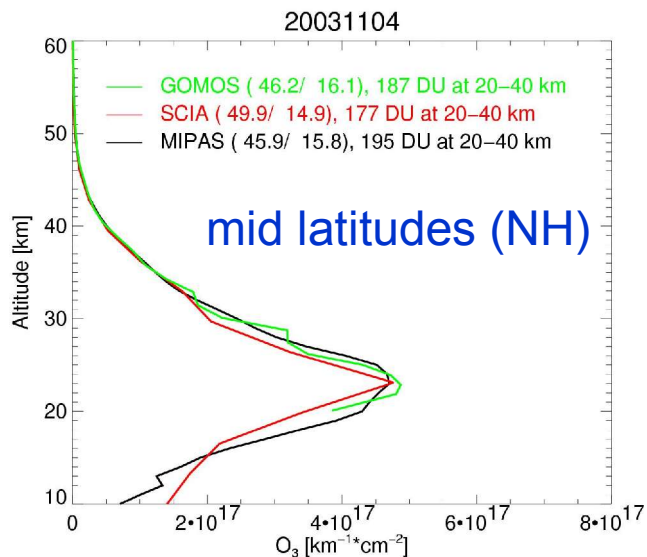


to SAGE_Model
at 15 – 32 km:
-10 – -35% (+/-5 – 14%)
increasing with
decreasing altitude
10 % Bias between
HALOE and SAGE II !
(pers. comm. L. Thomason
, NASA-LaRC)

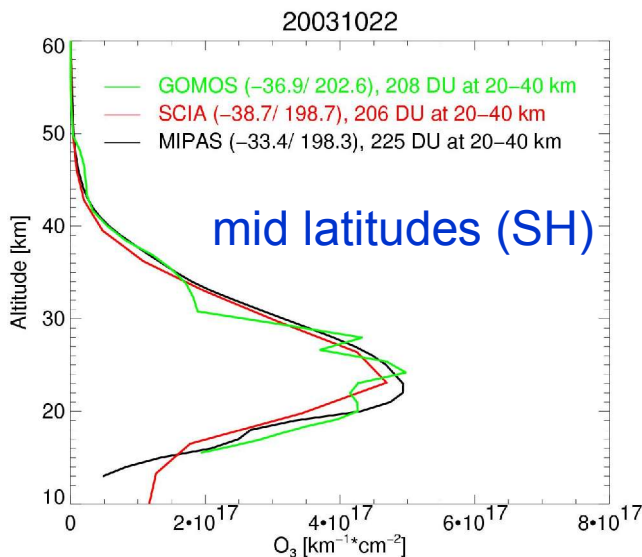


SCIA-IUP, MIPAS-IMK and GOMOS ozone profiles

68 triple collocations in Oct-Nov 2003:57 at 18°S to 44°S and 11 at 40°N to 50°N

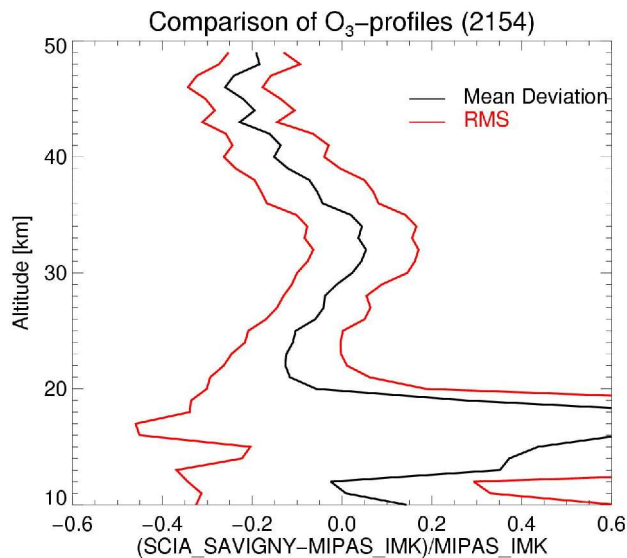


MIPAS_IMK
SCIA_IUP (1.6)
GOMOS_dark (6.0a)

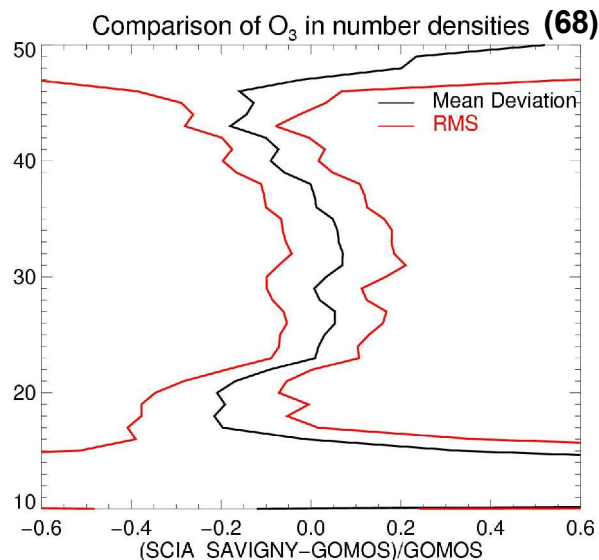


SCIA-IUP, MIPAS-IMK and GOMOS ozone profiles

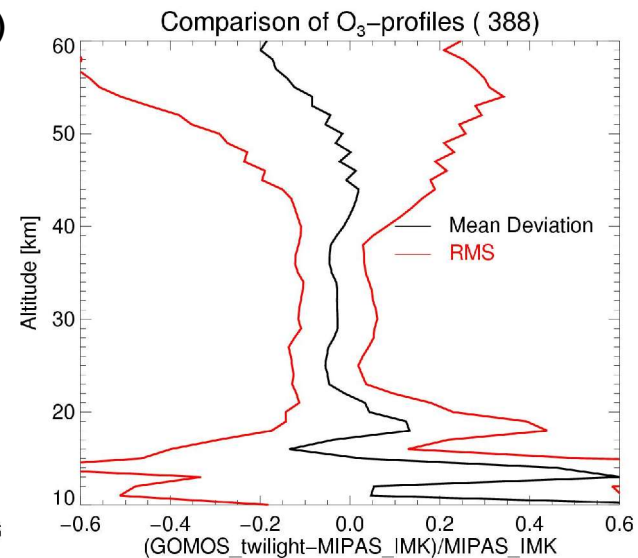
SCIA-MIPAS/MIPAS



SCIA-GOMOS/GOMOS



GOMOS-MIPAS/MIPAS



21-42 km: -12 to +5%
(RMS 10-13%)

22-42 km: +/- 9%
(RMS 9-12%)

21-41 km: 0 to -5%
(RMS 7-11%)

15-40 km subcolumns:
-2% (RMS 9%)

20-40 km subcolumns:
<0.1 (RMS 7%)

20-50 km subcolumns:
-4% (RMS 5%)

Publications published in scientific journals

1. **Bramstedt K., Gleason J., Loyola D., Thomas W., Bracher A., Weber M., Burrows J.P. (2003) Comparison of total ozone from the satellite instruments GOME and TOMS with measurements from the Dobson network 1996-2000. Atmospheric Chemistry and Physics 3: 1409-1419**
2. **Bracher A., Weber M., Bramstedt K., Tellmann S., Burrows J.P. (2004) Long-term global measurements of ozone profiles by GOME validated with SAGE II considering atmospheric dynamics. Journal of Geophysical Research 109: D20308, doi:10.1029/2004JD004677**
3. **Bracher A., Sinnhuber M., Rozanov A., Burrows J.P. (2004) NO₂ Modelling used for the comparison of NO₂ satellite measurements at different solar zenith angles. Atmospheric Chemistry and Physics Discussion 4: 5515-5548 (in revision)**

Publications submitted for publication in scientific journals (I)

1. Amekudzi L.K., Bracher A., Meyer J., Rozanov A., Bovensmann H., Burrows J.P. (2004) Lunar occultation with SCIAMACHY: First retrieval results. *Advances in Space Research*: submitted
2. Bracher A., Bovensmann H., Bramstedt K., Burrows J. P., von Clarmann T., Eichmann K.-U., Fischer H., Funke B., Gil-López S., Glatthor N., Grabowski U., Höpfner M., Kaufmann M., Kellmann S., Kiefer M., Koukouli M. E., Linden A., López-Puertas M., Mengistu Tsidu G., Milz M., Noël S., Rohen G., Rozanov A., Rozanov V.V., von Savigny C., Skupin J., Sinnhuber M., Steck T., Stiller G. P., Wang D.-Y., Weber M., Wuttke M. W. (2004) Cross validation of O₃ and NO₂ profiles measured by the atmospheric ENVISAT instruments GOMOS, MIPAS, and SCIAMACHY. *Advances in Space Research*: submitted
3. Meyer J., Bracher A., Rozanov A., Schlesier A., Bovensmann H., Burrows J.P. (2004) Solar occultation with SCIAMACHY: Algorithm description and first validation. *Atmospheric Chemistry and Physics*: submitted
4. Rohen G. J., von Savigny C., Llewellyn E. J., Kaiser J. W., Eichmann K.-U., Bracher A., Bovensmann H., Burrows J. P. (2004) Upper stratospheric / lower mesospheric ozone retrieved from SCIAMACHY limb spectra: theory, first validation and ozone depletion at the solar proton event in Oct./Nov. 2003. *Advances in Space research*: submitted
5. Rozanov A., Bovensmann H., Bracher A., Hrechany S., Rozanov V., Sinnhuber M., Stroh F., Burrows J.P. (2004) NO₂ and BrO vertical profile retrieval from SCIAMACHY limb measurements: sensitivity studies. *Advances in Space research*: submitted
6. Bracher A., Weber M., Bramstedt K., Coldewey-Egbers M., Lamsal L. N., Burrows J.P. (2004) Global satellite validation of SCIAMACHY ozone columns to GOME WFDOS. *Atmospheric Chemistry and Physics*: to be submitted

Publications in conference proceedings and reports (I)

1. Bracher A., Weber M., Bramstedt K., Richter A., Rozanov A., von Savigny C., von König M., Burrows J.P. (2002) Validation of ENVISAT trace gas data products by comparison with GOME/ERS-2 and other satellite sensors, in: Lacoste H. (ed.) Proceedings of the Envisat Validation Workshop, ESA Publications Division, Noordwijk, The Netherlands, SP-531
2. Bracher A., Bramstedt K., Richter A., Sinnhuber M., Weber M., Burrows J.P. (2004) Validation of GOMOS (GOPR 6.0a) and SCIAMACHY (v5.1/2.1) O₃ and NO₂ products with GOME (v3.0), HALOE (v19) and SAGE II (6.2). In: Danesy D. (ed.), Proceedings of the Second Workshop on the Atmospheric Chemistry Validation of ENVISAT (ACVE-2), 3-7 May 2004, ESA ESRIN, Frascati, Italy, ESA Publications Division, Noordwijk, The Netherlands, SP-562: 397-405
3. Brinksma E. J., PETERS A., Boyd I. S., Parrish A., Bracher A., von Savigny C., Bramstedt K., Sinnhuber M., et al. (2004) SCIAMACHY Ozone Profile Validation. In: Danesy D. (ed.), Proceedings of the Second Workshop on the Atmospheric Chemistry Validation of ENVISAT (ACVE-2), 3-7 May 2004, ESA ESRIN, Frascati, Italy, ESA Publications Division, Noordwijk, The Netherlands, SP-562: 124-134
4. Hilsenrath E., Bojkov B., Labow G., Bracher A. (2004) SCIAMACHY Column Ozone Validation. In: Danesy D. (ed.), Proceedings of the Second Workshop on the Atmospheric Chemistry Validation of ENVISAT (ACVE-2), 3-7 May 2004, ESA ESRIN, Frascati, Italy, ESA Publications Division, Noordwijk, The Netherlands, SP-562: 47-50
5. Lambert J.-C., Granville J., Blumenstock T., Boersma F., Bracher A., De Maziere M., et al. (2004) Geophysical validation of SCIAMACHY NO₂ vertical columns: overview of early 2004 results. In: Danesy D. (ed.), Proceedings of the Second Workshop on the Atmospheric Chemistry Validation of ENVISAT (ACVE-2), 3-7 May 2004, ESA ESRIN, Frascati, Italy, ESA Publications Division, Noordwijk, The Netherlands, SP-562: 59-71

Publications in conference proceedings and reports (II)

1. Milz M., Bracher A., von Savigny C., Rozanov A., Funke B., Glatthor N., Gil S., Bovensmann H., Schwarz G. (2003) Inter-Envisat comparison MIPAS-SCIAMACHY. In: Deliverable 71 of EU project “Advanced MIPAS level 2 data analysis (AMIL2DA)” (project no. EV61-CT-1999-00015)
2. Milz M., Bracher A., von Savigny C., Rozanov A., Funke B., Glatthor N., Gil S., Bovensmann H., Schwarz G. (2003) Comparison to SCIAMACHY data, WP 5620 in: Final Report of EU project “Advanced MIPAS level 2 data analysis (AMIL2DA)” (project no. EV61-CT-1999-00015)
3. von Savigny C., Bracher A., Bramstedt K., Rozanov A., Sinnhuber M., Sioris C., Butz A., Dorf M., Pfeilsticker K., Grunow K., Goutail F., Pommereau J.-P., Hurrett N. (2004) SCIAMACHY limb NO₂ profile validation. In: Danesy D. (ed.), Proceedings of the Second Workshop on the Atmospheric Chemistry Validation of ENVISAT (ACVE-2), 3-7 May 2004, ESA ESRIN, Frascati, Italy, ESA Publications Division, Noordwijk, The Netherlands, SP-562: 135-142
4. Weber M., Bracher A., Noel S., Skupin J., Burrows J. P. (2001) Validation of SCIAMACHY in-flight measured irradiances, radiances and selected ENVISAT trace gas products by comparison with measurements from independent satellite instruments. In: esa-ACVE (Hrsg.) Pre-launch Workshop on the Atmospheric Chemistry Validation of ENVISAT (ACVE) 16-18 May 2001, WPP 186: 155-159

ACKNOWLEDGEMENTS

DLR & ESA/ESRIN for GOME and SCIAMACHY Iv 1 & Iv 2 data

HALOE group at NASA LaRC

SAGE II group at NASA LaRC

For Funding:

DLR-Bonn (contract No. 50 EE0025)