

SCIAMACHY NO₂ Column Validation

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Contributors

Analysis

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Special Thanks

P. Gerard and T. Jacobs

Correlative Data Acquisition

Analysis teams +

BAS, UK
CAO, Russia
CNRS/SA, France
DMI, Denmark
FHG, Germany
FMI/Sodankylä, Finland
IAP, Russia
IUP/Heidelberg, Germany
KNMI, The Netherlands
KSNU, Kyrgyzstan

MSC, Canada
NIWA, New Zealand
U. Chalmers, Sweden
U. Denver, CO
U. Liège, Belgium
U. Réunion, France
U. Sao Paulo, Brazil
U. Toronto, Canada
U. Wales, UK
U. Wollongong, Australia

SCIAMACHY and GOME Data Processing

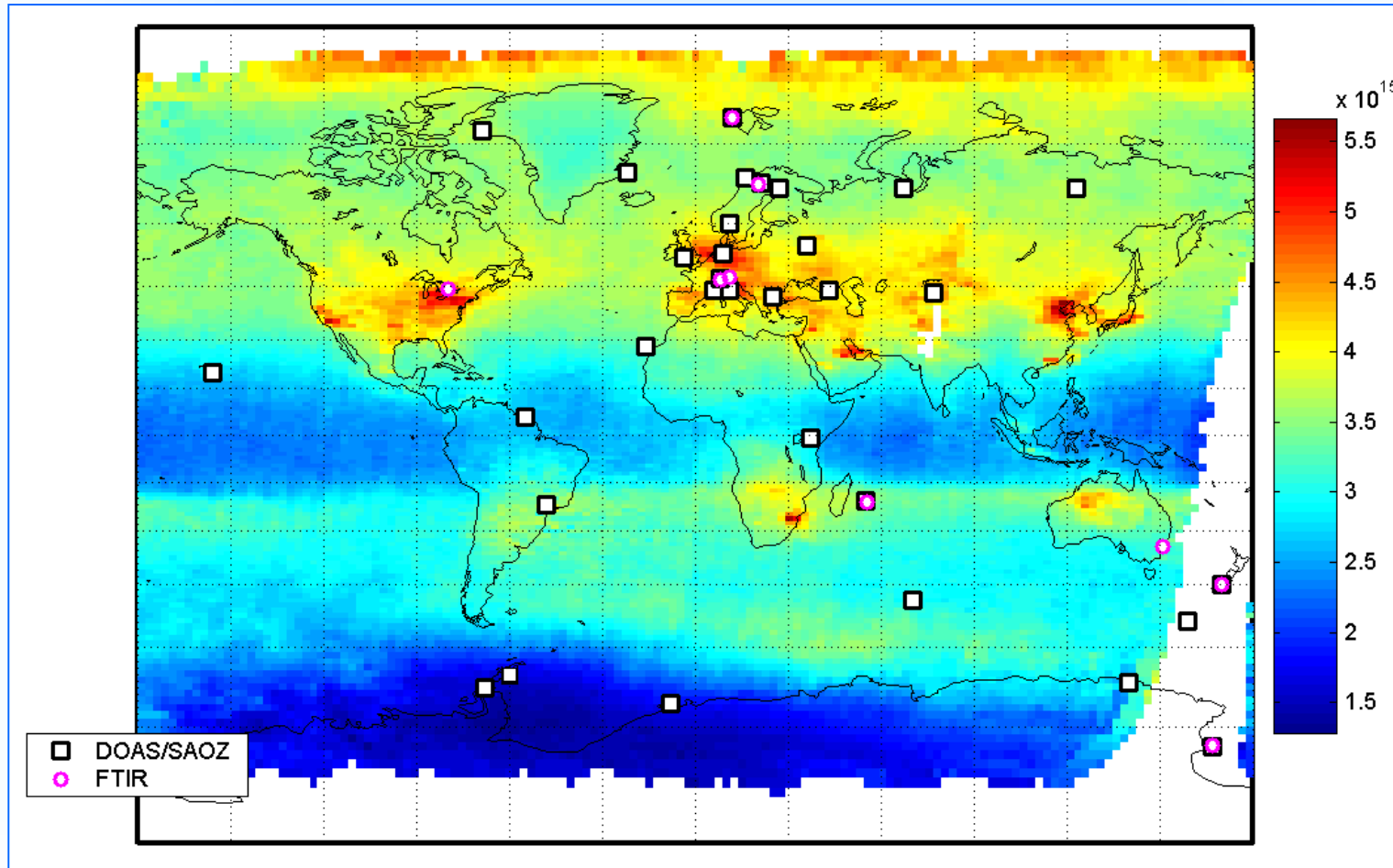
Operational Processing Teams at ESA and DLR
F. Boersma and H. Eskes, KNMI, The Netherlands
I. De Smedt and M. Van Roozendael, BIRA-IASB, Belgium
A. Richter, IUP/Bremen, Germany
C. Sioris, SAO, USA

Outline

1. Correlative data
 - NDSC/UVVIS, NDSC/FTIR, ERS-2 GOME
 - Methodology
2. Operational NRT product
 - GB comparisons
 - SCIA/GOME comparisons
3. Non operational products
 - IUP, BIRA-IASB, KNMI, SAO
4. Conclusion and outlook



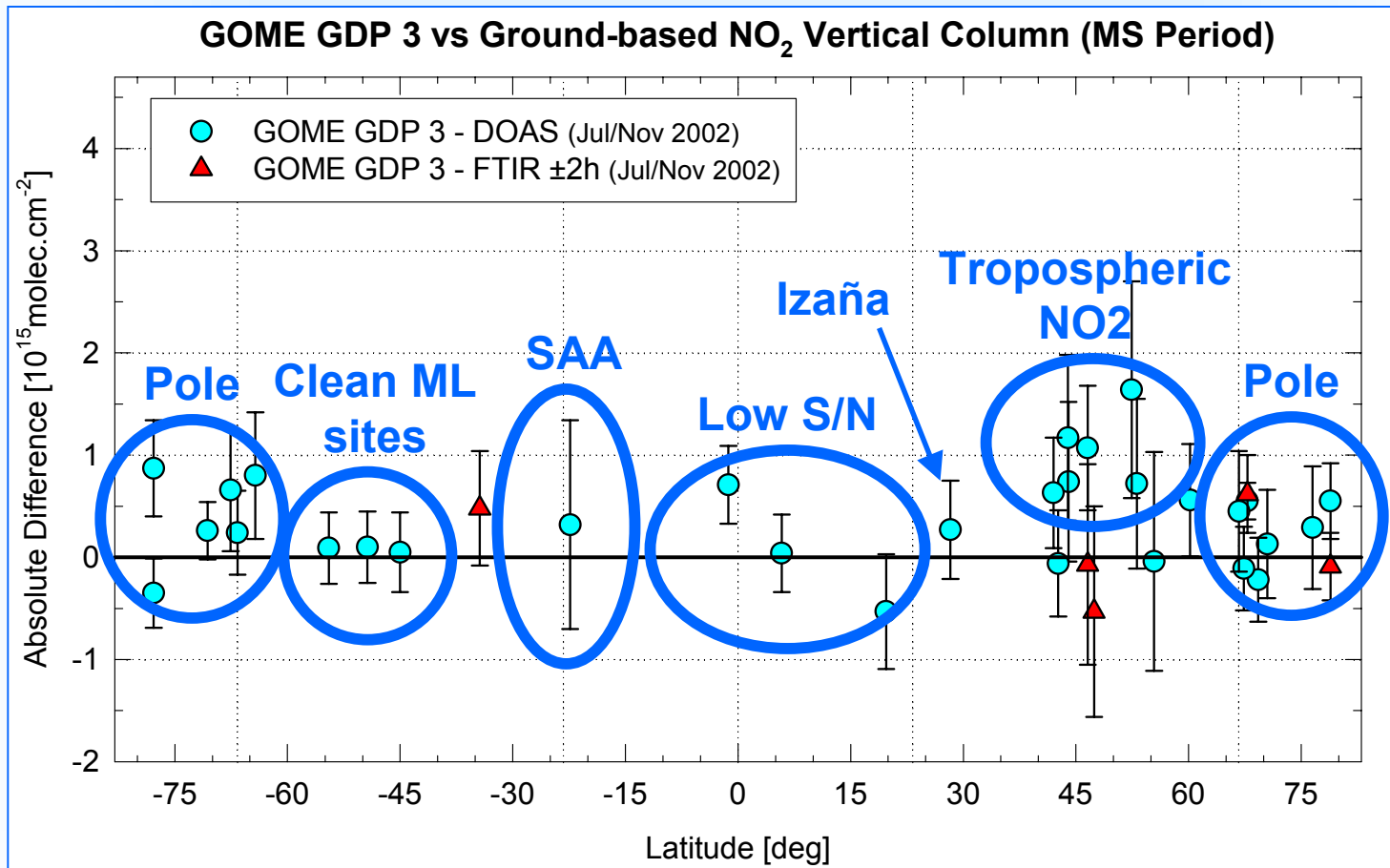
Contributing Ground-based Sensors



Methodology for GB Comparisons

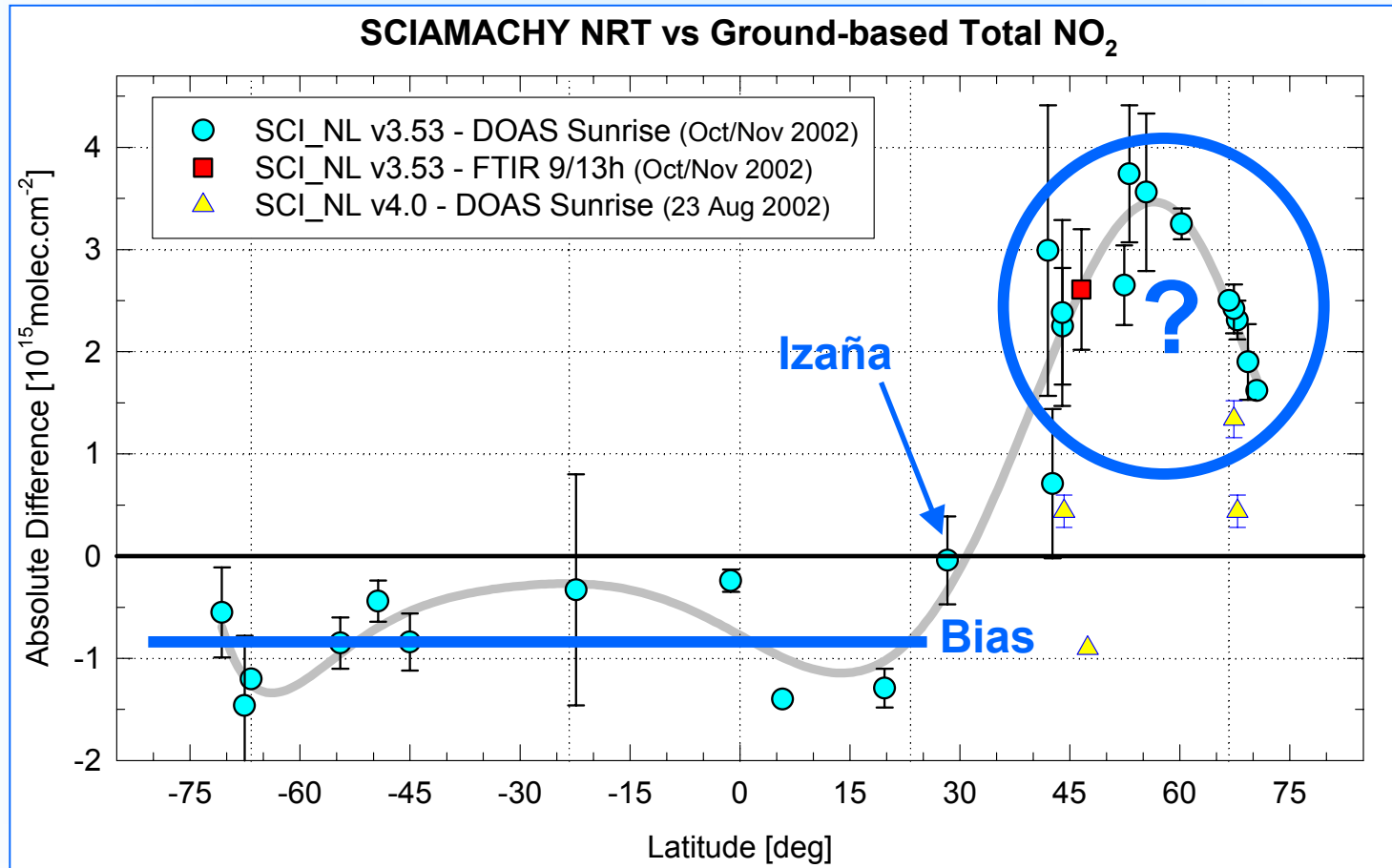
- Qualitative and quantitative studies
- Space criteria: SCIA pixels selected to match effective GB air mass (ray tracing)
- Date criteria: day of the SCIA measurement
- Diurnal cycle:
 - PSCBOX/SLIMCAT modelling
 - Low and middle latitudes: SCIA vs. GB sunrise
 - Polar day: NO/NO₂ equilibrium adjustment
- Sensitivity to tropospheric NO₂

GOME GDP v3 (SCIA MS period)



J-C. Lambert and J. Granville, BIRA-IASB

OPERATIONAL NRT v3.53 (reminder)



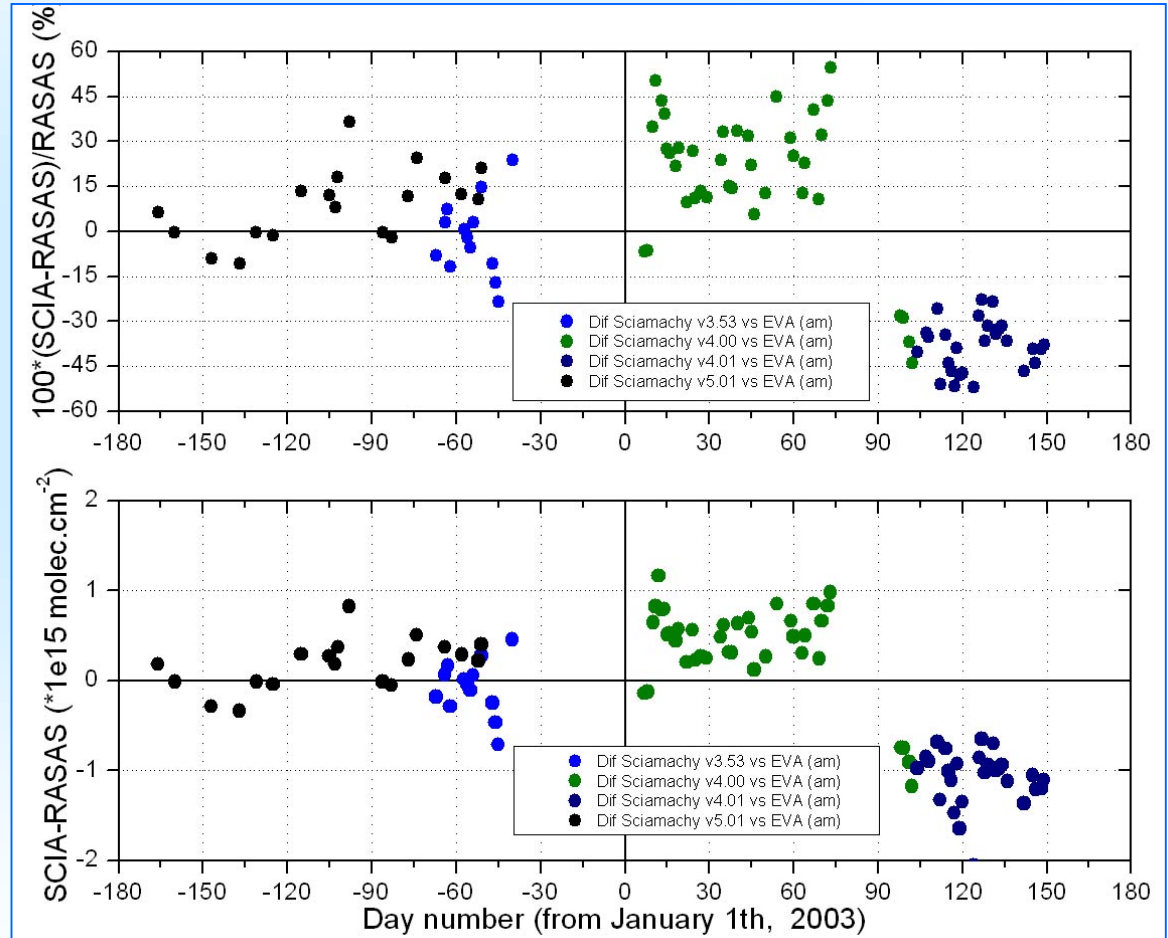
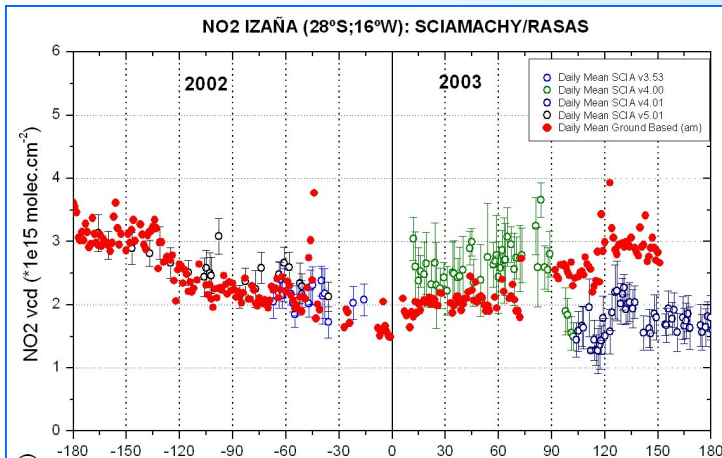
Lambert et al., ESA SP 531, 2003



SCIAMACHY Processor Changes at Izaña

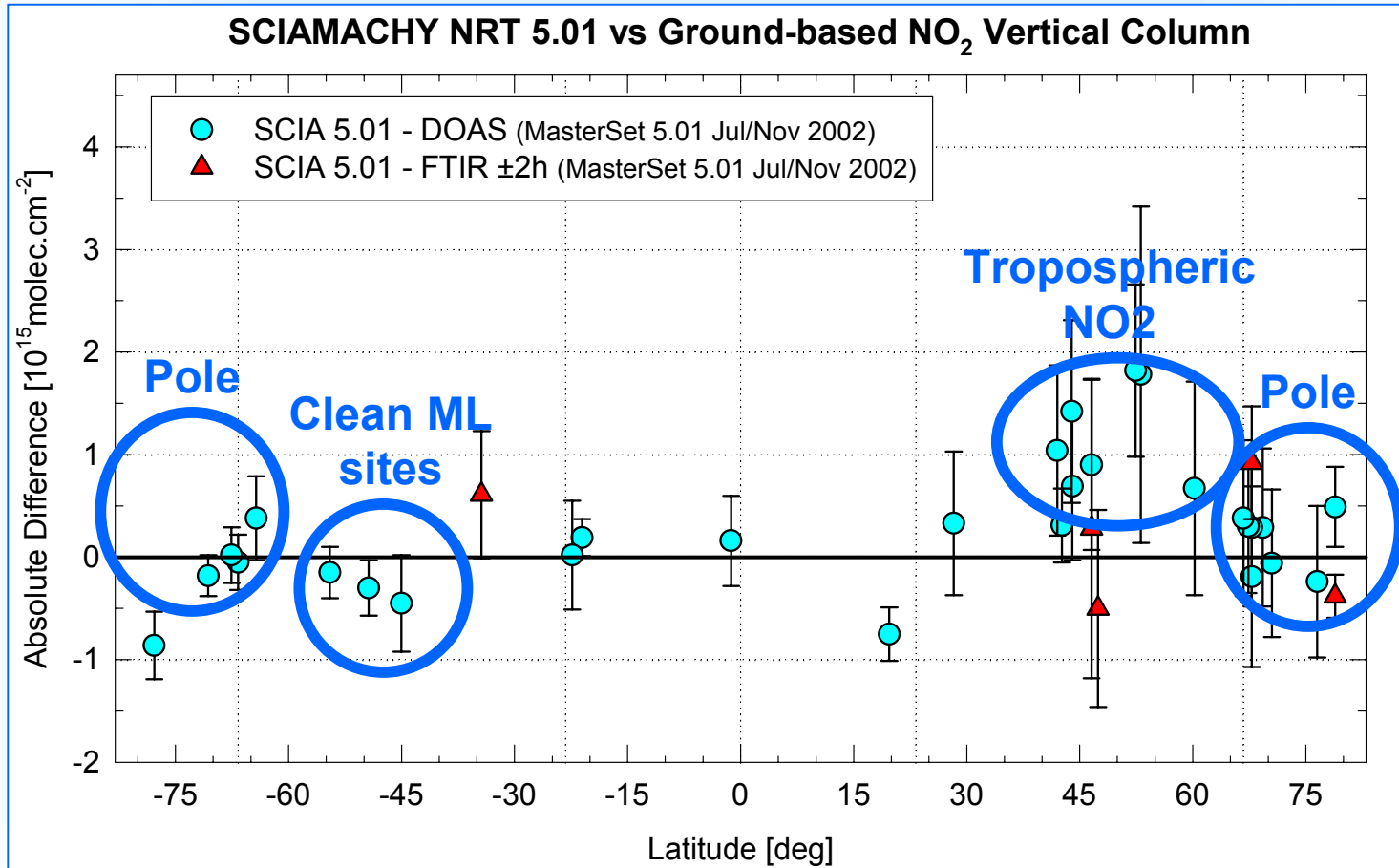
SCIA versions

- 3.53: OK
- 4.00: too high
- 4.01: too low
- 5.01: OK



Courtesy M. Navarro Comas and M. Gil, INTA

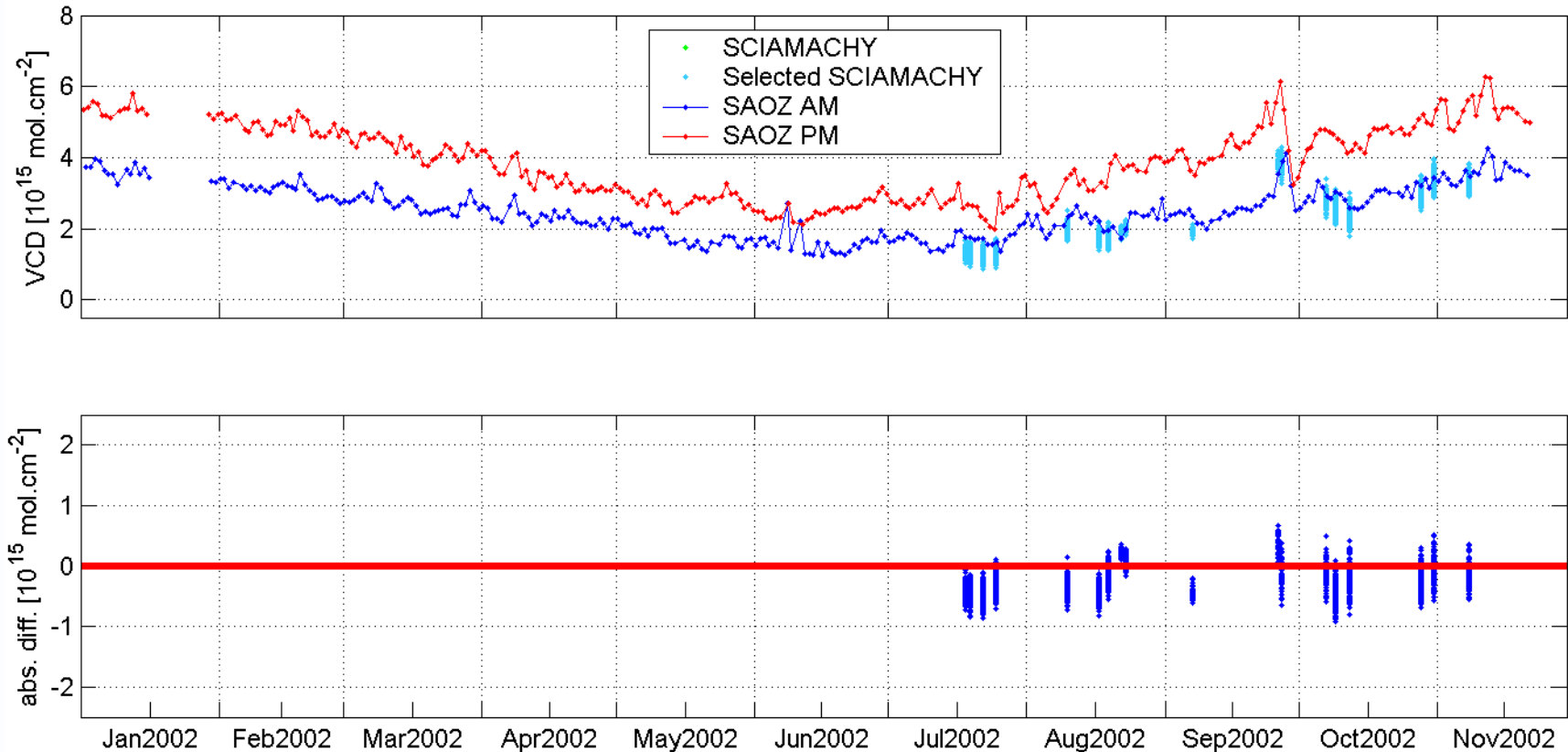
OPERATIONAL NRT v5.01: Global View



J-C. Lambert and J. Granville, BIRA-IASB

OPERATIONAL NRT v5.01: Clean SH ML

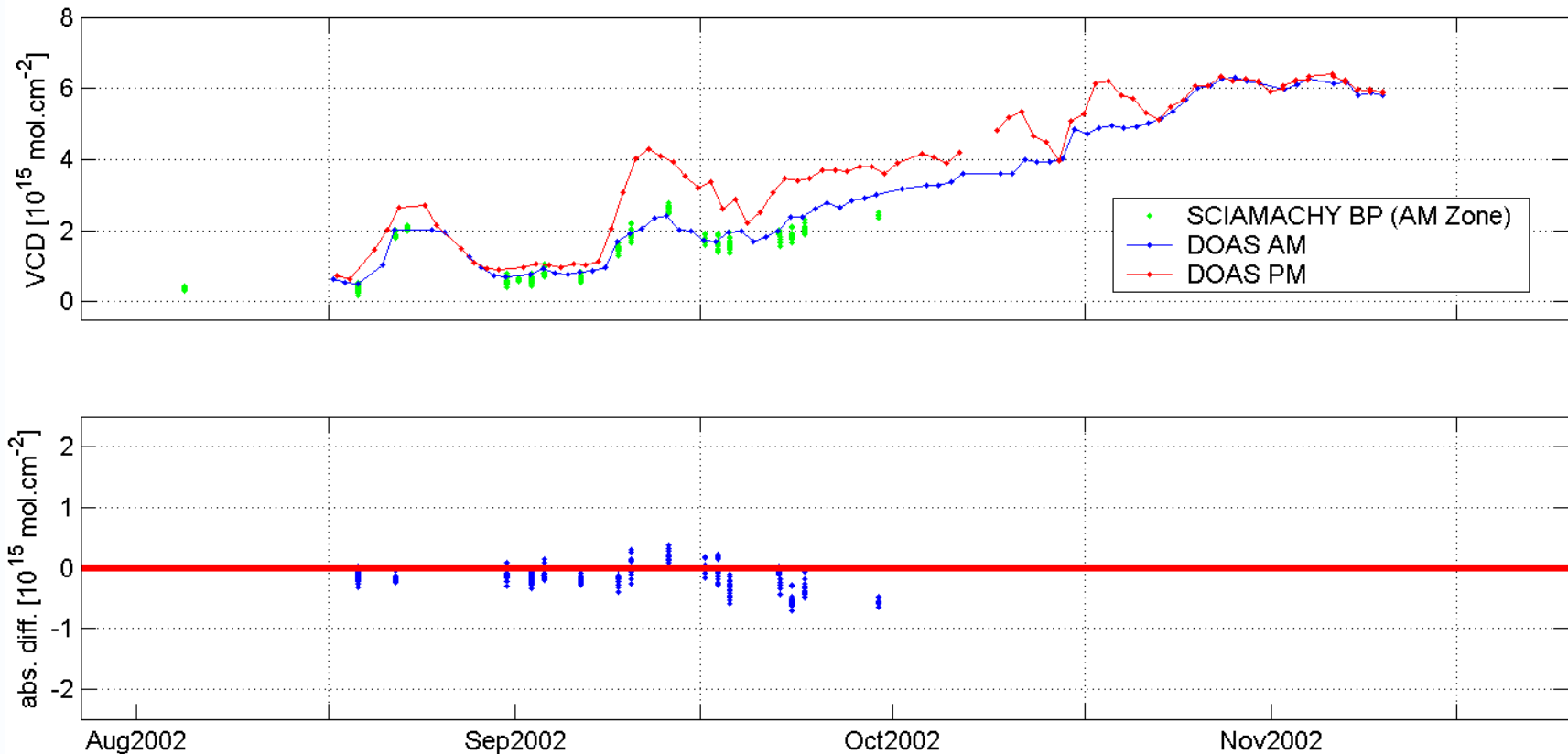
Kerguelen Island (Indian Ocean, 50°S)



SAOZ data from CNRS

OPERATIONAL NRT v5.01: Poles

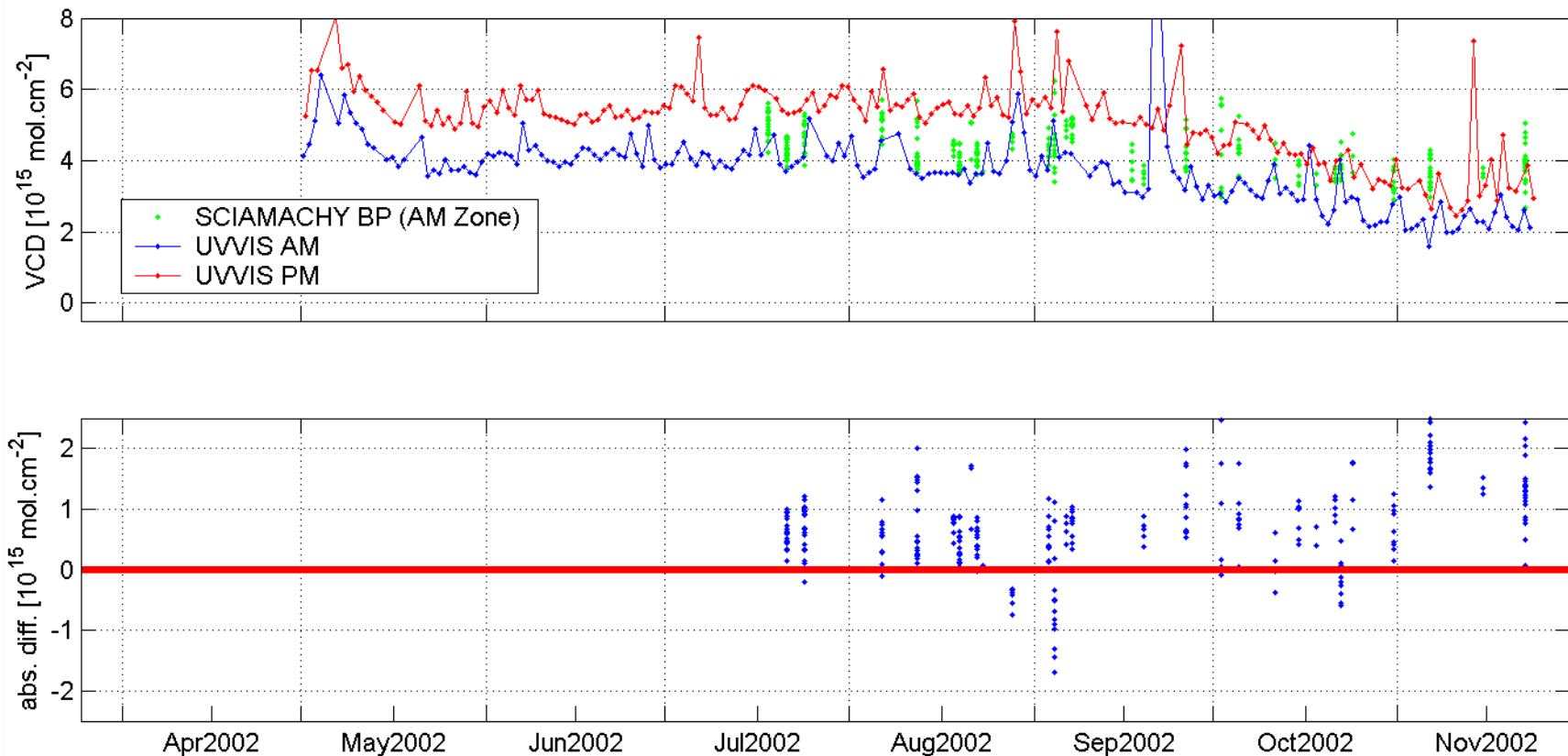
Neumayer (Antarctica, 71°S)



DOAS data from IUP/Heidelberg

OPERATIONAL NRT v5.01: NH Mid-Latitudes

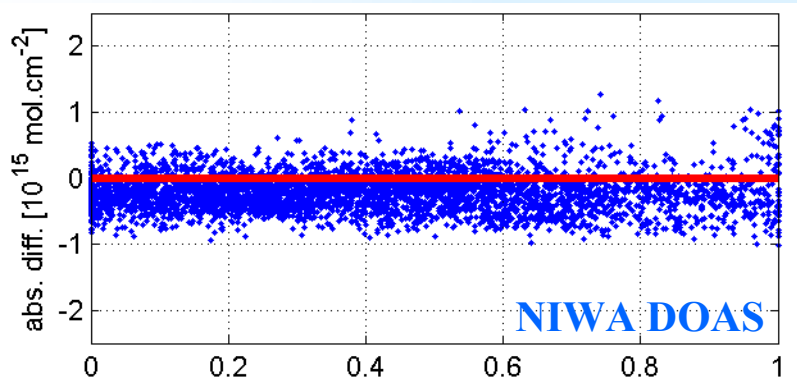
Monte Cimone (Italy, 44°N)



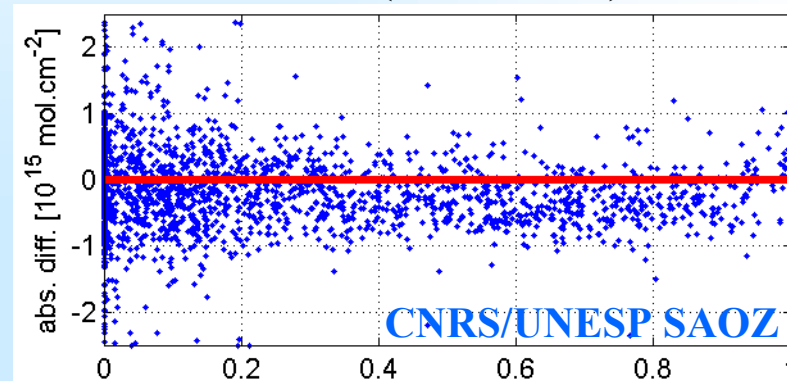
DOAS data from ISAC/CNR

OPERATIONAL NRT v5.01: Cloud Fraction

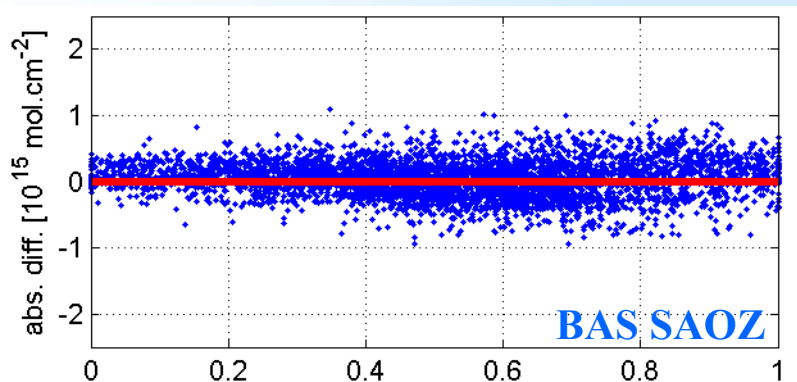
Macquarie Island (Australia, 55°S)



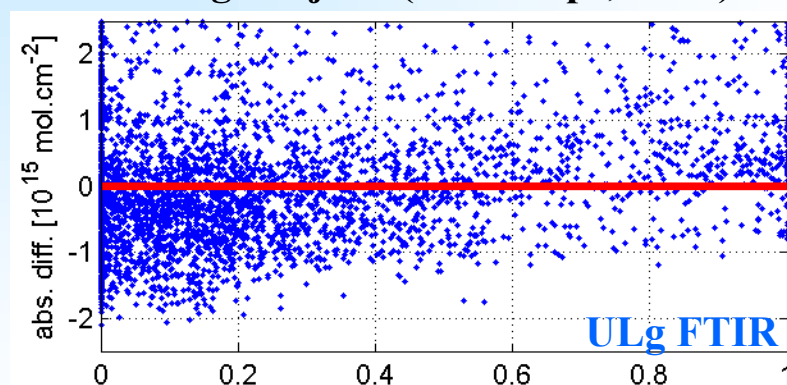
Bauru (Brazil, 22°S)



Rothera (Antarctica, 68°S)

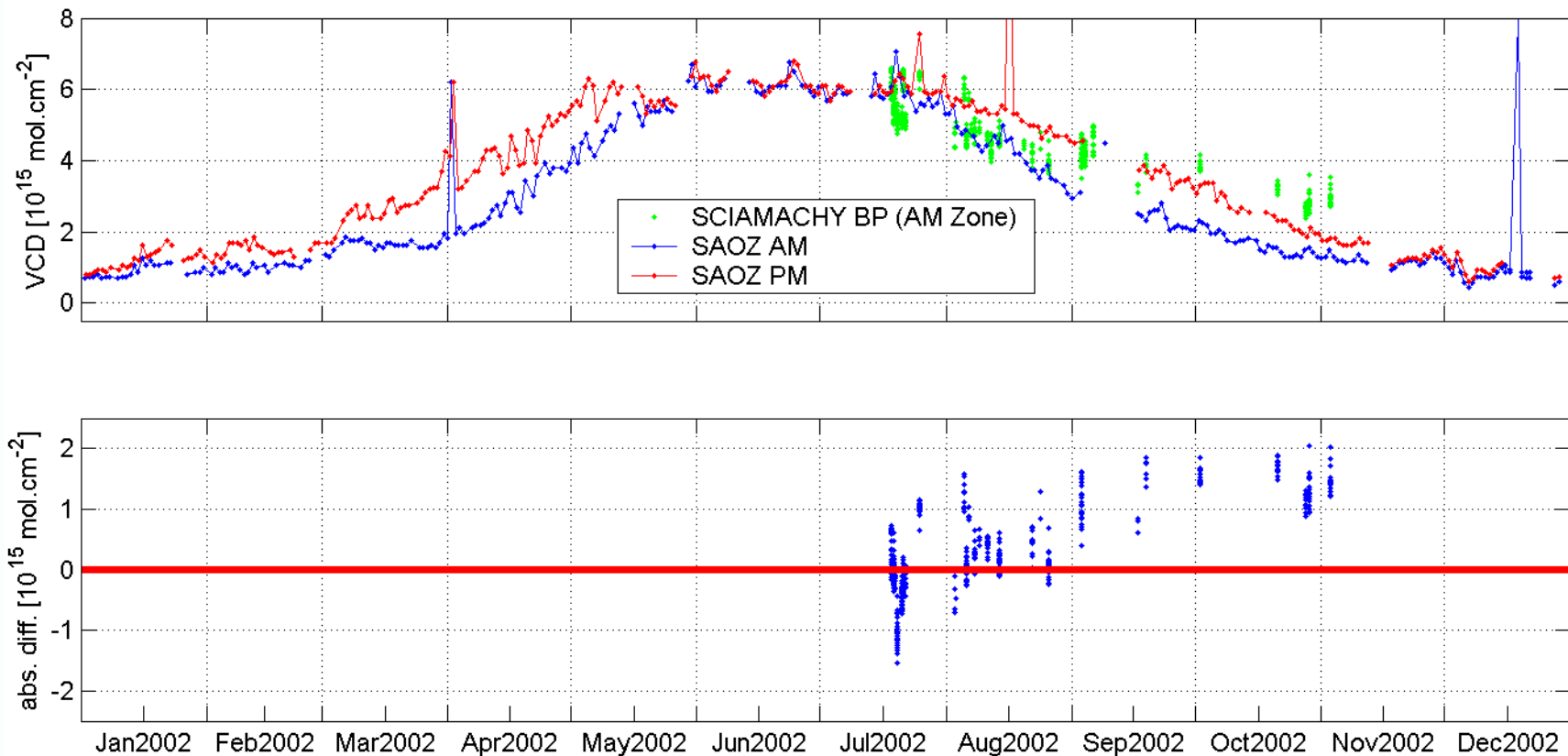


Jungfraujoch (Swiss Alps, 46°N)



OPERATIONAL NRT v5.01: Zhigansk

Zhigansk (Eastern Siberia, 67°N)

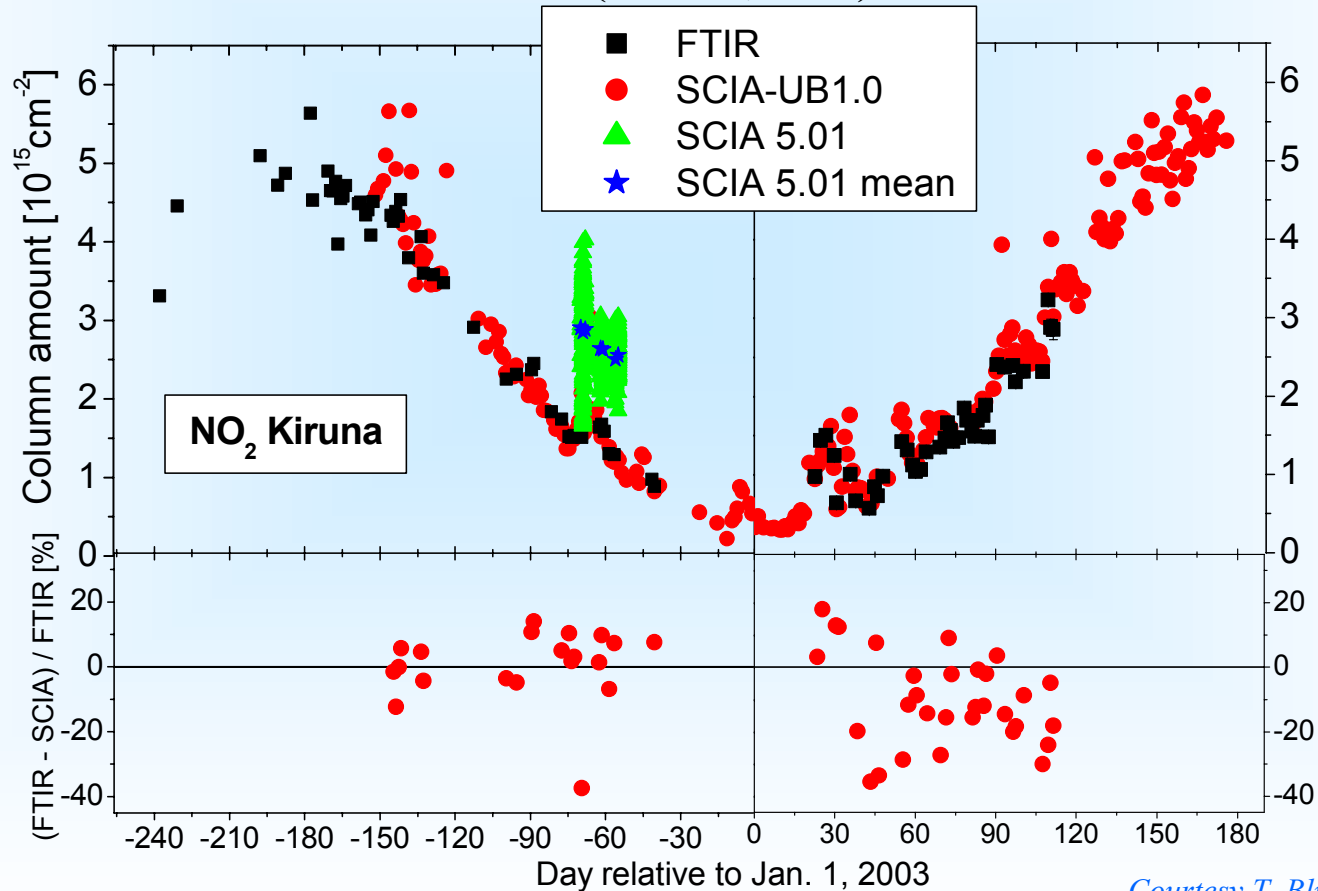


SAOZ data from CNRS/CAO

OPERATIONAL NRT v5.01: Kiruna



Kiruna (Sweden, 68°N)



Courtesy T. Blumenstock, IMK-FZK

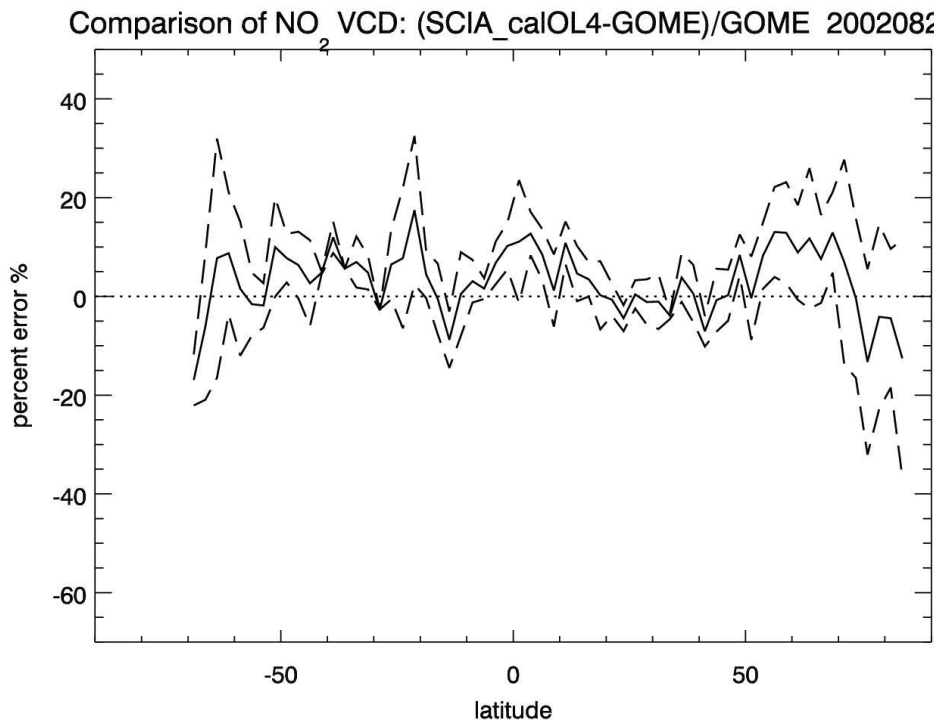
SCIA / GOME COMPARISONS

- Comparison between SCIAMACHY (NRT 5.01 and IUP) and GOME (GDP 3 and IUP) by IUP/Bremen
- Two calibration orbits (23 August 2002)
- Similar geographical patterns

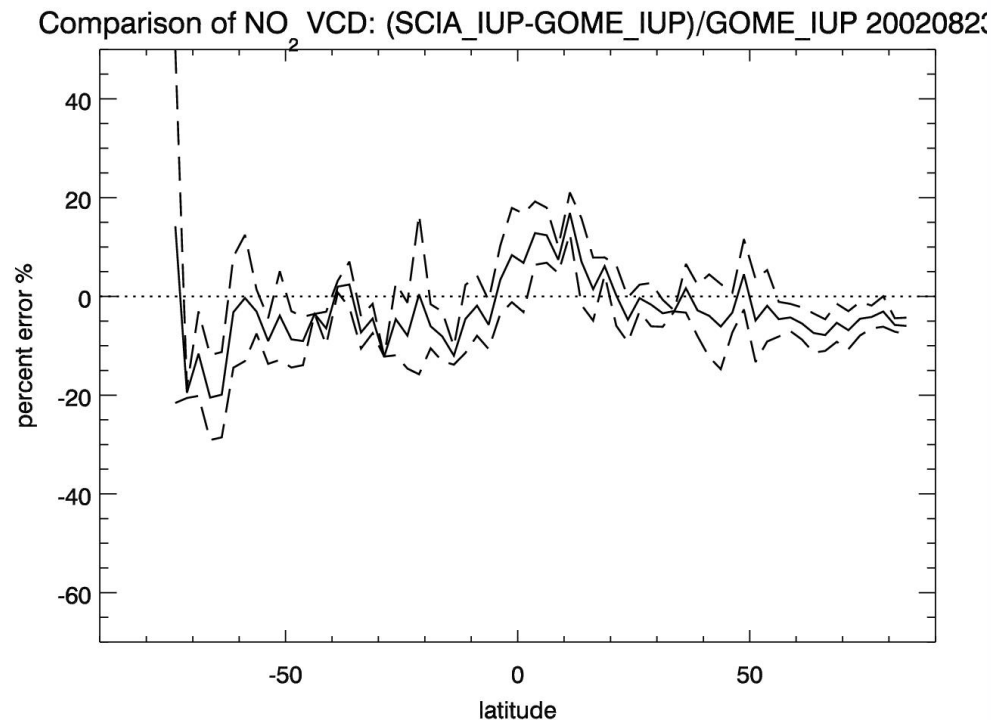


(SCIA v5.1-GOME 3.0) GOME 3.0

(SCIA IUP-GOME IUP) GOME_IUP



mean relative deviation -15% – +15%
with RMS of 5 to 20%



mean relative deviation -20% – +15%
with RMS of 2 to 15%

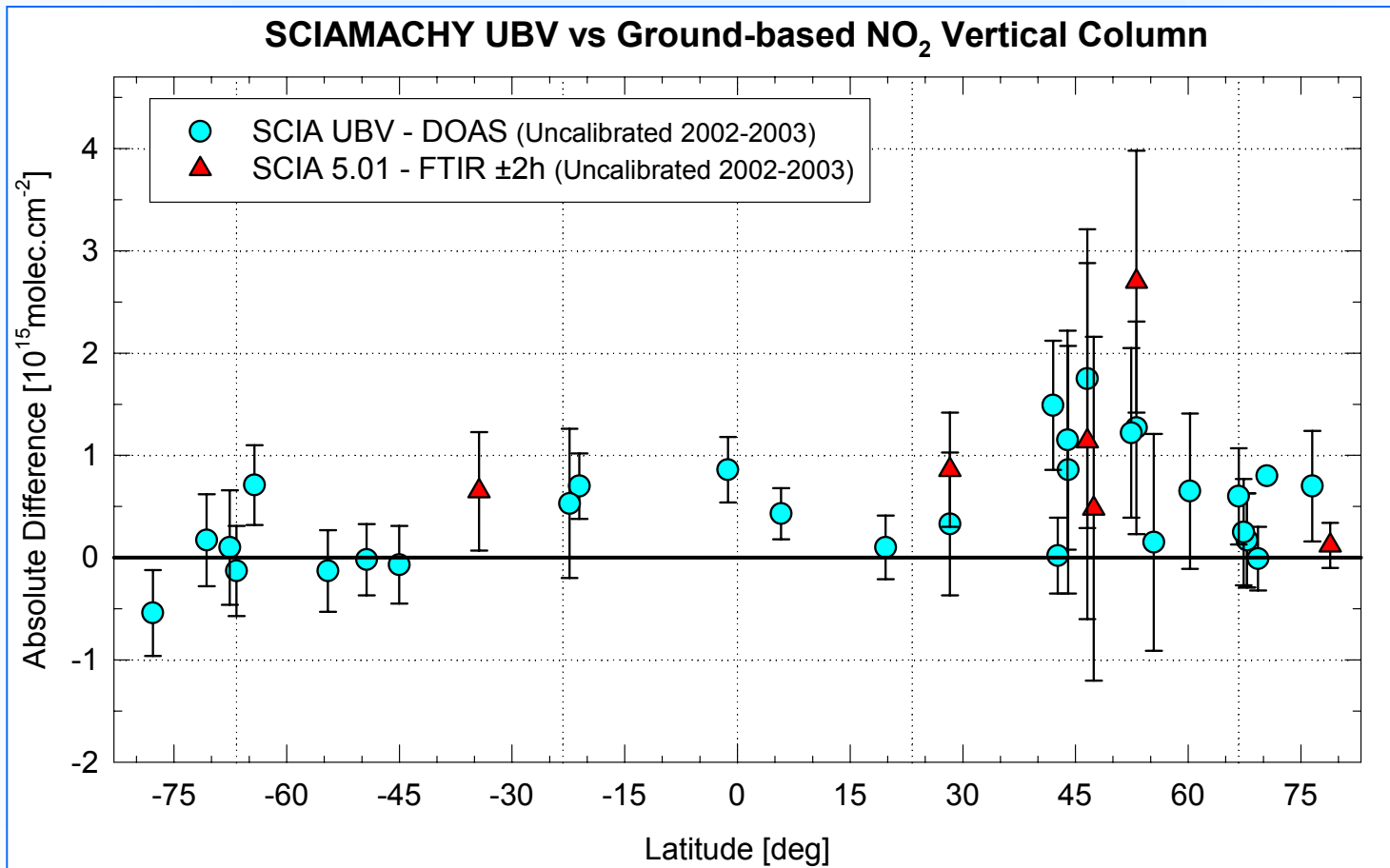
Courtesy A. Bracher, IUP/Bremen

NON OPERATIONAL ALGORITHMS

- UBV (A. Richter): 'uncalibrated' L1
- GDOAS (I. De Smedt): 'uncalibrated' L1, MS 4.02 & 5.01
 - Effect of L1 calibration ?
- KNMI (F. Boersma): GDOAS slant + KNMI's AMF (2003)
 - Stratospheric AMF vs. Tropospheric AMF ?
- SAO (C. Sioris): MS 5.01

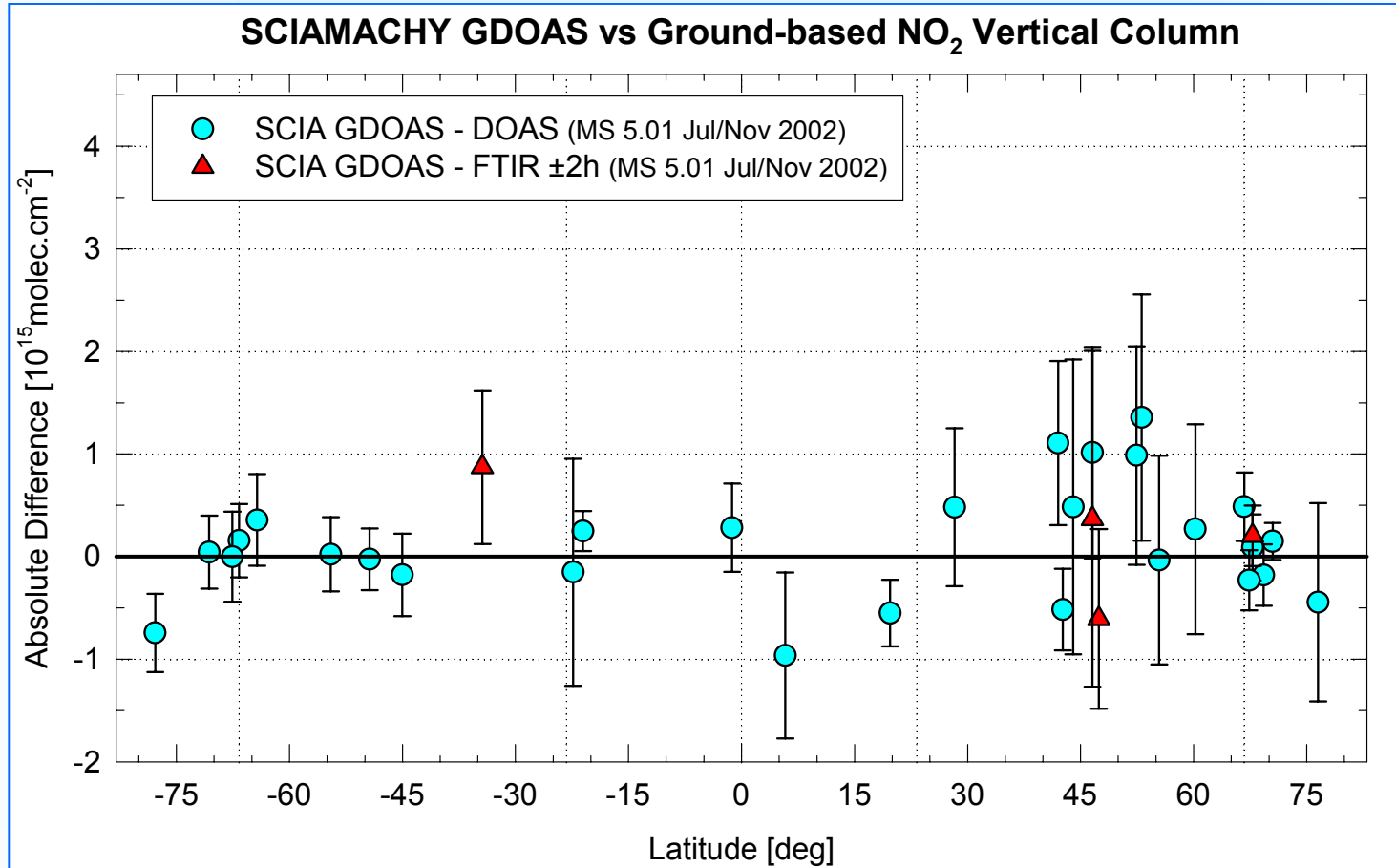


UBV (uncalibrated L1)



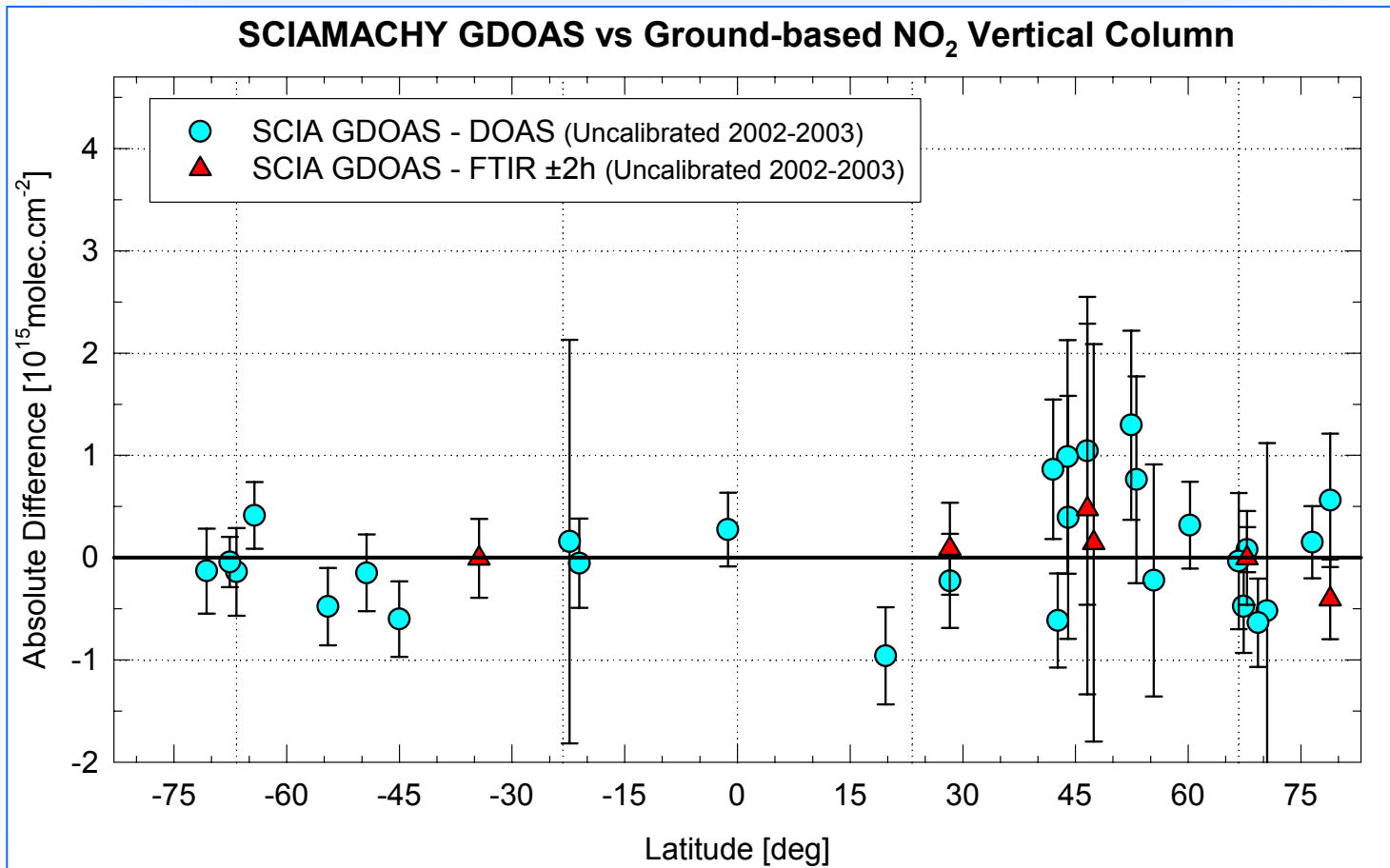
*J-C. Lambert and J. Granville, BIRA-IASB
SCIAMACHY data from A. Richter, IUP/Bremen*

GDOAS (L1 MS 5.01)



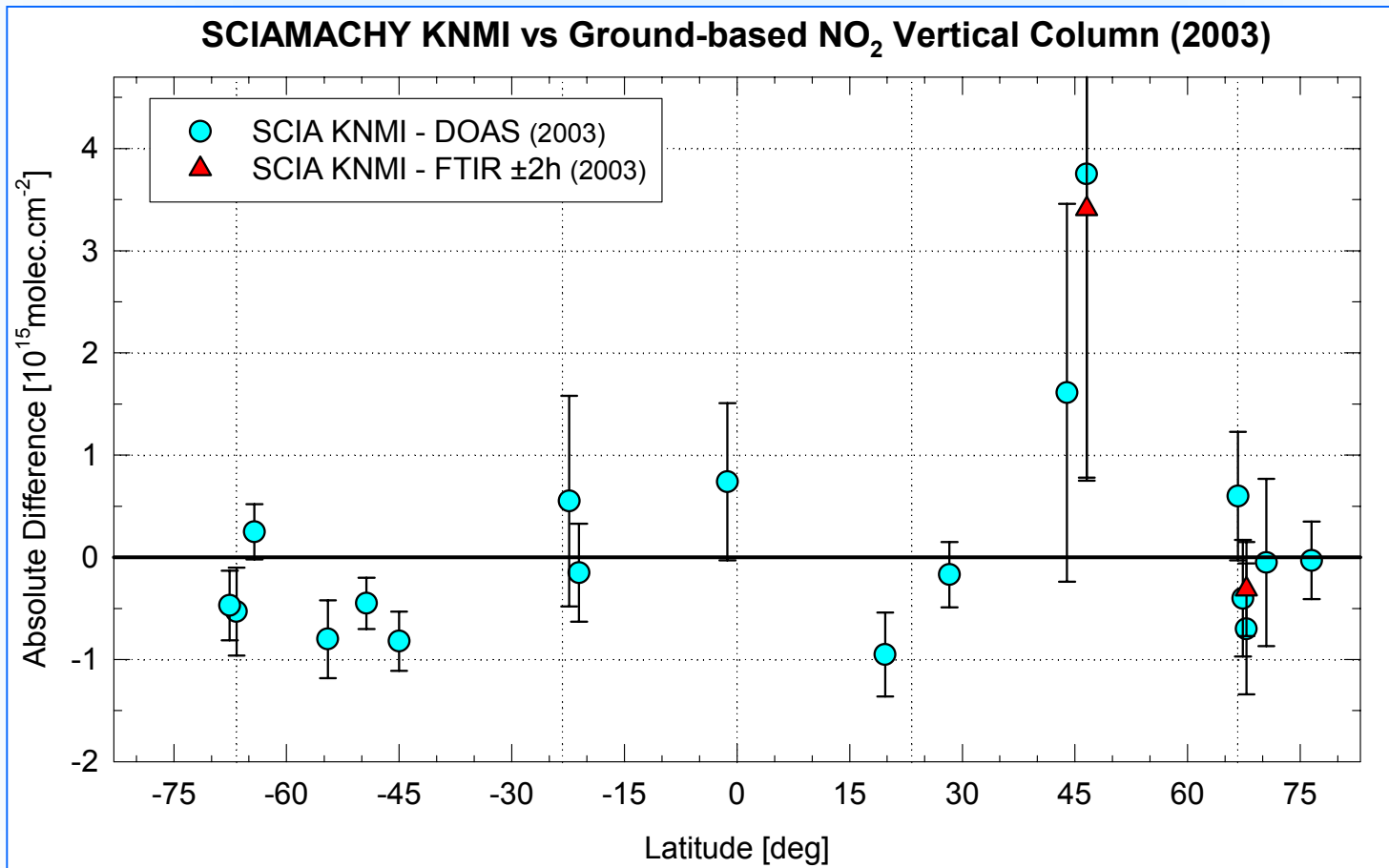
J.-C. Lambert, J. Granville and I. De Smedt, BIRA-IASB

GDOAS (uncalibrated L1)



J.-C. Lambert, J. Granville and I. De Smedt, BIRA-IASB

KNMI (GDOAS slants + KNMI AMFs)

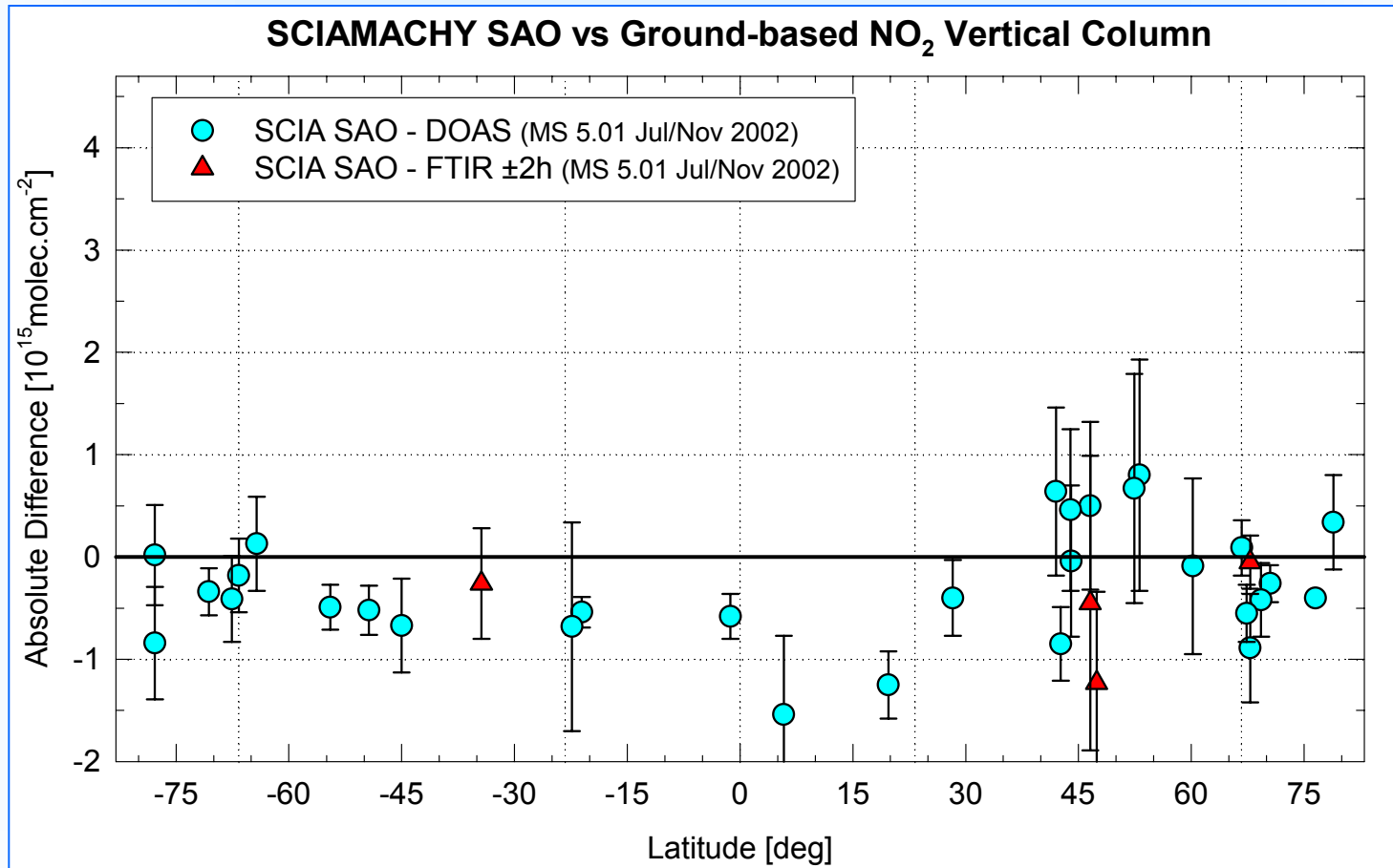


J-C. Lambert and J. Granville, BIRA-IASB

SCIAMACHY data from F. Boersma, KNMI, and I. De Smedt, BIRA-IASB



SAO (L1 MS 5.01)



*J-C. Lambert and J. Granville, BIRA-IASB
SCIAMACHY data from C. Sioris, SAO*

CONCLUSION (1)

- Comparison methods developed for GOME work well with SCIAMACHY.
- NRT operational processor v5.01:
 - Improved geophysical consistency
 - Improved quantitative agreement
 - Remaining issues and inconsistencies
 - Ready for public release (from validation point of view)

CONCLUSION (2)

- Non operational 'scientific' products:
 - Good geophysical consistency
 - UBV: OK; overestimation at low latitudes
 - GDOAS: OK; probably better with MS 5.01 L-1
 - SAO: OK; underestimation at low and mid-latitudes
 - KNMI: OK; so far, accuracy unclear: maybe more realistic AMFs, but apparent bias at some latitudes

OUTLOOK

- Master Set should be extended.
- Validation in polluted areas is still a challenge.
- ZLS-DOAS / MAX-DOAS, airborne experiments and tropospheric modelling support are needed.