Temperature dependence of total ozone difference between SAOZ, satellites and ground-based measurements

J. P. Pommereau, F. Goutail, A Pazmino

LATMOS CNRS

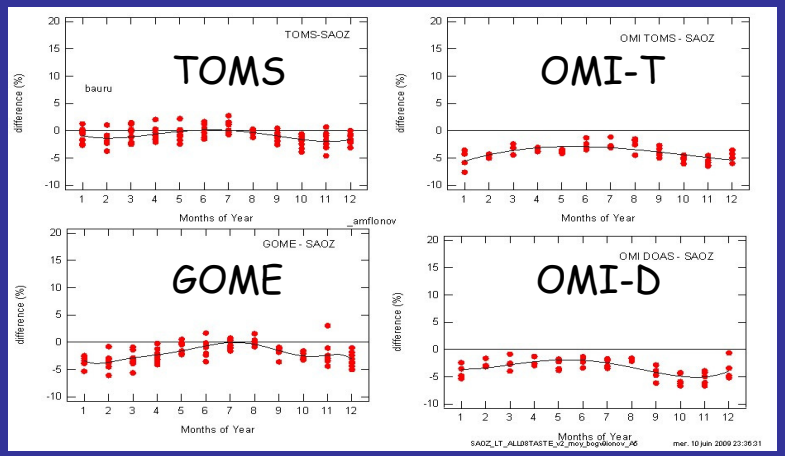
SAOZ OZONE V2

NDACC UV-VIS WG Recommendations

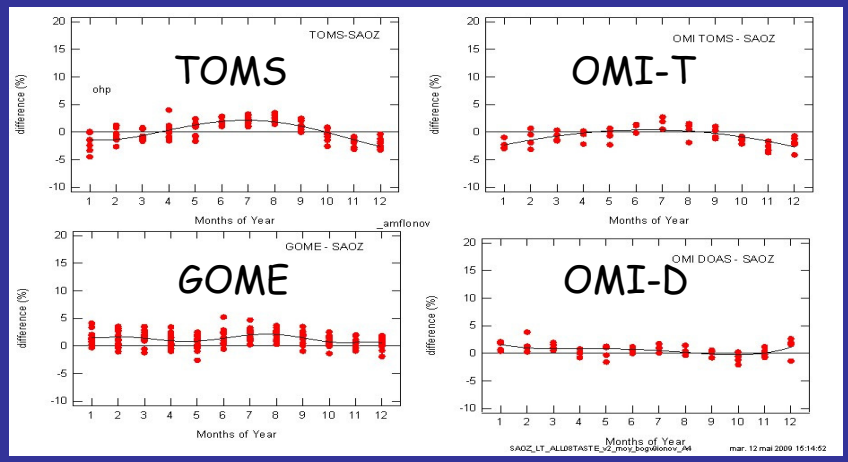
Visible: 450-550 nm Bogumil 223 K cross-sections

AMF Toms v8 monthly-zonal climatology
DISORT (Hendrick et al 2006)
SCIATRAN (Ionov)

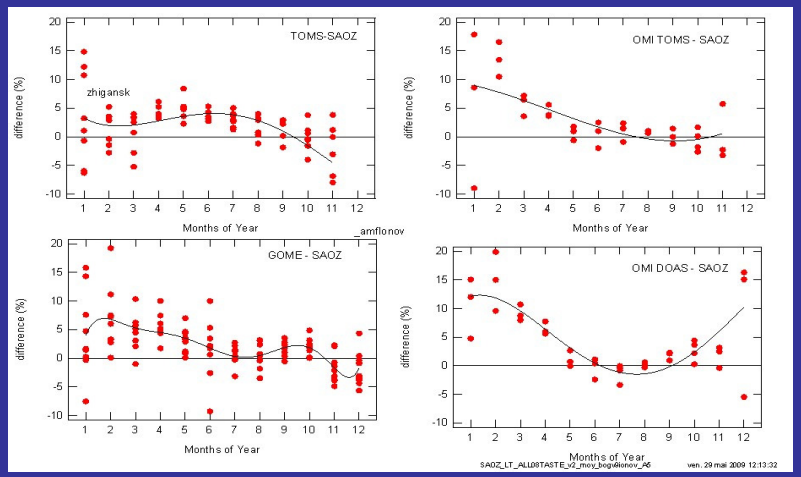
Total ozone Satellites-SAOZ (%)



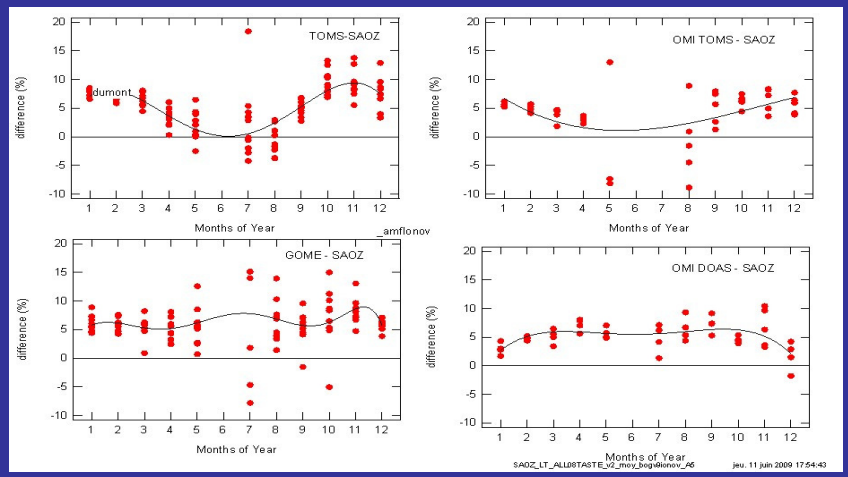
Tropics Bauru, Brazil 22S



Mid-latitude, OHP 43°N



Arctic Zhigansk, Siberia 67 N



Antarctic Dumont d'Urville 67S

Systematic seasonal cycle

- Maximum in the summer season
(not in phase with ozone seasonnal cycle)

- Larger at high latitude

- Different between satellites

Average biases

- Variable with satellite and stations

Analysis
(Limited to SZA < 84°)

$$dO3/O3 = a + b \times \text{Temp (50 hPa)} + c \times O3$$

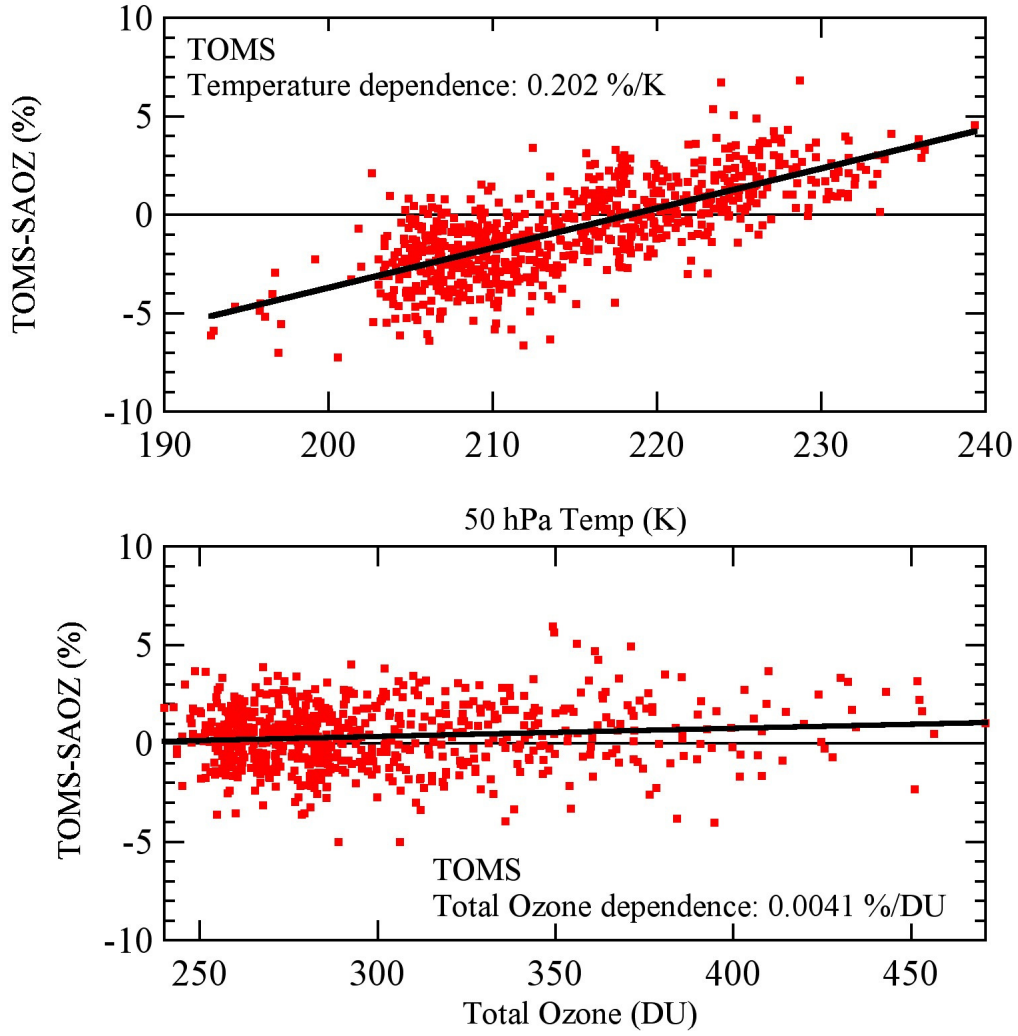
Bias: absolute cross-section, AMF, Zero calibration, Tropospheric O3

Cross-section temp dependence, Influence of temp on AMF calculation

O3 profile climatology, AMF calculation

Application to several stations together: Sodankyla, Zhigansk, OHP, Bauru, Reunion, Keguelen, Dumont d'Urville

TOMS

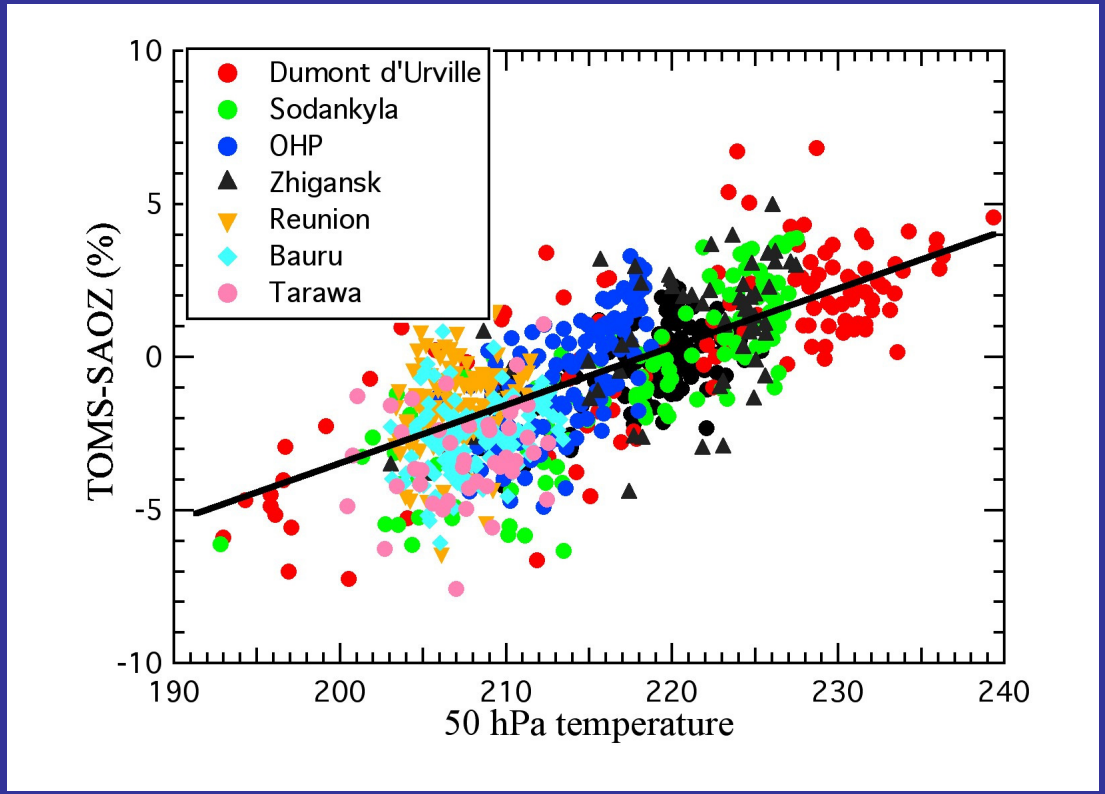


b = 0.202 ± 0.007 %/K

c = 4 ± 1 10-3 %/DU

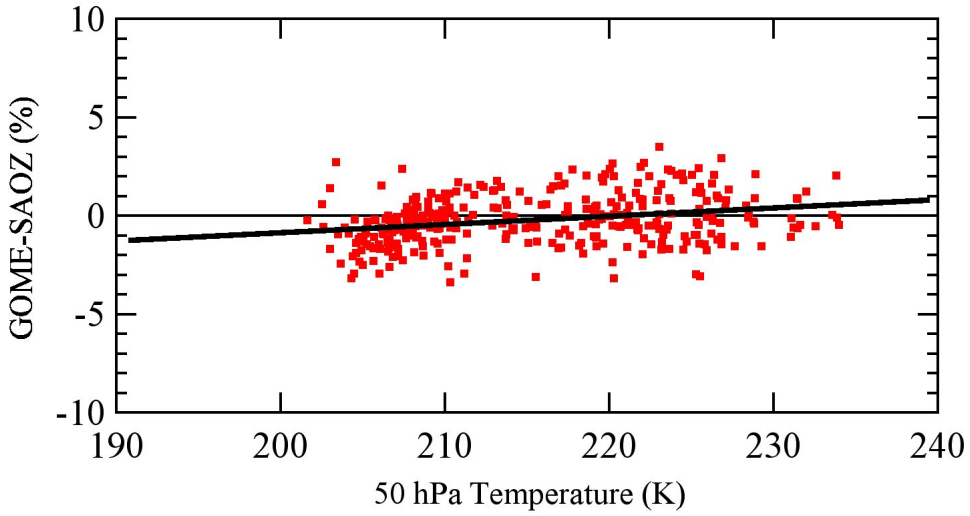
a = 1.5 ± 4.9 %

TOMS

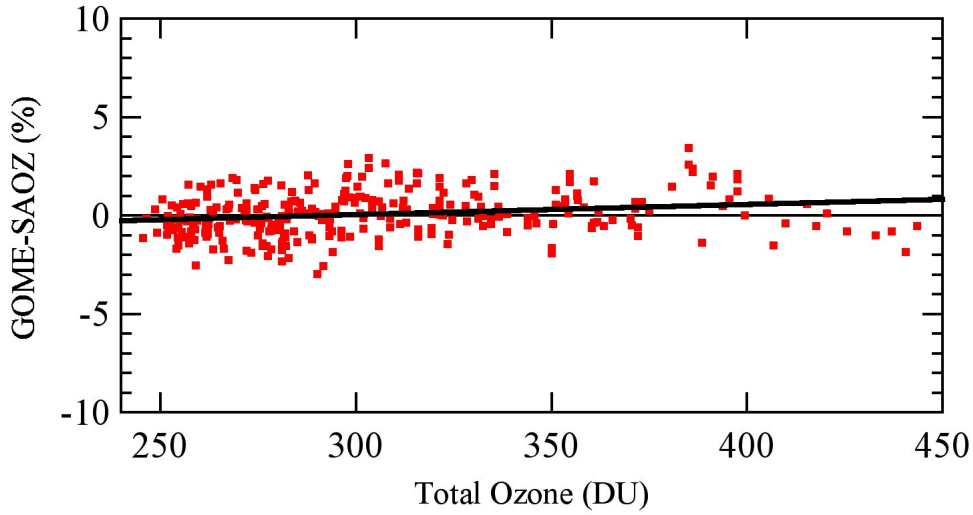


Temperature dependence similar on all stations

OMI-Toms



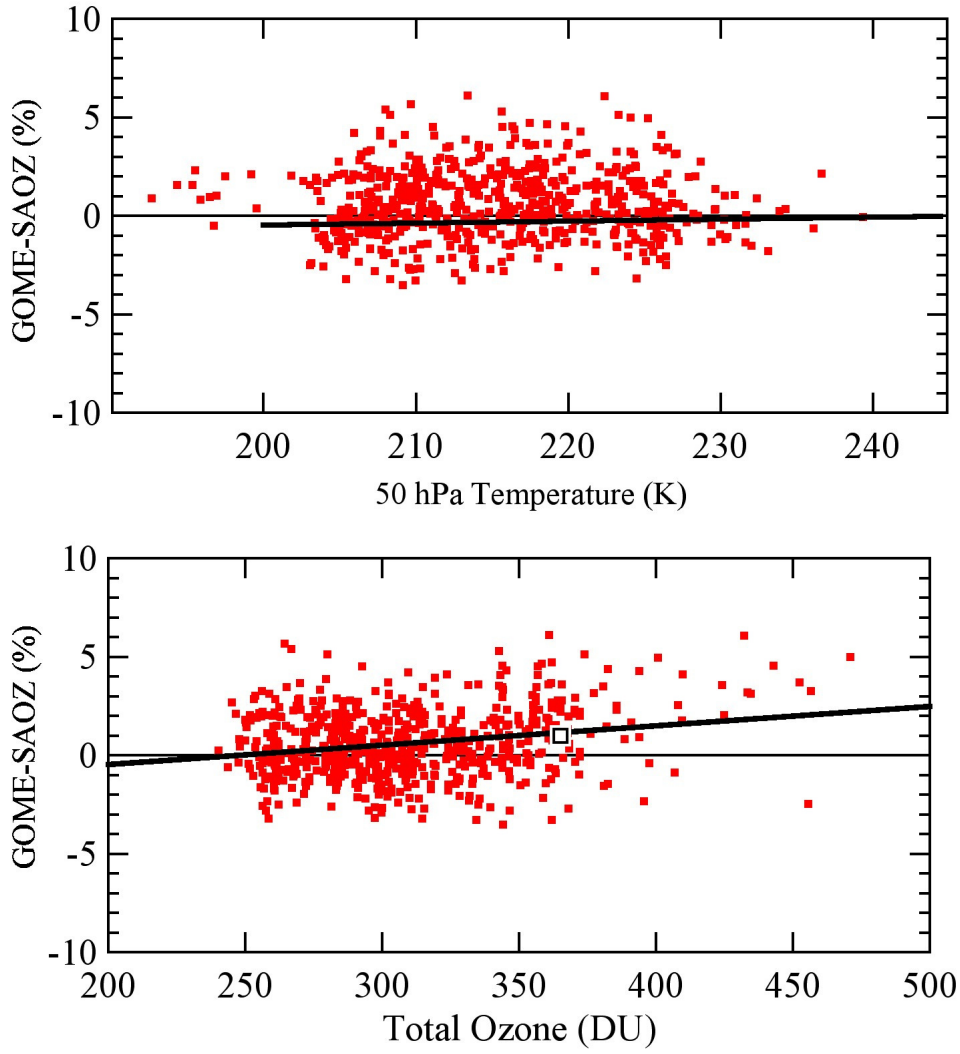
b = 0.042 ± 0.008 %/K



c = 5 ± 1 10-3 %/DU

a = 0.132 ± 3.4 %

GOME

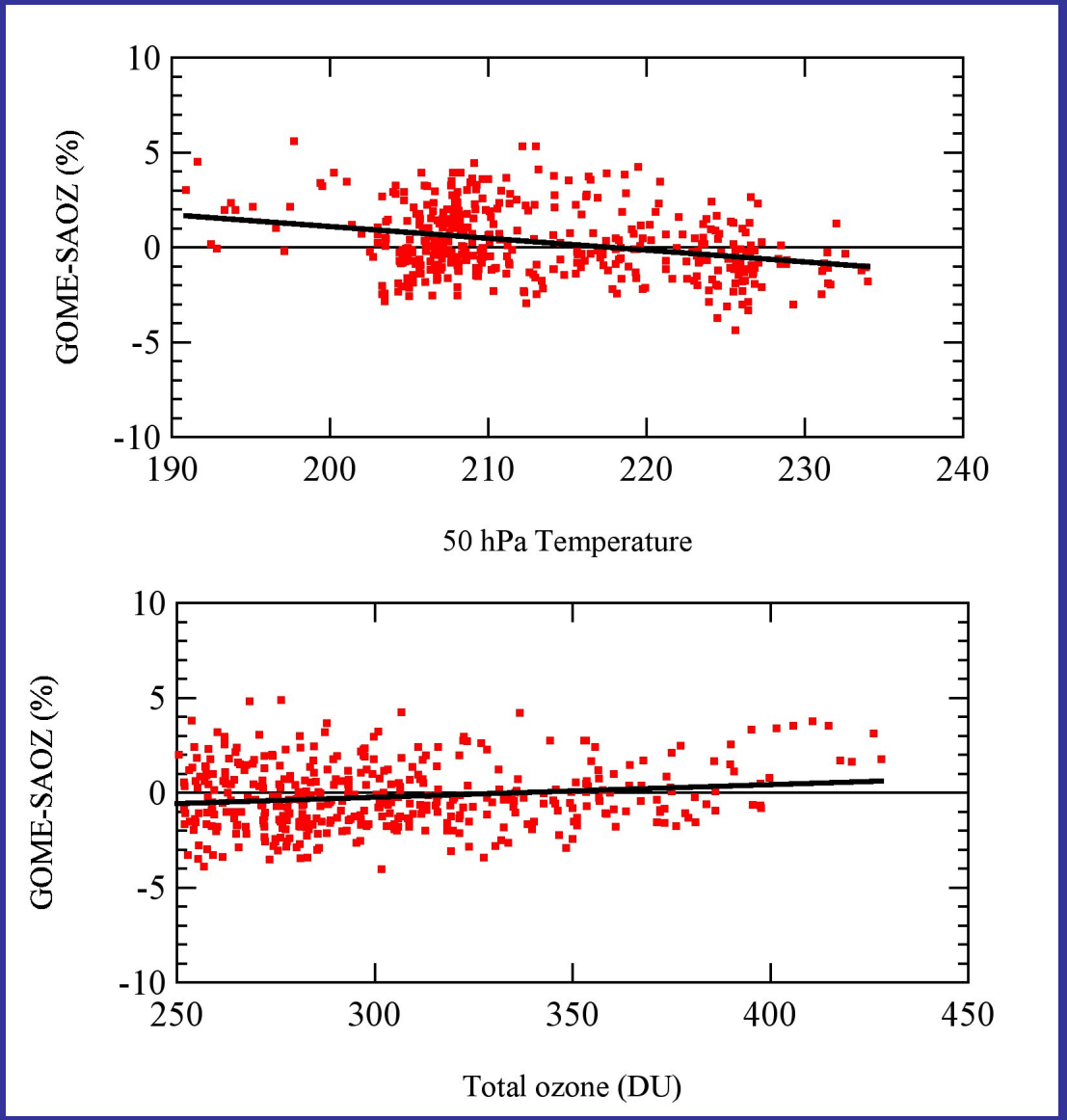


b = 0.003 ± 0.008 %/K

c = 10 ± 1.6 10-3 %/DU

a = 2.86 ± 5.2 %

OMI-D

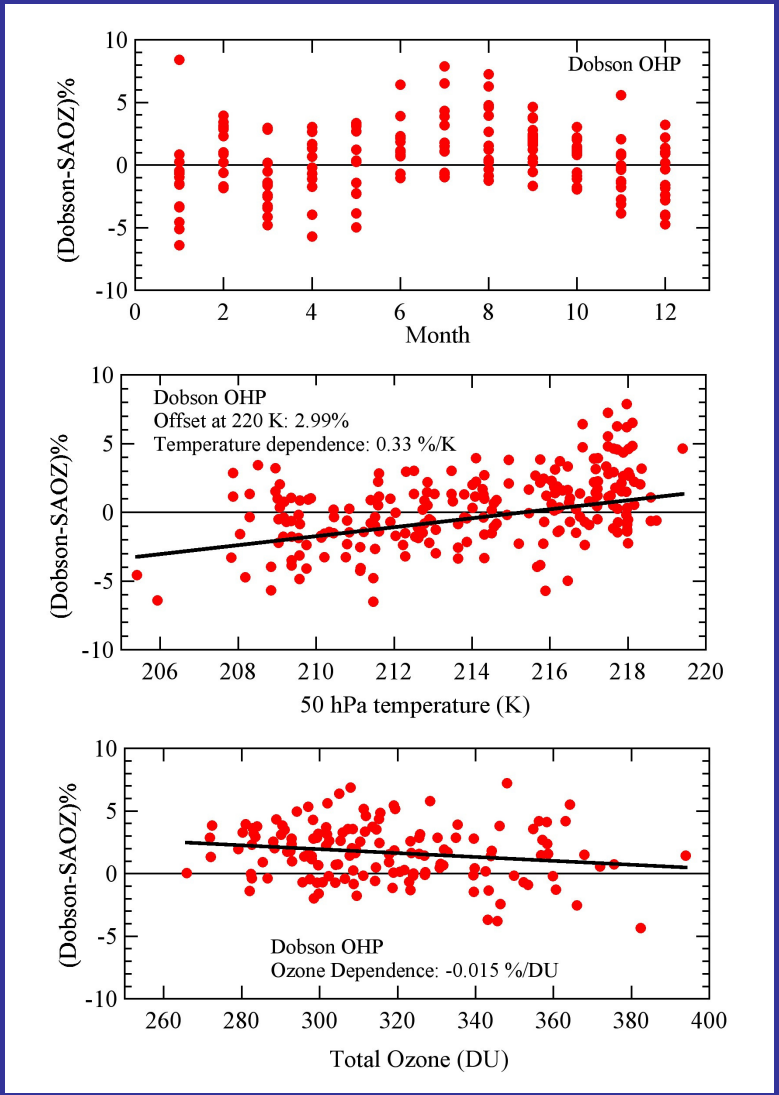


b = -0.062 ± 0.009 %/K

c = 6 ± 2 10-3 %/DU

a = -0.68 ± 5.0 %

Dobson OHP

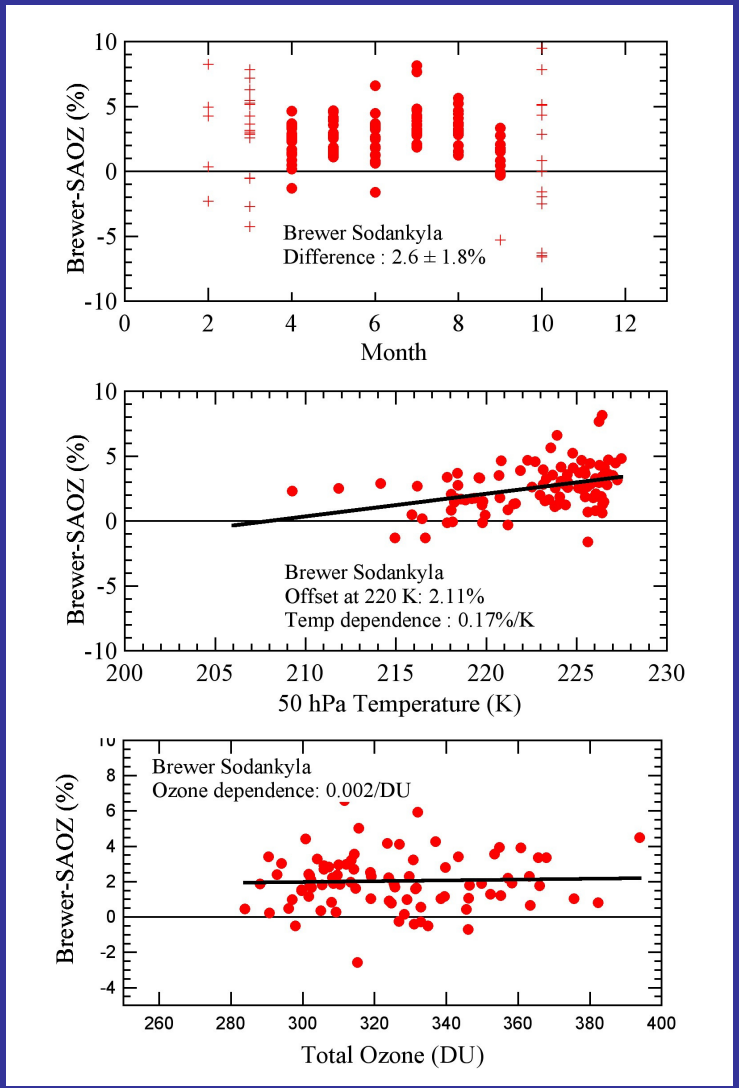


b = 0.33 ± 0.05 %/K

c =-15 ± 7 10-3 %/DU

a = 1.92 ± 2.1 %

Brewer Sodankyla (April-Sept) DS only



Large dispersion at lwo sun from October to March

b = 0.174 ± 0.04 %/K

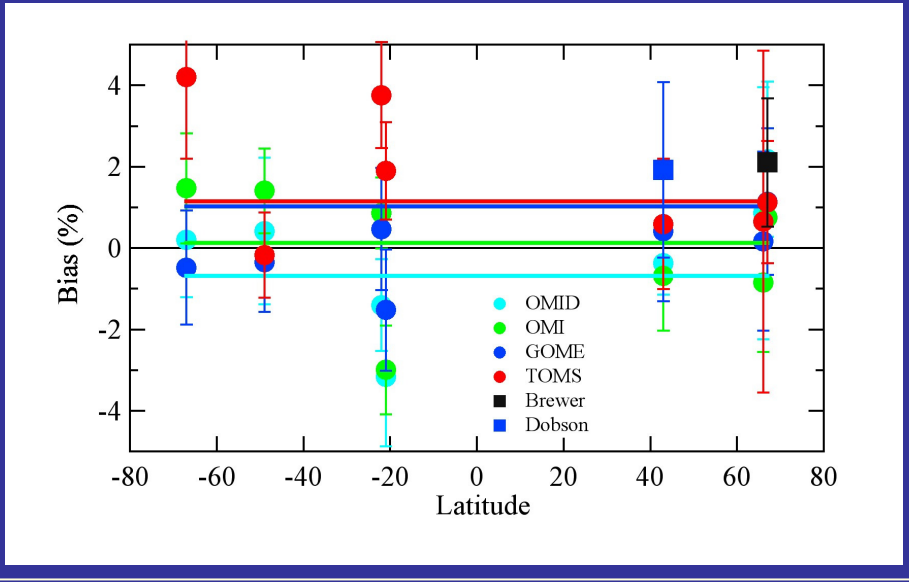
c = 2 ± 7 10-3 %/DU

a = 2.11 ± 1.58 %

Summary

Instrument	a %	B %/K	C %/DU
TOMS	1.15 ± 4.9	0.202 ± 0.07	0.004 ± 0.001
GOME	1.03 ± 1.58	0.003 ± 0.008	0.010 ± 0.002
OMI-T	0.13 ± 3.45	0.042 ± 0.008	0.006 ± 0.001
OMI-D	-0.68 ± 5.0	-0.062 ± 0.09	0.006 ± 0.002
BREWER	2.11 ± 1.58	0.174 ± 0.04	0.002 ± 0.007
DOBSON	1.92 ± 2.16	0.387 ± 0.05	-0.015 ± 0.007

a) Biaises after correction for temperature and column dependences



World average: all satellites within ± 1% : limited errors in absolute cross-sections and AMF calculations

Significant differences at some stations:

Toms Antarctic (zonal climatology little representative of DDU at edge of vortex)

Tropics (Tropospheric ozone larger in Bauru than Reunion, SAOZ zero ozone)

Brewer and Dobson: +2% larger than SAOZ and 1-3% than satellites Absolute cross-sections?

b) Temperature dependences

Largest contributor to differences with SAOZ

Wavelength dependent

- Large on UV instruments 317/330 nm Dobson, Brewer, Toms,
- Smaller on Omi T 331/360 nm
- Absent in Gome
- Negative on OMI-D

Since SAOZ AMF calculated as AMF satellites (Toms climato, UVSPEC/DISORT RT or SCIATRAN):

mainly cross-sections temperature dependence

C) Column dependences

Limited influence (0.01 %/DU, i.e. 3 DU only for a 300 DU column for the largest (GOME)

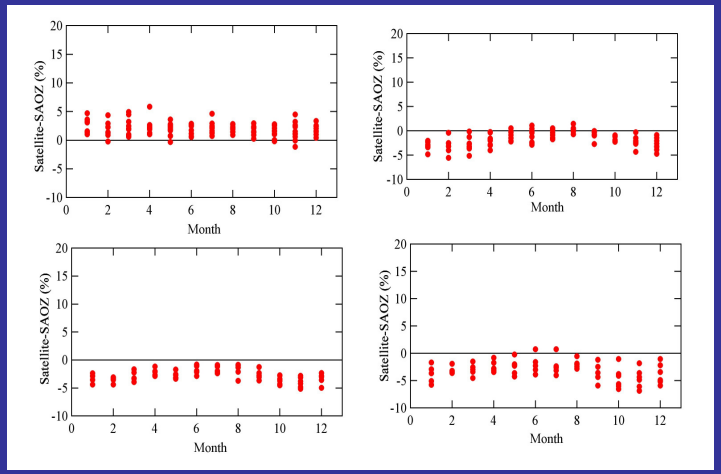
Similar on OMI-T and OMI-D

Ozone profile climatology and AMF calculations

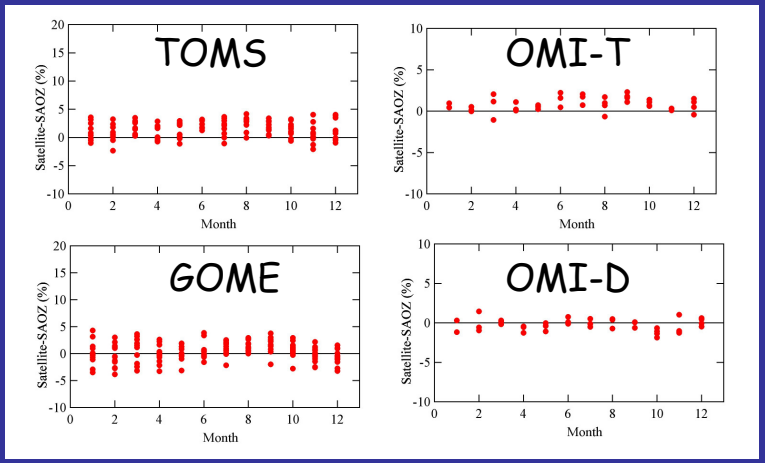
Tropospheric ozone

Negative on Dobson (SZA influence ?)

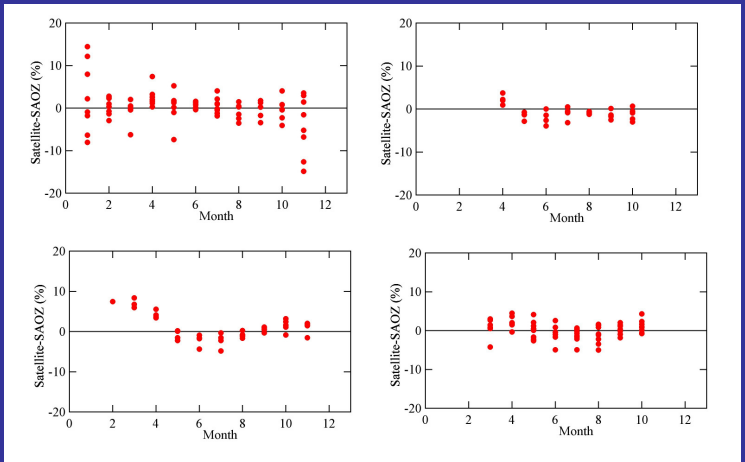
Total ozone Satellites-SAOZ (%) after correction for Temp dependence



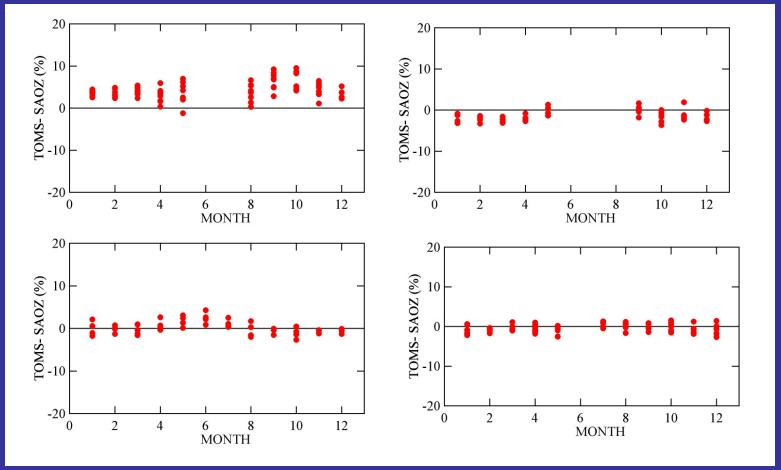
Tropics Bauru, Brazil 22S



Mid-latitude, OHP 43°N



Arctic Zhigansk, Siberia 67 N



Antarctic Dumont d'Urville 67S

CONCLUSION

MOST INFLUENT PARAMETER ON TOTAL OZONE ACCURACY:

OZONE CROSS-SECTIONS TEMPERATURE DEPENDENCES