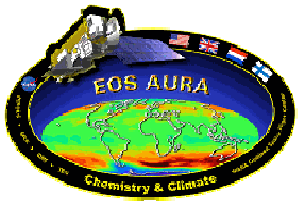


KNMI

OMI

OMI Ozone DOAS and Profile Products Impact of Ozone Cross Sections

Pepijn Veefkind, Maarten Sneep,
Mark Kroon, and Pieternel Levelt

Royal Netherlands Meteorological Institute (KNMI), De Bilt, The Netherlands

Introduction

- Total ozone OMI DOAS algorithm OMDOAO3.
- OMI Ozone Profile algorithm OMO3PR.
- Cross sections tested:
  - Bass Paur
  - Brion Mallicet Daumont

OMDOAO3 Algorithm

- Fitting window 331.6 - 336.6 nm.
- Fit function:

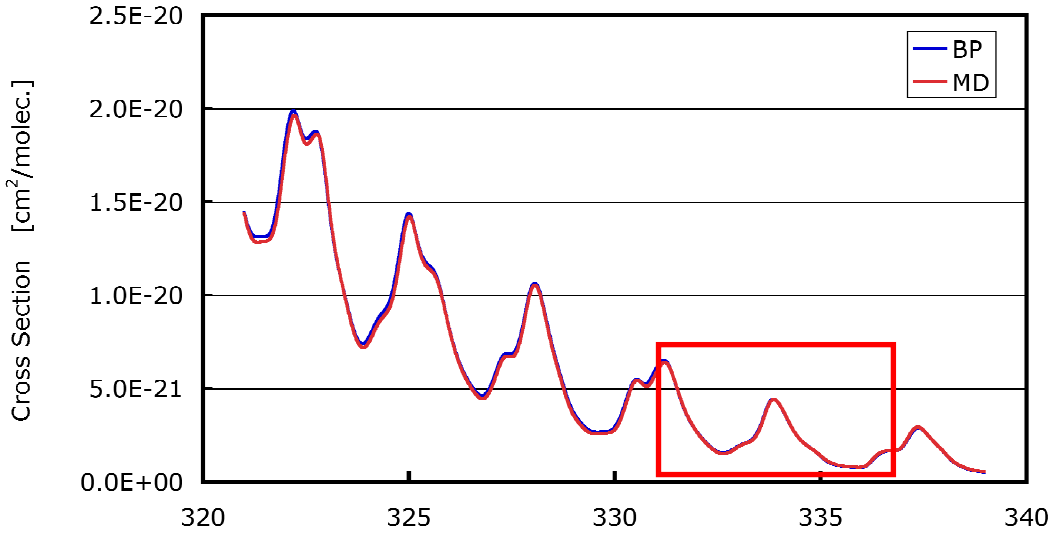
$$\frac{I(\lambda)}{F(\lambda)} = P(\lambda)\ \exp\left[-N_s\ \sigma_{O3}(\lambda, T_{eff})\right] + c_{Ring}\ \frac{I_{Ring}(\lambda)}{F(\lambda)}\ \exp\left[-N_s\ \sigma'_{O3}(\lambda, T_{eff})\right]$$

- Where:

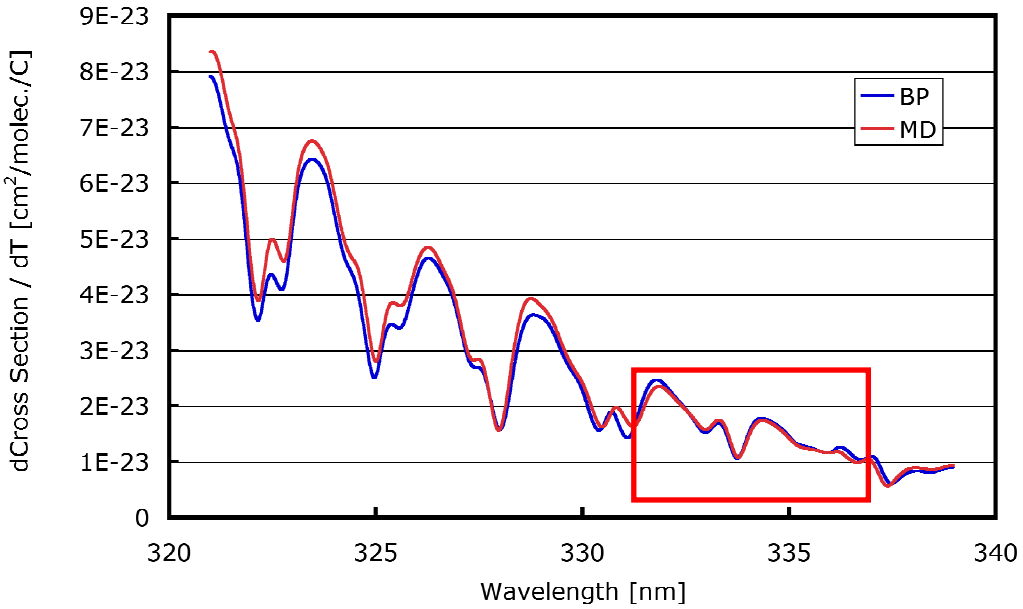
$$\sigma_{O3}(\lambda, T_{eff}) = \sigma_{O3}(\lambda, T_0) + \left(T_{eff} - T_0\right)\left.\frac{d\sigma_{O3}(\lambda)}{dT}\right|_{T=T_0}$$

- Fit parameters: slant ozone column, effective ozone temperature, Ring parameters, polynomial coefficients (2nd order).
- Linearization of the ozone cross section around 220 K.
- Bass-Paur are the default cross sections used.

Comparison of cross sections

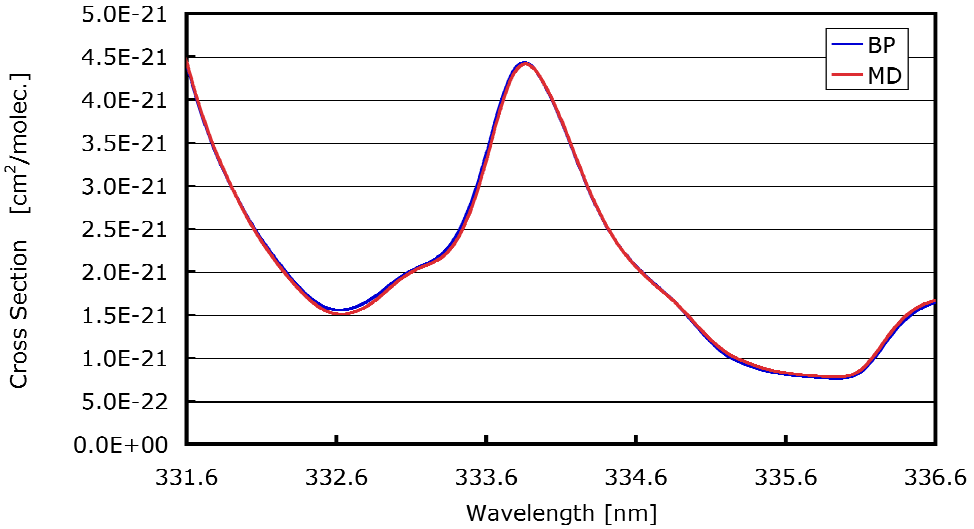


Cross sections @ 220 K

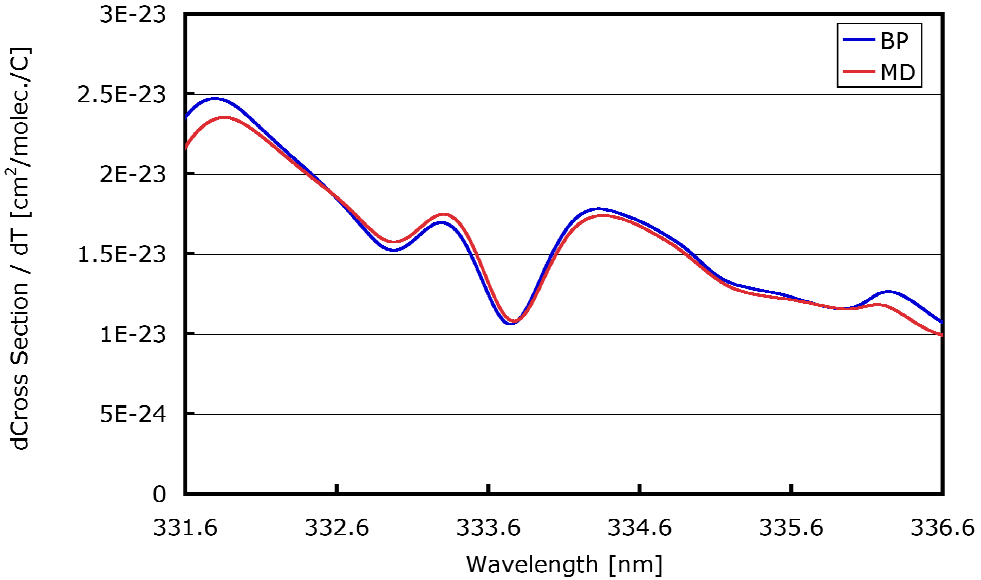


Temperature derivative @ 220 K

Comparison of cross sections

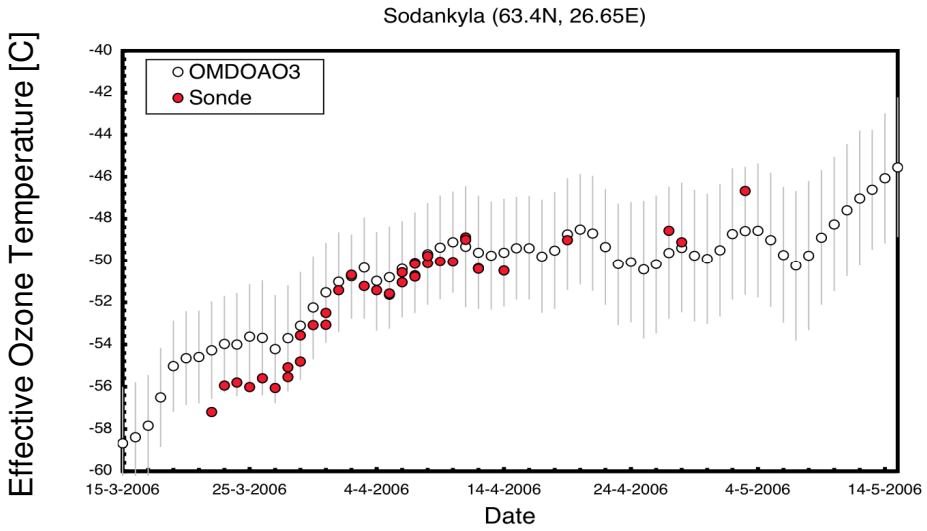


Cross sections @ 220 K

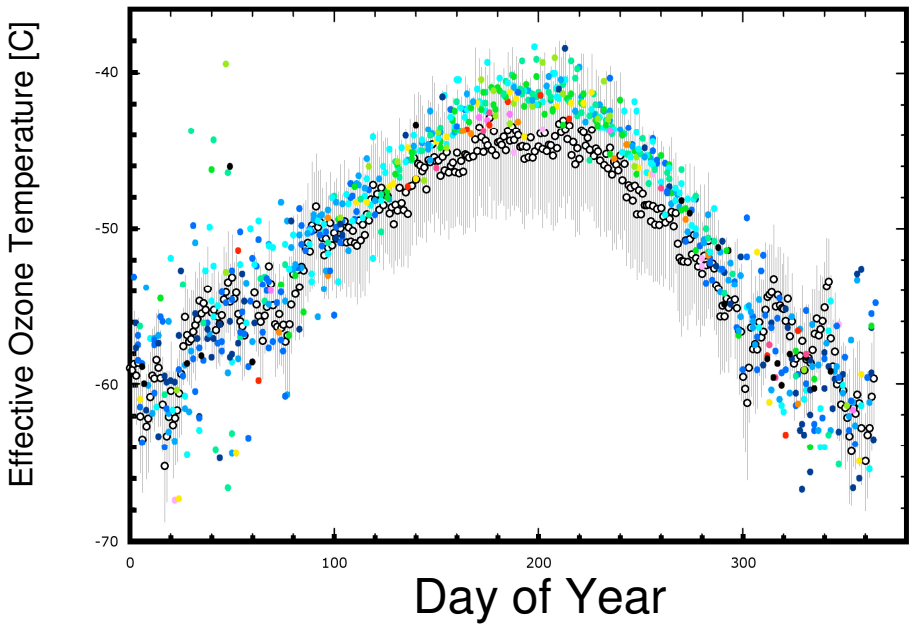


Temperature derivative @ 220 K

Effective Ozone Temperature



Sodankyla
SAUNA Campaign 2006

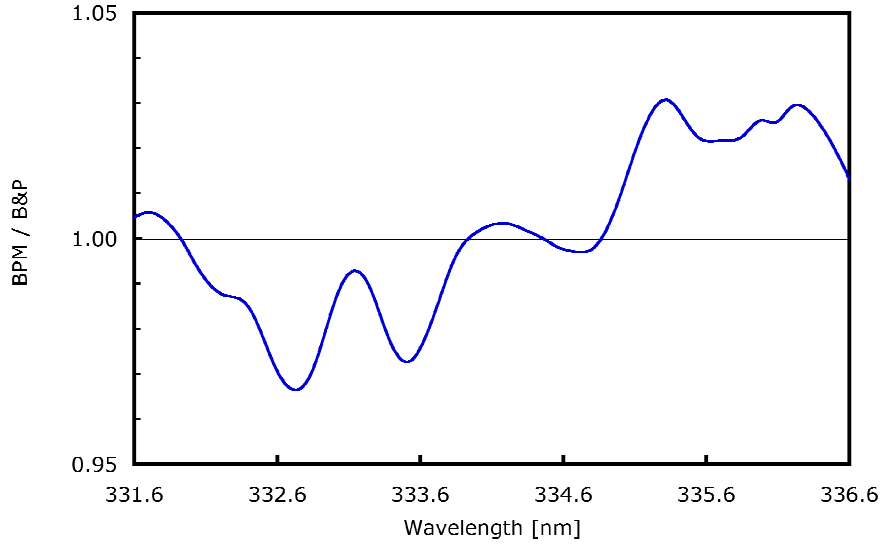


De Bilt
Colors: sonde
Black: OMI DOAS 2006

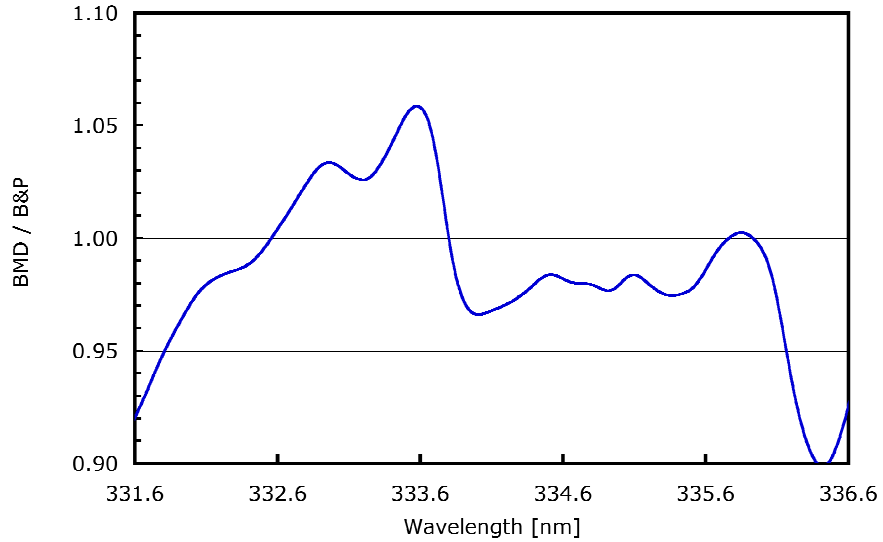
Cross section test

- Orbits 6783 to 6796 of October 2005.
- Bass-Paur and Malicet-Daumont-Brion cross sections are concvolved with the same slit functions.
- Analysis with the CAMA tool.

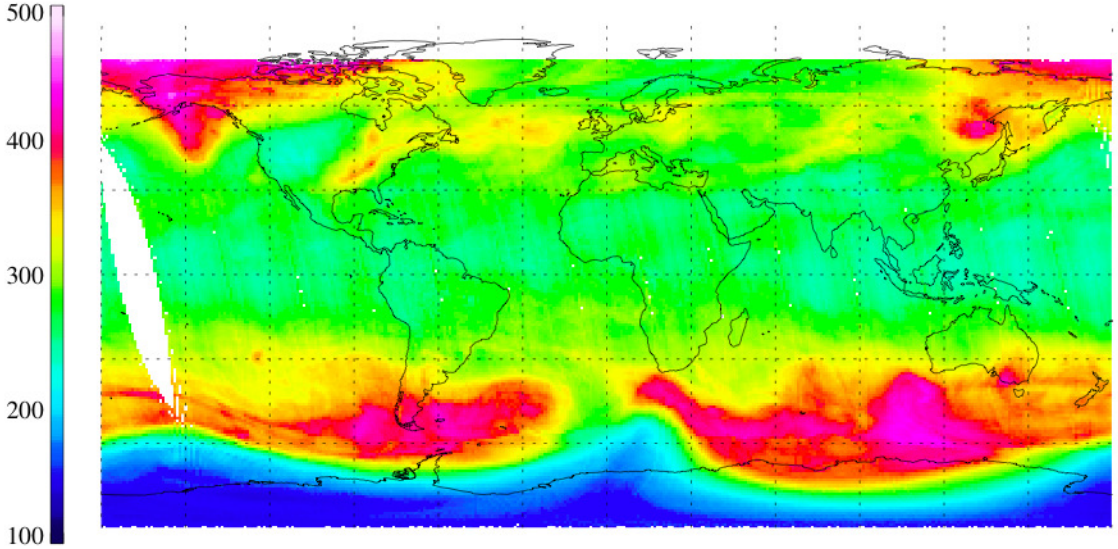
Comparison of cross sections



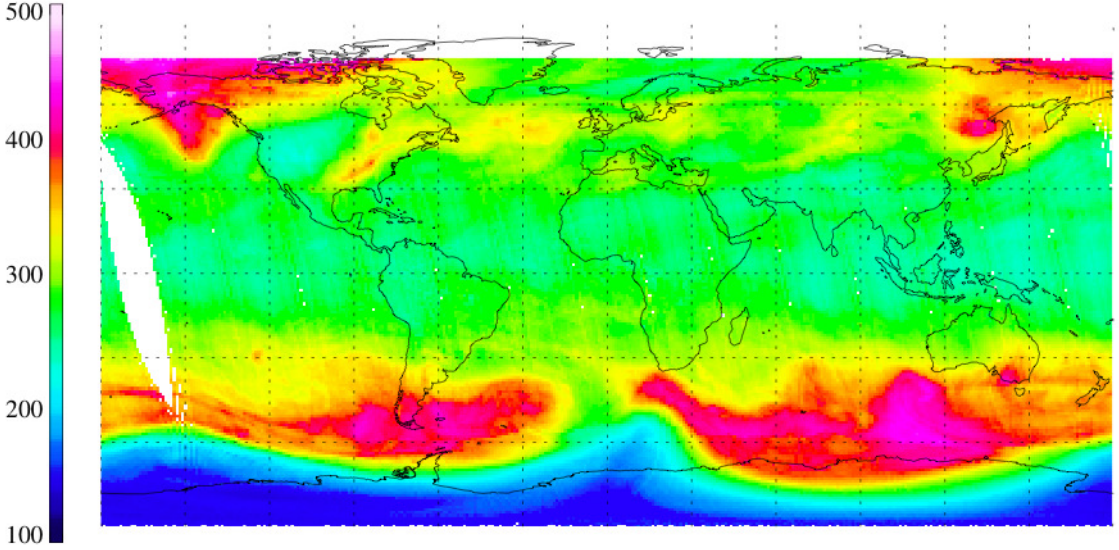
Cross sections @ 220 K



Temperature derivative @ 220 K



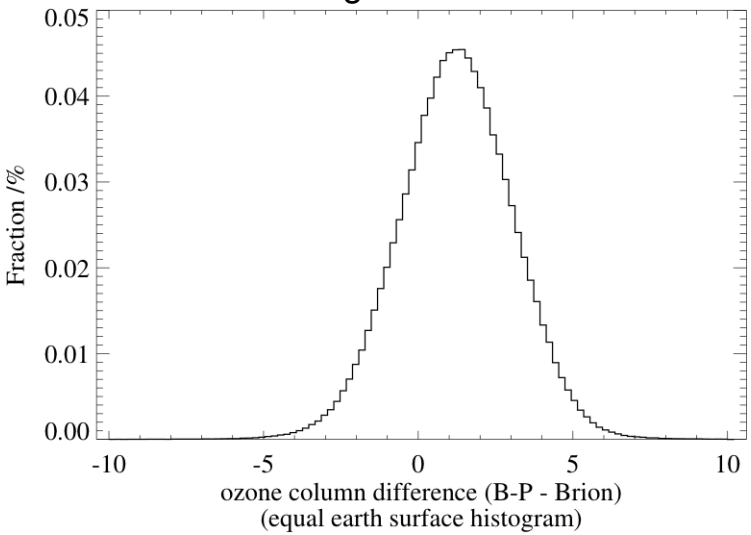
O_3 [DU]:: BP



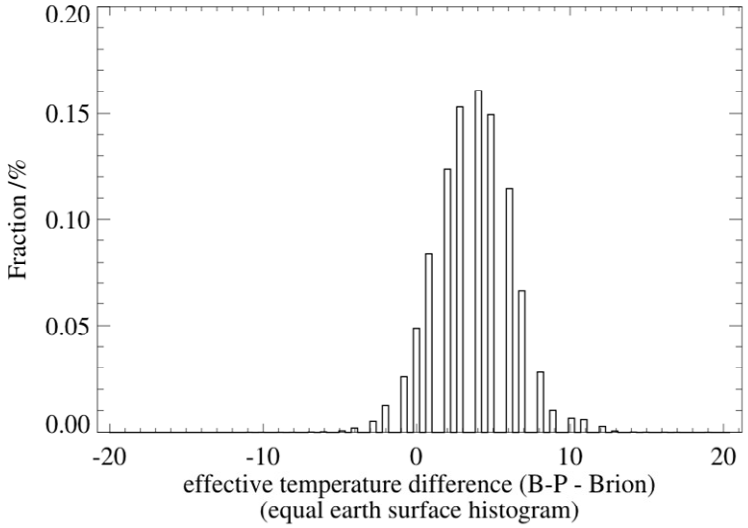
O_3 [DU]:: MDB

Statistics

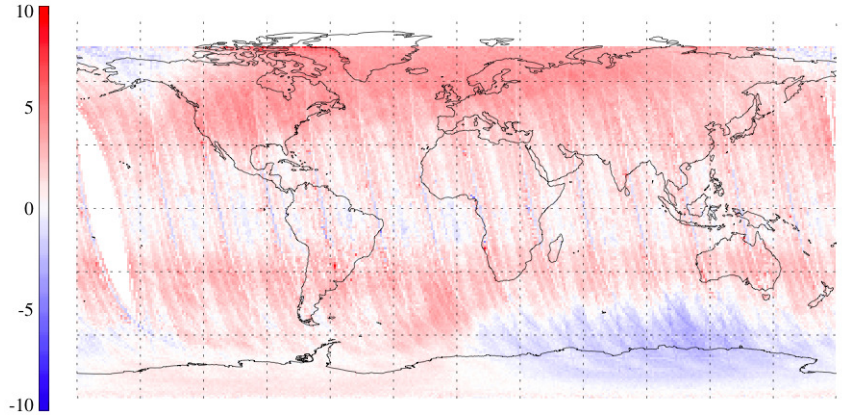
O_3 Column



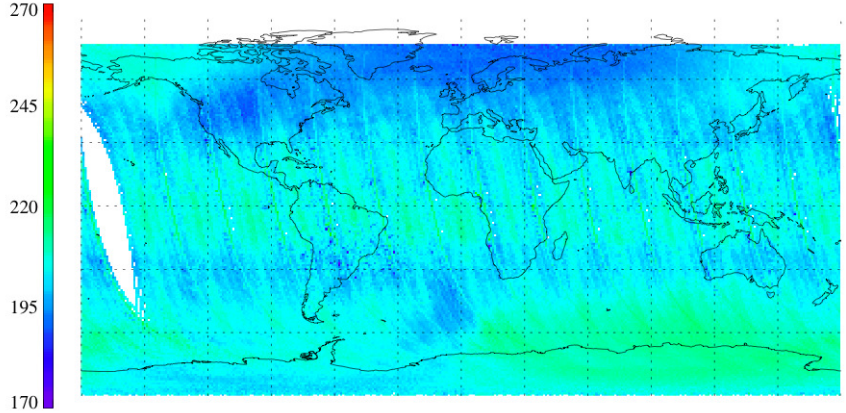
Effective O_3 Temperature



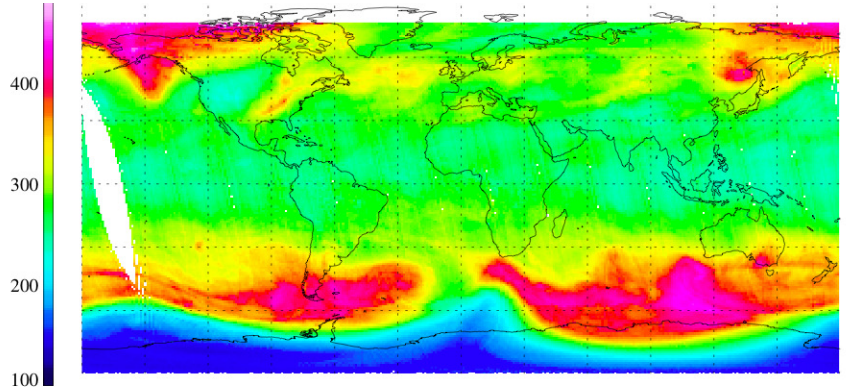
	Bass-Paur	Mallicet-Daumont-Brion
O_3 Column	284 ± 63.6 DU	283 ± 63.5 DU
O_3 Column Precision	4.06 ± 1.88 DU	4.36 ± 2.04 DU
O_3 Column Difference	1.13 ± 1.92 DU	N/A
Effective O_3 Temperature	207 ± 5.23 K	203 ± 6.93 K
Effective O_3 Temperature Precision	3.74 ± 2.78 K	5.21 ± 2.56 K



O_3 [DU]:: BP-BMD



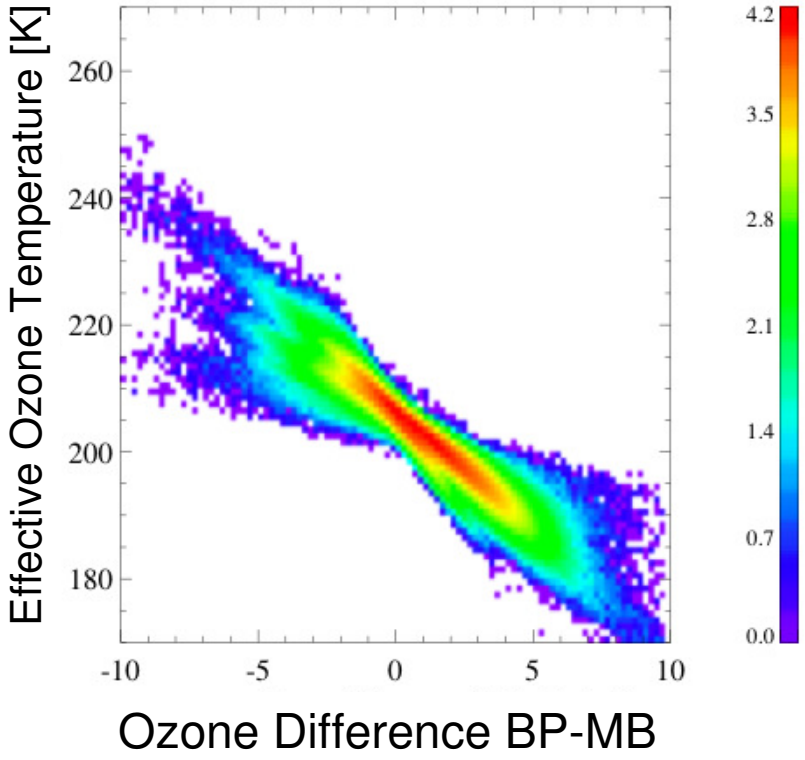
EO_3T [K]:: BMD



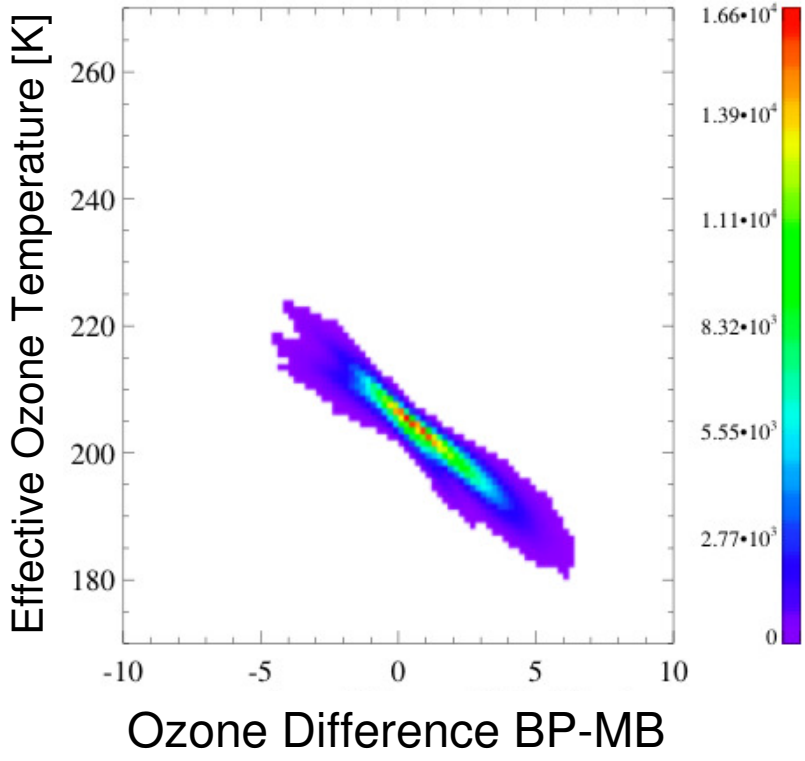
O_3 [DU]:: BP

Correlation between Temperature and Ozone Difference

Log Color Scale



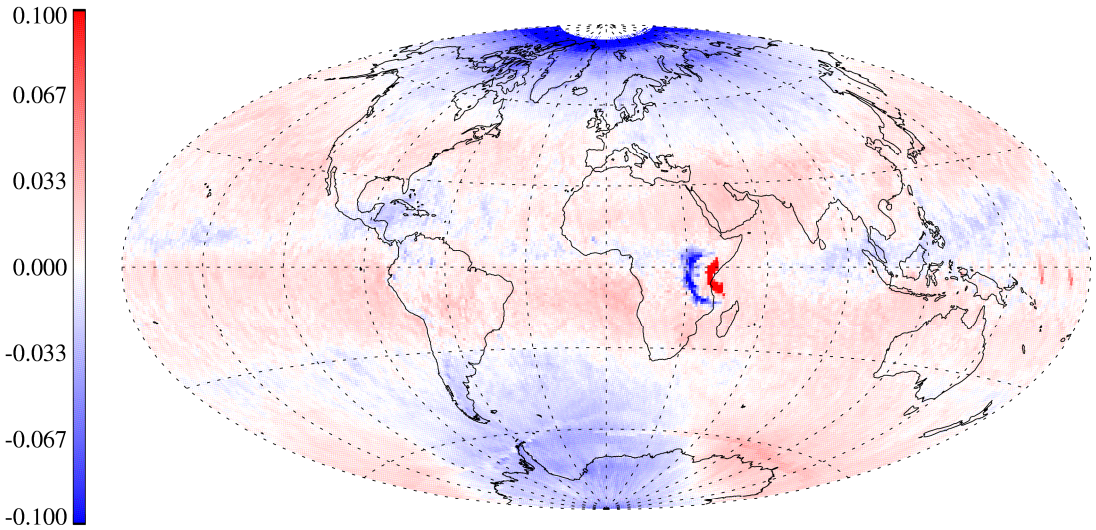
Linear Color Scale



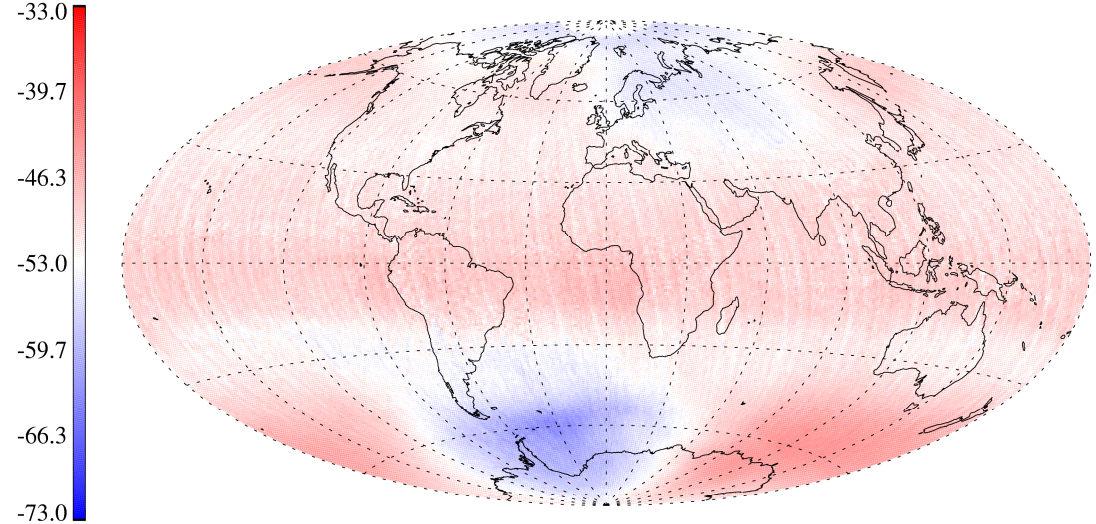
Correlation coefficient 0.9

Conclusions OMDOAO3

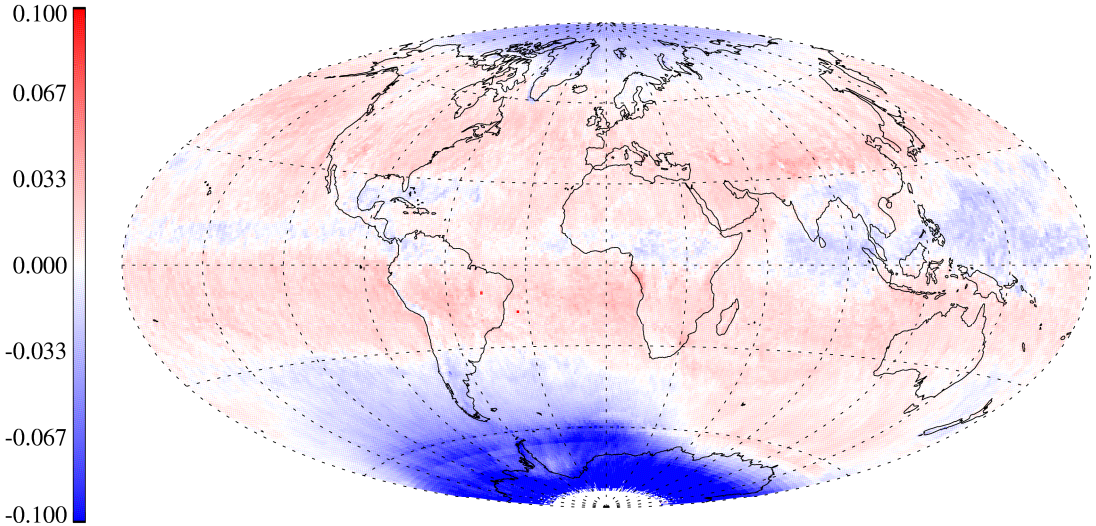
- Difference in ozone column 1 ± 2 DU (1-sigma).
- Bass-Paur fit the data with higher precision and less residual.
- Difference in ozone correlates with the retrieved effective ozone temperature.
- For this fit window there is no clear reason to shift to other cross-sections.



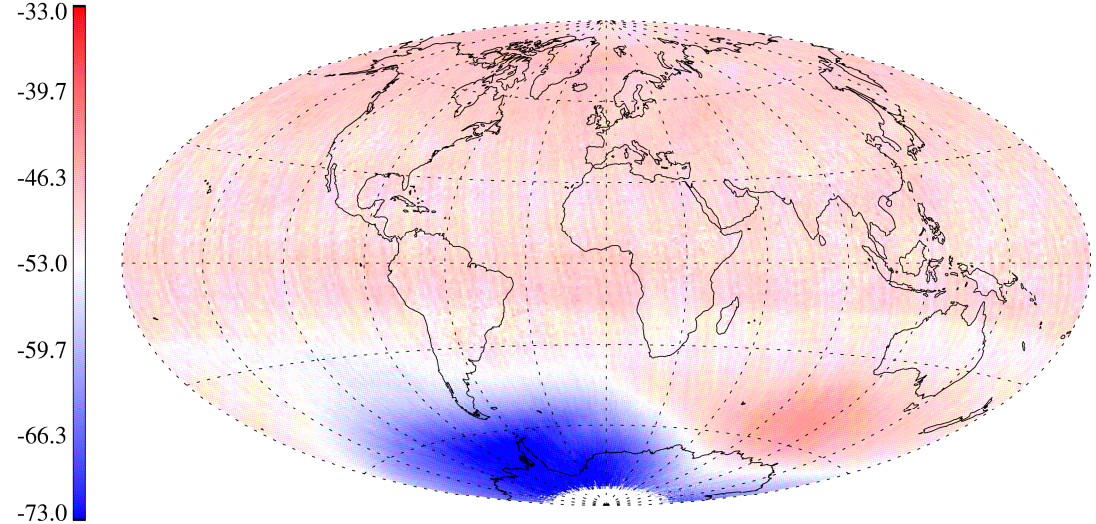
(TOMS-DOAS)/DOAS



OMDOAO3 Eff. Temp. (ºC)



(TOMS-DOAS)/DOAS



OMDOAO3 Eff. Temp. (ºC)

OMI OMO3PR

- Optimal estimation
- Wavelength range:
  - 270 - 308.5 OMI UV-1
  - 311.5 - 330 OMI UV-2
- State vector includes:
  - Ozone at 18 layers
  - UV-1 and UV-2 Albedo (surface/cloud, 2nd order polynomial)
  - UV-1 and UV-2 Radiance stray light (2nd order polynomial)
- Pressure-Temperature profile from ECMWF.
- Cloud pressure for O_2-O_2 cloud product.
- A-prior Labow, Logan, McPeters, with 20% error and 6 km correlation length.

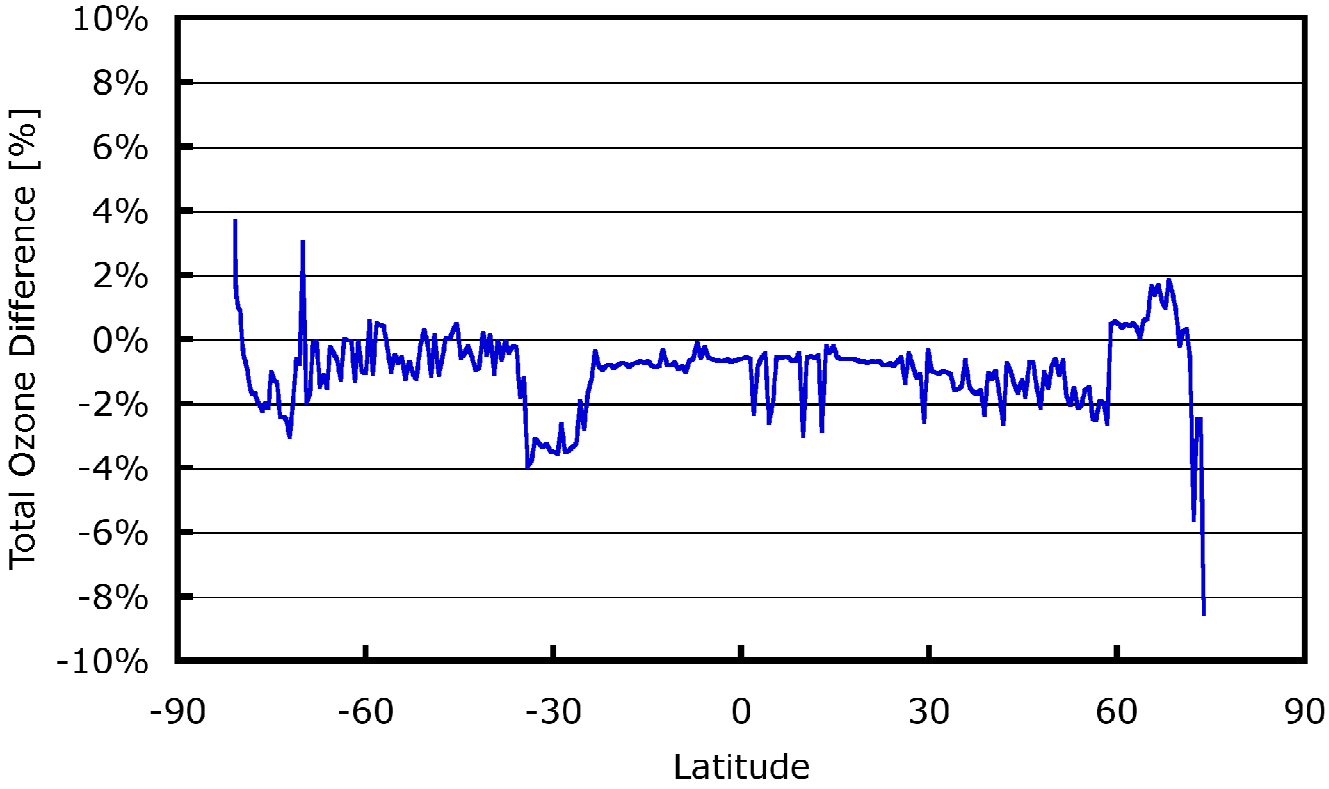
Forward Model

- LABOS (Layers Based Orders of Scattering).
- Includes Raman scattering.
- Polarization is corrected using LUTs.

Test Setup

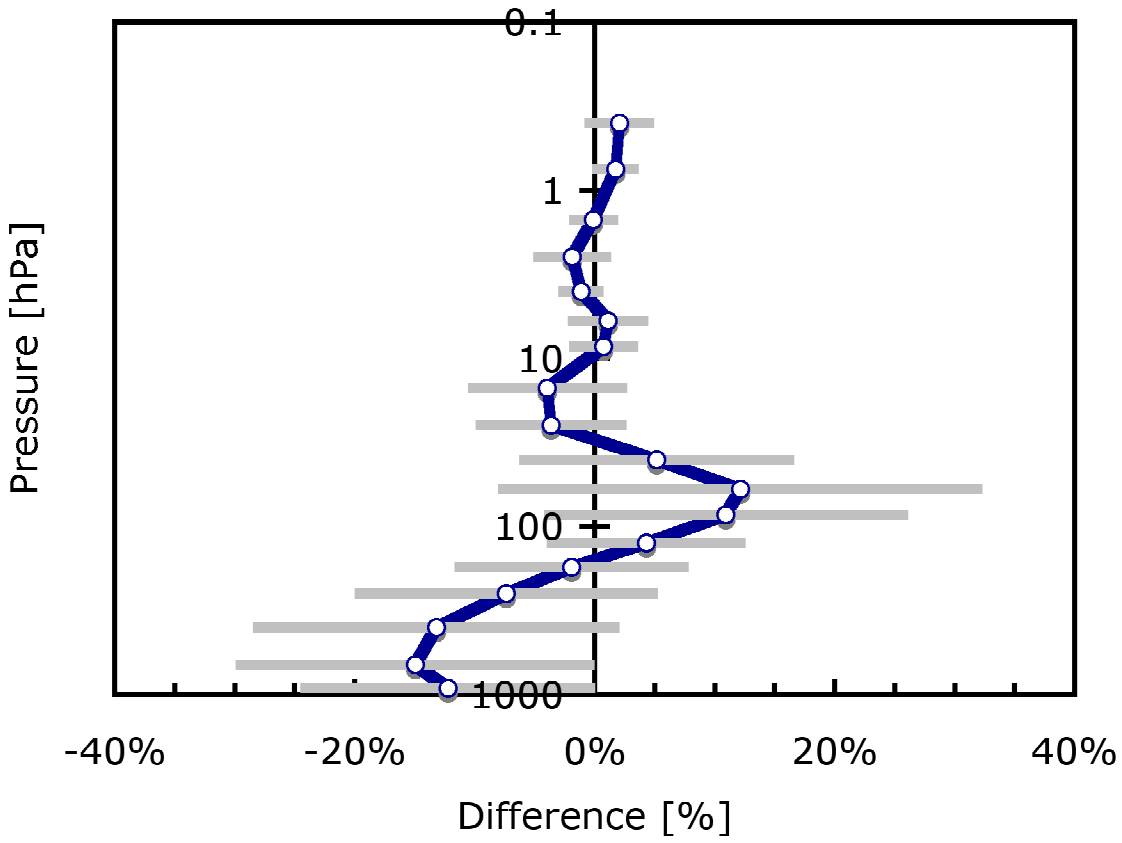
- Single Orbit 6704, across track position 17.
- Orbits has been run using Bass and Paur (BP) and Brion Malicet Daumont (BMD) Cross section.

Comparison of Total Ozone



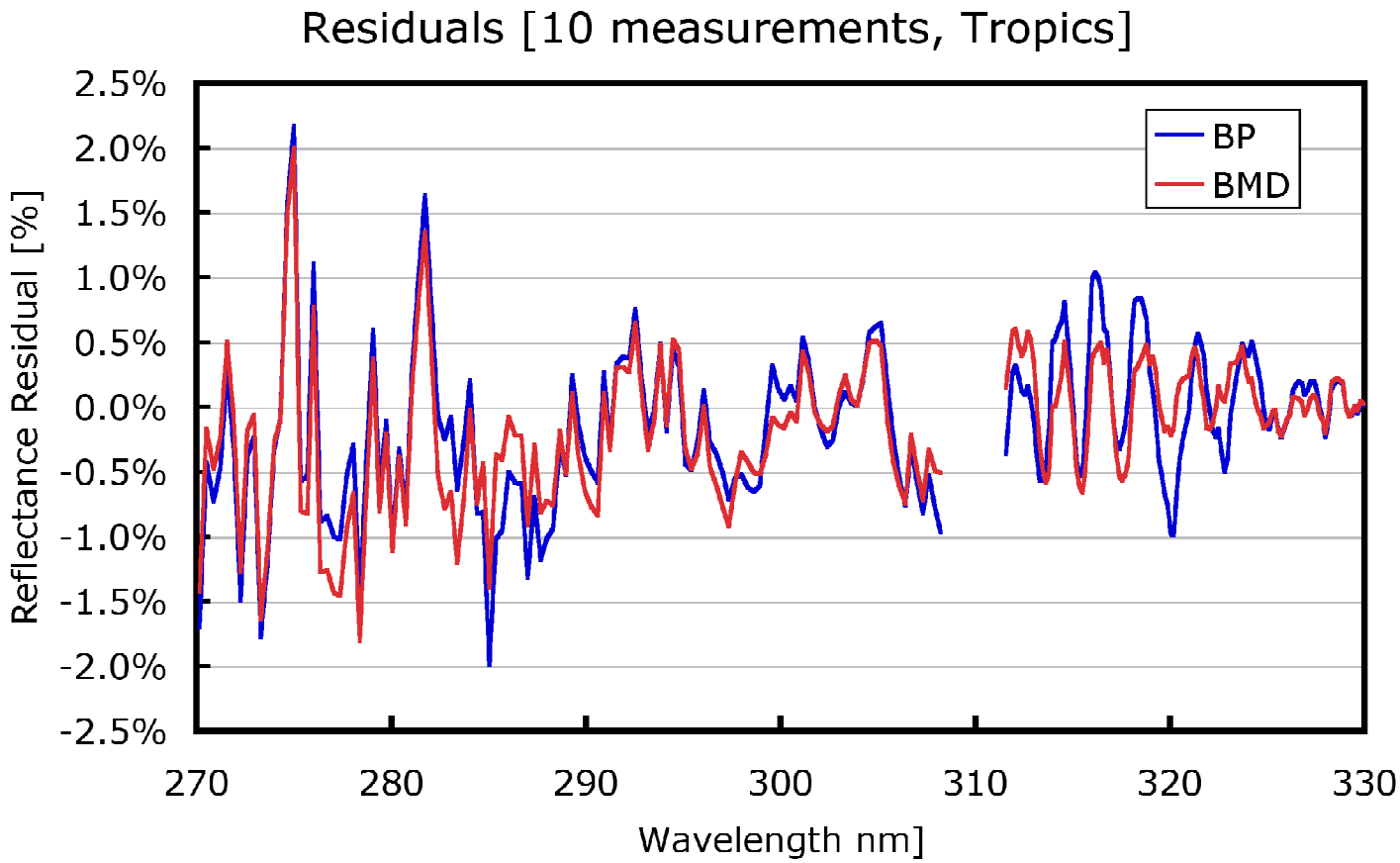
2* (BP - BMD) / (BP + BMD) : -0.92 ± 1.26 %

Difference in Ozone Profile

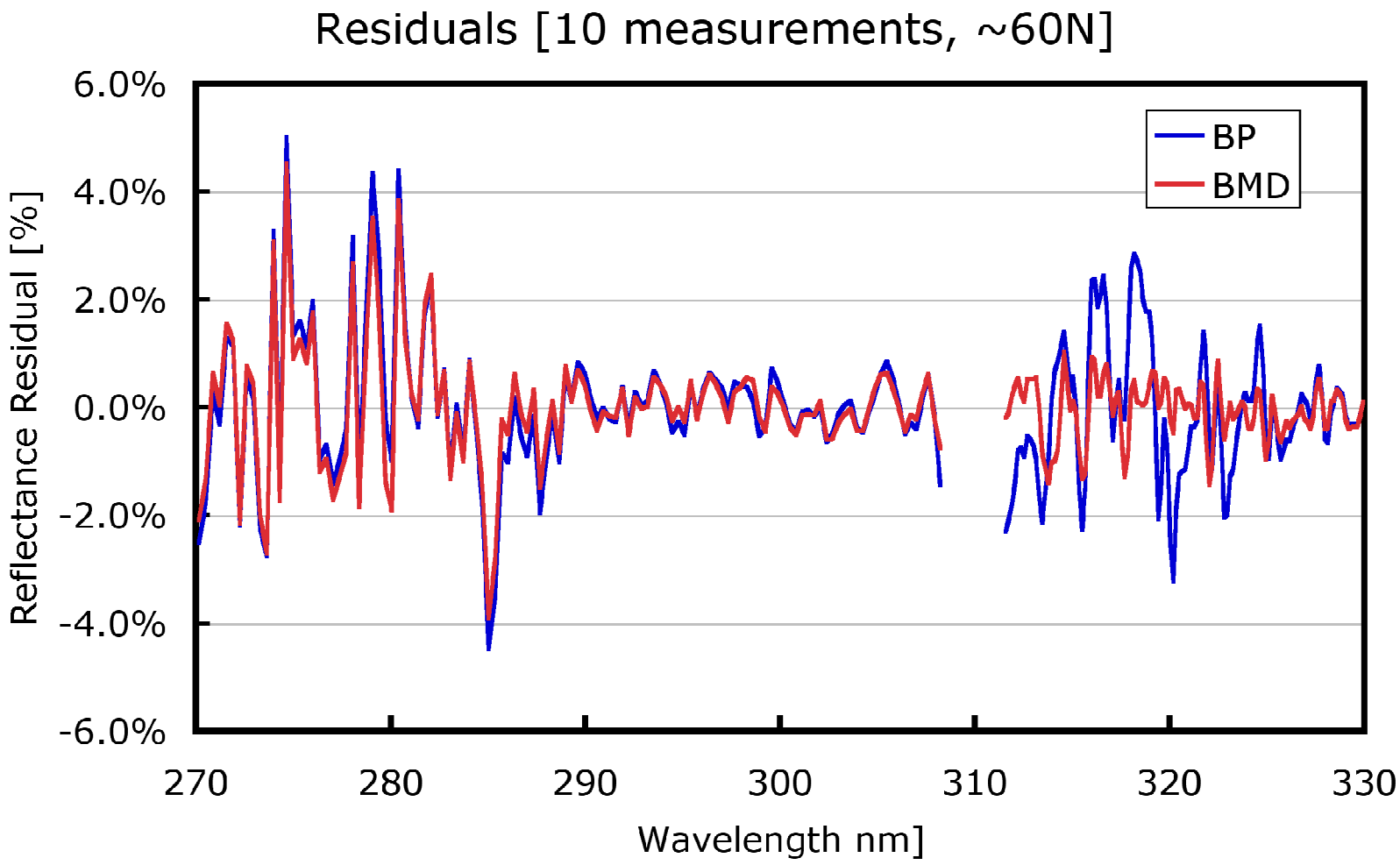


2 * (BMD - BP) / (BMD + BP)
Mean over 1 orbit, xtrack position 17

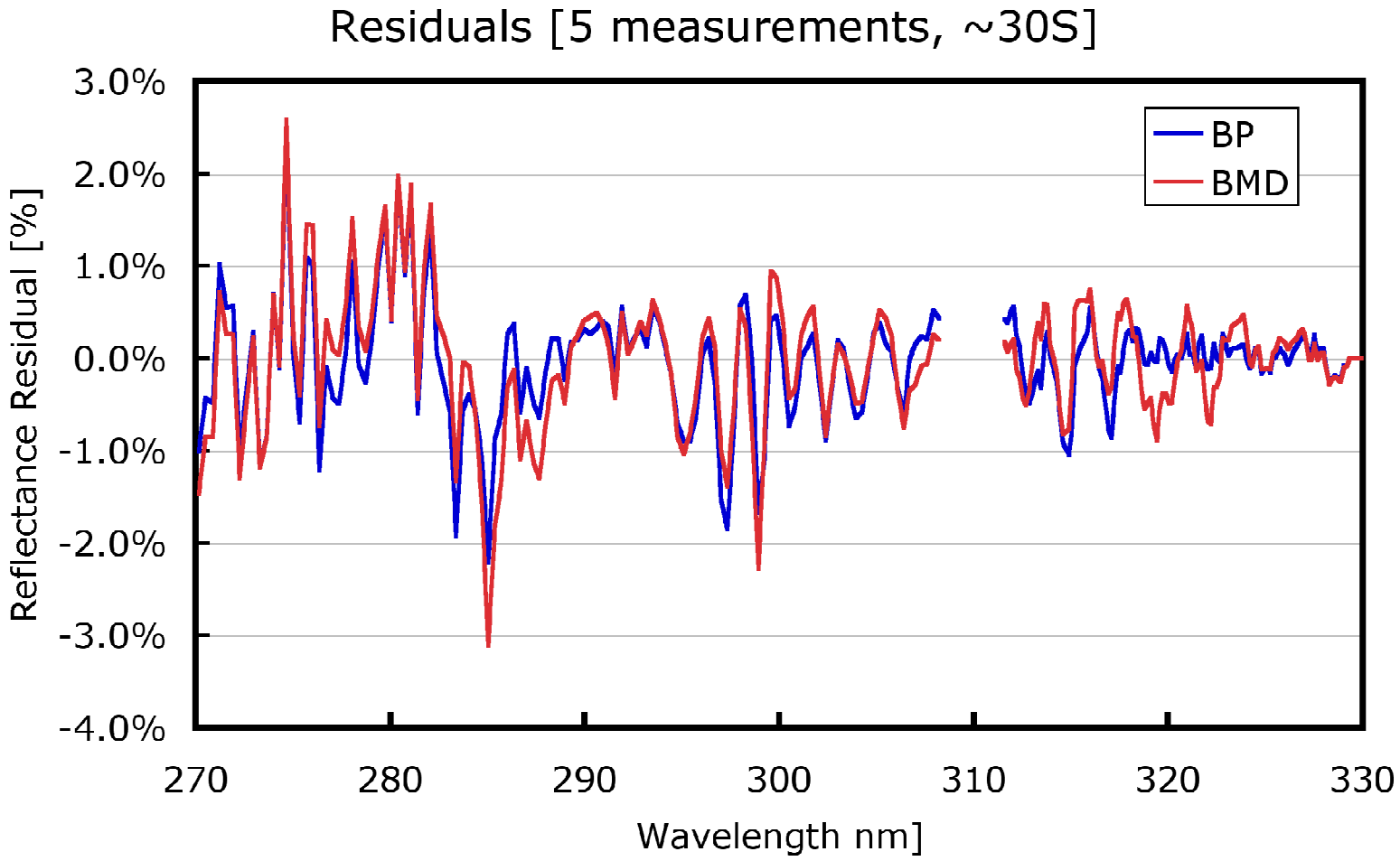
Comparison of Residuals



Comparison of Residuals



Comparison of Residuals



Conclusions OMO3PR

- *Results based on a limited data set.*
- Total column ozone ~1 ± 1% lower values for BMD.
- Difference at specific layers can be 10-15%, increasing towards the troposphere.
- From the residuals there is no clear indication which cross sections are better.