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Effects of Ozone Cross Sections on the OMI OMDOAO3 and OMO3PRO products

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- OMDOAO3: New results

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Activities Related to ACSO

- Checked our version of the cross-sections with the ACSO database.
- Released a document [TN-OMIE-KNMI-943] on the impact on OMDOAO3.
- Investigated the impact on OMDOAO3 and OMO3PR.

OMDOAO3 Algorithm

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

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

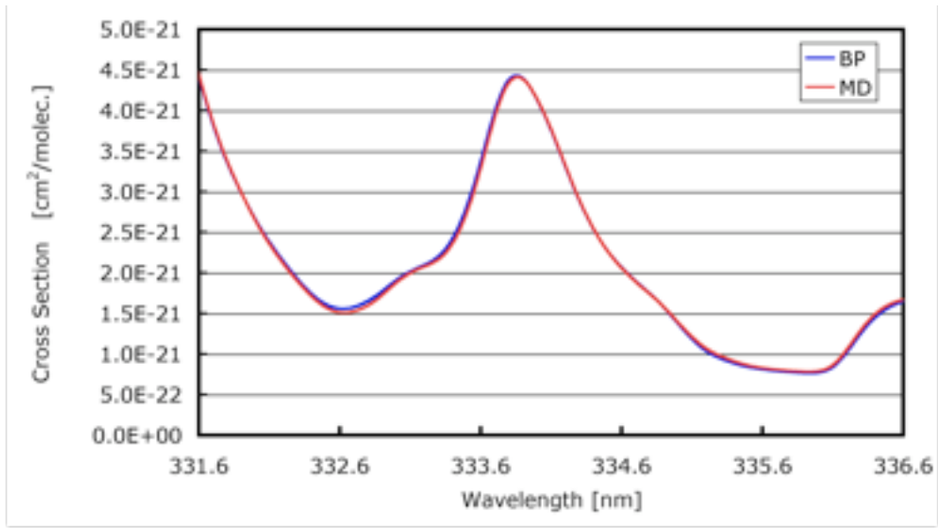
- Where:

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

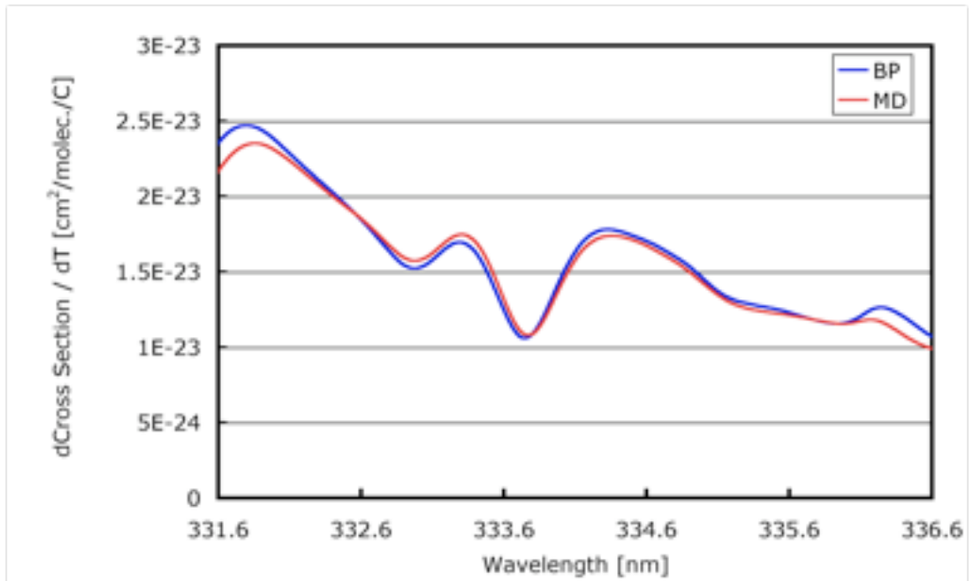
- Fit parameters: slant ozone column, effective ozone temperature, Ring parameters, polynomial coefficients (2nd order).
- Linearization of the ozone cross section around 220 K.
- Bass-Paur are the default cross sections used.

Comparison of the Cross Sections

- Difference in the cross section <1.5%
- Difference in the T dependence <~20%



Cross sections @ 220 K



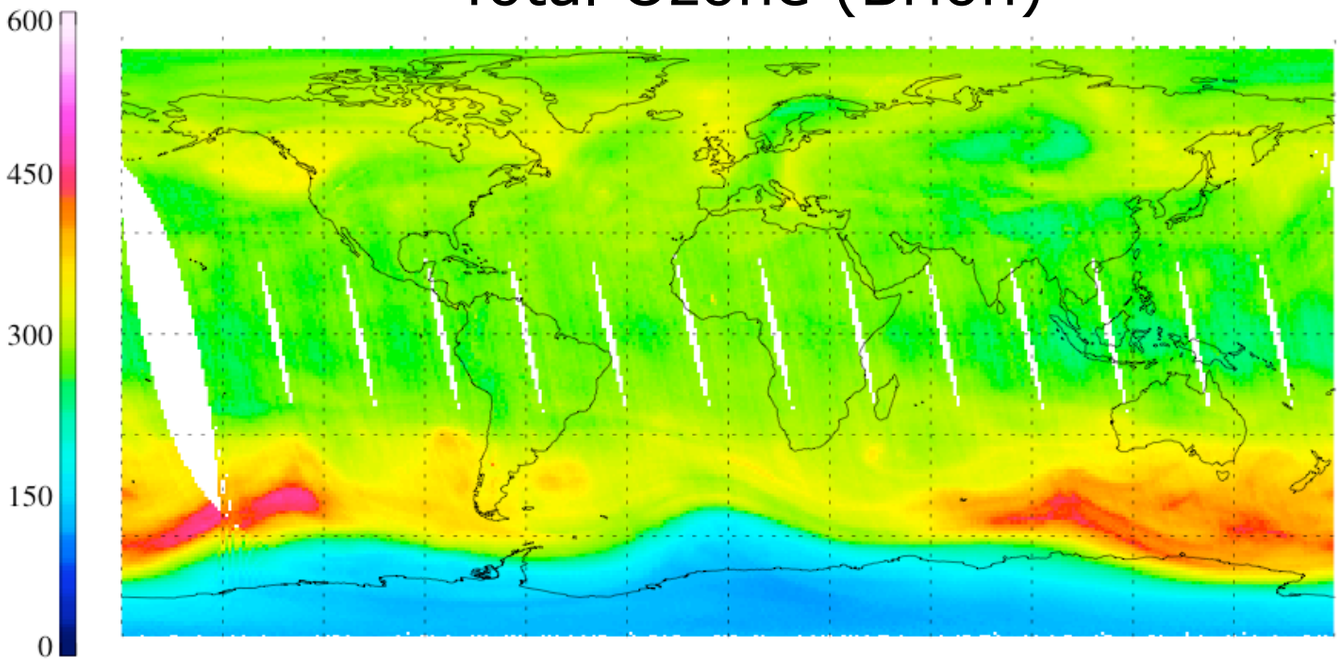
Temperature derivative @ 220 K

2009 Conclusions OMDOAO3

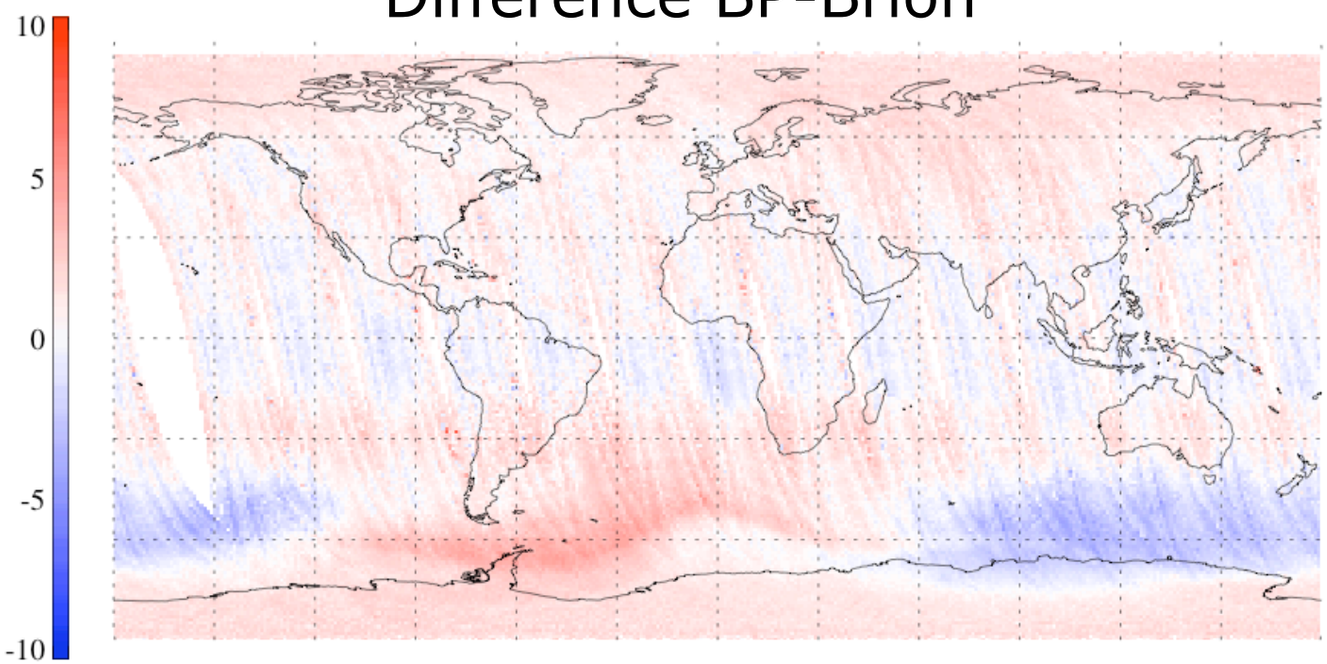
- Difference in ozone column 1 ± 2 DU (1-sigma).
- Bass-Paur fit the data with higher precision and less residual.
- Difference in ozone correlates with the retrieved effective ozone temperature.
- For this fit window there is no clear reason to shift to other cross-sections.

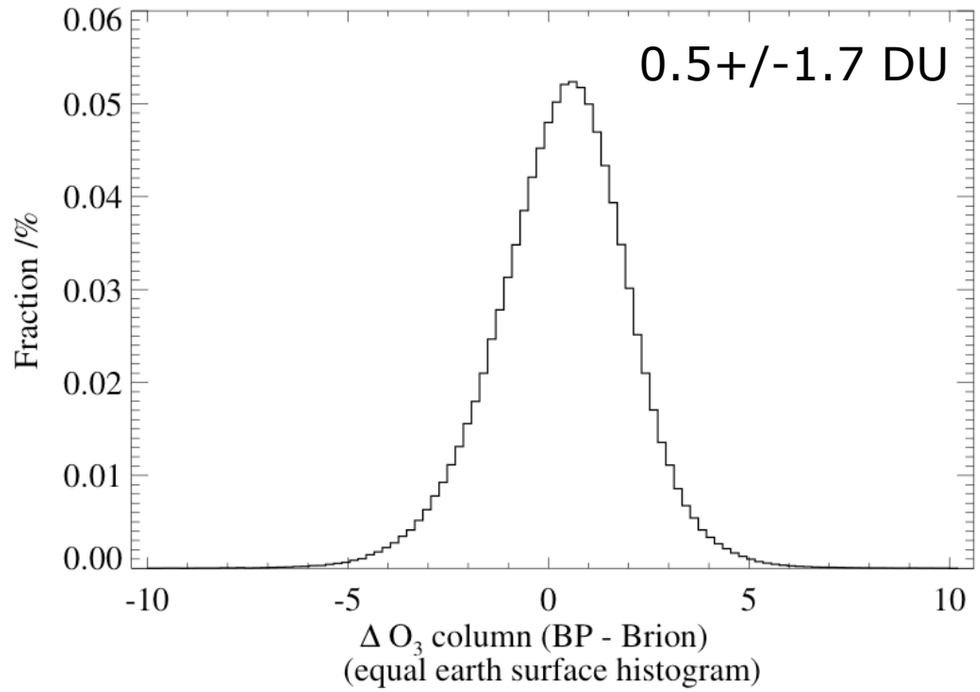
Comparisons 2005-10-01

Total Ozone (Brion)

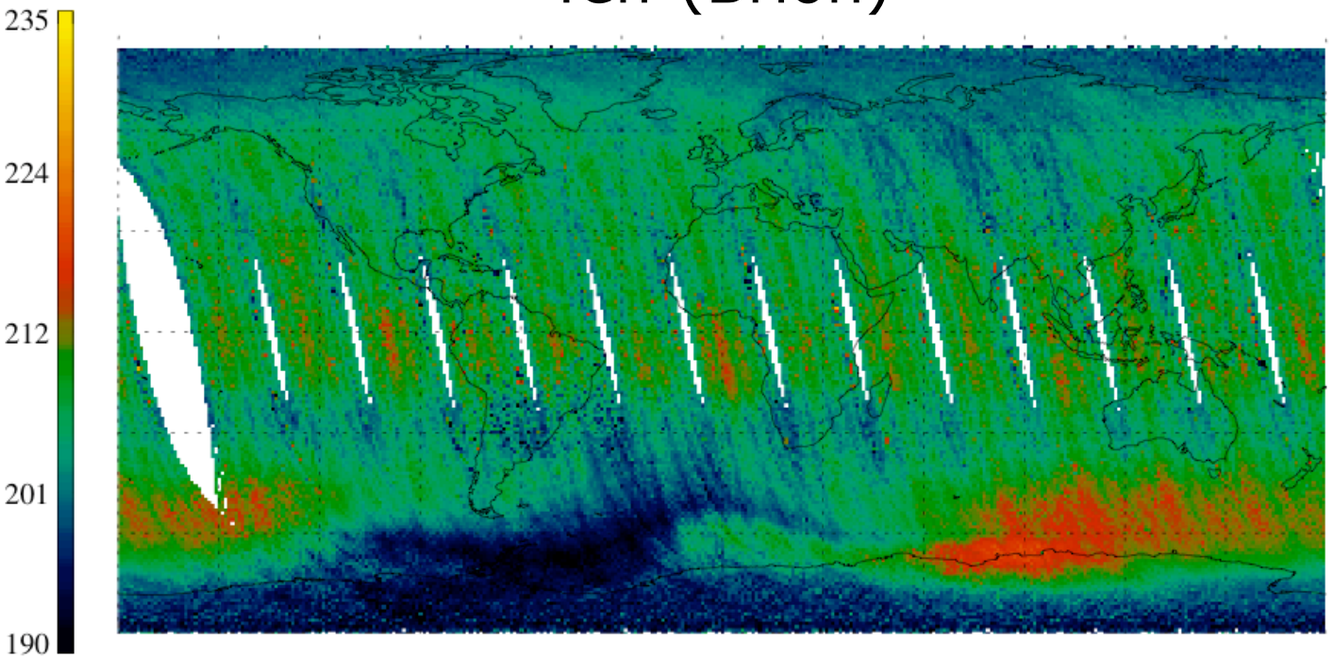


Difference BP-Brion

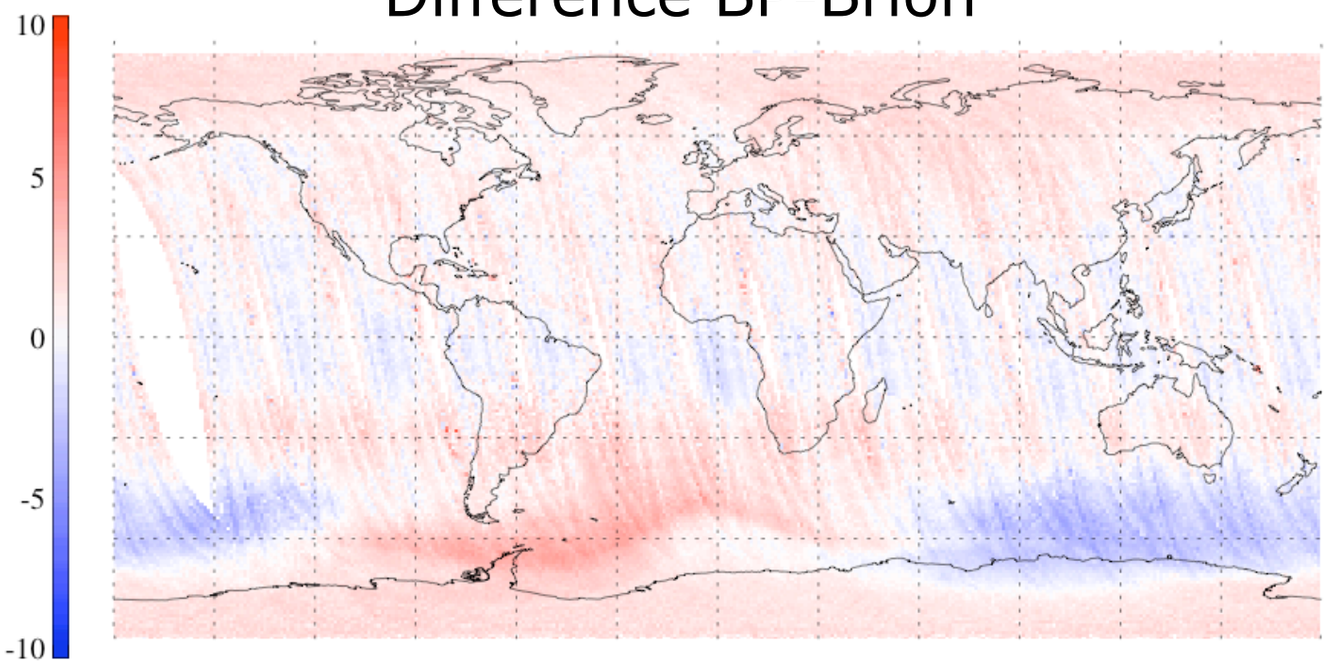


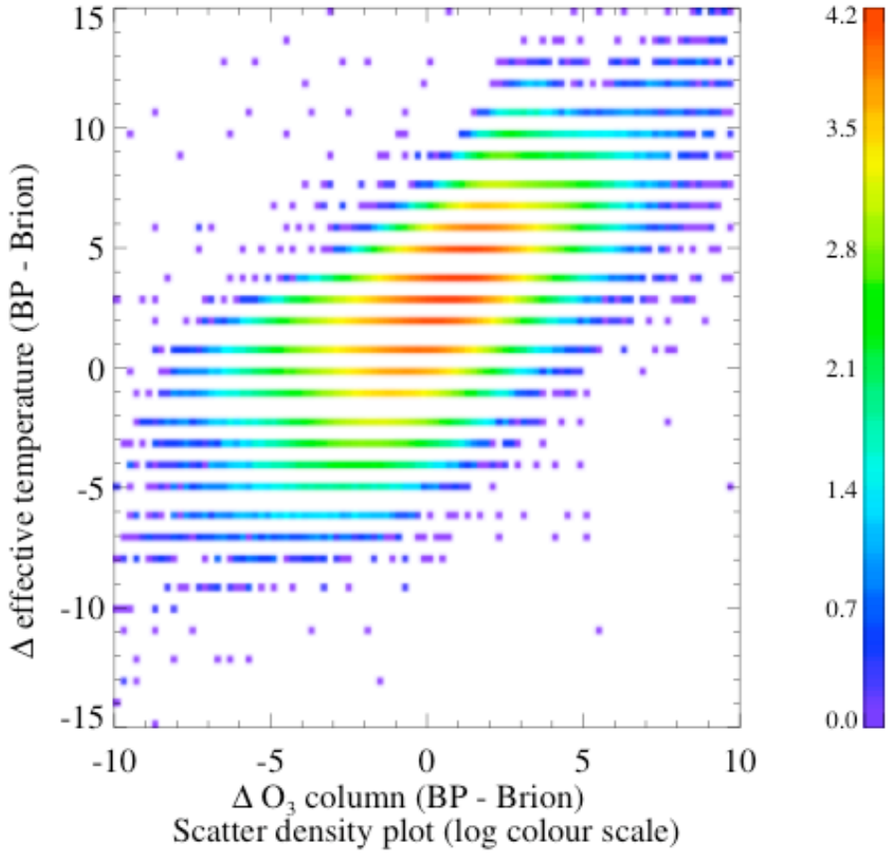


Teff (Brion)

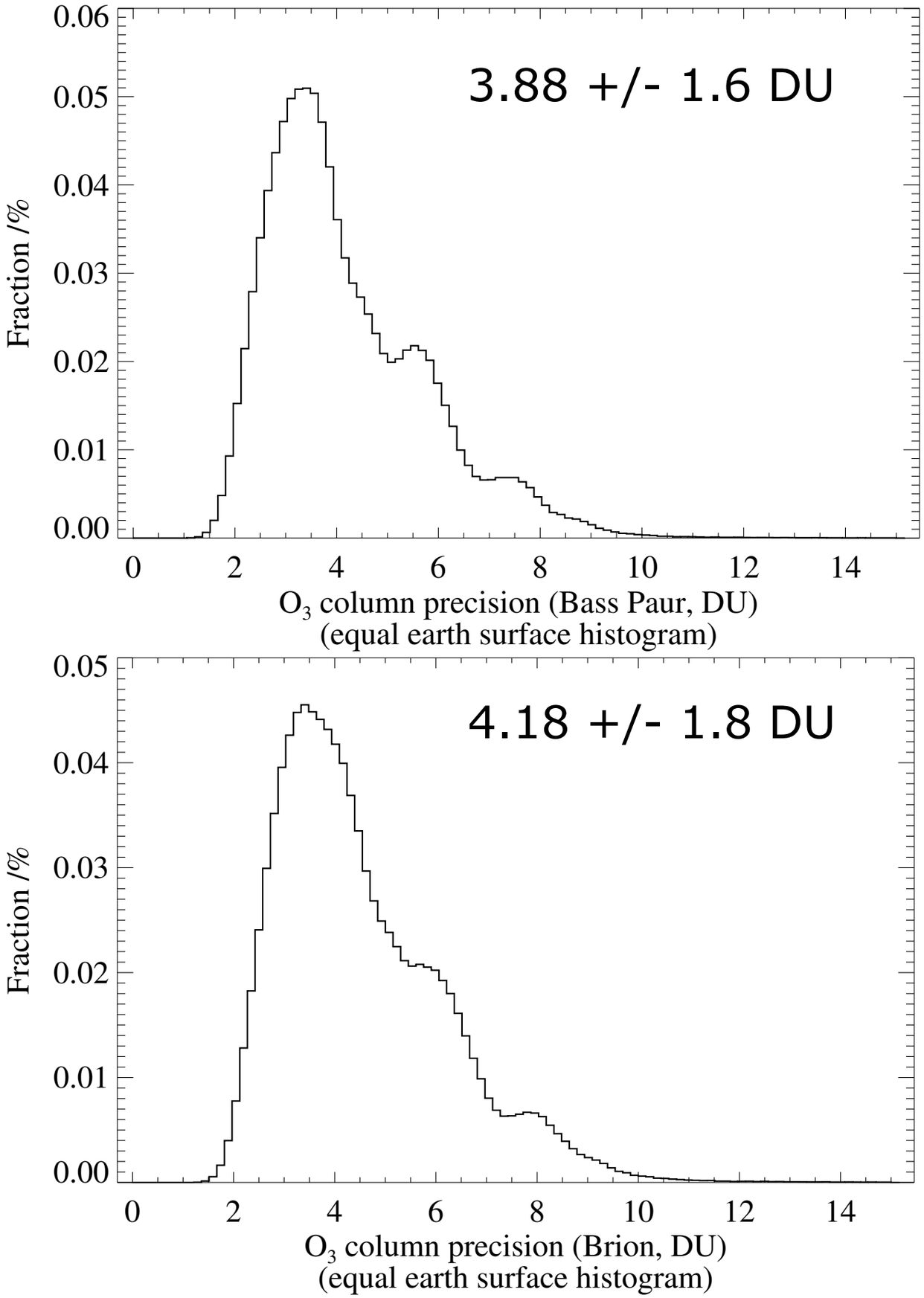


Difference BP-Brion

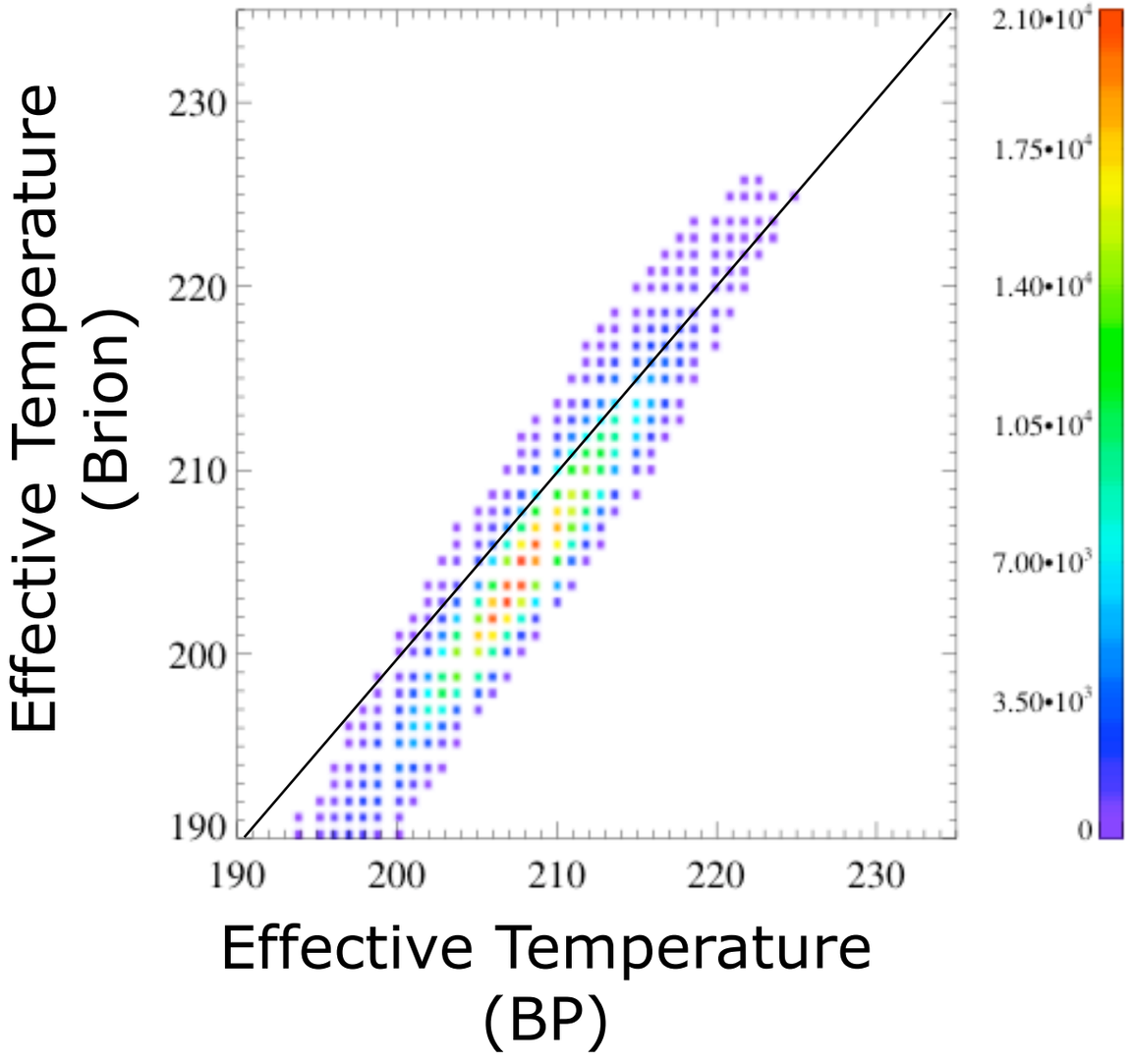


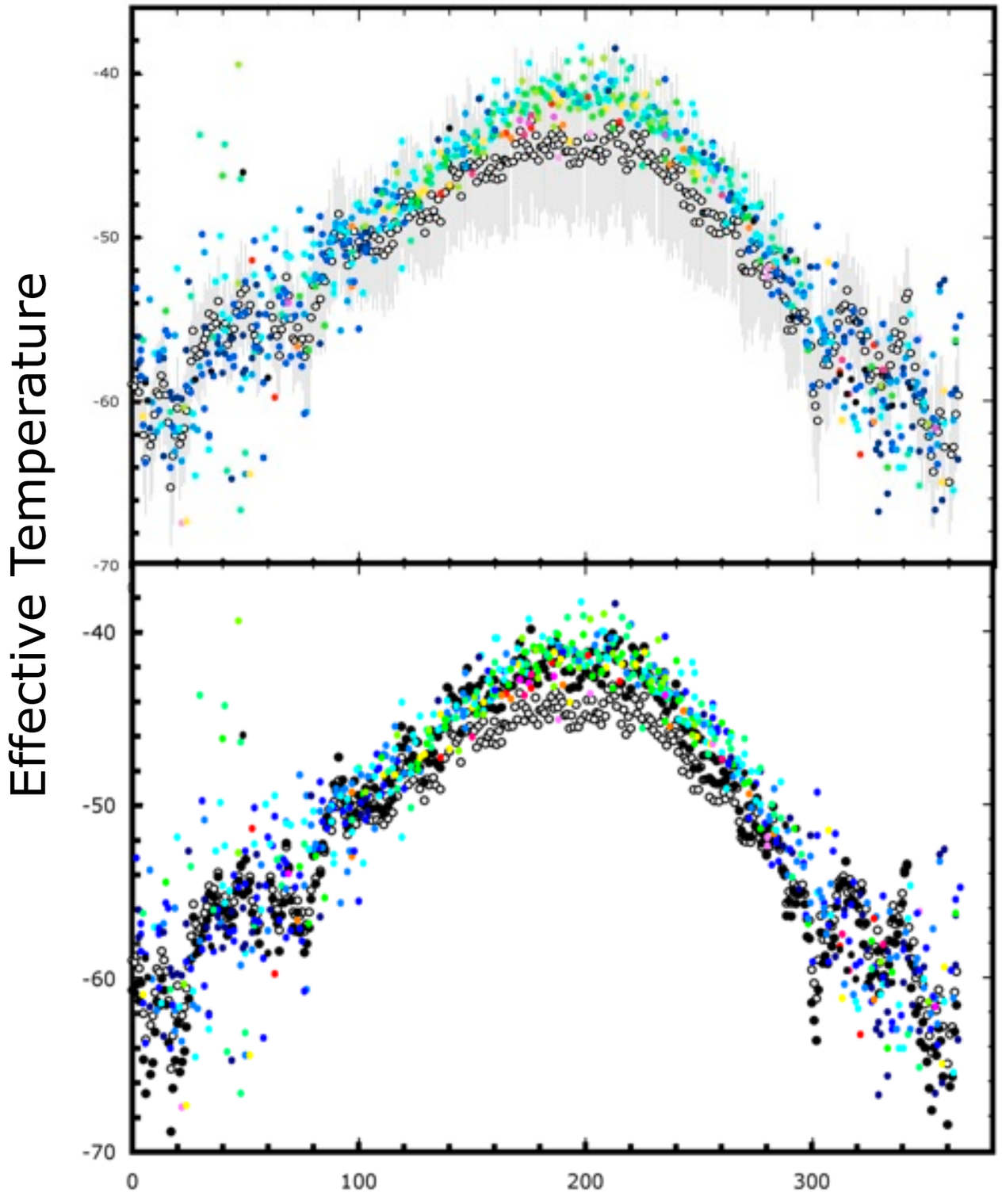


Ozone Column Precision



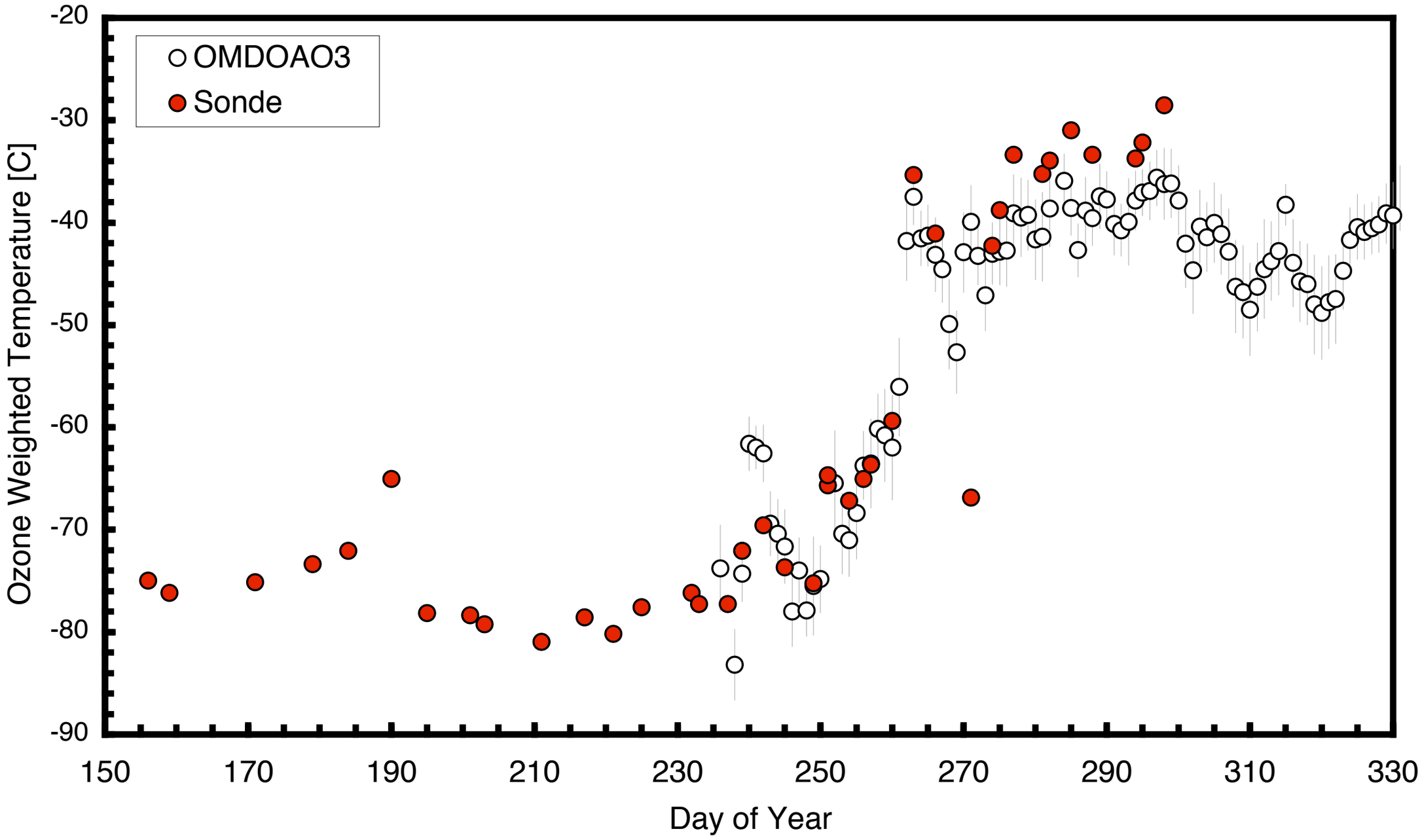
Effective Temperature





De Bilt
Colors: sonde
Black: OMI DOAS 2006

Comparison at high SZA



Conclusions OMDOAO3

- The difference in total ozone is small: 0.5+/-1.7 DU.
- The differences in ozone depend on the ozone effective temperature.
- The slope between the effective temperatures is ~1.3, with Brion giving a larger variation.
- Fit quality of the BP cross sections is marginally better.
- Final conclusion may be derived from effective temperature validation.

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.

http://disc.sci.gsfc.nasa.gov/Aura/data-holdings/OMI/omo3pr_v003.shtml

2009 Conclusions OMO3PR

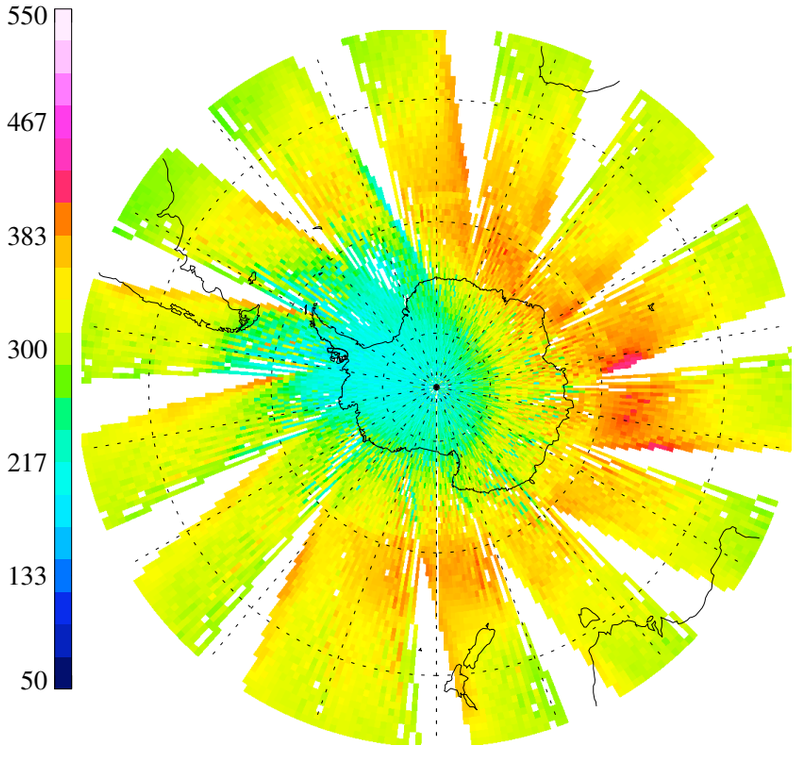
- *Results based on a limited data set.*
- Total column ozone ~1 ± 1% lower values for BMD.
- Difference at specific layers can be 10-15%, increasing towards the troposphere.
- From the residuals there is no clear indication which cross sections are better.

Comparison Setup

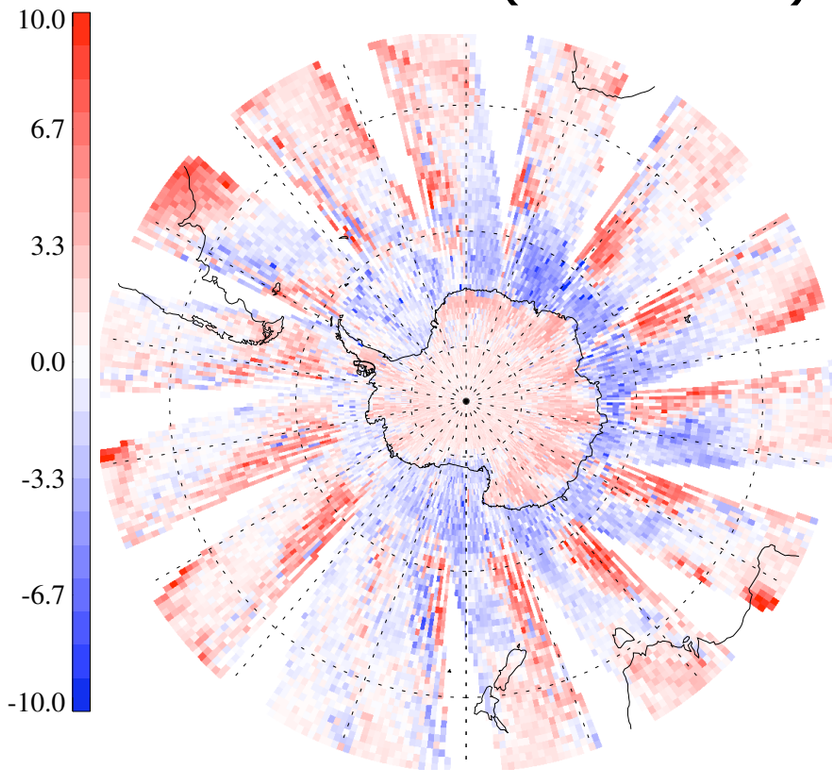
- Comparisons for four days of November 2009.
- Retrievals selected are for the SH and for across track pixels 1-13.
- Number of comparisons >120,000
- Focus on the total ozone and the reflectance cost function.

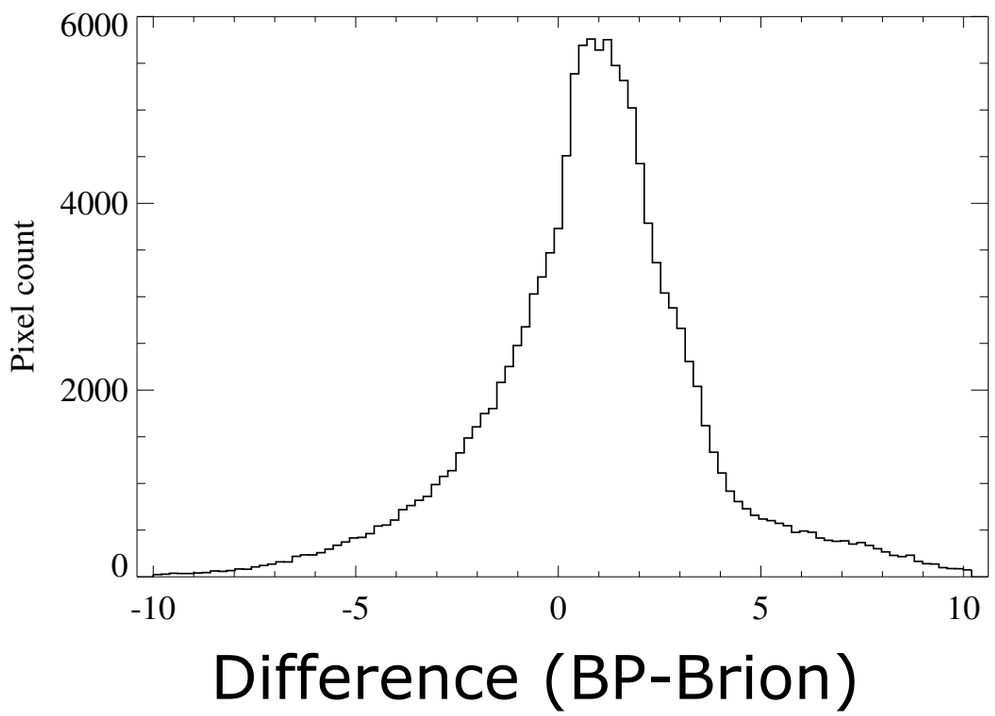
Total Ozone

Total Ozone (Brion)



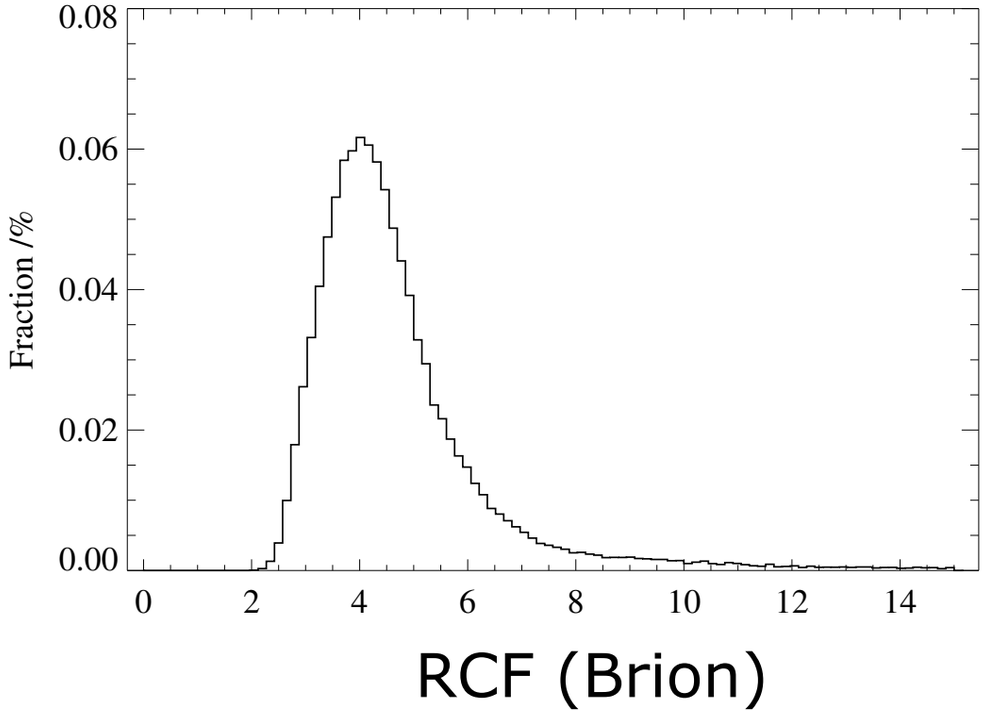
Difference (BP-Brion)

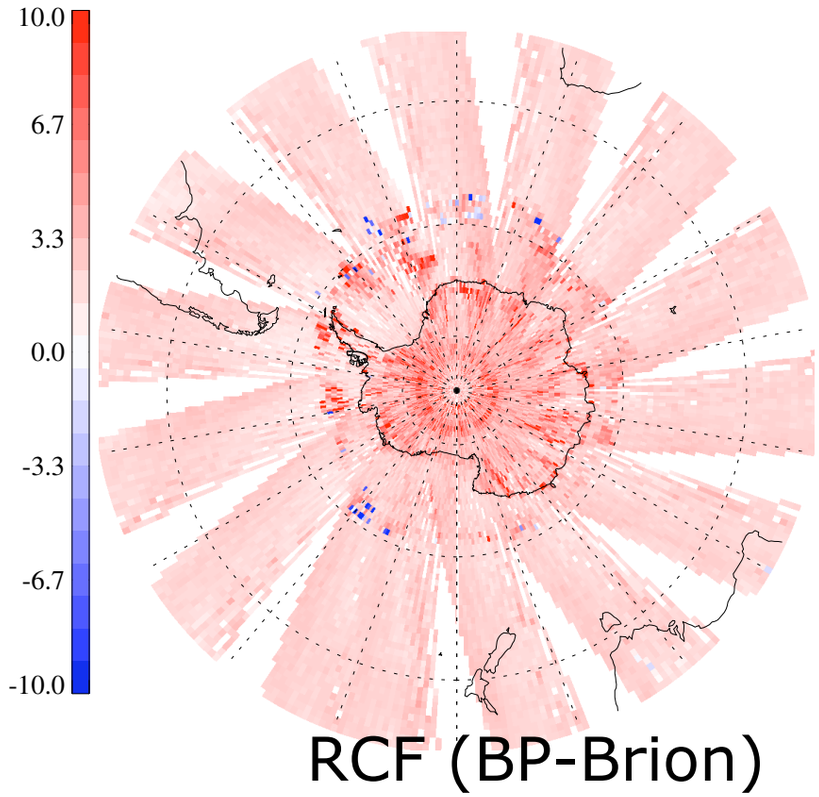


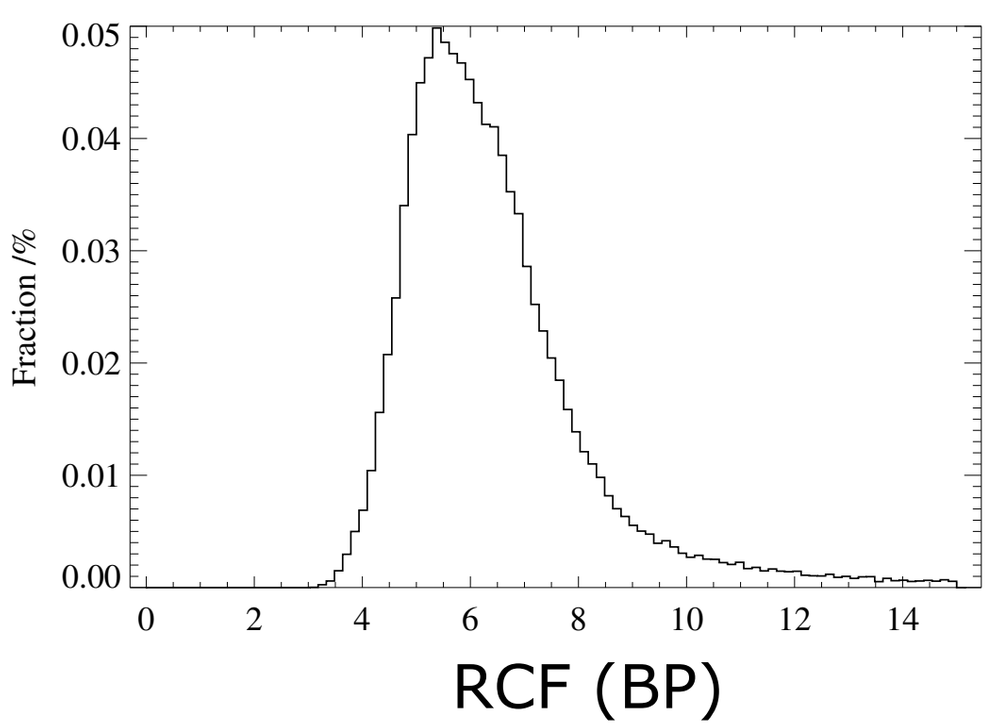


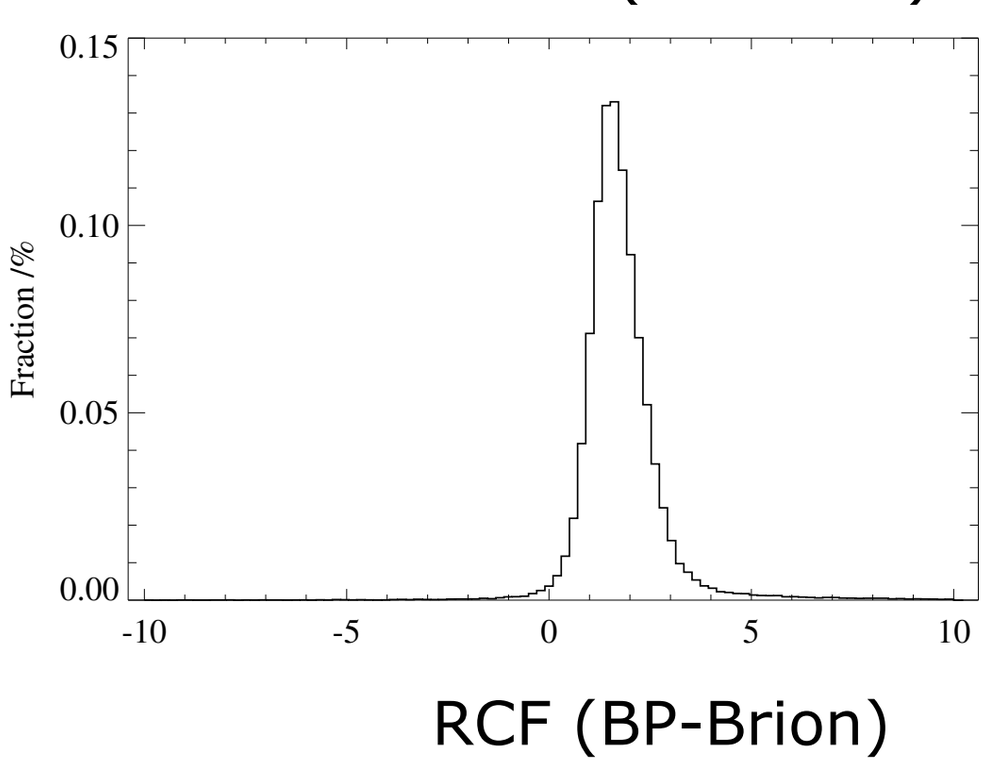
Difference (BP-Brion)
0.9 +/- 2.8 DU

Reflectance Cost Function









Conclusions OMO3PR

- The difference in total ozone is small: 0.9+/-2.8 DU.
- The residuals for Brion are significantly smaller compared to BP.
- Based on the reflectance cost functions we recommend the Brion cross sections.

Future Plans

- OMDOAO3: Effective temperature validation.
- OMO3PR: Write report for the obtained results.
- Implement the ACSO recommended cross section in operational algorithms.