GOMOS retrievals with Serdyuchenko et al. O3 cross sections

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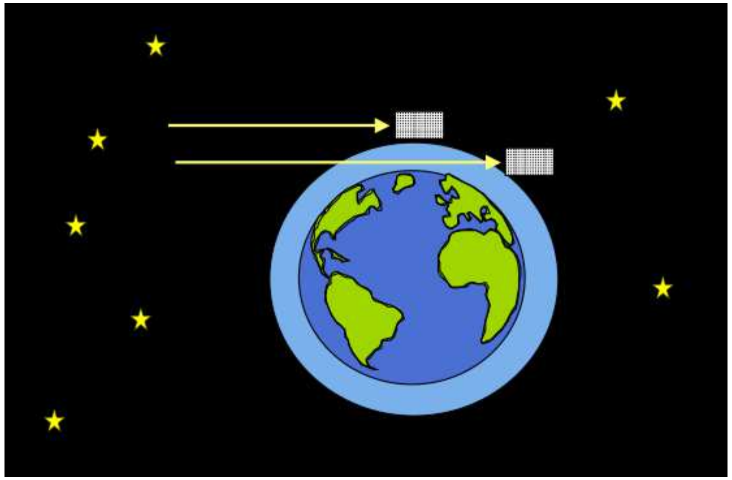
FMI



Meeting on Ozone Absorption Cross Sections

3-5 June, 2013

WMO Headquarters 7 bis, Avenue de la Paix CH-1211 Geneva

Contents

1. GOMOS retrieval and cross sections
2. Serdyuchenko et al. and Bogumil et al. V3 cross sections compared
3. GOMOS ozone profile changes
4. Conclusions

GOMOS O3 cross sections and retrieval

1. Bogumil cross sections at temperatures 203K,
 223K, 243K, 273K, 293K in 245-700 nm.
For GOMOS Additional temperatures by interpolation to 213K, 233K,
253K, 263K, 283K, 288K

2. Serdyuchenko et al. cross sections 193K, 203K, 213K,
 223K, 233K, 243K, 253K, 263, 273K, 283K, 293K in 245-700 nm

3. Convolution with the GOMOS instrumental function (next slide)

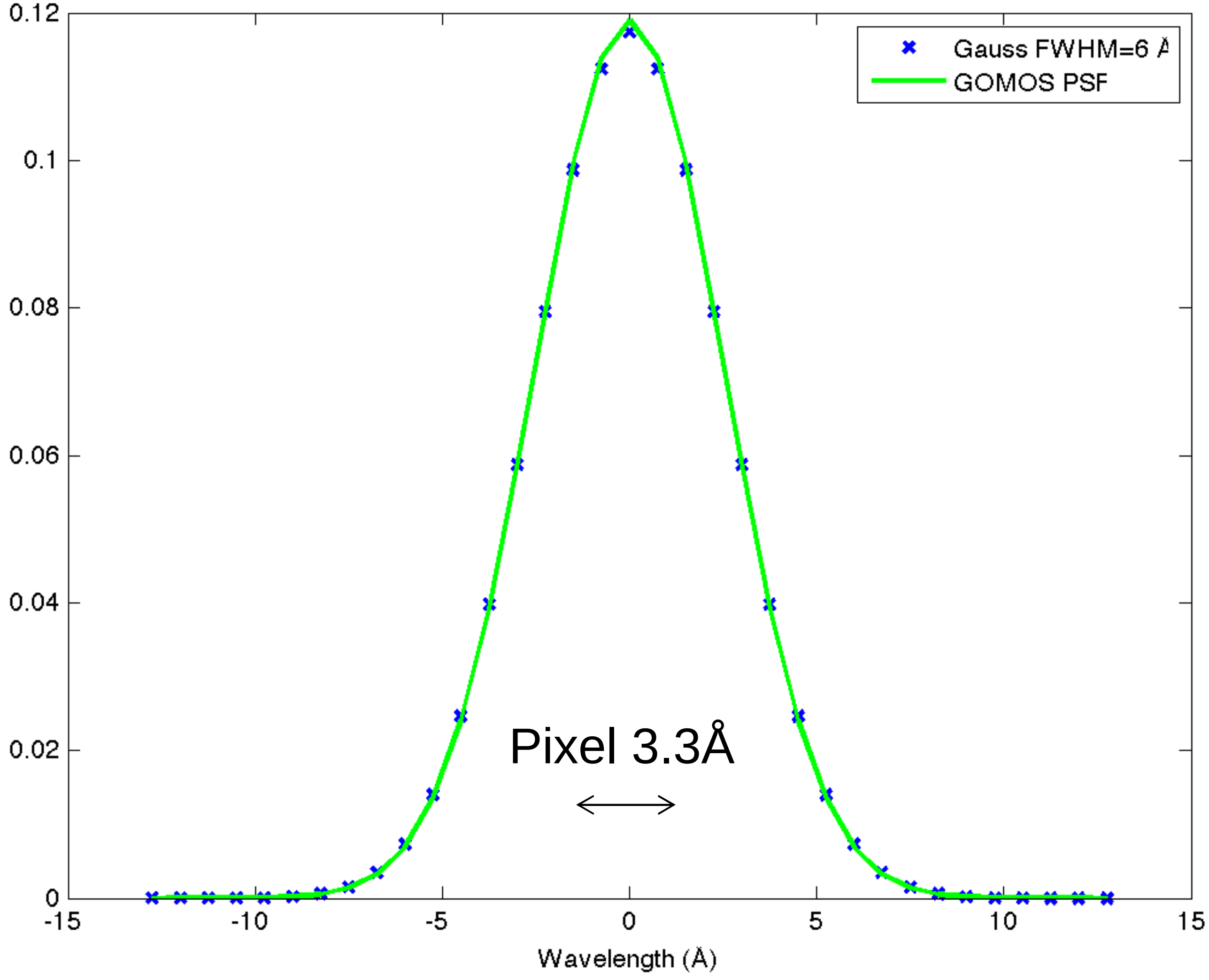
4. Temperatures from ECMWF + MSIS90

5. Cross sections for retrieval at a given temperature by
 linear interpolation

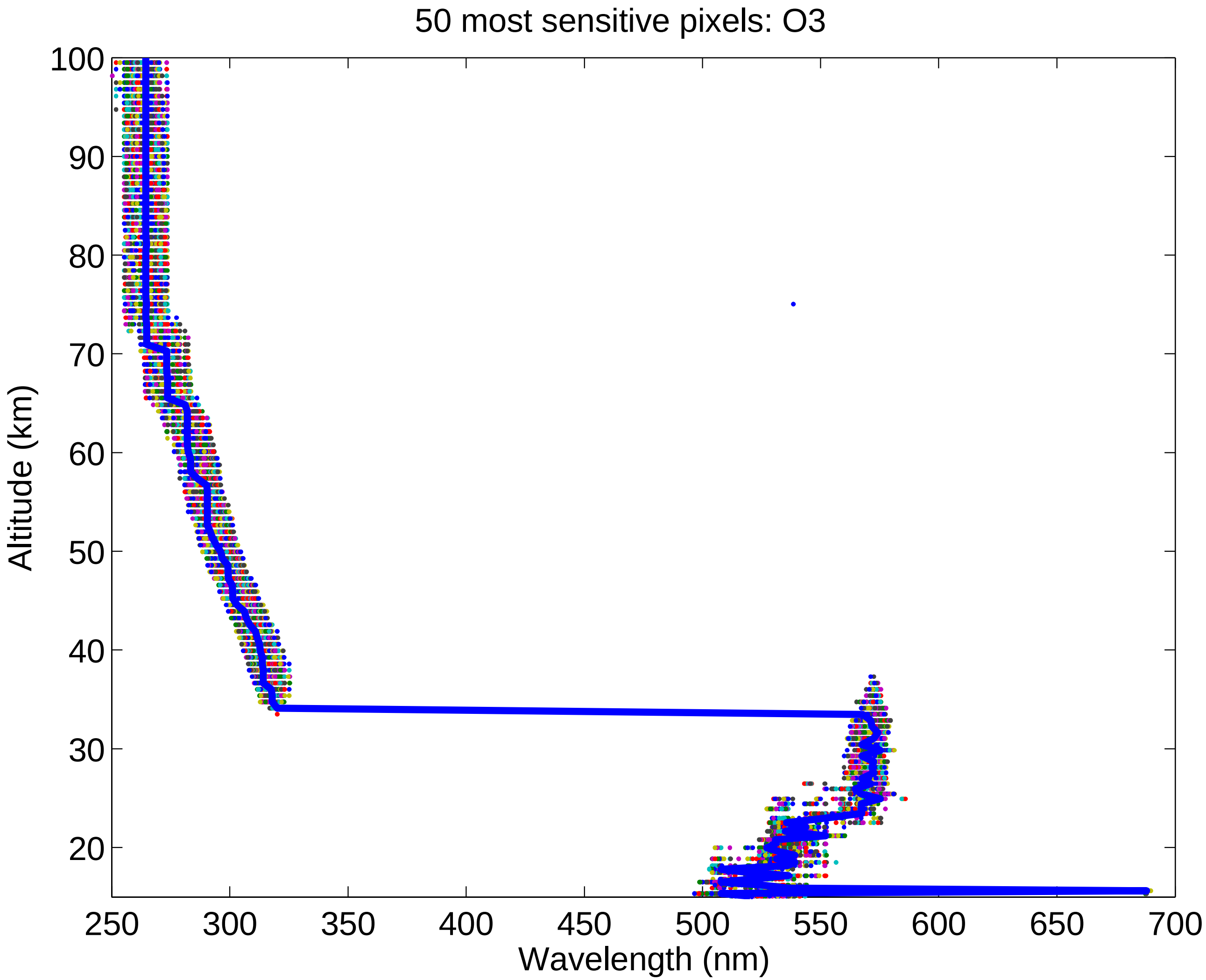
6. Temperatures outside the temperature range of
cross sections approximated by the nearest value.

7. Retrievals by FMI's GomLab-breadboard

GOMOS static PSF

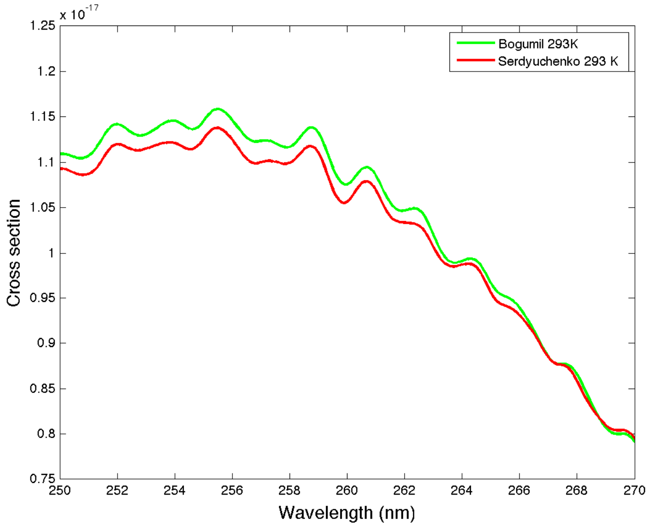


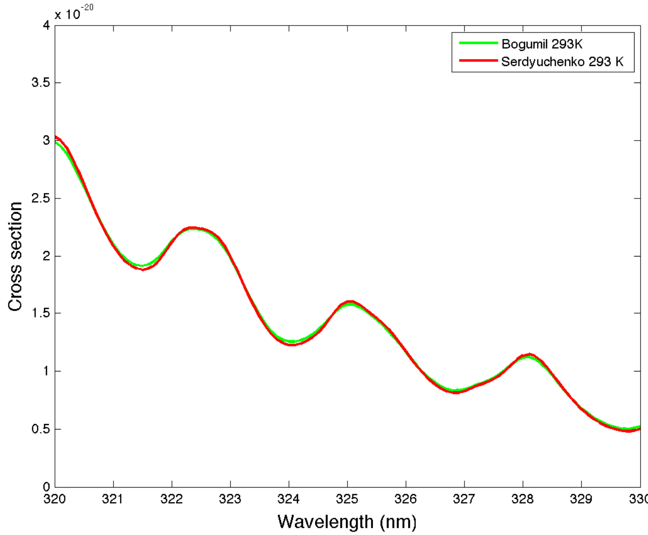
GOMOS effective retrieval window for ozone

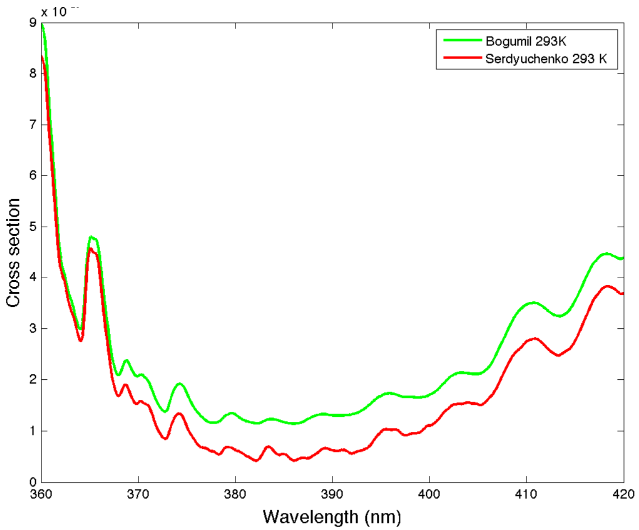


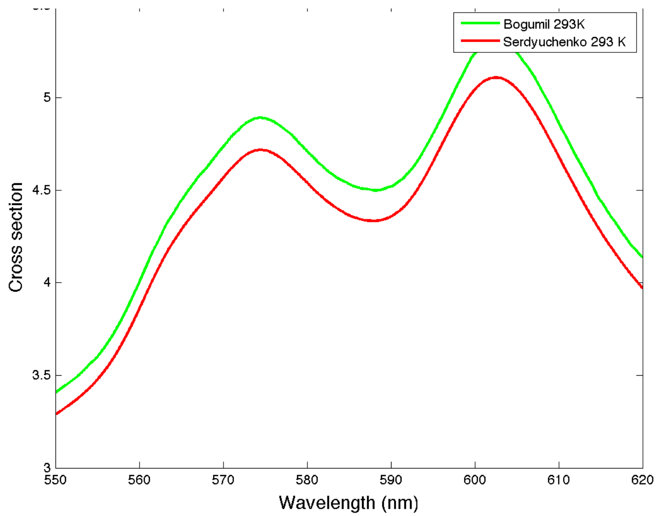
Details depend on the atmospheric state of the occultation

Differences in cross sections (293 K)

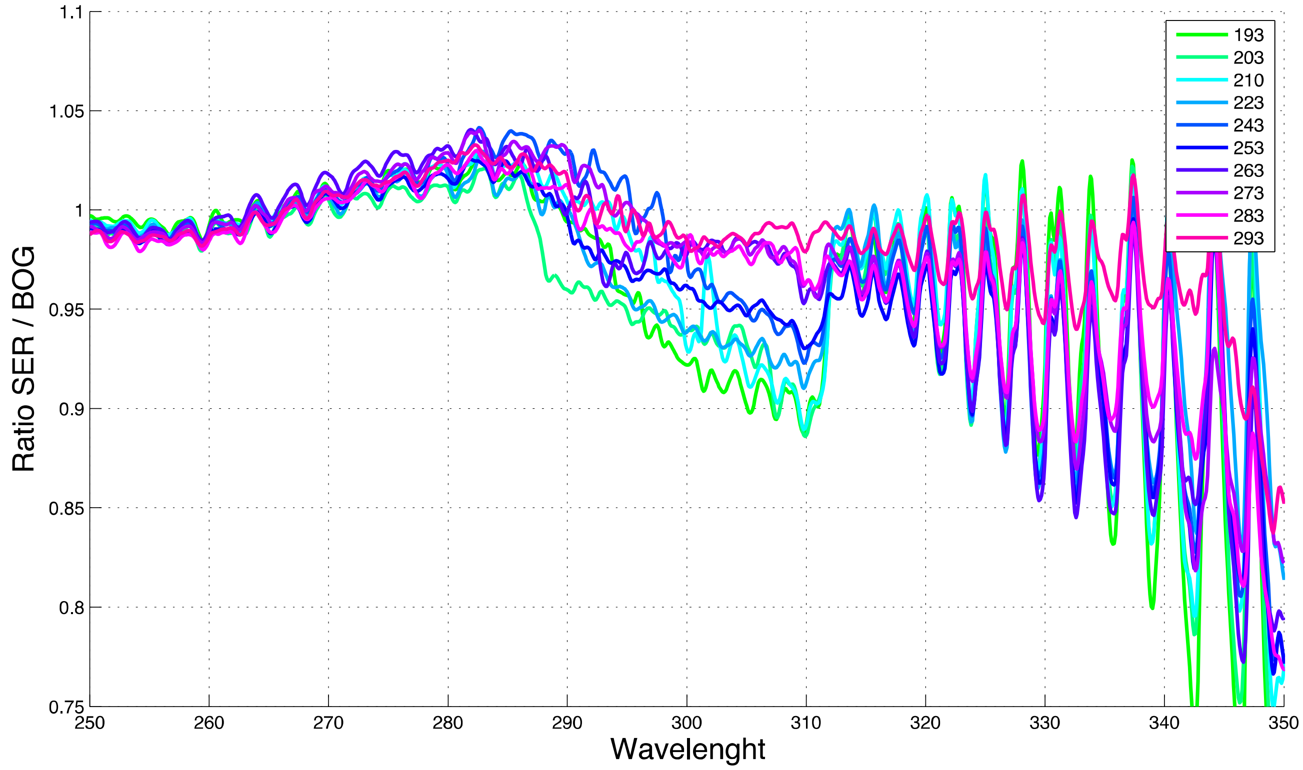




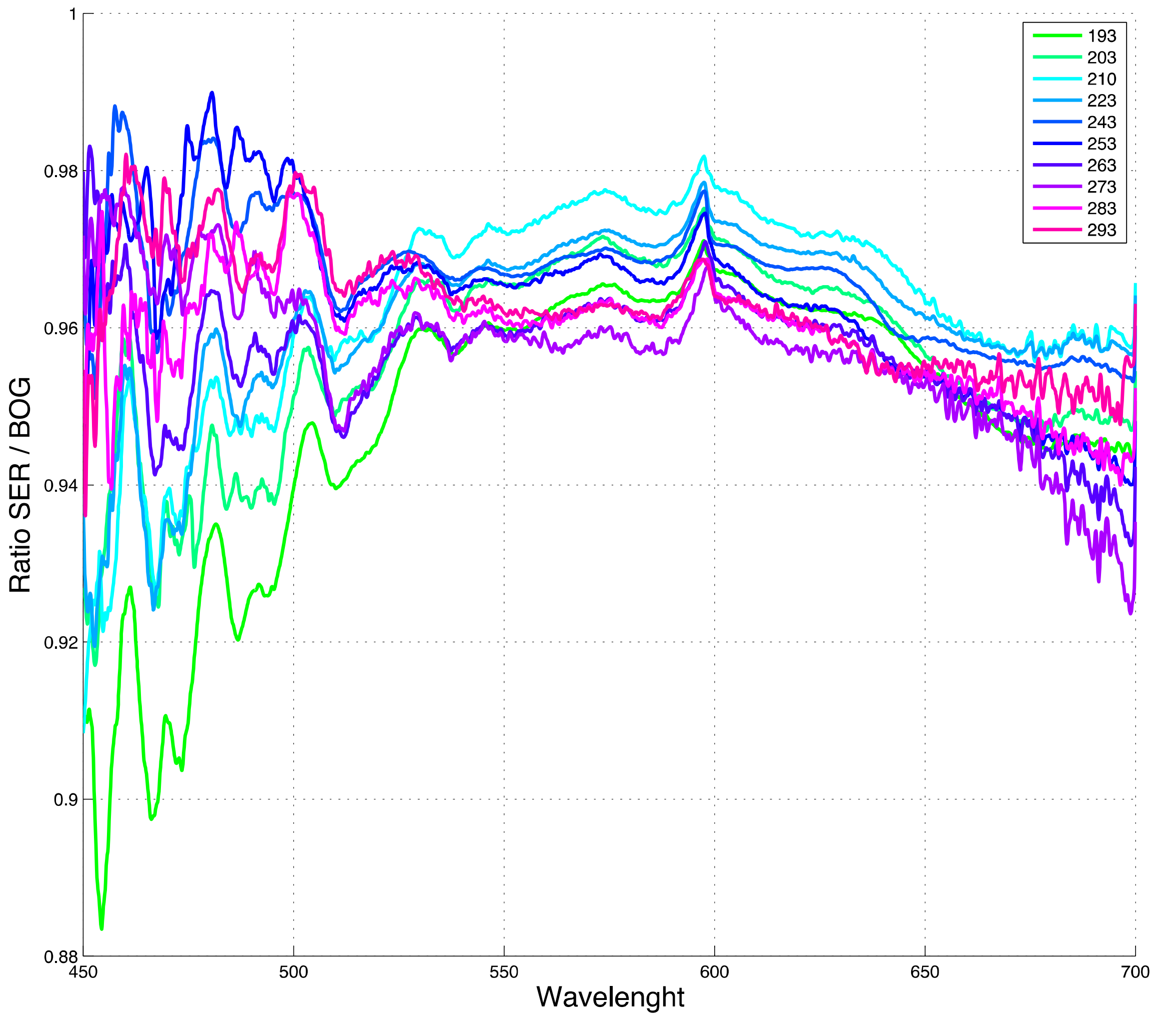




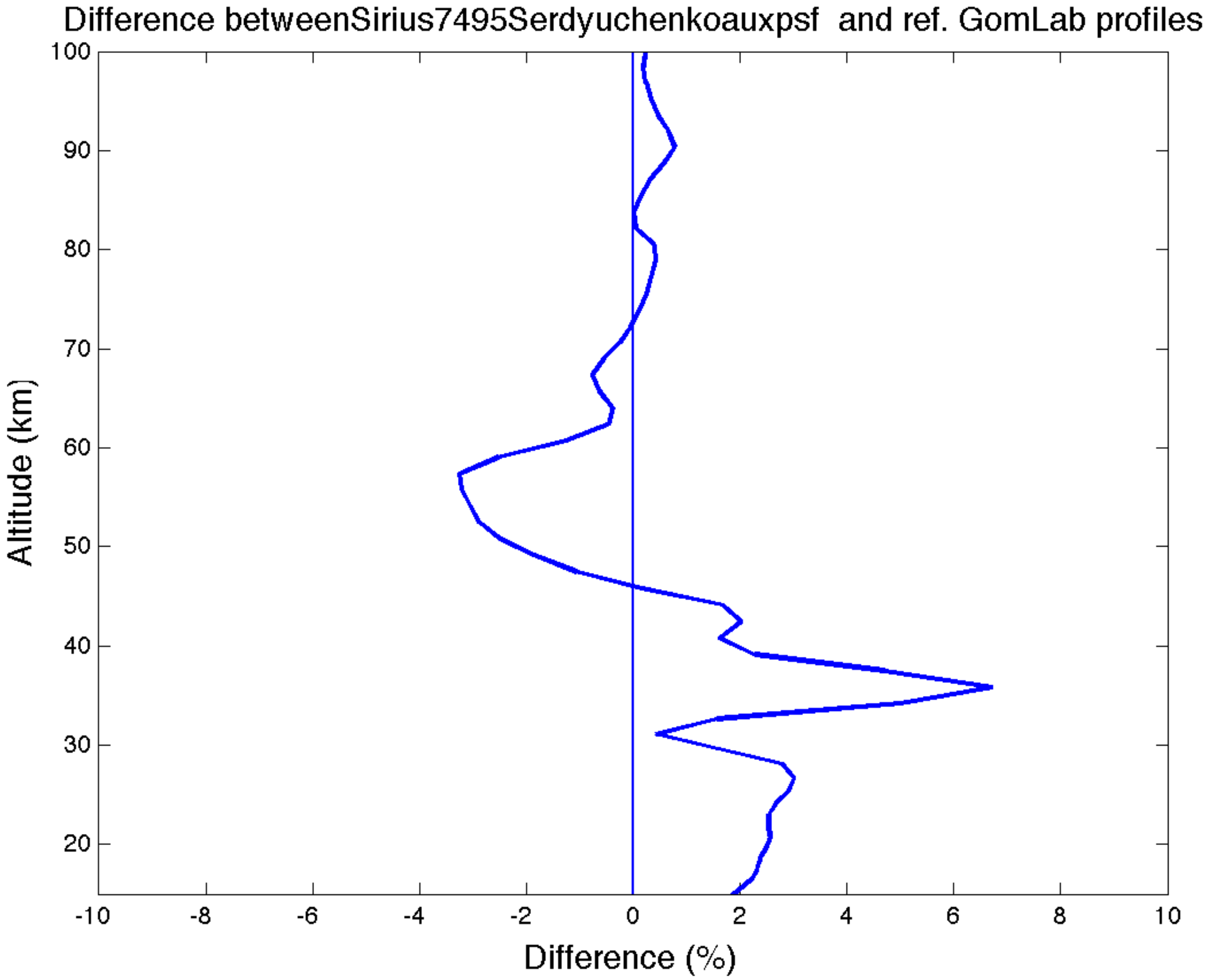
Ratio SER / BOG at various temp



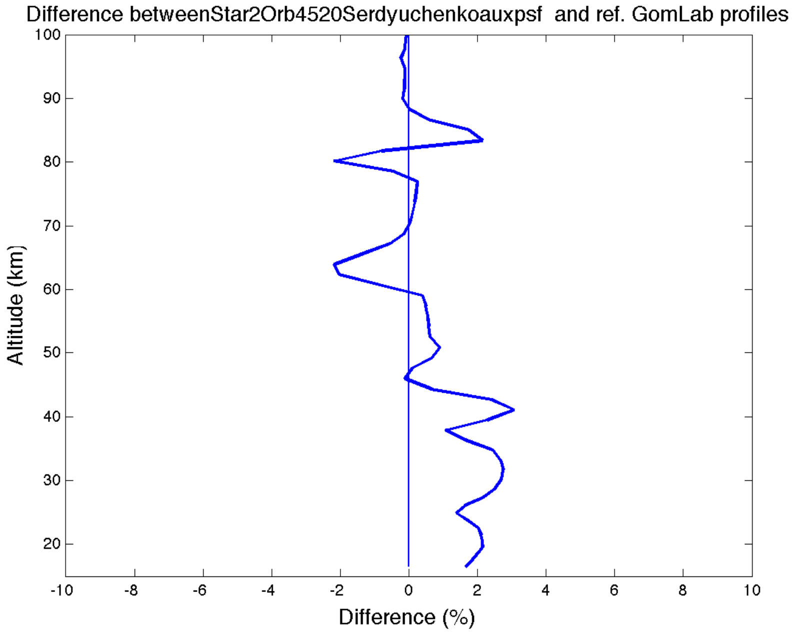
Ratio SER / BOG at various temp

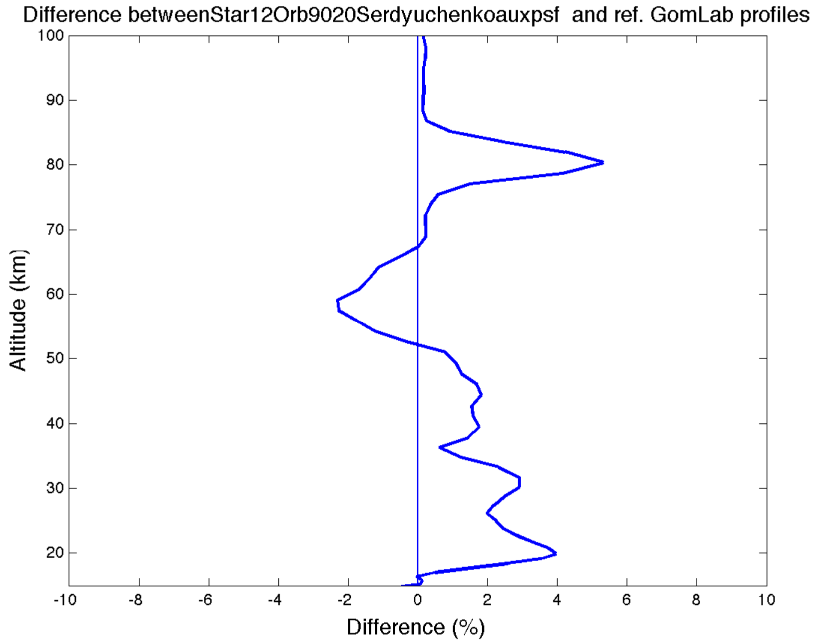


Changes in a GOMOS ozone profile when Bogumil et al. -> Serdyuchenko et al.: Brightest star Sirius m=-1.4, T=11 000 K



Changes in GOMOS ozone profiles when Bogumil et al. -> Serdyuchenko et al.: Hot and cool star





Star 2, m=-0.7, T=7000 K

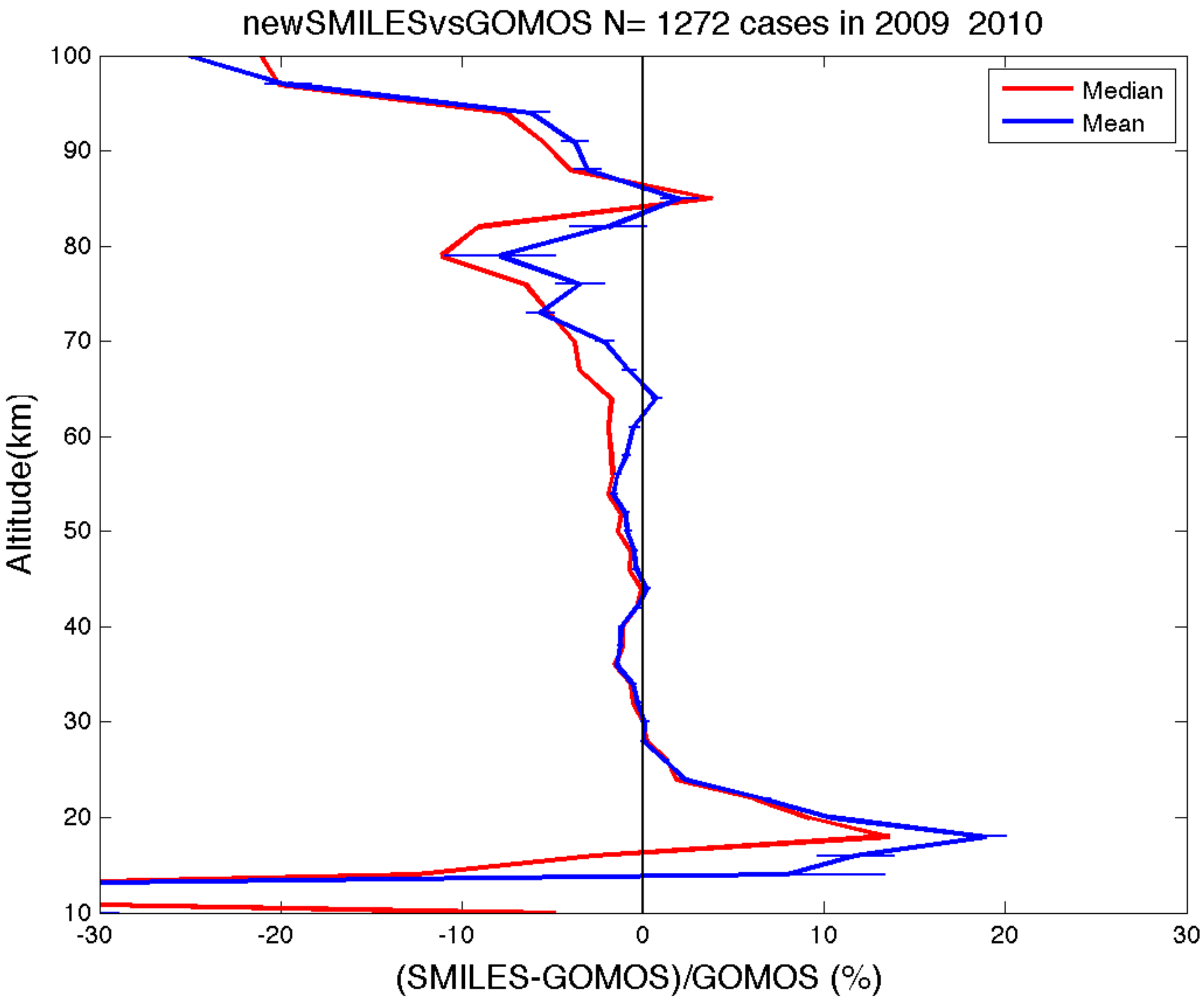
Star 12, m=0.8, T=30 000 K

How to select the “best” ozone cross section?

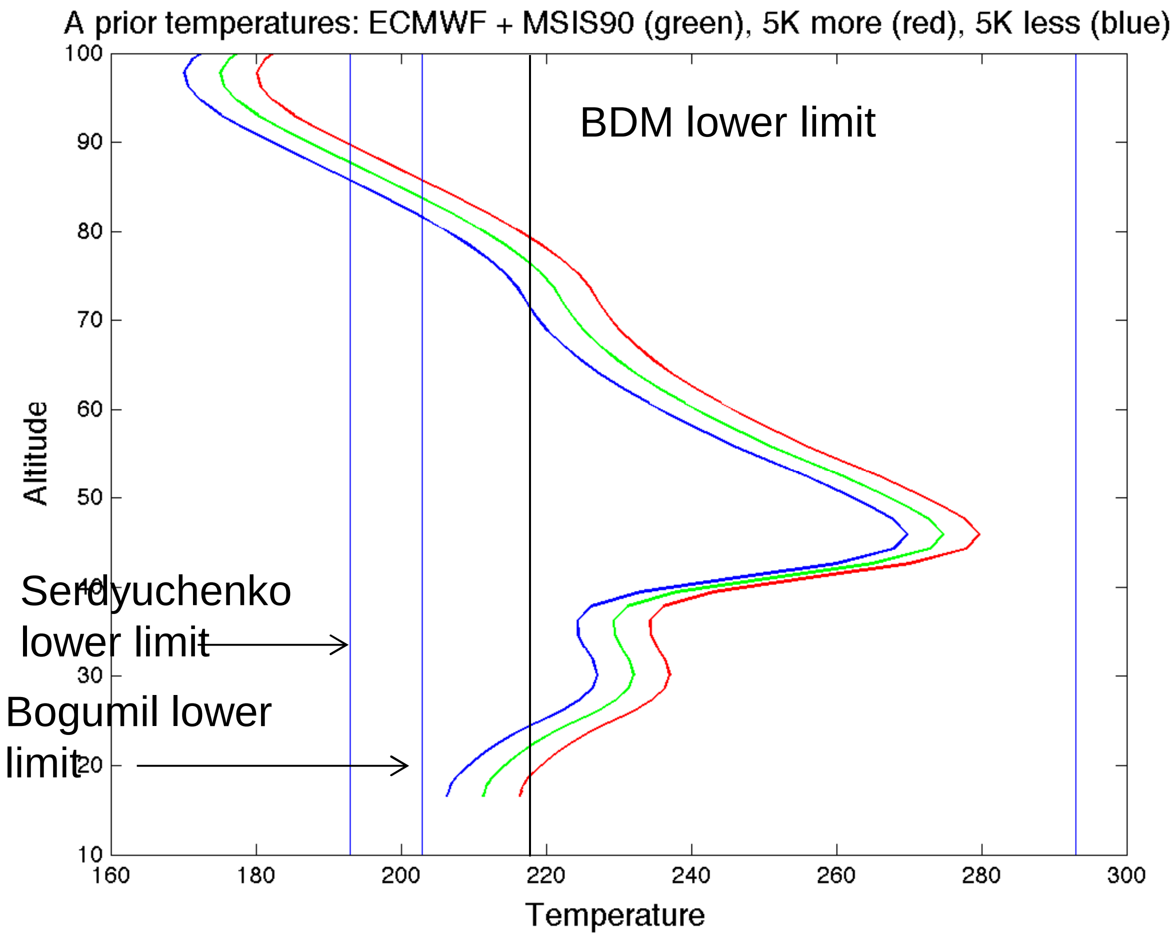
1.Inspect residuals: For GOMOS PSF the shapes
of Bogumil et al. and Serdyuchenko et al. cross sections
are very similar in shape. Therefore, residuals are not
necessarily decisive.

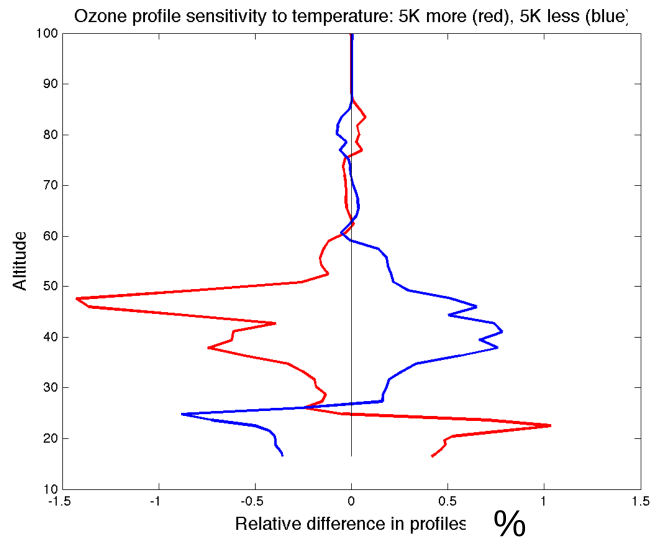
2.Use validation with instruments using other wavelength regions
or methods. Assuming, od course, that these results are somehow
accurate! See GOMOS-SMILES. These comparisons are not
straightforward as ozone cross sections depend on temperature
and there is diurnal variation of ozone.

GOMOS (V 6) - SMILES (JAXA L2)



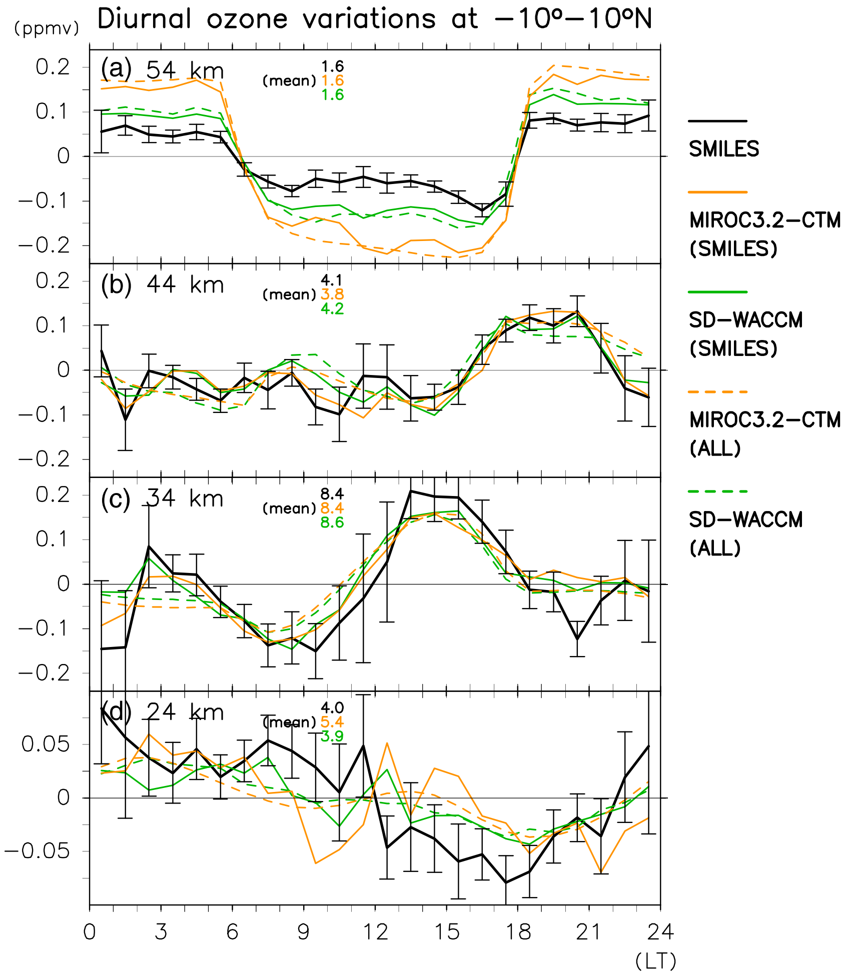
Temperature profiles and ozone dependency on T





- Ozone cross sections depend on temperature.
- Temperature errors change ozone profiles.

Other sources of difference: Diurnal variation of ozone



Sakazaki et al., JGR, 2013

Conclusions

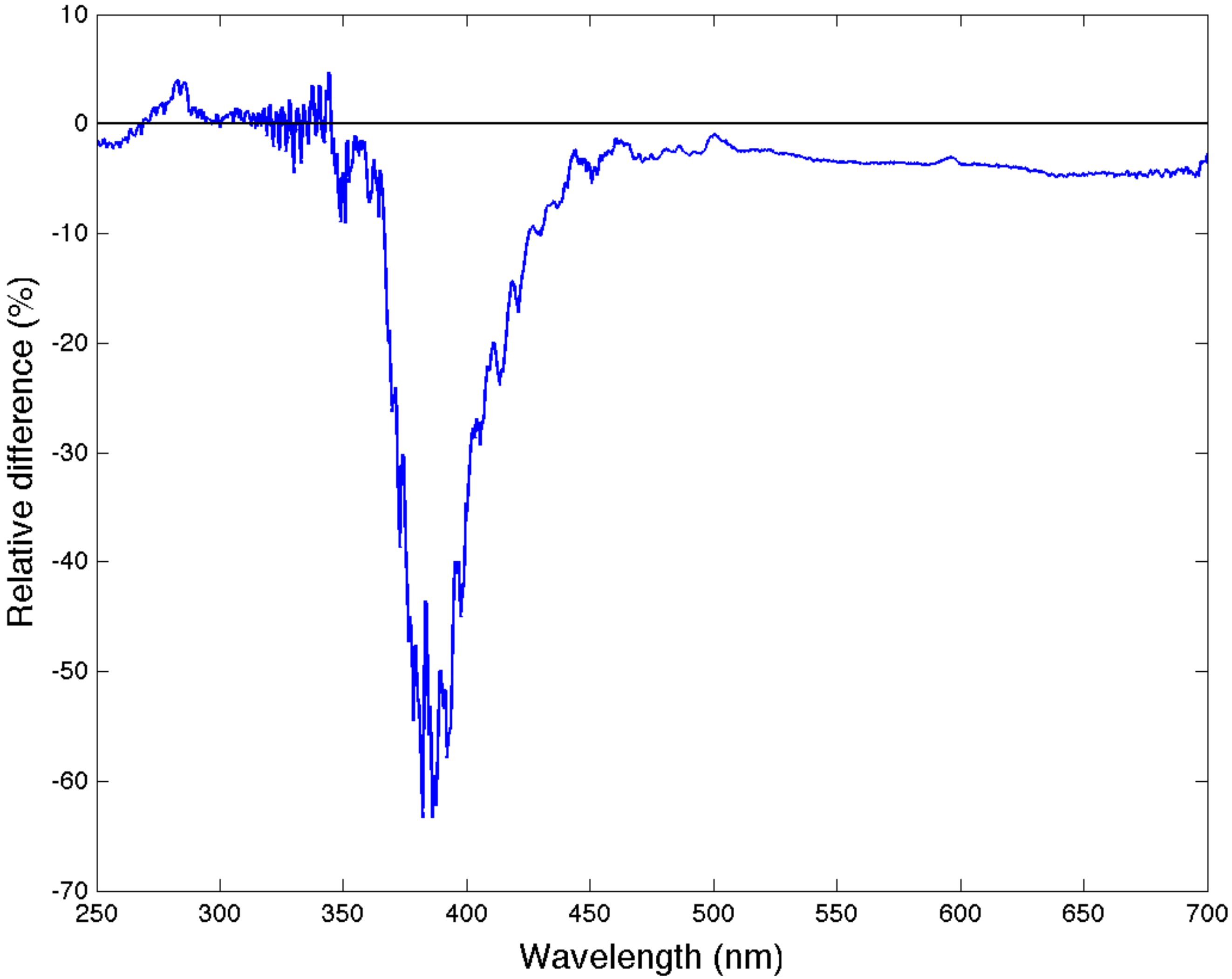
- GOMOS retrievals with Serdyuchenko et al. cross section show up to 2-6% more ozone than with Bogumil et al. in the altitude region 20-45 km.
- Between 50-60 km the new cross sections provide up to 2% less ozone.
- Varying changes are taking place around the ozone minimum 80 km.

Recommendations

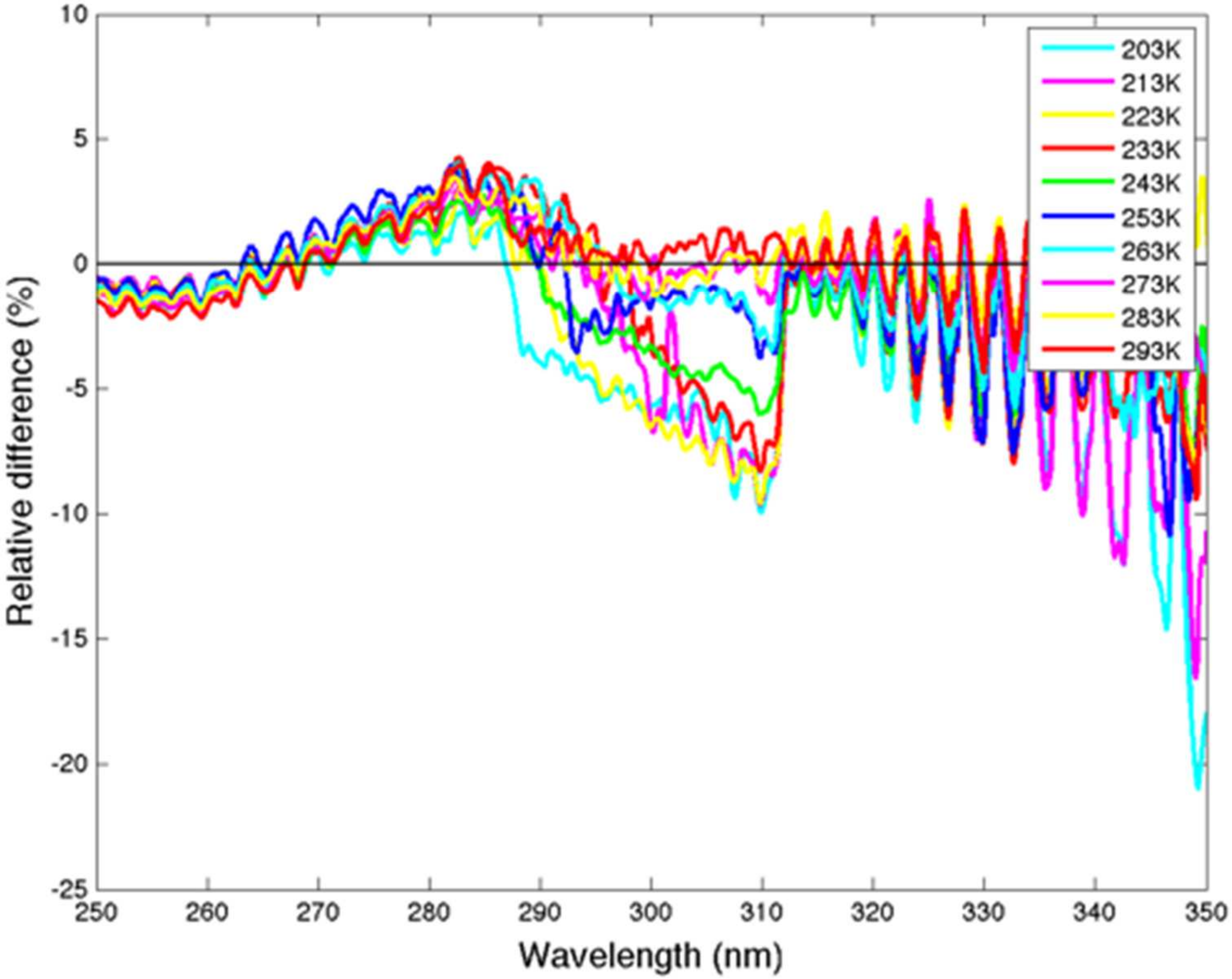
1. Temperature coverage of the ozone cross section data should still be extended below 193 K in order to cover temperatures encountered in polar and mesospheric regions

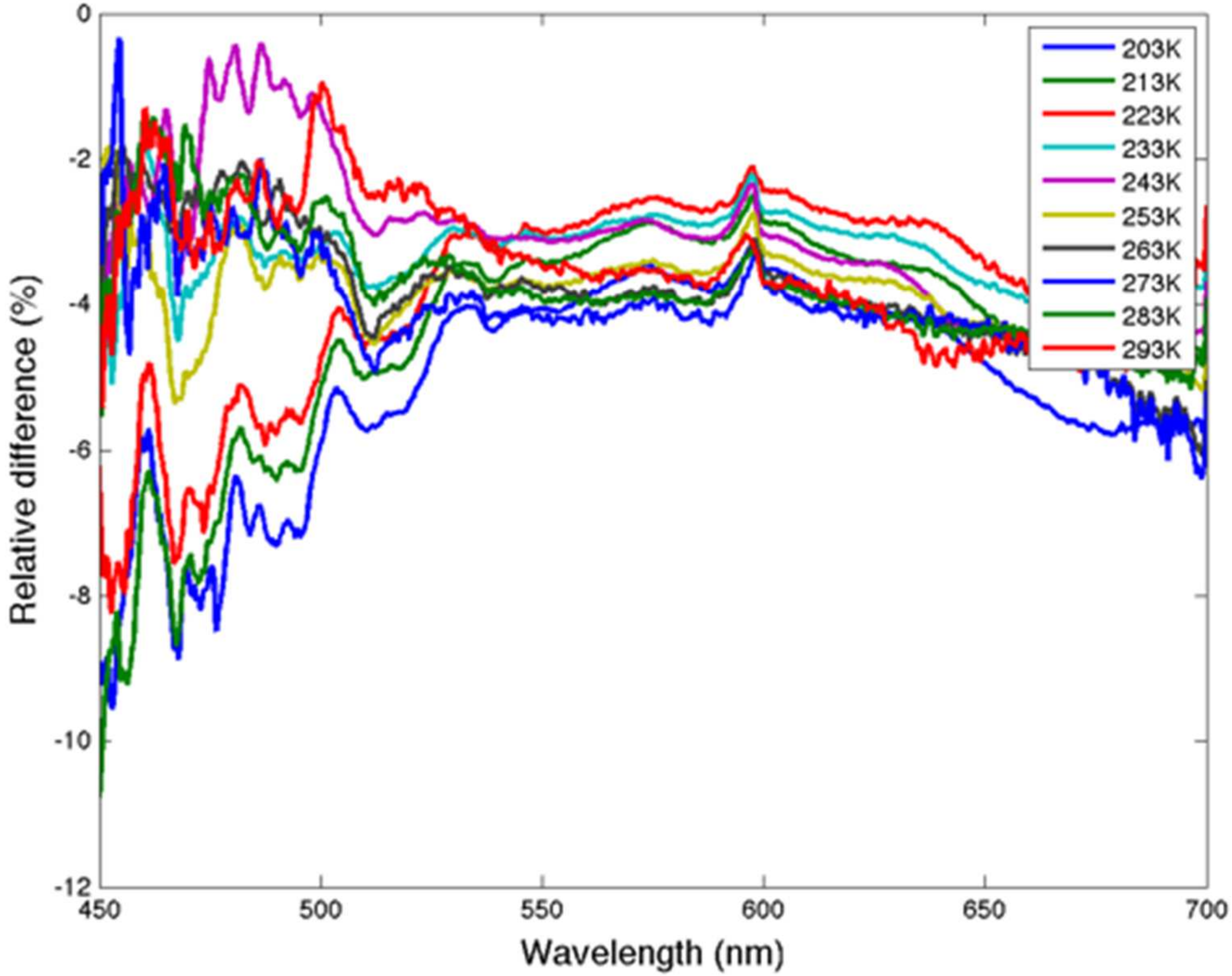
2. Consistency of ozone retrievals from different wavelength regions should be studied carefully in order to select the most accurate cross section in the UV-visible region.

Relative difference at 293 K



Relative difference at various temp




203K
213K
223K
233K
243K
253K
263K
273K
283K
293K
0
-2
-4
-6
-8
-10
-12
450
500
550
600
650
700
Relative difference (%)
Wavelength (nm)