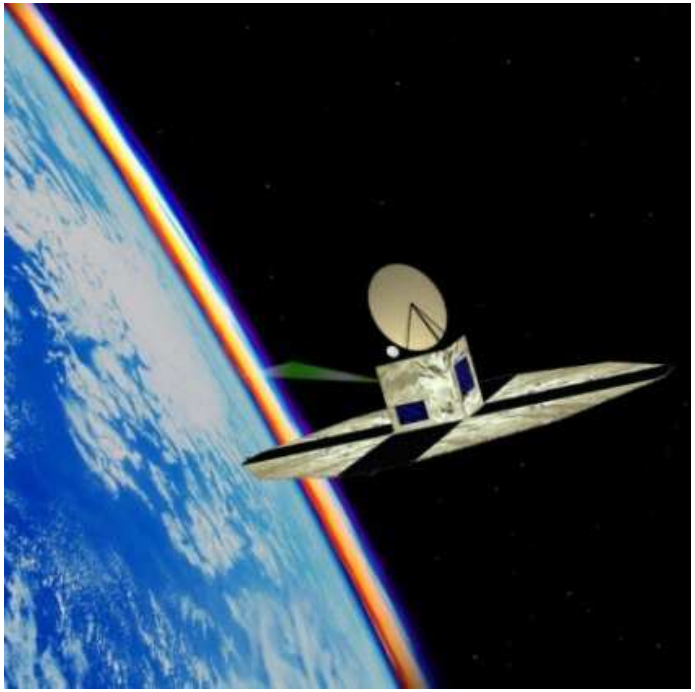
University of Saskatchewan



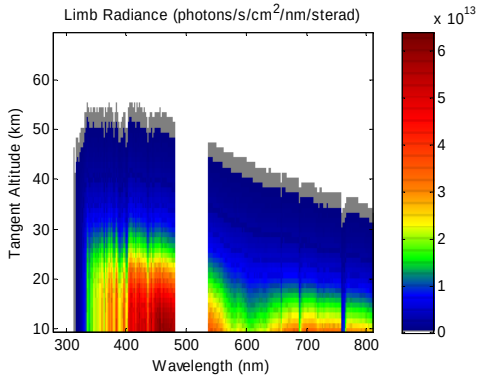
Limb Scatter Ozone from Odin-OSIRIS

June 4, 2013

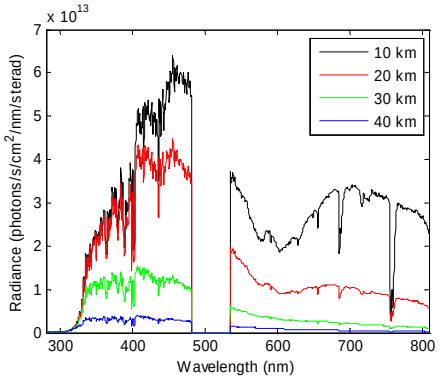
Geneva, Switzerland

CSA ASC

Optical Spectrograph and Infra-Red Imager System (OSIRIS)



1) Optical Spectrograph
   - Single line of sight along satellite track
     - Narrow horizontal slit (1 arc minute)
   - Grating spectrograh
     - 280-810 nm, 1 nm resolution
   - Measures spectrum of scattered sunlight
     - Tangent altitudes 0 to 100 km
     - Odin moves to point OSIRIS
2) Infrared Imager
   - Three channel filtered vertical imager
   - 1.26 and 1.27 micron Singlet Delta O_2
   - 1.53 micron OH Meinel



O_3 Dust

Forest Fires

Noctilucent Clouds

The Aurora

OH

NO

NO_2

BrO

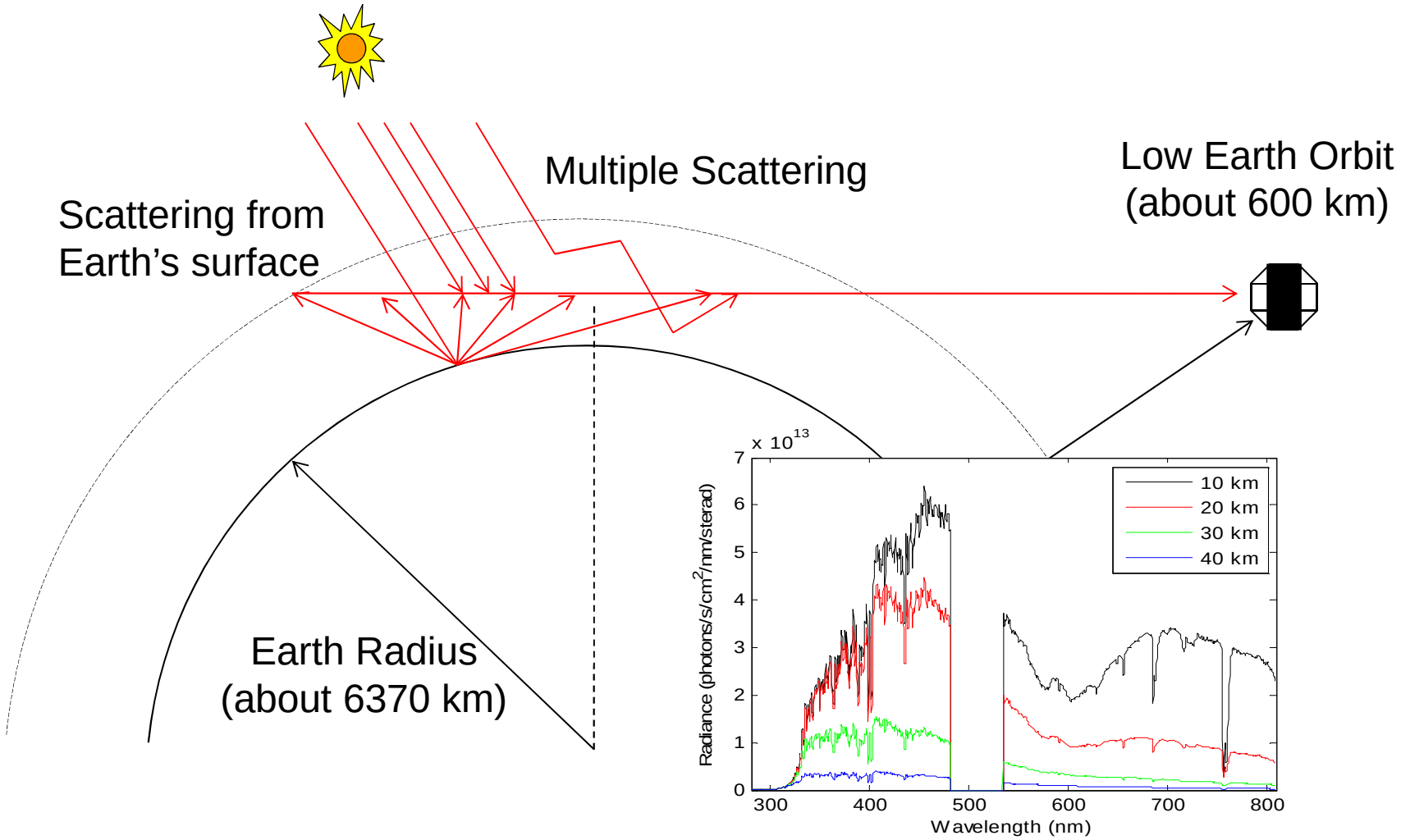
Sodium

Sulphate Aerosol

Subvisual Cirrus

Limb Scattering

A measurement of the intensity of sunlight scattered from the atmosphere



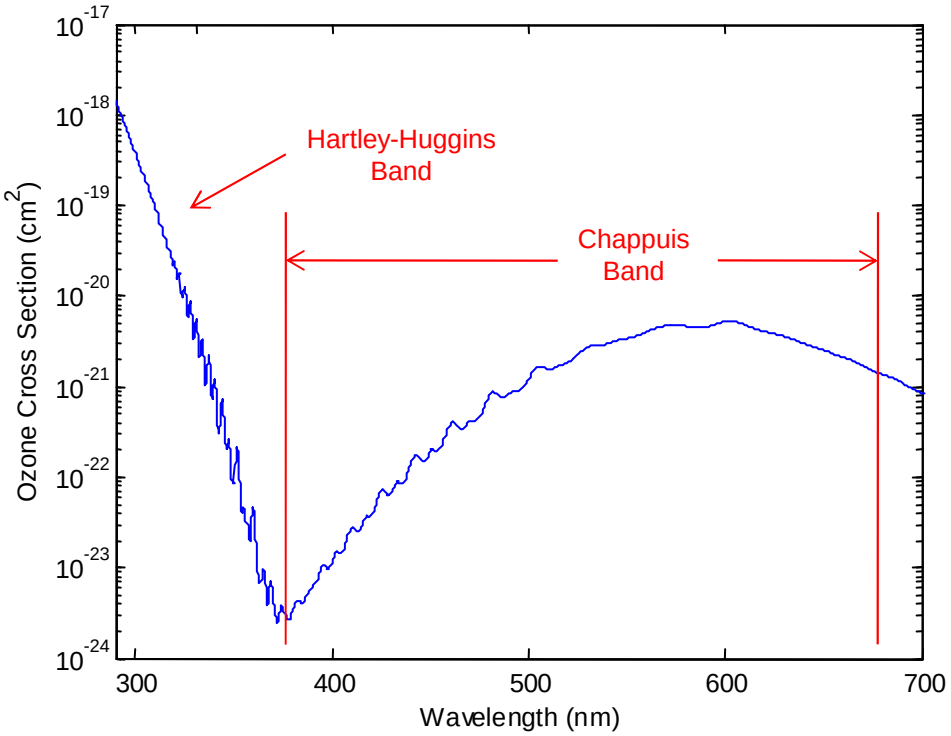
Ozone: Limb Scatter Signature

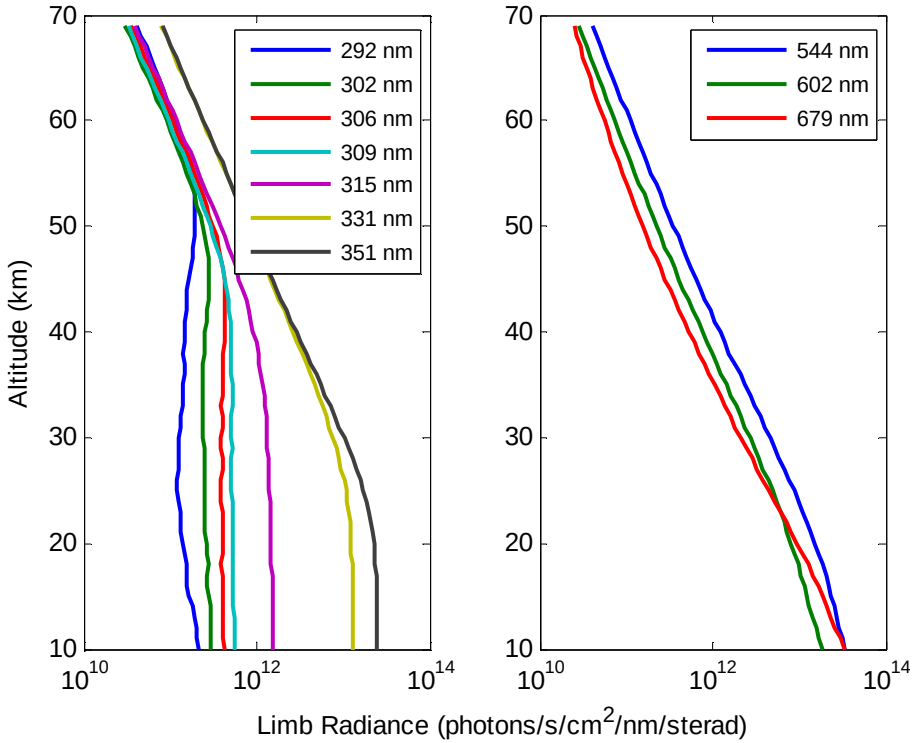
Ozone Retrieval at Optical Wavelengths

- UV wavelengths (Hartley-Huggins bands)
- Visible wavelengths (Chappuis bands)

Limb Signature of Ozone

- Minimum altitude probed by a line of sight identified by a “knee” in the radiance profile (optically thick)

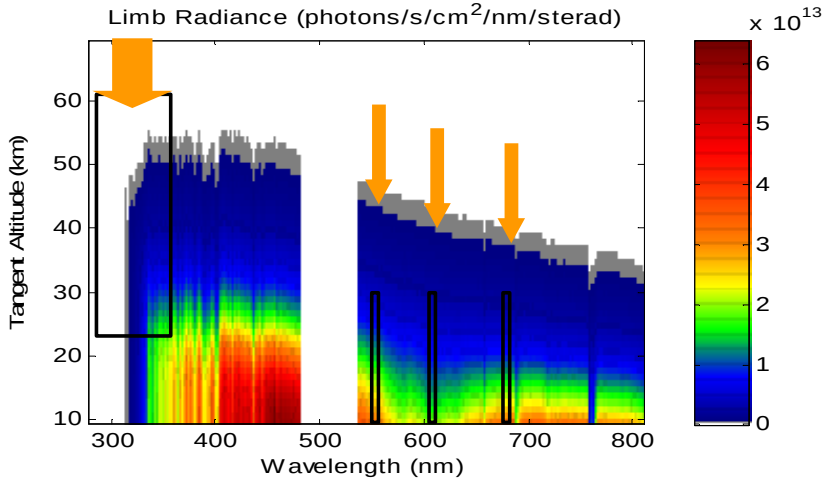




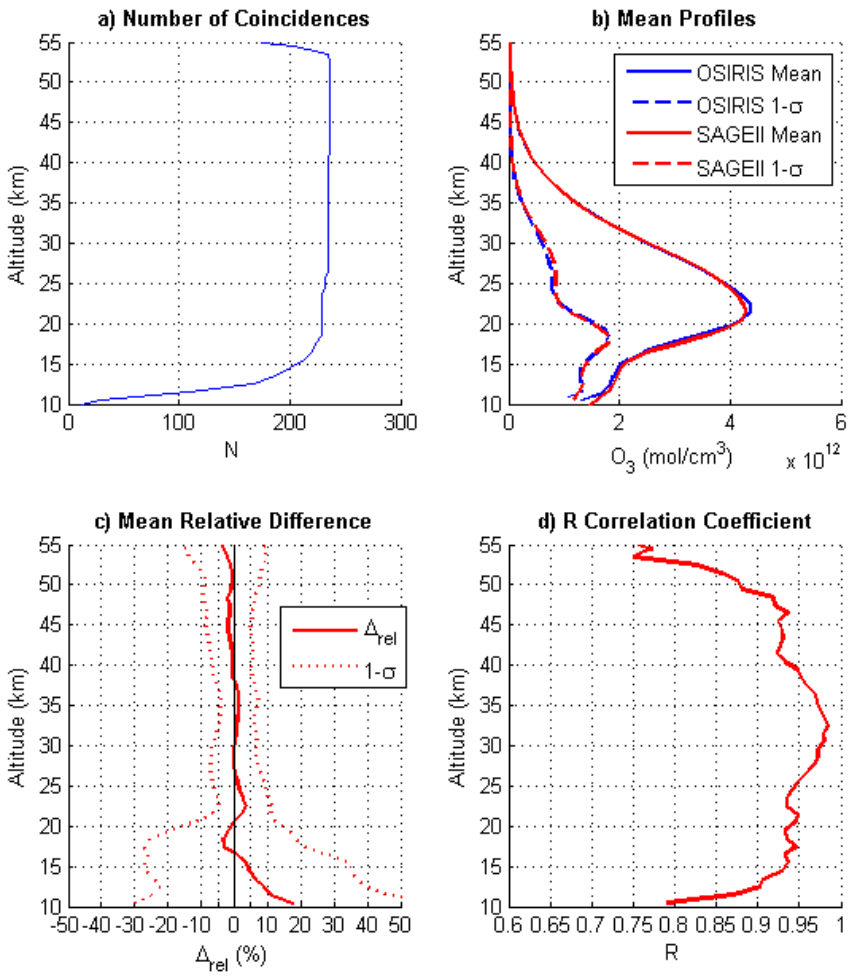
The use of normalized wavelength pairs and triplets make the ozone retrieval process self calibrating so instrument stability is less of an issue

Altitude Range and Wavelengths

	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9
Absorbing Wavelength (nm)	292	302	306	309	315	322	331	599	602
Minimum Altitude (km)	47	42	40	37	31	24	18		
Maximum Altitude (km)	60	60	54	50	44	40	37	28	28



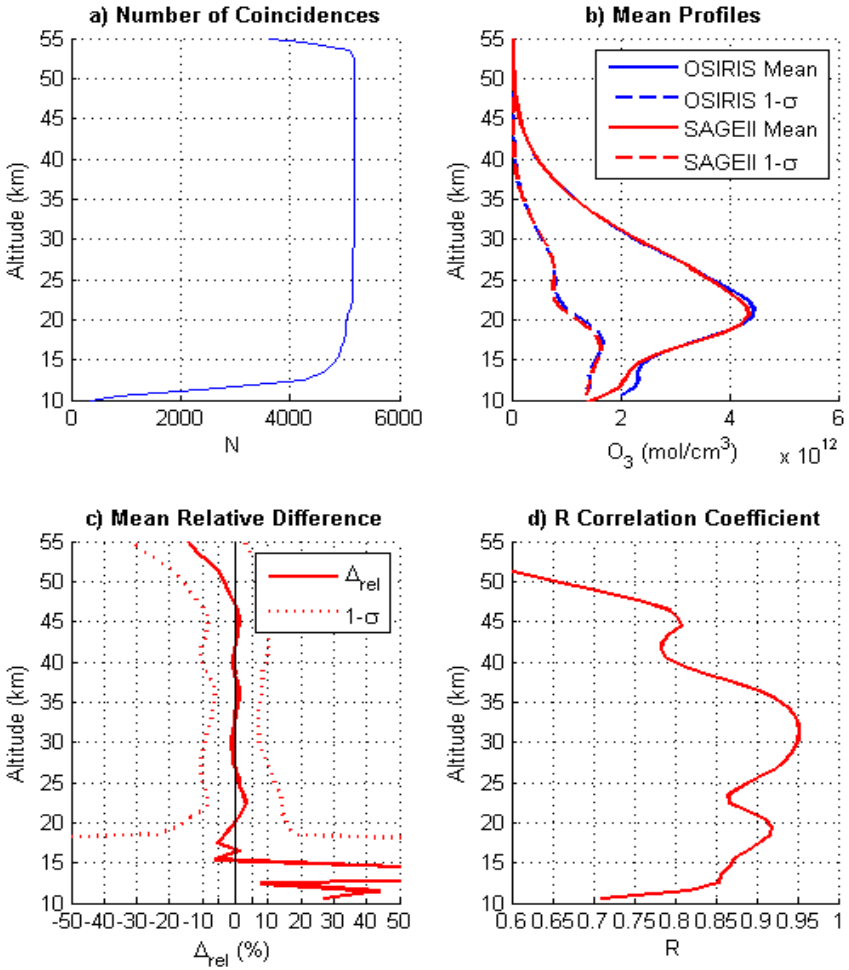
Ozone: OSIRIS - SAGE II Version 7.0 Beta Comparison



Over 200 coincidences with very strict requirements (+/- 1 hour, +/- 1 degree latitude and +/-500 km).

- Retrieved profiles are very well correlated.
- Small positive biases at 35 and 22.5 km.
- Below 17 km the level of agreement decreases.

Ozone: OSIRIS - SAGE II Version 7.0 Beta Comparison



Almost 5000 “coincident” profiles compared with less that 3% bias between 20 and 45 km. The coincident criteria is +/- 24 hours, +/- 1 degree latitude and +/- 1000 km.

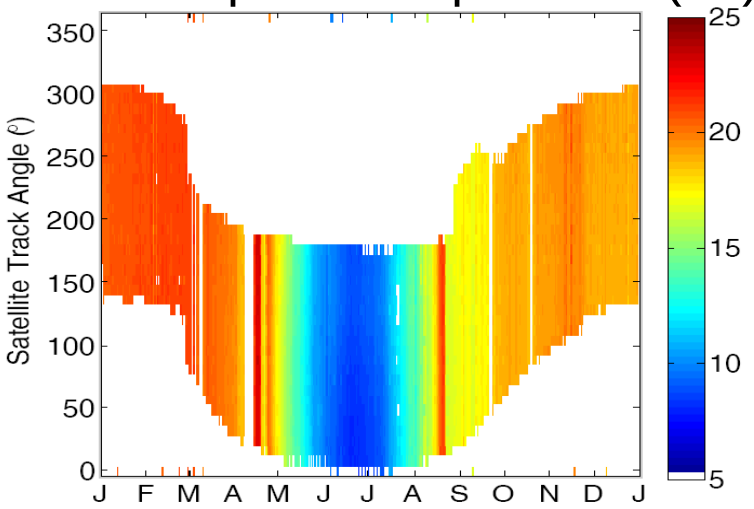
- Retrieved profiles are not as well correlated.
- Small positive biases still exist at 35 and 22.5 km.
- Below 15 km the level of agreement decreases.

Other Relevant Information

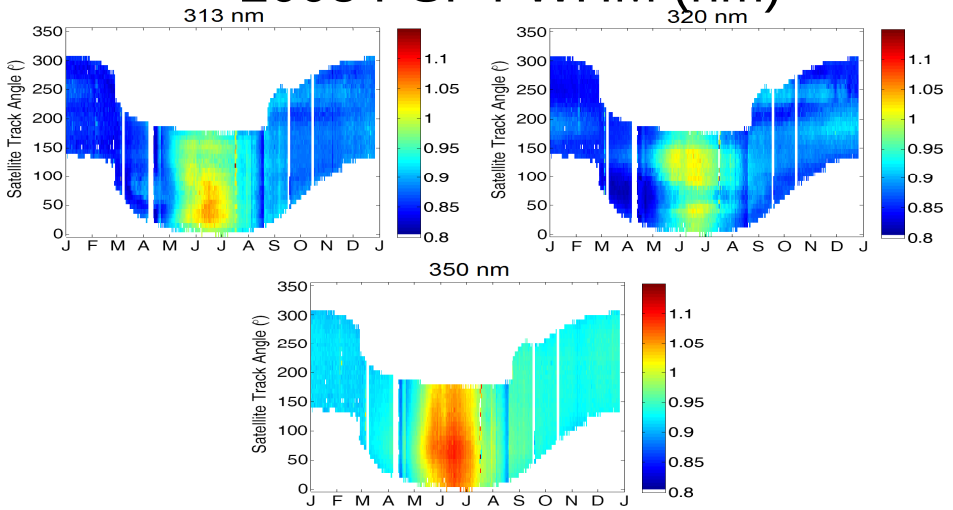
- We use the operational version of ECMWF for the temperature profile
- Vertical profile of temperature is accounted for in the radiative transfer model
- The cross section is pre-convolved to the resolution of the OSIRIS instrument
- Our current version of ozone retrieval uses an old version of SCIAMACHY Bogumil cross section that we cannot repeat
- We have an optics temperature dependent spectral point spread function that we should account for
- Since our retrieval uses both Huggins and Chappuis we had to use our old Chappuis cross-section for the DBM retrievals

The OSIRIS Spectral Point Spread Function

2008 Optics Temperature (°C)



2008 PSF FWHM (nm)

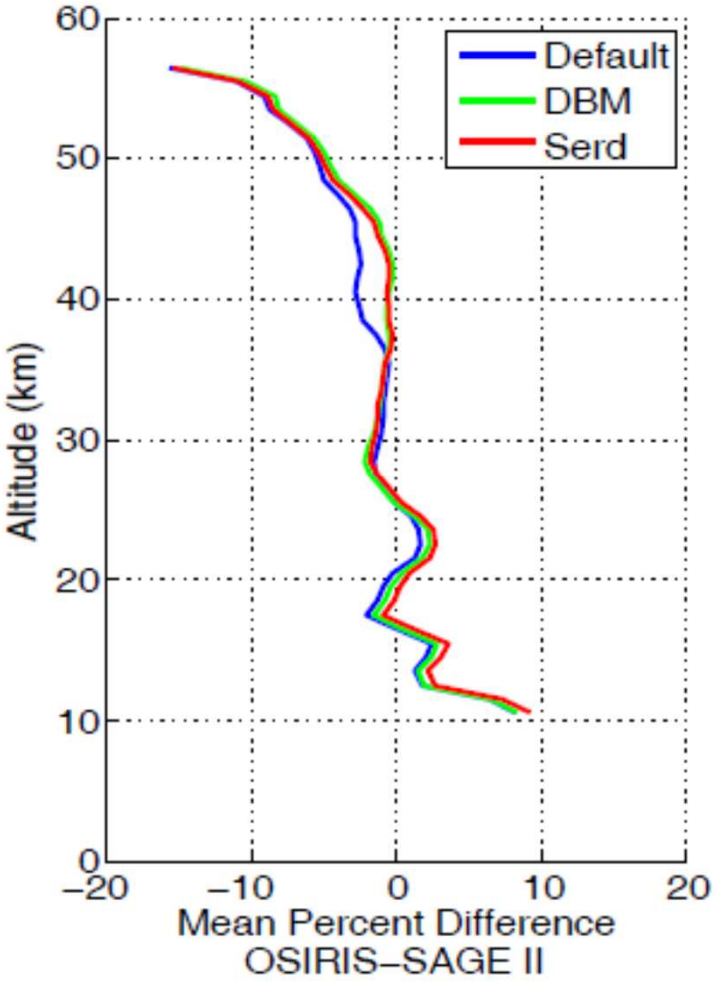


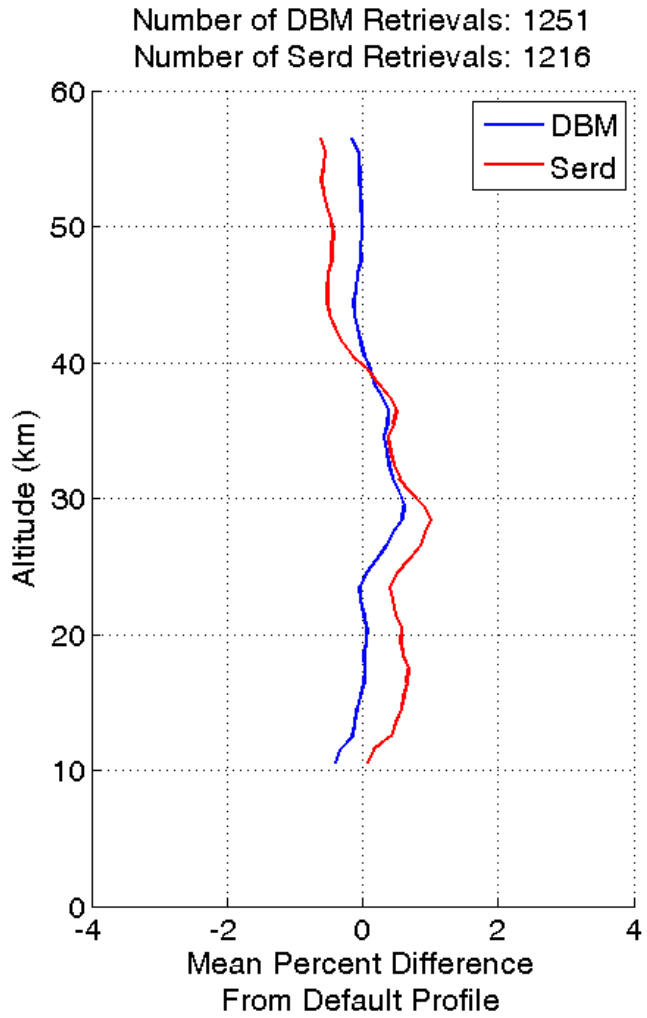
- We found a definite correlation between the OSIRIS optics temperature and the spectral point spread function
- This issue has been diagnosed and is now accounted for

- Comparisons for a low optics temperature subset of the previously shown SAGE II coincident data set

- Implementing the modelled time-dependent SPSF and the new cross-sections improves the mean percent difference between OSIRIS and SAGE II scans by 1-2% from 35-48 km.

- Both cross-section data sets yield similar results

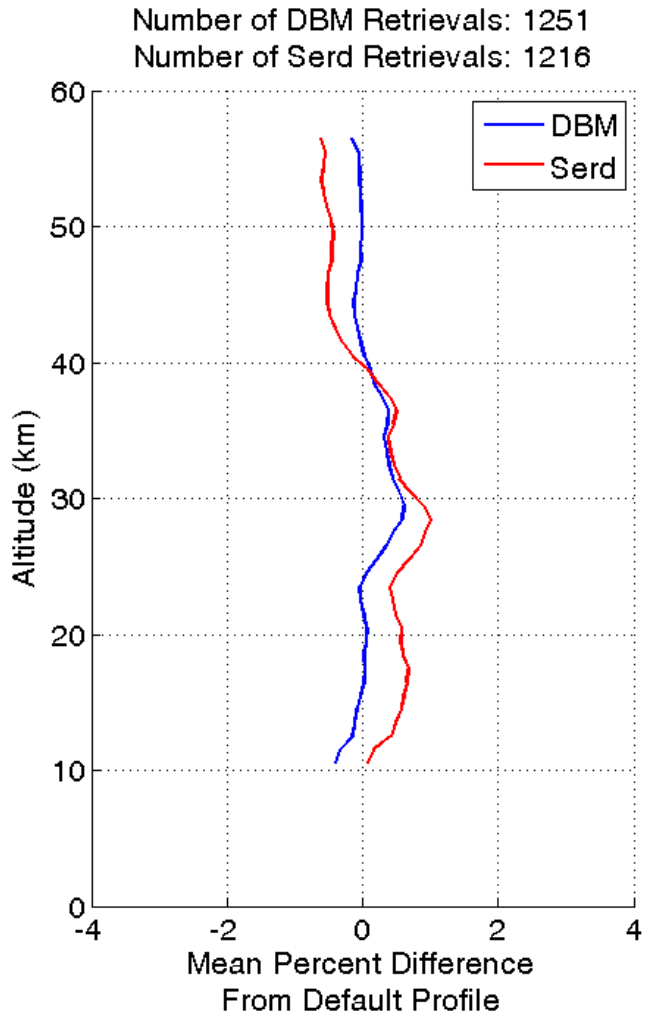




37 – 60 km uses wavelengths less than 309 nm

25 to 37 km uses wavelengths between 315 and 331 nm

10 to 25 km is the Chappuis



- The DBM cross-sections give results that are more consistent with our current retrievals
- However, this is not sufficient for us to say we prefer this data set
- We are content with whatever decision is made