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Retrieval of GOMOS bright limb profiles

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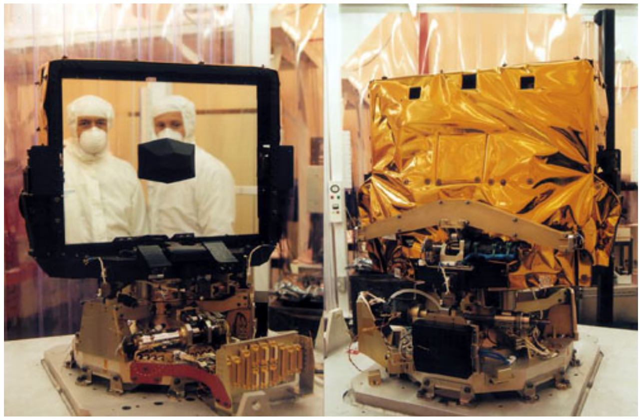
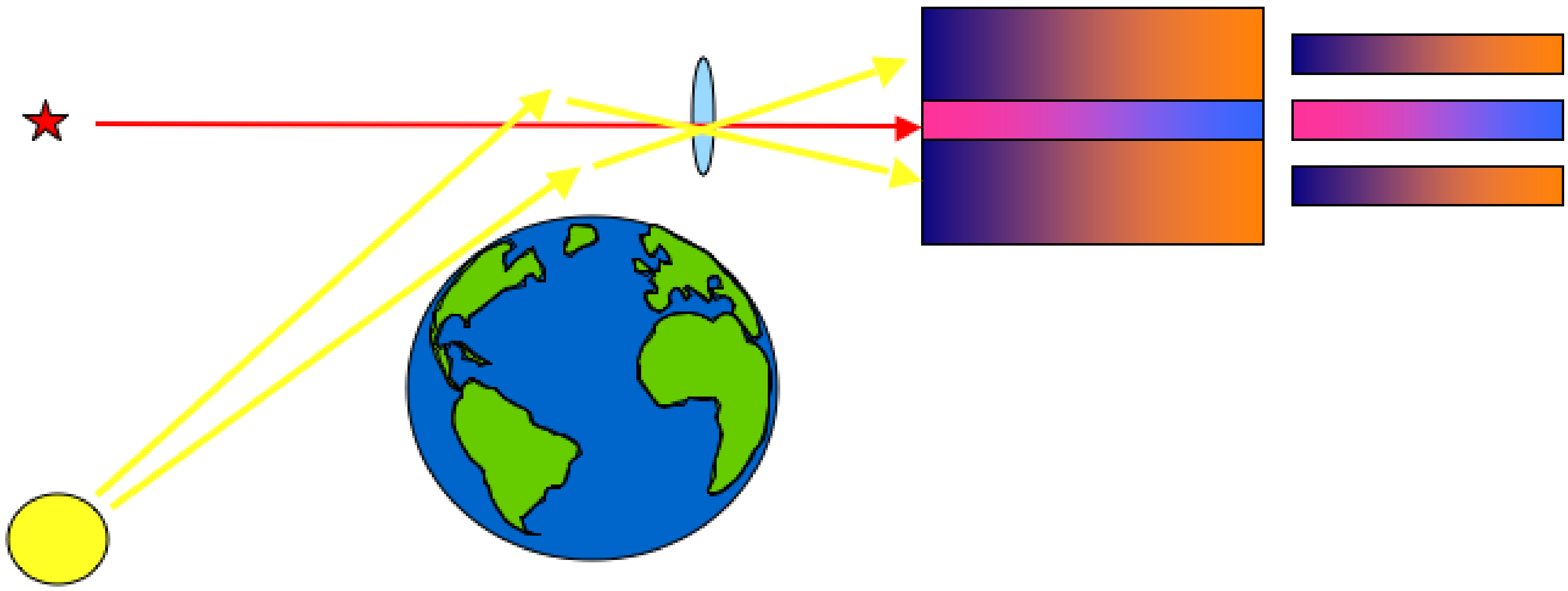
GOMOS

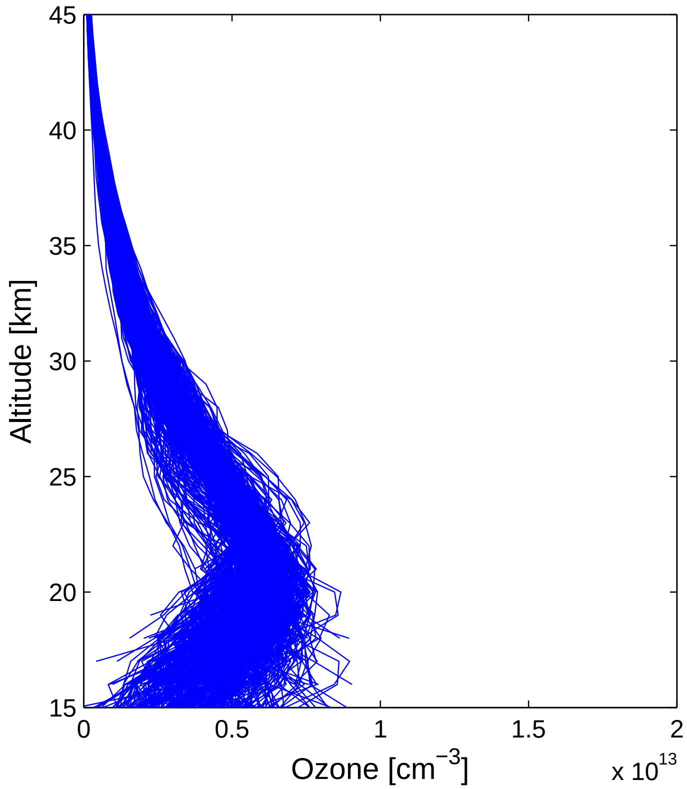
- on board the Envisat satellite, launched in 2002
- stellar occultation instrument
- scans the atmosphere between 10–120 km

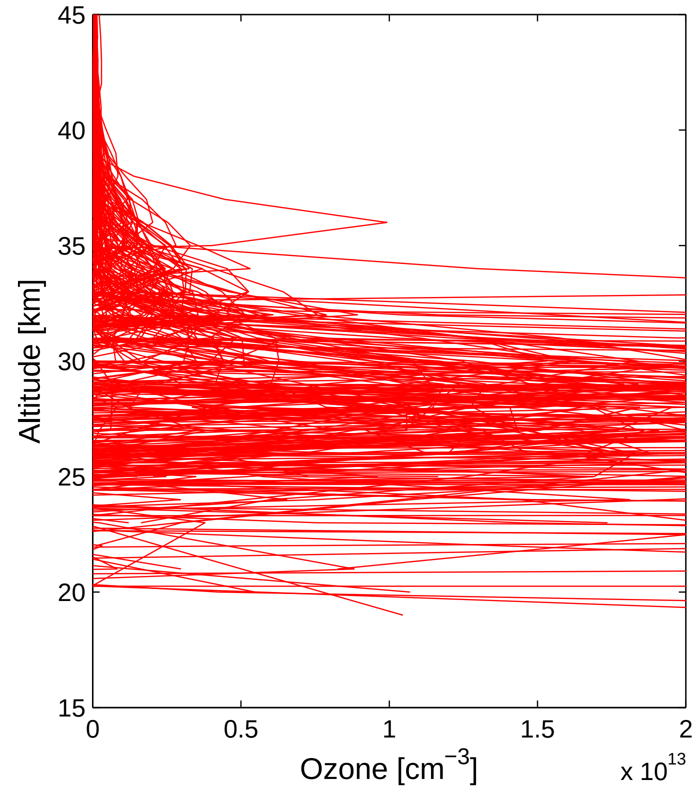


During day occulations, both stellar and limb signal are recorded

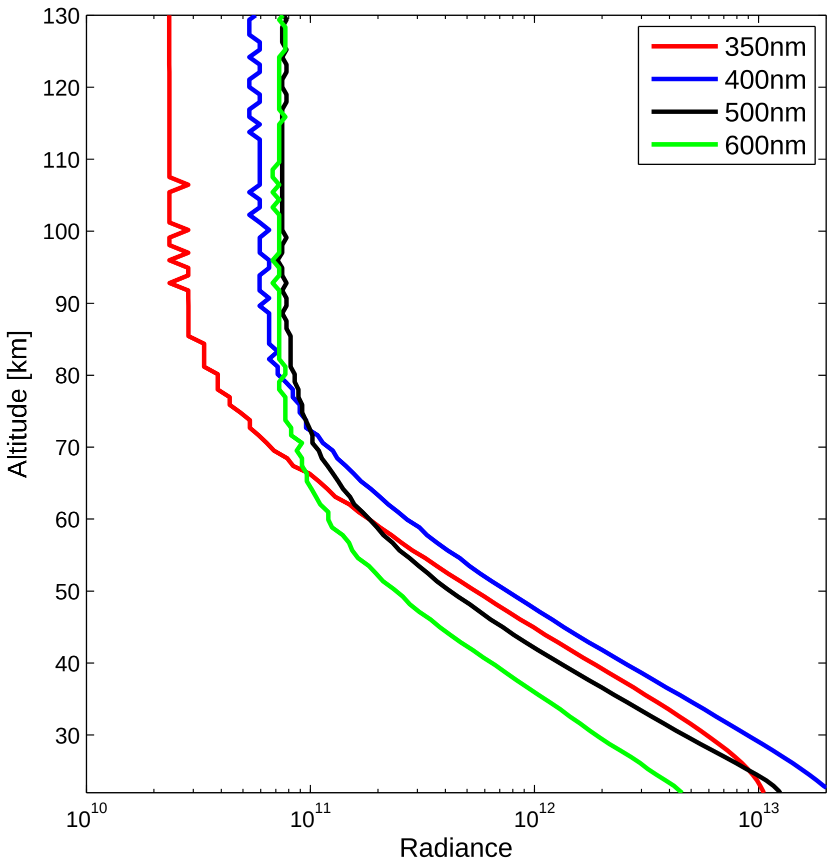


night vs. day occultation quality





GOMOS stray light



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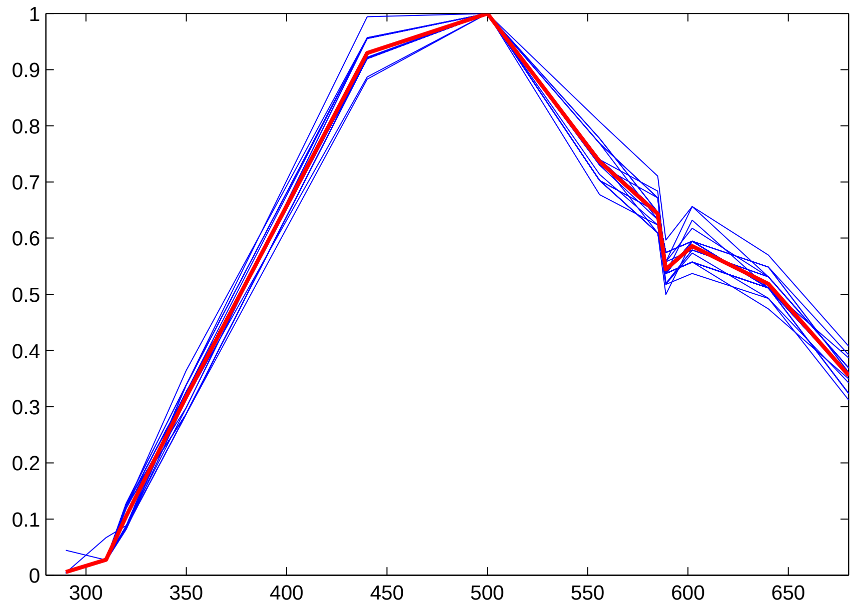
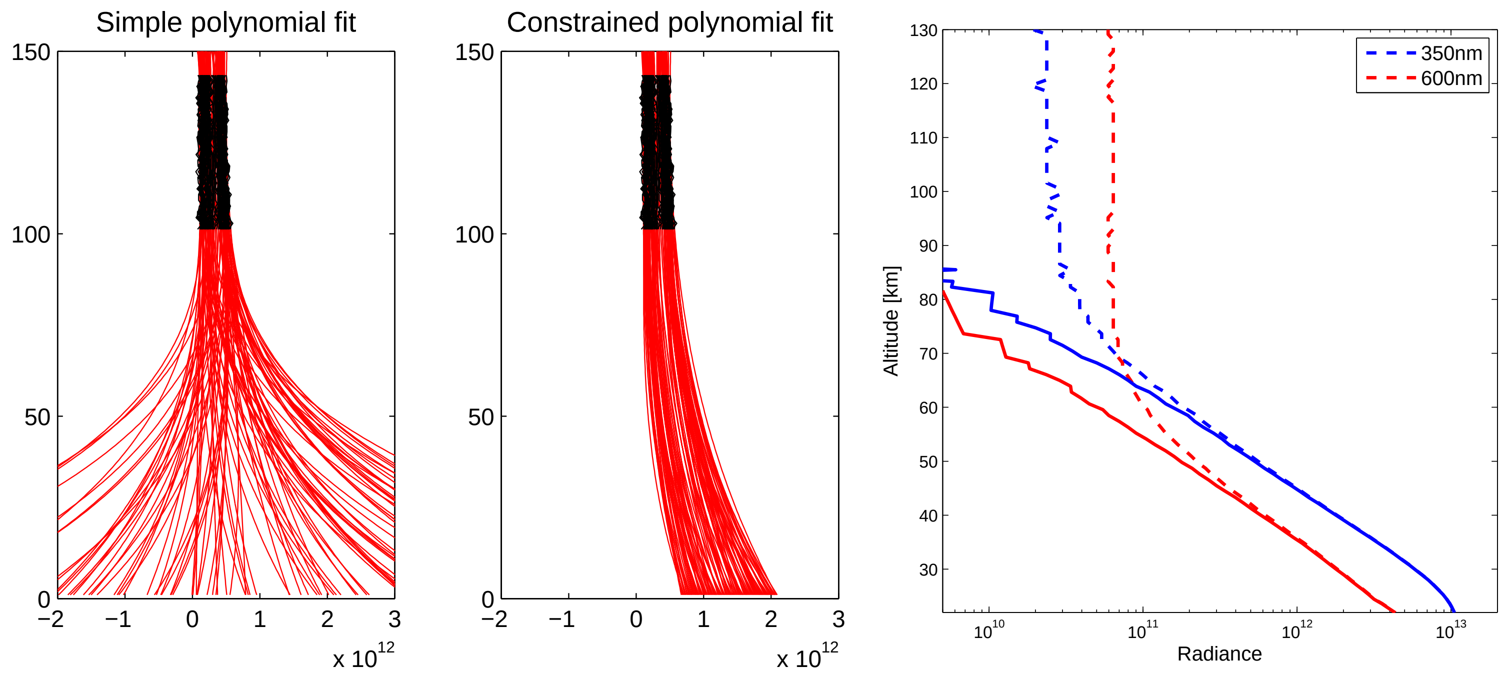
Stray light removal

- Step 1: Calculate mean relative stray light spectrum above 100 km. The signal is pure stray light.

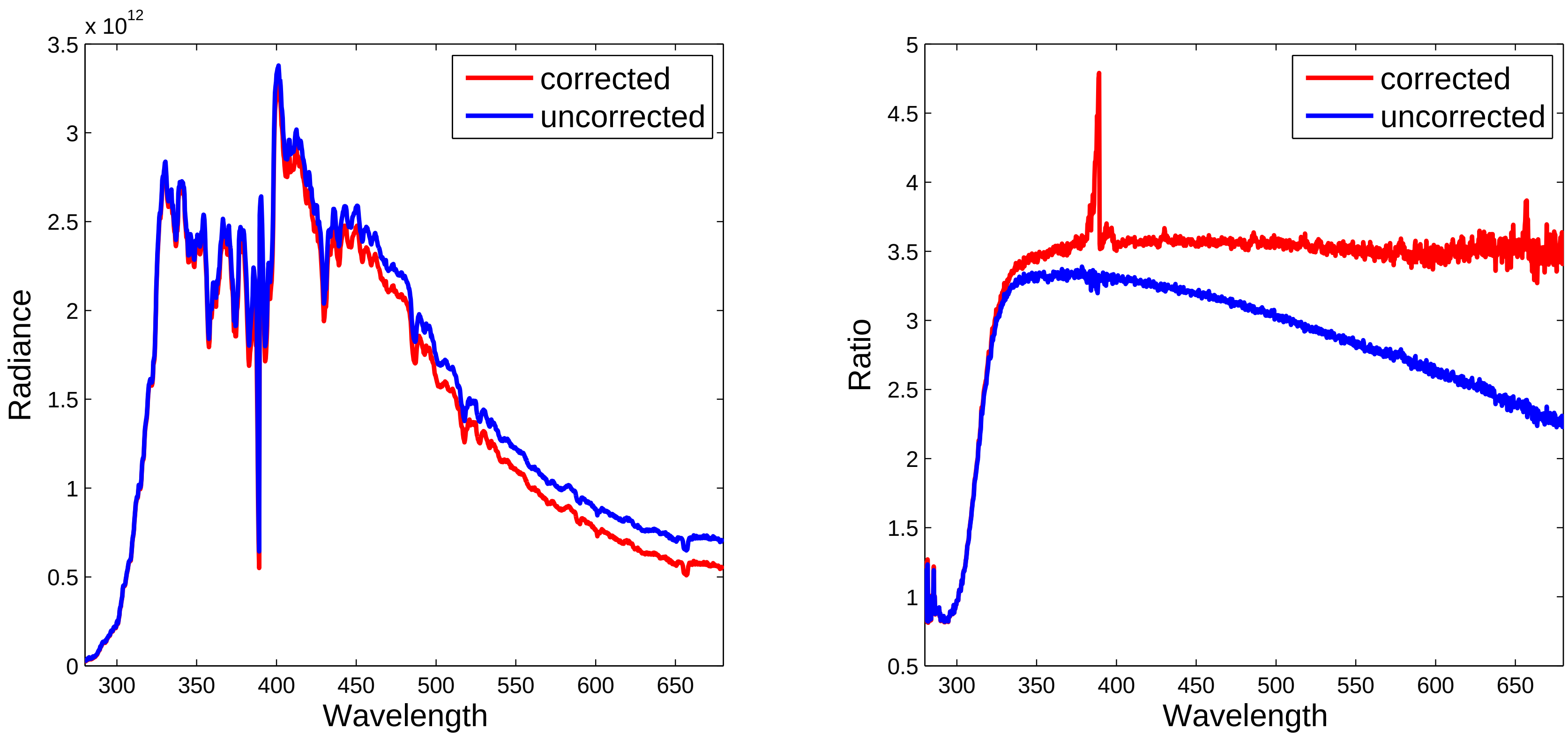


- Step 2: Calculate 3rd degree polynomial fit for each wavelength using altitudes above ∼80 km as the fitting range.

- Step 3: Extrapolate at low altitudes with the spectral shape of stray light as a constrain.

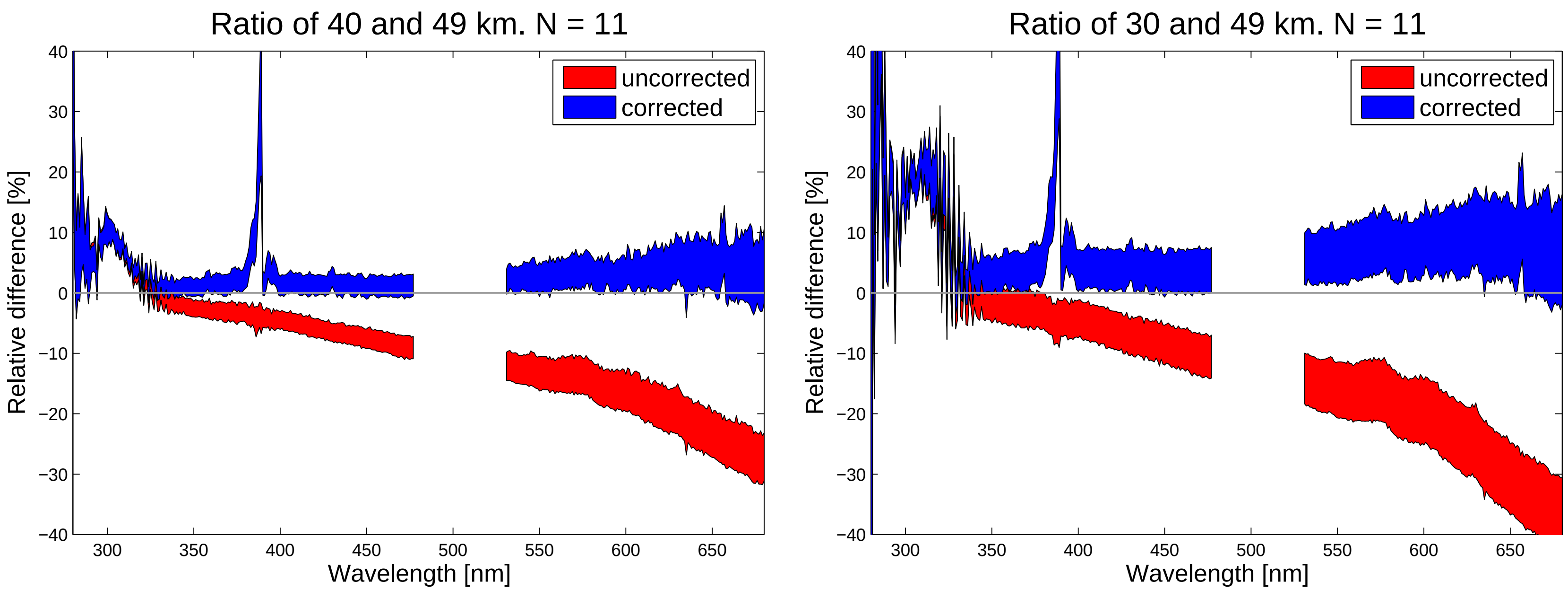


Radiance ratio



Ratio of 40 and 50 km.

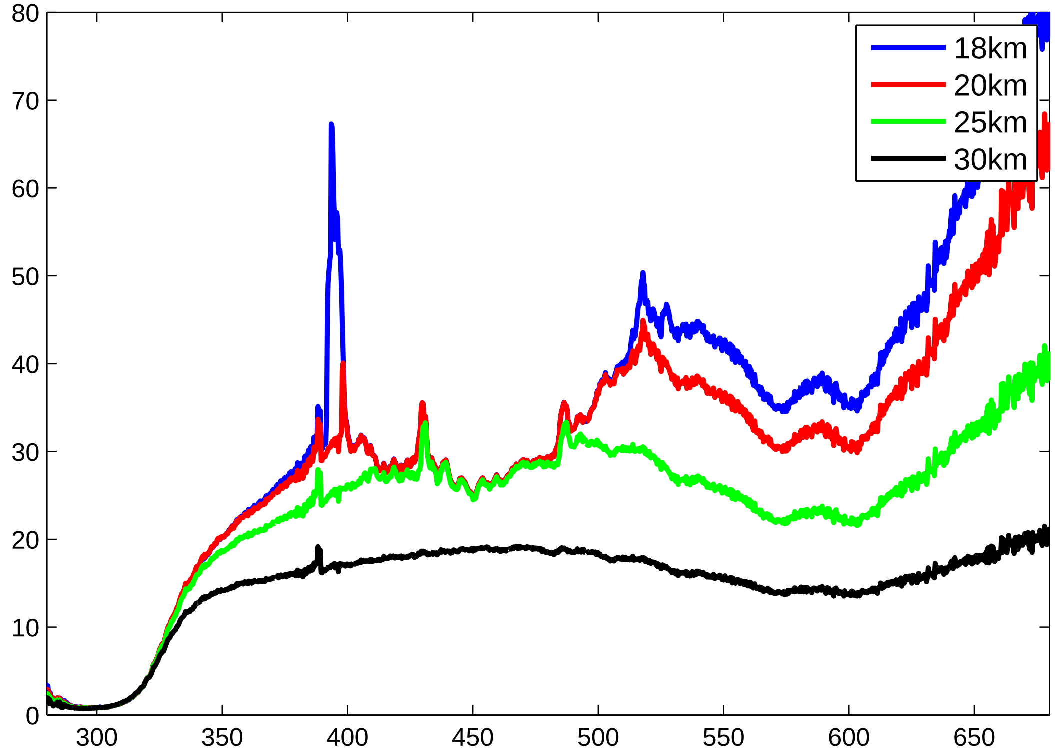
Ratio comparison vs. OSIRIS



(mean) Relative difference of radiance ratios (GOMOS-OSIRIS)/OSIRIS*100[%]

Saturation

Signal saturates below 30km between ∼400–530nm



Normalized by 50 km

Inversion method

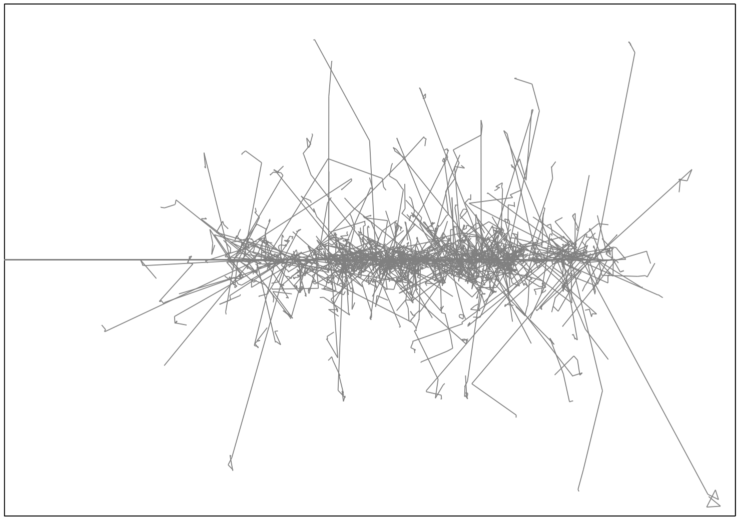
- Onion peeling type method (as used with OSIRIS)
- Weighted least squares fit of model and data for every layer
- $\sim$70 wavelengths in the 280–680 nm band
- MC model Siro for multiple scattering correction (LUT)

Multiple scattering LUT

- zenith: 40,45...,90
- azimuth: 40, 50,.., 180
- albedo: 0.1, 0.5, 0.9
- altitude: 15–70 km
- climatologies: tropic, mid (summer), mid (winter), antarctic, arctic

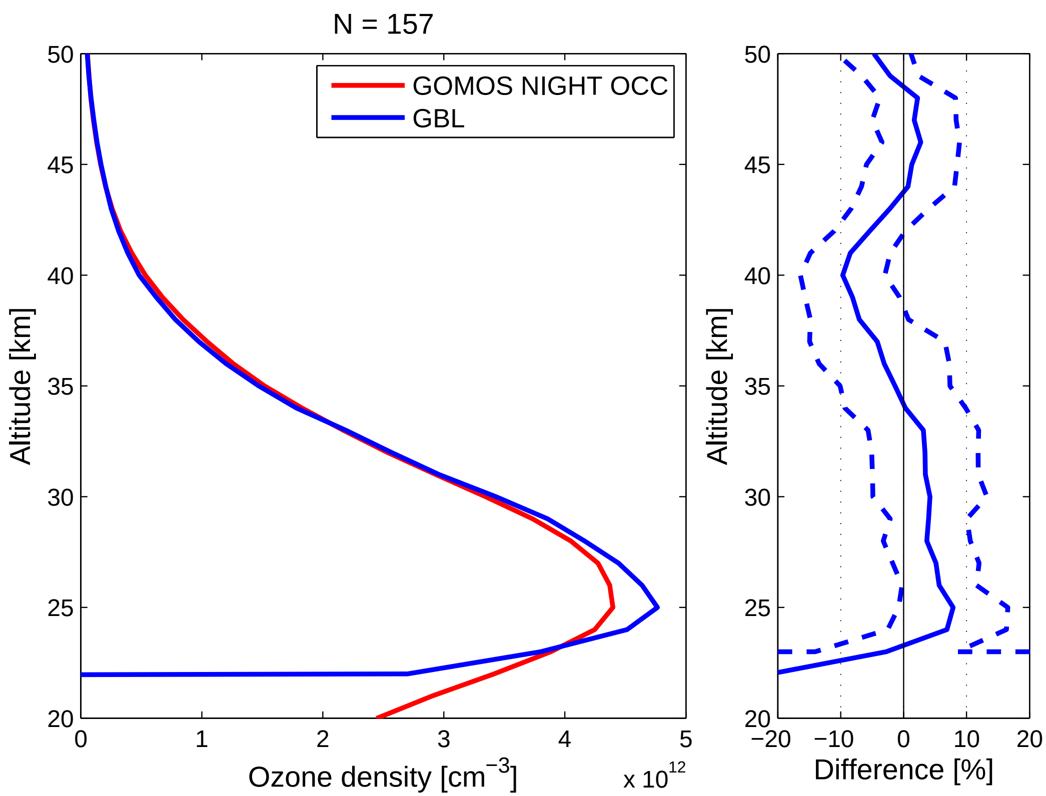
Siro

- Backward Monte Carlo model of photon paths through the atmosphere
- 3D geometry, 1-N scattering orders, polarization, refraction..
- One 500wl UV-vis spectrum in ∼15 min with 100000 photons



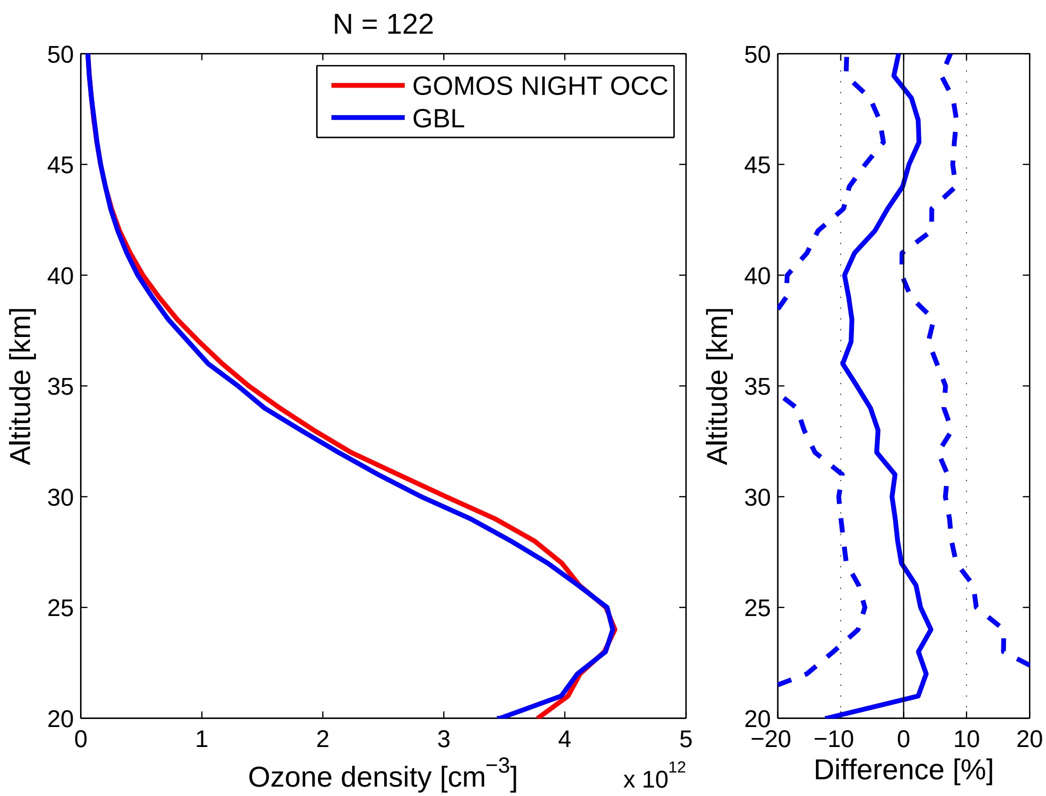
O3 validation (GOMOS vs. GOMOS)

Year 2003, 30S–30N, Δlat $< 1.5^o$, Δlon $< 3^o$, Δtime < 24 h:



O3 validation (GOMOS vs. GOMOS)

Year 2003, 30S–60S, Δlat $< 1.5^o$, Δlon $< 3^o$, Δtime < 24 h:



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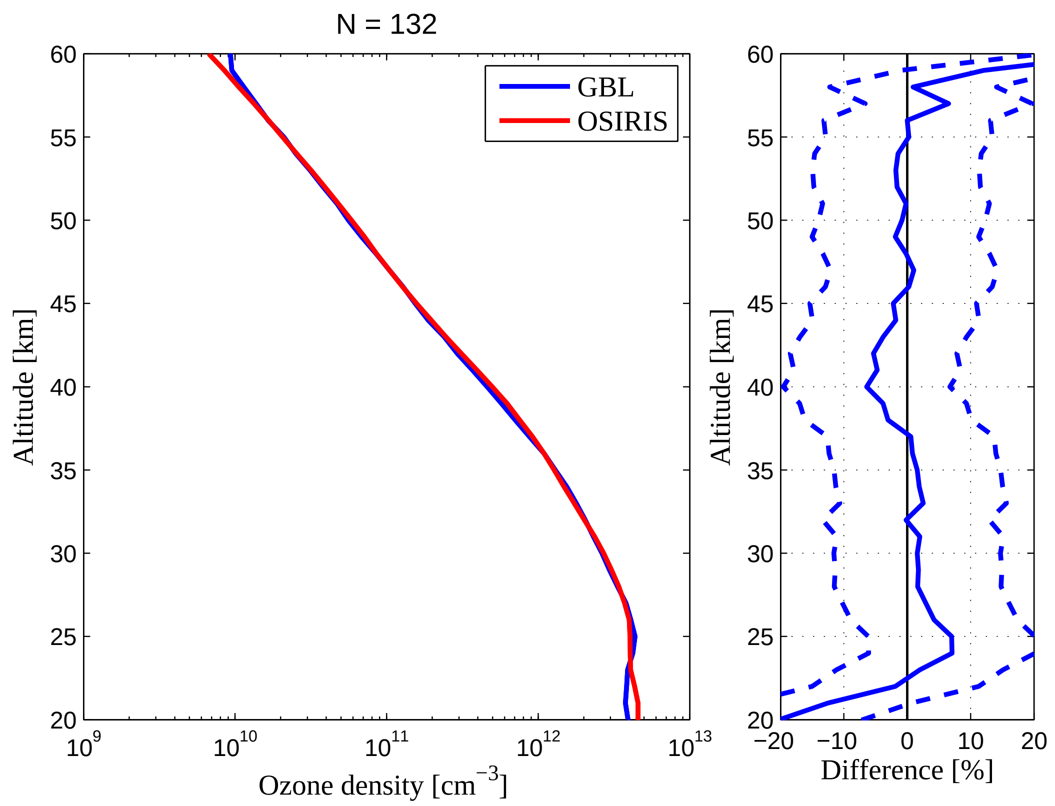
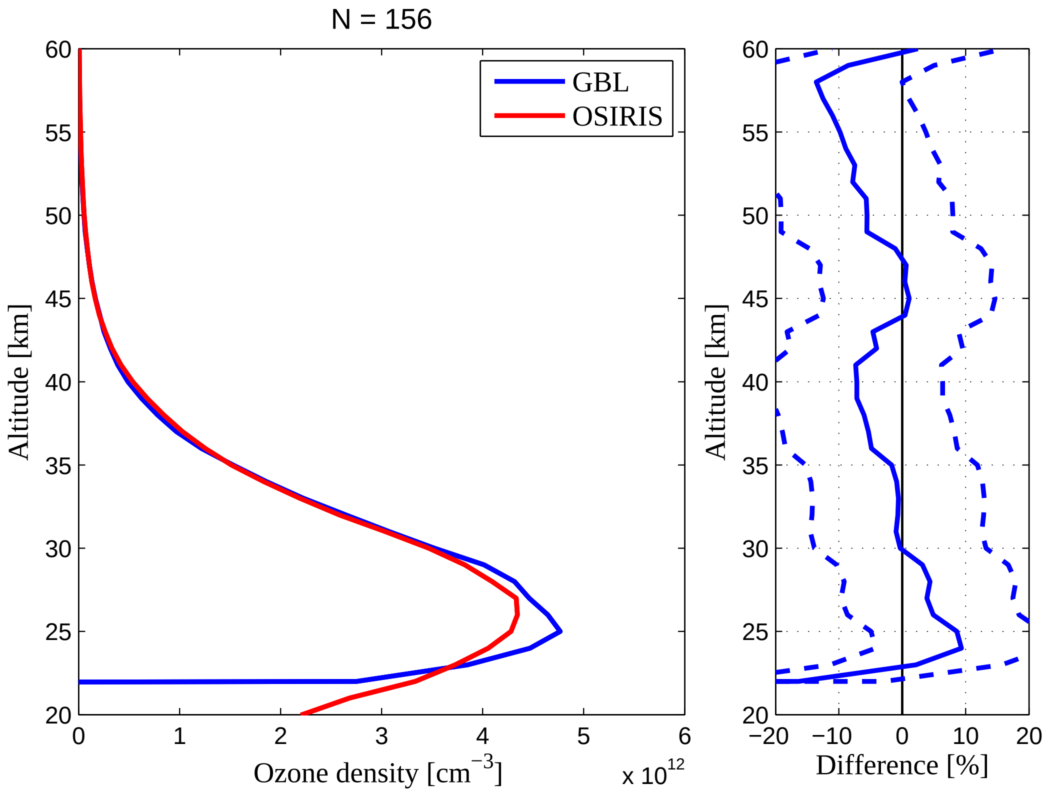
O3 validation (GOMOS vs. OSIRIS)

Year 2003, 90S–90N, Δlat $< 2^o$, Δlon $< 4^o$, Δtime < 2h:



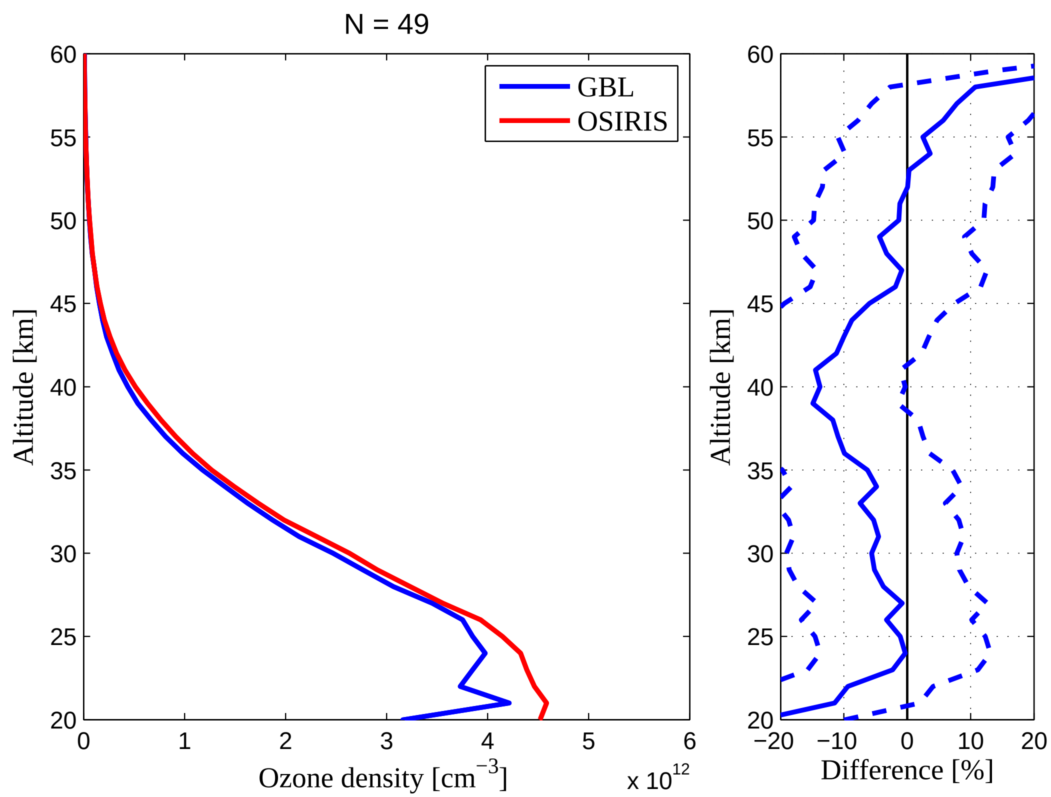
O3 validation (GOMOS vs. OSIRIS)

Year 2003, 30S–30N, Δlat $< 1^o$, Δlon $< 2^o$, Δtime < 24 h:



O3 validation (GOMOS vs. OSIRIS)

Year 2003, 50S–60S, Δlat $< 1^o$, Δlon $< 2^o$, Δtime < 24 h:



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Conclusions

- Use of limb signal instead of stellar signal can vastly improve GOMOS day time O_3 measurements.

- First validation results indicate better than 10% accuracy between 22–55 km.