GOME Total Ozone Column Retrieval Development

Phase 1 Meeting

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Phase 1 Investigations

- Optimum parameter space of LUT

- Complexity of Ring effect

- Parameters relevant for the fit

- Spectral fit window

- Shift and Squeeze

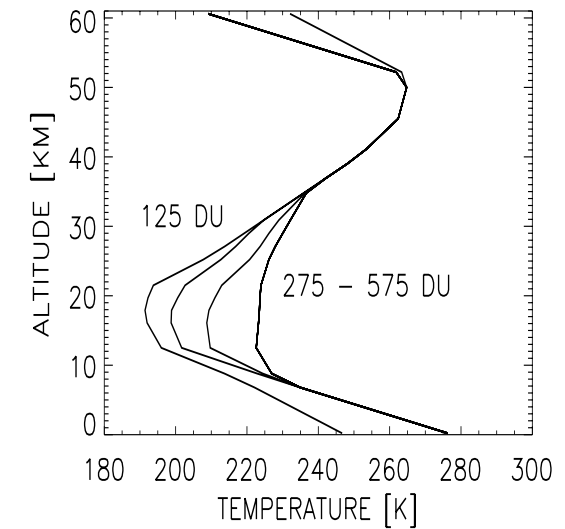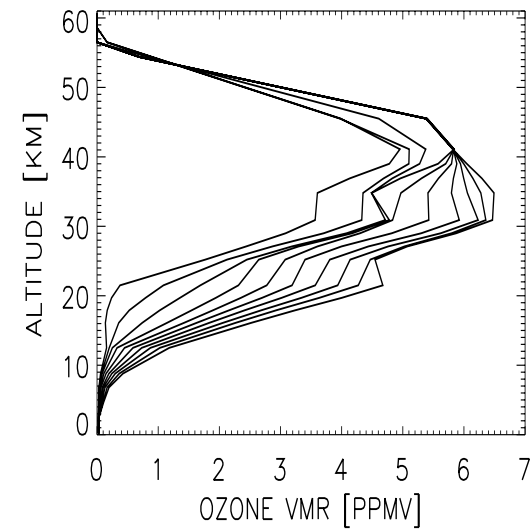- Radiative transfer model and geolocation information

Optimum parameter space for Look-up-table I

1. Total Ozone and Profile Shape
▷ TOMS V7 climatology :

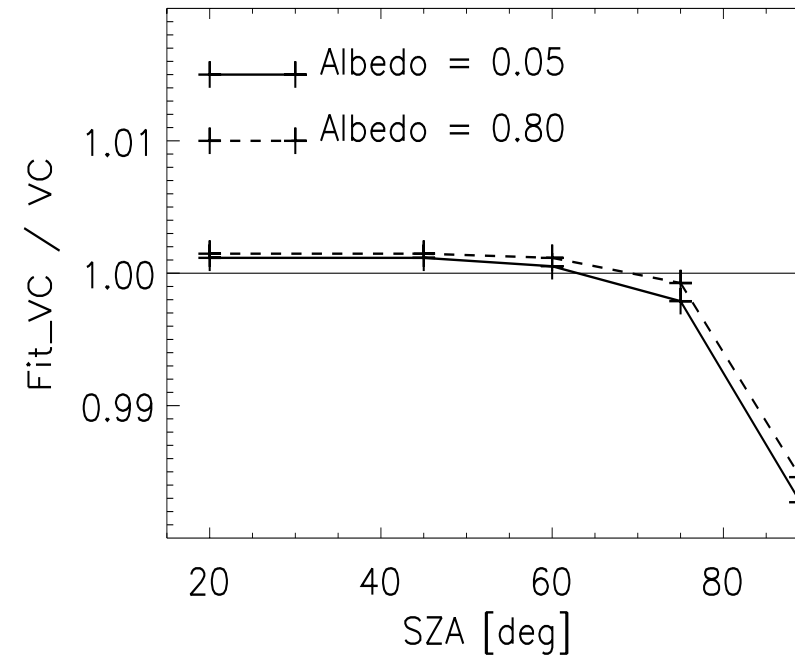| Zone		Min - Max	N
High latitudes	60° - 90°	125 - 575 DU	10
Mid latitudes	30° - 60°	125 - 575 DU	10
Low latitudes	0° - 30°	225 - 475 DU	6

Optimum parameter space for Look-up-table II

1. Total Ozone and Profile Shape

Reference Spectra : 325 and 375 DU
Simulated Test Spectra : 350 DU

Optimum parameter space for Look-up-table III

2. Solar Zenith Angle

SZA	Δ	Linear interpolation error
0° - 70°	5°	$\leq 0.05\%$
71° - 80°	1°	$\leq 0.05\%$
81° - 90°	1°	$\leq 0.9\%$

$\Rightarrow$ No linear interpolation

$\triangleright$ polynomial coefficients

Measured SZA :

Zone		SZA
High Lat	:	35° - 92°
Mid Lat	:	14° - 89°
Low Lat	:	14° - 62°

$\triangleright$ Reduce LUT size

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Optimum parameter space for Look-up-table IV

3. Albedo

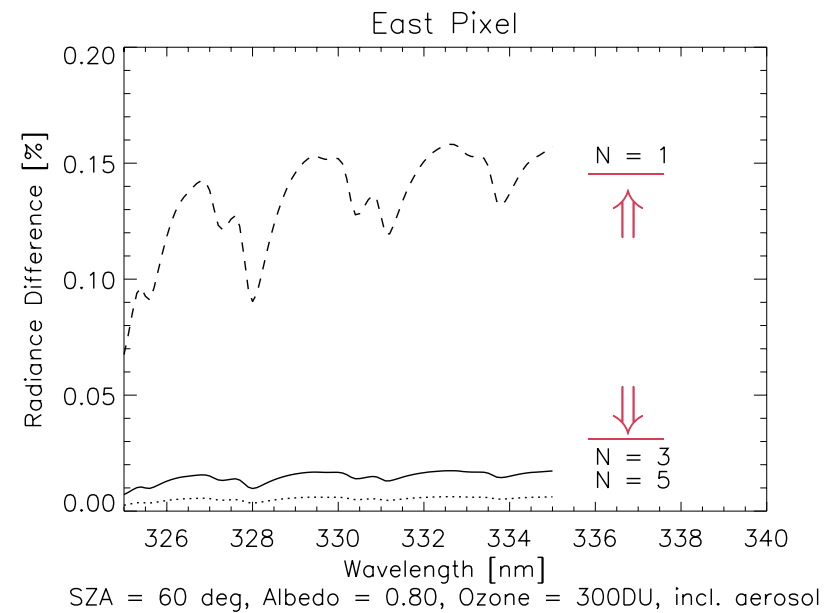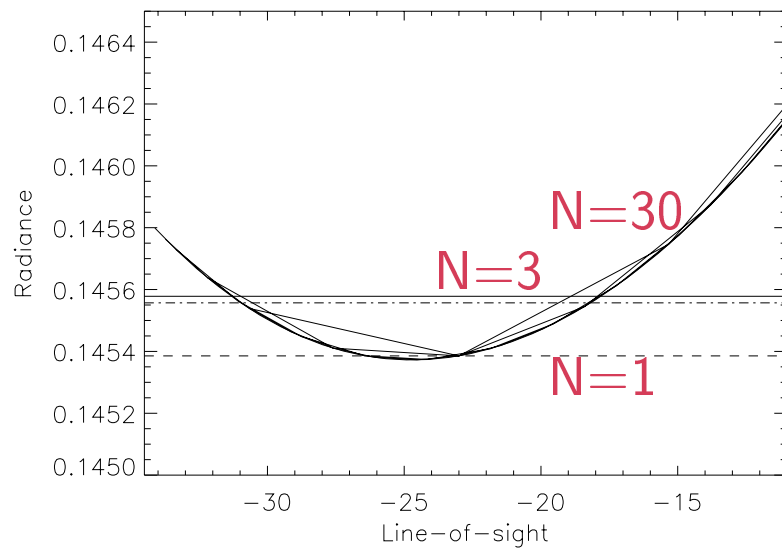   0.05, 0.2, 0.4, 0.6, 0.8, 0.98 ▷ linear interpolation

4. Altitude

   0, 2, 4, 6, 8 km ▷ linear interpolation

Optimum parameter space for Look-up-table V

5. Line-of-sight :   Scan Simulation (east pixel / LOS $= 34.5° - 11.5°$) :

30 Spectra / $\Delta = 0.7\bar{6}°$

3 Spectra / $\Delta = 11.5°$

1 Spectrum / LOS $= 23°$

SZA = 60 deg, Albedo = 0.80, Ozone = 300DU, incl. aerosol

Optimum parameter space for Look-up-table VI

Atmospheric Parameter	Min	Max	Δ	N
Total Ozone (high latitudes)	125 DU	575 DU	50 DU	10
Total Ozone (mid latitudes)	125 DU	575 DU	50 DU	10
Total Ozone (low latitudes)	225 DU	475 DU	50 DU	6
Solar Zenith Angle	15°	90°	5° if SZA $\leq$ 70° 1° if SZA > 70°	32
Line-Of-Sight	-34.5°	34.5°	11.5°	7
Surface Albedo	0.05	0.98	$\sim$0.2	6
Ground Altitude	0 km	8 km	2 km	5

Relevant parameters for the fit I
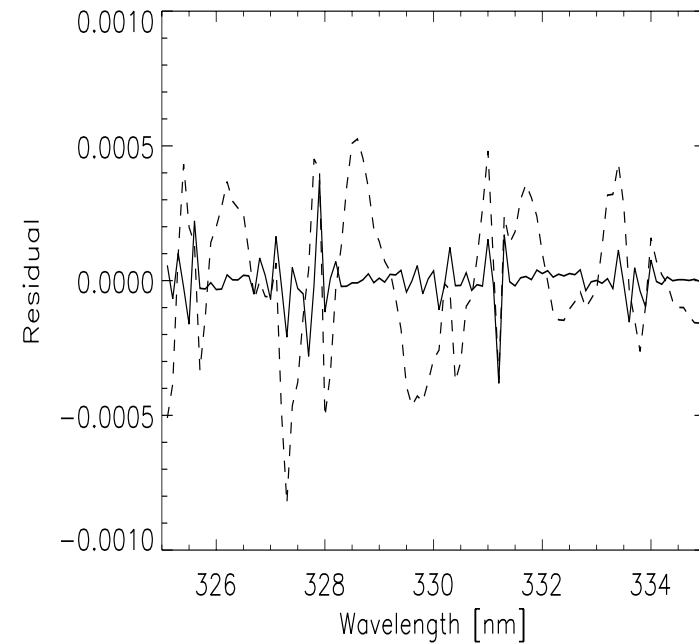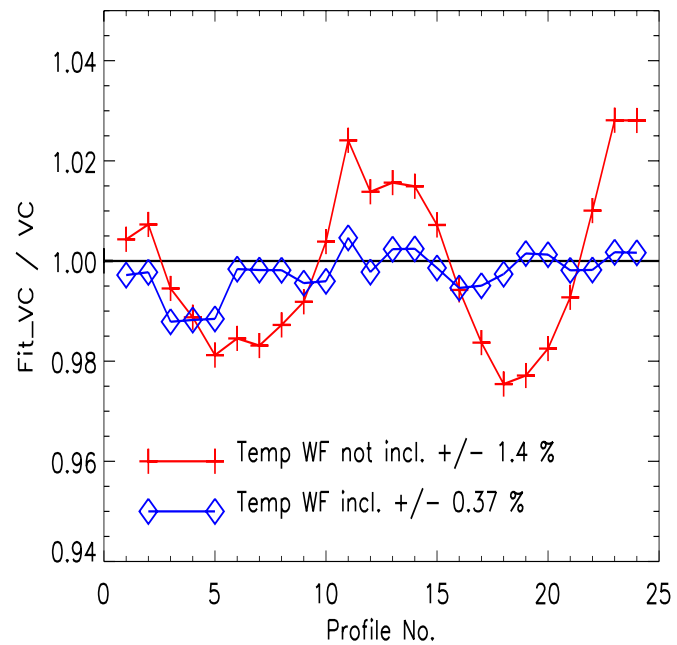
Weighting functions :
Ozone and Temperature

Cross Sections :
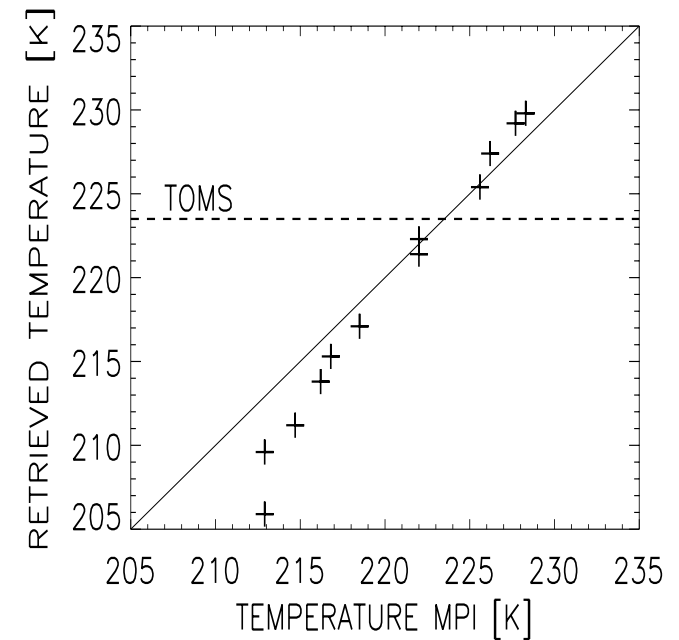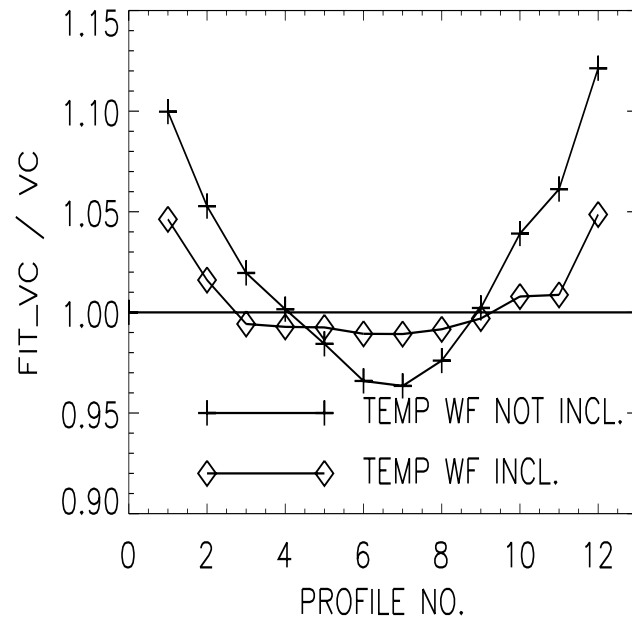NO_2 and BrO

Other Spectra :
Ring and undersampling
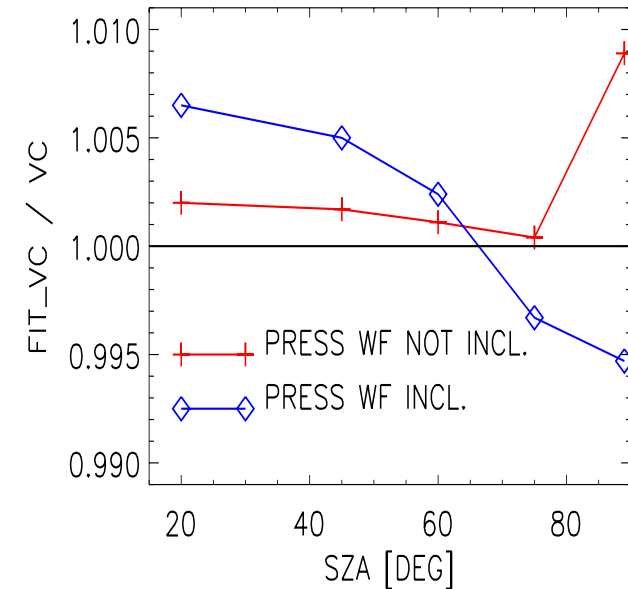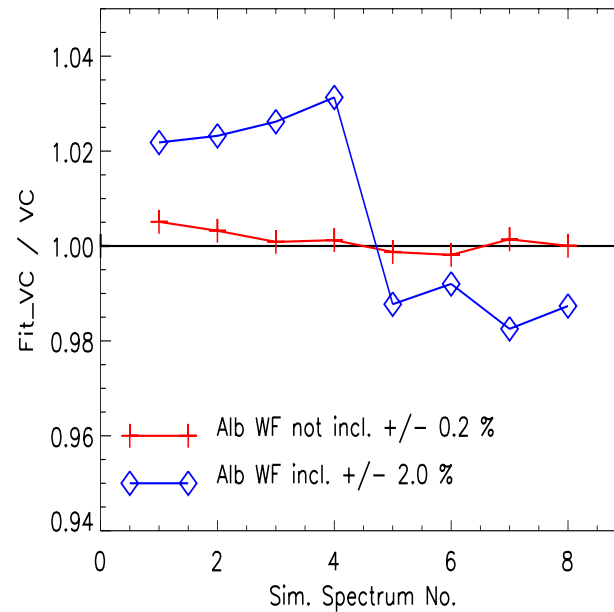
Relevant parameters for the fit II

Temperature Weighting Function :

# Relevant parameters for the fit III

Temperature Weighting Function:

Ring Effect Studies I

- Fraunhofer filling-in and molecular filling-in contribute to the Ring spectral signature

- Ring spectra and simulated radiances for 72 representative trace gas scenarios (SLIM-CAT), seasons (Jan, Apr, Jul, Oct), latitudes ($5°$, $55°$, $75°$), albedo (0.05, 0.8), and different line-of-sight ($-32°$, $0°$, $32°$) have been calculated

- WFM-DOAS retrieval using Ring spectra which were calculated with one trace gas scenario for 32 different solar zenith angles

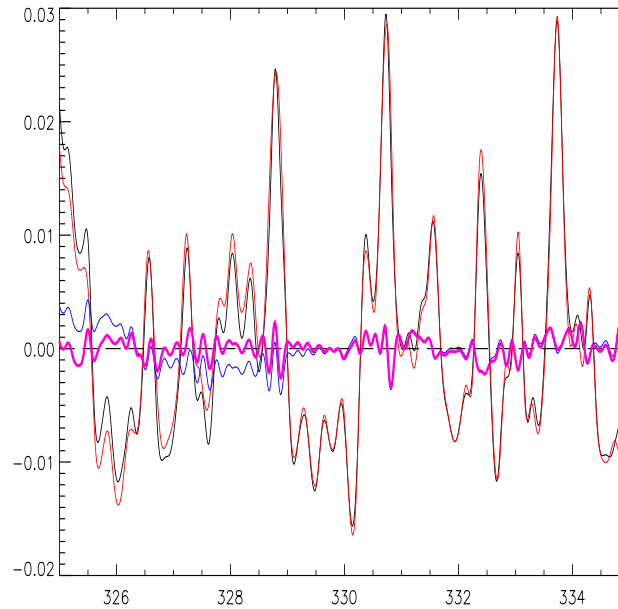- Error in ozone retrieval 0.2% - 3.7% when neglecting the ozone profile shape dependence
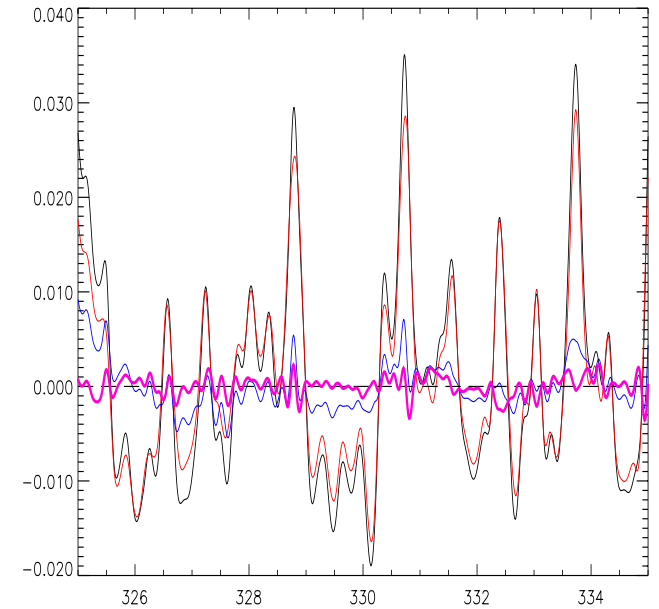
Ring Effect Studies II

East, 0.05
RMS = 9.51e-4
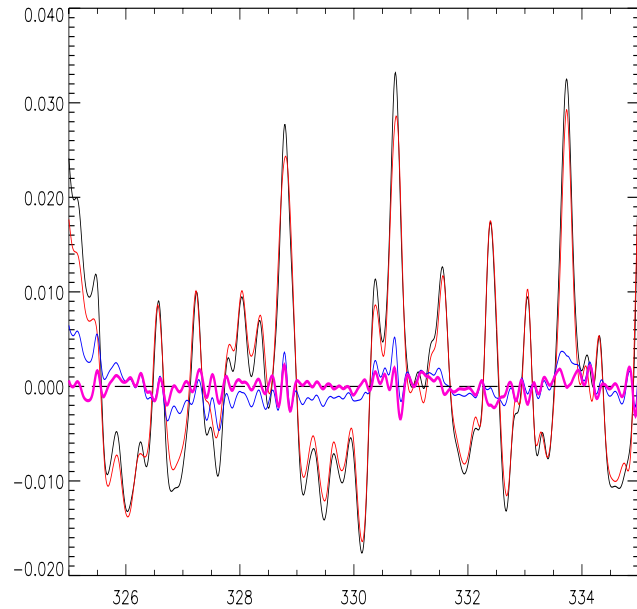
Nadir 0.05
RMS = 9.51e-4

Nadir 0.80
RMS = 1.028e-3

Ring Effect Studies III

- The surface albedo is an important parameter ($\sim 1\%$ error)

- Line-of-sight dependence negligible

- Check : height dependence

  $\Rightarrow$ Ring LUT as function of SZA, α_S, ozone profile, and altitude (?)
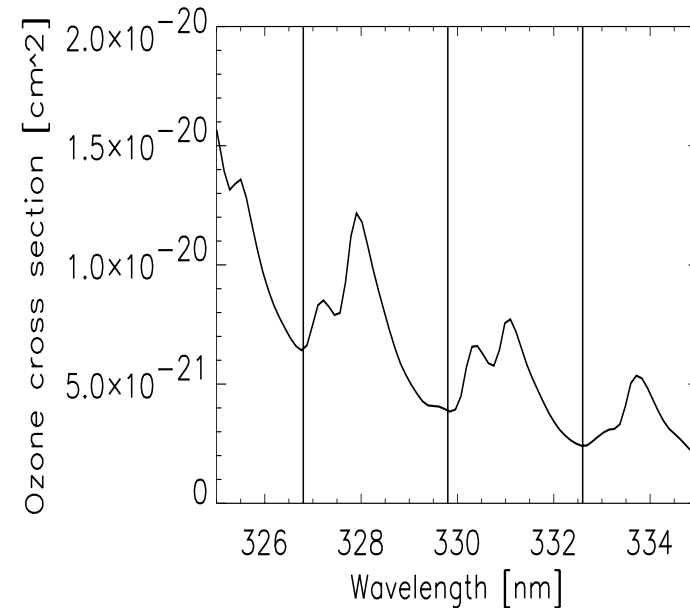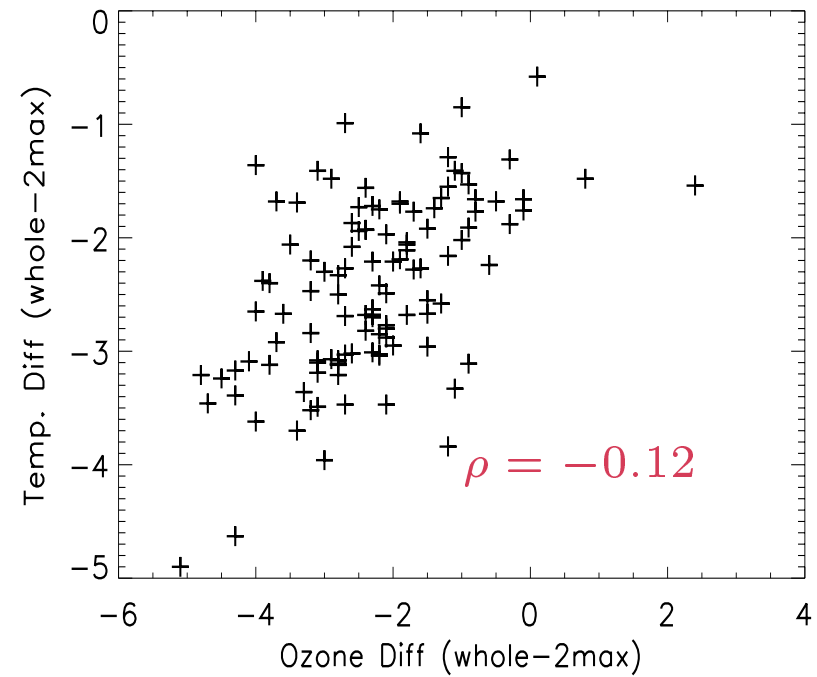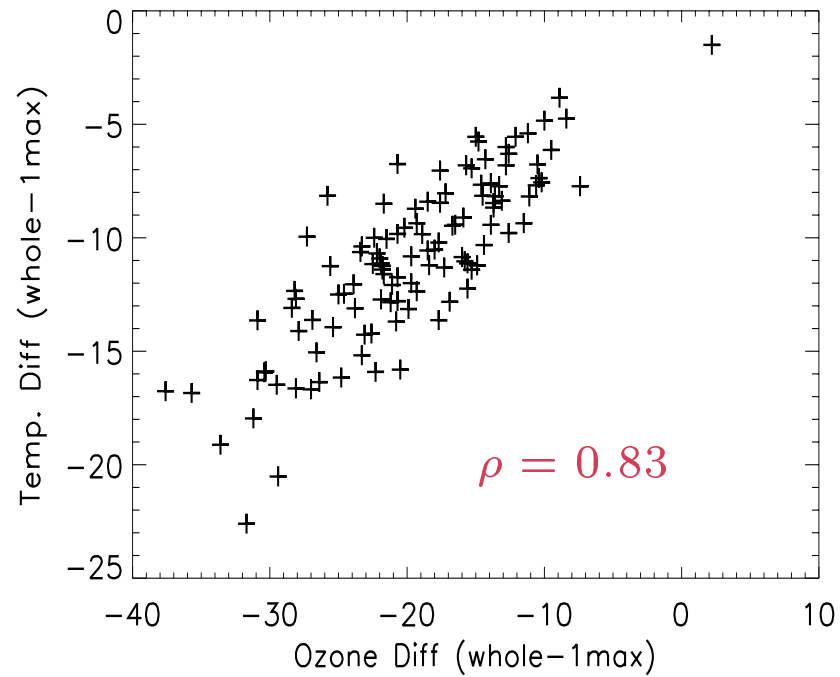
Fit window selection I

1. 326.8 - 335.0 nm (3 ozone maxima)
2. 326.8 - 332.6 nm (2 ozone maxima)
3. 326.8 - 329.8 nm (1 ozone maxima)

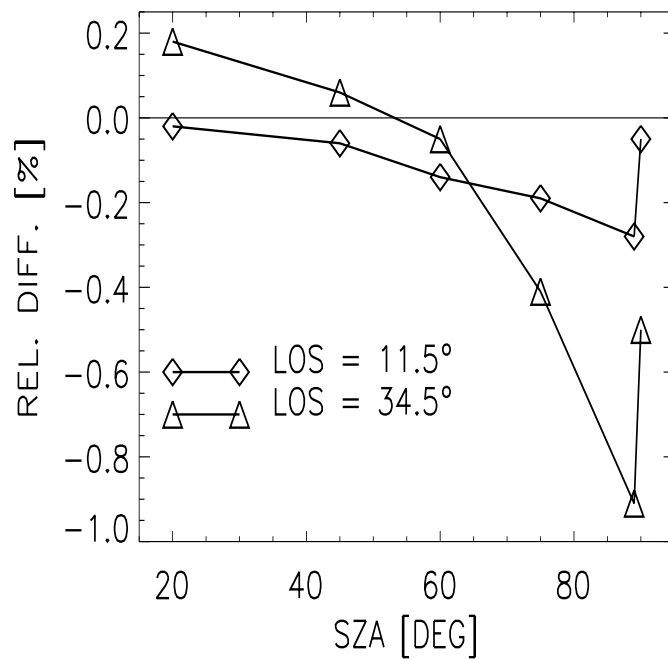Correlation between O_3 WF and Temperature WF:

1. $\rho = -0.63$
2. $\rho = -0.76$
3. $\rho = -0.89$

Fit window selection II

Geolocation Information

▷ Select viewing geometry for ground for calculation of reference spectra with pseudo-sperical RTM

▷ SCIATRAN is used instead of CDI