Comparison of UV-RSS Spectral Measurements and TUV Model Runs for the May 2003 ARM Aerosol Intensive Observation Period

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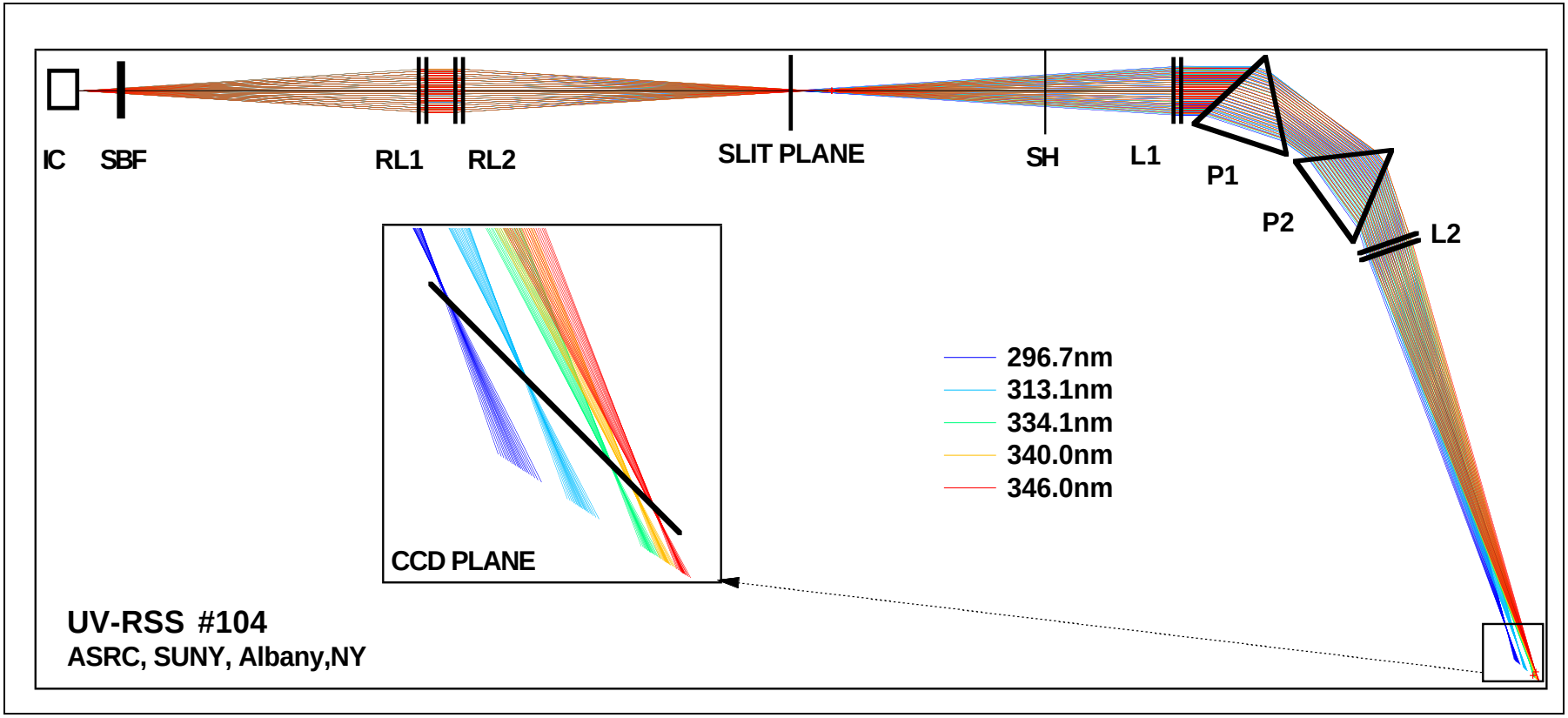
- The Ultraviolet-Rotating Shadowband Spectroradiometer
- Model inputs (most are extrapolations from visible) to the Tropospheric UV Visible (TUV) Radiative Transfer model
- The trouble with extraterrestrial solar spectra
- Comparisons of diffuse and direct transmittance

Deployments

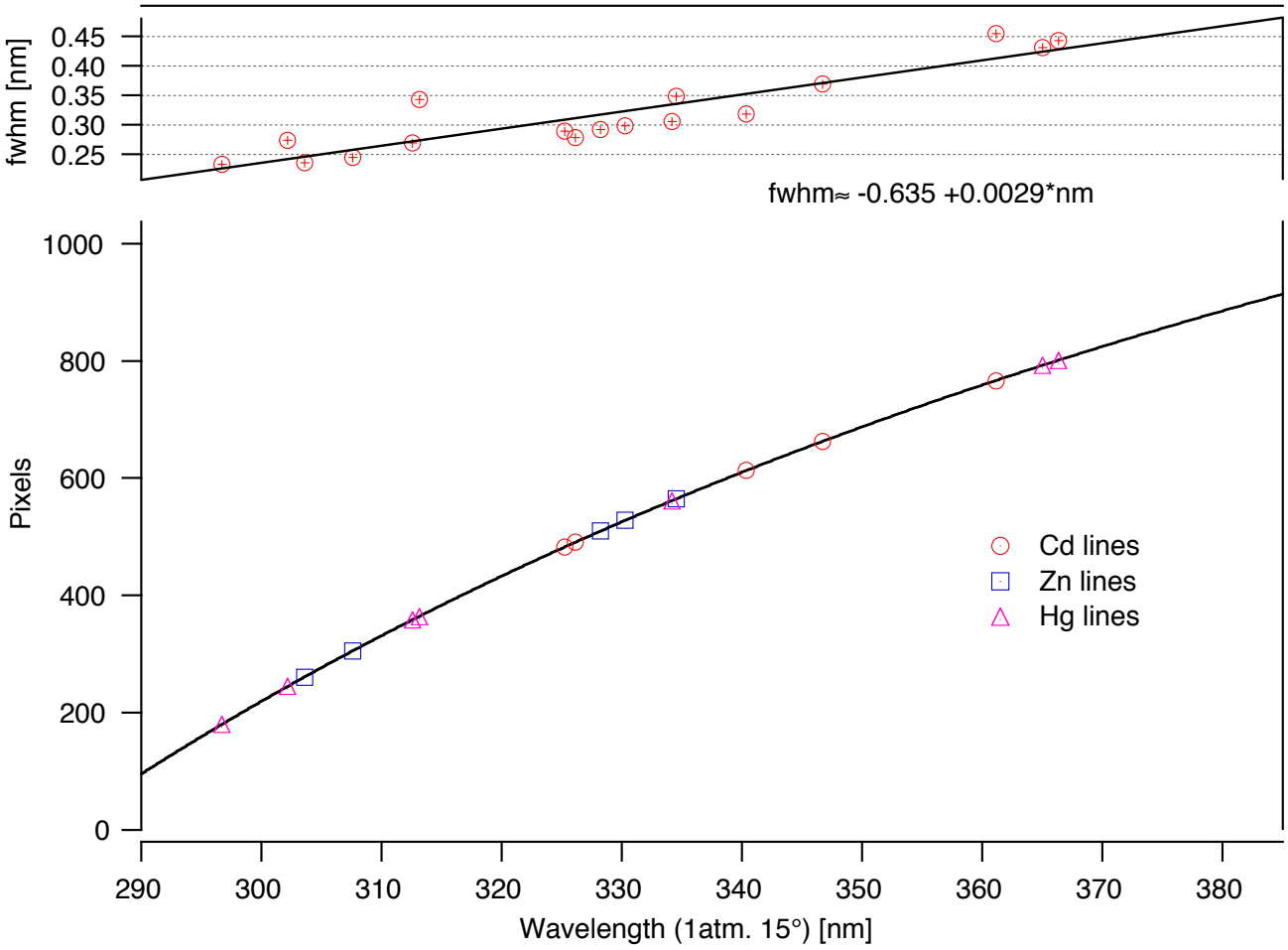
10/97 Intercomparison, Table Mt., CO
Prototype NMOS: 512 pixels

09/01 Diffuse IOP, SPG, OK
05/03 Aerosols IOP, SPG, OK
06/03 Intercomparison, Table Mt., CO

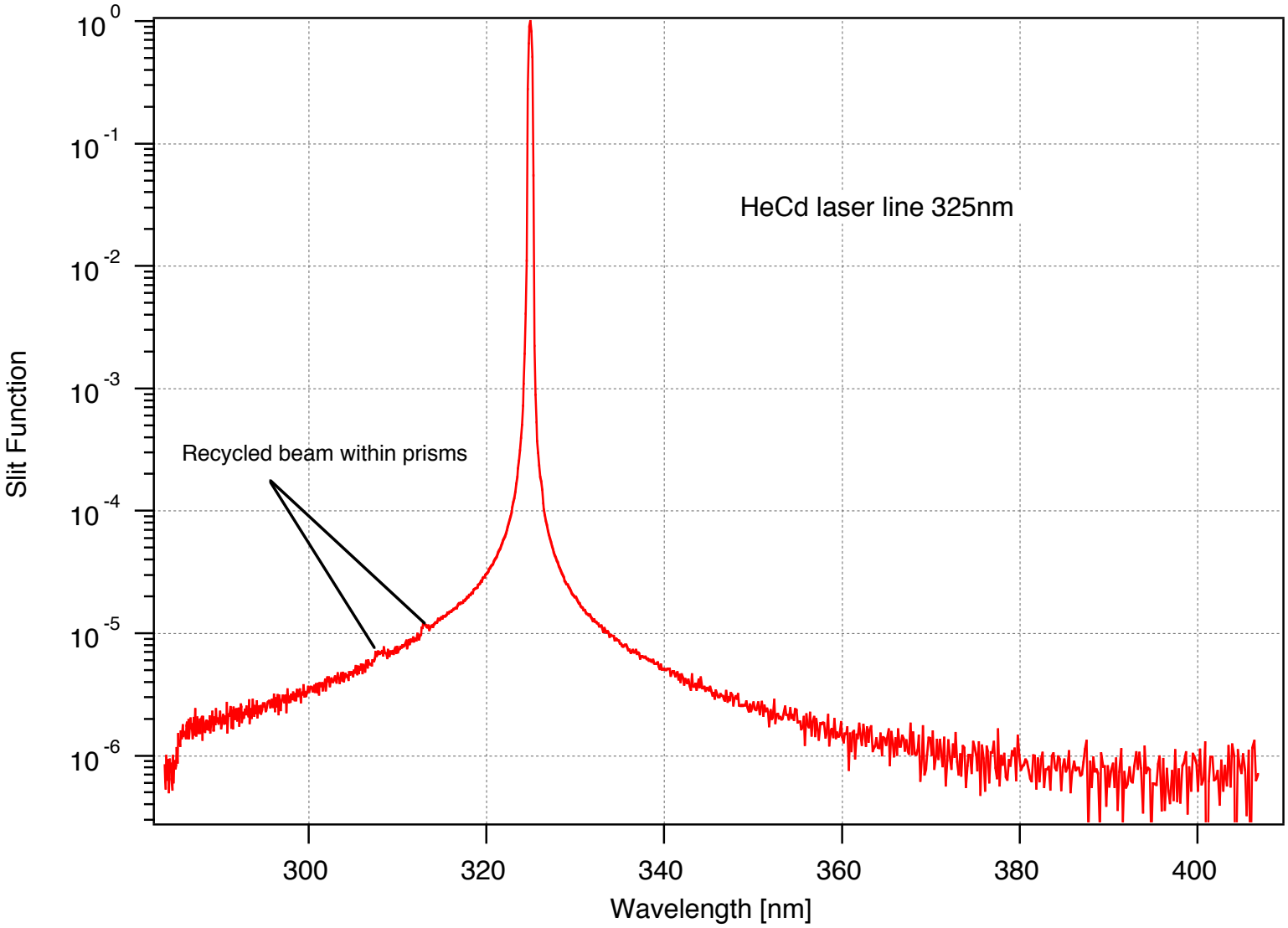
UV-RSS optical layout and ray-trace



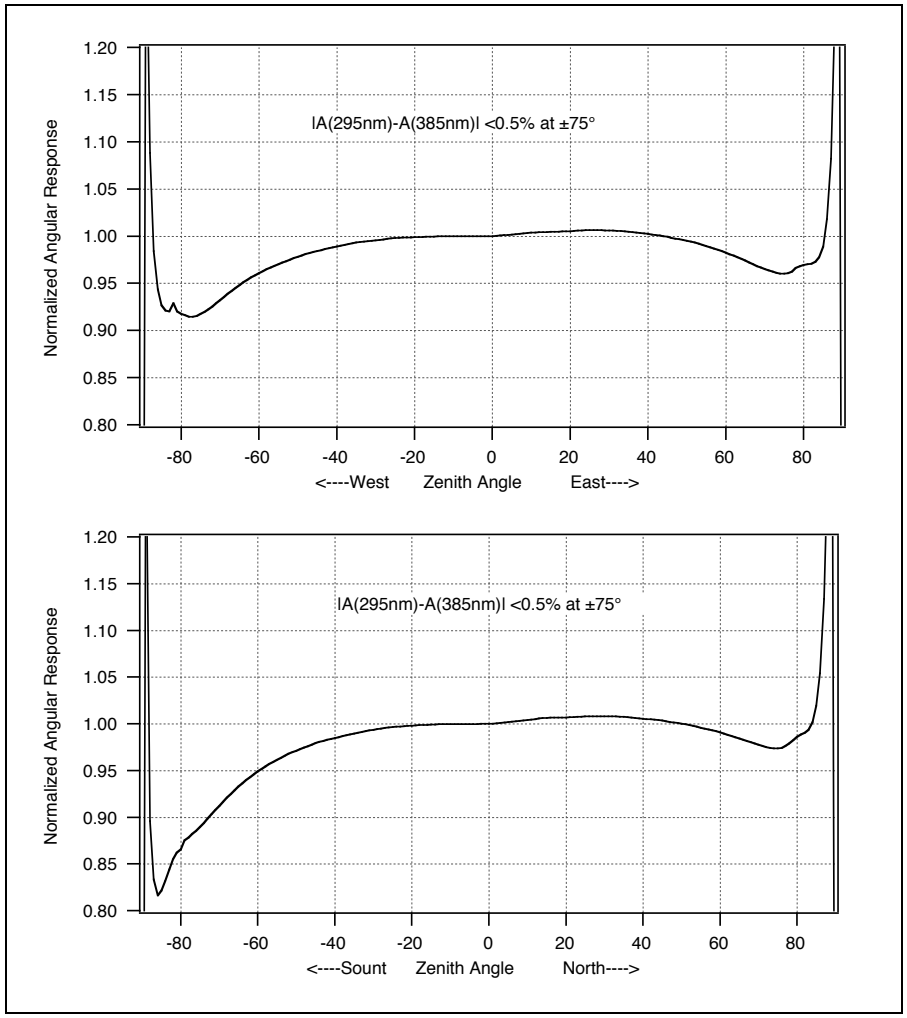
RSS104 resolution and pixel-wavelength dependence

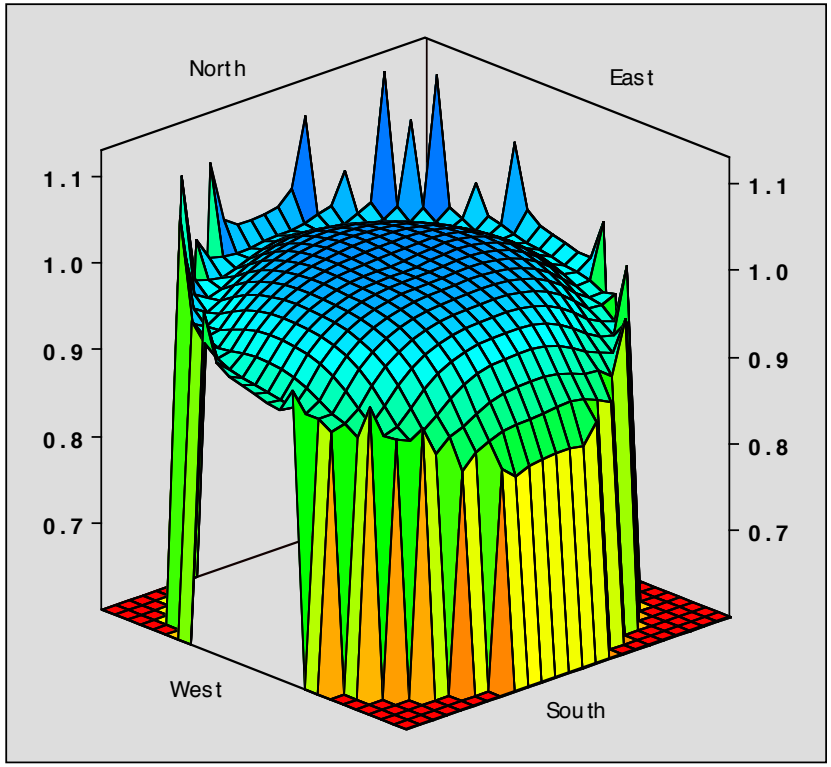


RSS104 Slit function



UV-RSS cosine response



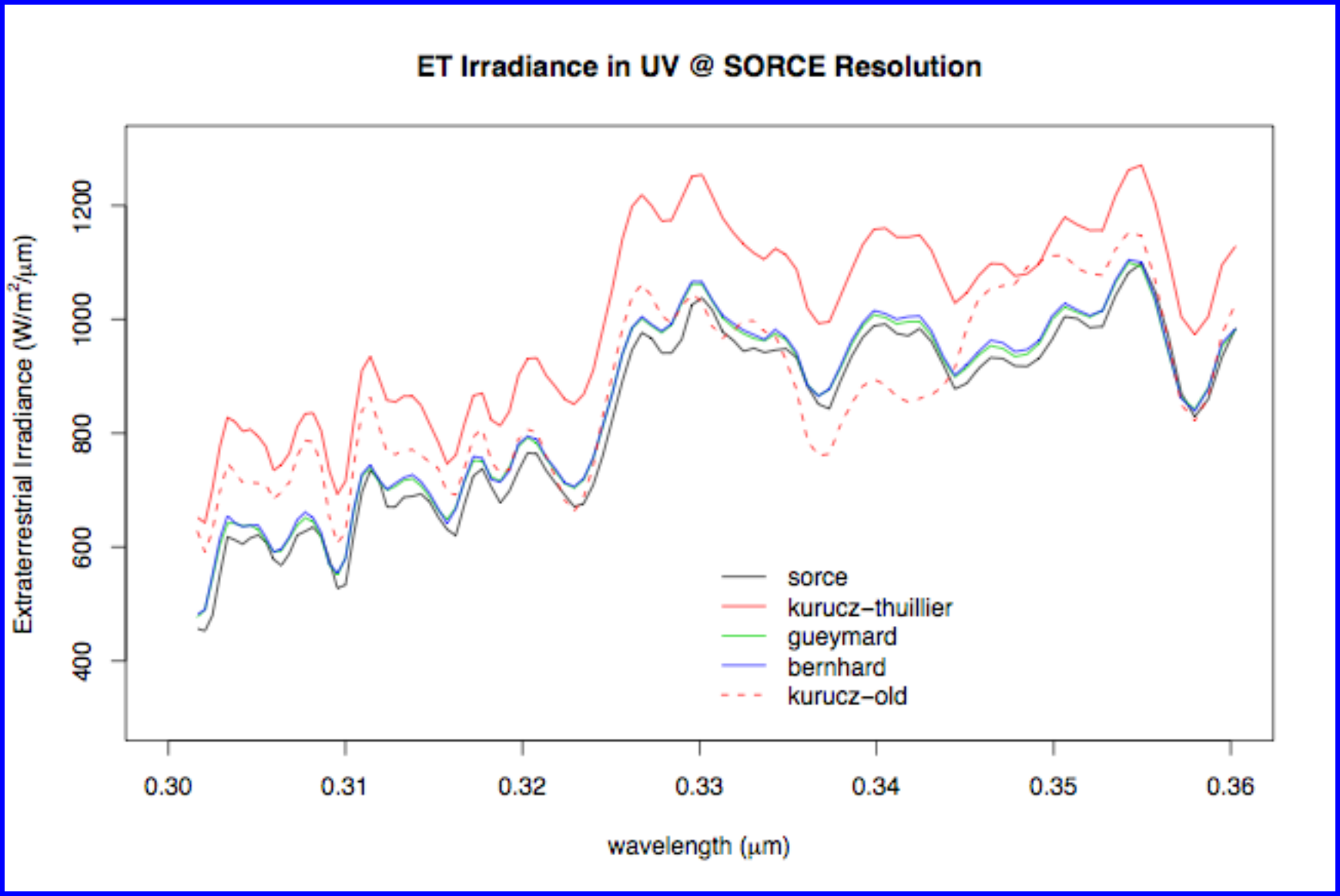


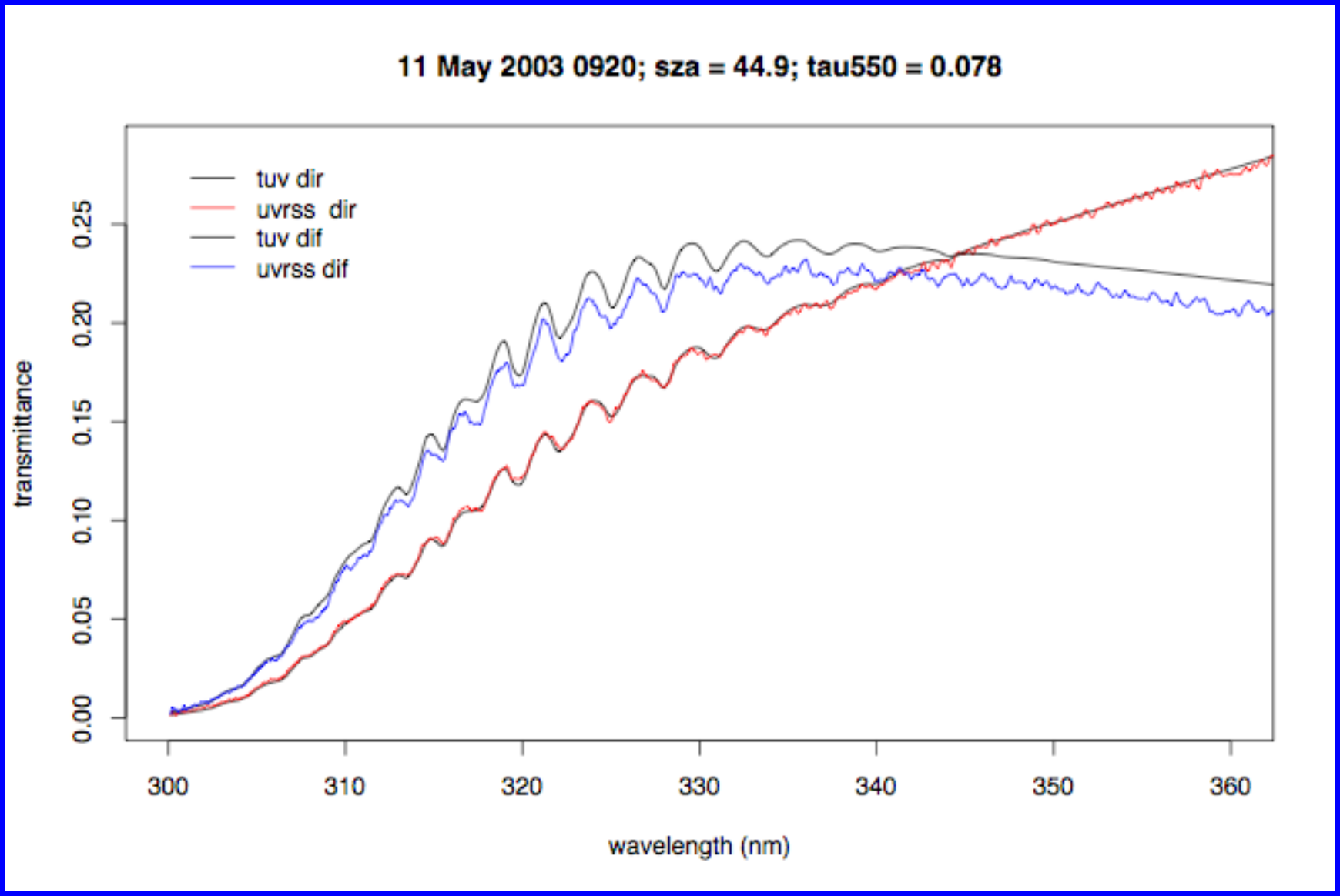
$$\iint \sin(\zeta)\cos(\zeta)(A_R(\zeta,\alpha)-1)Rd\alpha d\zeta < 0.5\%$$

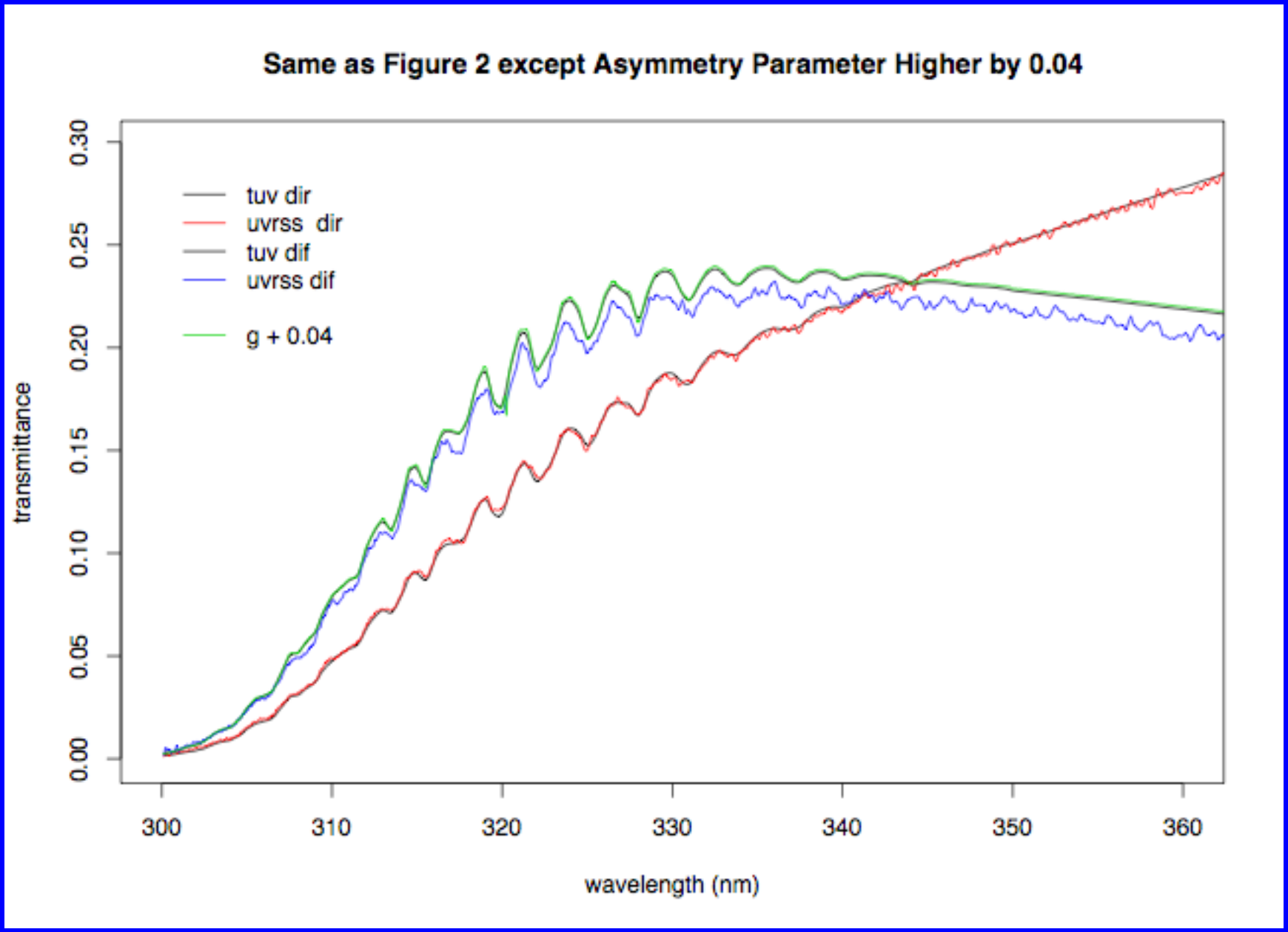
Tropospheric UV Visible (TUV) RT Model (Madronich@NCAR)

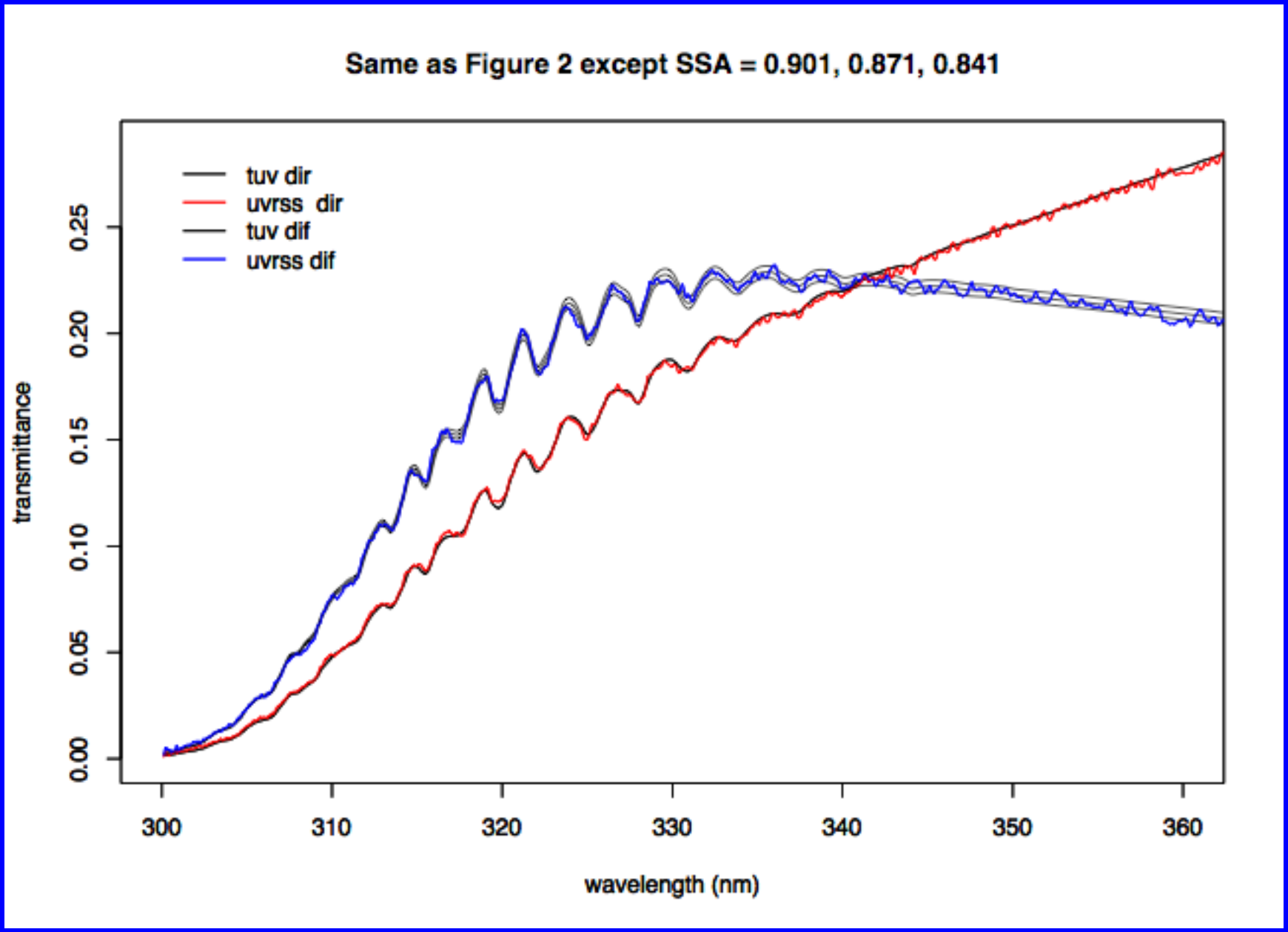
- Run at 0.1 nm resolution from 300-360 nm
- Bernhard ET spectrum (JGR-Atmos 2004)
- **Inputs:** 550 nm ssa; 550 nm asymmetry parameter; AOD and alpha based on τ @ 332, 415, and 500 nm; ozone was average of up to five measurements; assumed 0.015 surface albedo

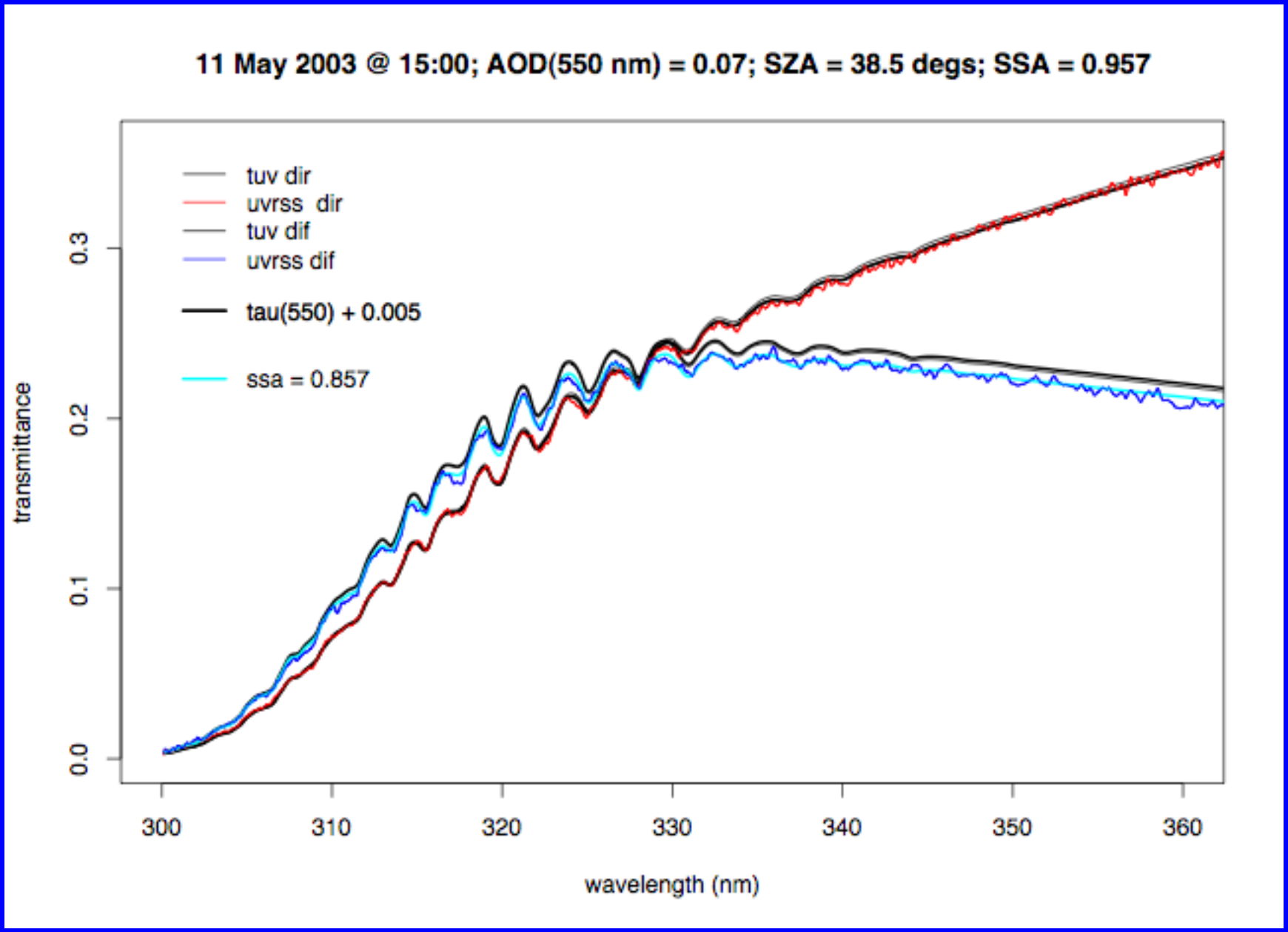
Date	LST	solar elv (degs)	H2O (cm)	ozone (DU)	ssa	g	alpha	tau (550 nm)
11-May-03	920	45.1	1.09	320	0.971	0.573	1.047	0.078
11-May-03	1230	71.3	1.14	320	0.944	0.582	0.69	0.084
11-May-03	1500	51.5	1.13	320	0.957	0.552	0.606	0.07
12-May-03	730	23.3	1.53	328	0.883	0.572	1.25	0.074
12-May-03	950	51.1	1.54	328	0.934	0.562	1.308	0.077
22-May-03	800	30.4	2.43	326	0.939	0.66	1.08	0.18
28-May-03	1800	17.9	2.71	322	0.951	0.619	1.108	0.183

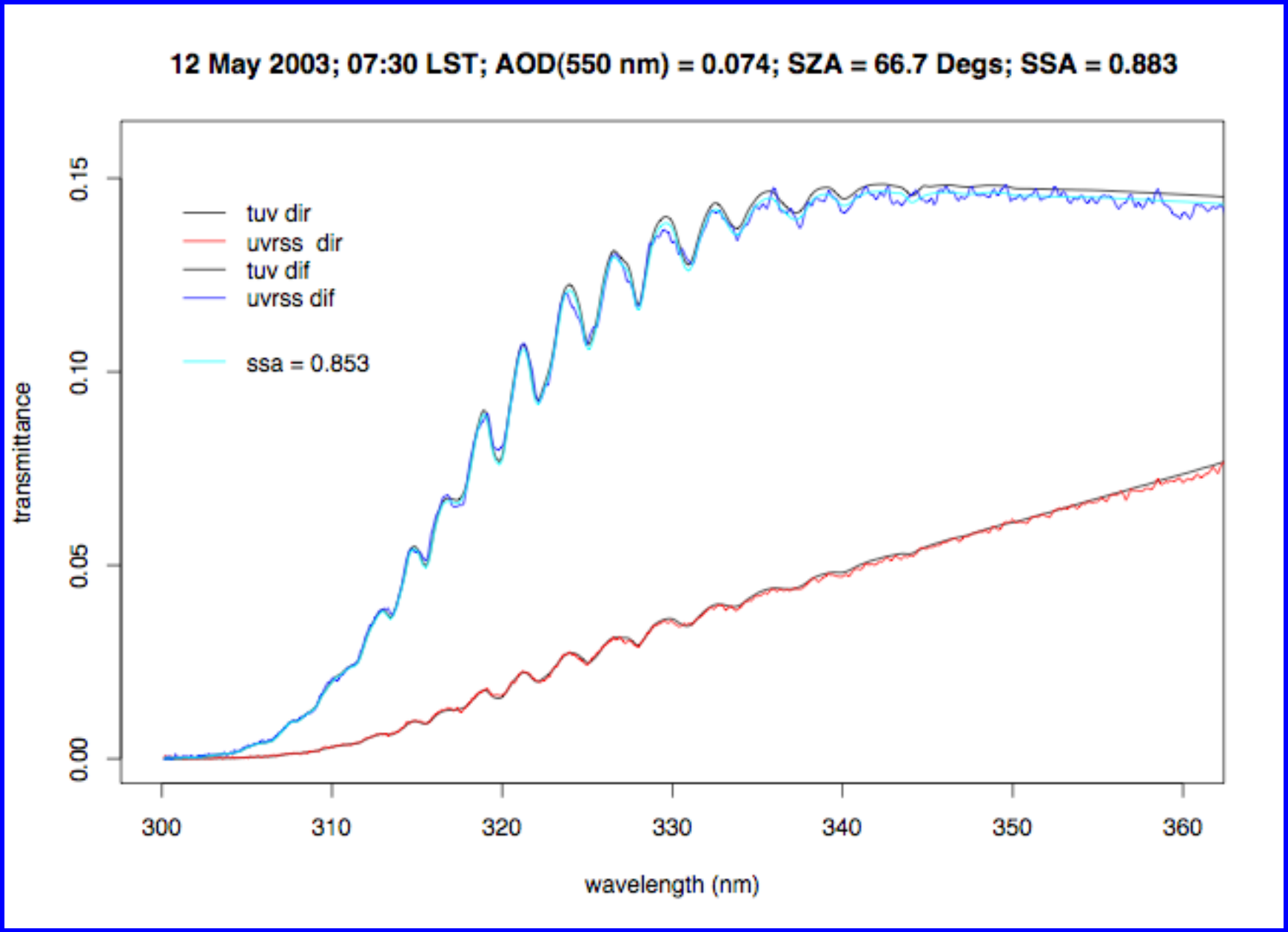

ET Irradiance in UV @ SORCE Resolution
Extraterrestrial Irradiance (W/m²/μm)
400
600
800
1000
1200
0.30
0.31
0.32
0.33
0.34
0.35
0.36
wavelength (μm)
sorce
kurucz−thuillier
gueymard
bernhard
kurucz−old

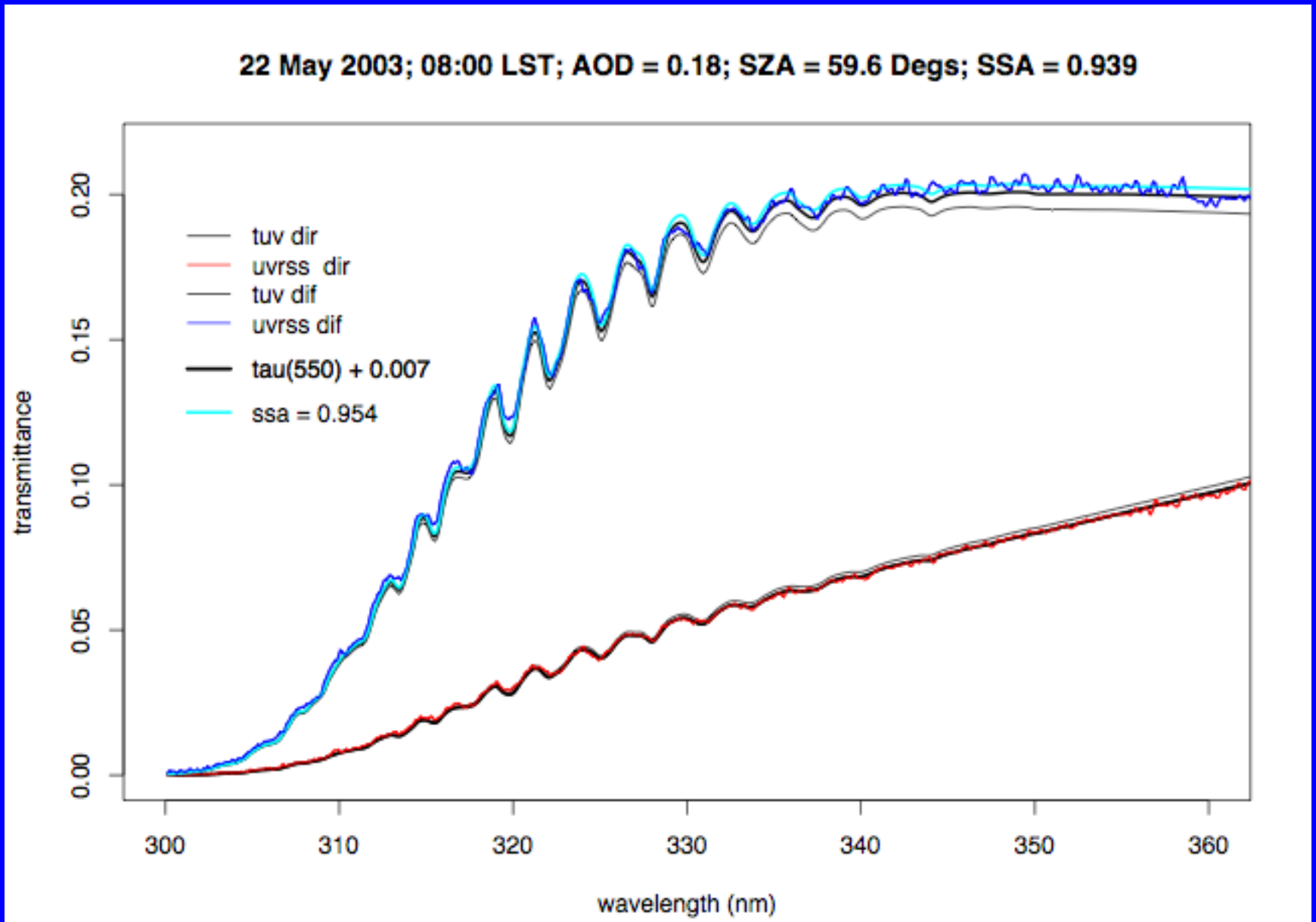

11 May 2003 0920; sza = 44.9; tau550 = 0.078
tuv dir
uvrss dir
tuv dif
uvrss dif
transmittance
0.00
0.05
0.10
0.15
0.20
0.25
300
310
320
330
340
350
360
wavelength (nm)


Same as Figure 2 except Asymmetry Parameter Higher by 0.04
tuv dir
uvrss dir
tuv dif
uvrss dif
g + 0.04
transmittance
0.00
0.05
0.10
0.15
0.20
0.25
0.30
300
310
320
330
340
350
360
wavelength (nm)


Same as Figure 2 except SSA = 0.901, 0.871, 0.841
tuv dir
uvrss dir
tuv dif
uvrss dif
transmittance
0.00
0.05
0.10
0.15
0.20
0.25
300
310
320
330
340
350
360
wavelength (nm)


11 May 2003 @ 15:00; AOD(550 nm) = 0.07; SZA = 38.5 degs; SSA = 0.957
tuv dir
uvrss dir
tuv dif
uvrss dif
tau(550) + 0.005
ssa = 0.857
transmittance
0.0
0.1
0.2
0.3
300
310
320
330
340
350
360
wavelength (nm)


12 May 2003; 07:30 LST; AOD(550 nm) = 0.074; SZA = 66.7 Degs; SSA = 0.883
tuv dir
uvrss dir
tuv dif
uvrss dif
ssa = 0.853
transmittance
0.00
0.05
0.10
0.15
300
310
320
330
340
350
360
wavelength (nm)


22 May 2003; 08:00 LST; AOD = 0.18; SZA = 59.6 Degs; SSA = 0.939
tuv dir
uvrss dir
tuv dif
uvrss dif
tau(550) + 0.007
ssa = 0.954
transmittance
0.00
0.05
0.10
0.15
0.20
300
310
320
330
340
350
360
wavelength (nm)

Future Efforts

- Check slit functions over UV spectrum
- Exploit retrieval potential, specifically, ozone retrievals with 3 available x-sections
- ϖ_0 (ssa) retrievals in UV
- Validate models with UV inputs