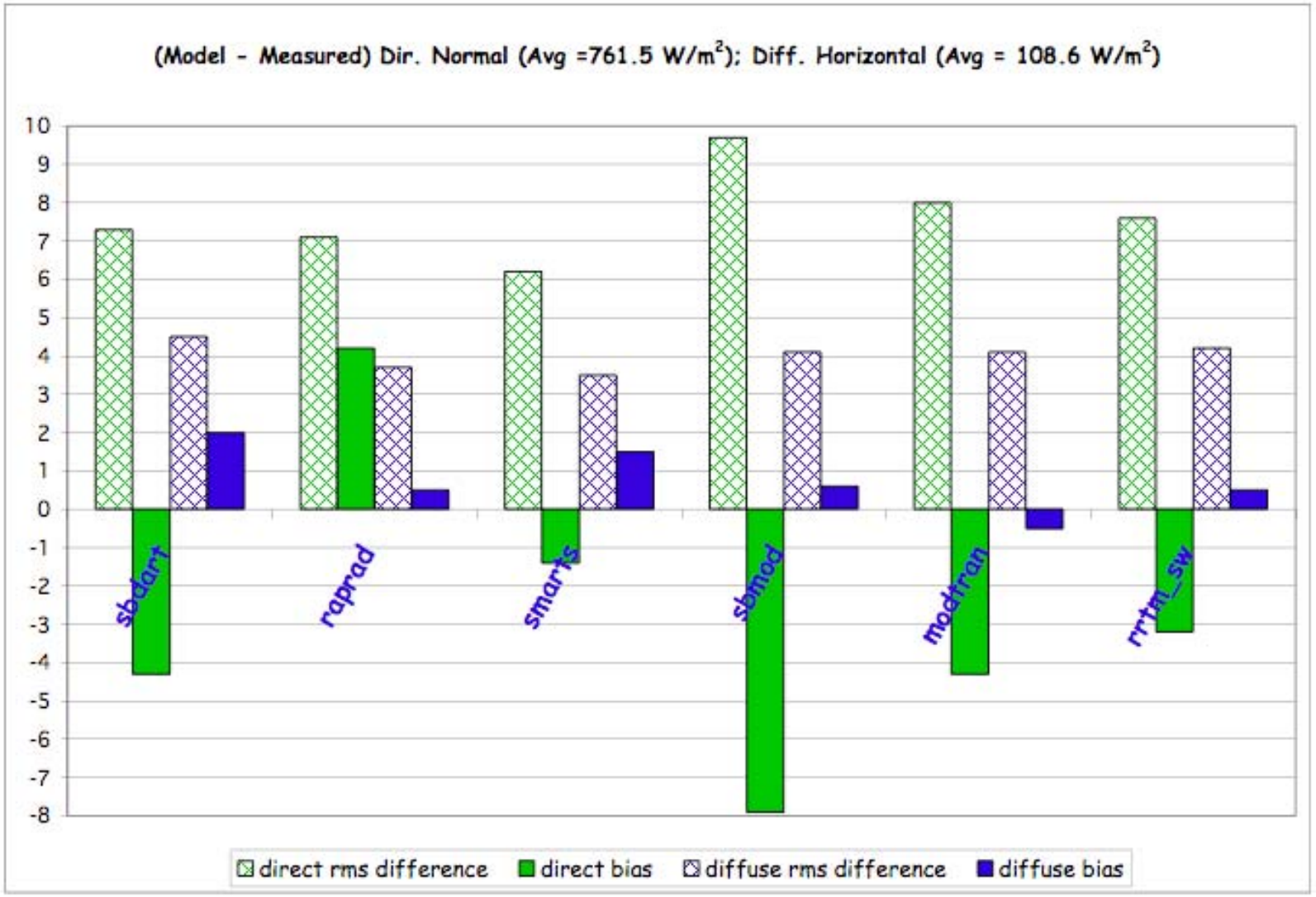
Comparison of RSS spectral measurements and RT model calculations for clear skies

J. Michalsky, G. Anderson, J. Delamere, P. Kiedron, E. Mlawer

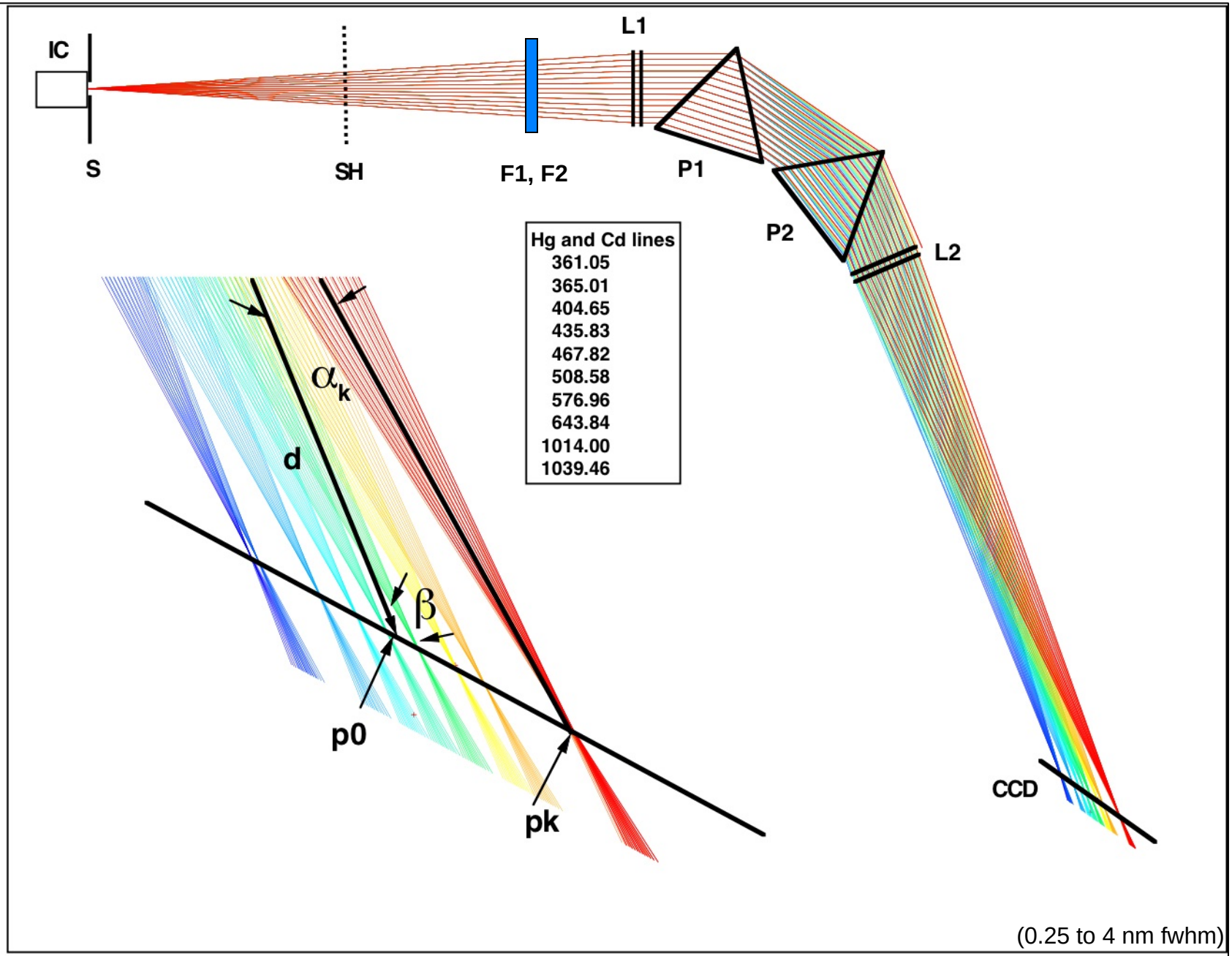
- Purpose - Compare irradiance at moderate spectral resolution
- Rotating shadowband spectroradiometer (RSS)
- Why work in transmission
- Inputs to the models
- Six clear-sky comparisons
- Summarize results to this point

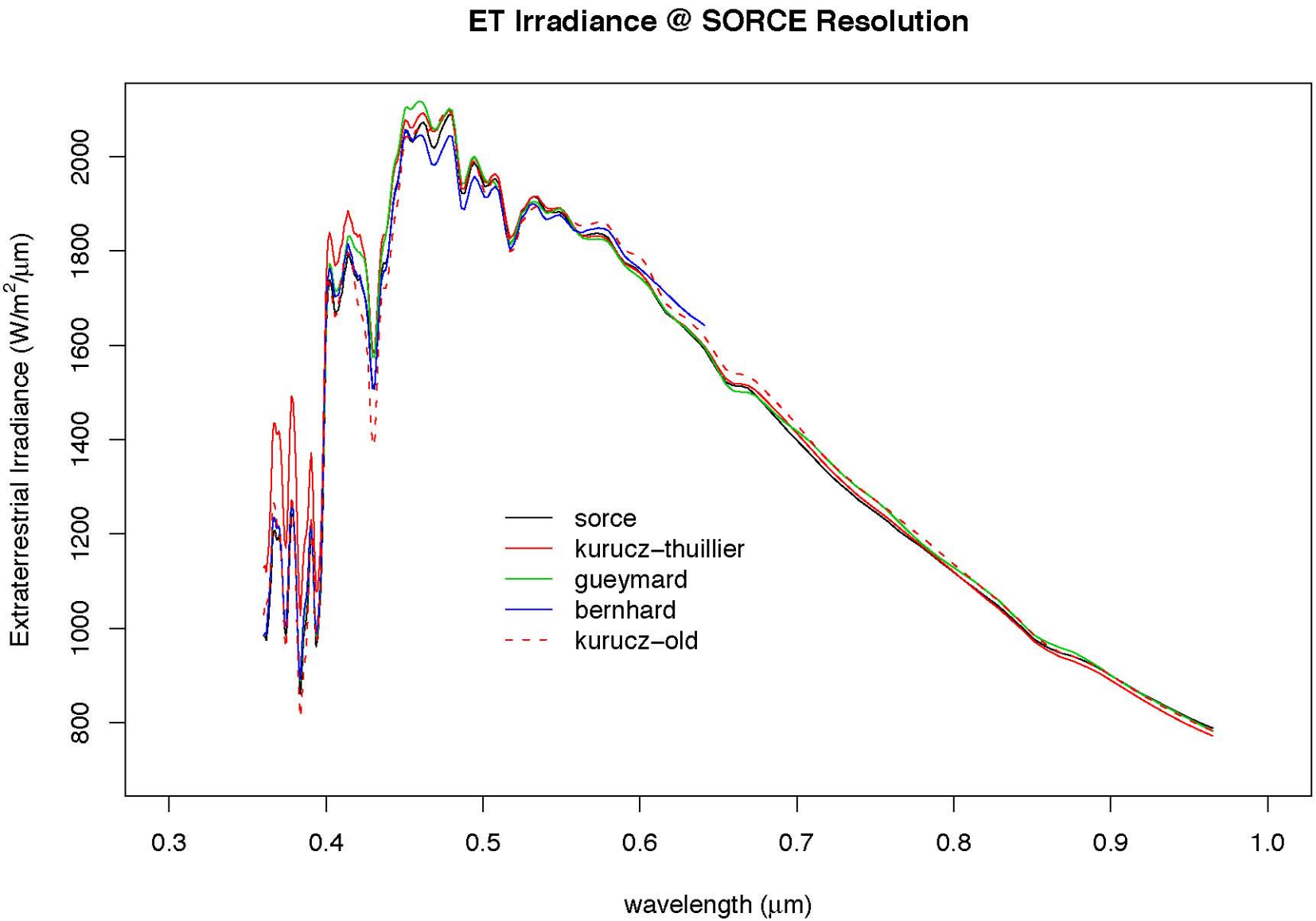
Broadband SW Model and Measurement Comparison



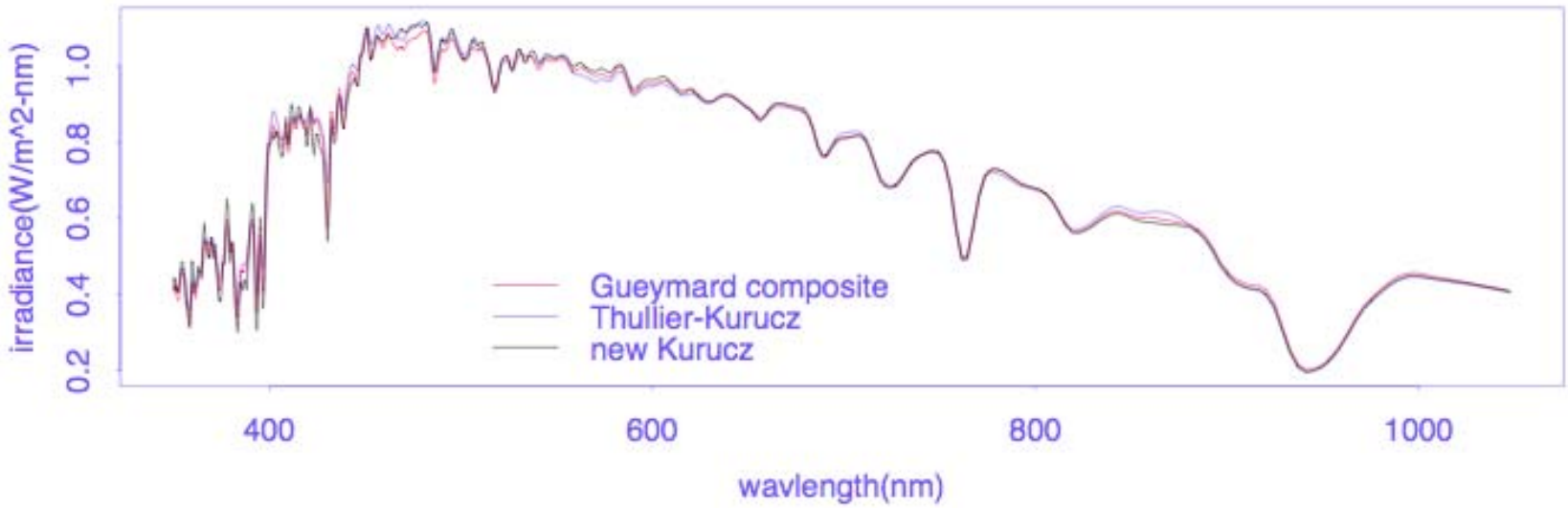
JGR-Atmospheres 2006

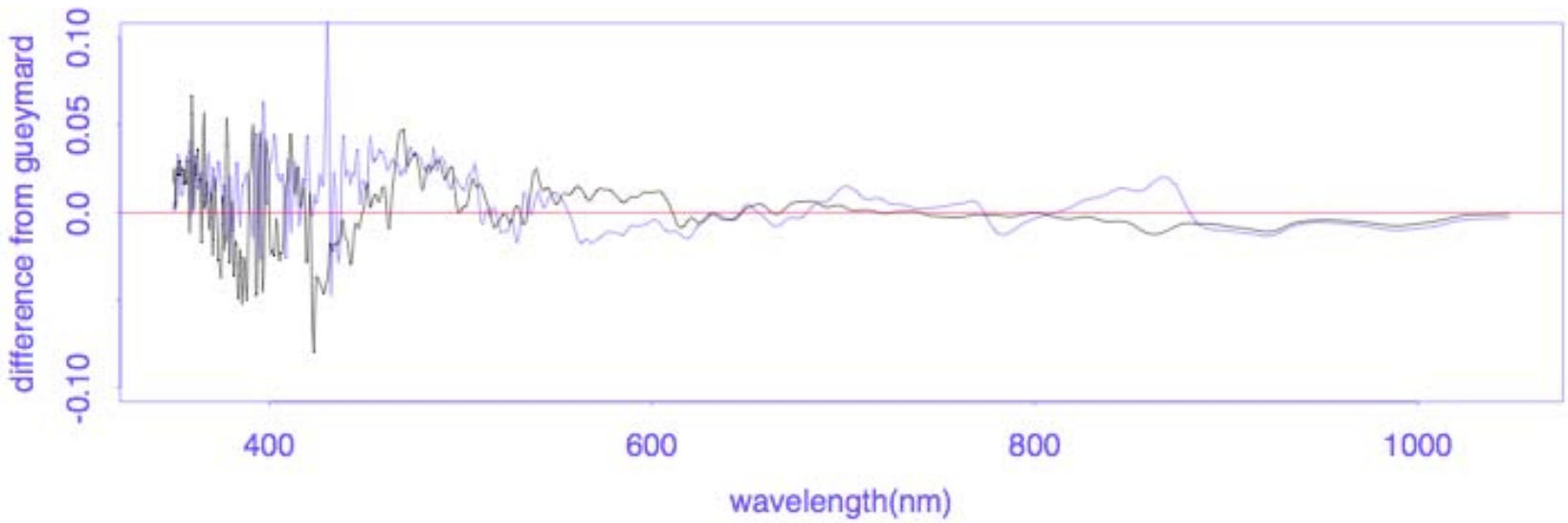
Rotating Shadowband Spectroradiometers
at ARM in Oklahoma, USA


IC
S
SH
F1, F2
L1
P1
P2
L2
CCD
Hg and Cd lines
361.05
365.01
404.65
435.83
467.82
508.58
576.96
643.84
1014.00
1039.46
α_k
d
β
p0
pk
(0.25 to 4 nm fwhm)

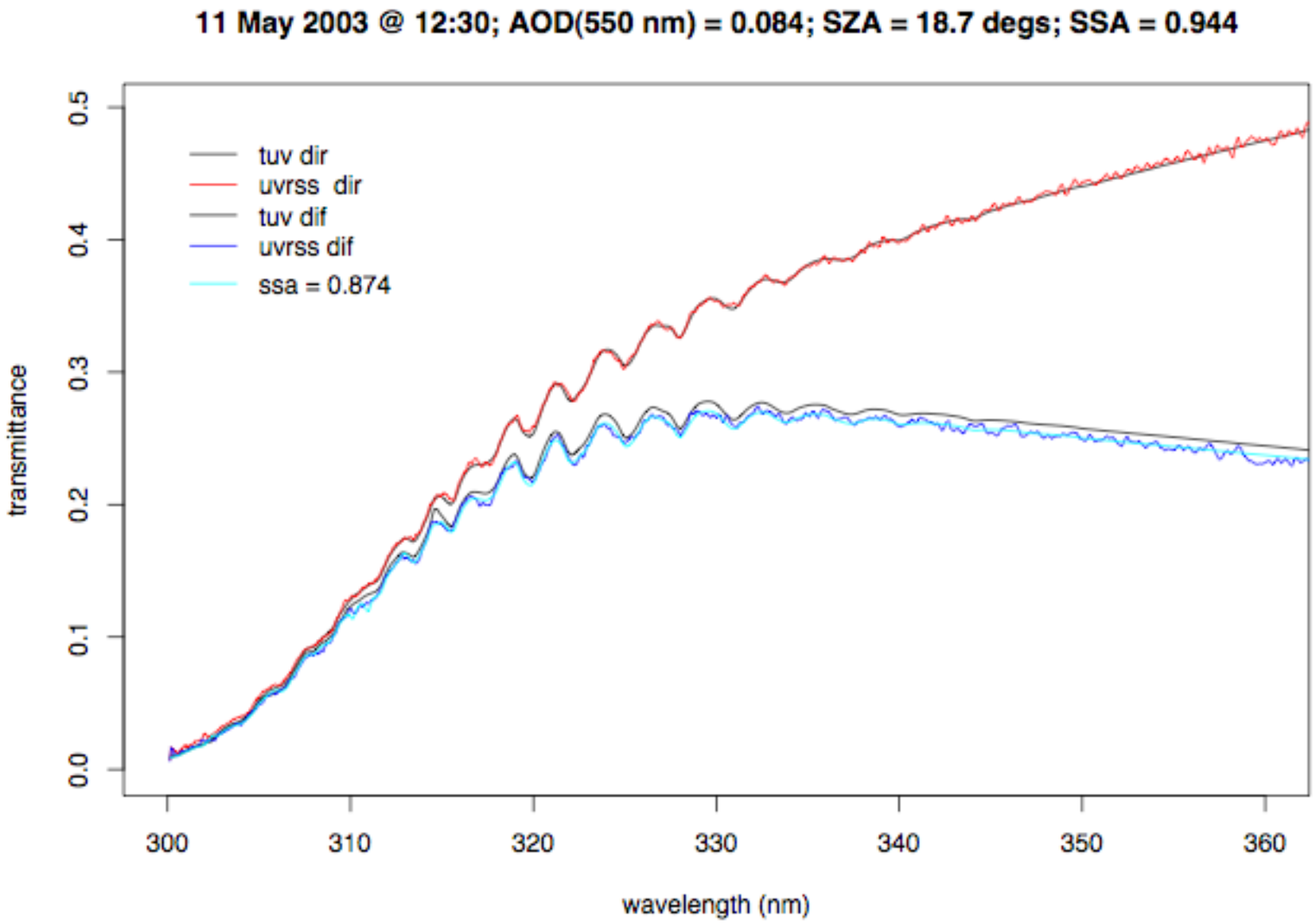

ET Irradiance @ SORCE Resolution
Extraterrestrial Irradiance (W/m^2/μm)
800
1000
1200
1400
1600
1800
2000
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
wavelength (μm)
sorce
kurucz–thuillier
gueymard
bernhard
kurucz–old

Some Differences Caused by ET Source Functions in SMARTS2





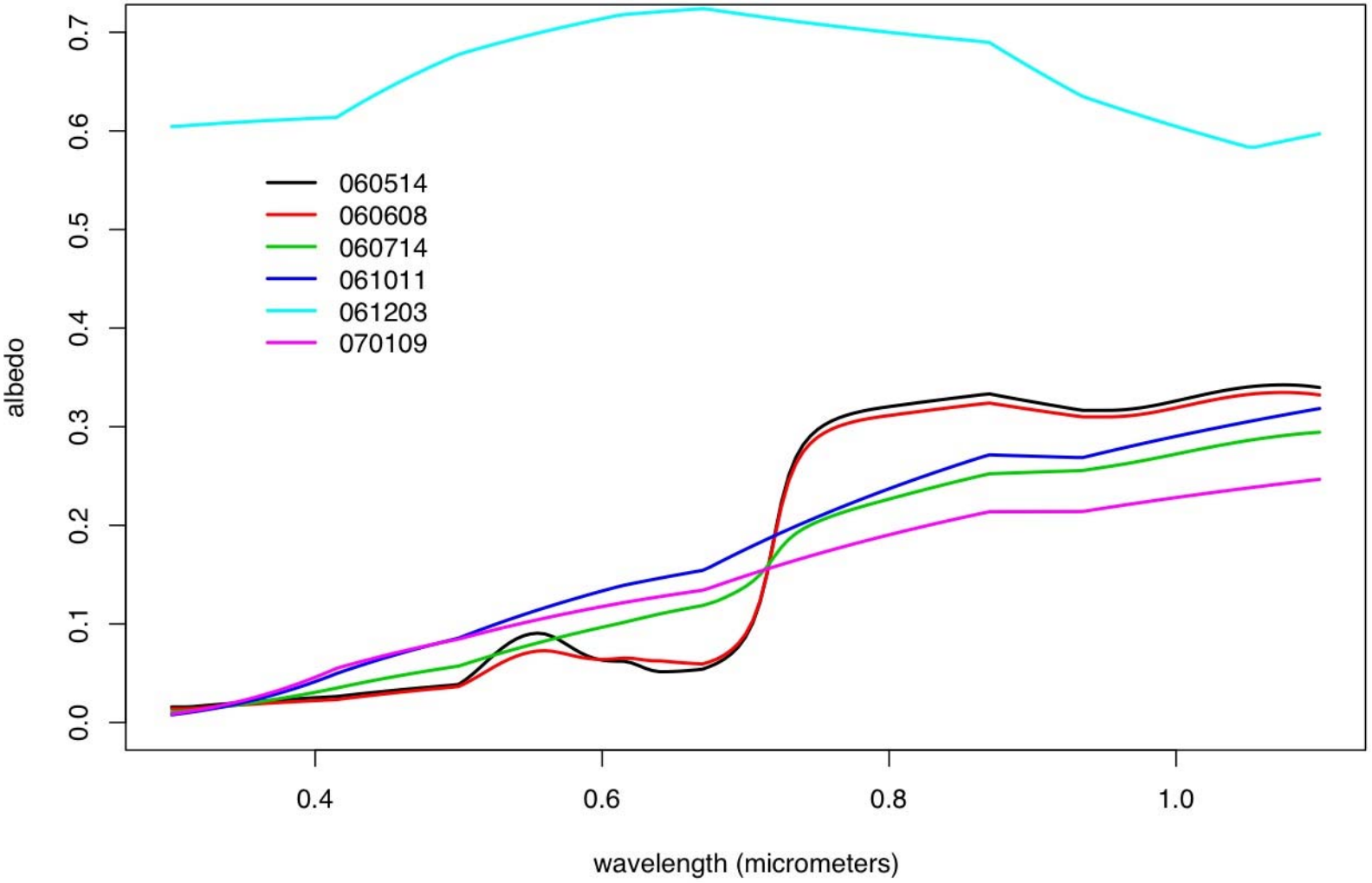
Results from Using UV-RSS in Transmission



Date	Time (UT)	SZA	H2O (cm)	ozone (cm)	tau(500 nm)	alpha	ssa550	g550
20060514	134.728449	21.87	1.71	0.339	0.093	1.1	0.9	0.51
20060608	159.728426	18.88	2.26	0.311	0.083	1.23	0.92	0.49
20060714	195.728519	20.84	3.37	0.297	0.121	1.19	0.93	0.62
20061011	284.729259	45.1	1.27	0.288	0.045	1.73	0.81	0.48
20061203	337.72912	59.92	0.38	0.306	0.064	1.37	0.9	0.46
20070109	9.729167	60.75	0.65	0.289	0.034	0.67	0.87	0.52

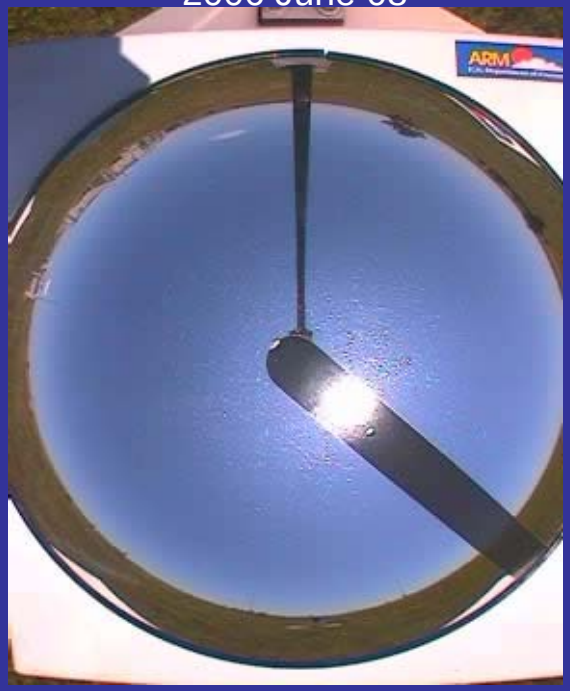
Assigned ssa

Albedos Based on Six Spectral Filter Measurements Above Crop and Pasture

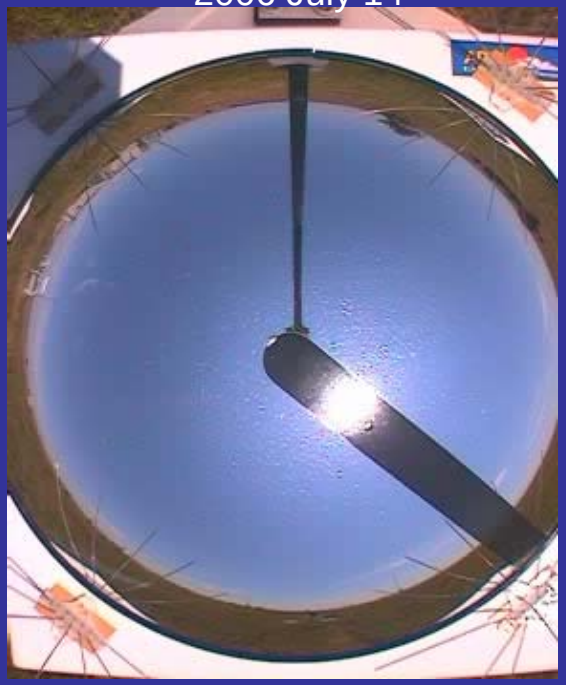


2006 May 14

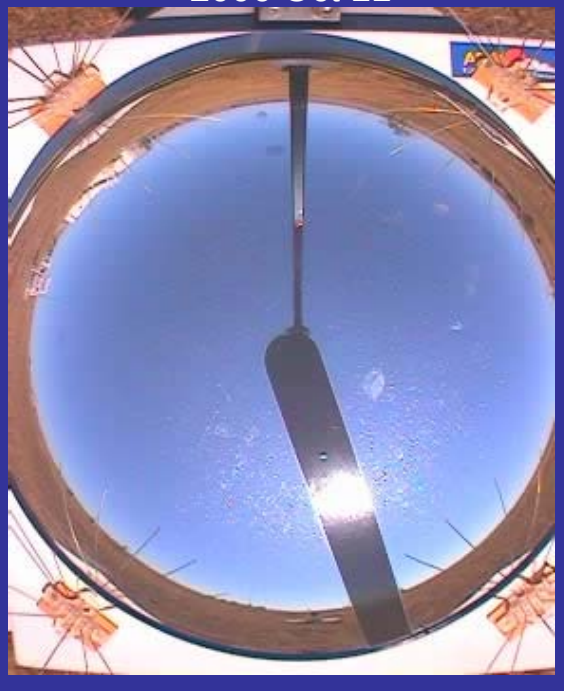
2006 June 08



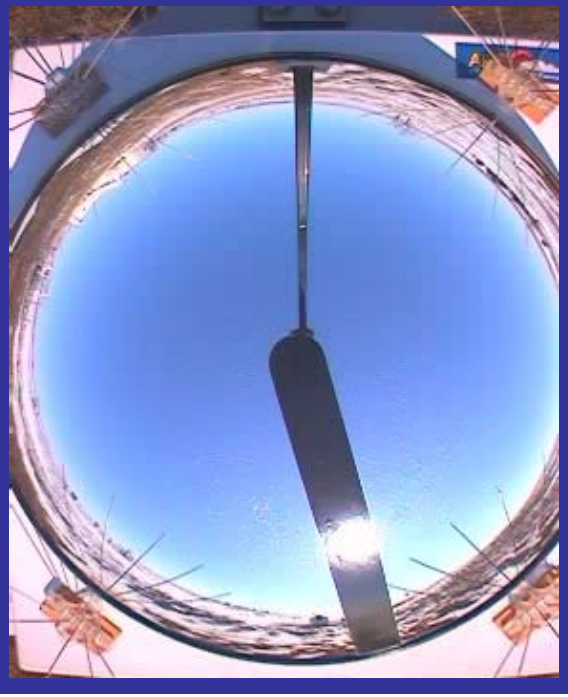
2006 July 14



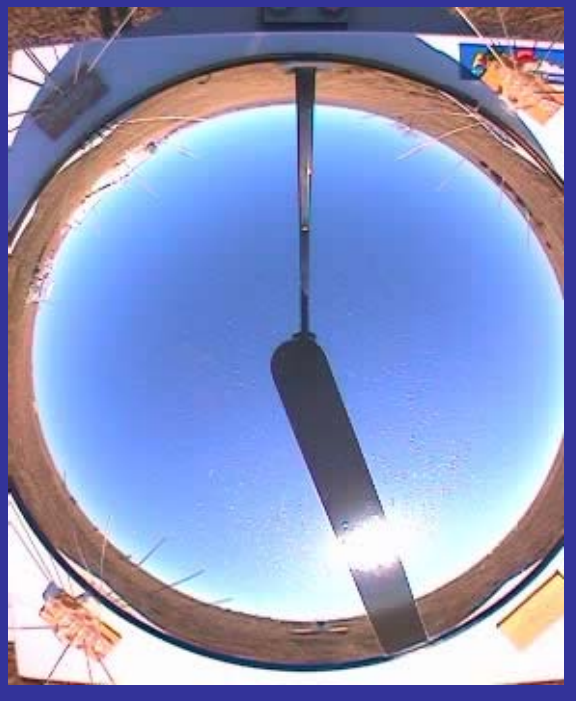
2006 Oct 11

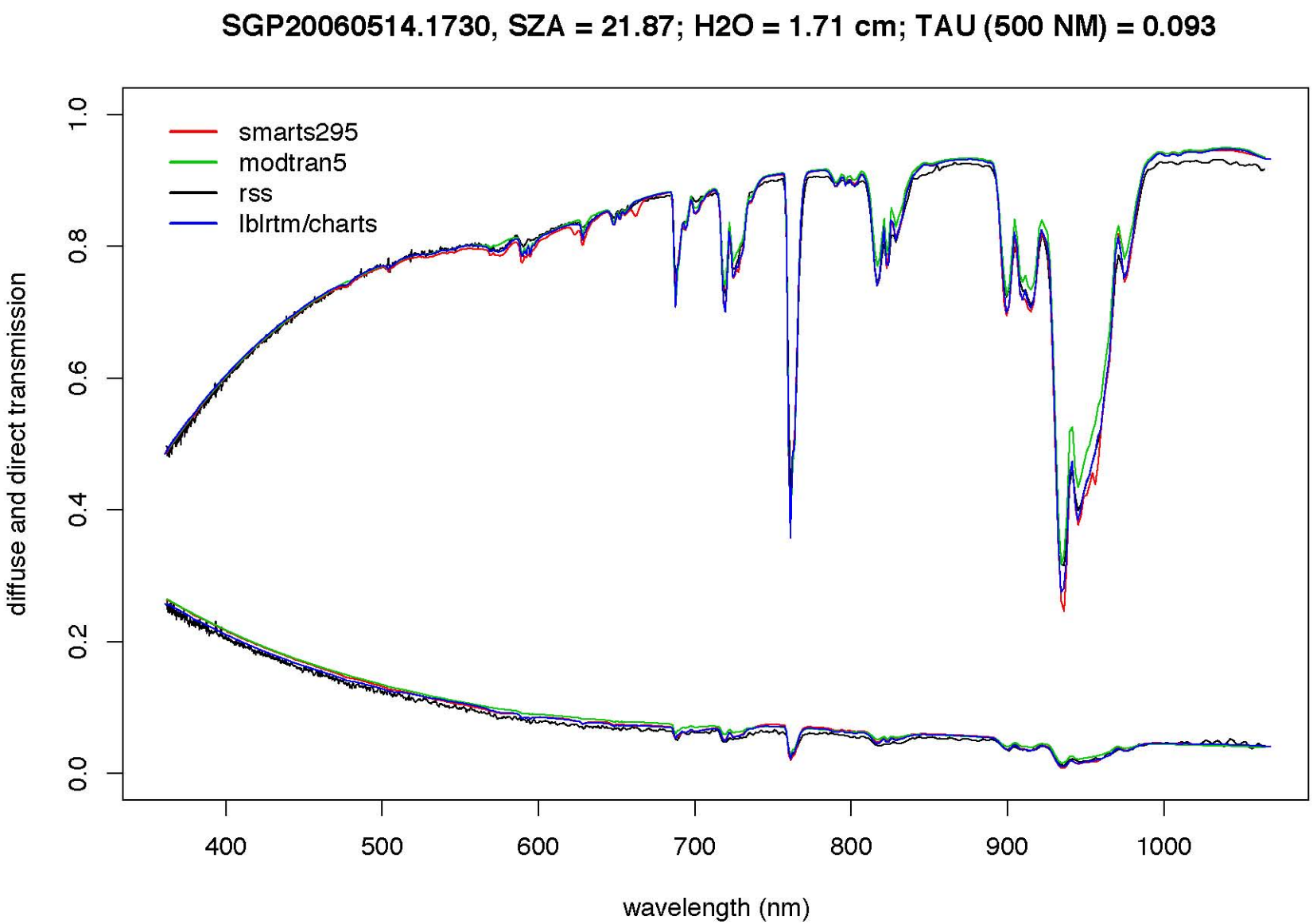


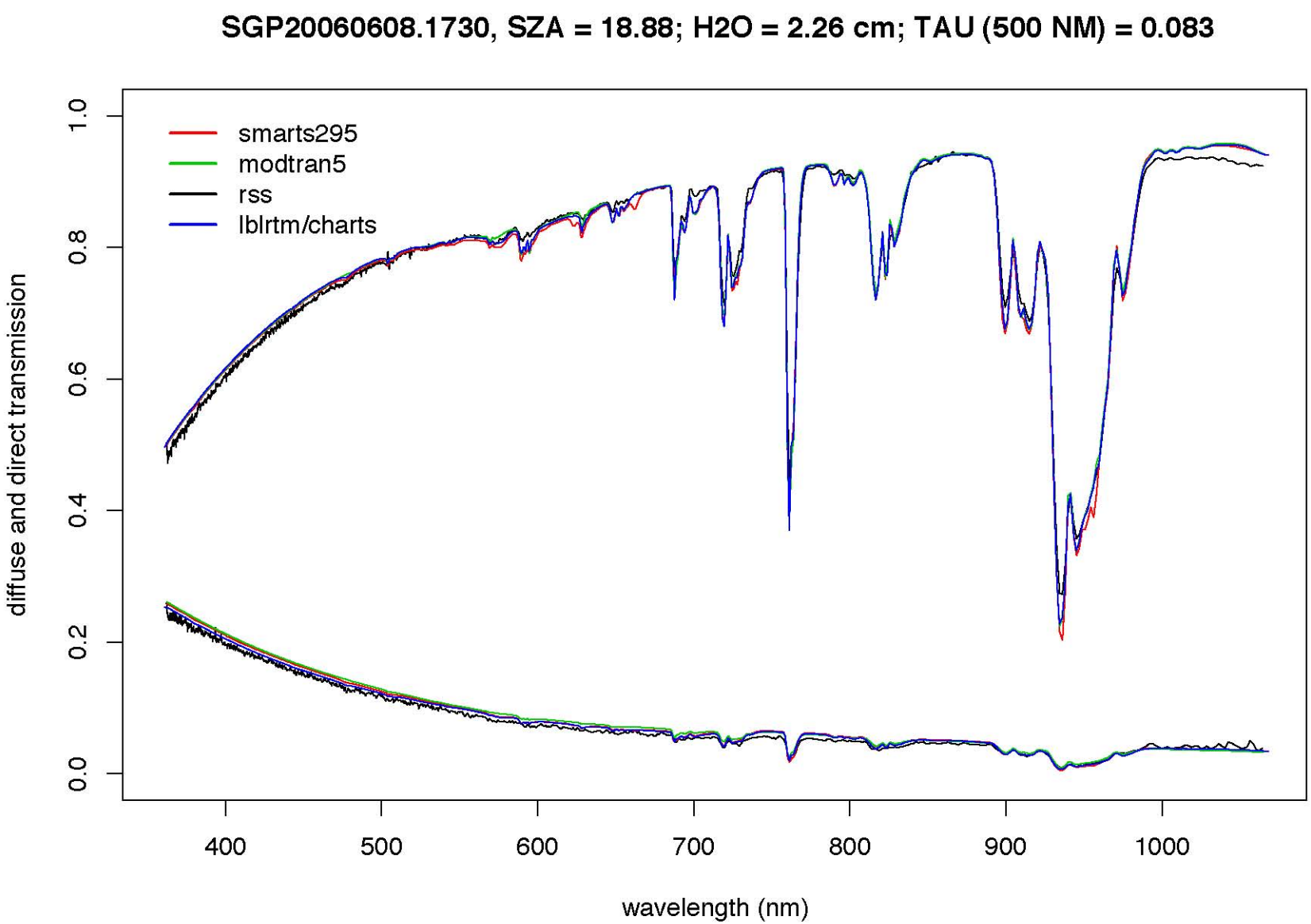
2006 Dec 03

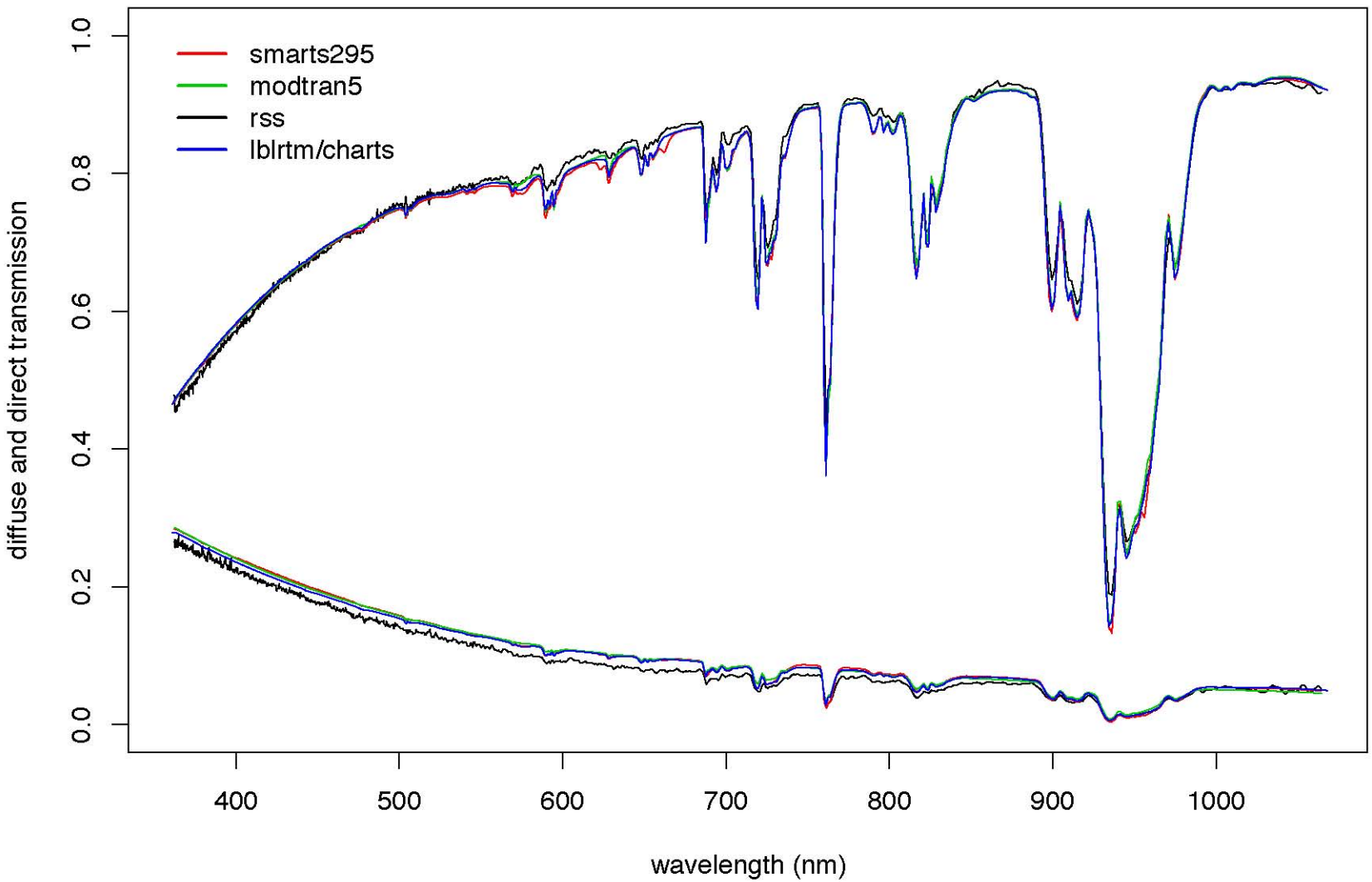


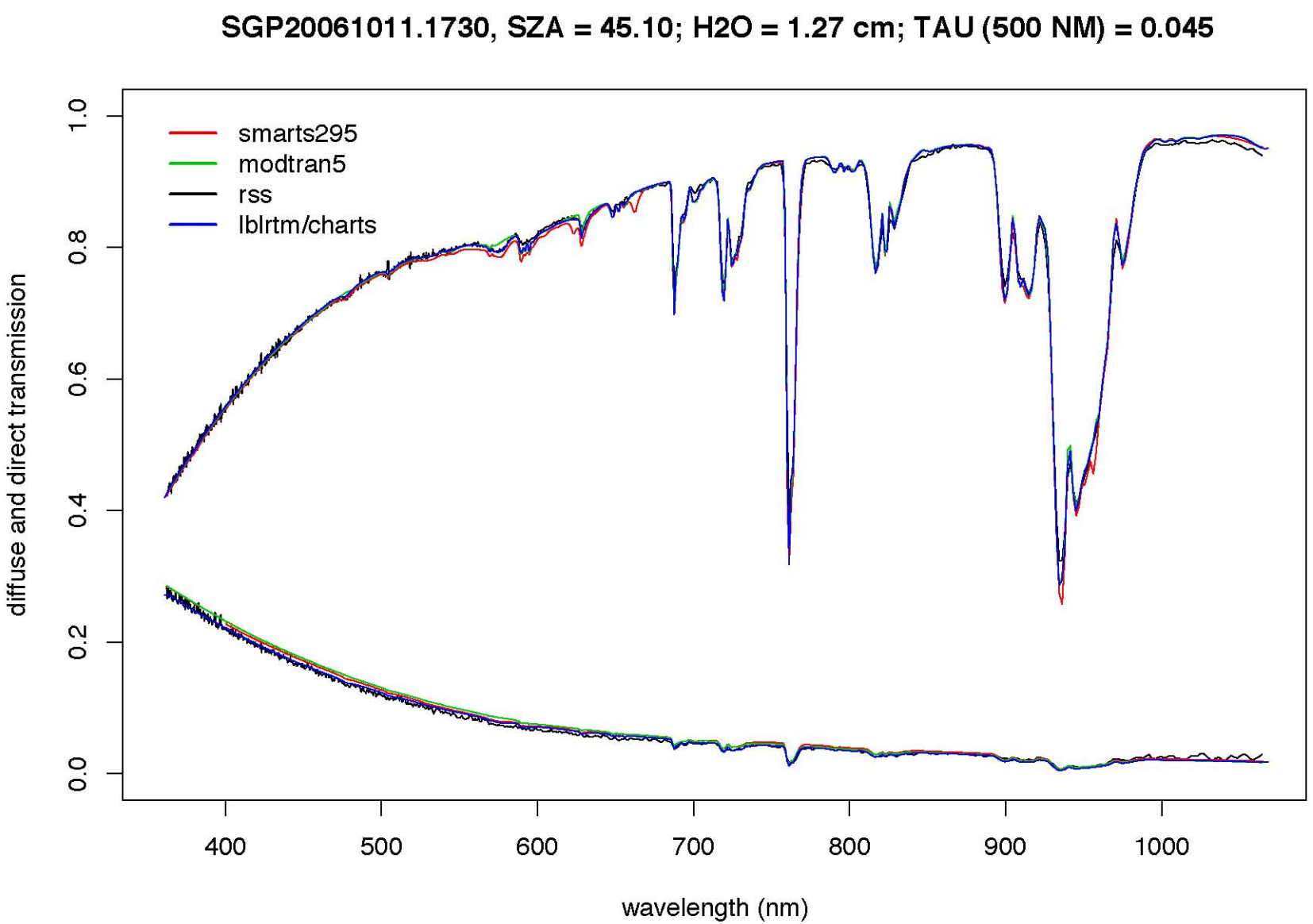
2007 Jan 09

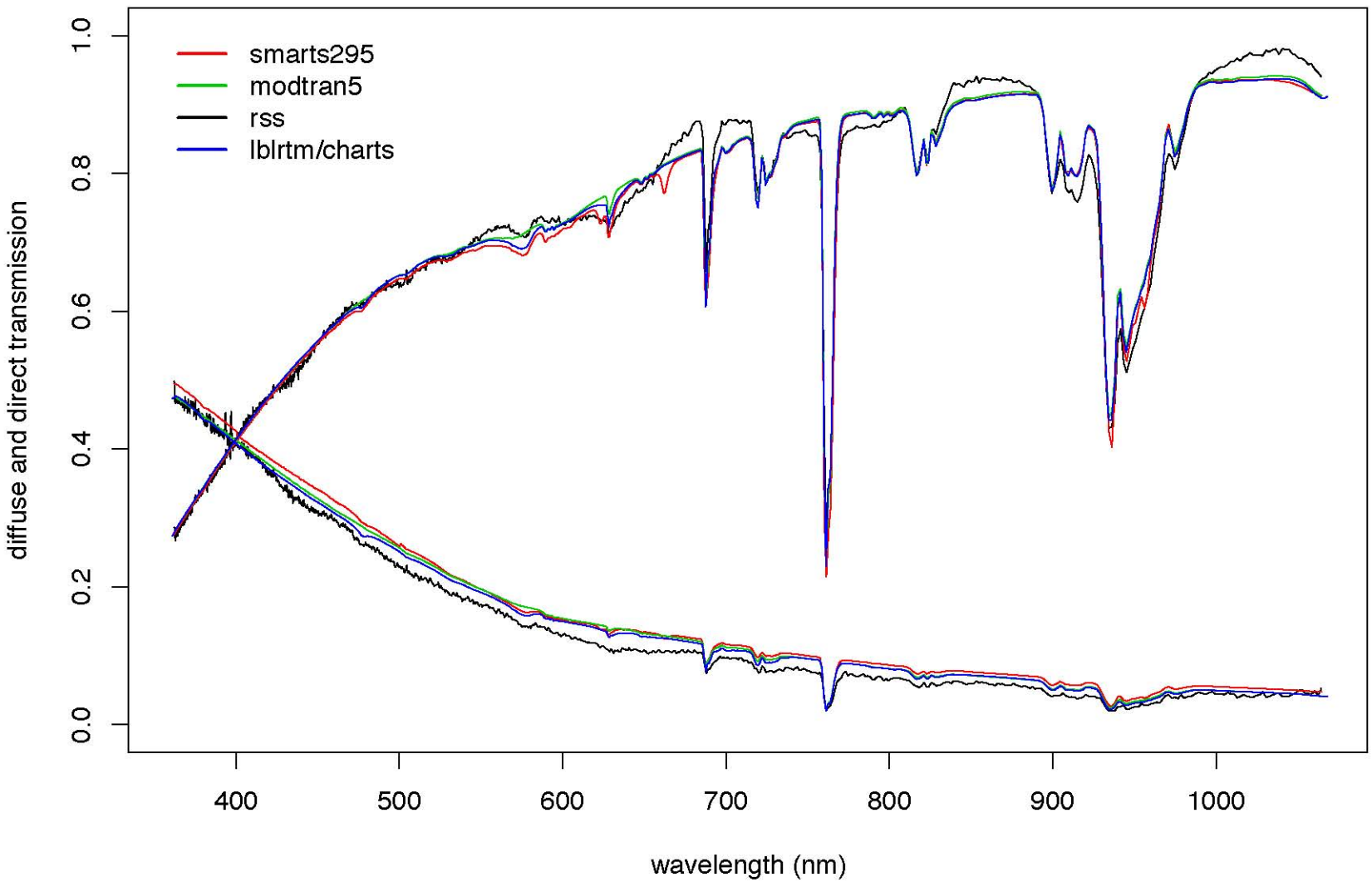


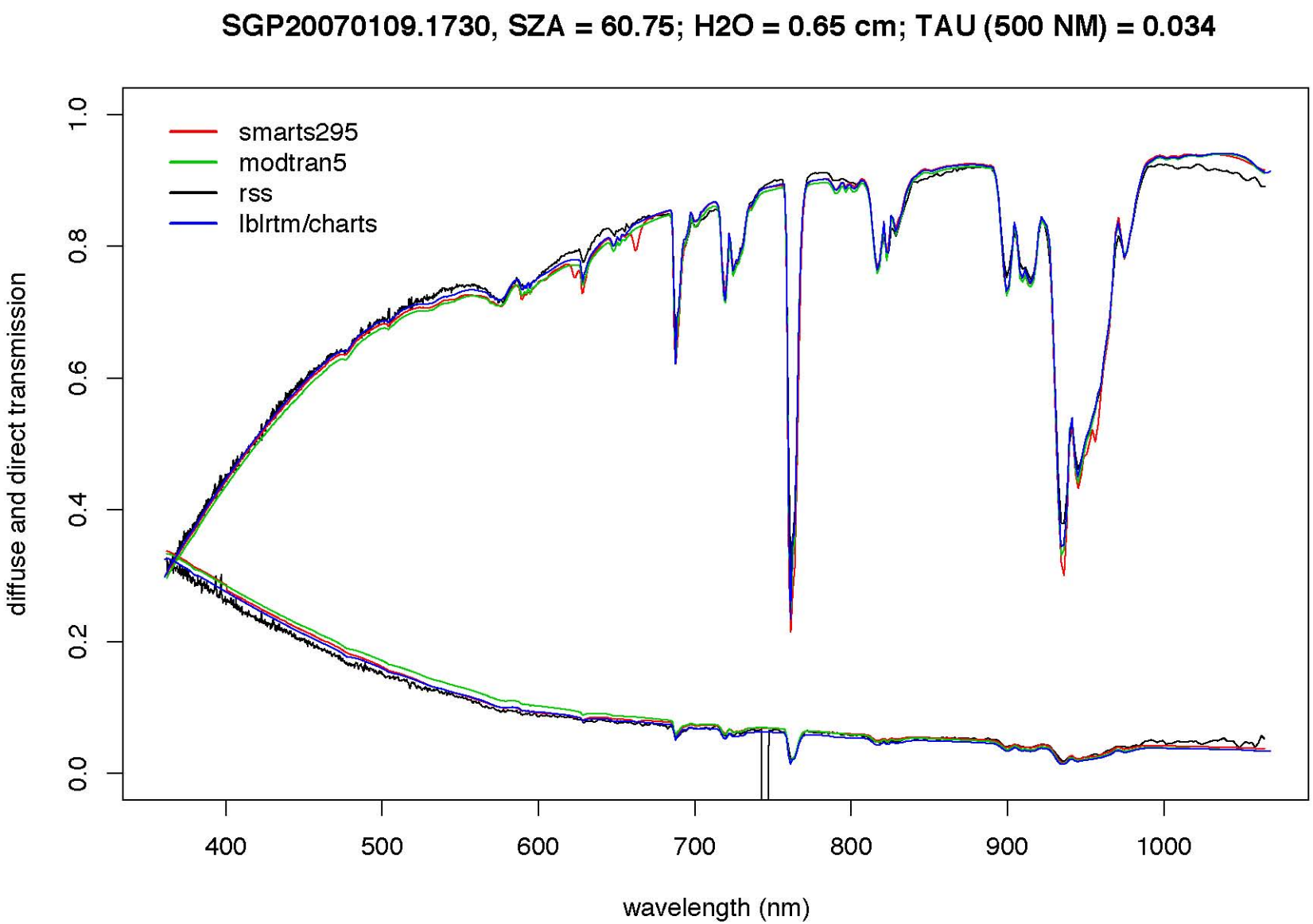

SGP20060514.1730, SZA = 21.87; H2O = 1.71 cm; TAU (500 NM) = 0.093
smarts295
modtran5
rss
lblrtm/charts
diffuse and direct transmission
0.0
0.2
0.4
0.6
0.8
1.0
400
500
600
700
800
900
1000
wavelength (nm)


SGP20060608.1730, SZA = 18.88; H2O = 2.26 cm; TAU (500 NM) = 0.083
smarts295
modtran5
rss
lblrtm/charts
diffuse and direct transmission
0.0
0.2
0.4
0.6
0.8
1.0
400
500
600
700
800
900
1000
wavelength (nm)


SGP20060714.1730, SZA = 20.84; H2O = 3.37 cm; TAU (500 NM) = 0.121
smarts295
modtran5
rss
lblrtm/charts
diffuse and direct transmission
0.0
0.2
0.4
0.6
0.8
1.0
400
500
600
700
800
900
1000
wavelength (nm)


SGP20061011.1730, SZA = 45.10; H2O = 1.27 cm; TAU (500 NM) = 0.045
smarts295
modtran5
rss
lblrtm/charts
diffuse and direct transmission
0.0
0.2
0.4
0.6
0.8
1.0
400
500
600
700
800
900
1000
wavelength (nm)


SGP20061203.1730, SZA = 59.92; H2O = 0.38 cm; TAU (500 NM) = 0.064
smarts295
modtran5
rss
lblrtm/charts
diffuse and direct transmission
0.0
0.2
0.4
0.6
0.8
1.0
400
500
600
700
800
900
1000
wavelength (nm)


SGP20070109.1730, SZA = 60.75; H2O = 0.65 cm; TAU (500 NM) = 0.034
smarts295
modtran5
rss
lblrtm/charts
diffuse and direct transmission
0.0
0.2
0.4
0.6
0.8
1.0
400
500
600
700
800
900
1000
wavelength (nm)

Summary to Date

- Would like to know of others' efforts to compare spectrally at these wavelengths
- Trying to refurbish the RSS for better stability
- Transmission is a viable approach for comparisons
- Blue-green diffuse is overestimated by models
- Some model modifications clearly warranted
- Coarse mode may not be represented well by simple Angstrom model; need more certain ssa's(λ) and g's(λ)