Protocol of the intercomparison at INTA, El Arenosillo, Spain on September 03 to 13, 2007 with the travelling reference spectroradiometer QASUME[†] from PMOD/WRC

Report prepared by Gregor Hülsen

Operators: Gregor Hülsen, Julian Gröbner

The purpose of the visit was the comparison of spectral global solar irradiance measurements between the 16 spectroradiometers participating in the 2nd Regional Brewer Calibration Center – Europe (RBCC-E) Campaign (see Figure 1 and Table 1) and the travel reference spectroradiometer QASUME. The measurement site is located at El Arenosillo; Latitude 37.10 N, Longitude 6.73 W and altitude 50 m.a.s.l.
The horizon of the measurement site is free down to at least 85° solar zenith angle (SZA). Measurements between 5:00 UT and 18:00 UT have been analysed.

QASUME arrived at INTA in the morning of September 03, 2007. The spectroradiometer was installed in line to the Brewer spectrophotometers with the entrance optic of QASUME between 2 and 20 m away from the other instruments. The measurement campaign lasted eleven days, from noon of September 03 to the afternoon of September 13; the core comparison days were September 08 to 11.

QASUME was calibrated several times during the campaign period using a portable calibration system. Three lamps (T61251, T68522 and T61254) were used to obtain an absolute spectral irradiance calibration traceable to the primary reference held at PMOD/WRC, which is traceable to PTB. The daily mean responsivity of the instrument based on these calibrations varied by less than ±1 % during the intercomparison period. The internal temperature of QASUME was 29.5±0.2 °C. The diffuser head was heated to a temperature of 26.8±1.3 °C.
The wavelength shifts relative to an extraterrestrial spectrum as retrieved from the SHICRivm analysis were between ±50 pm in the spectral range 290 to 400 nm.

[†] The QASUME spectroradiometer B5503 is made available by the Physical and Chemical Exposure Unit of the Joint Research Centre of the European Commission, Ispra, Italy through a collaboration agreement with PMOD/WRC.

Table 1: Participating Brewer spectrophotometers; 8 single and 8 double monochromators.

Instrument ID	Institution	Operator	Country
#017-MKII	IOS	Ken Lamb	Canada
#051	SMN CASABL.	Mustapha Zaidi	Morroco
#070-MKIV	INM MADRID	María Lopez	Spain
#075	UMK	John Rimmer	U.K.
#102-MKII	SMP LISBOA	Diamantino Henriquez	Portugal
#117-MKIV	INM MURCIA	Jose Antonio Parodi	Spain
#145 MKIII	MSC	Tom McElroy	Canada
#150-MKIII	INTA HUELVA	Jose Manuel Vilaplana	Spain
#151-MKIV	INM CORUÑA	Francisco García	Spain
#158-MKIII	Kipp & Zonen	Kristian Boot	The Netherlands
#163-MKIII (ISQ)	PMOD/WRC	Julian Gröbner	Switzerland
#165-MKIII	SMN CASABL.	Zaidouni Taoufik	Morroco
#166-MKIV	INM ZARAGOZA	Jose Luis Jimenez	Spain
#172-MKIII	UMH	John Rimmer	U.K.
#185-MKIII (IZ3)	INM IZAÑA	Alberto Redondas	Spain
#186-MKIII	INM MADRID	Jose Montero	Spain

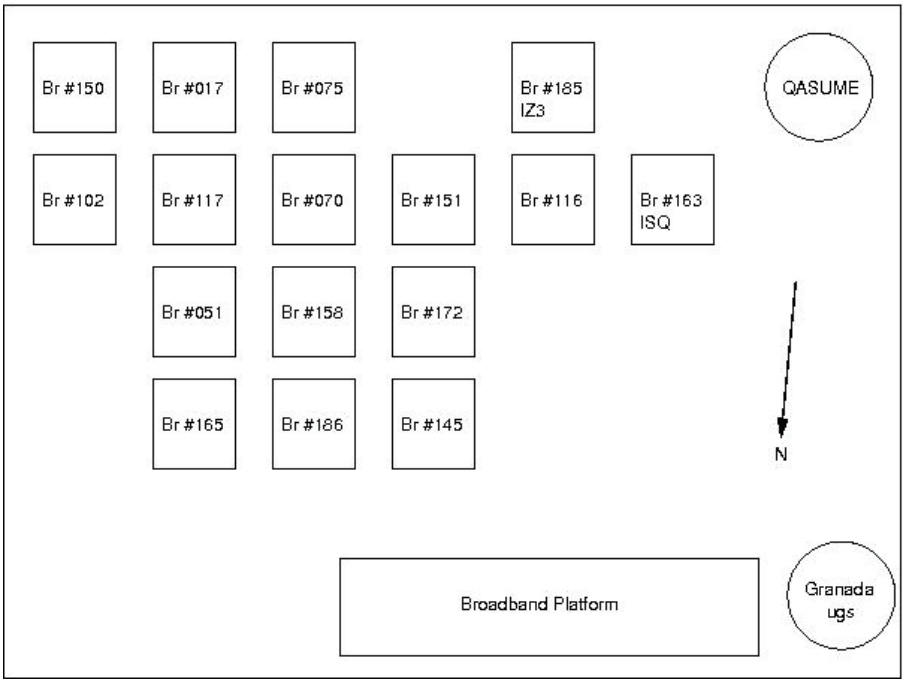


Figure 1: Roof setup at INTA

Protocol:

The measurement protocol was to measure one solar irradiance spectrum every 30 minutes from 290 to 400 nm, every 0.25 nm, and 1.5 seconds between each wavelength increment.

September 03 (246) Monday:

QASUME was installed on the measurement site at 7:30 UT. The internal temperature of QASUME reached its nominal temperature at 10:00 UT. Solar spectra are available from 12:00 to 19:00 UT. Weather conditions were clear sky with cirrus and haze.

QASUME was calibrated at 17:16 UT.

September 04 (247) Tuesday:

Solar spectra are available from 6:00 to 19:00 UT. Weather conditions were clear sky with cirrus and haze.

QASUME was calibrated at 11:42 and 11:56 UT.

September 05 (248) Wednesday:

Solar spectra are available from 6:00 to 19:00 UT. Weather conditions were a mix of sun and clouds and haze.

QASUME was calibrated at 15:12 UT.

September 06 (249) Thursday:

Solar spectra are available from 6:00 to 19:00 UT. Weather conditions were clear sky with haze.

September 07 (250) Friday:

Solar spectra are available from 6:00 to 19:00 UT. Weather conditions were clear sky and haze.

QASUME was calibrated at 9:43 UT.

September 08 (251) Saturday:

Solar spectra are available from 6:00 to 19:00 UT. Weather conditions were a mix of sun and clouds and haze.

September 09 (252) Sunday:

Solar spectra are available from 6:00 to 19:00 UT. Weather conditions were mostly overcast sky with haze and more sun in the afternoon.

QASUME was calibrated at 9:47 UT.

September 10 (253) Monday:

Solar spectra are available from 6:00 to 19:00 UT. Weather conditions were a mix of sun and clouds and haze.

QASUME was calibrated at 16:13 UT.

Most Brewers were turned off during the night to Tuesday, because of a forecasted thunderstorm.

September 11 (254) Tuesday:

Solar spectra are available from 6:00 to 19:00 UT. Weather conditions were a mix of sun and clouds and haze. The scans in the afternoon are affected by few rain drops.

QASUME was calibrated at 11:42 UT.

Most Brewers were turned off during the night to Wednesday, because of a forecasted thunderstorm.

September 12 (255) Wednesday:

Solar spectra are available from 6:00 to 19:00 UT. Weather conditions were a mix of sun and clouds and occasional rain. The scans in the morning are affected by rain drops.

September 13 (256) Thursday:

Solar spectra are available from 6:00 to 14:00 UT. Weather conditions were a mix of sun and clouds and rain. Because of a thunderstorm a power failure occurred at INTA at 10:50 UT. Therefore almost all Brewers were turned off for one hour.

QASUME was calibrated at 14:34 and 14:53 UT.

End of the campaign at 15:05 UT.

Results:

In total 2 to 171 synchronised simultaneous spectra from QASUME and the Brewer spectrophotometers are available from the measurement period. Measurements between 6:30 and 18:30 UT have been analysed (SZA smaller than 87°).

Remarks:

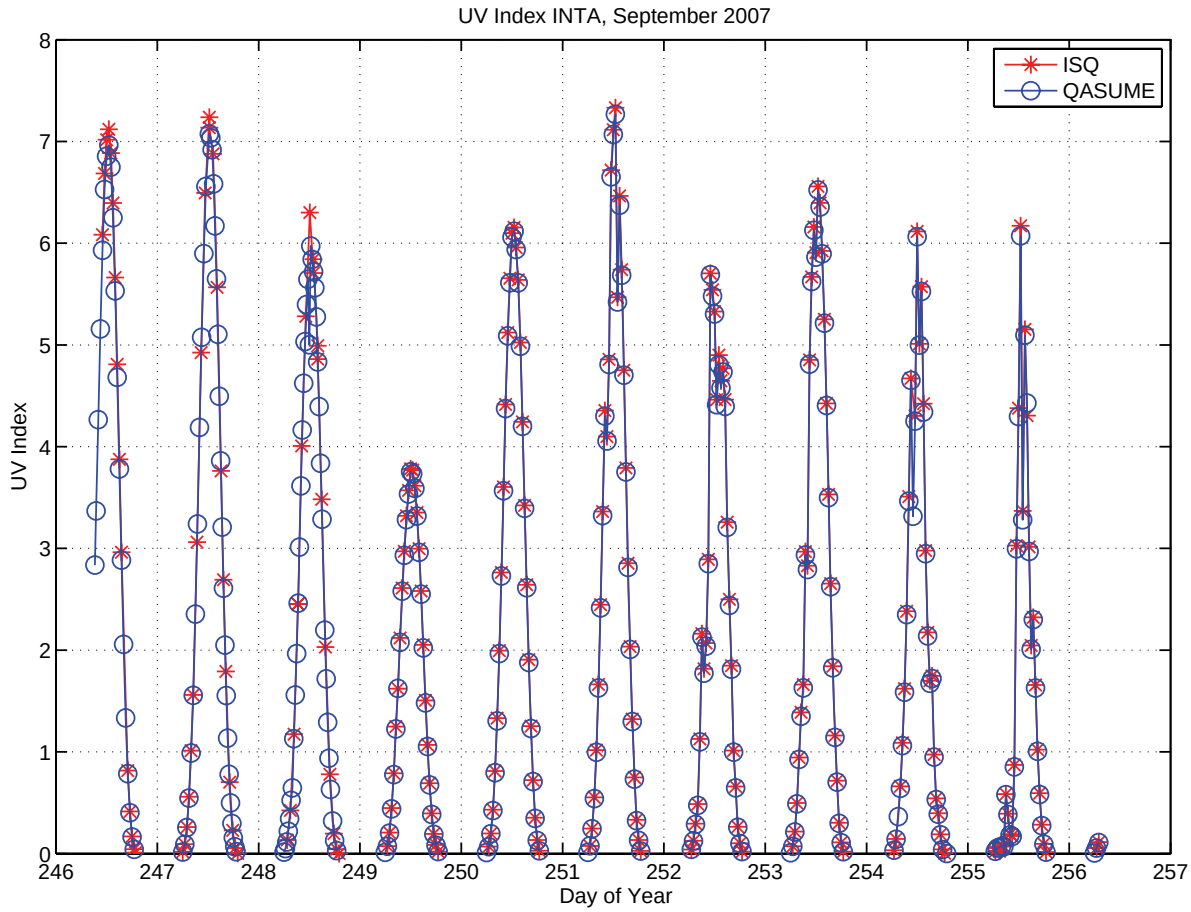
1. The official UV-days for the intercomparison of the instruments where 08 till 11 September (251-254). However the first day was dedicated to the training phase.
2. Because of the different calibrations and measurements performed during the campaign, traffic on the roof could not be completely omitted. Therefore several scans are disturbed.
3. The time synchronisation between QASUME and various Brewers was not optimal, which led to a higher variability of the ratios between the reference instrument and the bad synchronised Brewers. The time lag was sometimes several minutes.
4. For the production of the calibration certificates all solar scans are excluded which are affect by rain.
5. Very few synchronised solar spectra are available from Brewer #075 and #172.

Recommendations:

1. Brewer #145 has a relative difference to QASUME larger than 10%. It is advised to review the calibration procedure.
2. For the majority of the participating Brewers the diurnal variability is within ±3%. The cosine error of the entrance optic and the temperature dependence of the instrument probably contribute for the most part to this variability. For Brewer #145, #165 and #166 the diurnal variability is larger than ±5%.
3. The wavelength shifts of Brewers can be as small as ±40 pm. Recalibration of the wavelength alignment is advised for Brewer #117, #150 and #165.
4. The wavelength calibration of the following Brewers changed on the 8 September: Brewer #70, #117, #150, #165 and #186.

Table 2: Mean values of the ratio Brewer/QASUME, the diurnal variability and the wavelength shifts (in brackets: wavelength shifts before 8 September).

Instrument ID	Br/QASUME [%]	Diurnal variability [%]	wavelength shift [pm]
#017	-8	±3	+5 .. +10
#051	-4	±3	-10 .. +40
#070	-2	±2	+10 .. +40 (+10..+100)
#075	NaN	NaN	-10 .. +35
#102	-5	±4	-10 .. +5
#117	-3	±4	-5 .. +120 (-5..+70)
#145	-12	±6	-15 .. +20
#150	0	±2	-70 .. -5 (-30..-5)
#151	-2	±4	-20 .. +10
#158	-3	±2	-15 .. +30
#163 (ISQ)	+2	±2	-40 .. -5
#165	-8	±5	-80 .. -20 (-30..+10)
#166	-6	±5	-40 .. +50
#172	-4	NaN	-5 .. +40
#185 (IZ3)	-2	±2	-5 .. +45
#186	-2	±2	-30 .. +30 (-60..+20)


UV Index INTA, September 2007
ISQ
QASUME
UV Index
Day of Year
0
1
2
3
4
5
6
7
8
246
247
248
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250
251
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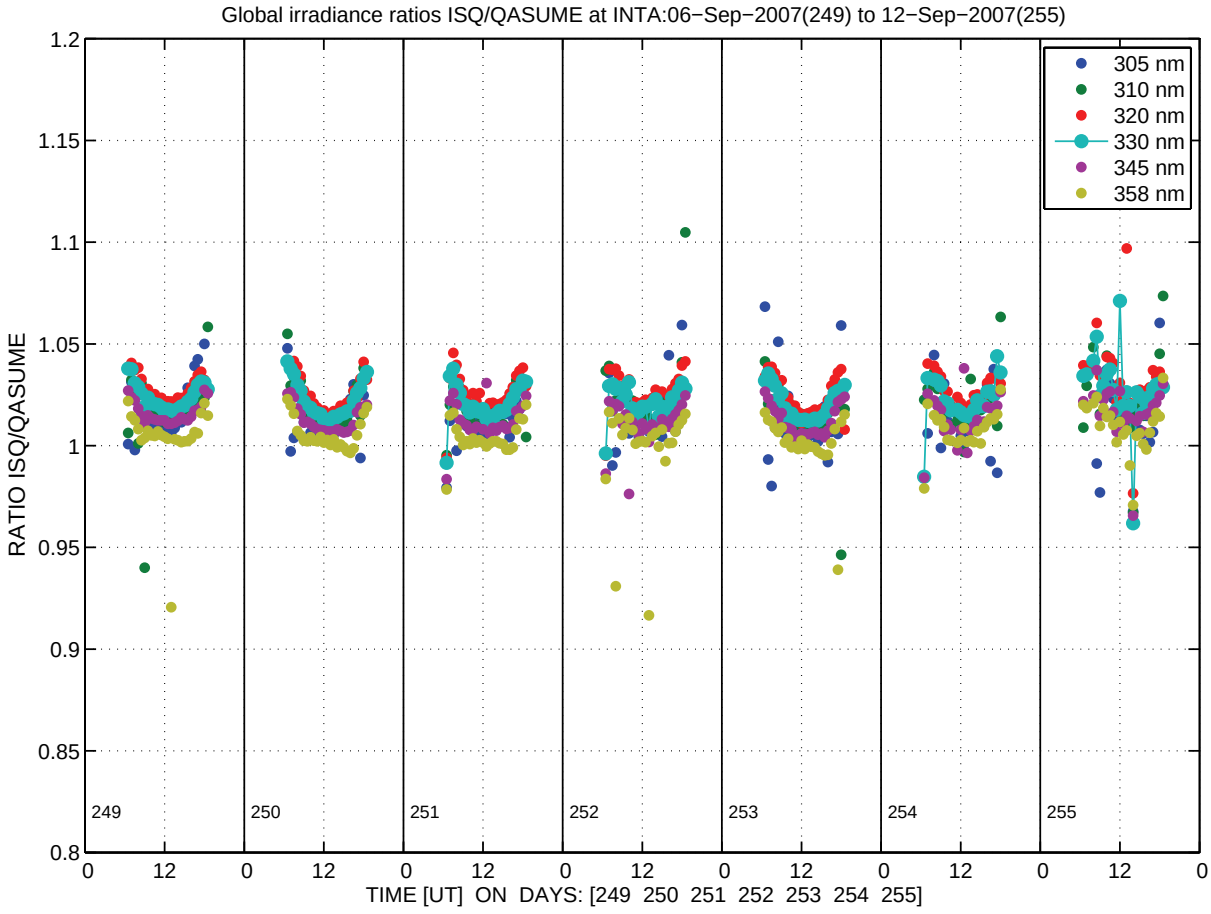
255
256
257


Global irradiance ratios ISQ/QASUME at INTA:06−Sep−2007(249) to 12−Sep−2007(255)
305 nm
310 nm
320 nm
330 nm
345 nm
358 nm
RATIO ISQ/QASUME
TIME [UT] ON DAYS: [249 250 251 252 253 254 255]
249
250
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252
253
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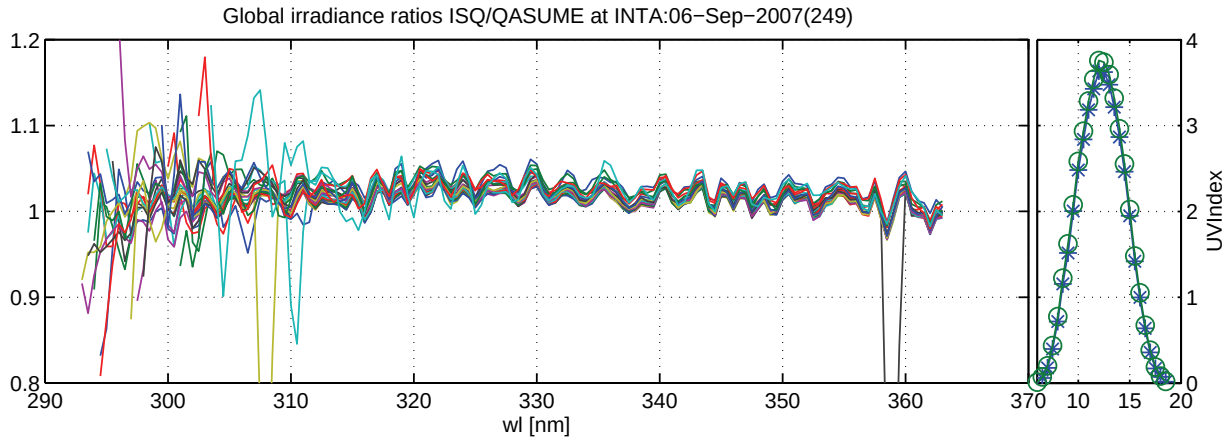
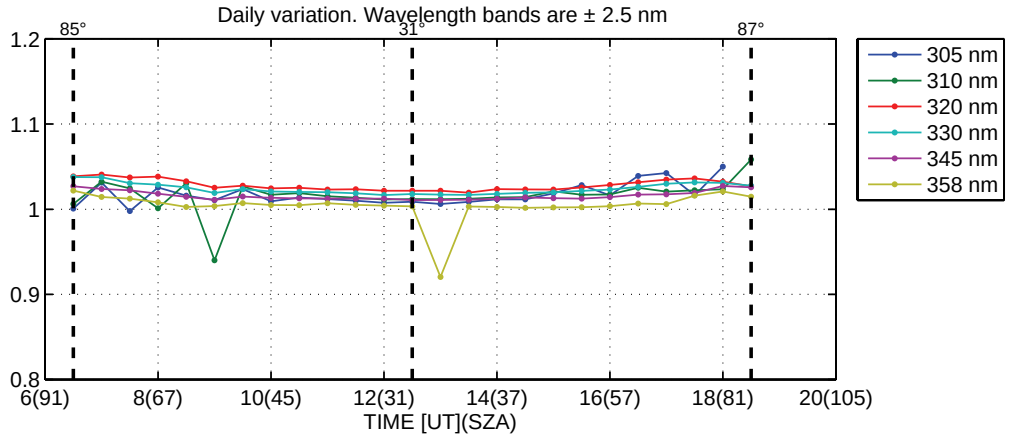
255
03−Oct−2007 12:34:17





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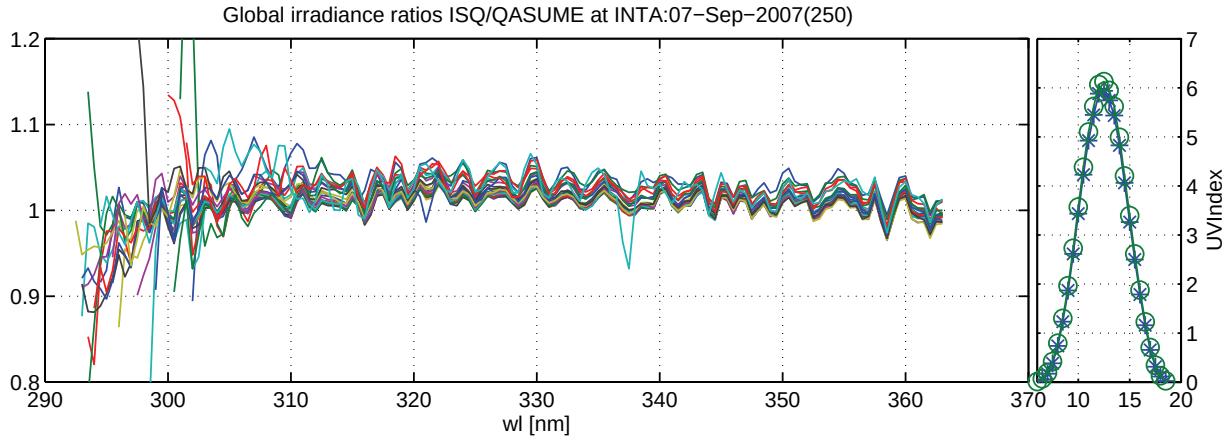

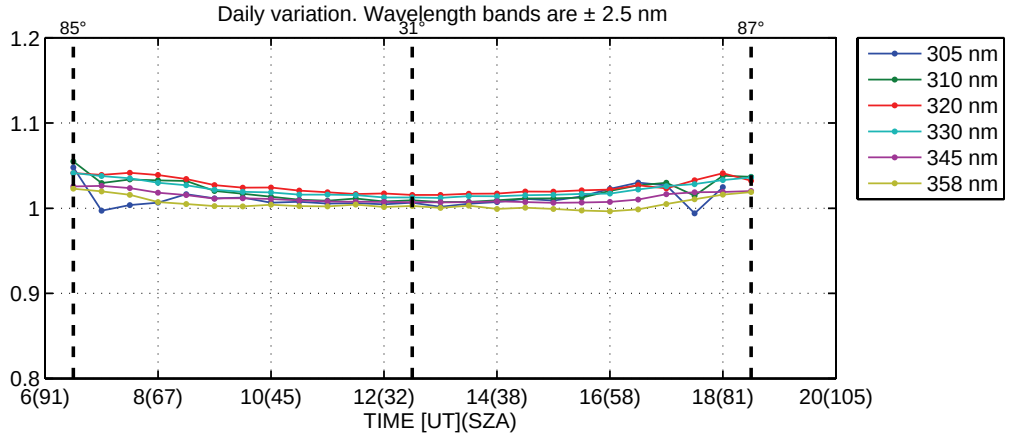

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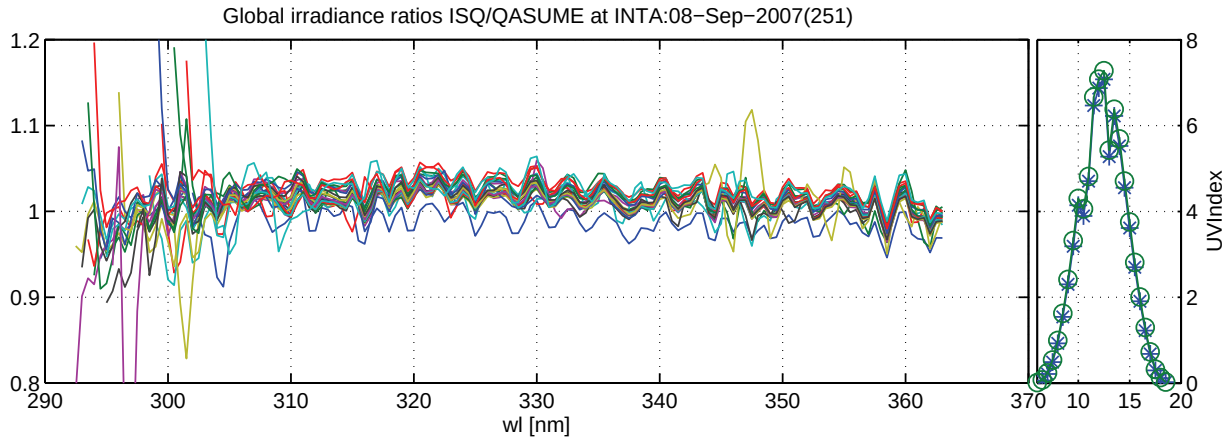

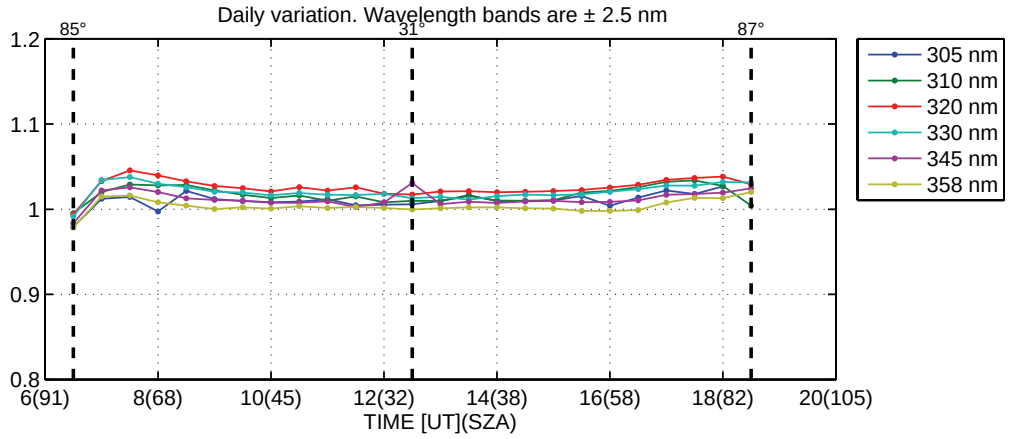

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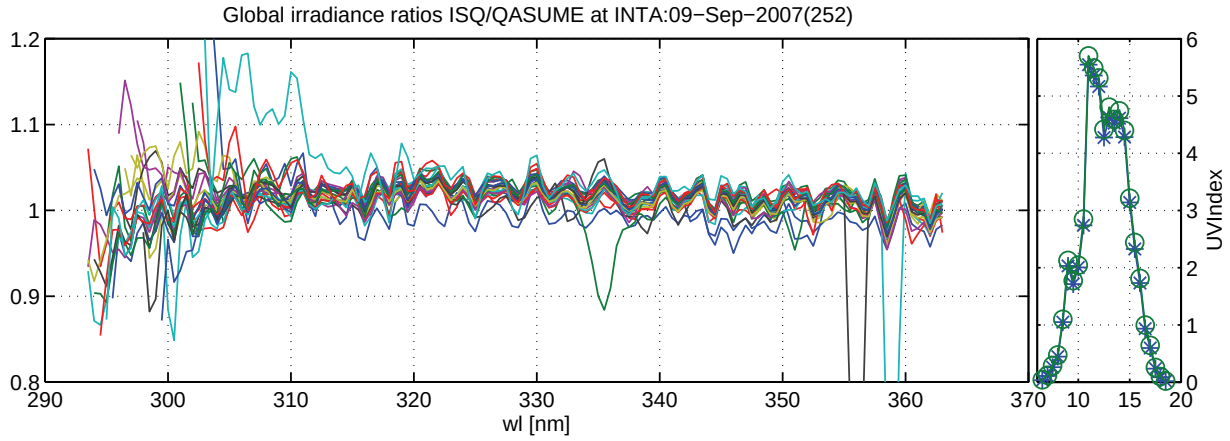

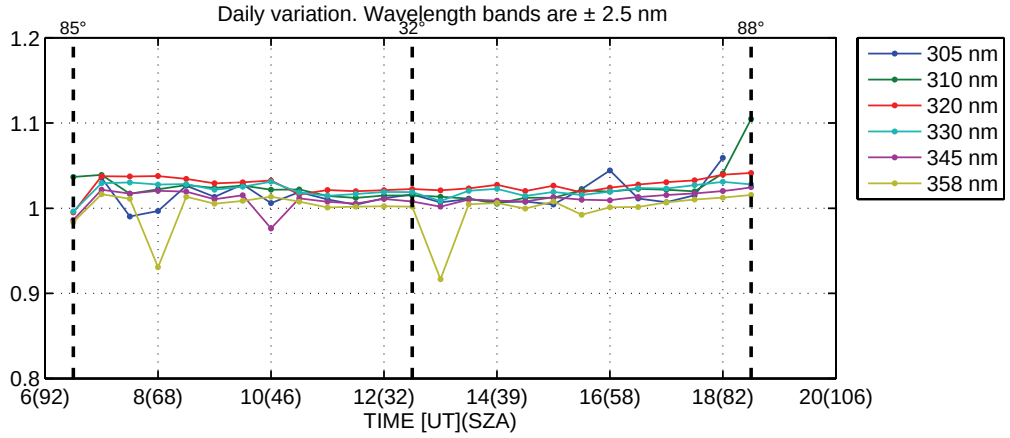

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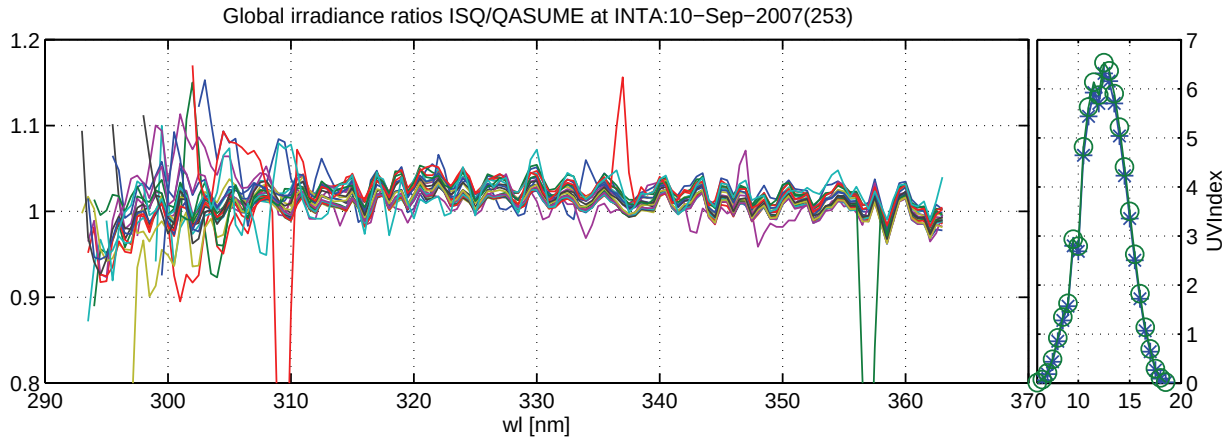

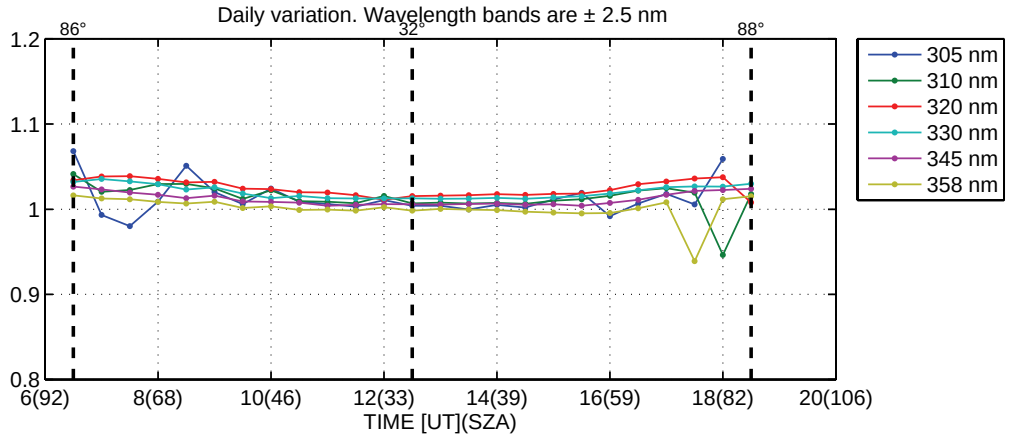

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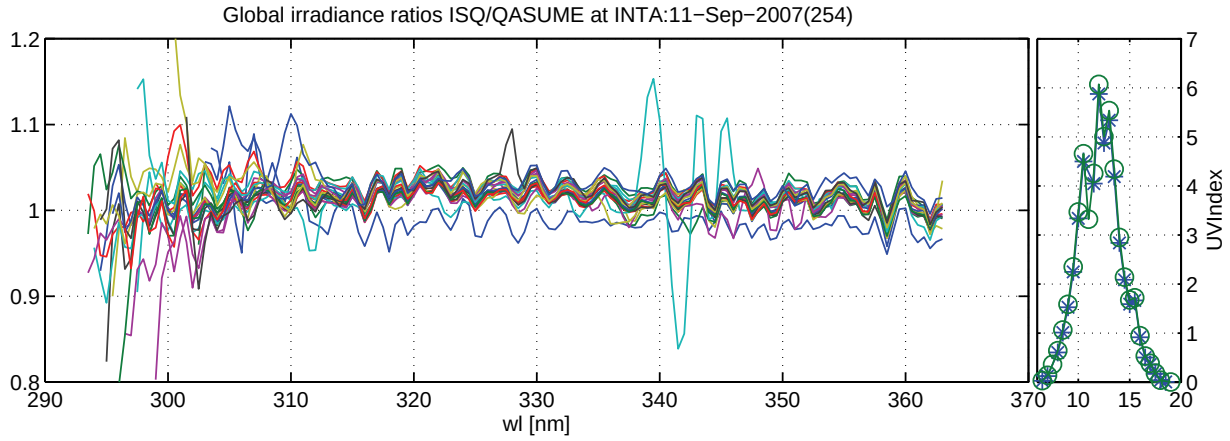

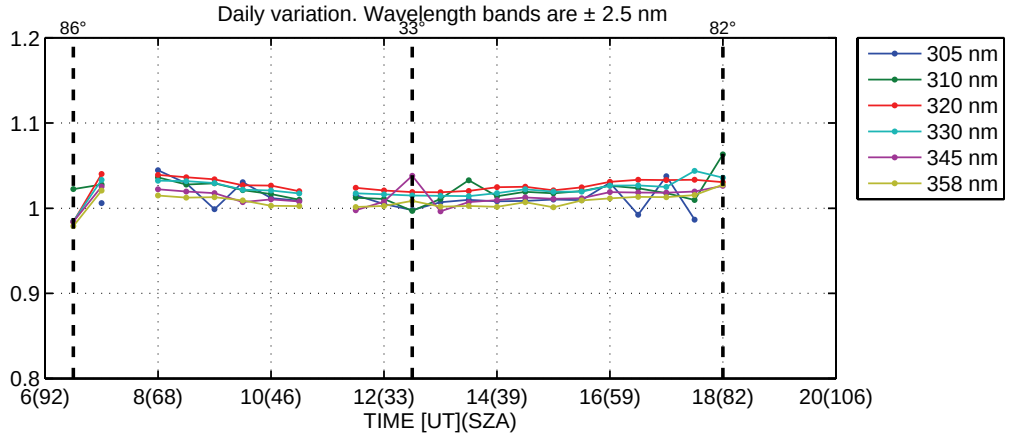

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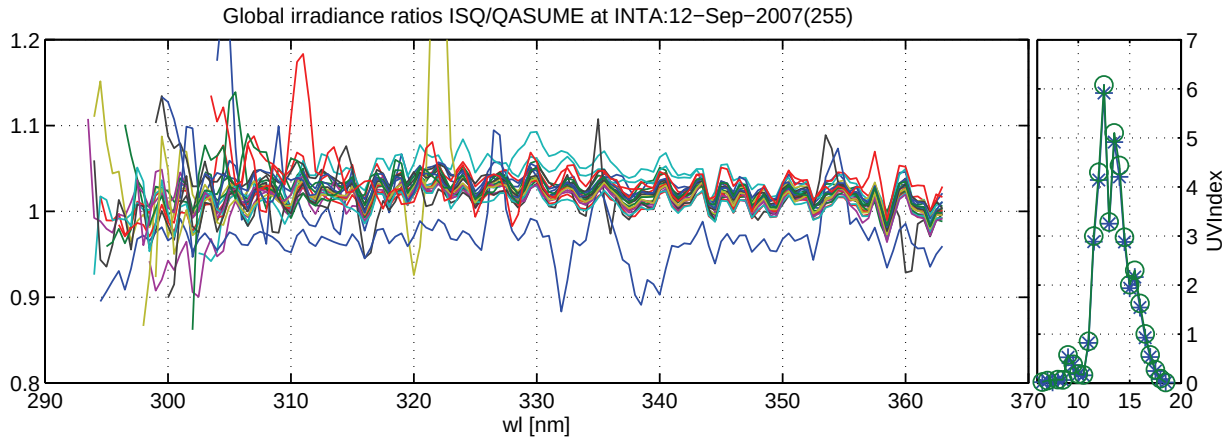

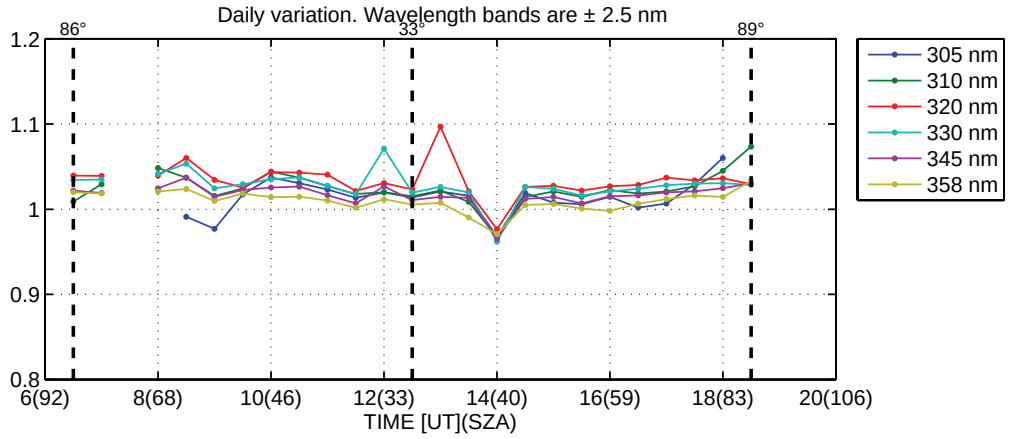

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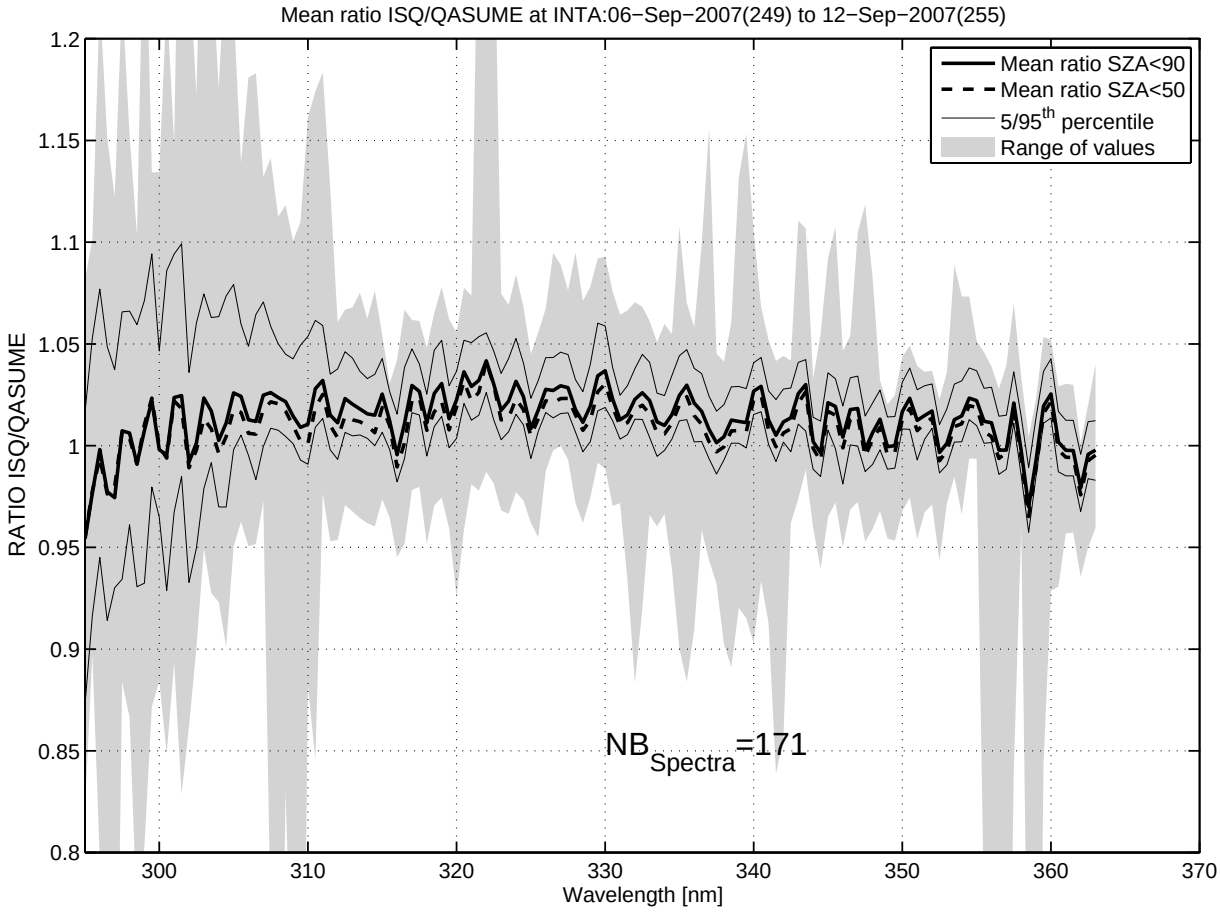

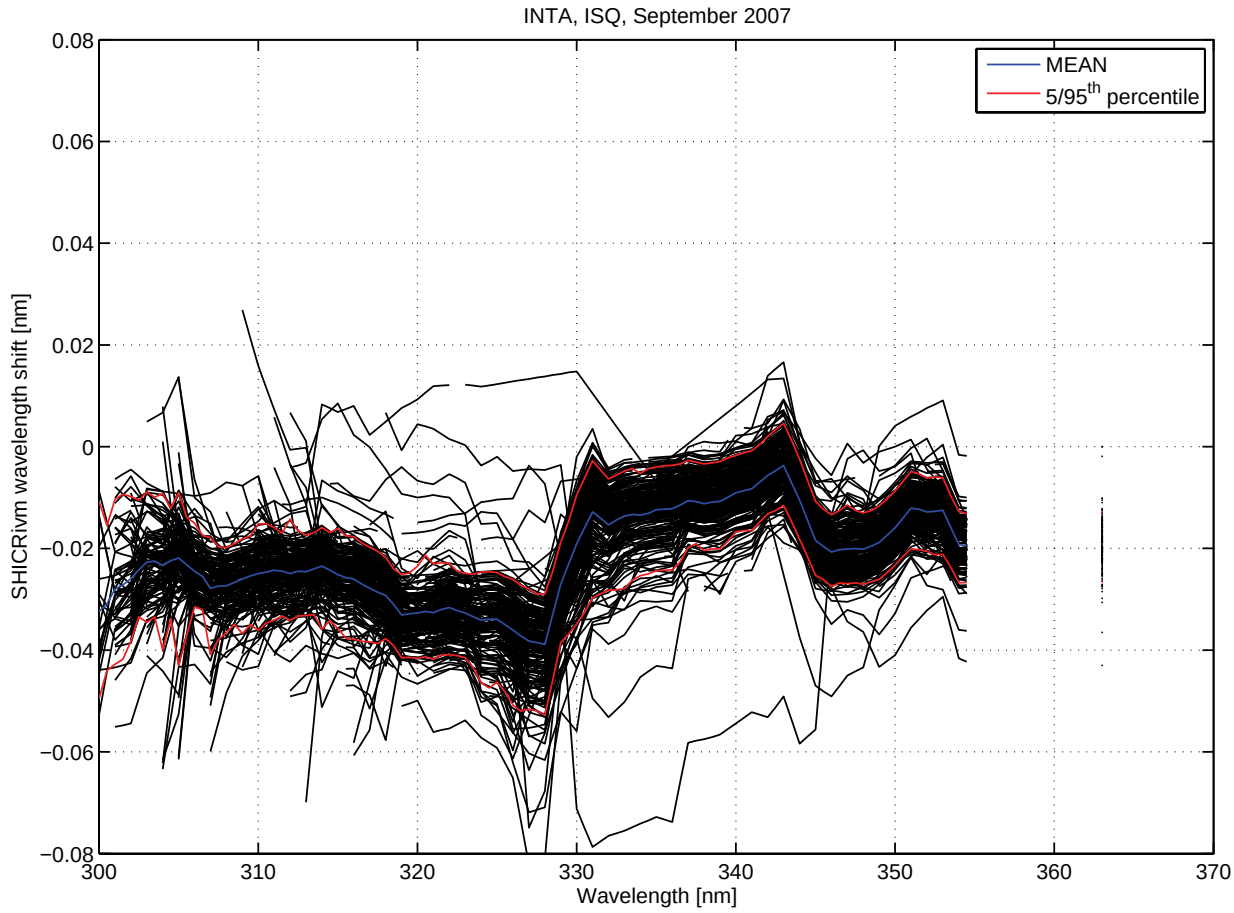
INTA, ISQ, September 2007
MEAN
5/95th percentile
SHICRivm wavelength shift [nm]
Wavelength [nm]
0.08
0.06
0.04
0.02
0
−0.02
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−0.08
300
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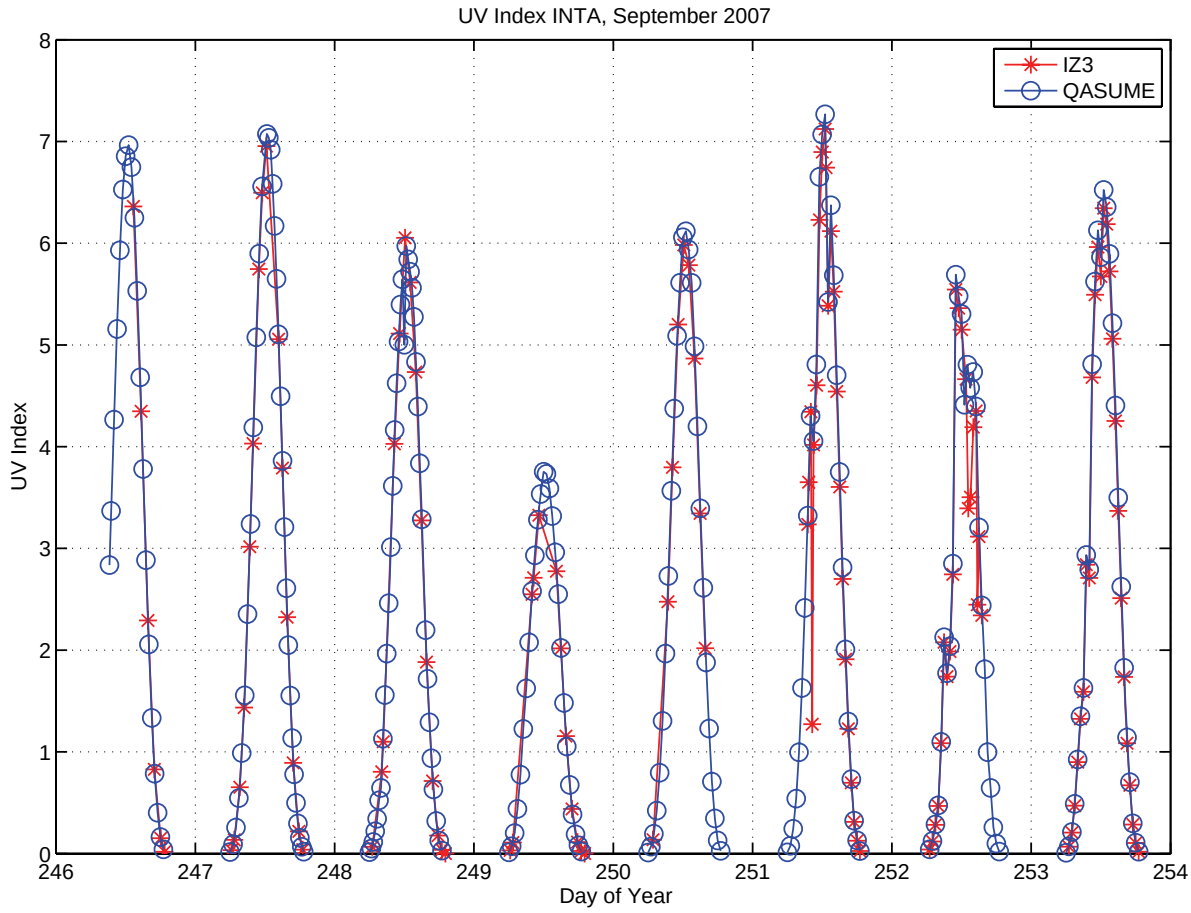
320
330
340
350
360
370


UV Index INTA, September 2007
IZ3
QASUME
UV Index
Day of Year
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2
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246
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248
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250
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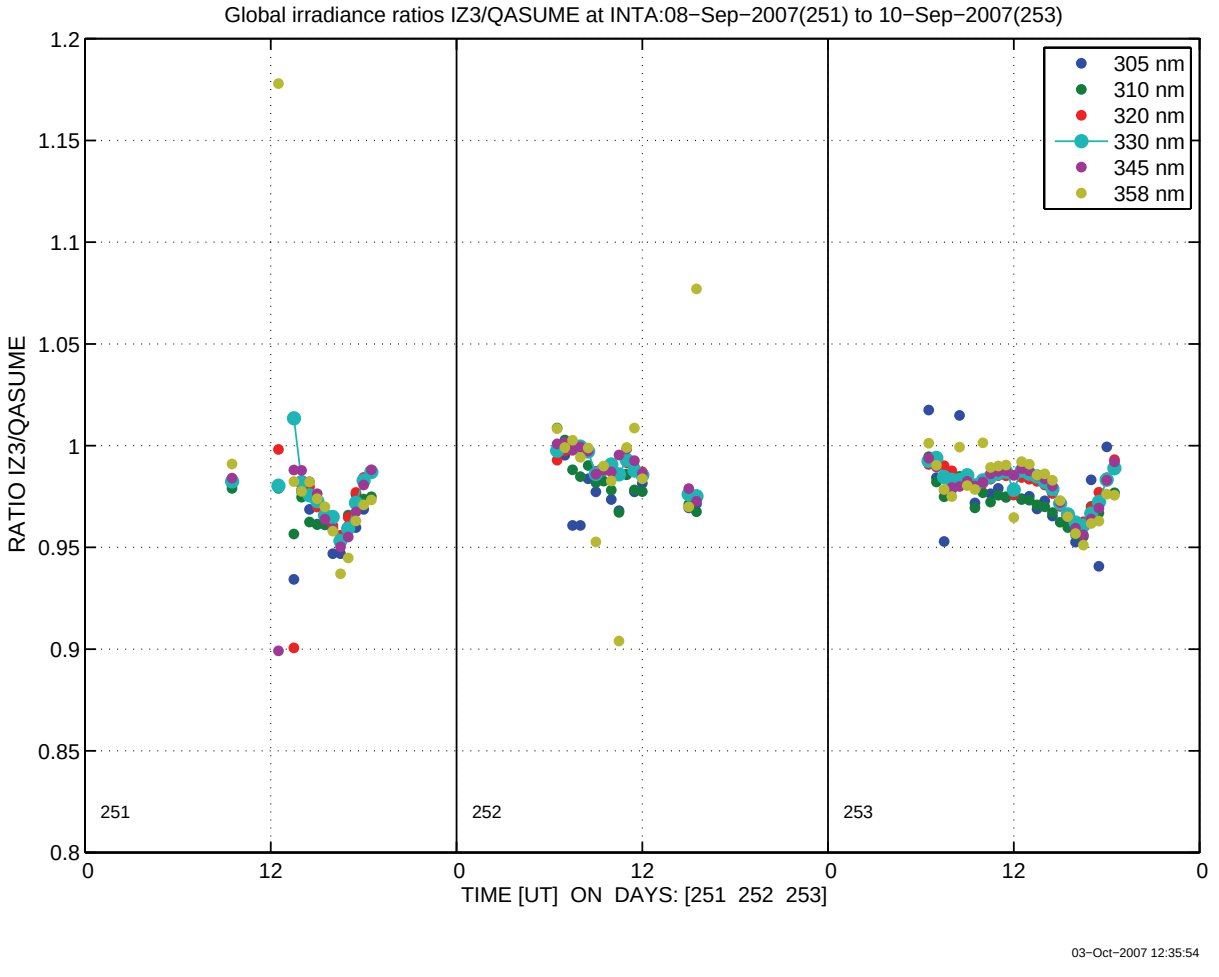
Global irradiance ratios IZ3/QASUME at INTA:08−Sep−2007(251) to 10−Sep−2007(253)
305 nm
310 nm
320 nm
330 nm
345 nm
358 nm
RATIO IZ3/QASUME
TIME [UT] ON DAYS: [251 252 253]
251
252
253
0.8
0.85
0.9
0.95
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1.1
1.15
1.2
0
12
0
12
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12
0
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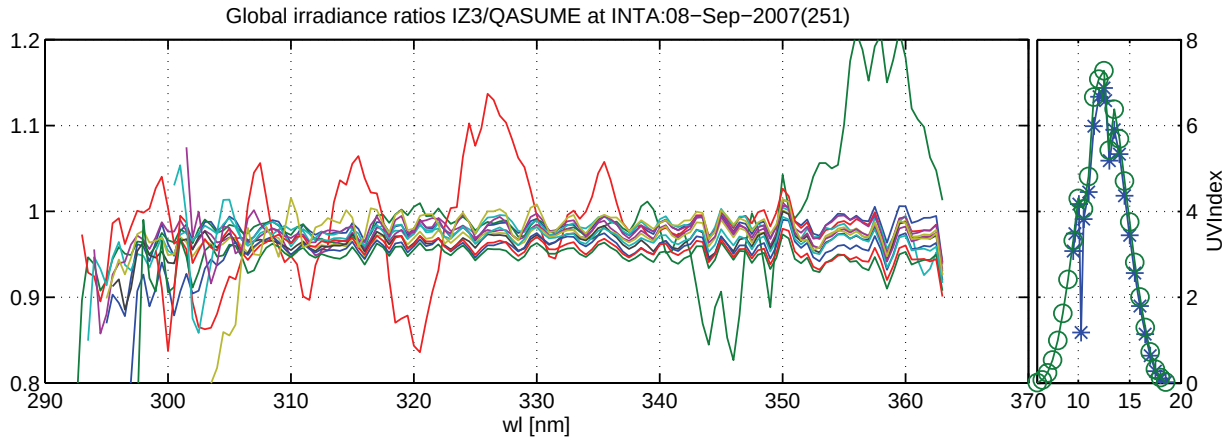

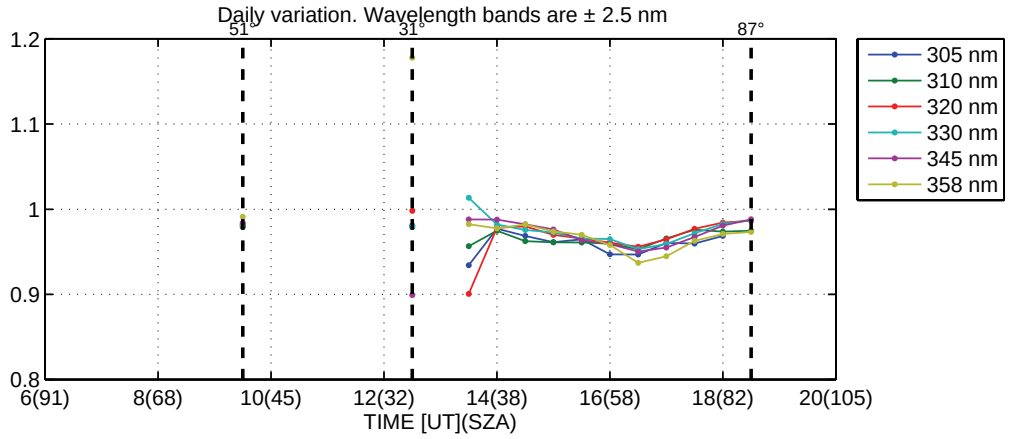

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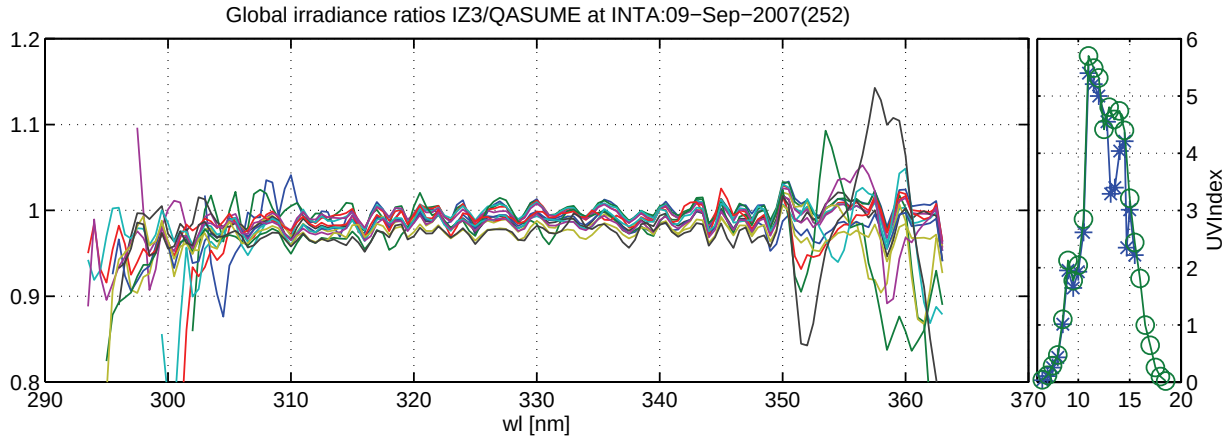

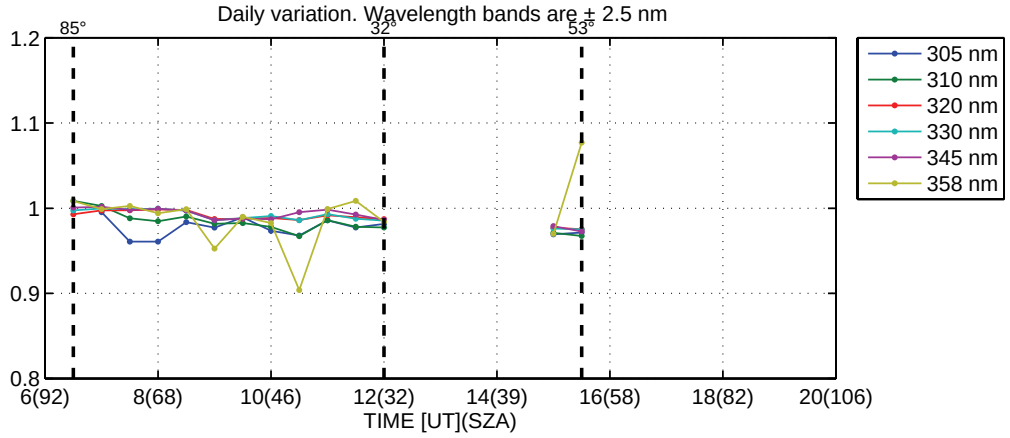

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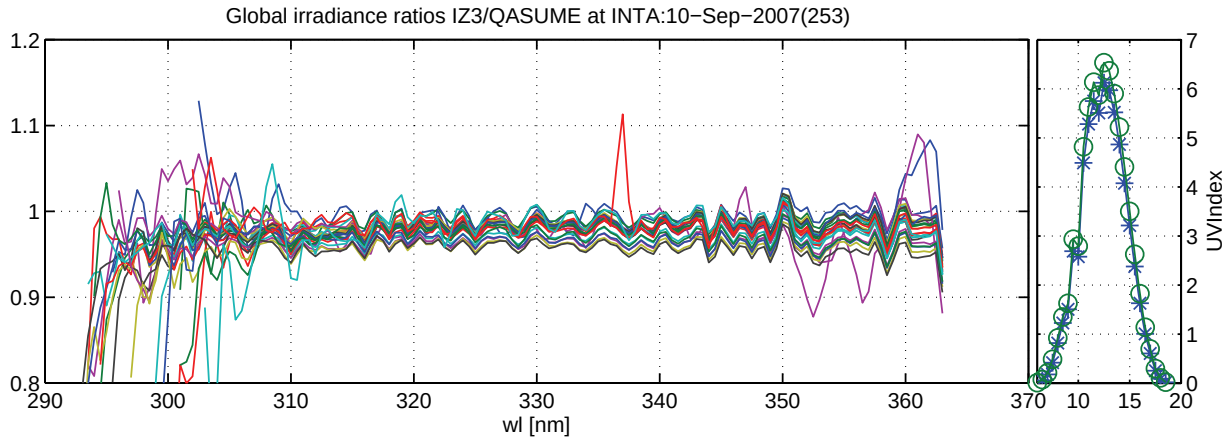

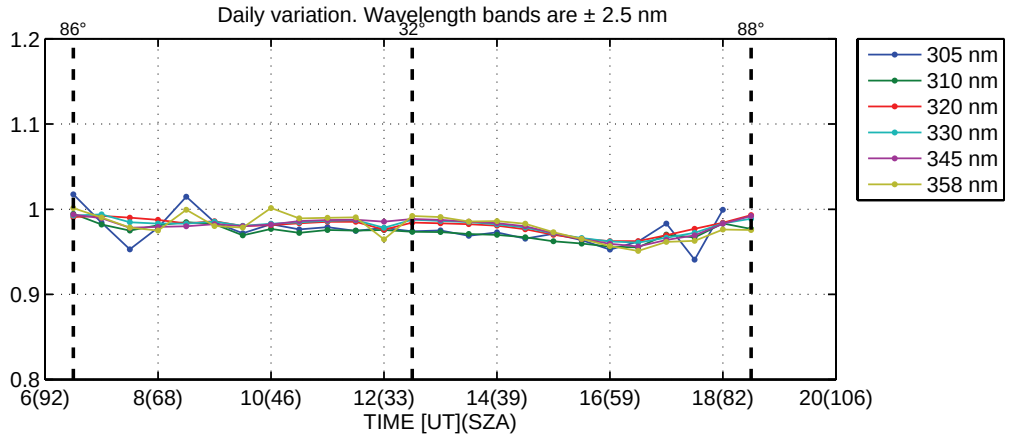

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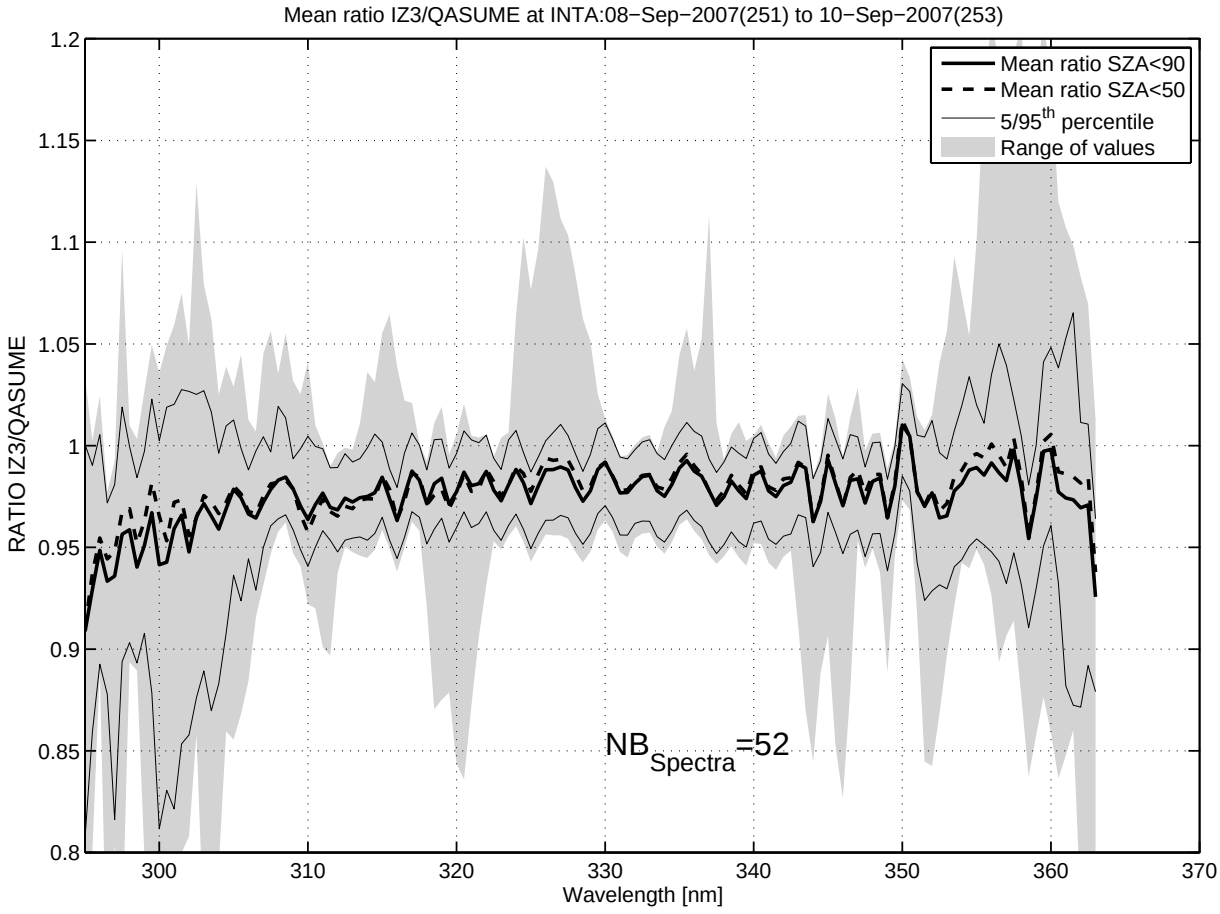

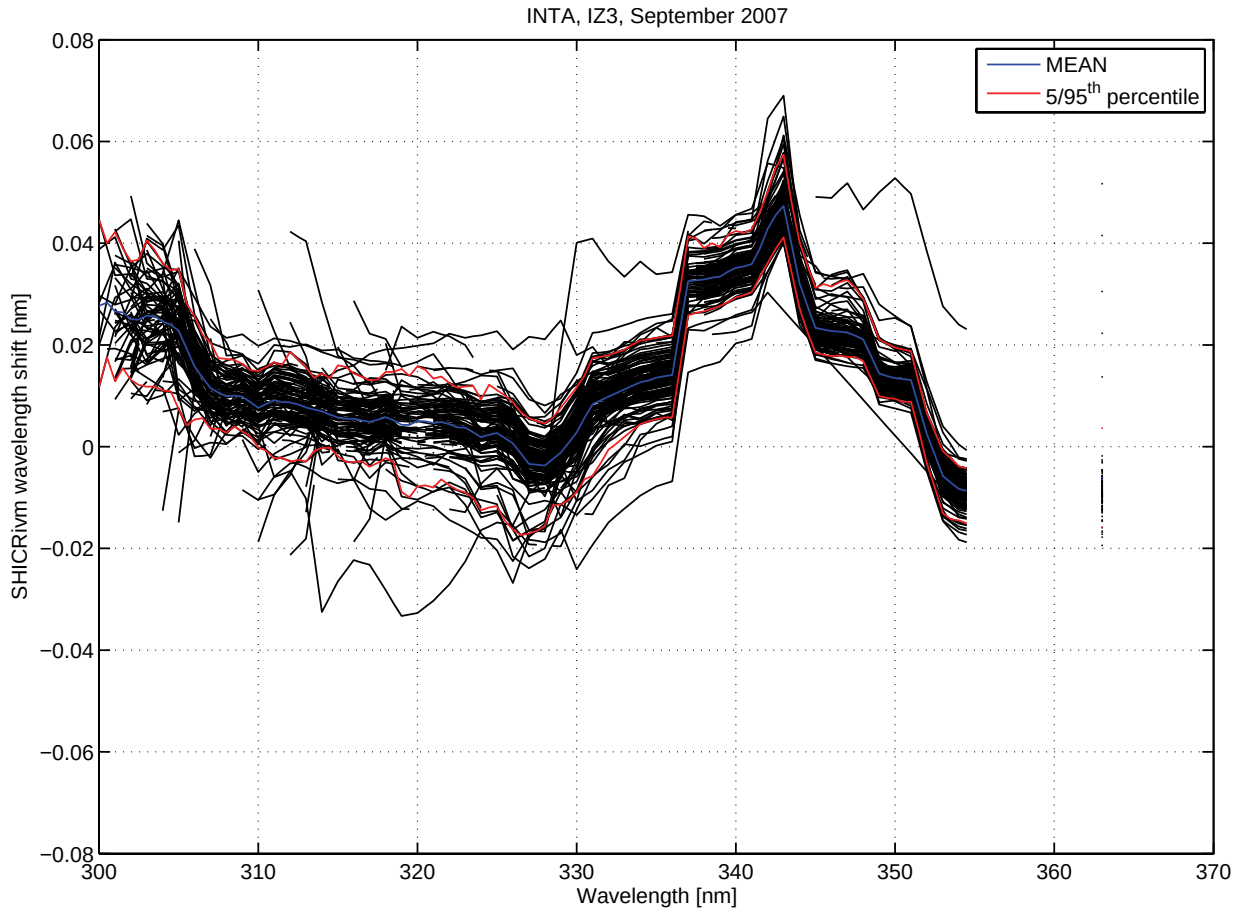
INTA, IZ3, September 2007
MEAN
5/95th percentile
SHICRivm wavelength shift [nm]
Wavelength [nm]
0.08
0.06
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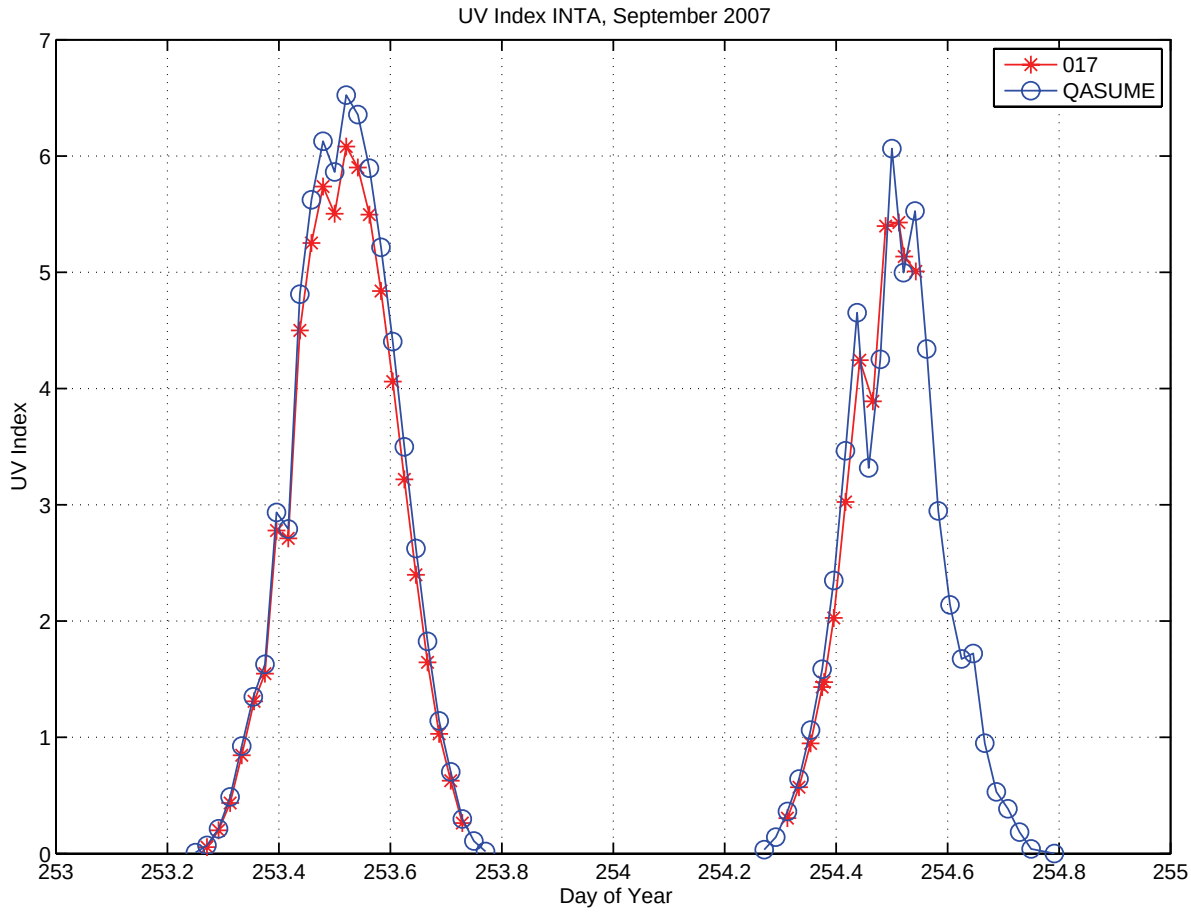
UV Index INTA, September 2007
017
QASUME
UV Index
Day of Year
0
1
2
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254.8
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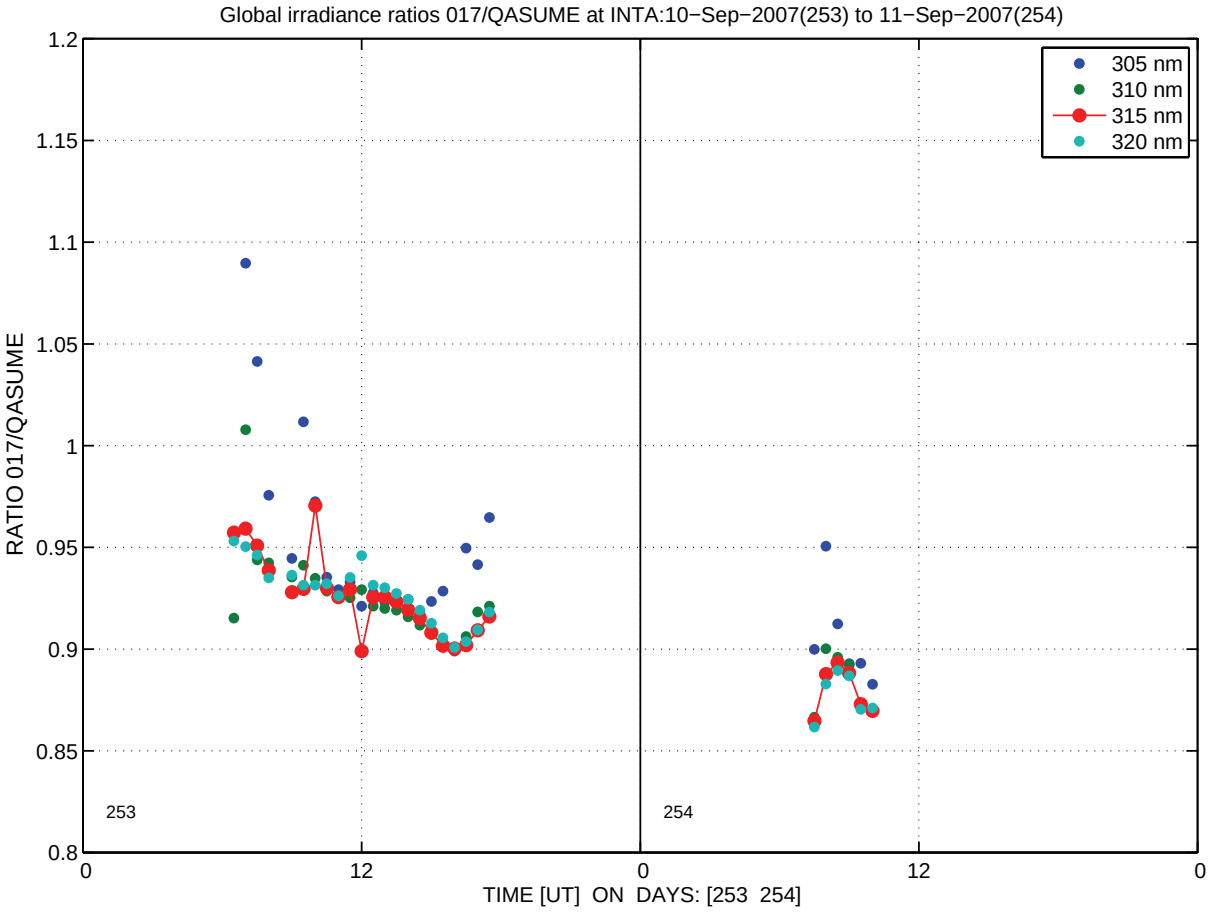
Global irradiance ratios 017/QASUME at INTA:10−Sep−2007(253) to 11−Sep−2007(254)
305 nm
310 nm
315 nm
320 nm
RATIO 017/QASUME
TIME [UT] ON DAYS: [253 254]
253
254
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
1.2
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12
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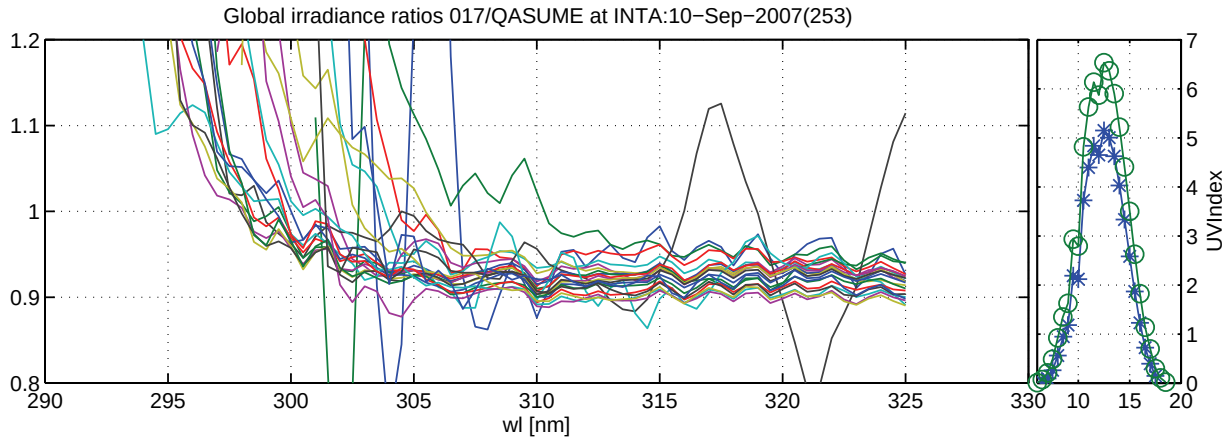
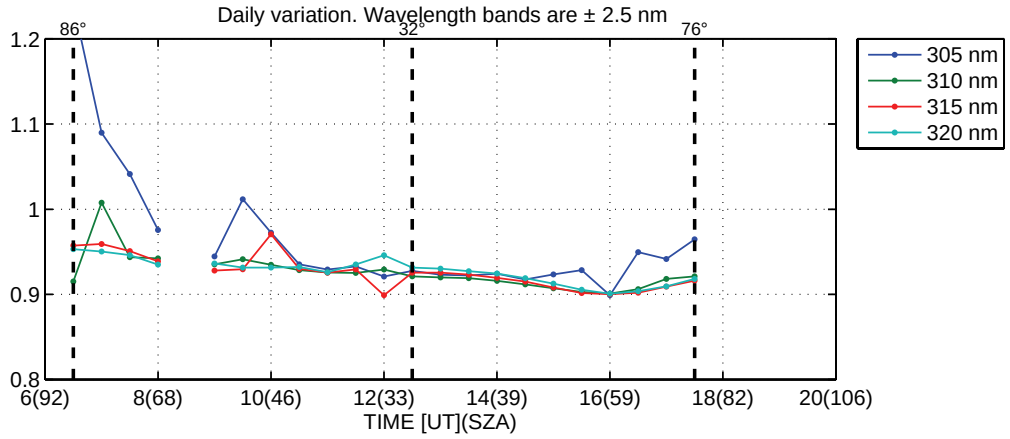
03−Oct−2007 12:36:27





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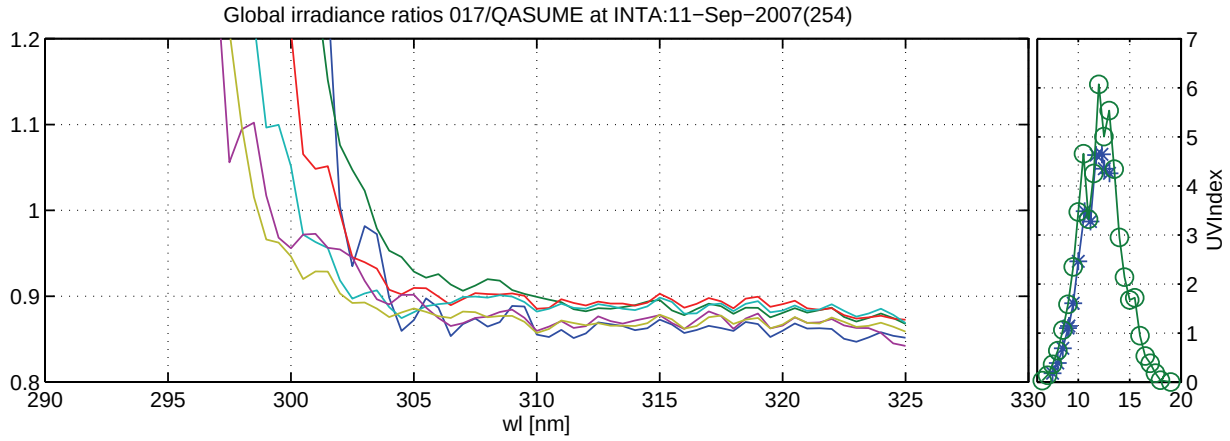

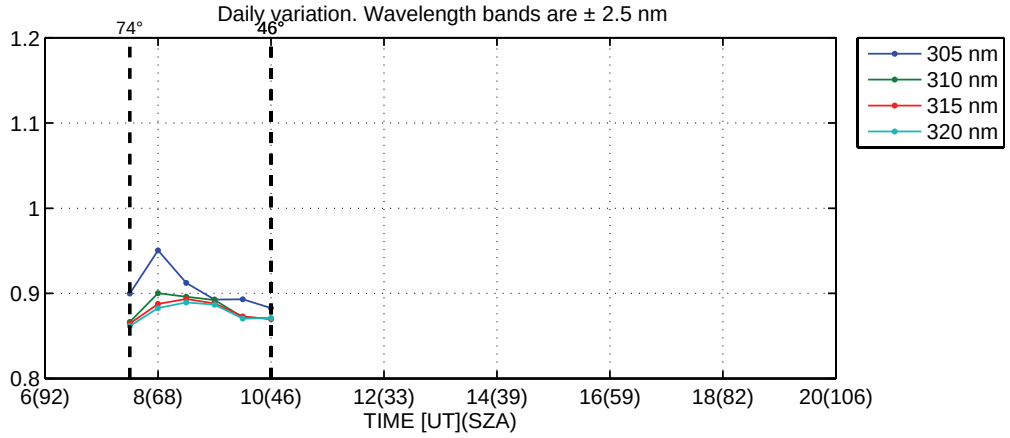

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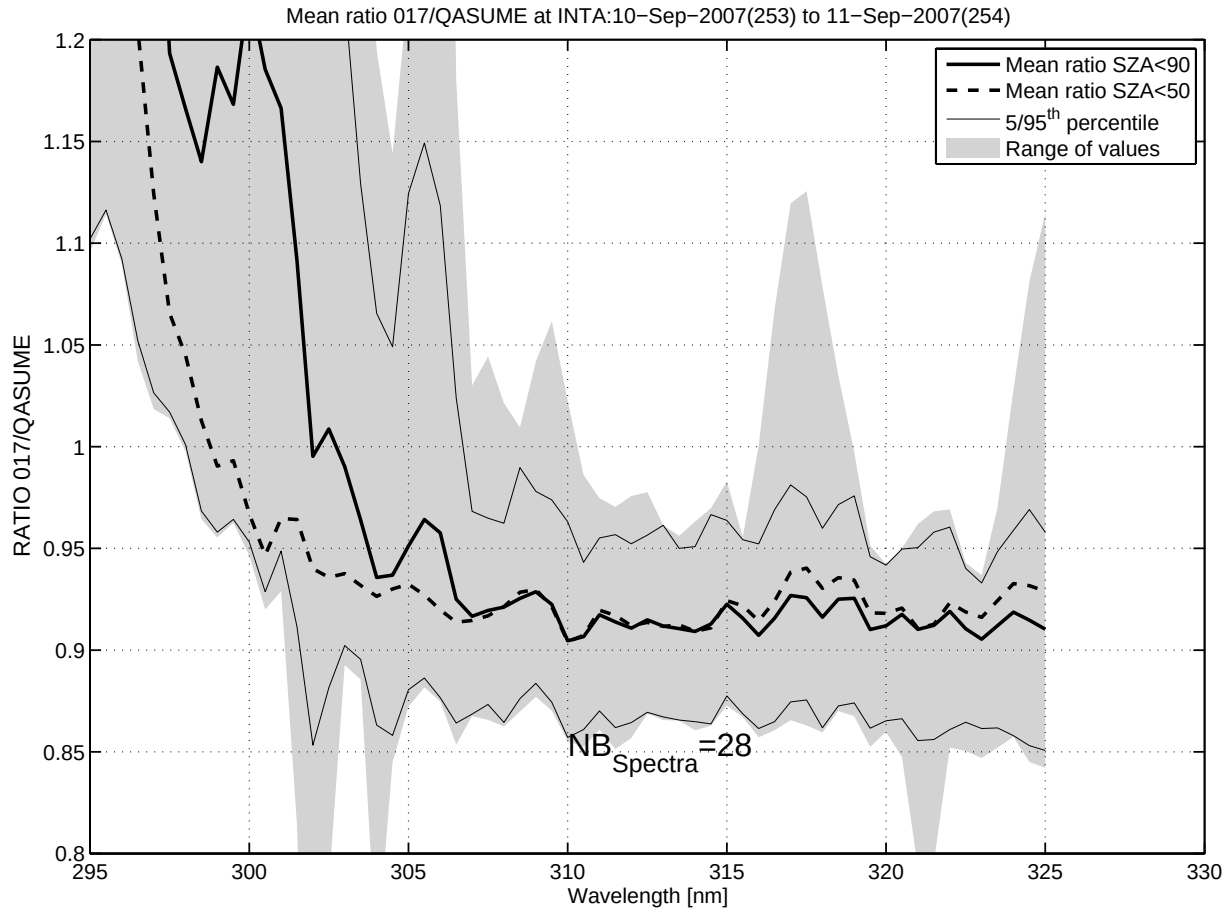
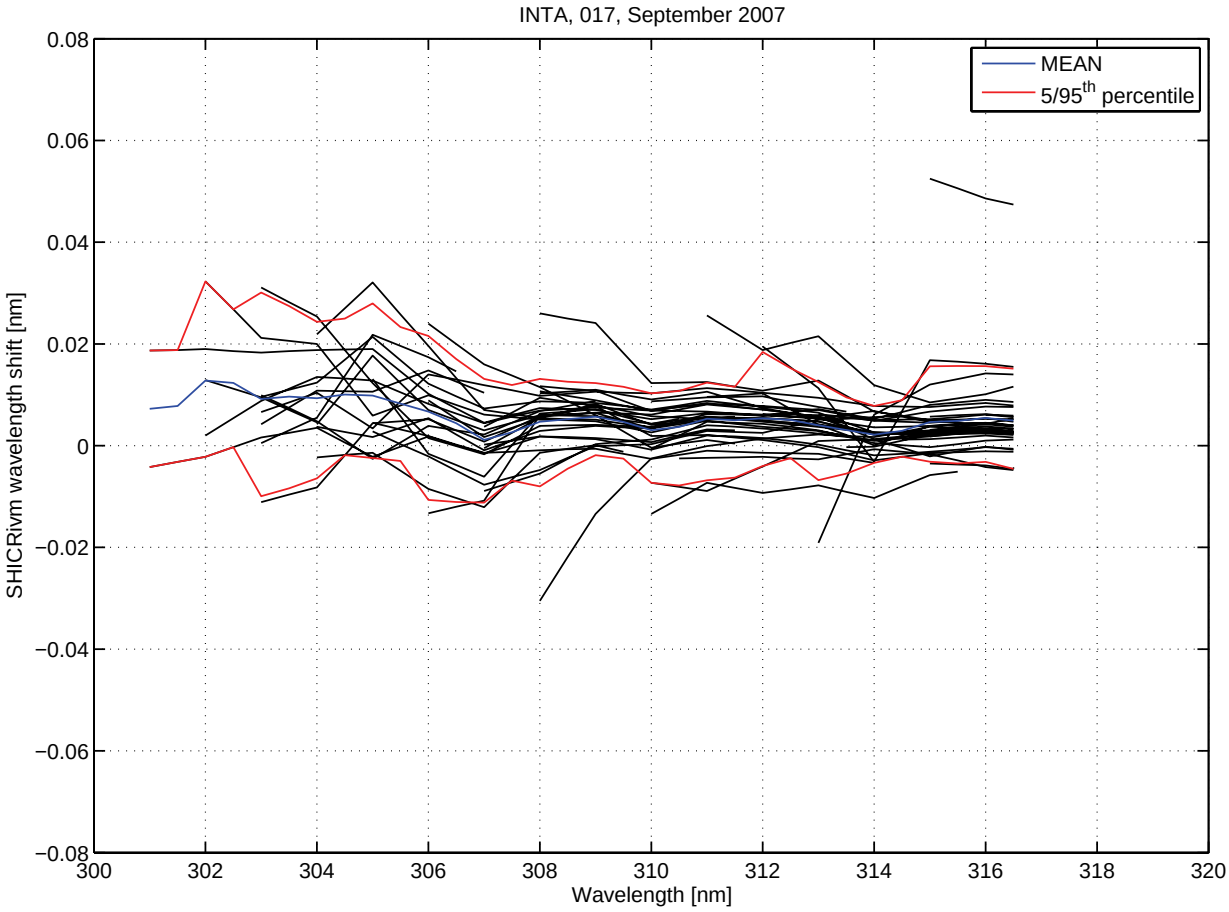
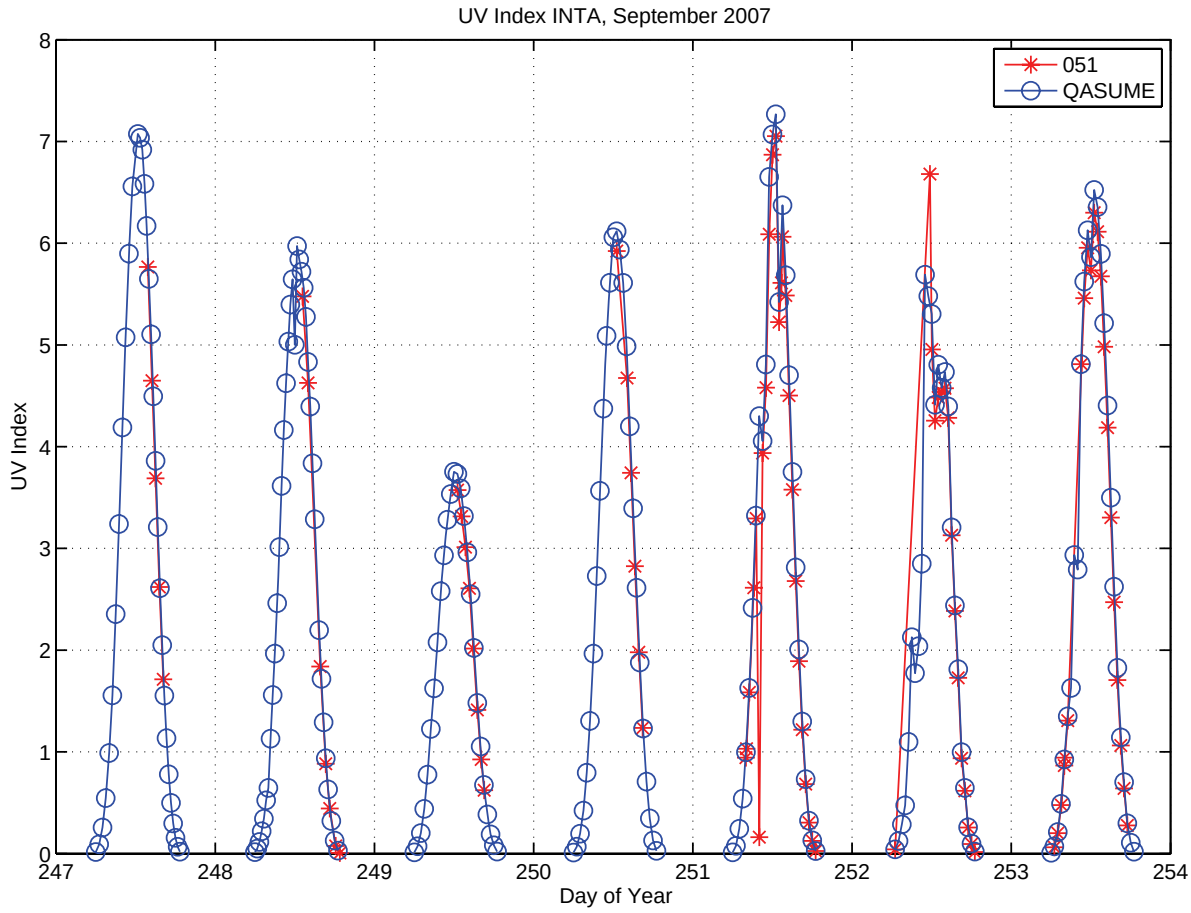
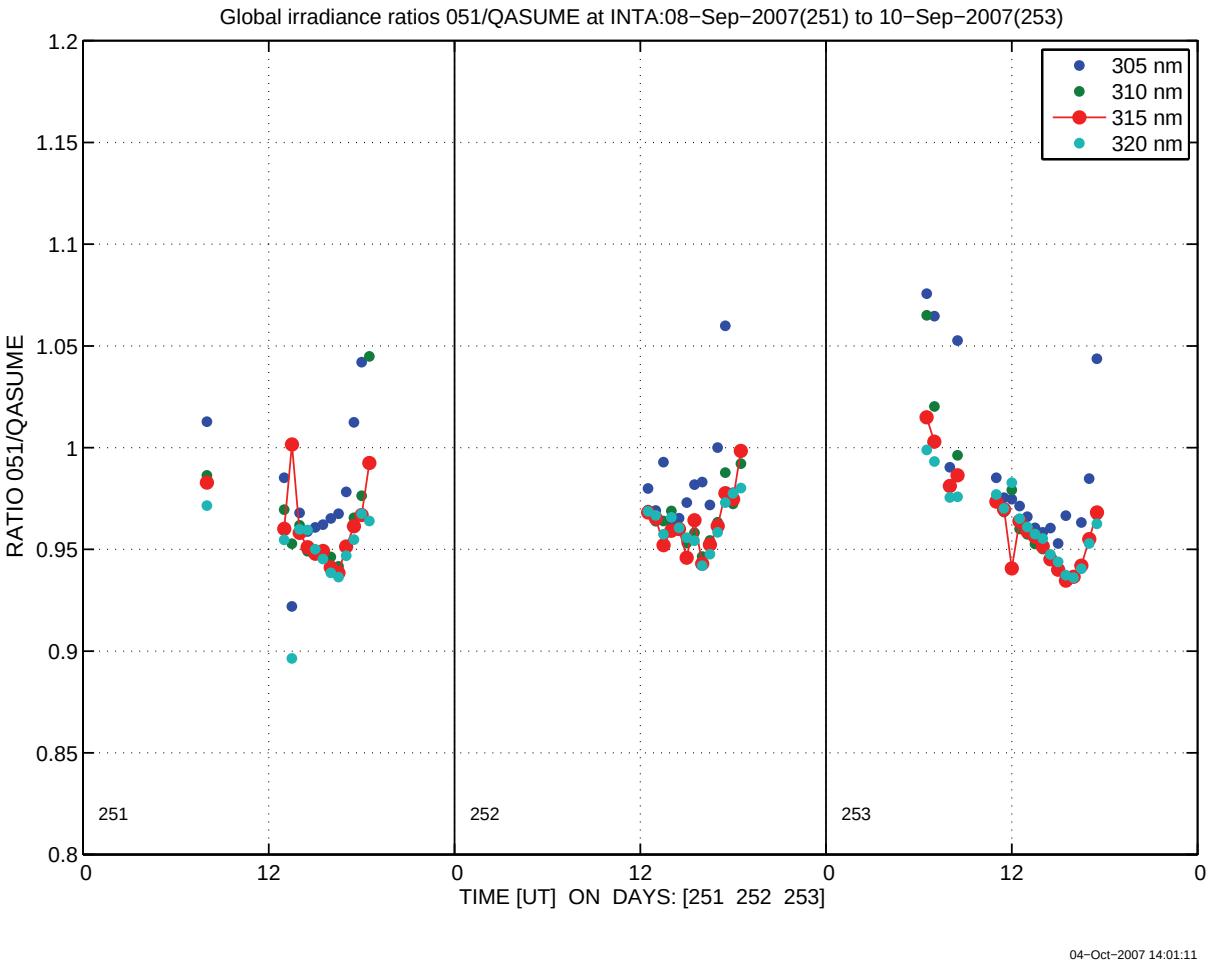
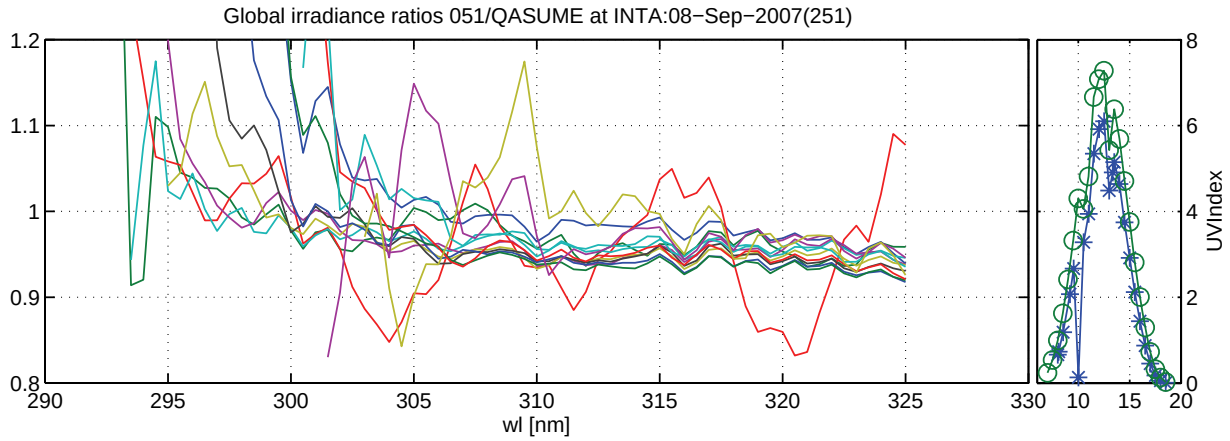
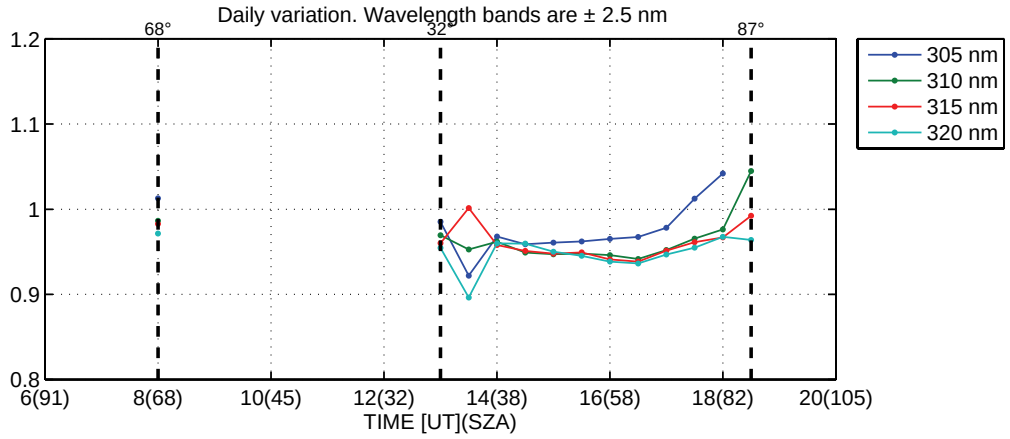

Mean ratio 017/QASUME at INTA:10−Sep−2007(253) to 11−Sep−2007(254)
Mean ratio SZA<90
Mean ratio SZA<50
5/95th percentile
Range of values
RATIO 017/QASUME
NBSpectra=28
Wavelength [nm]


INTA, 017, September 2007
MEAN
5/95th percentile
SHICRivm wavelength shift [nm]
Wavelength [nm]

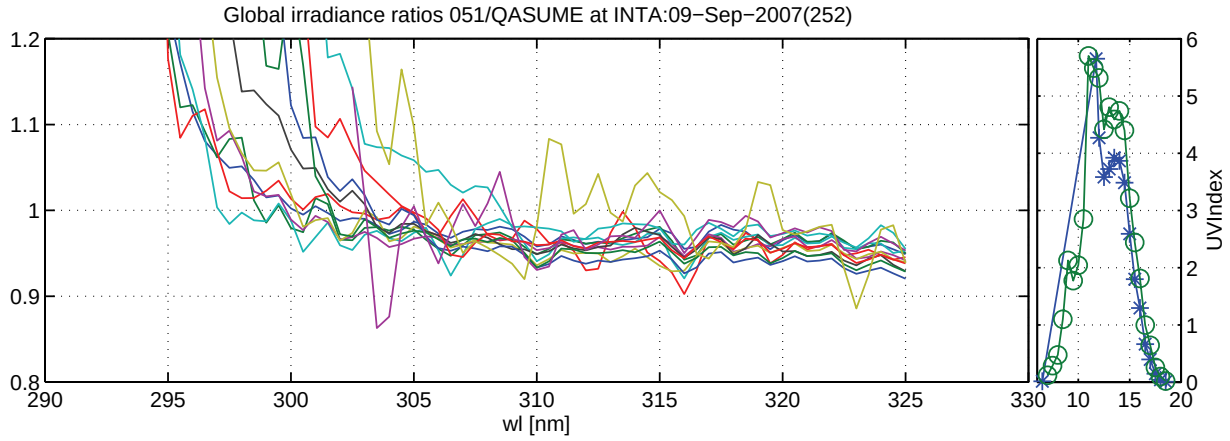

UV Index INTA, September 2007
051
QASUME
UV Index
Day of Year
0
1
2
3
4
5
6
7
8
247
248
249
250
251
252
253
254

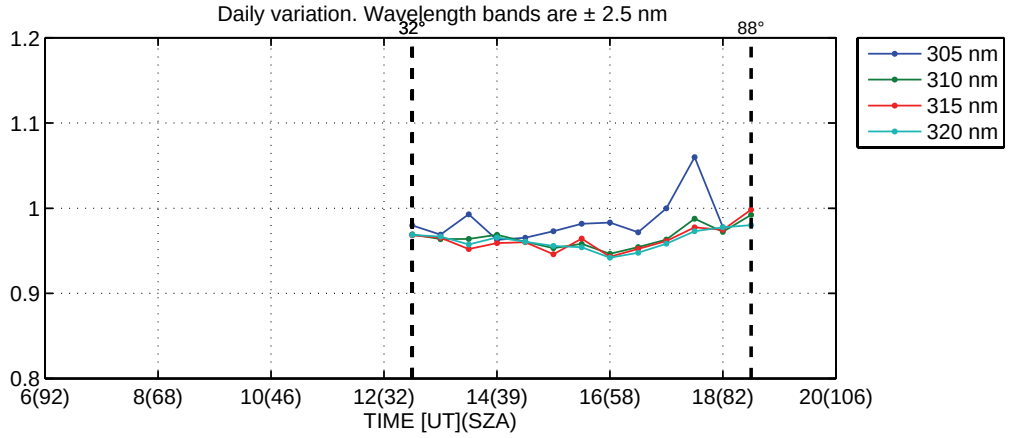

Global irradiance ratios 051/QASUME at INTA:08−Sep−2007(251) to 10−Sep−2007(253)
305 nm
310 nm
315 nm
320 nm
RATIO 051/QASUME
TIME [UT] ON DAYS: [251 252 253]
251
252
253
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
1.2
0
12
0
12
0
12
0
04−Oct−2007 14:01:11



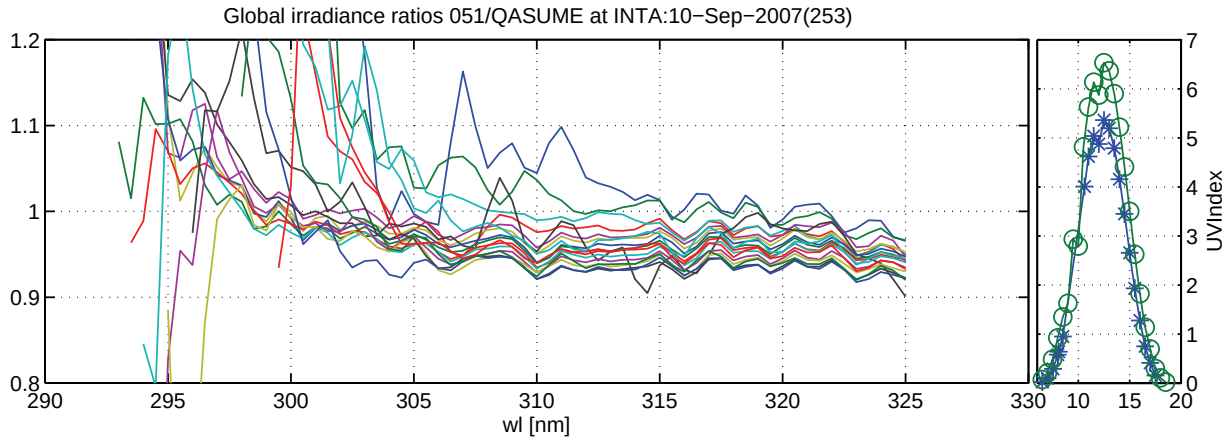


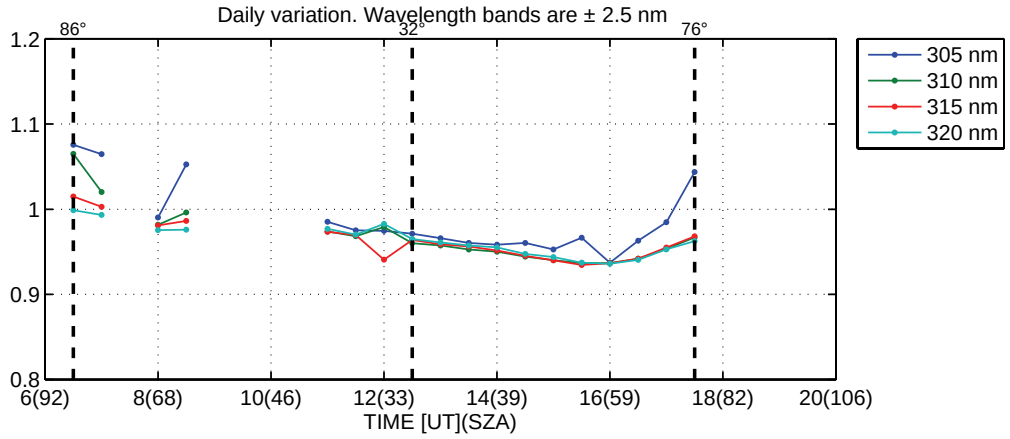
04−Oct−2007 14:01:11



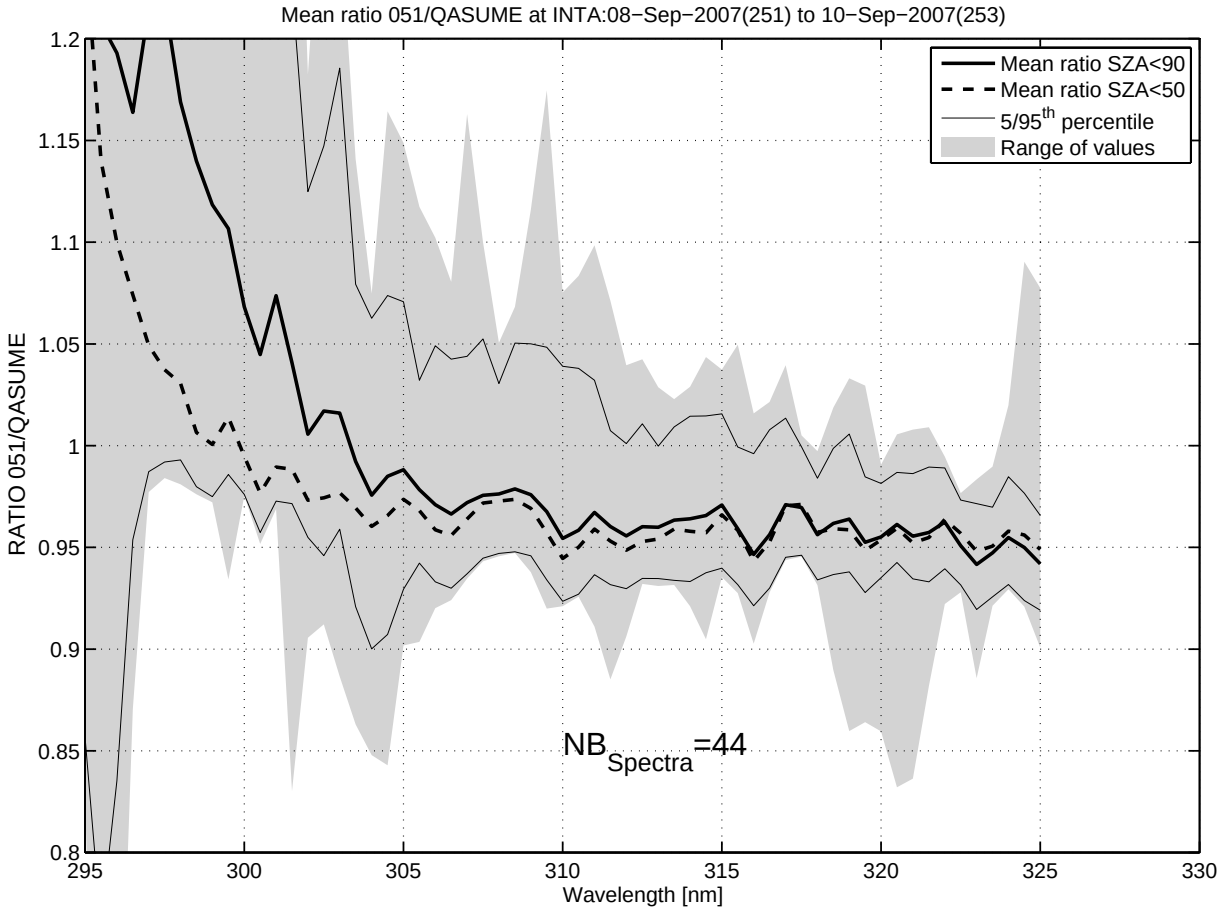


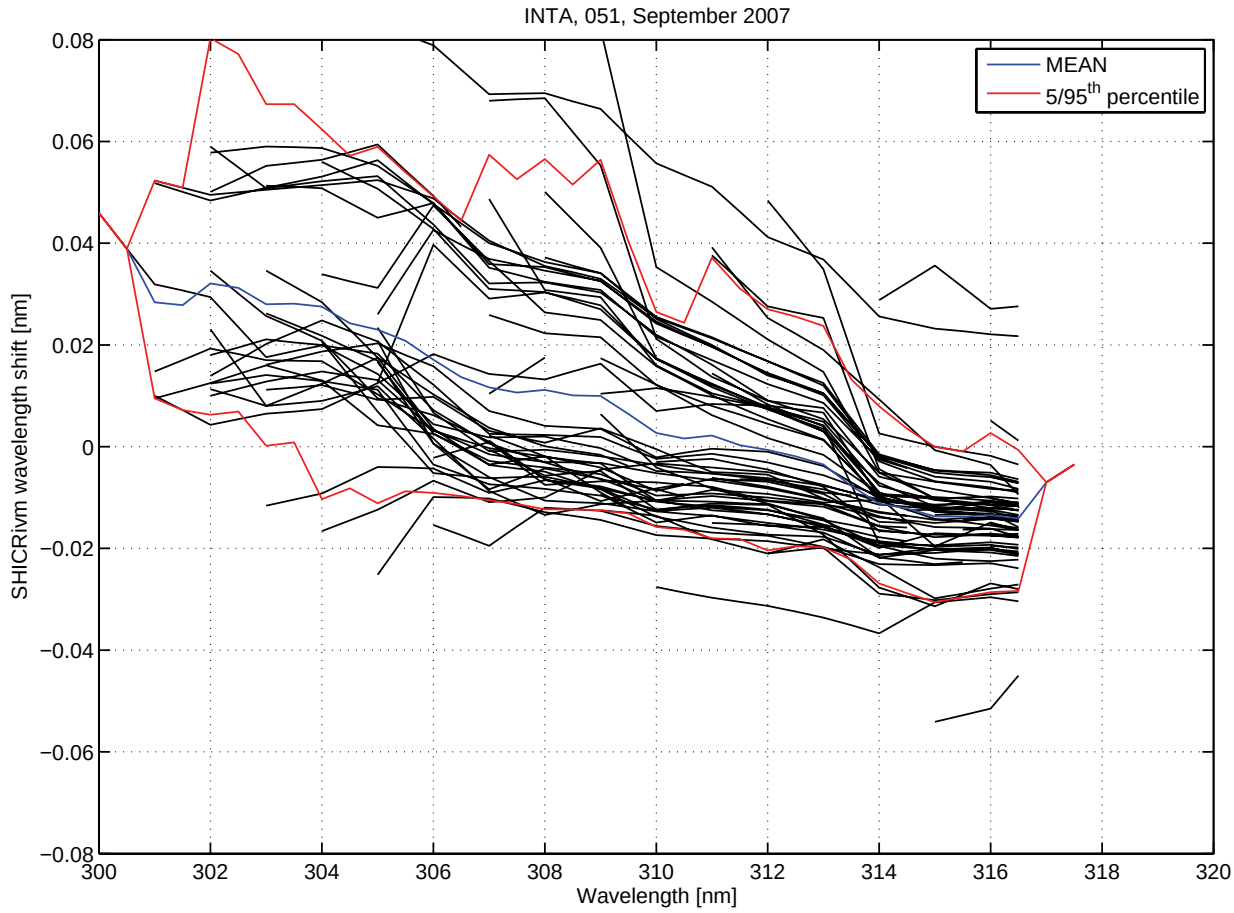
04−Oct−2007 14:01:11

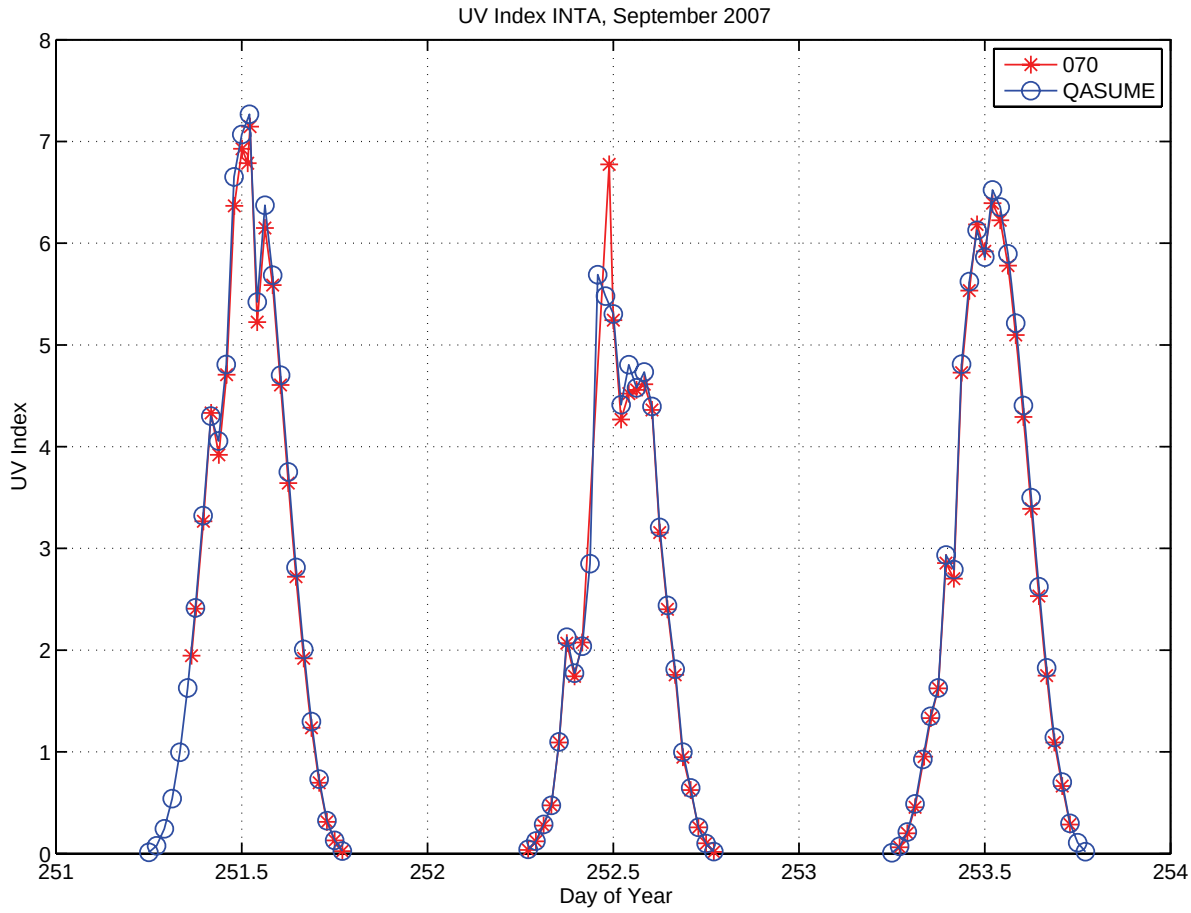


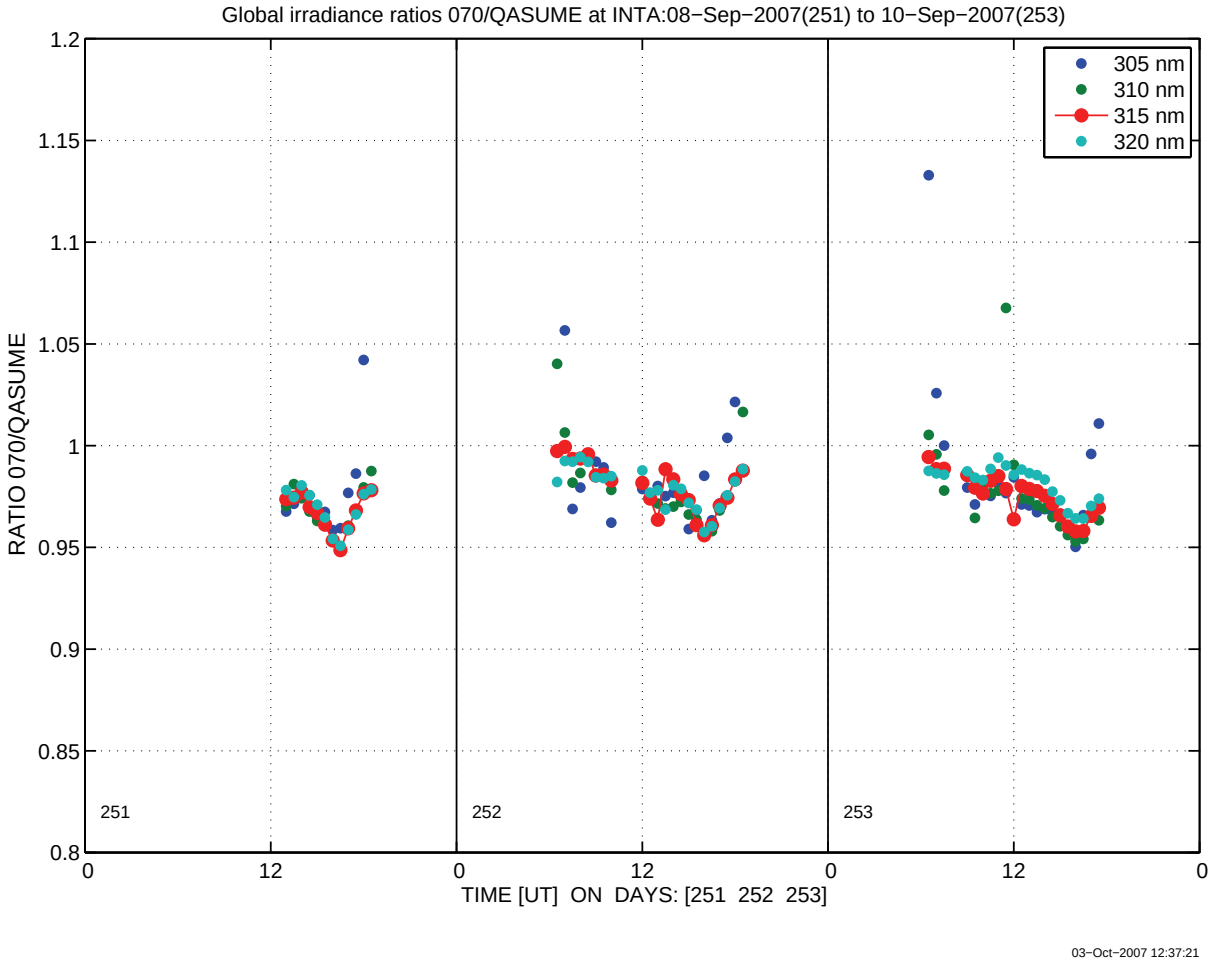


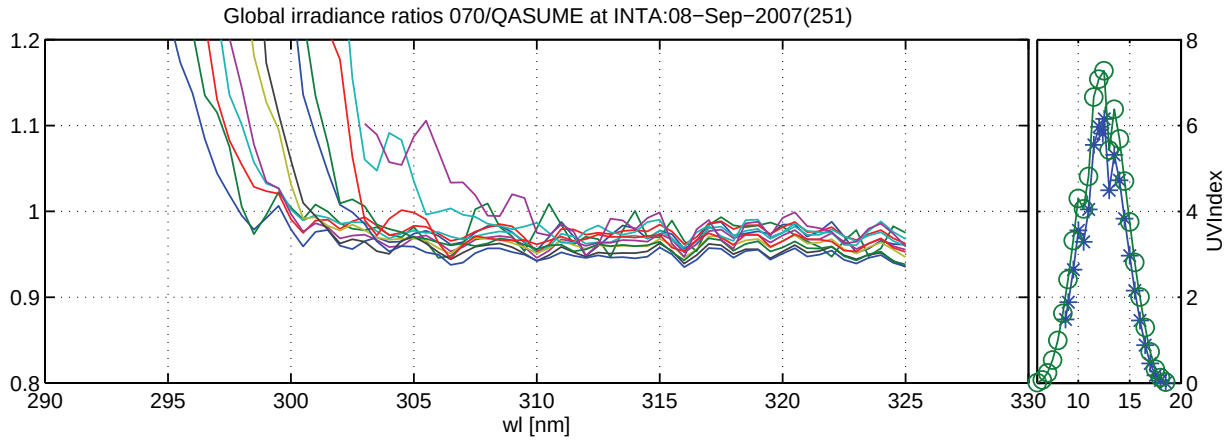
04−Oct−2007 14:01:11

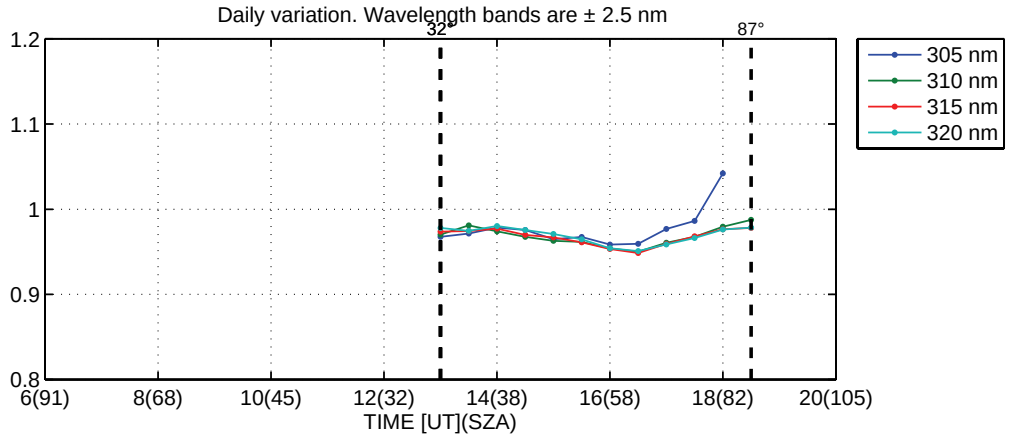



INTA, 051, September 2007
MEAN
5/95th percentile
SHICRivm wavelength shift [nm]
Wavelength [nm]
0.08
0.06
0.04
0.02
0
−0.02
−0.04
−0.06
−0.08
300
302
304
306
308
310
312
314
316
318
320

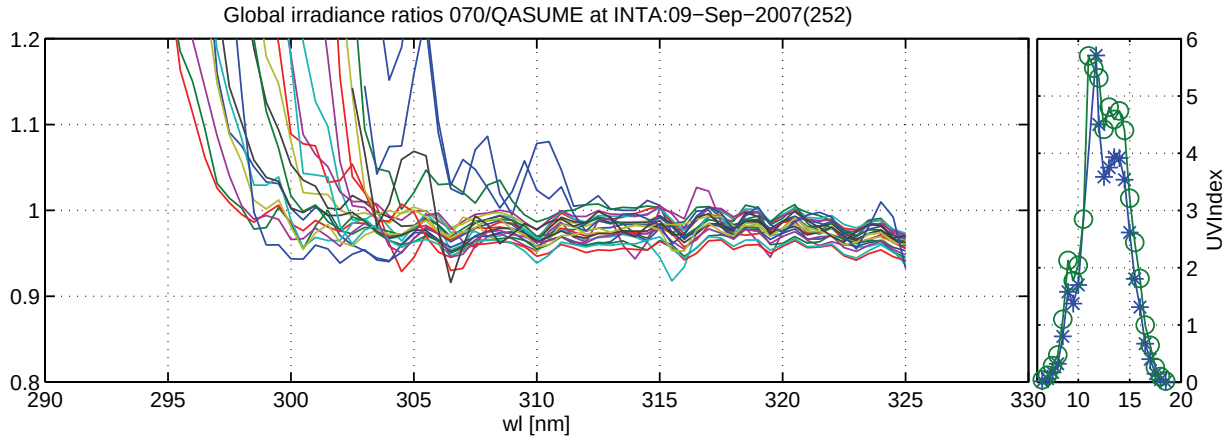

UV Index INTA, September 2007
070
QASUME
UV Index
Day of Year
0
1
2
3
4
5
6
7
8
251
251.5
252
252.5
253
253.5
254

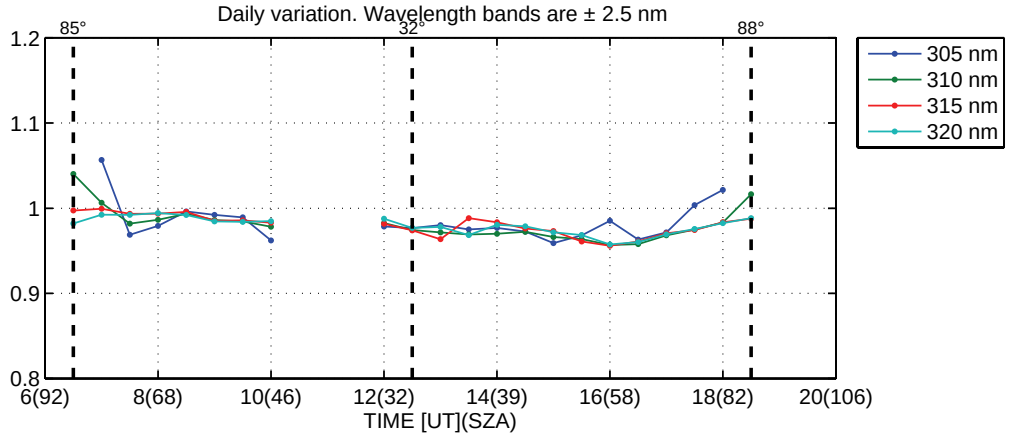

Global irradiance ratios 070/QASUME at INTA:08−Sep−2007(251) to 10−Sep−2007(253)
305 nm
310 nm
315 nm
320 nm
RATIO 070/QASUME
TIME [UT] ON DAYS: [251 252 253]
251
252
253
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
1.2
0
12
0
12
0
12
0
03−Oct−2007 12:37:21



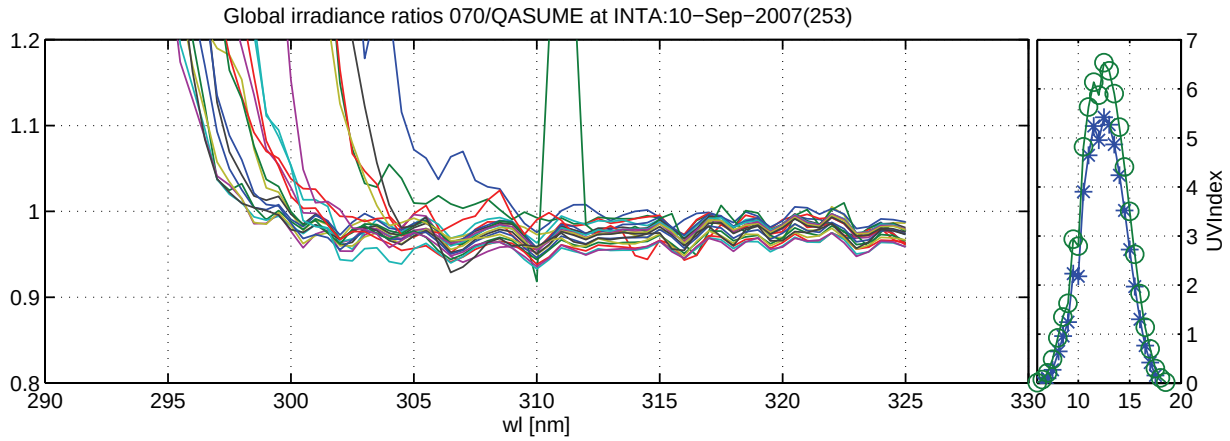


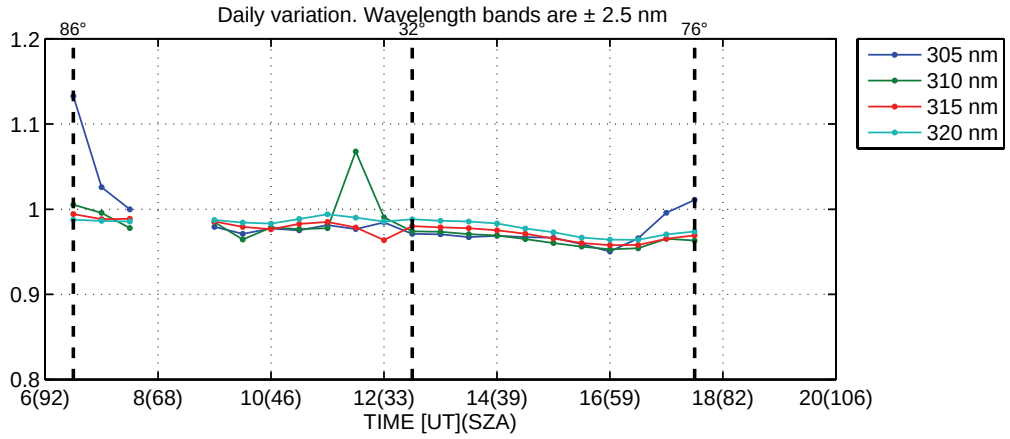
03−Oct−2007 12:37:21



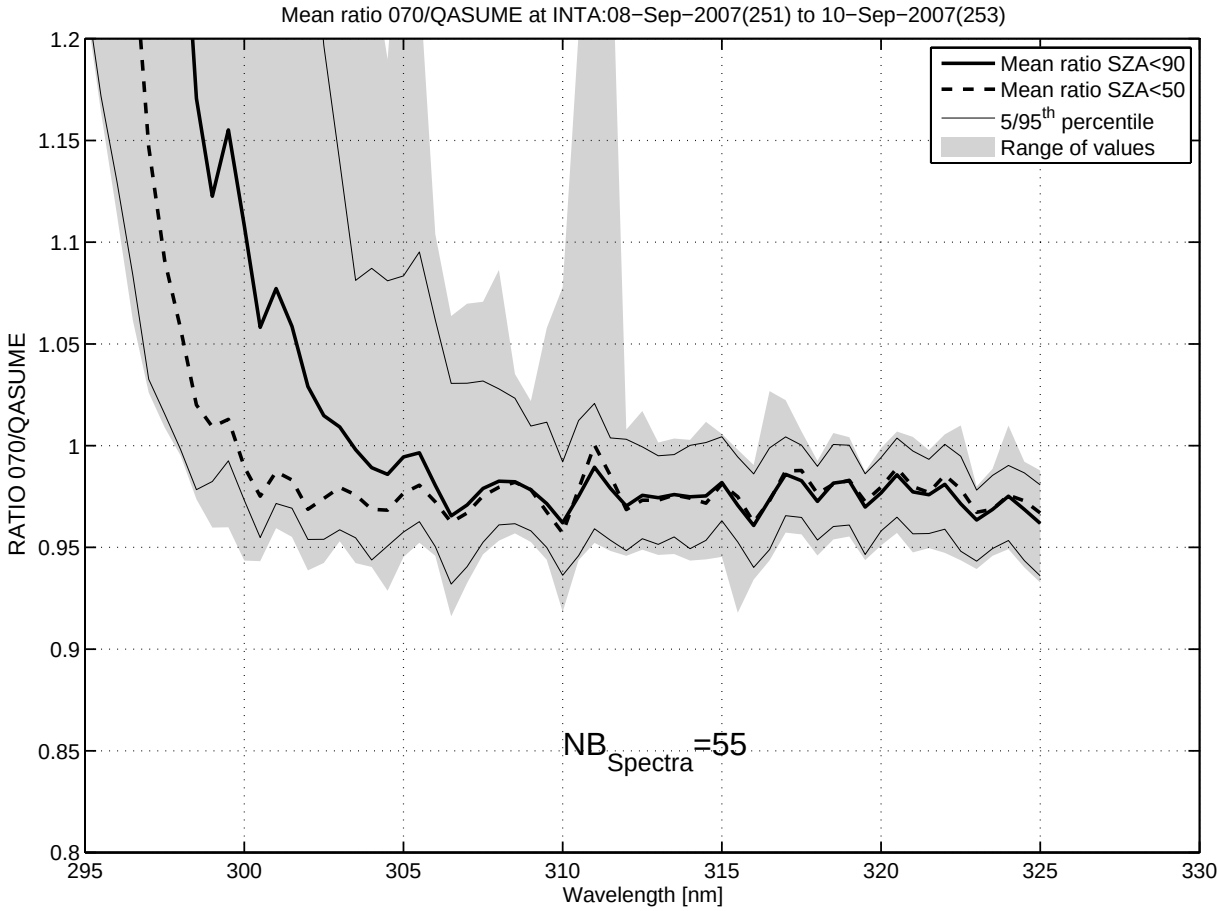


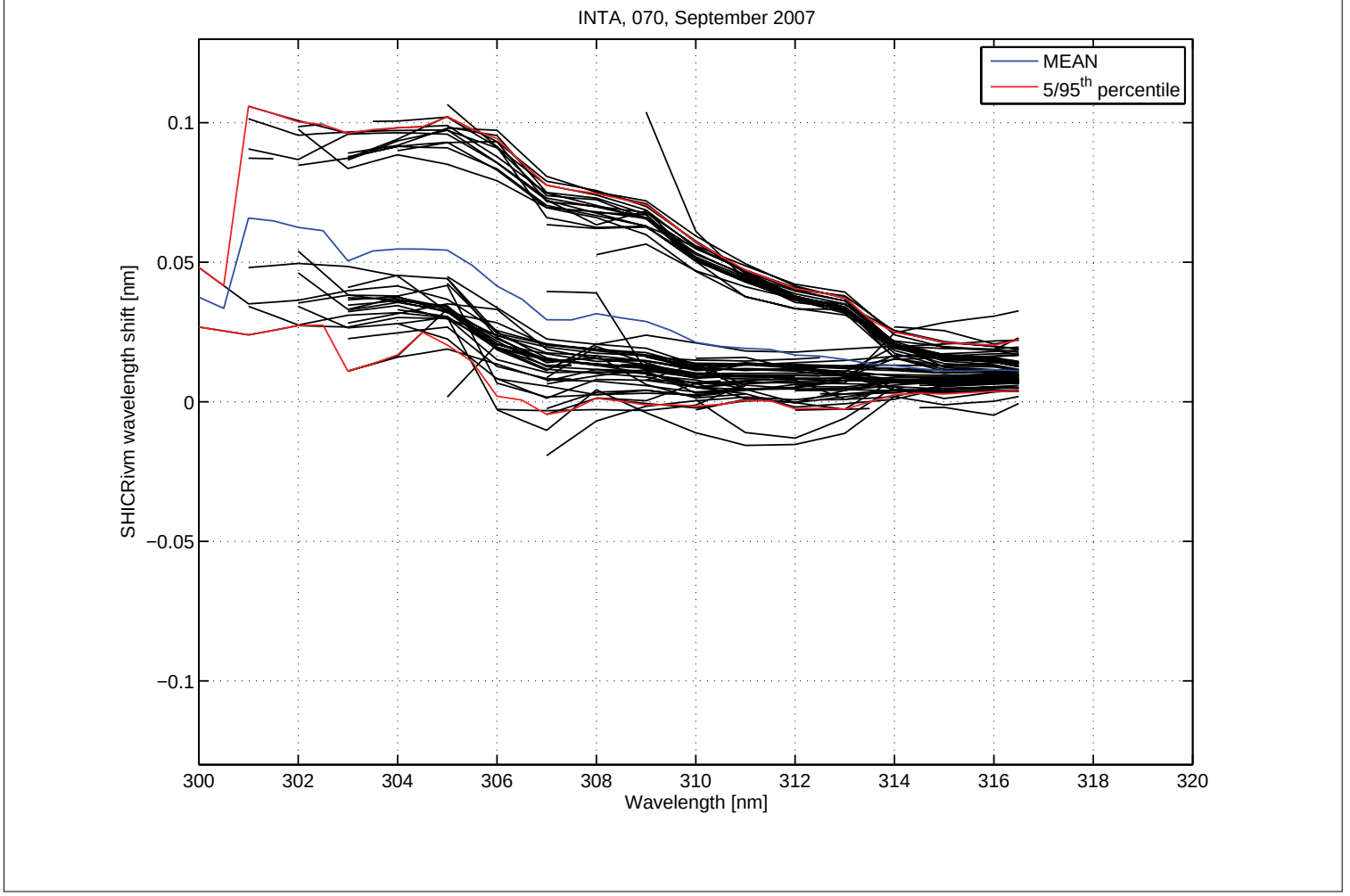
03−Oct−2007 12:37:21

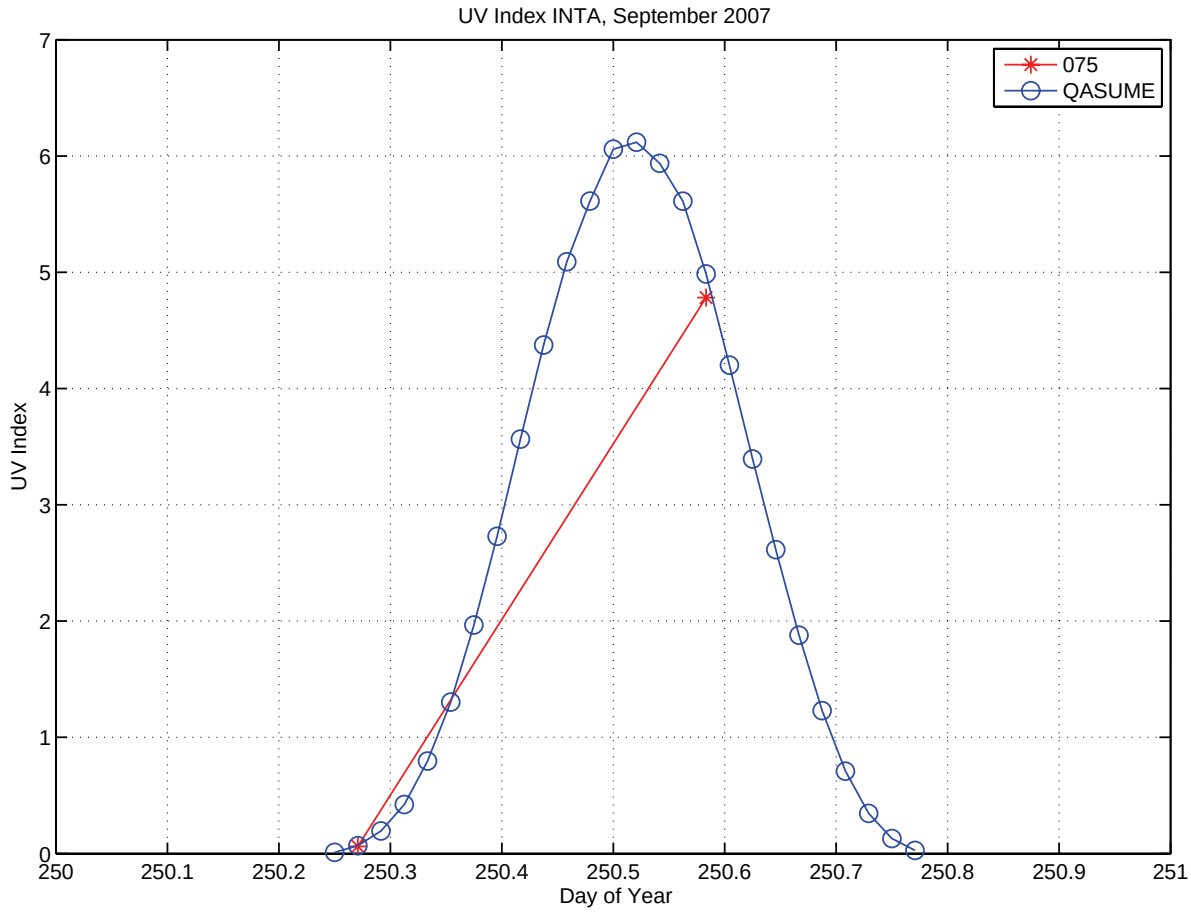


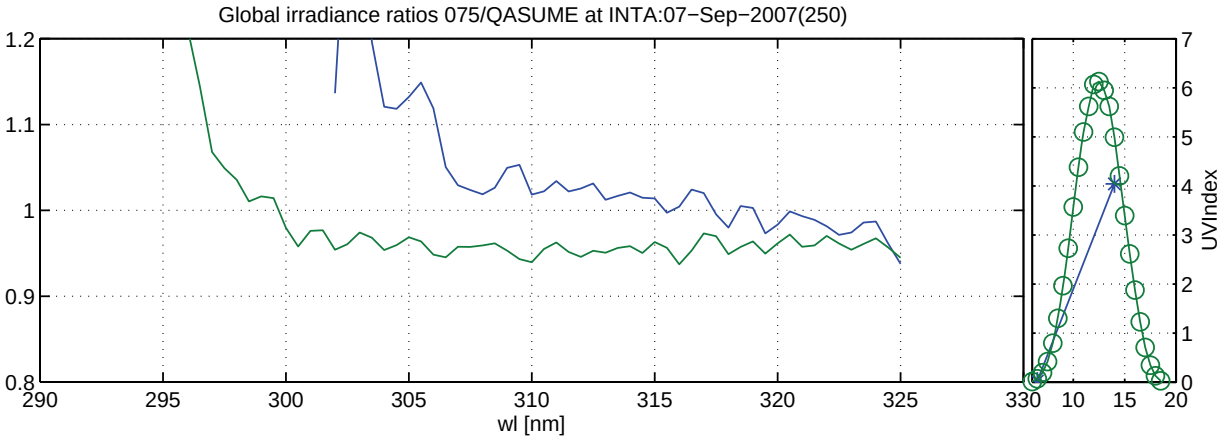


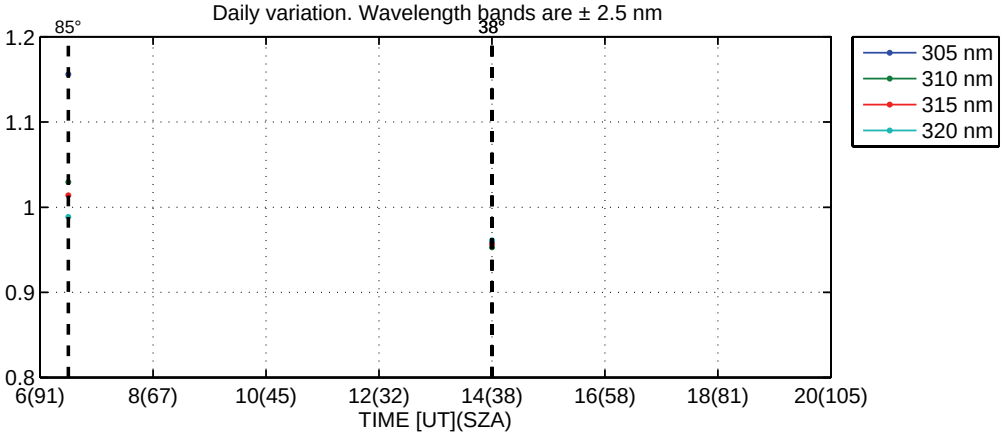
03−Oct−2007 12:37:21



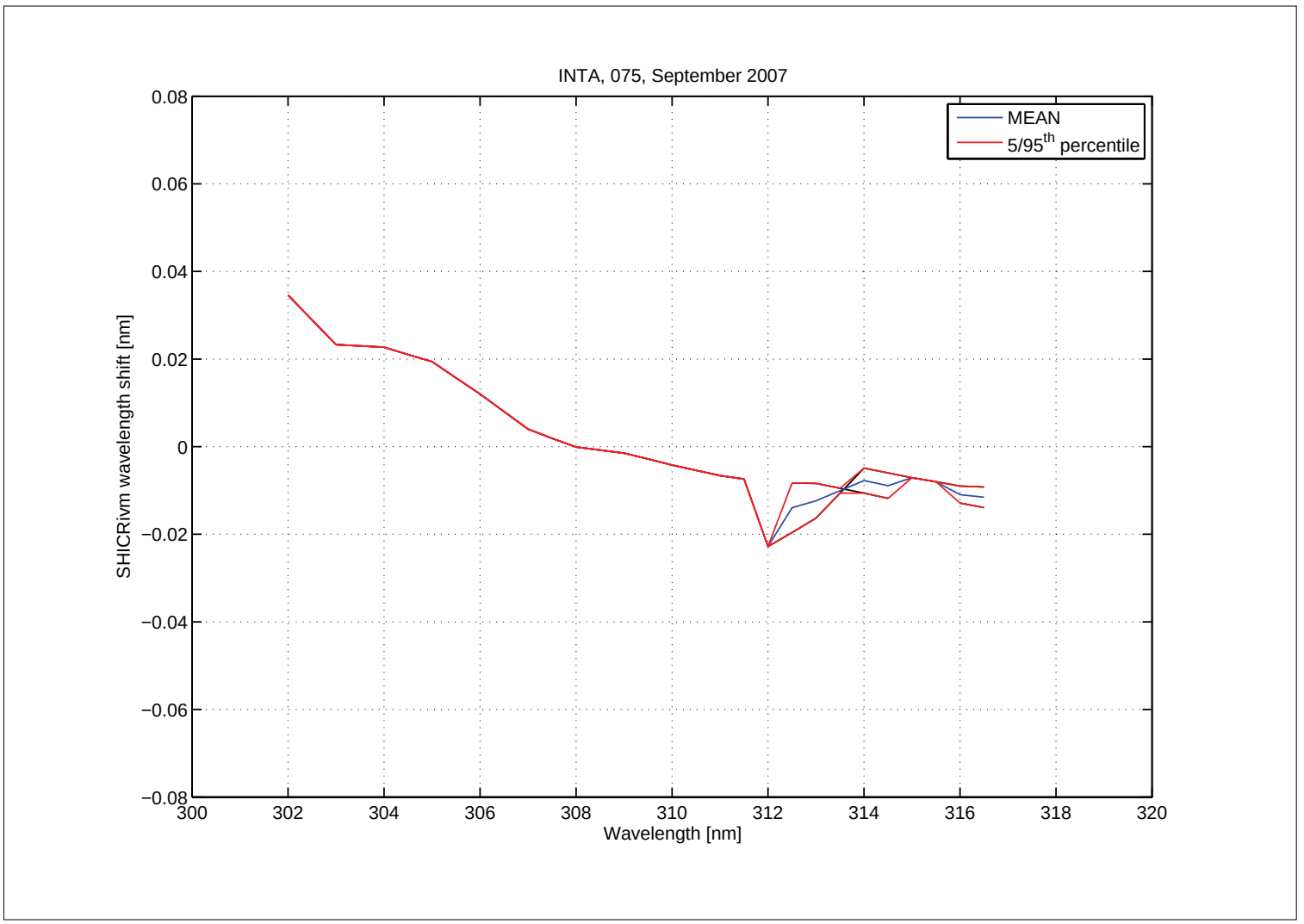

INTA, 070, September 2007
MEAN
5/95th percentile
SHICRivm wavelength shift [nm]
0.1
0.05
0
−0.05
−0.1
300
302
304
306
308
310
312
314
316
318
320
Wavelength [nm]

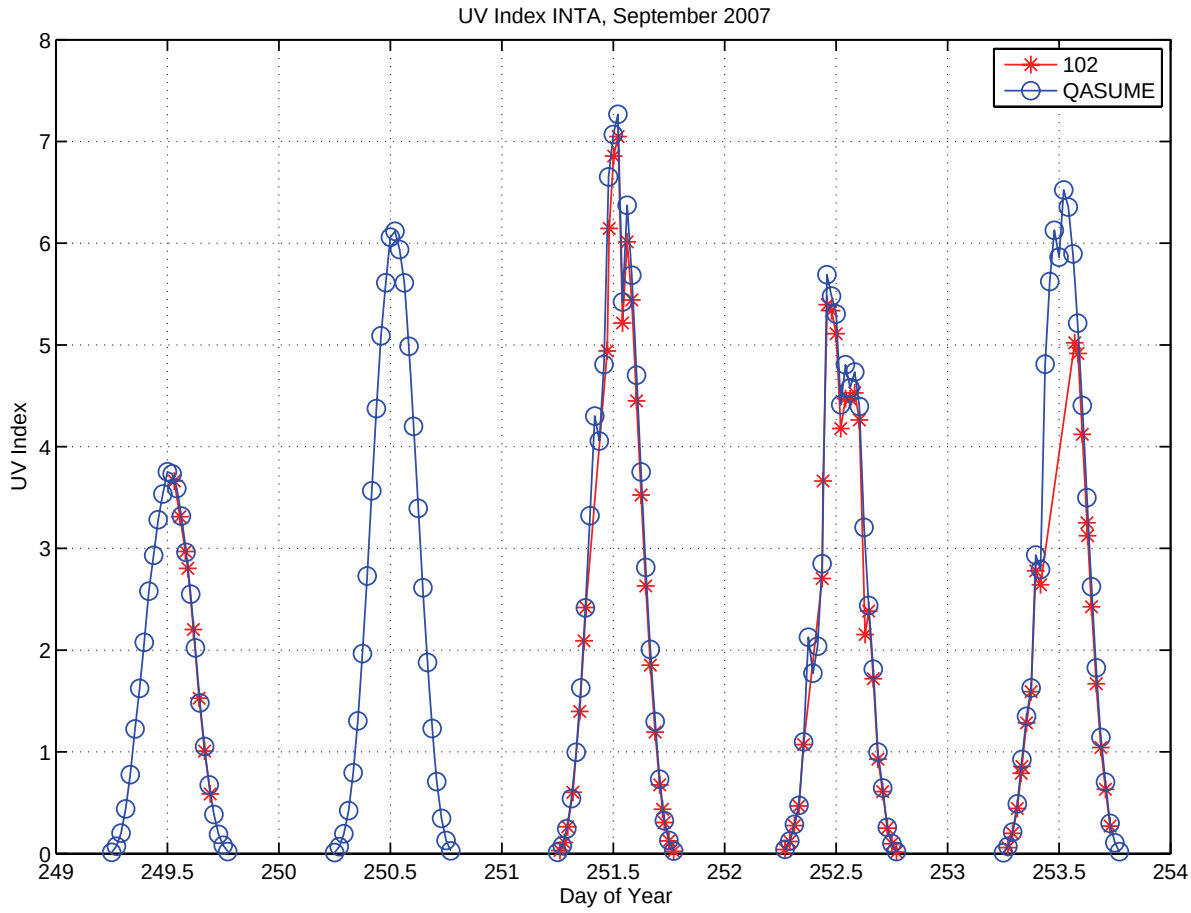


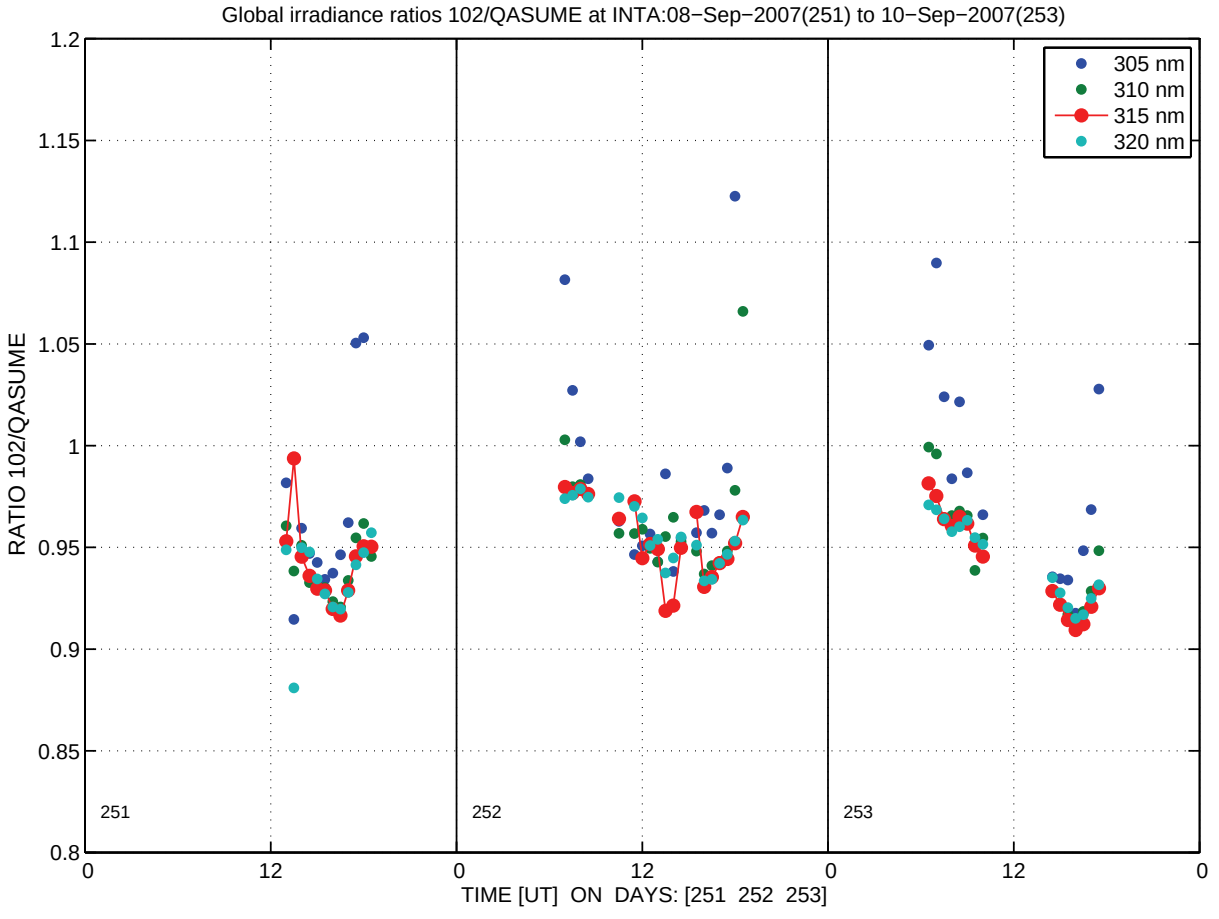


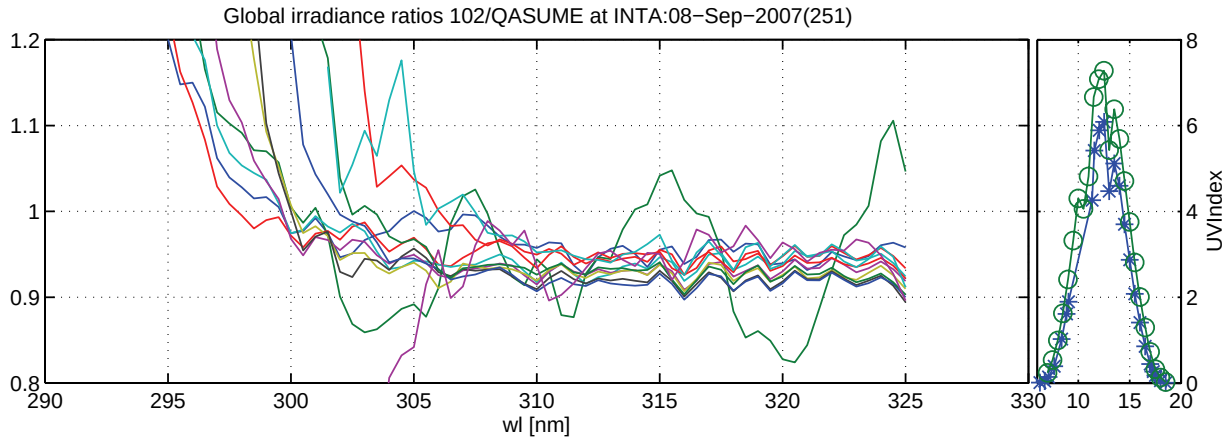


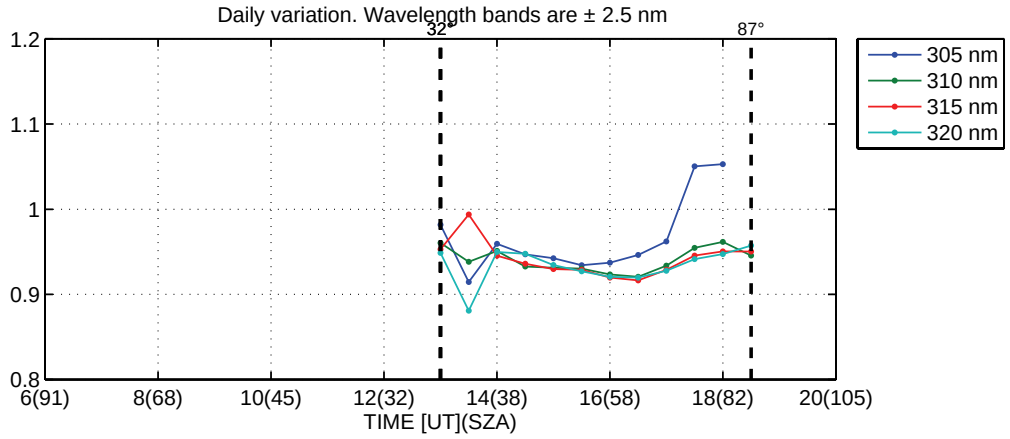
03−Oct−2007 13:27:11


INTA, 075, September 2007
MEAN
5/95th percentile
SHICRivm wavelength shift [nm]
Wavelength [nm]
0.08
0.06
0.04
0.02
0
−0.02
−0.04
−0.06
−0.08
300
302
304
306
308
310
312
314
316
318
320

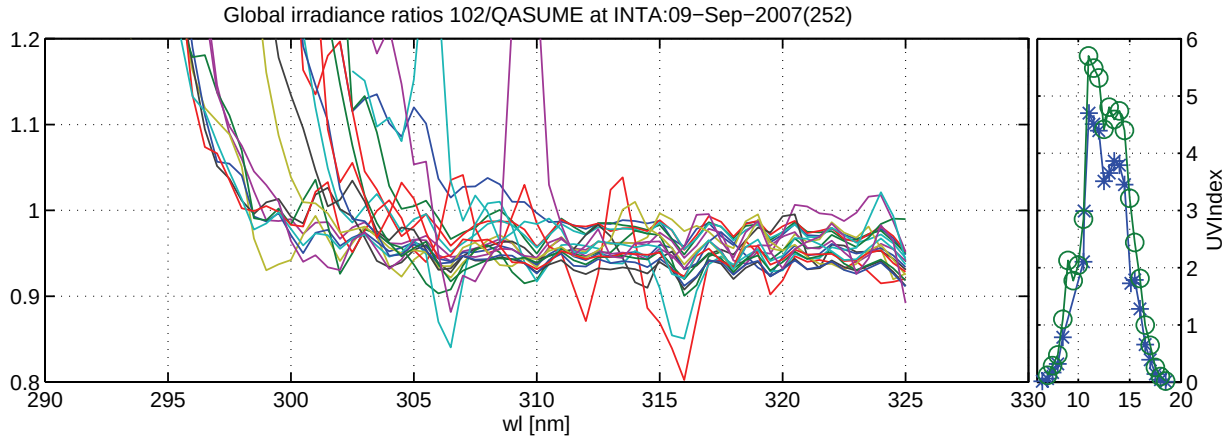

UV Index INTA, September 2007
102
QASUME
UV Index
Day of Year
0
1
2
3
4
5
6
7
8
249
249.5
250
250.5
251
251.5
252
252.5
253
253.5
254

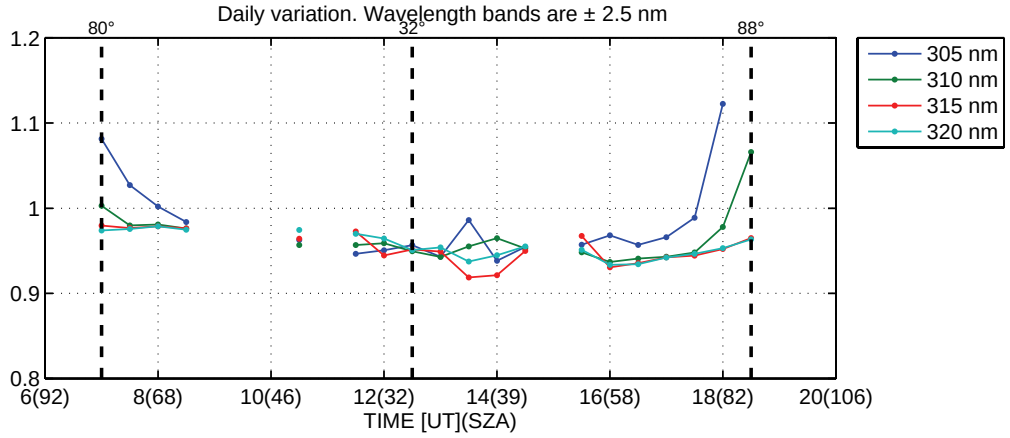

Global irradiance ratios 102/QASUME at INTA:08−Sep−2007(251) to 10−Sep−2007(253)
305 nm
310 nm
315 nm
320 nm
RATIO 102/QASUME
TIME [UT] ON DAYS: [251 252 253]
251
252
253
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
1.2
0
12
0
12
0
12
0
29−Oct−2007 10:46:14



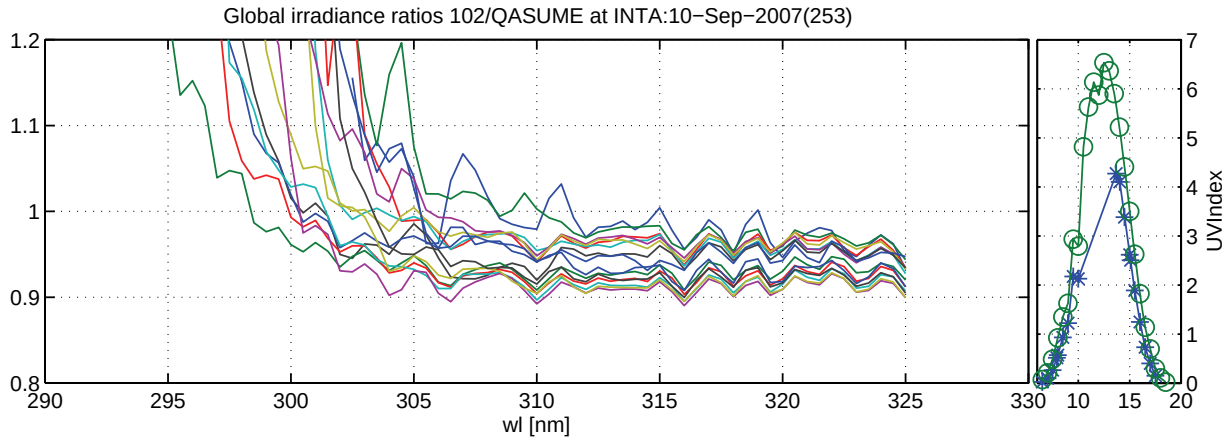


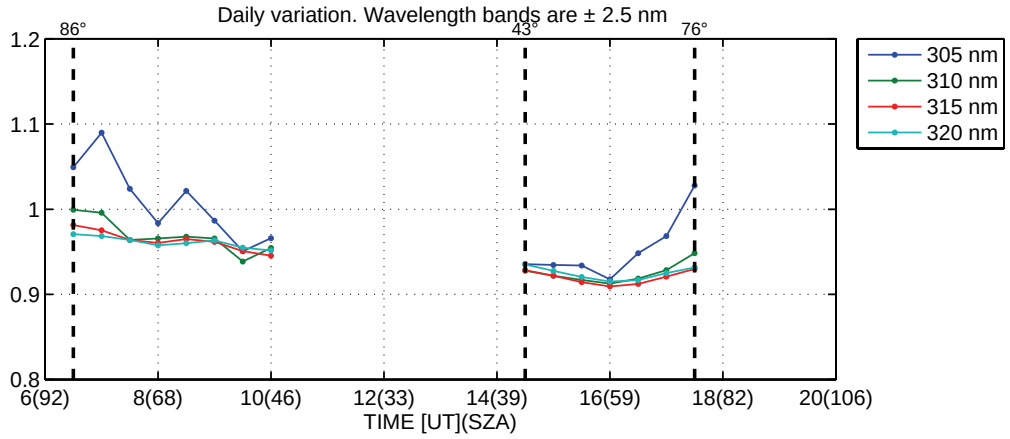
29−Oct−2007 10:46:14



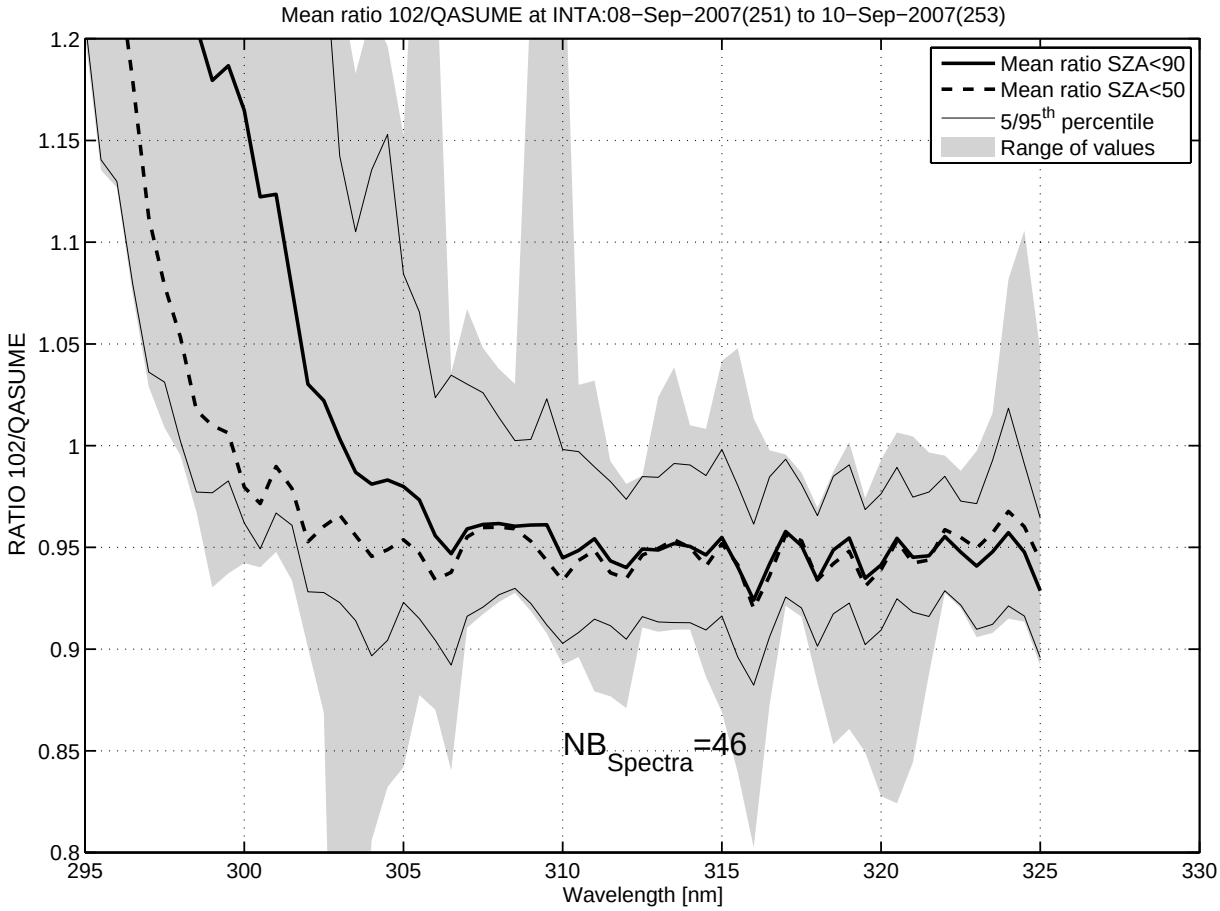


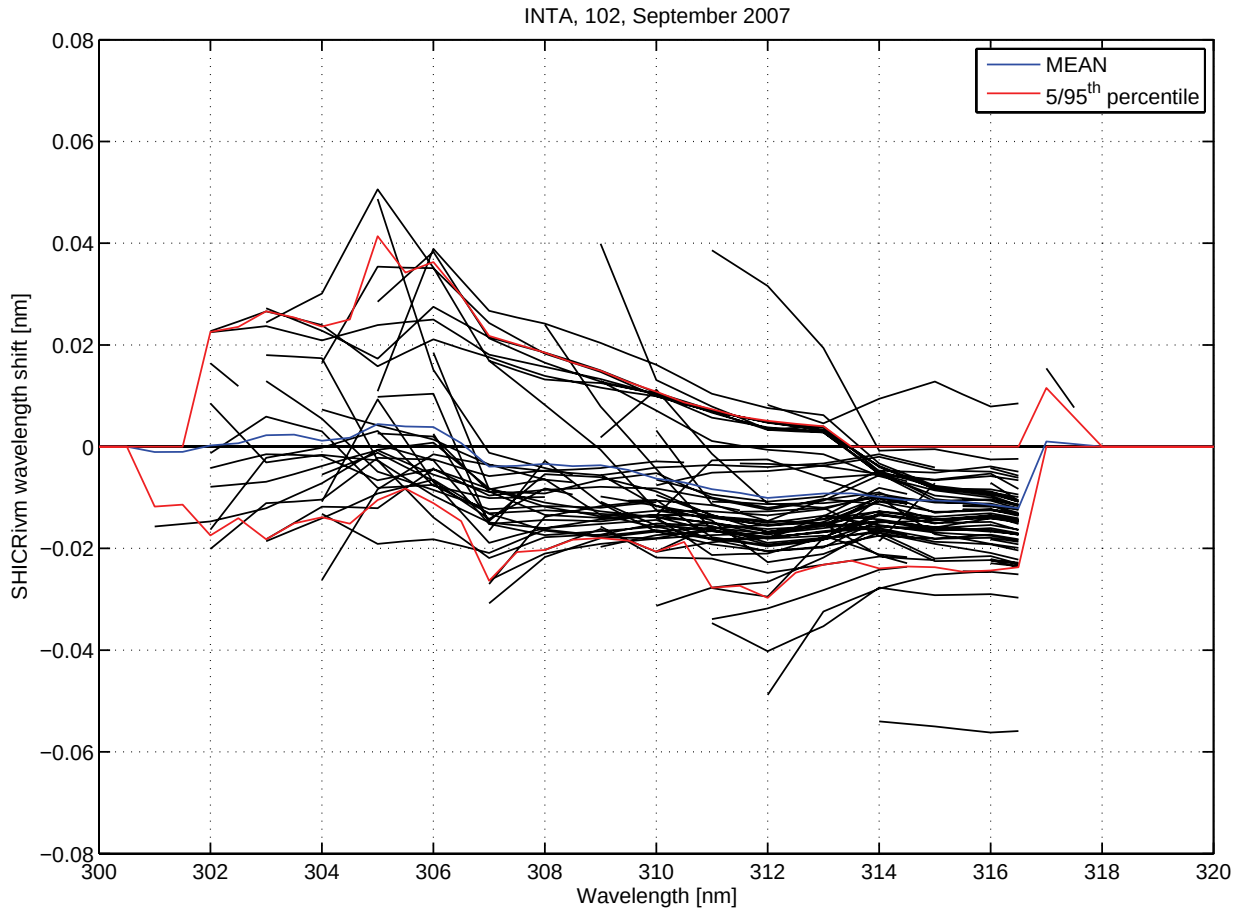
29−Oct−2007 10:46:14

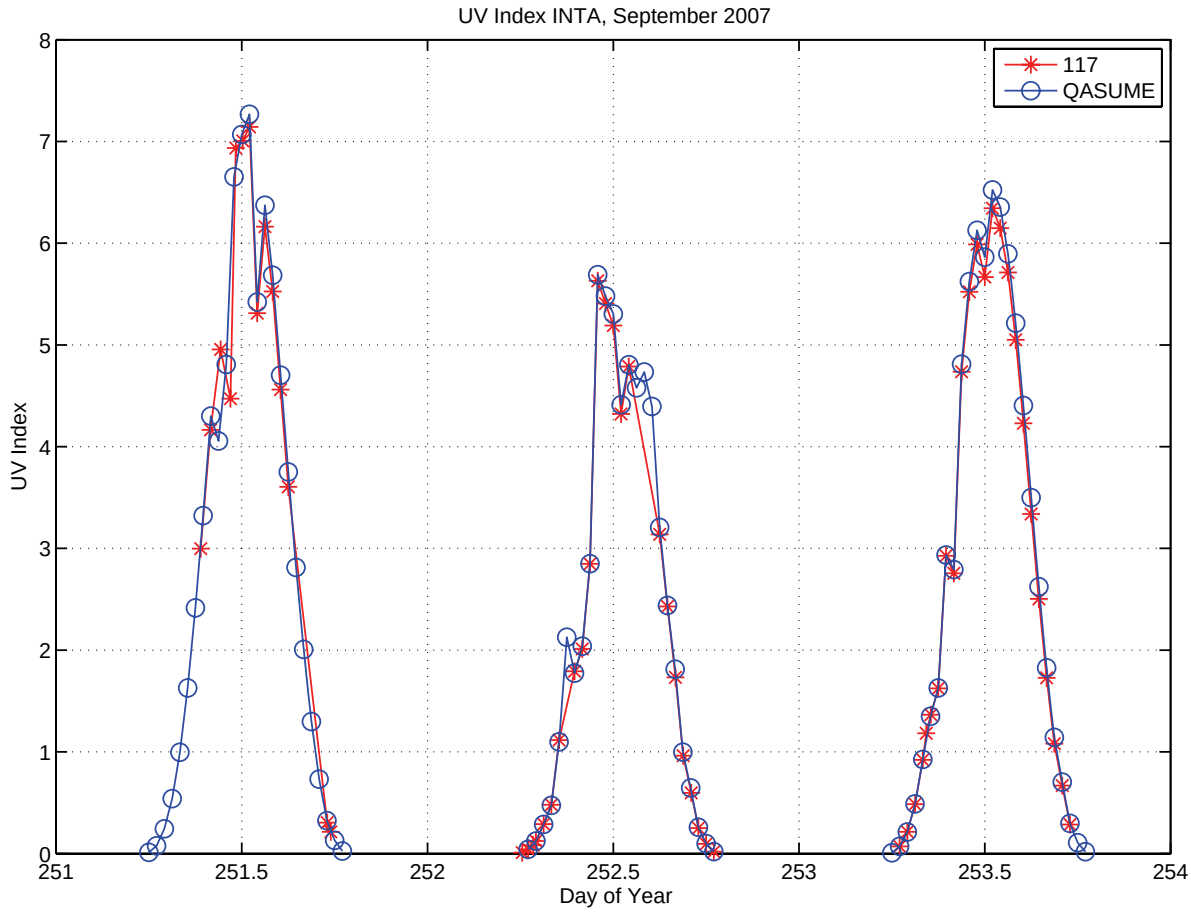


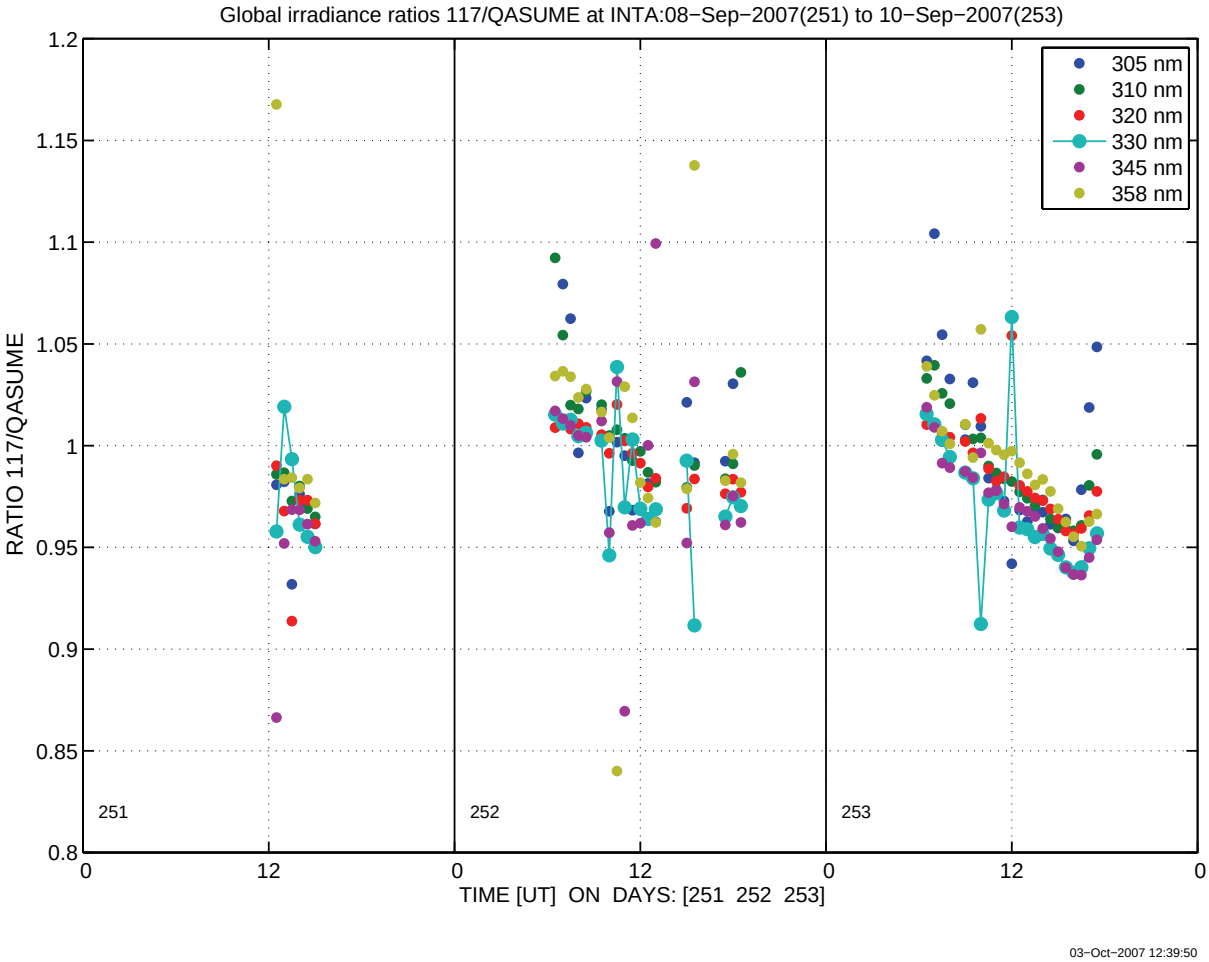


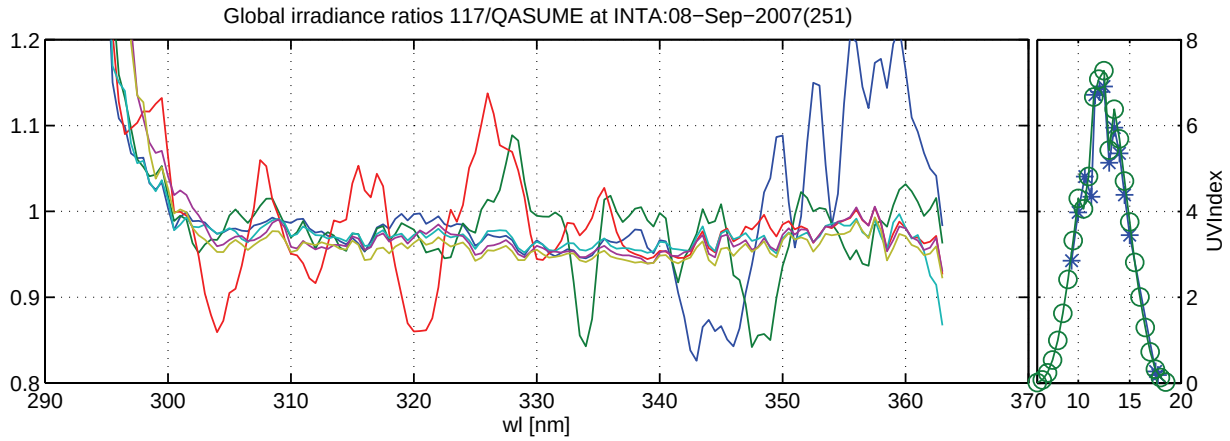
29−Oct−2007 10:46:14

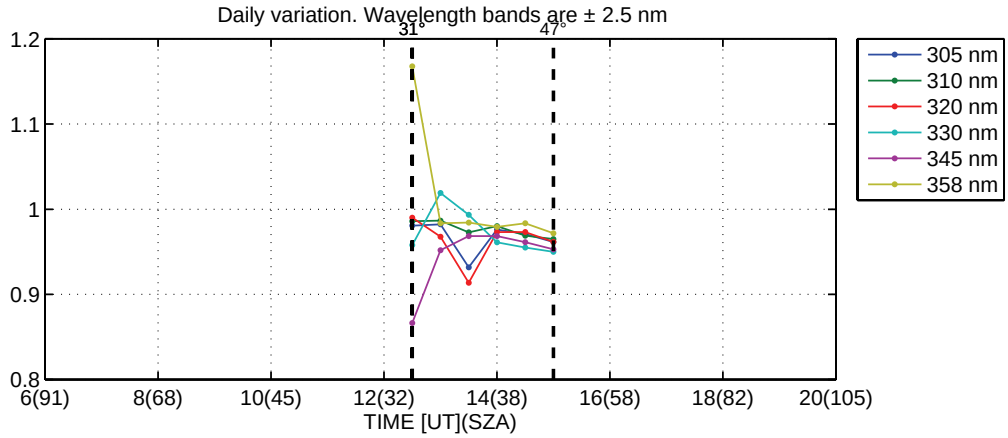



INTA, 102, September 2007
MEAN
5/95th percentile
SHICRivm wavelength shift [nm]
Wavelength [nm]
0.08
0.06
0.04
0.02
0
−0.02
−0.04
−0.06
−0.08
300
302
304
306
308
310
312
314
316
318
320

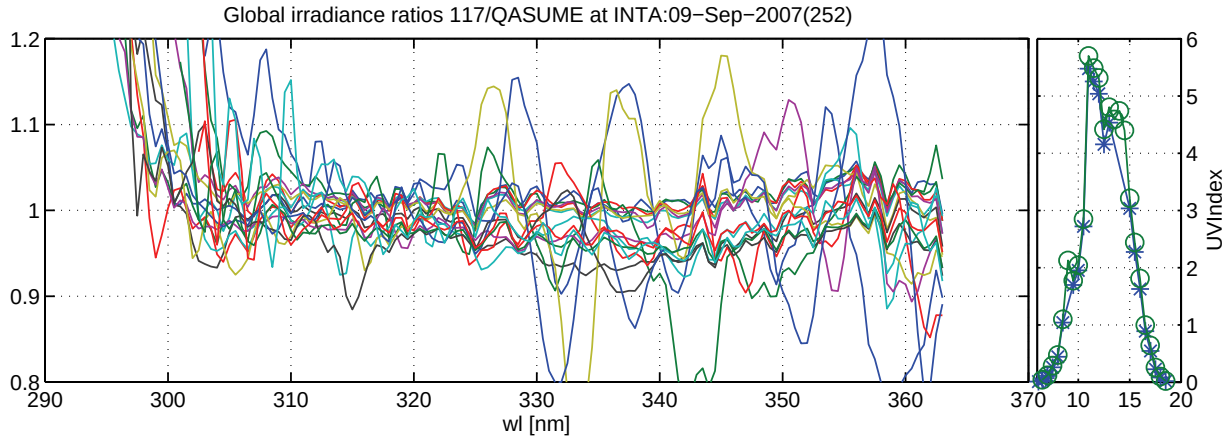

UV Index INTA, September 2007
117
QASUME
UV Index
Day of Year
0
1
2
3
4
5
6
7
8
251
251.5
252
252.5
253
253.5
254

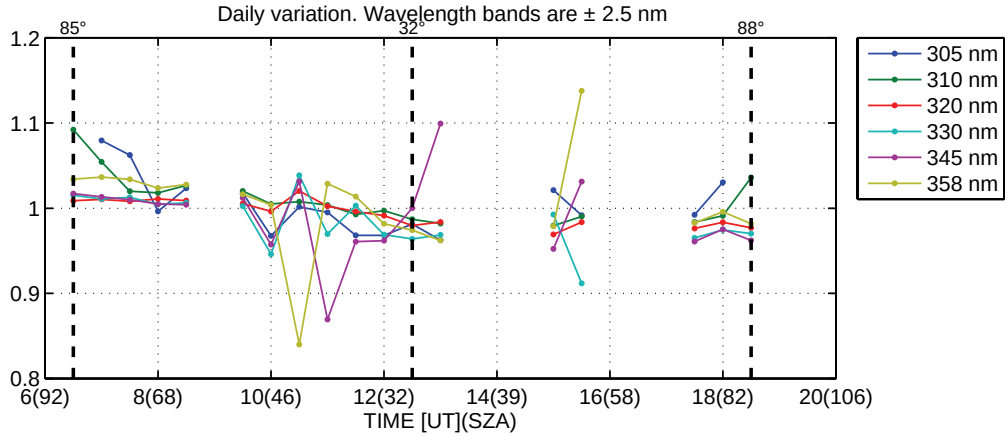

Global irradiance ratios 117/QASUME at INTA:08−Sep−2007(251) to 10−Sep−2007(253)
305 nm
310 nm
320 nm
330 nm
345 nm
358 nm
RATIO 117/QASUME
TIME [UT] ON DAYS: [251 252 253]
251
252
253
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
1.2
0
12
03−Oct−2007 12:39:50



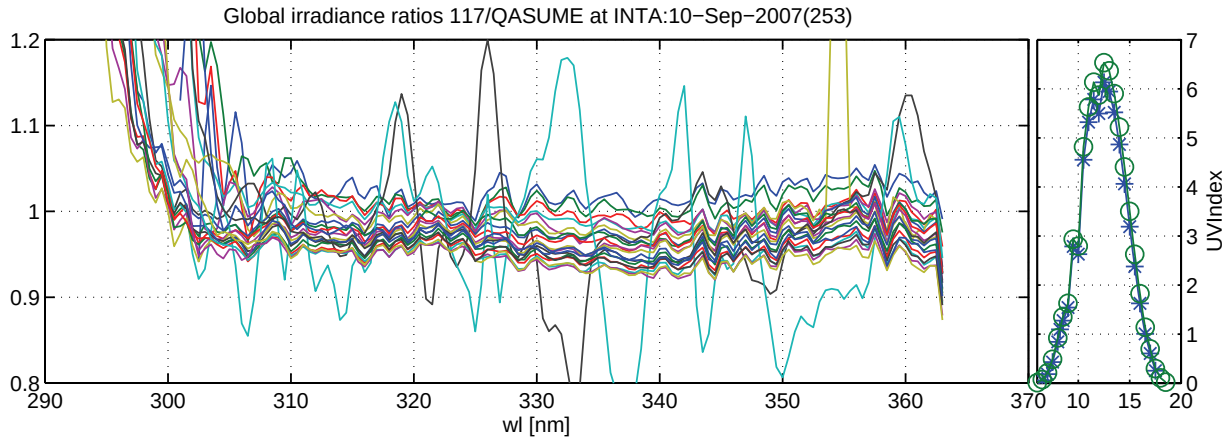


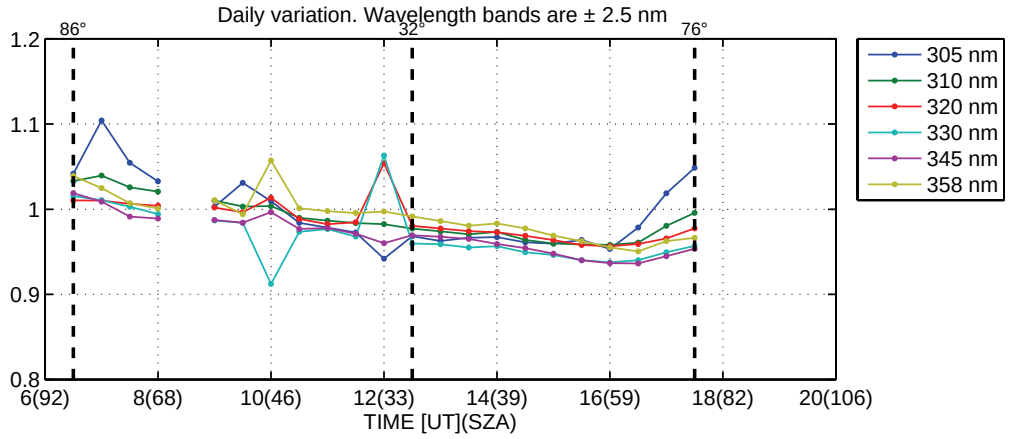
03−Oct−2007 12:39:50



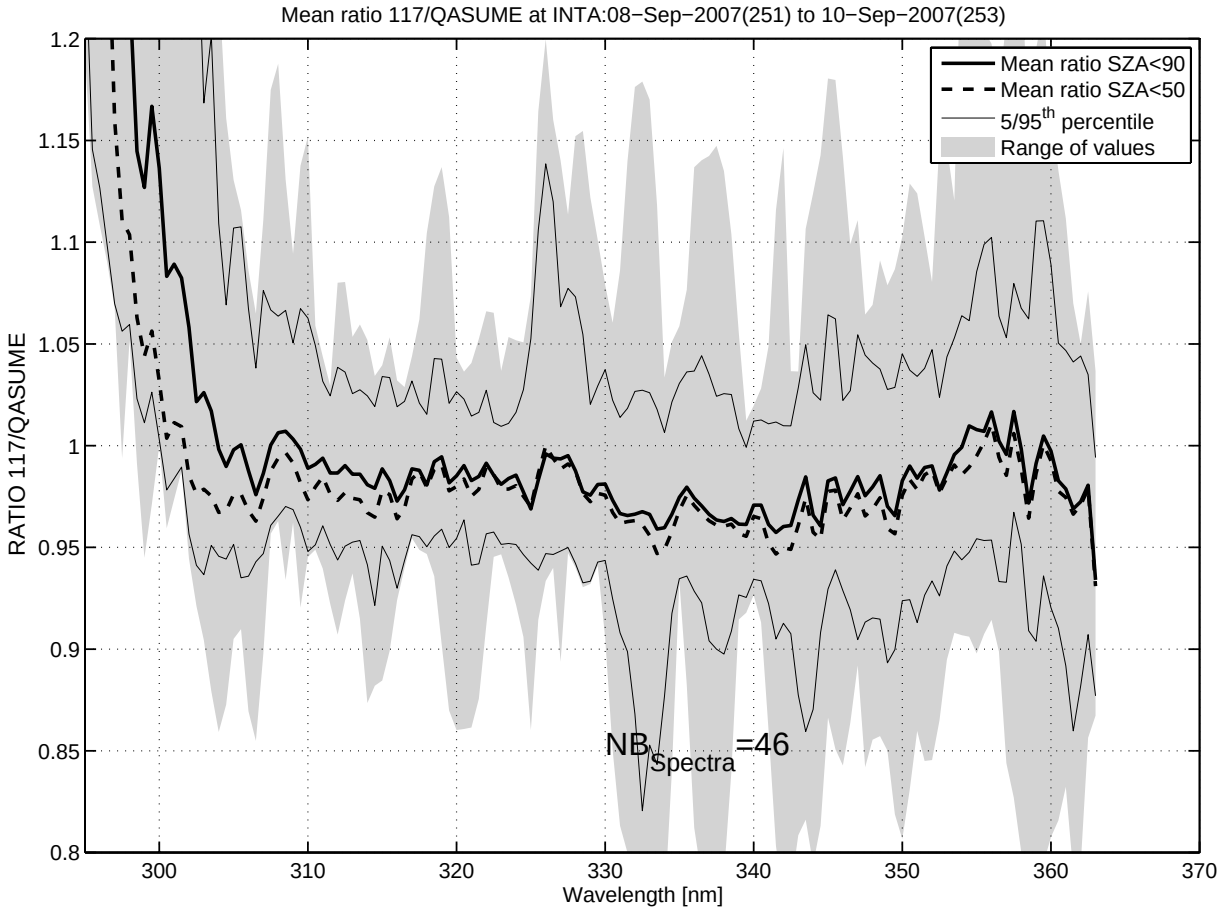


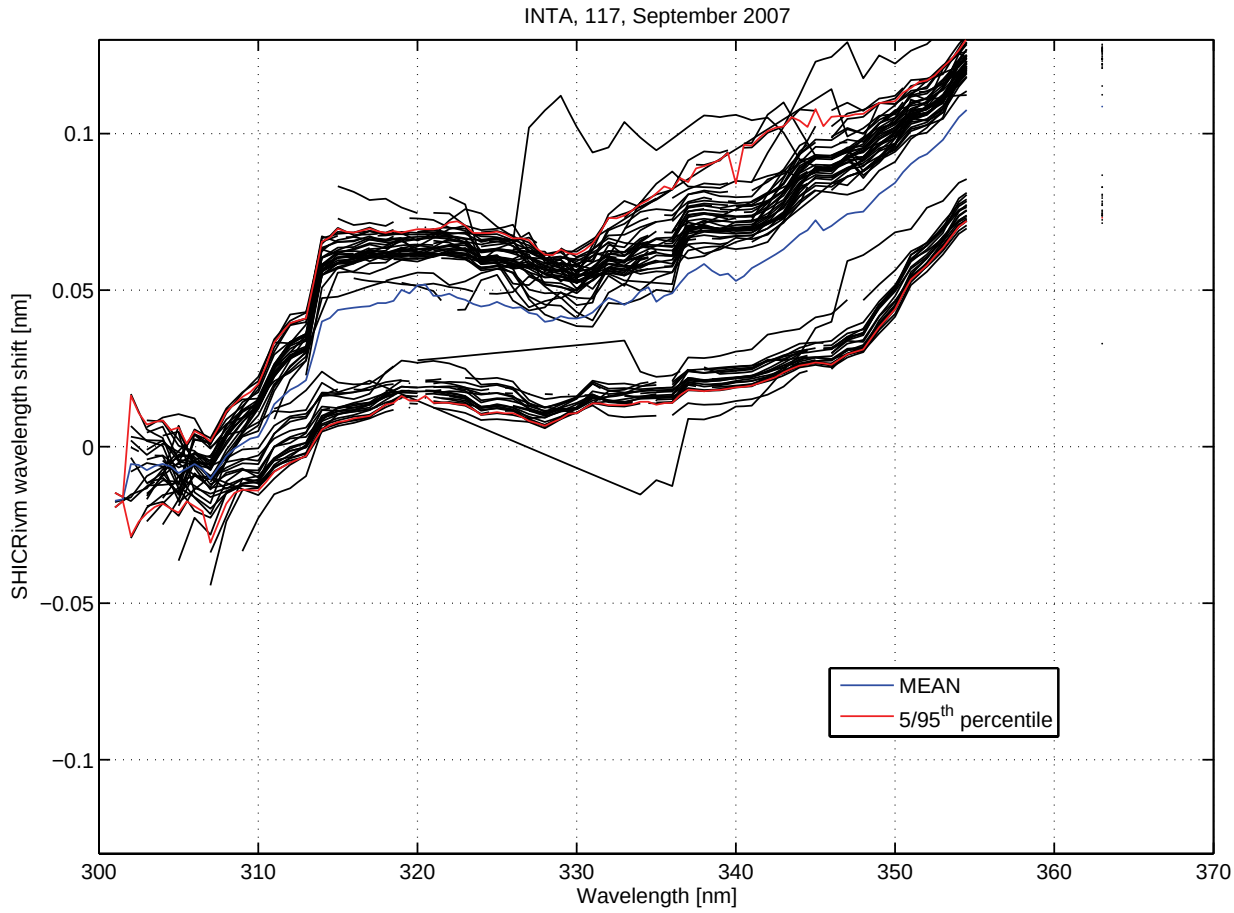
03−Oct−2007 12:39:50

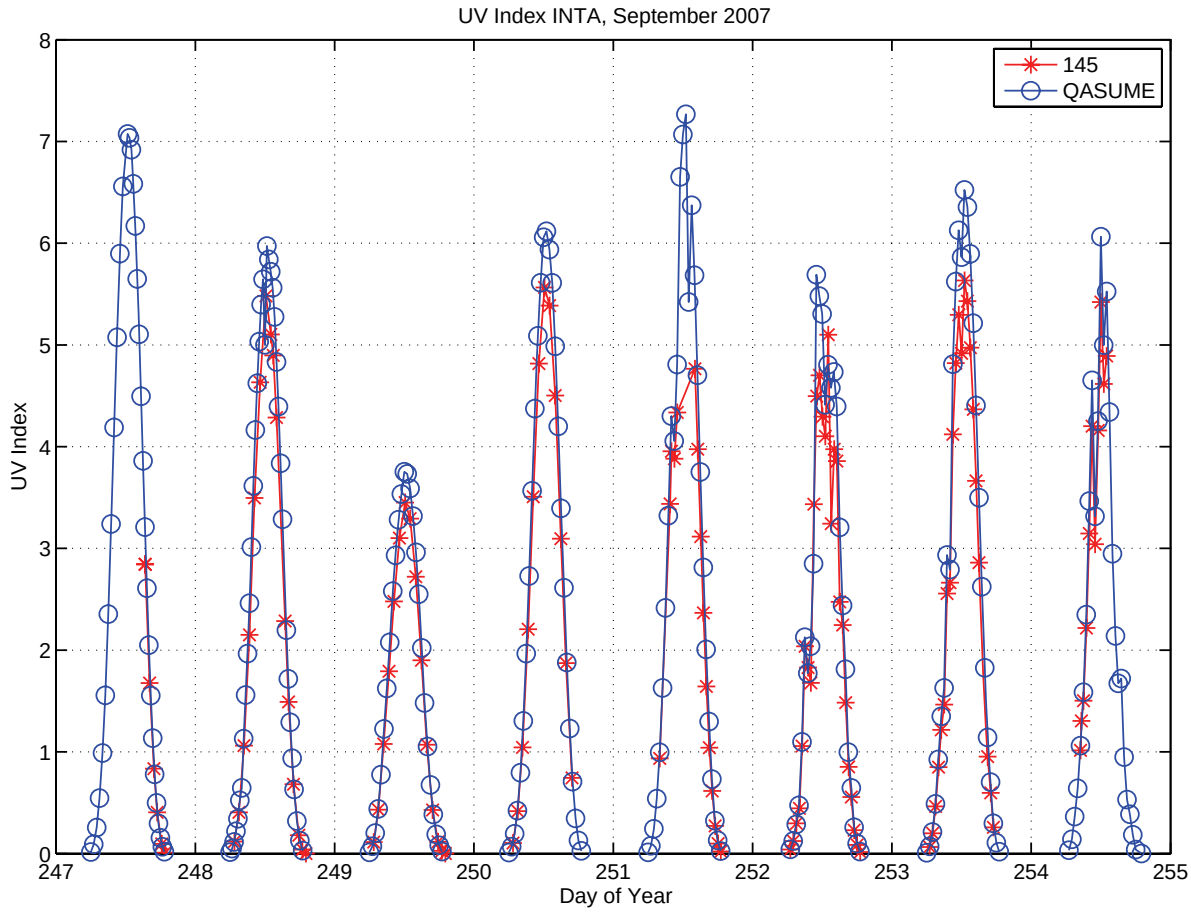


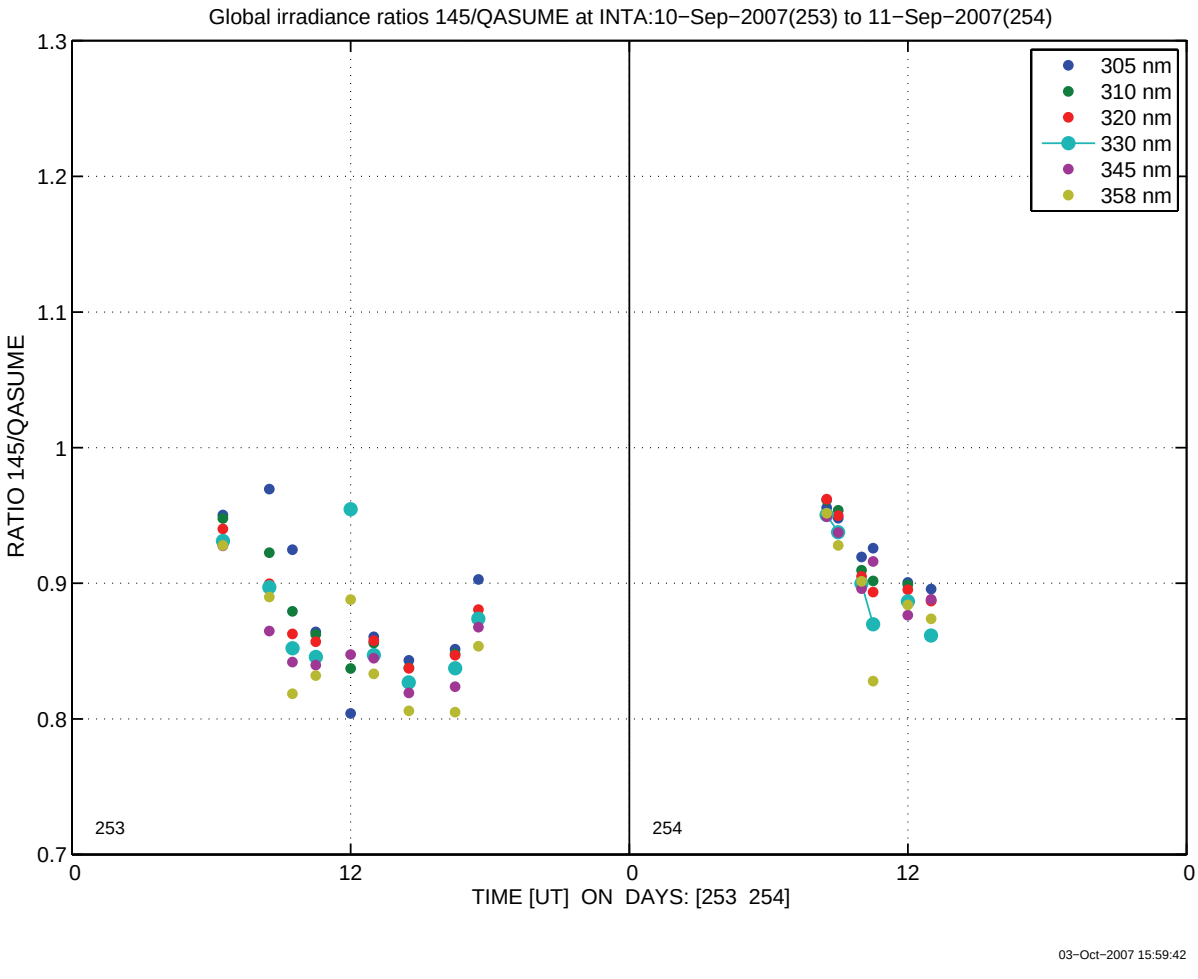


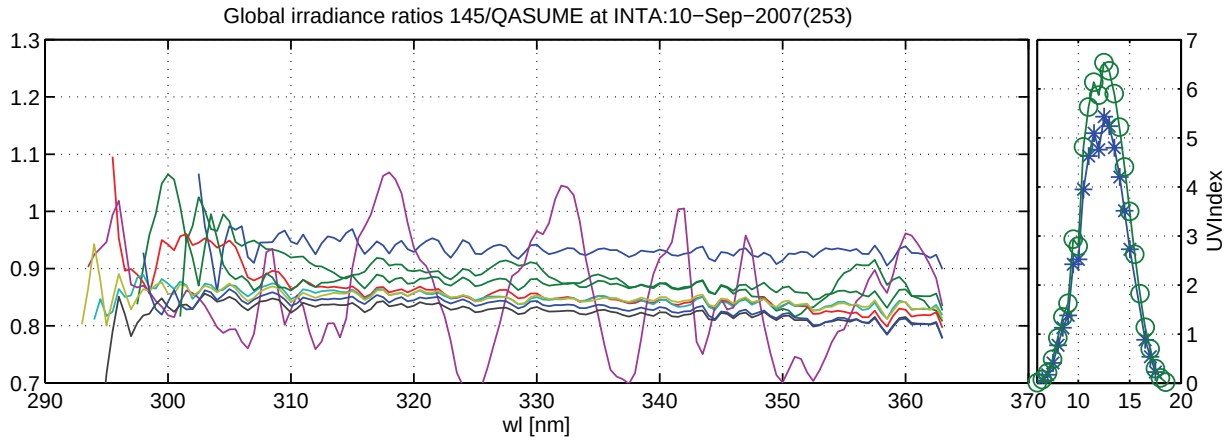
03−Oct−2007 12:39:50

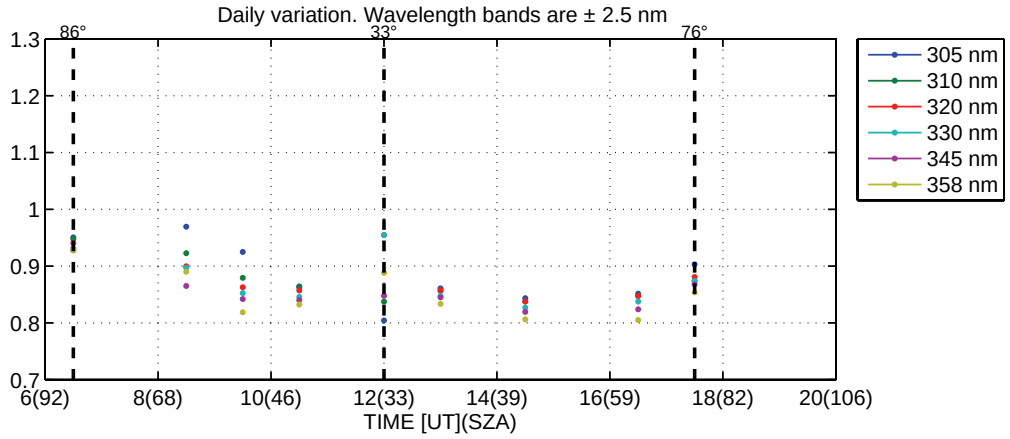



INTA, 117, September 2007
SHICRivm wavelength shift [nm]
0.1
0.05
0
−0.05
−0.1
300
310
320
330
340
350
360
370
Wavelength [nm]
MEAN
5/95th percentile

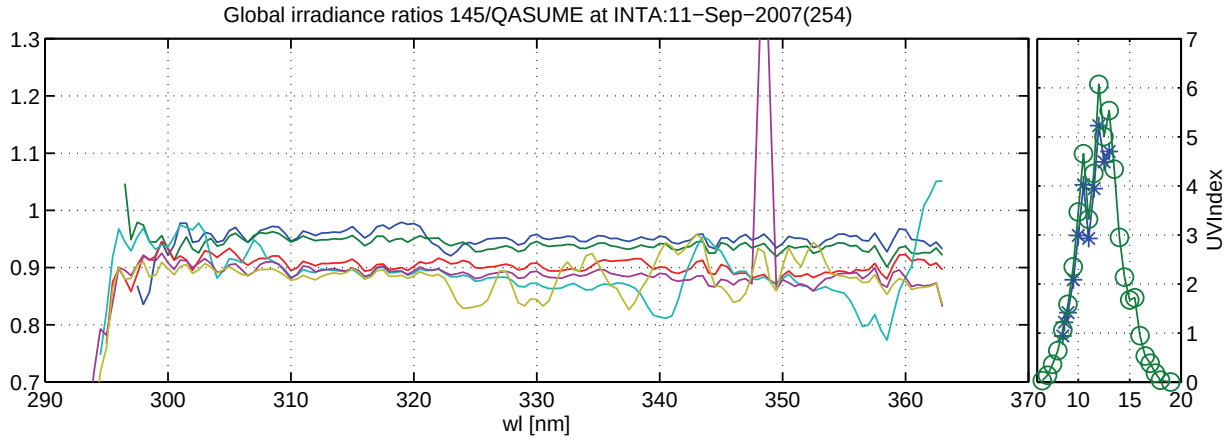

UV Index INTA, September 2007
145
QASUME
UV Index
Day of Year
0
1
2
3
4
5
6
7
8
247
248
249
250
251
252
253
254
255

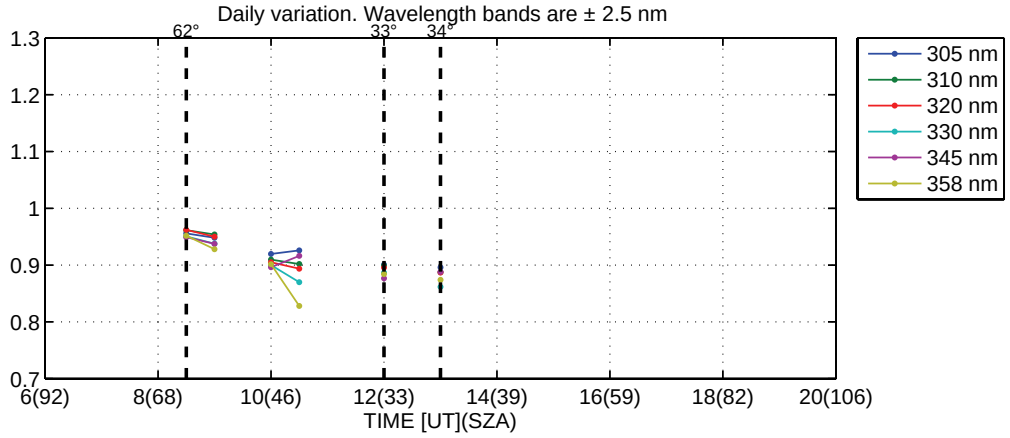

Global irradiance ratios 145/QASUME at INTA:10−Sep−2007(253) to 11−Sep−2007(254)
305 nm
310 nm
320 nm
330 nm
345 nm
358 nm
RATIO 145/QASUME
TIME [UT] ON DAYS: [253 254]
253
254
0.7
0.8
0.9
1
1.1
1.2
1.3
0
12
0
12
0
03−Oct−2007 15:59:42



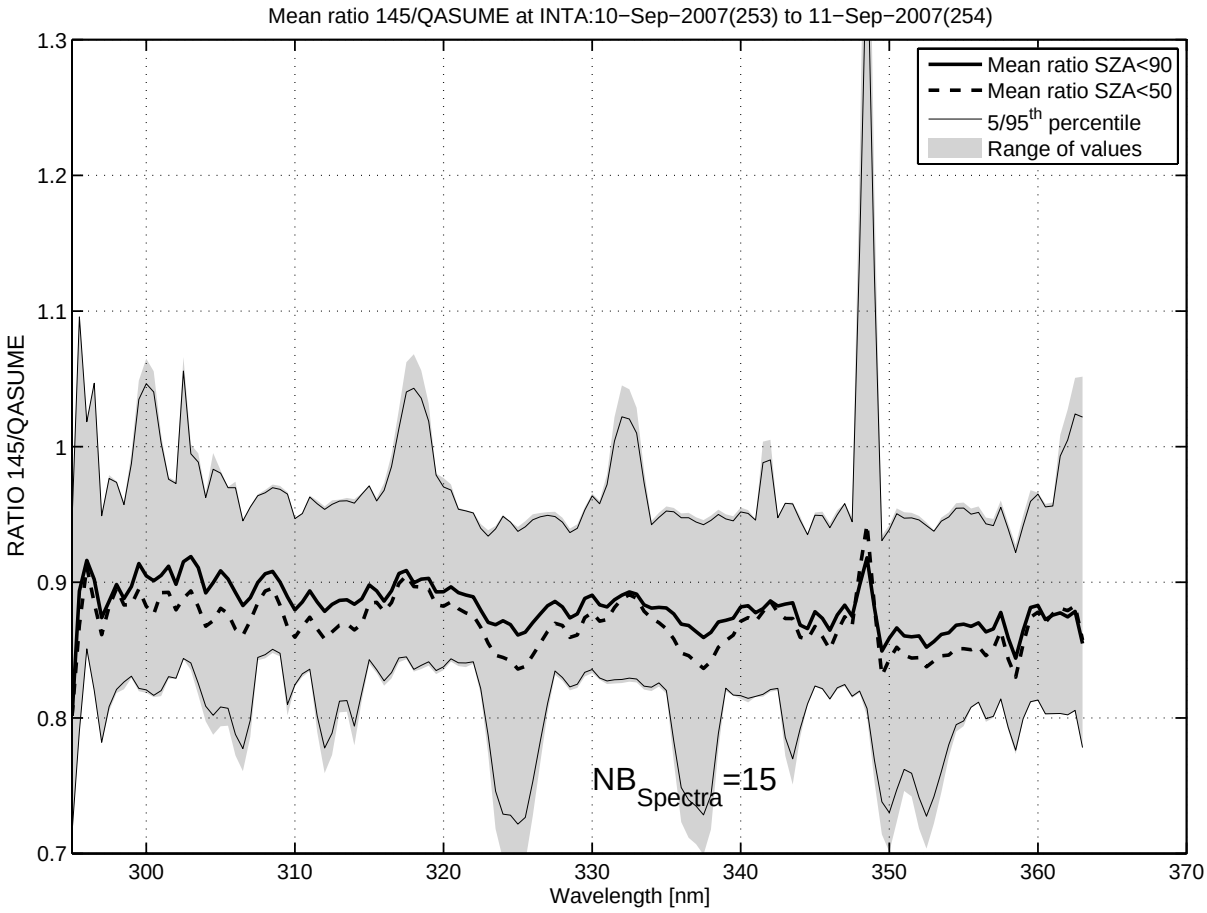


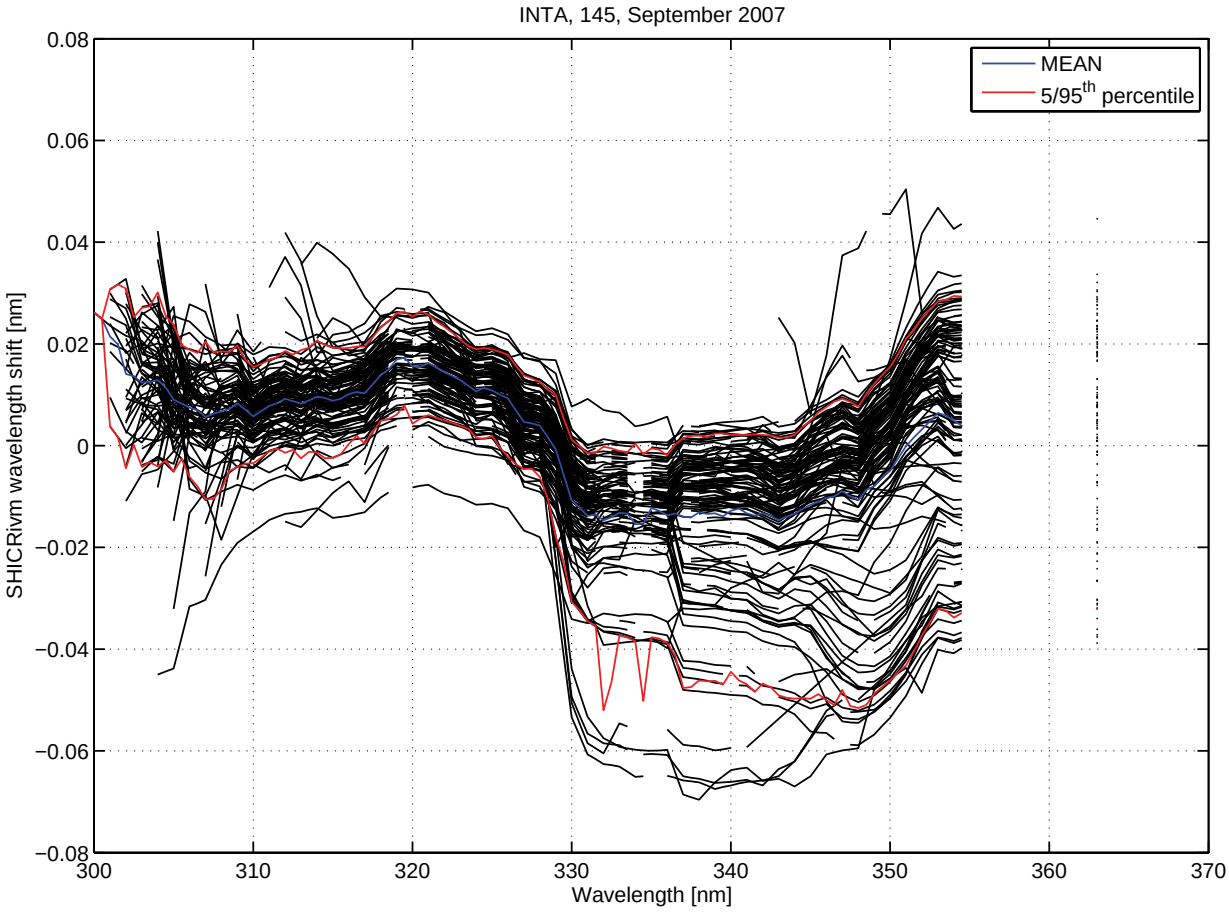
03−Oct−2007 15:59:42

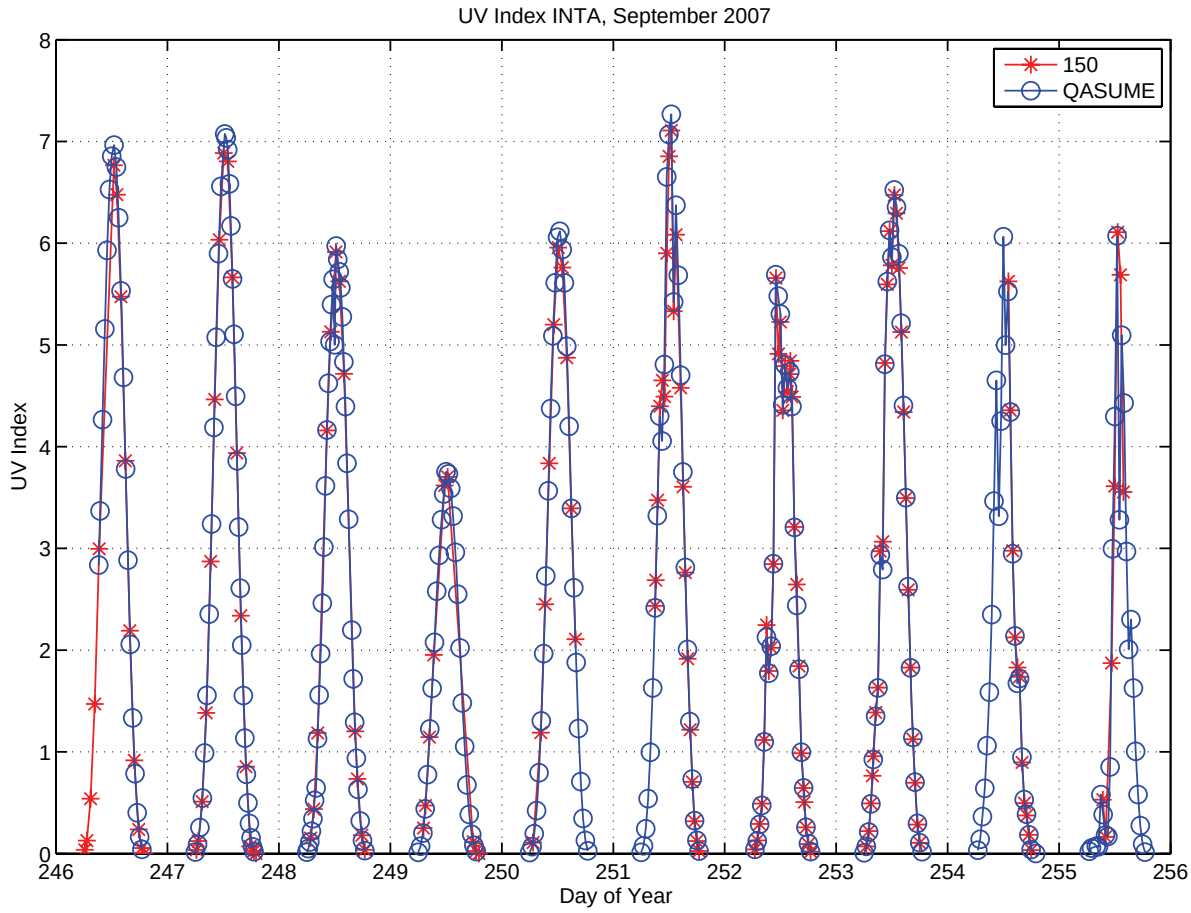


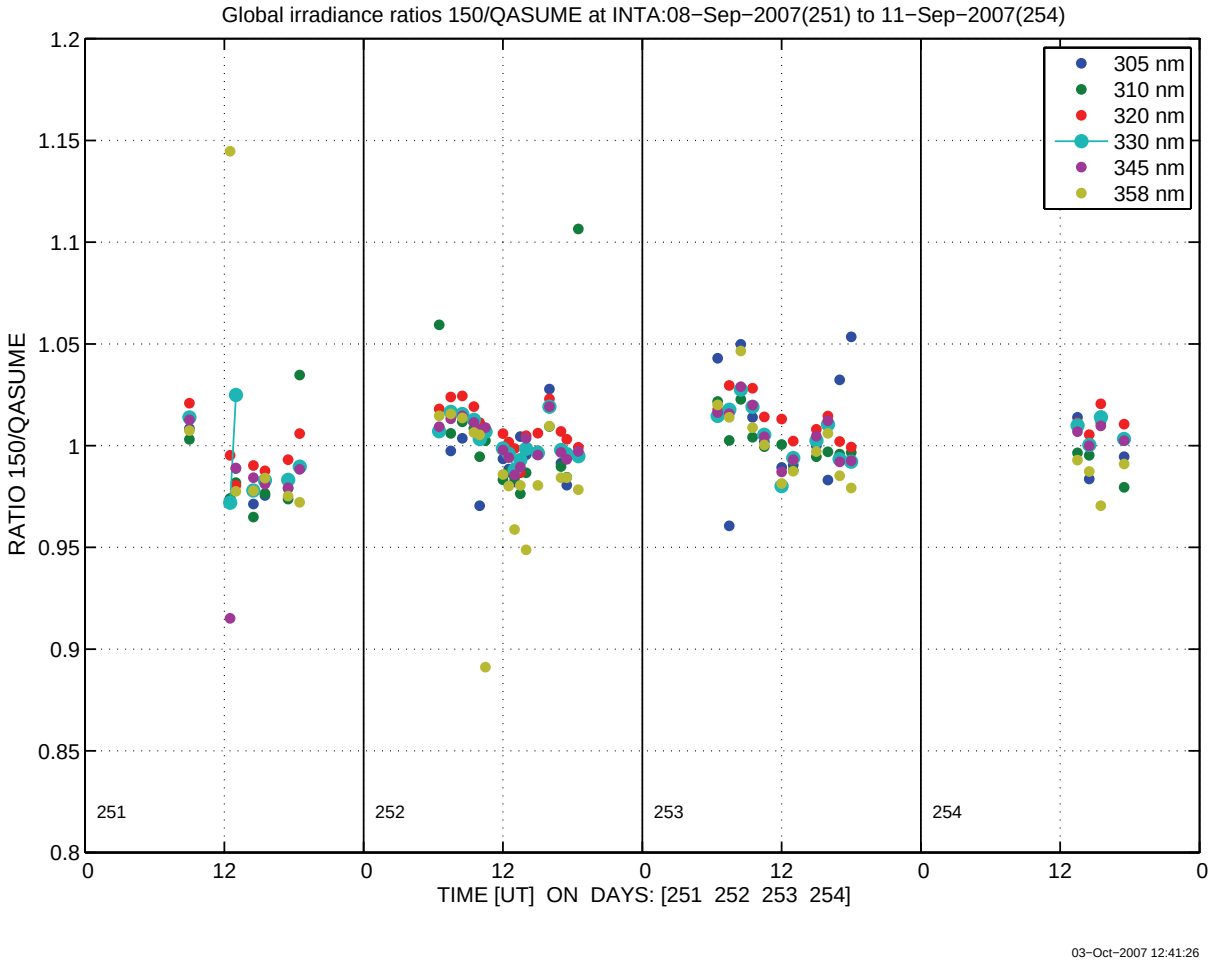


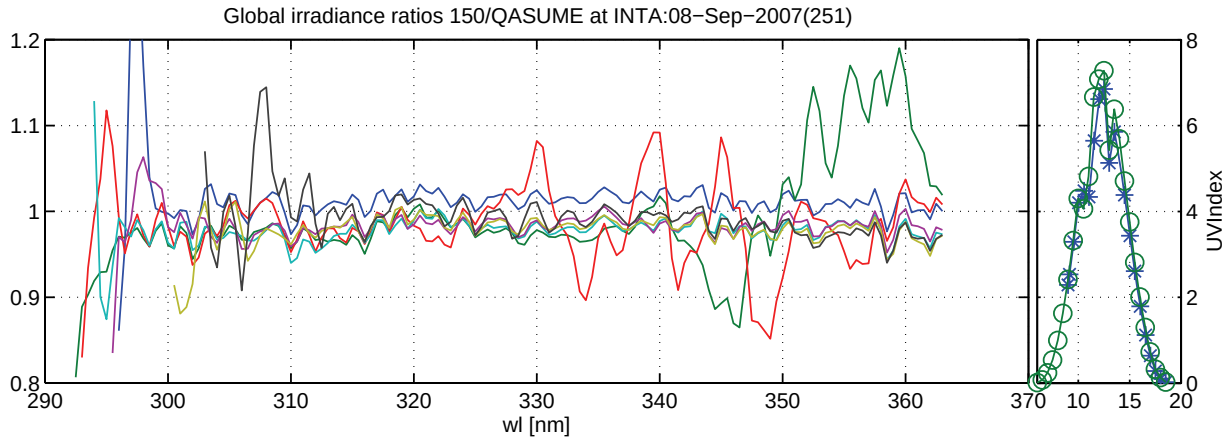
03−Oct−2007 15:59:42

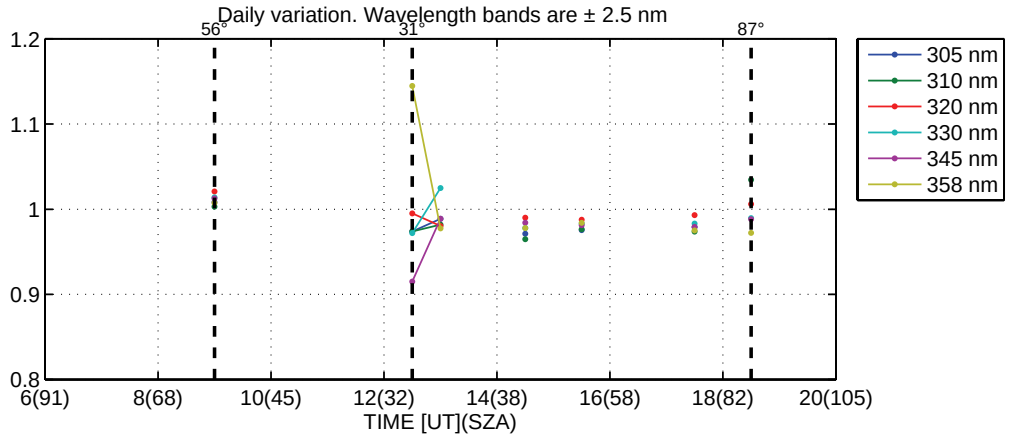

Mean ratio 145/QASUME at INTA:10−Sep−2007(253) to 11−Sep−2007(254)
Mean ratio SZA<90
Mean ratio SZA<50
5/95th percentile
Range of values
RATIO 145/QASUME
NBSpectra=15
Wavelength [nm]


INTA, 145, September 2007
MEAN
5/95th percentile
SHICRivm wavelength shift [nm]
Wavelength [nm]

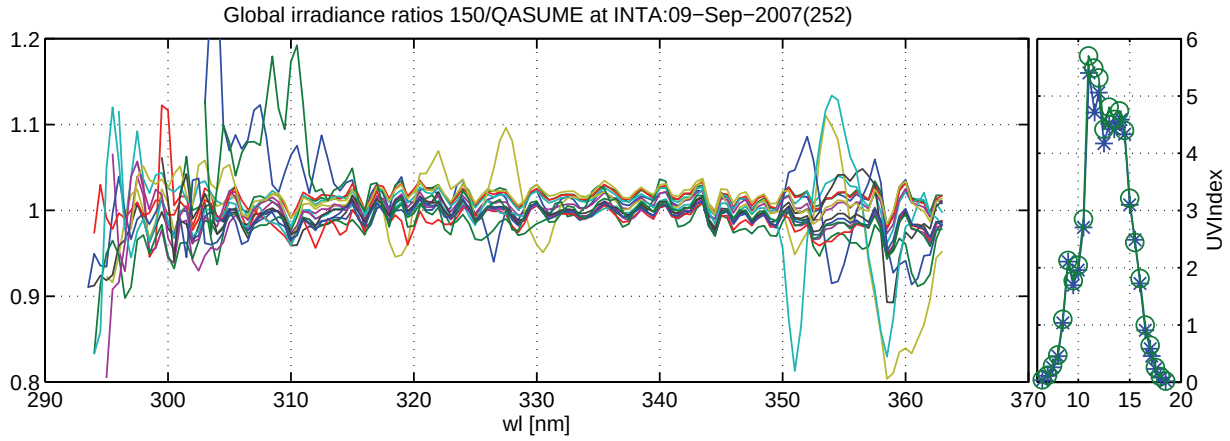

UV Index INTA, September 2007
150
QASUME
UV Index
Day of Year
0
1
2
3
4
5
6
7
8
246
247
248
249
250
251
252
253
254
255
256

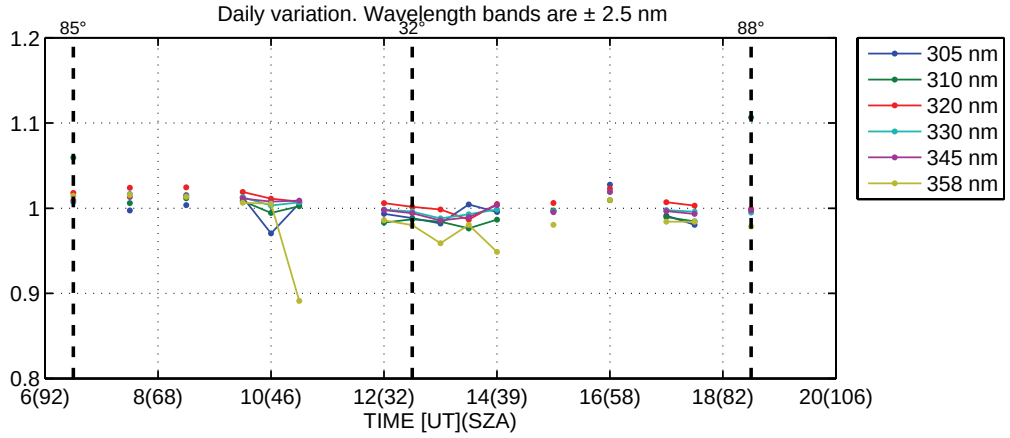

Global irradiance ratios 150/QASUME at INTA:08−Sep−2007(251) to 11−Sep−2007(254)
305 nm
310 nm
320 nm
330 nm
345 nm
358 nm
RATIO 150/QASUME
TIME [UT] ON DAYS: [251 252 253 254]
251
252
253
254
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
1.2
0
12
03−Oct−2007 12:41:26



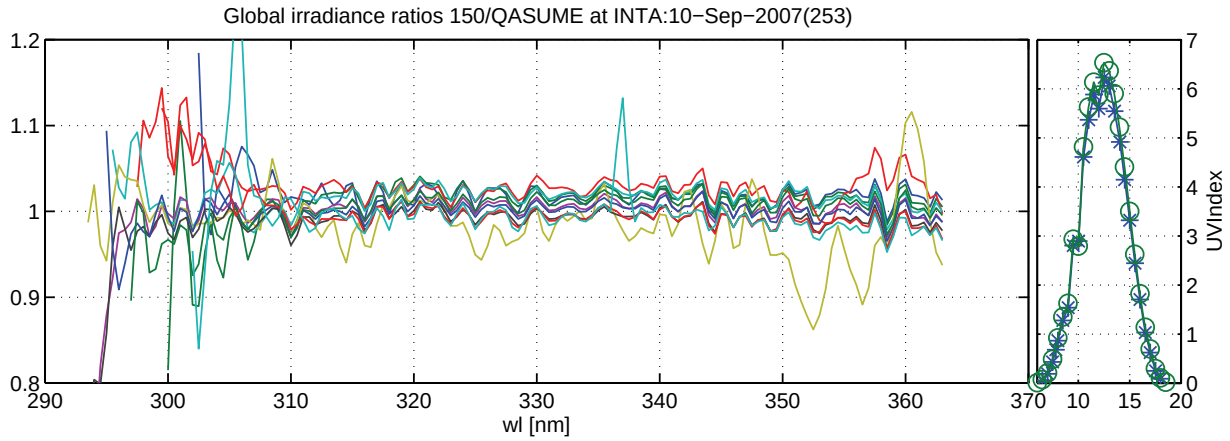


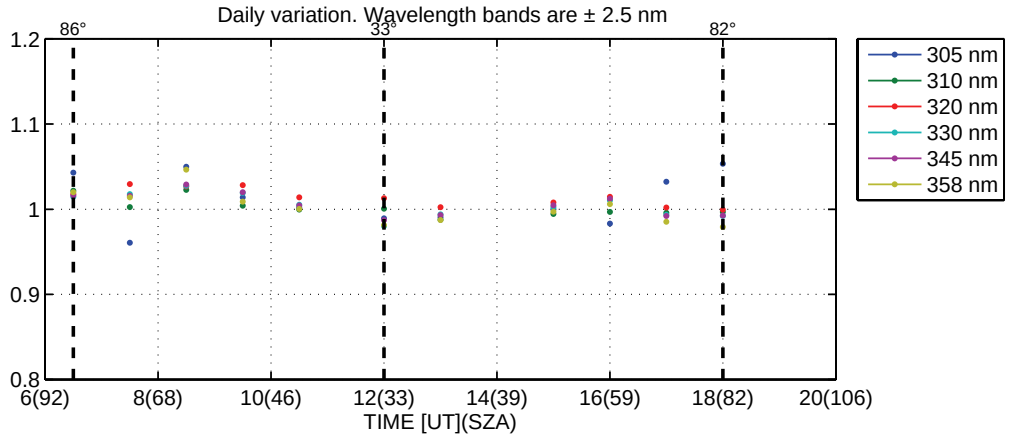
03−Oct−2007 12:41:26



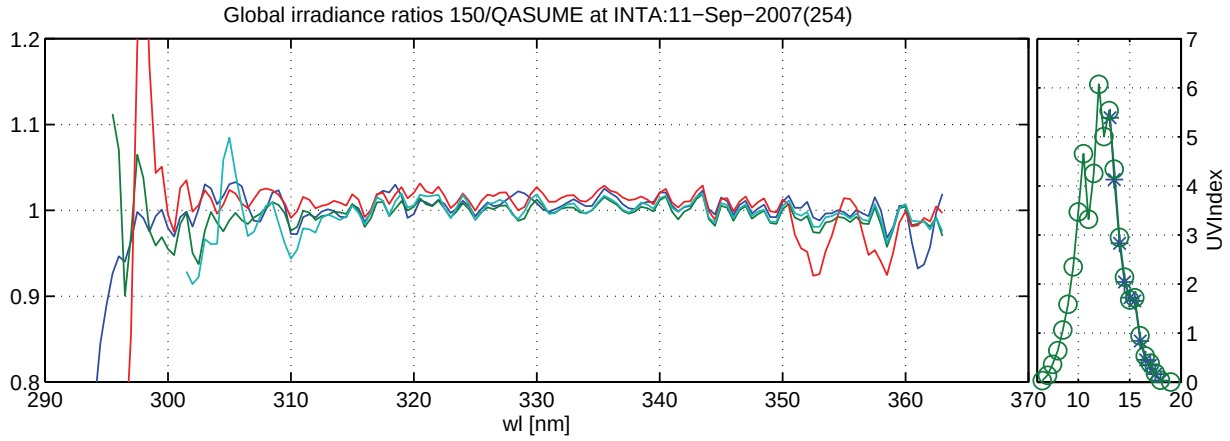


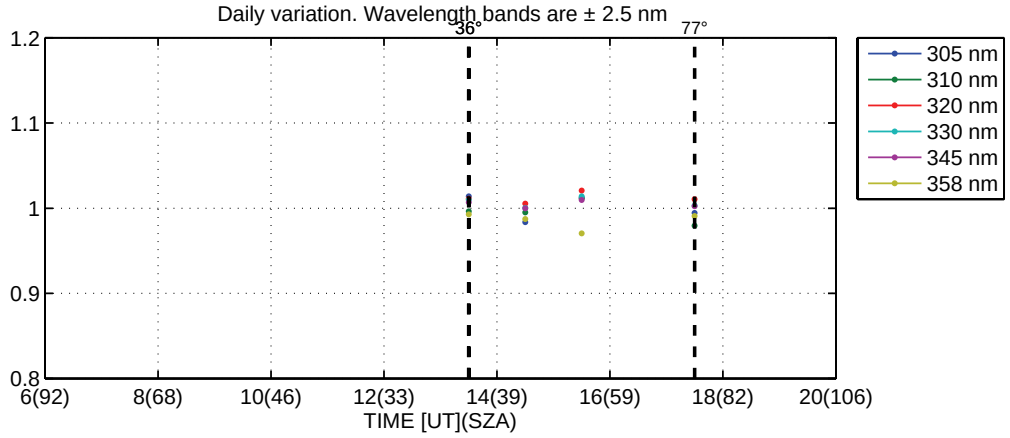
03−Oct−2007 12:41:26



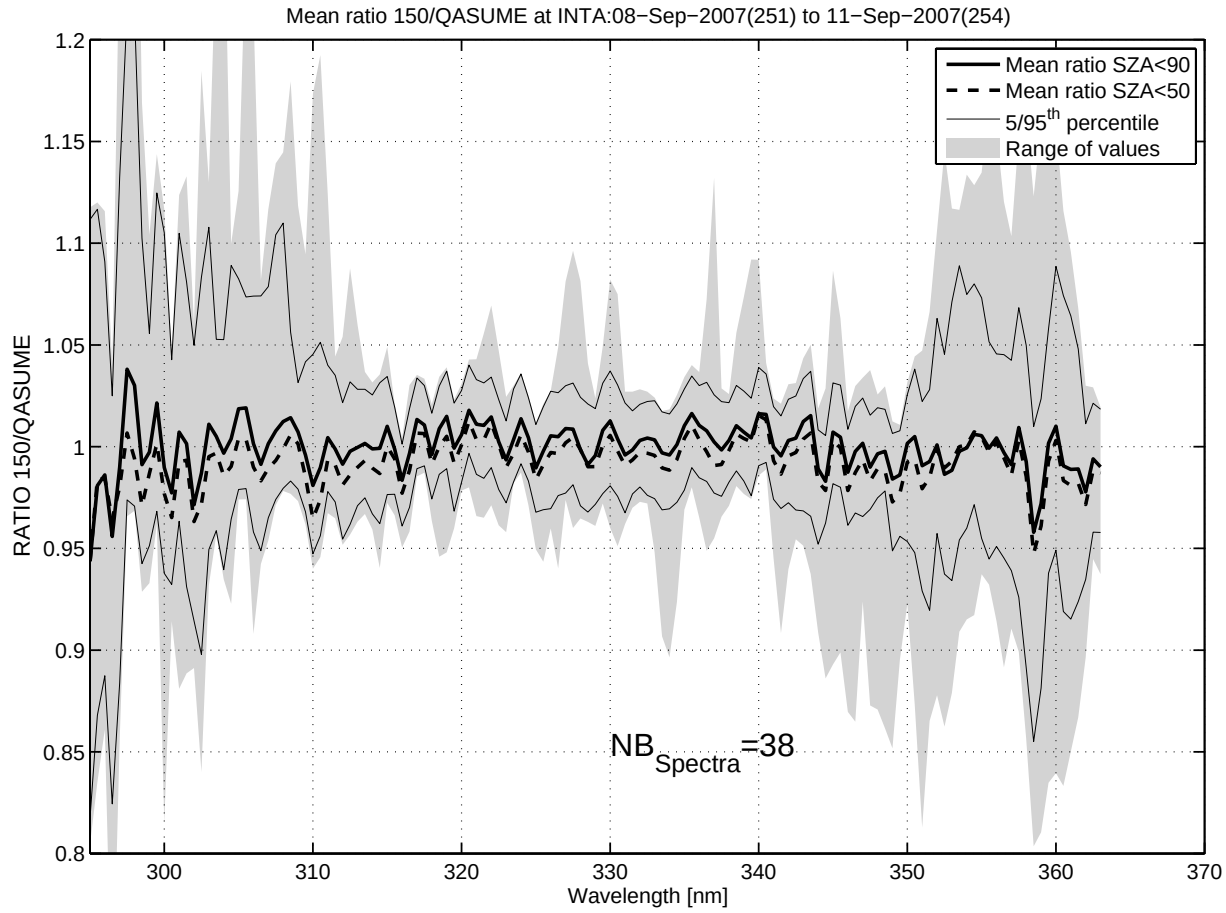


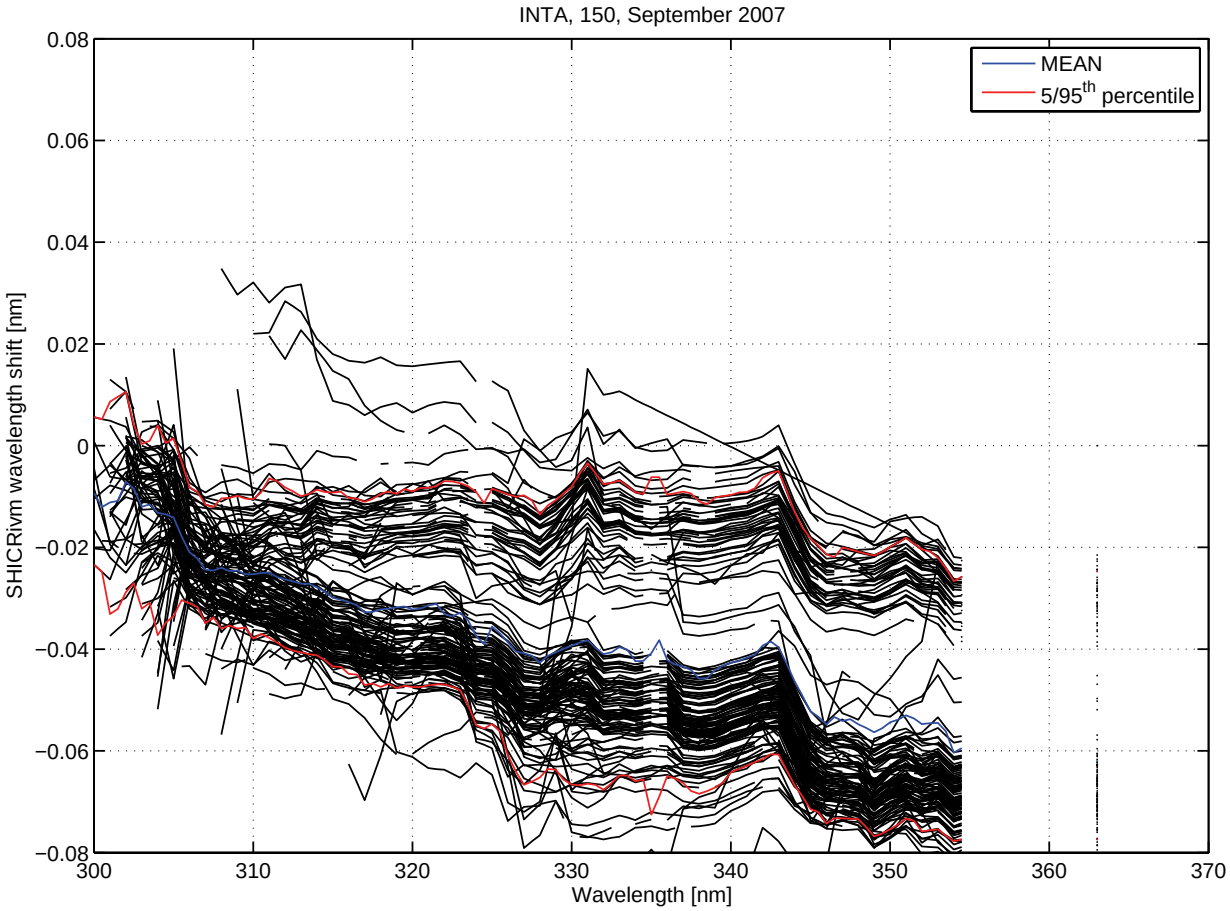
03−Oct−2007 12:41:26

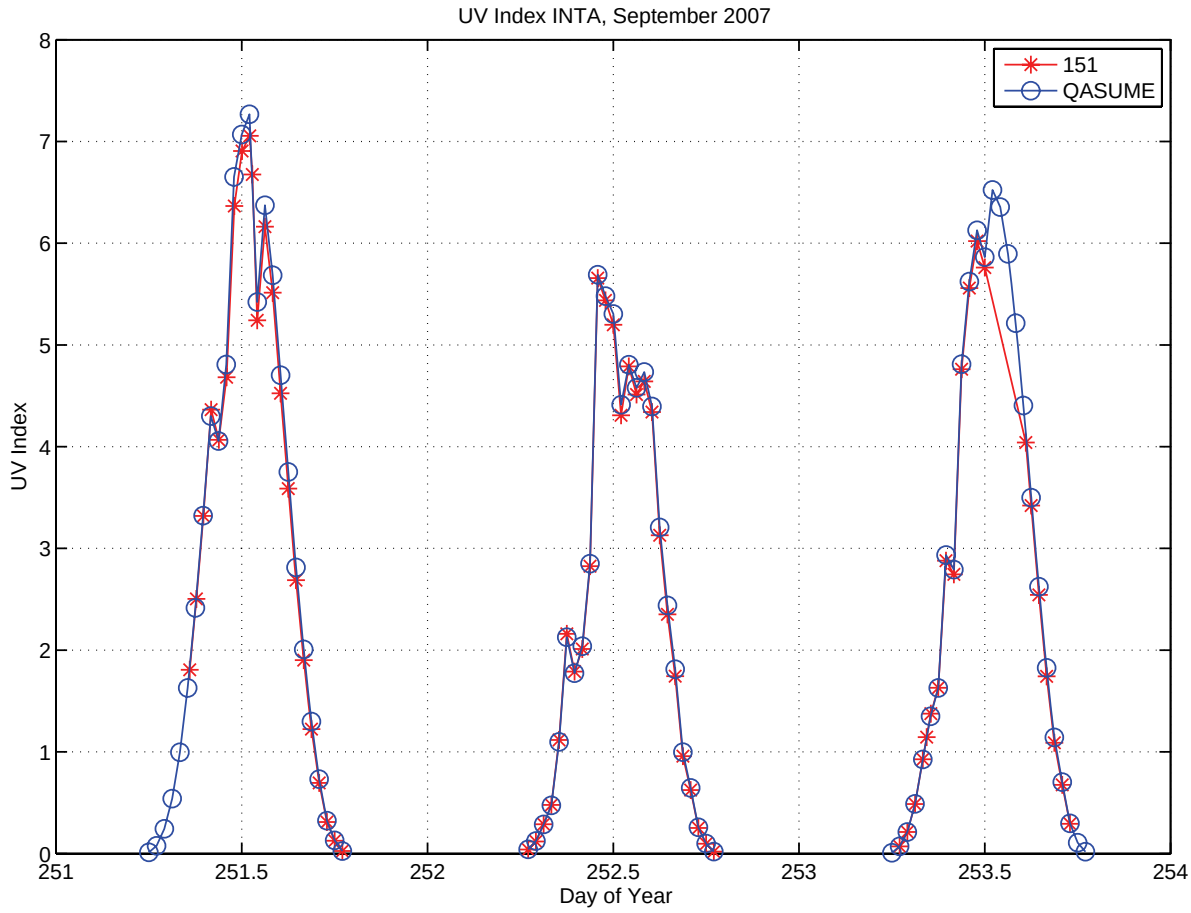


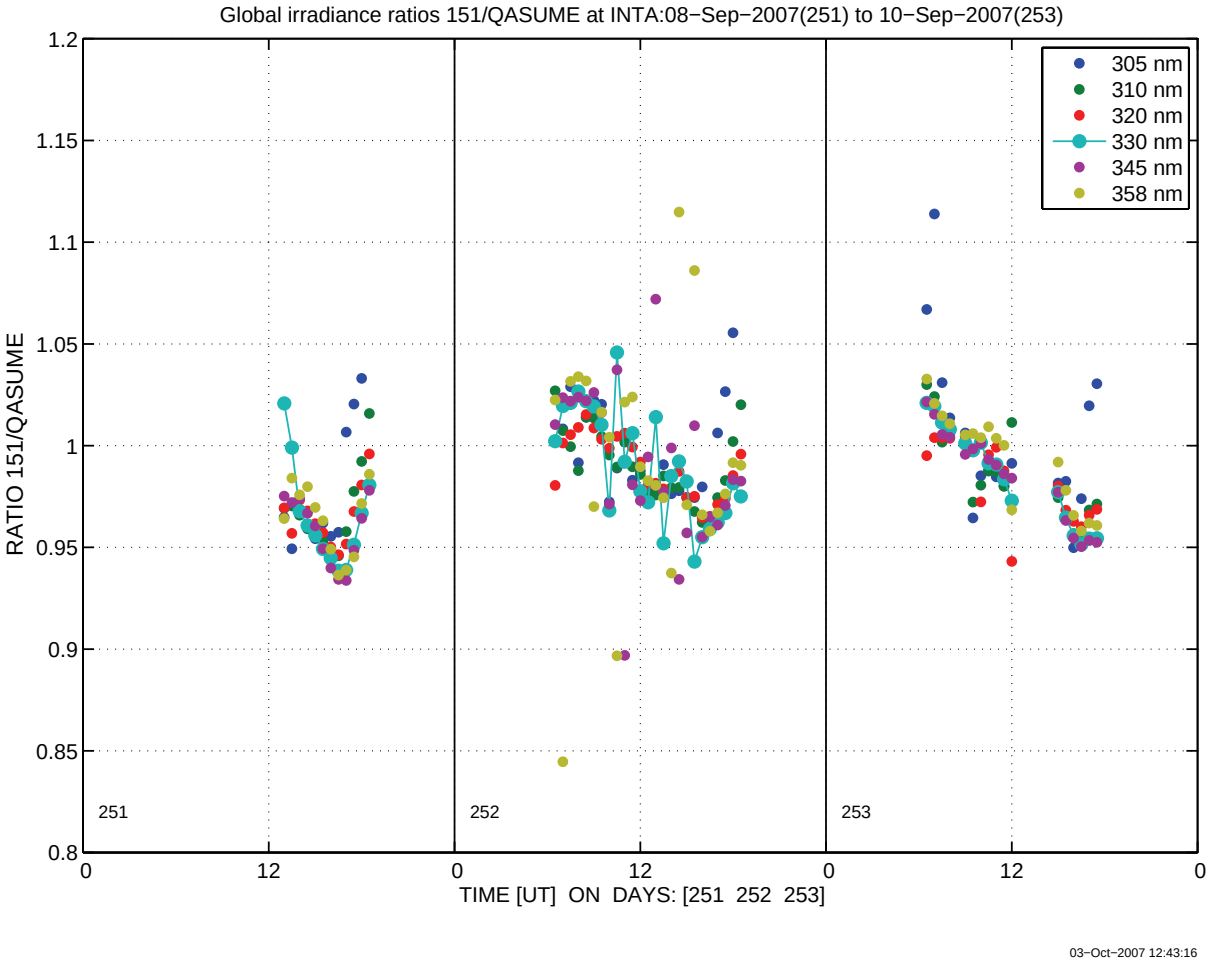


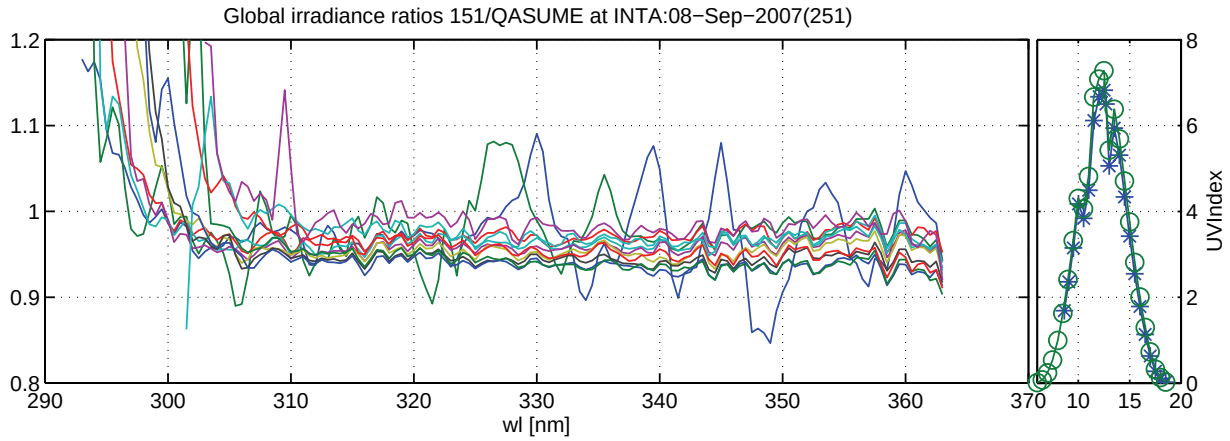
03−Oct−2007 12:41:26

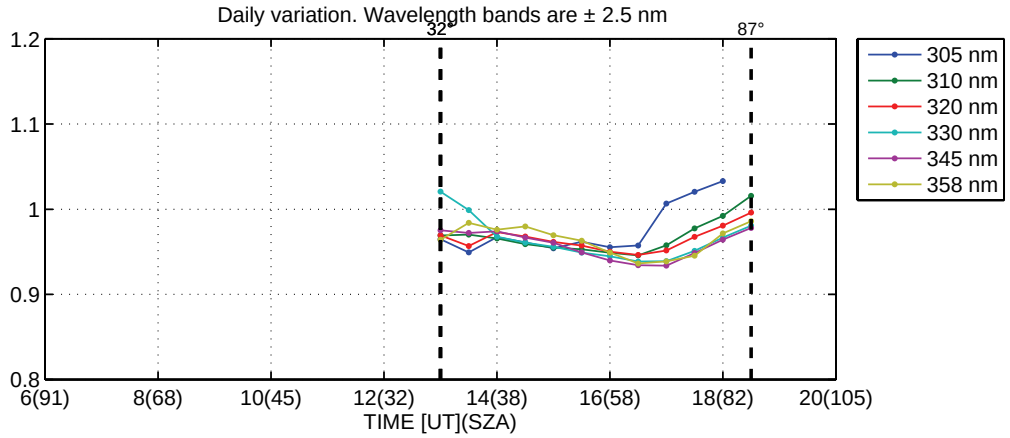

Mean ratio 150/QASUME at INTA:08−Sep−2007(251) to 11−Sep−2007(254)
Mean ratio SZA<90
Mean ratio SZA<50
5/95th percentile
Range of values
RATIO 150/QASUME
Wavelength [nm]
NBSpectra=38


INTA, 150, September 2007
MEAN
5/95th percentile
SHICRivm wavelength shift [nm]
Wavelength [nm]

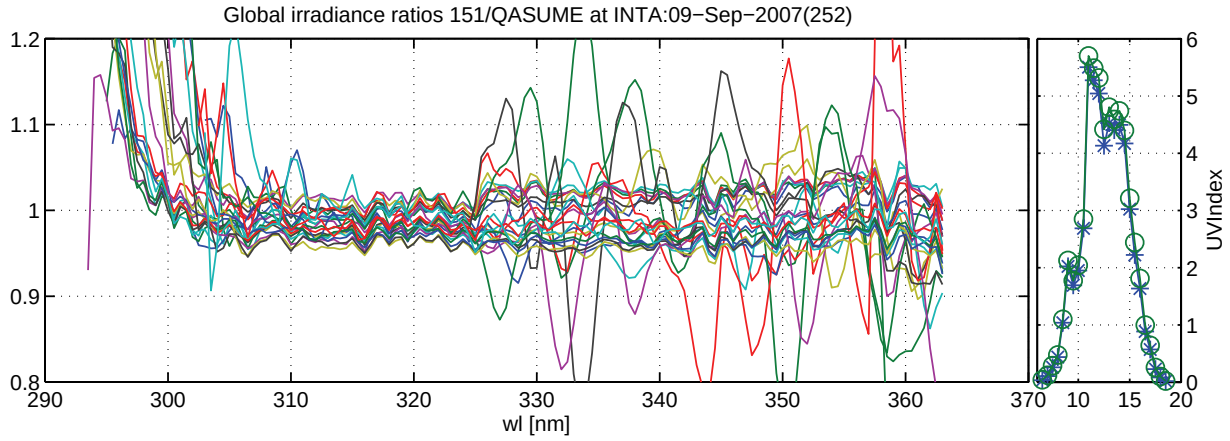

UV Index INTA, September 2007
151
QASUME
UV Index
Day of Year
0
1
2
3
4
5
6
7
8
251
251.5
252
252.5
253
253.5
254

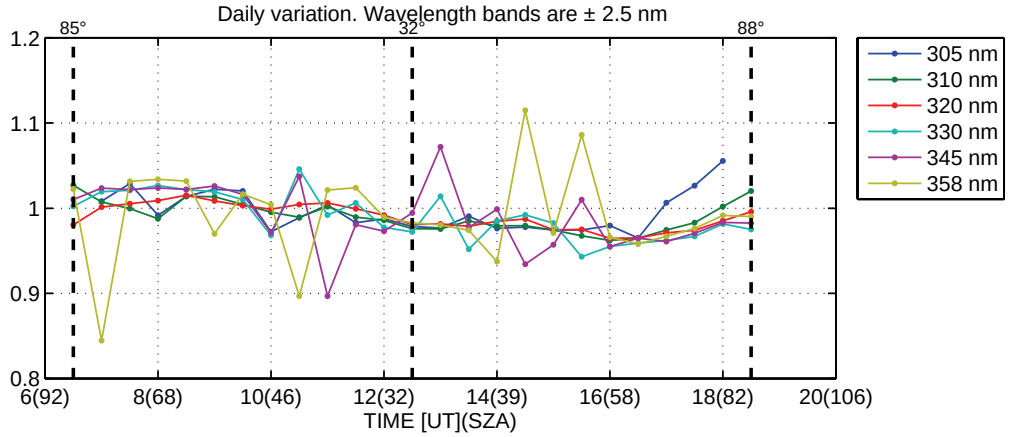

Global irradiance ratios 151/QASUME at INTA:08−Sep−2007(251) to 10−Sep−2007(253)
305 nm
310 nm
320 nm
330 nm
345 nm
358 nm
RATIO 151/QASUME
TIME [UT] ON DAYS: [251 252 253]
251
252
253
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
1.2
0
12
03−Oct−2007 12:43:16



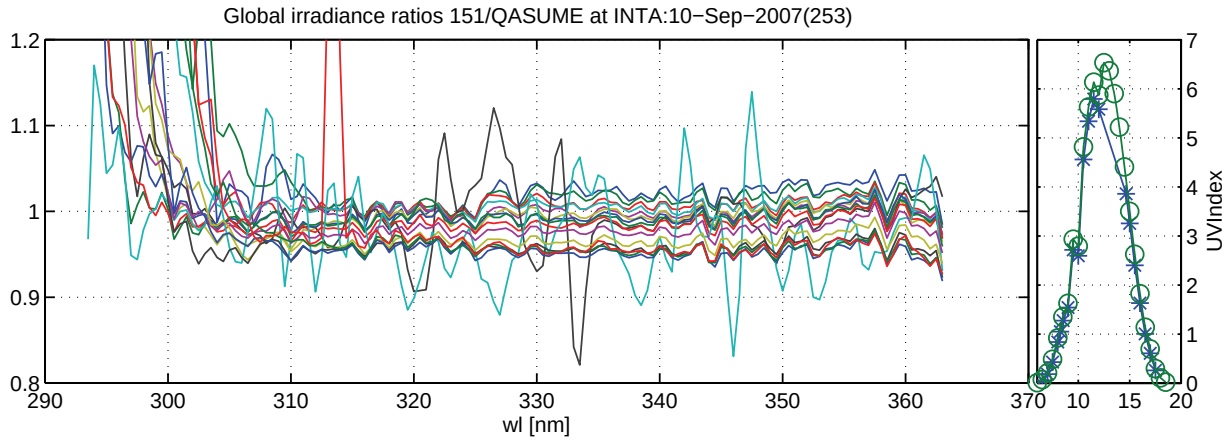


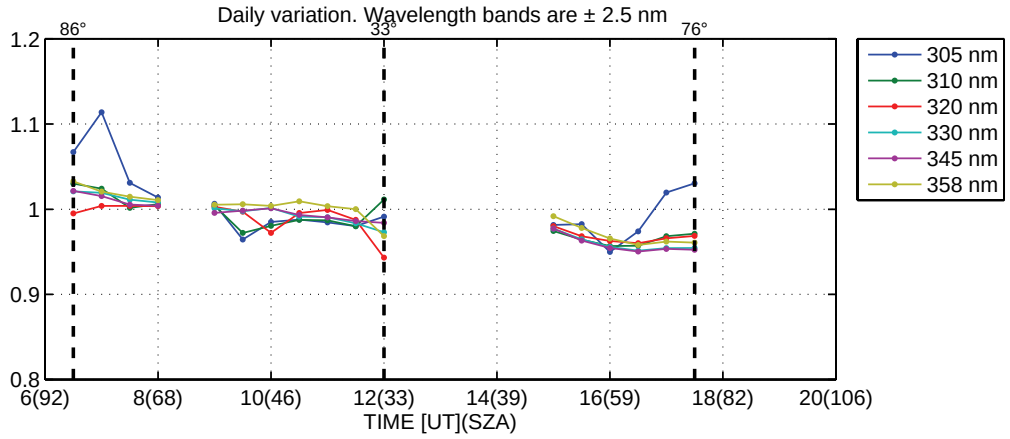
03−Oct−2007 12:43:16



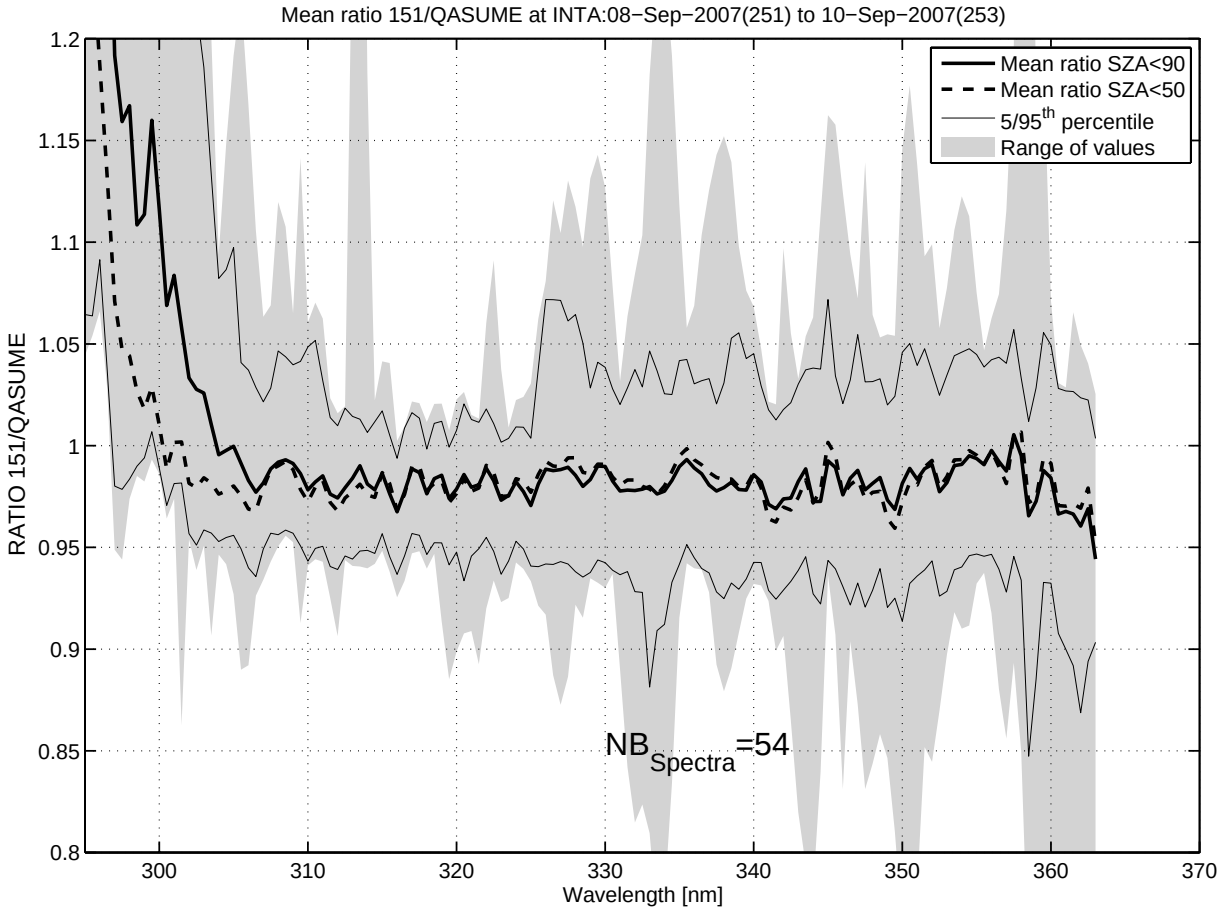


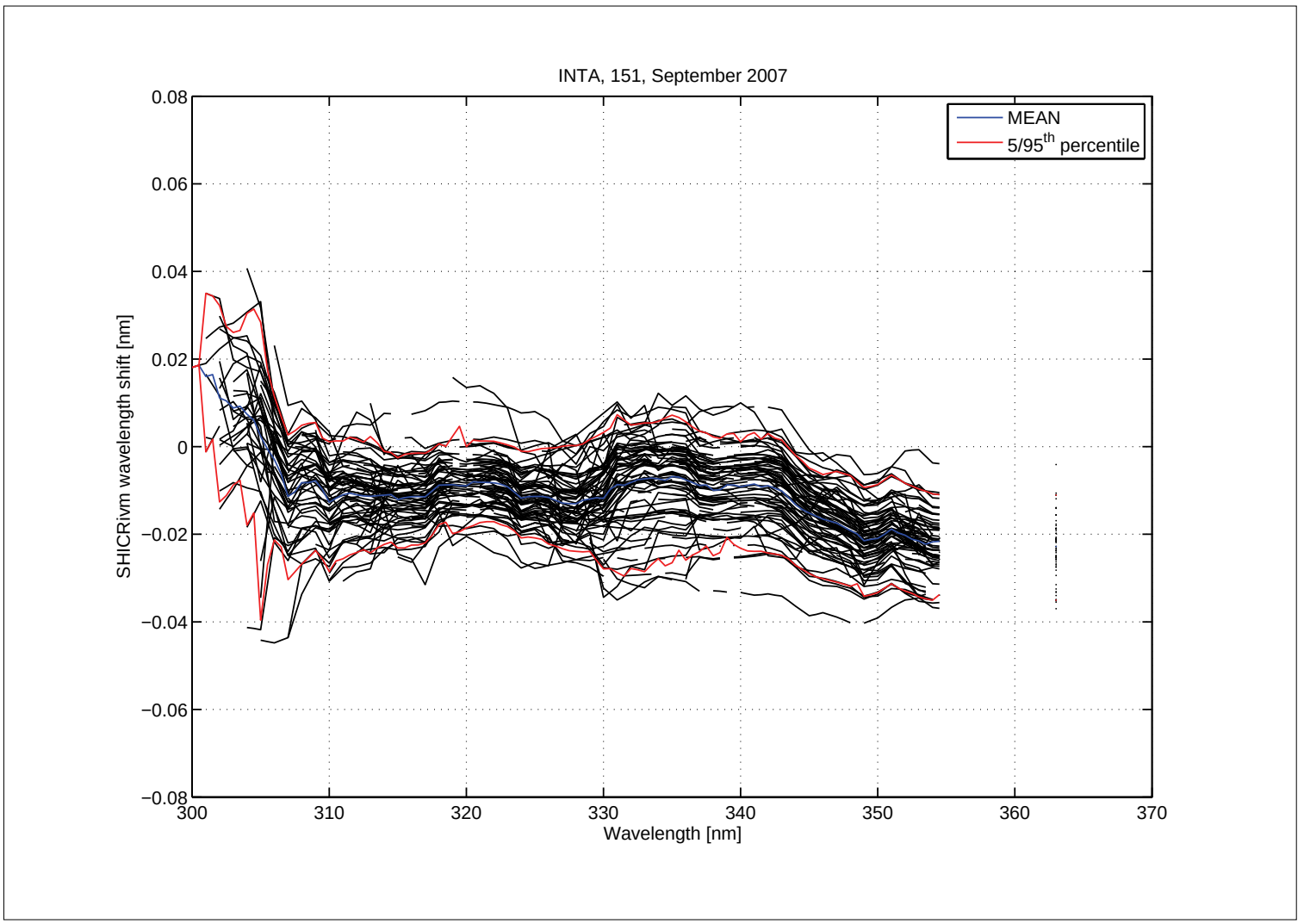
03−Oct−2007 12:43:16

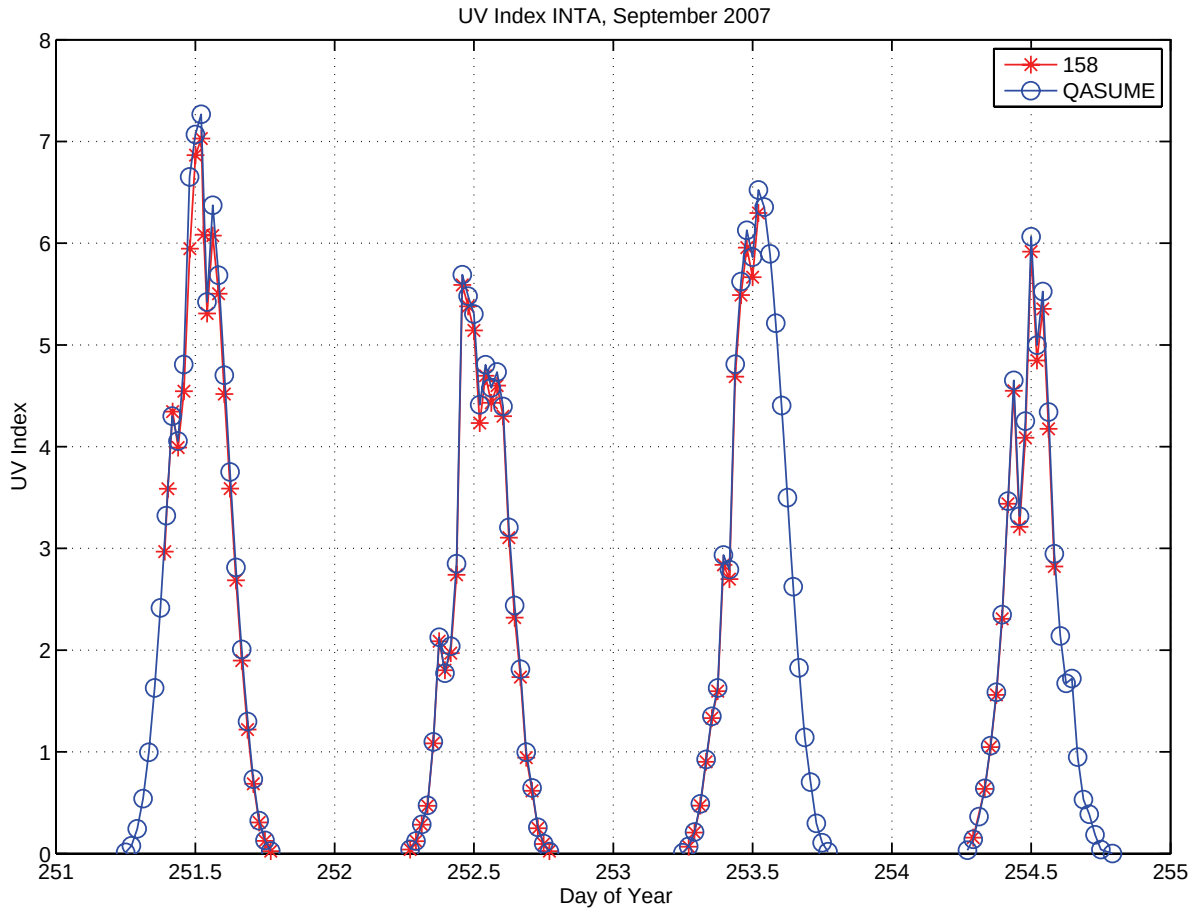


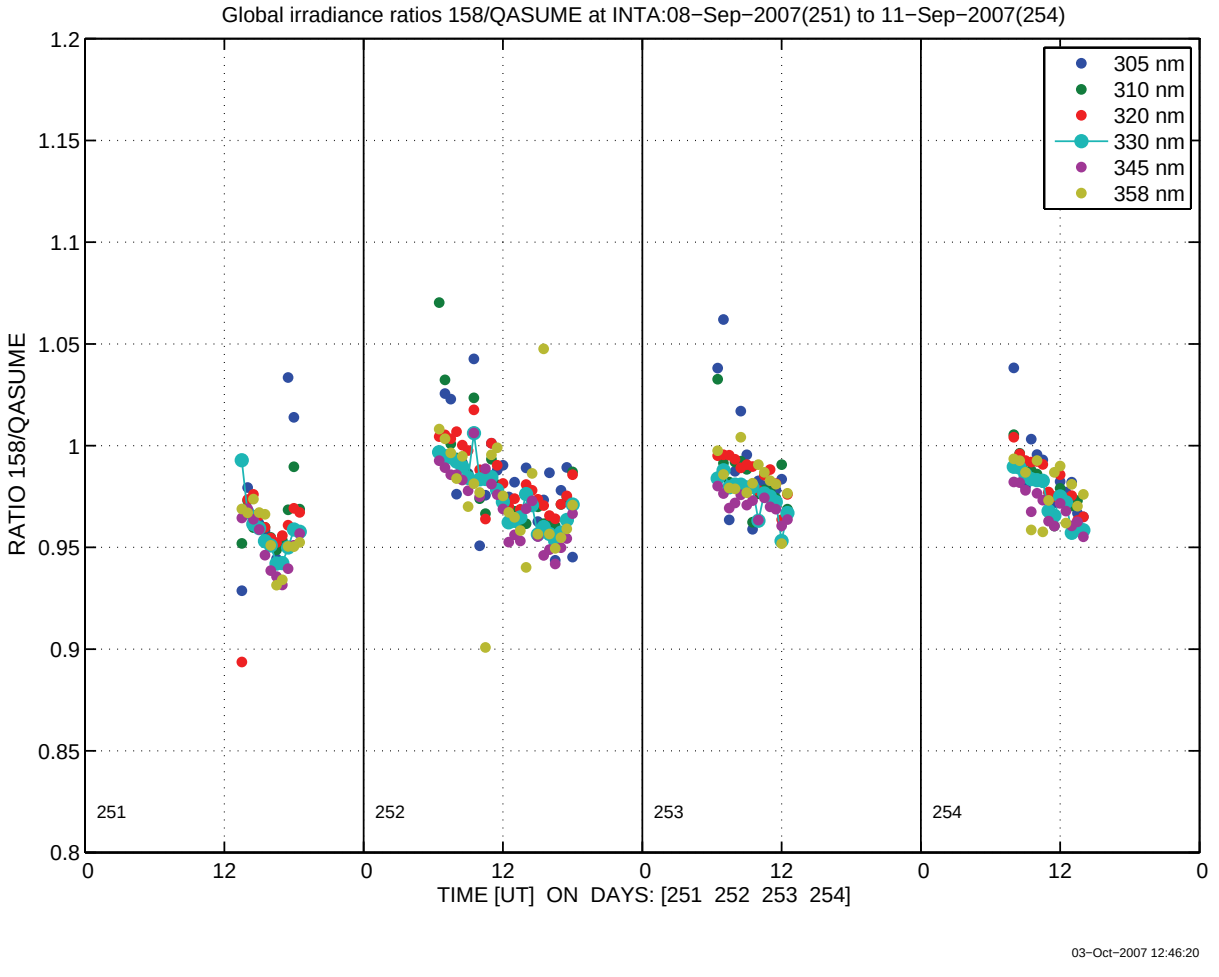


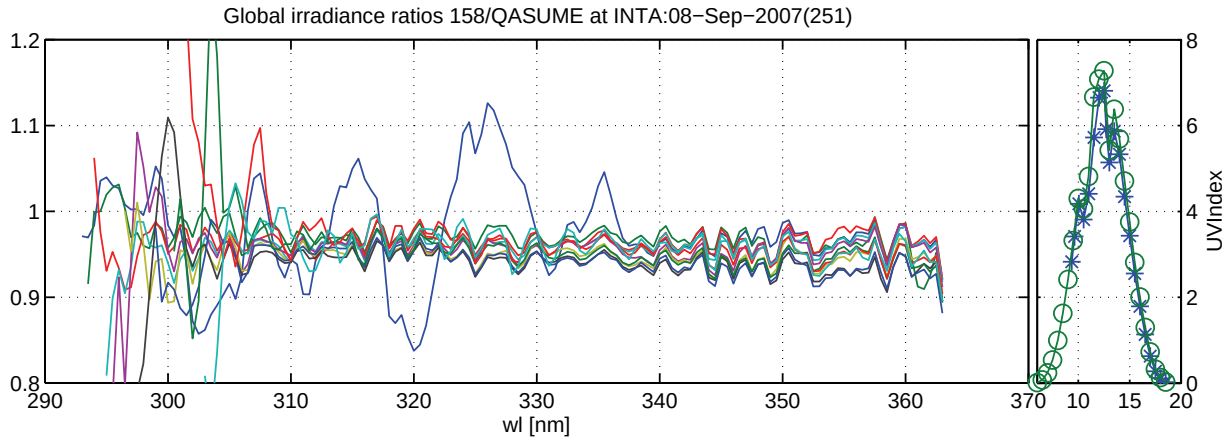
03−Oct−2007 12:43:16

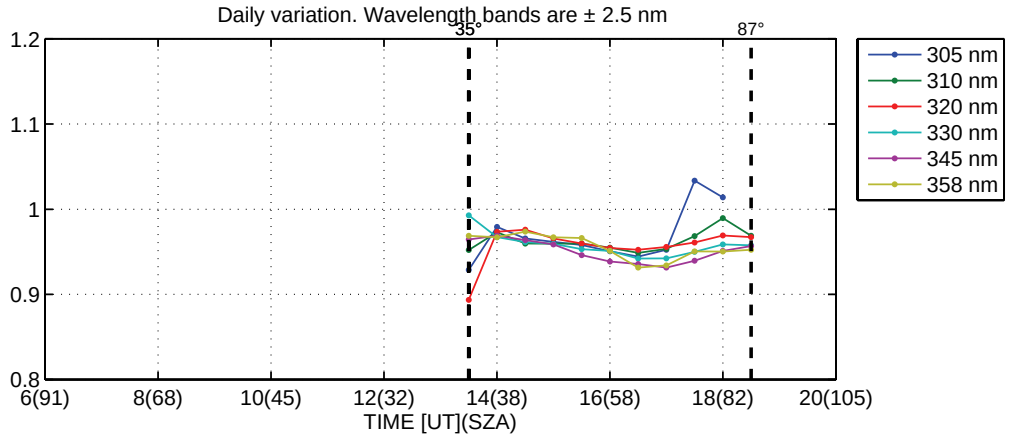



INTA, 151, September 2007
MEAN
5/95th percentile
SHICRivm wavelength shift [nm]
Wavelength [nm]
0.08
0.06
0.04
0.02
0
−0.02
−0.04
−0.06
−0.08
300
310
320
330
340
350
360
370

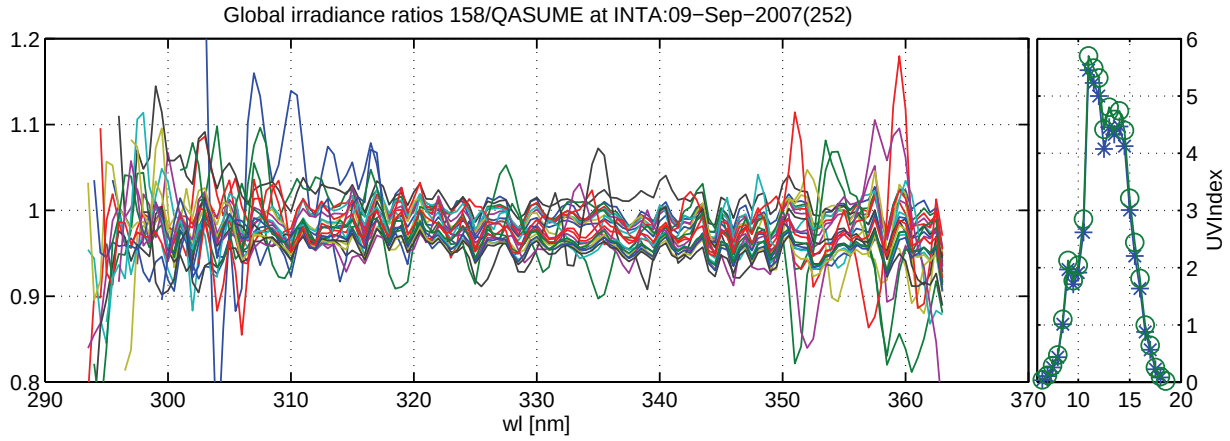

UV Index INTA, September 2007
158
QASUME
UV Index
Day of Year
0
1
2
3
4
5
6
7
8
251
251.5
252
252.5
253
253.5
254
254.5
255

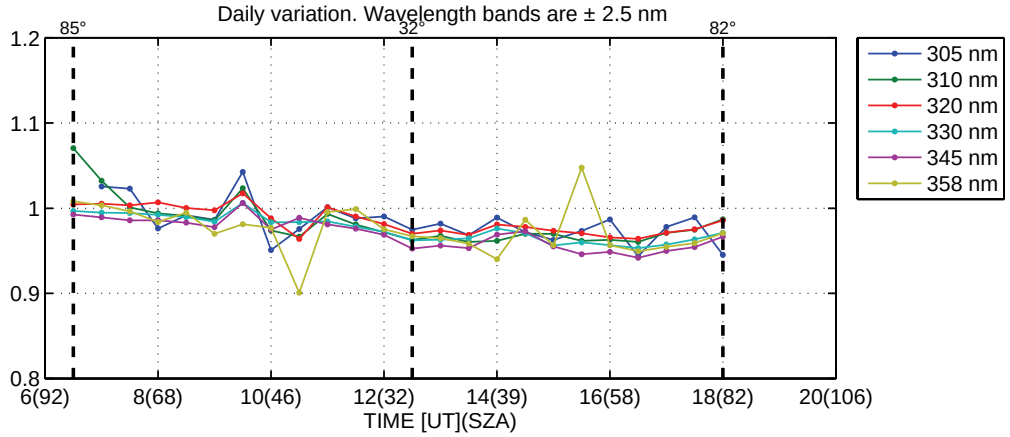

Global irradiance ratios 158/QASUME at INTA:08−Sep−2007(251) to 11−Sep−2007(254)
305 nm
310 nm
320 nm
330 nm
345 nm
358 nm
RATIO 158/QASUME
TIME [UT] ON DAYS: [251 252 253 254]
251
252
253
254
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
1.2
0
12
03−Oct−2007 12:46:20



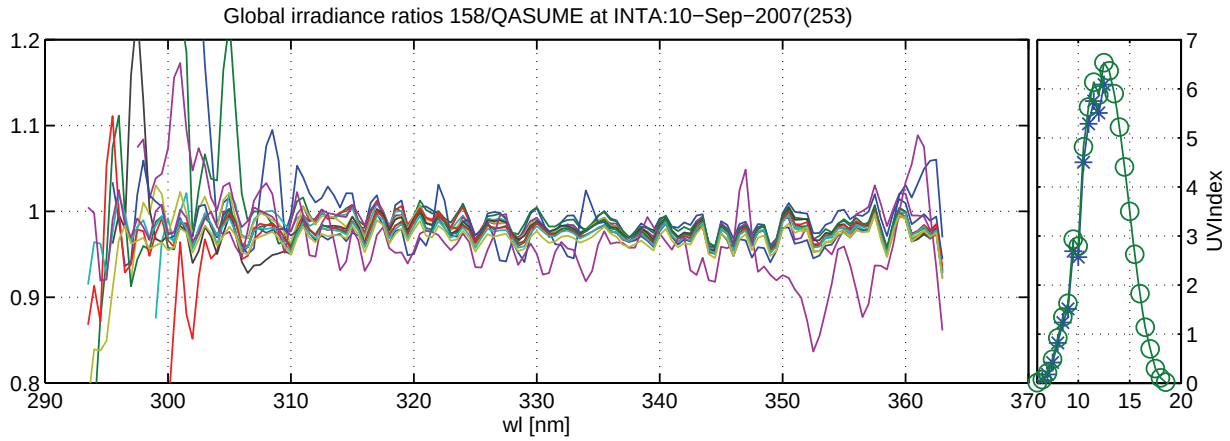


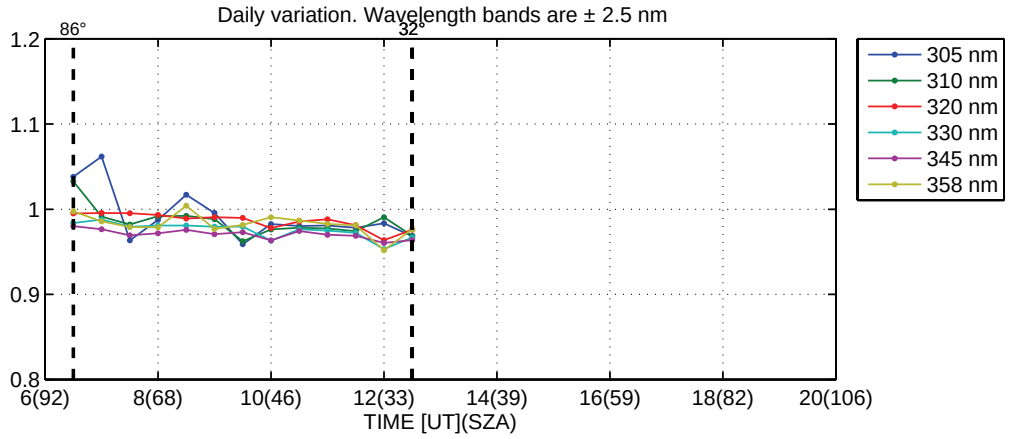
03−Oct−2007 12:46:20



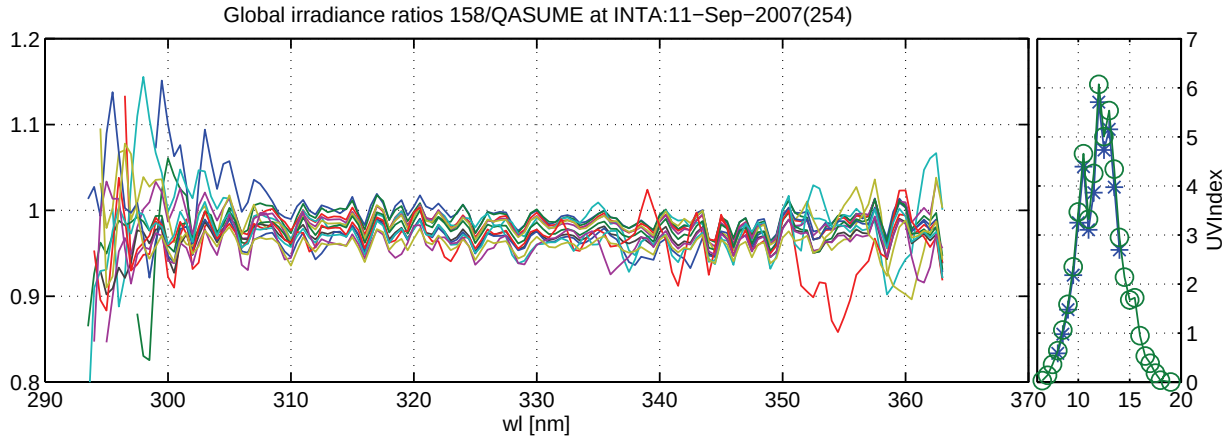


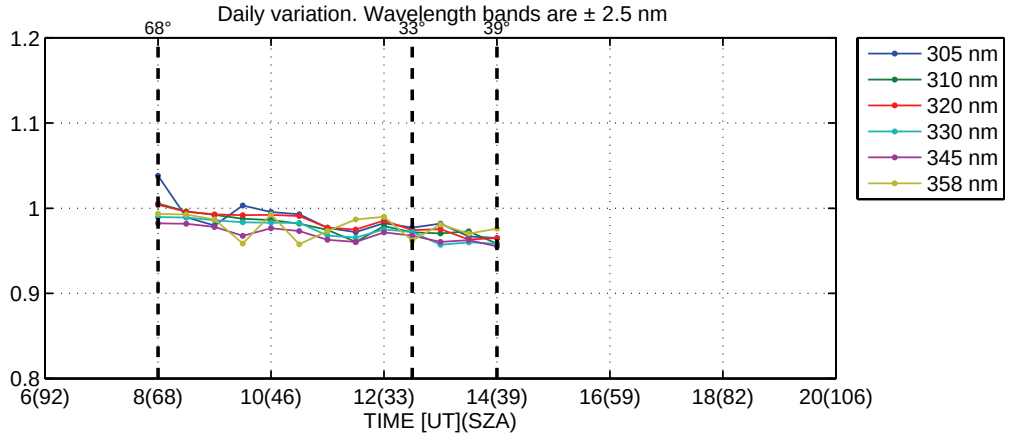
03−Oct−2007 12:46:20



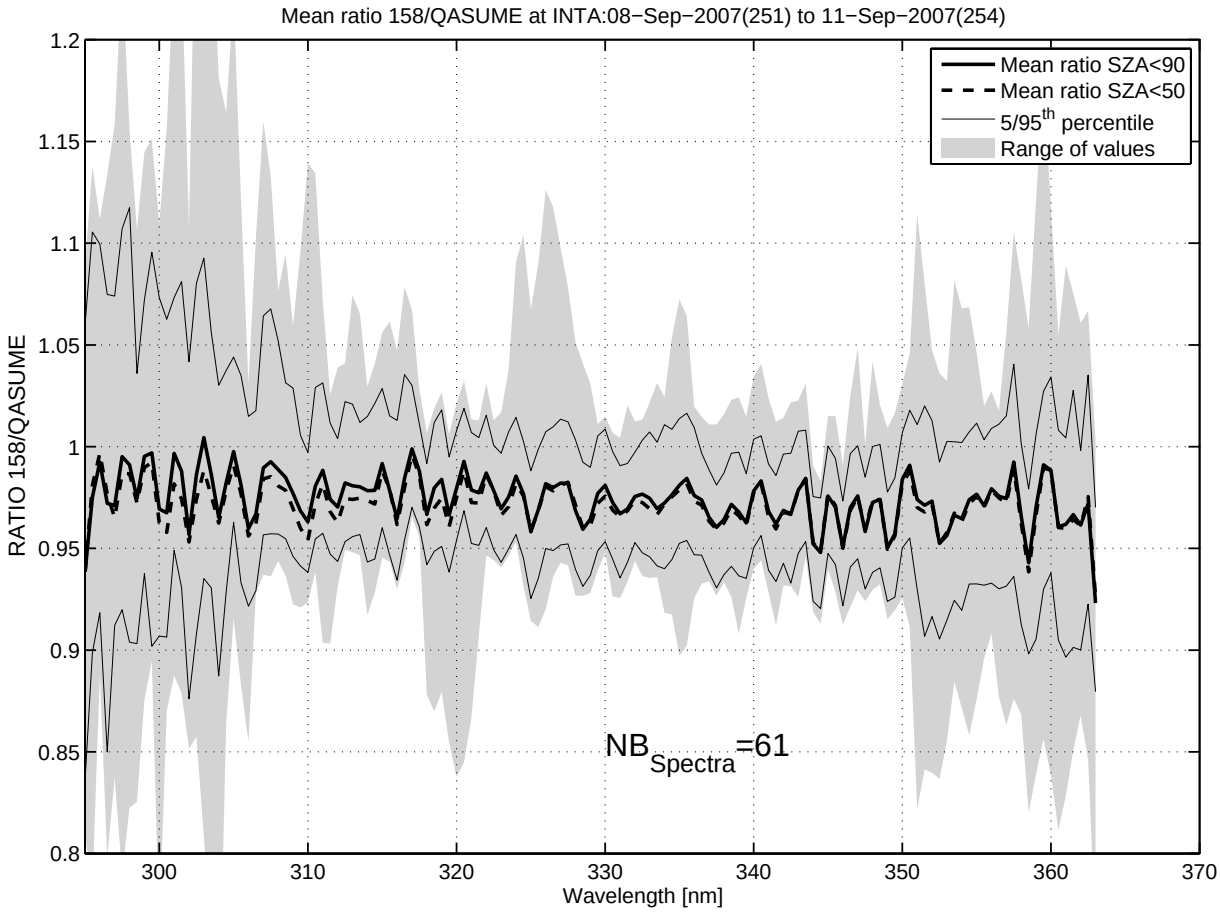


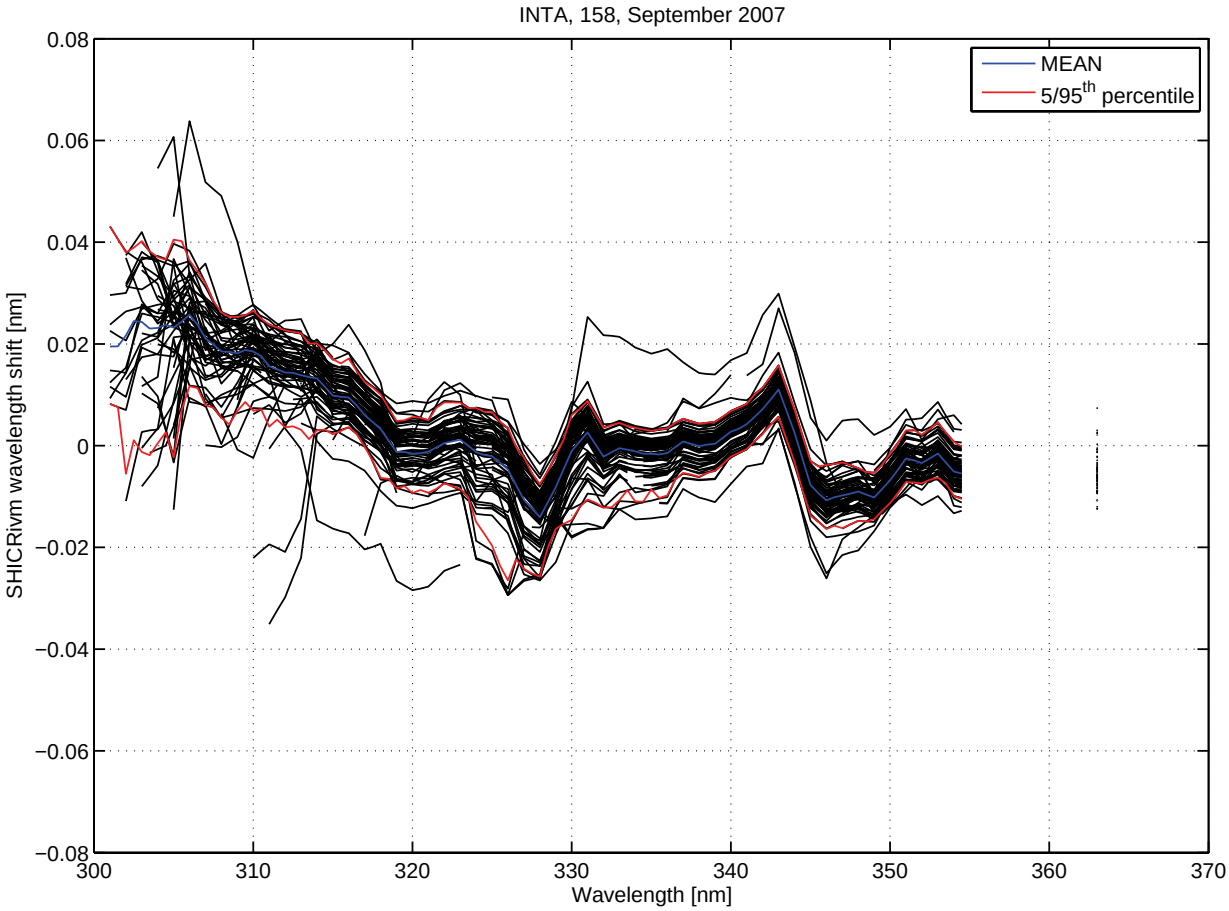
03−Oct−2007 12:46:20

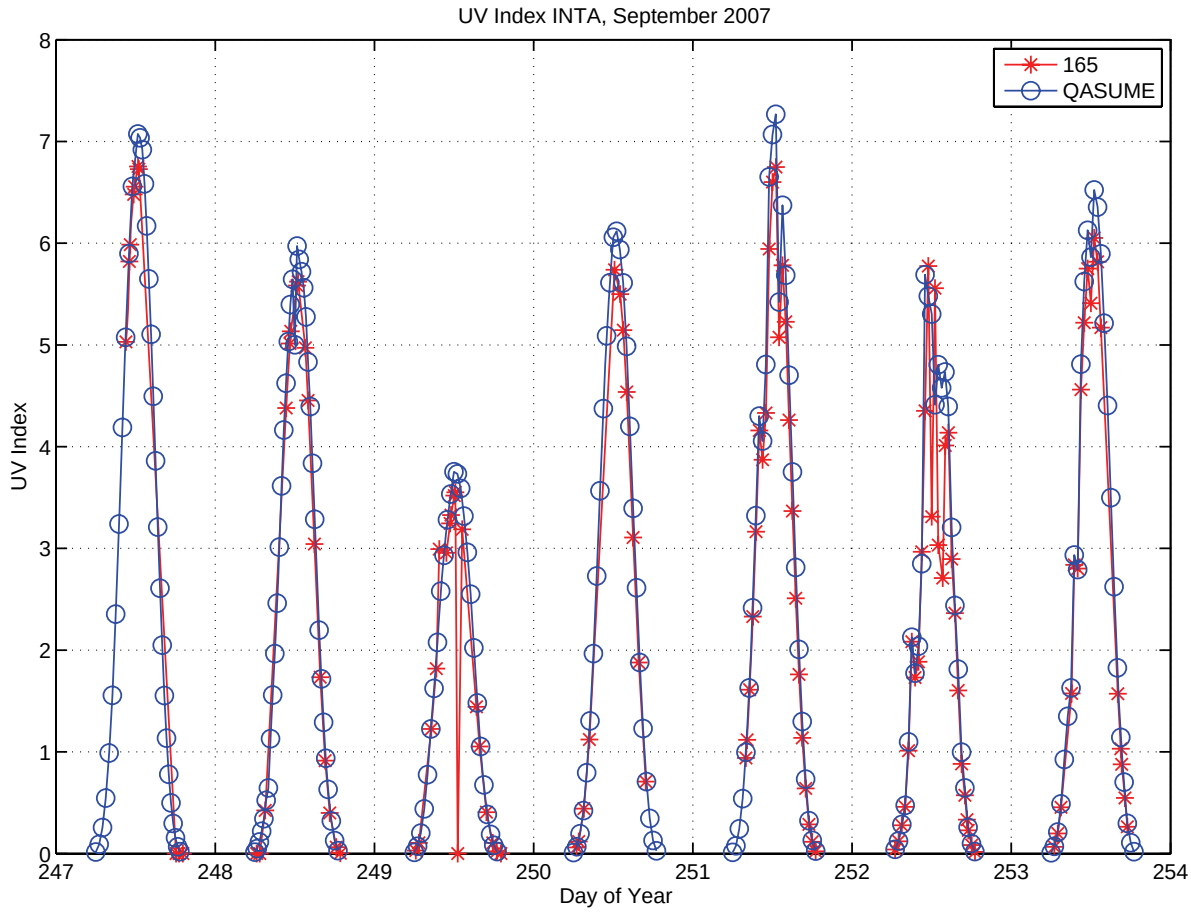


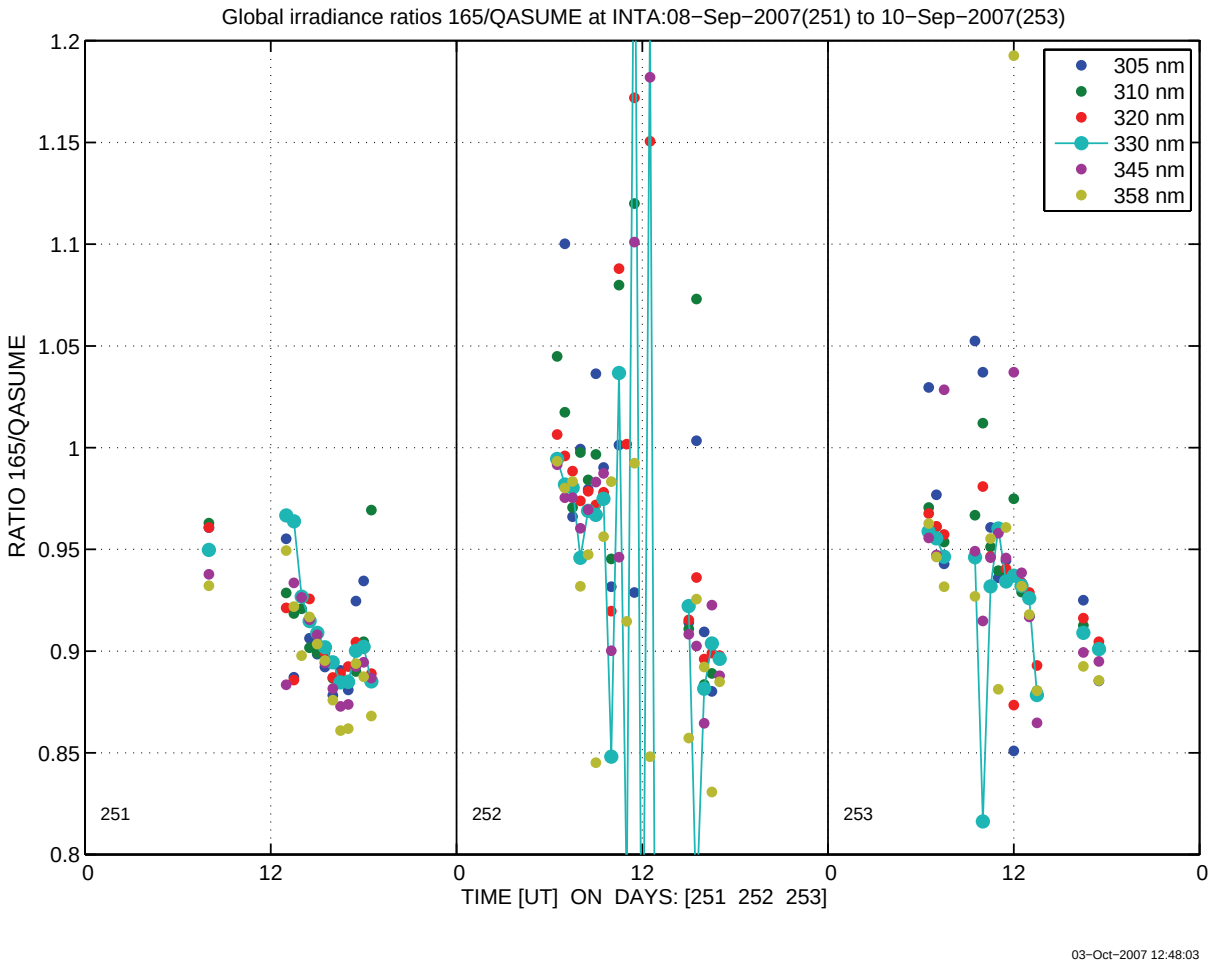


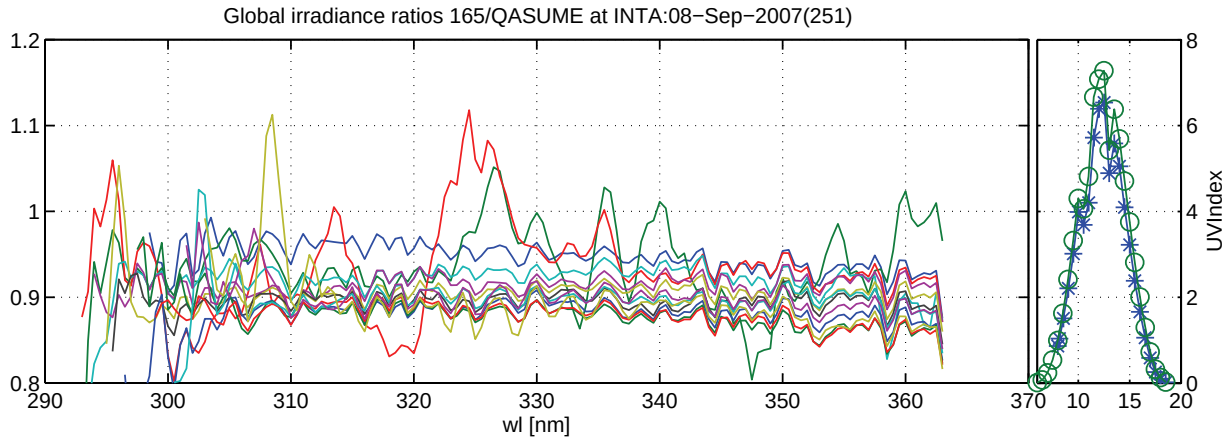
03−Oct−2007 12:46:20

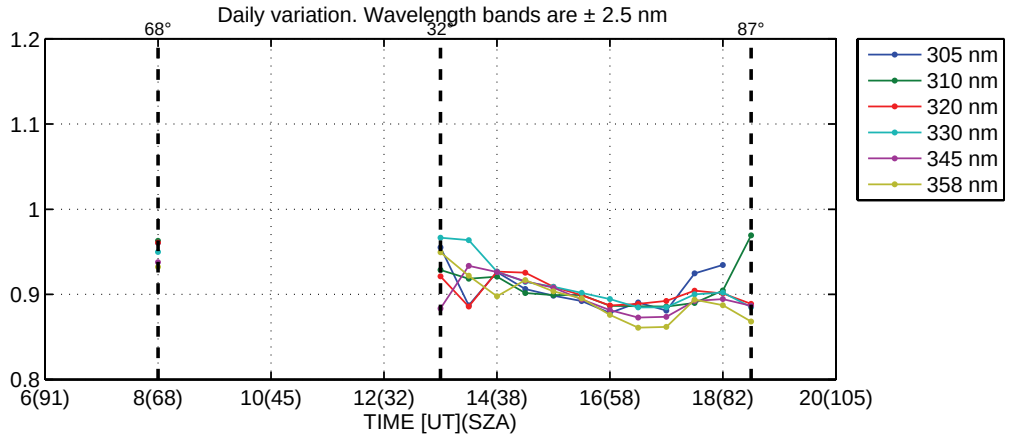

Mean ratio 158/QASUME at INTA:08−Sep−2007(251) to 11−Sep−2007(254)
Mean ratio SZA<90
Mean ratio SZA<50
5/95th percentile
Range of values
RATIO 158/QASUME
NBSpectra=61
Wavelength [nm]


INTA, 158, September 2007
MEAN
5/95th percentile
SHICRivm wavelength shift [nm]
Wavelength [nm]

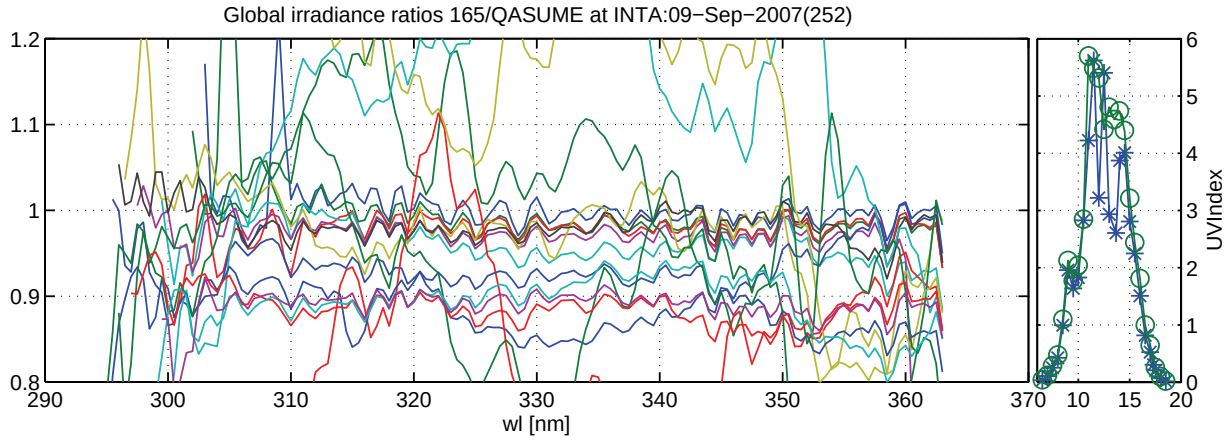

UV Index INTA, September 2007
165
QASUME
UV Index
Day of Year
0
1
2
3
4
5
6
7
8
247
248
249
250
251
252
253
254

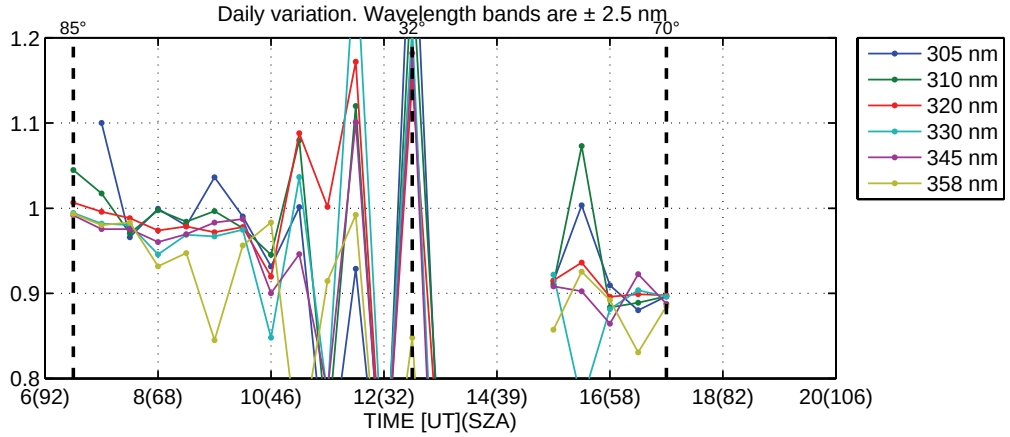

Global irradiance ratios 165/QASUME at INTA:08−Sep−2007(251) to 10−Sep−2007(253)
305 nm
310 nm
320 nm
330 nm
345 nm
358 nm
RATIO 165/QASUME
TIME [UT] ON DAYS: [251 252 253]
251
252
253
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
1.2
0
12
0
12
0
12
0
03−Oct−2007 12:48:03



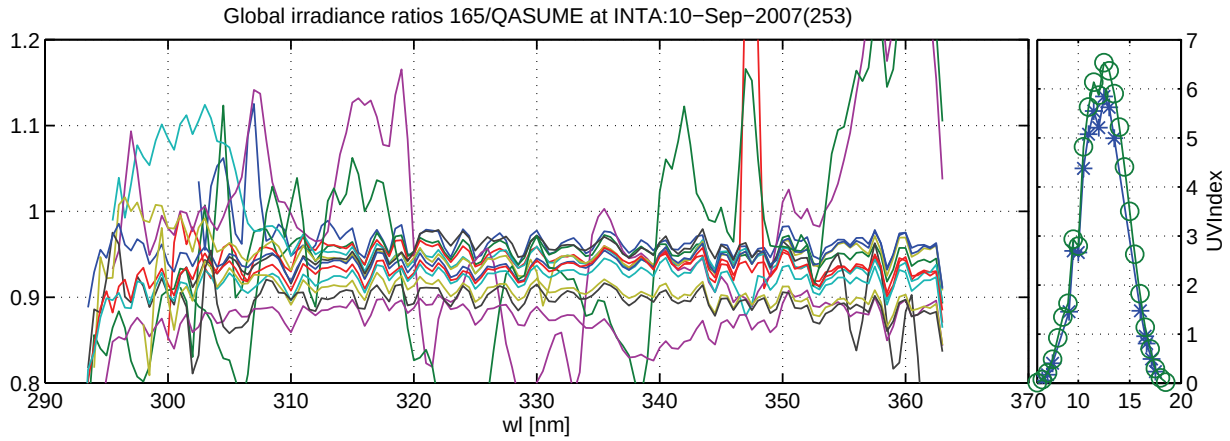


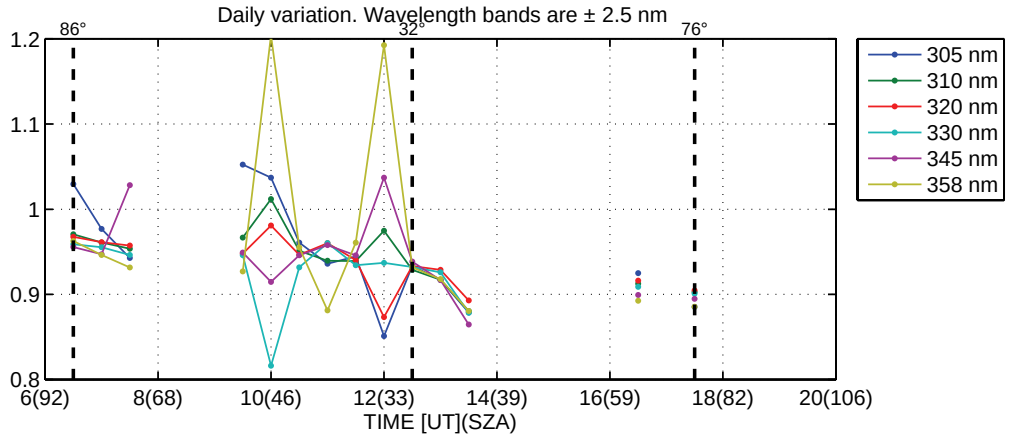
03−Oct−2007 12:48:04



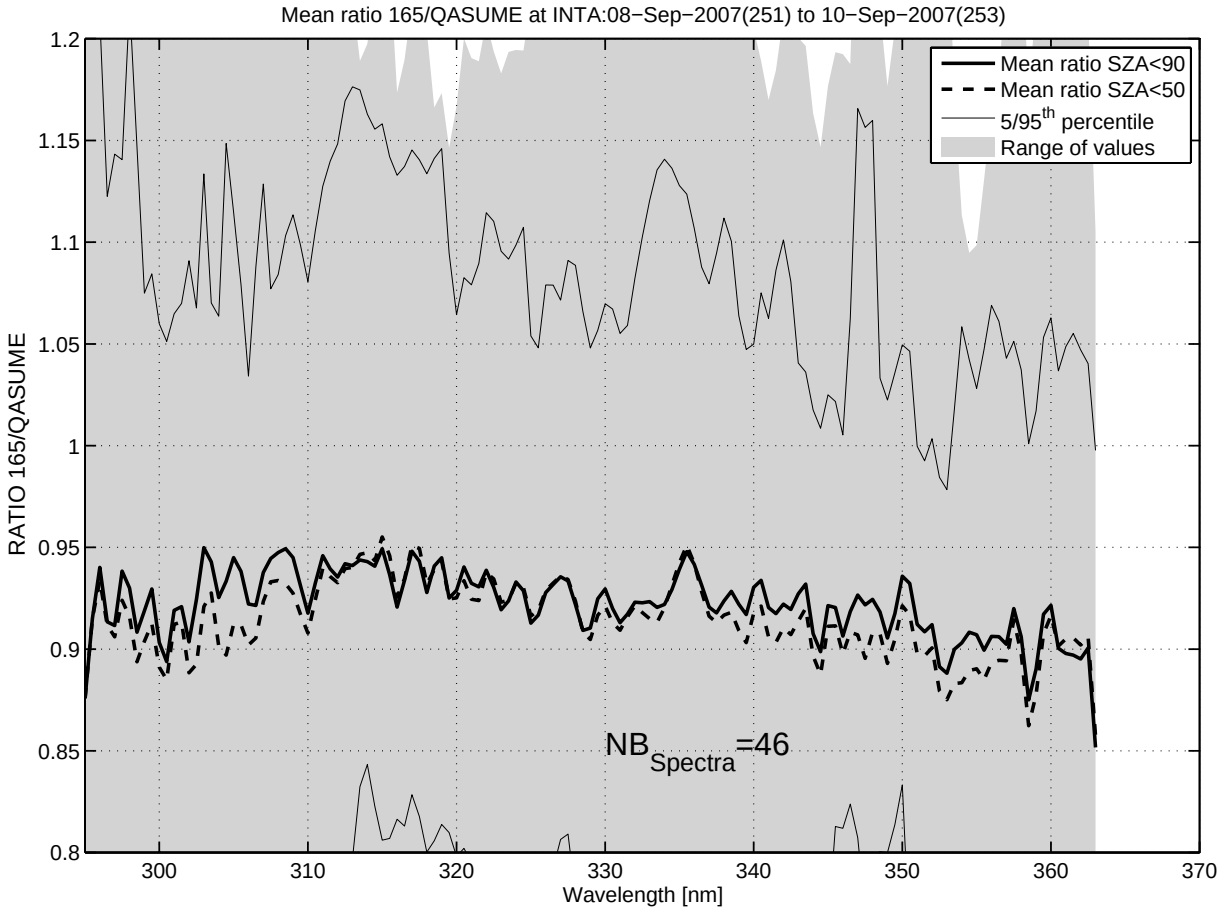


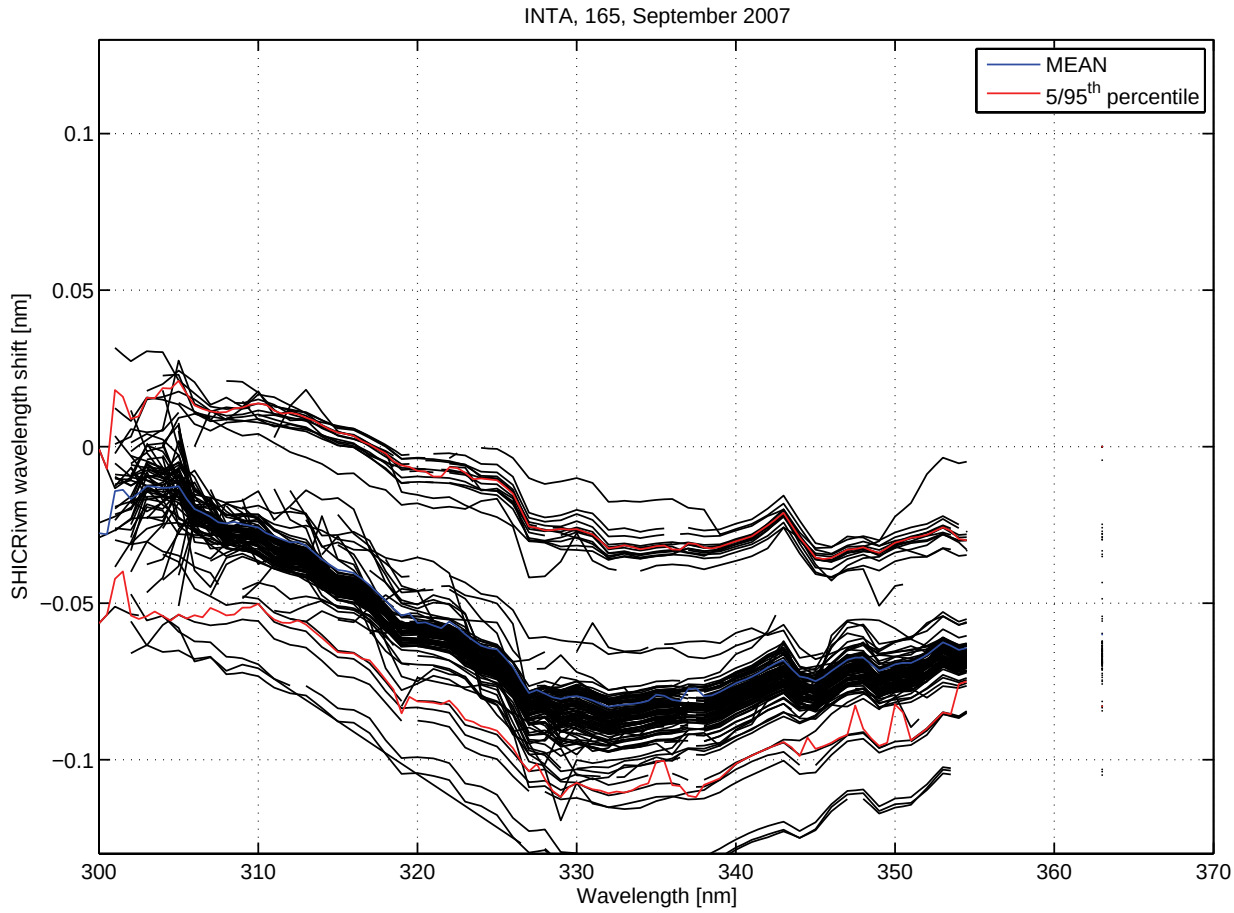
03−Oct−2007 12:48:04

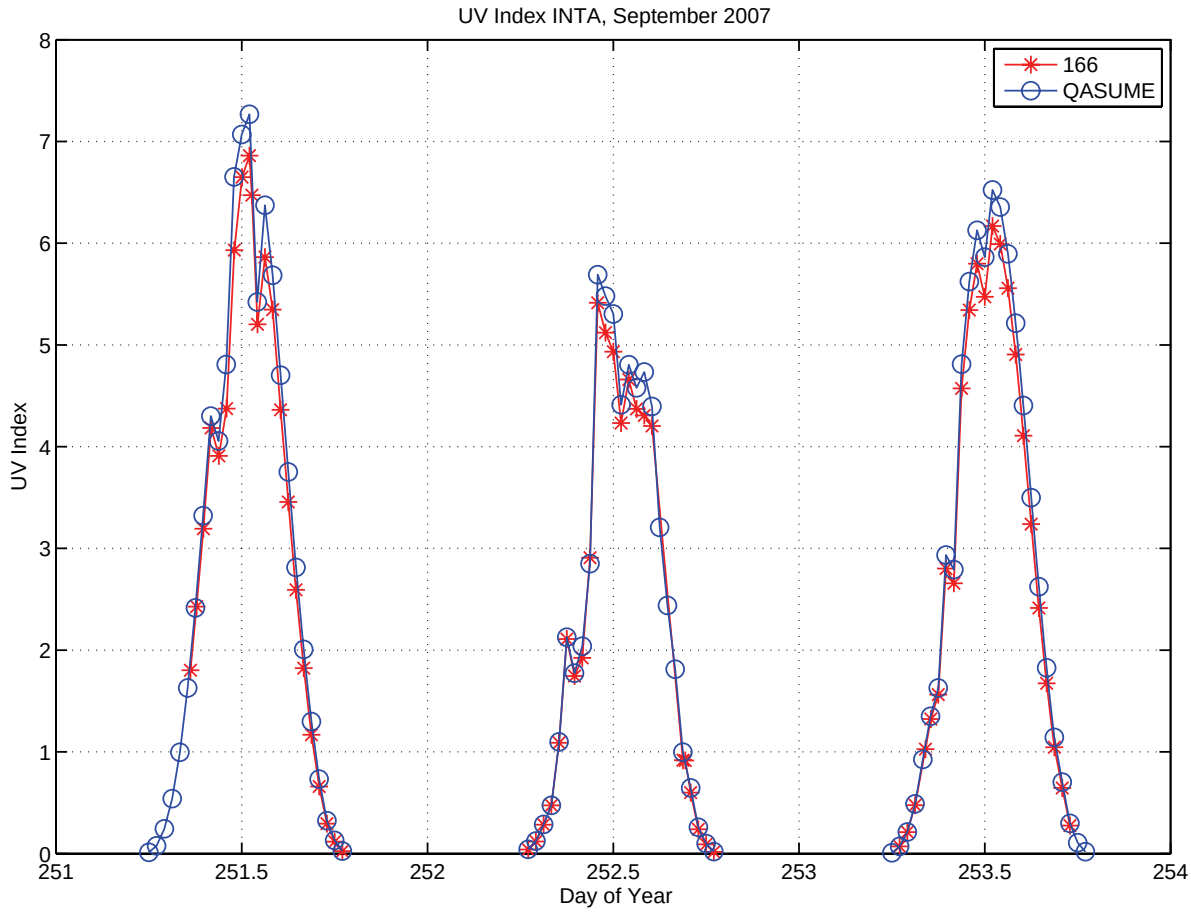


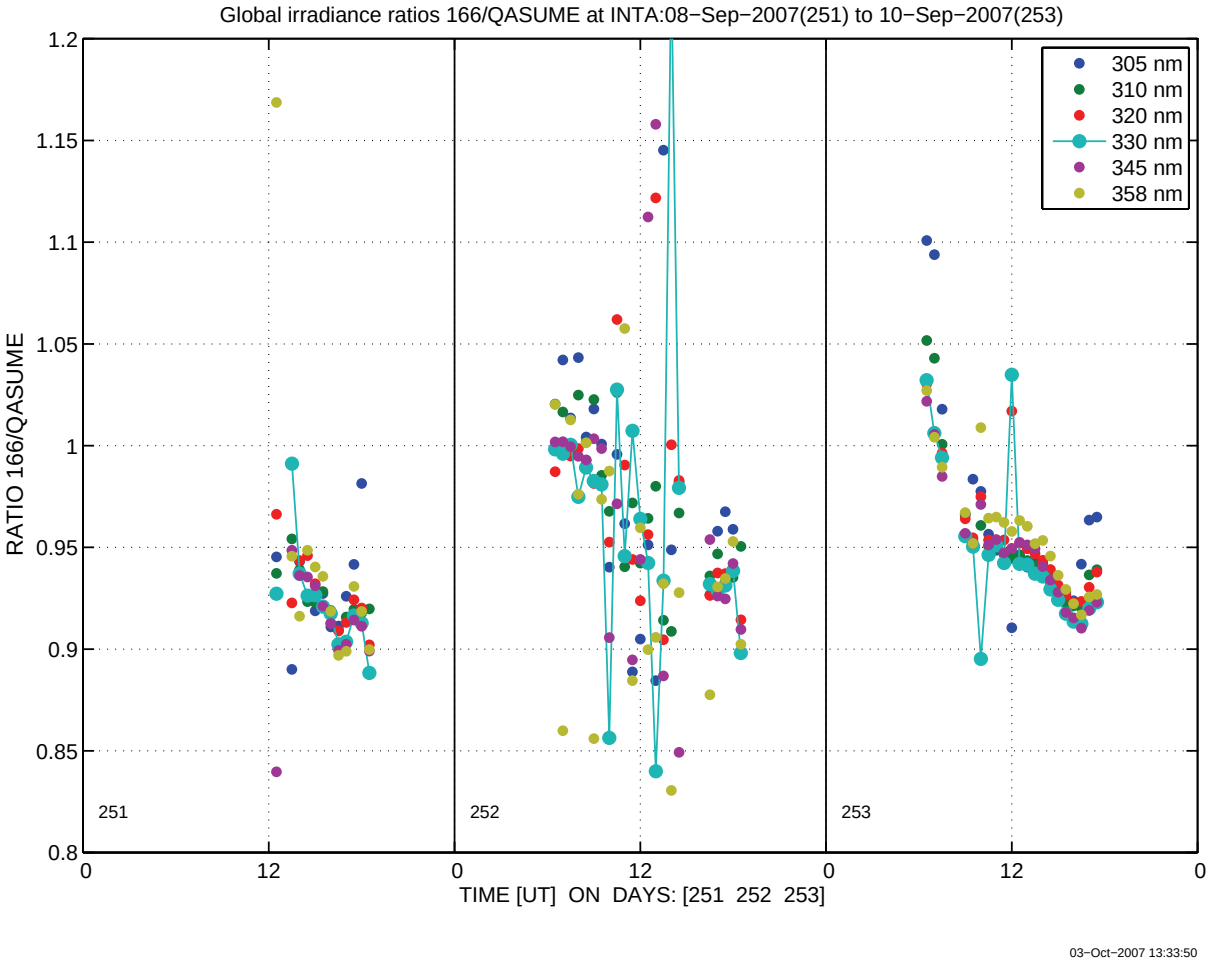


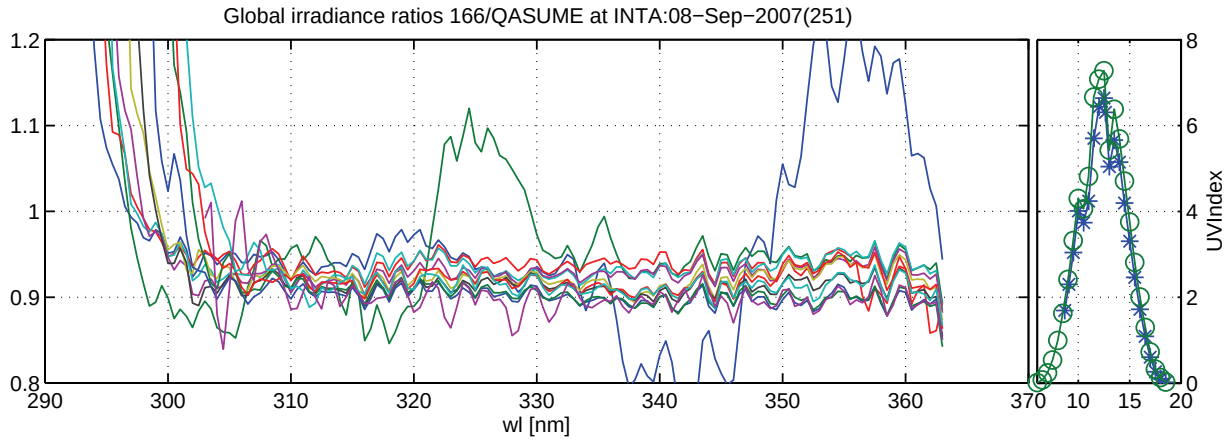
03−Oct−2007 12:48:04

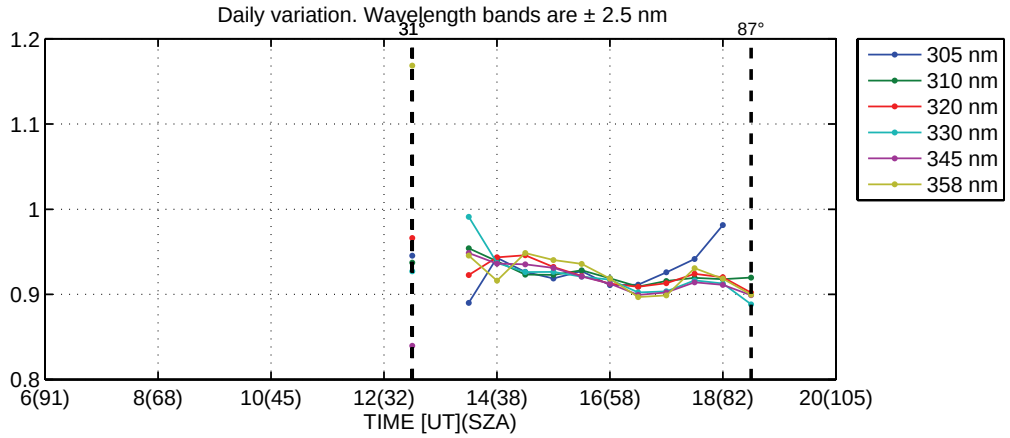



INTA, 165, September 2007
MEAN
5/95th percentile
SHICRivm wavelength shift [nm]
0.1
0.05
0
−0.05
−0.1
300
310
320
330
340
350
360
370
Wavelength [nm]

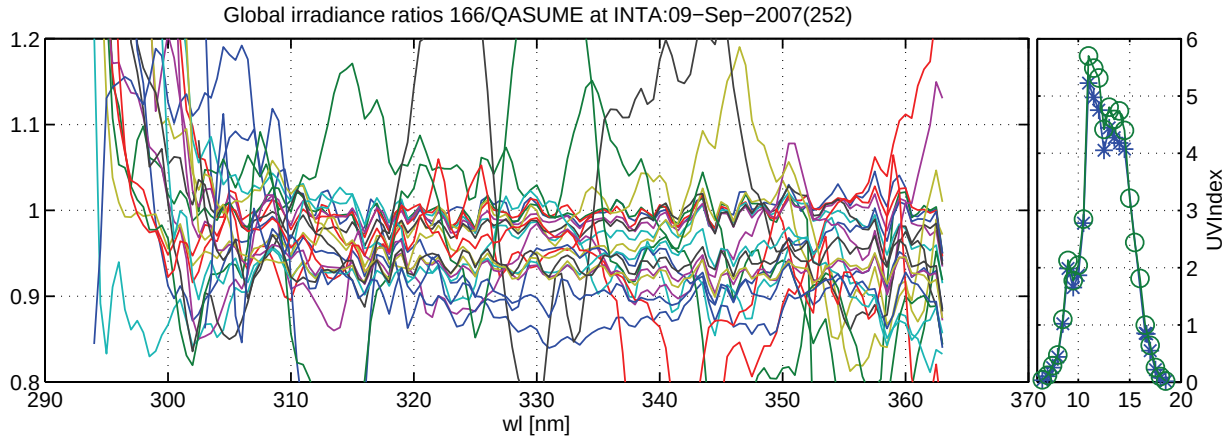

UV Index INTA, September 2007
166
QASUME
UV Index
Day of Year
0
1
2
3
4
5
6
7
8
251
251.5
252
252.5
253
253.5
254

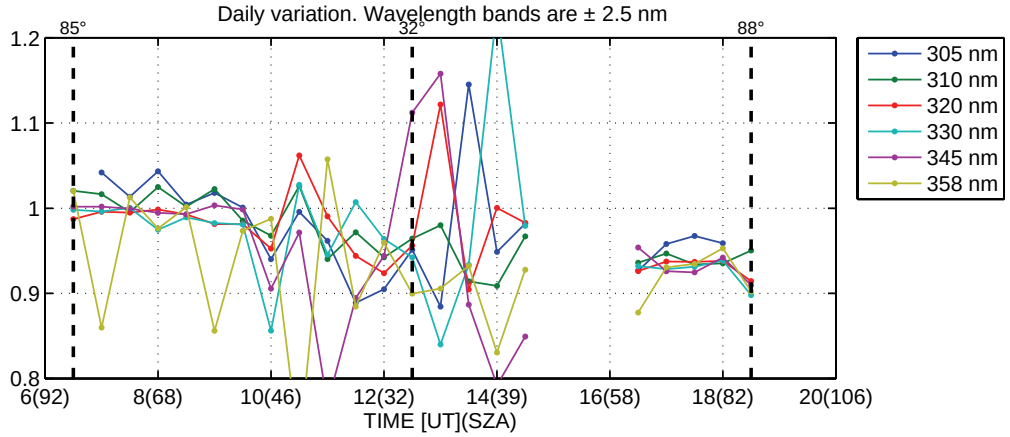

Global irradiance ratios 166/QASUME at INTA:08−Sep−2007(251) to 10−Sep−2007(253)
305 nm
310 nm
320 nm
330 nm
345 nm
358 nm
RATIO 166/QASUME
TIME [UT] ON DAYS: [251 252 253]
251
252
253
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
1.2
0
12
03−Oct−2007 13:33:50



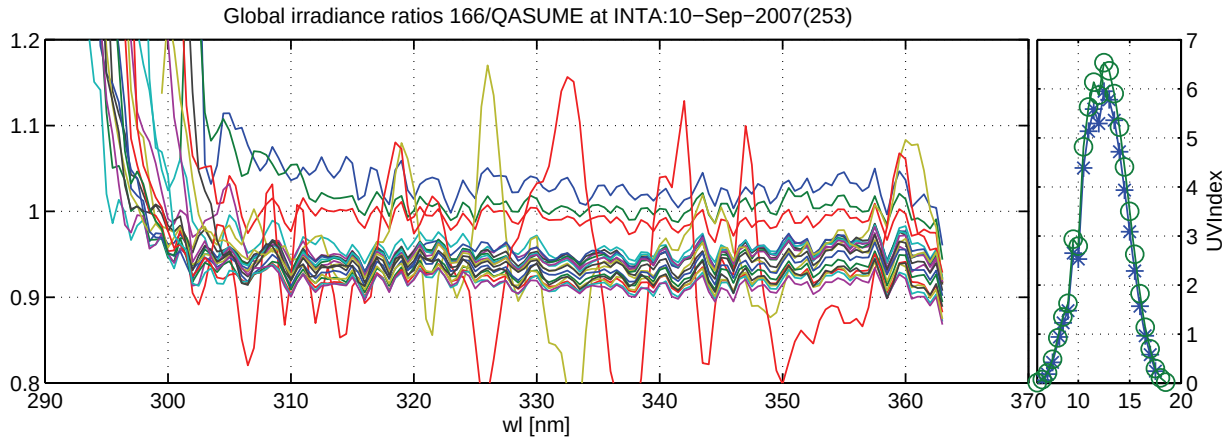


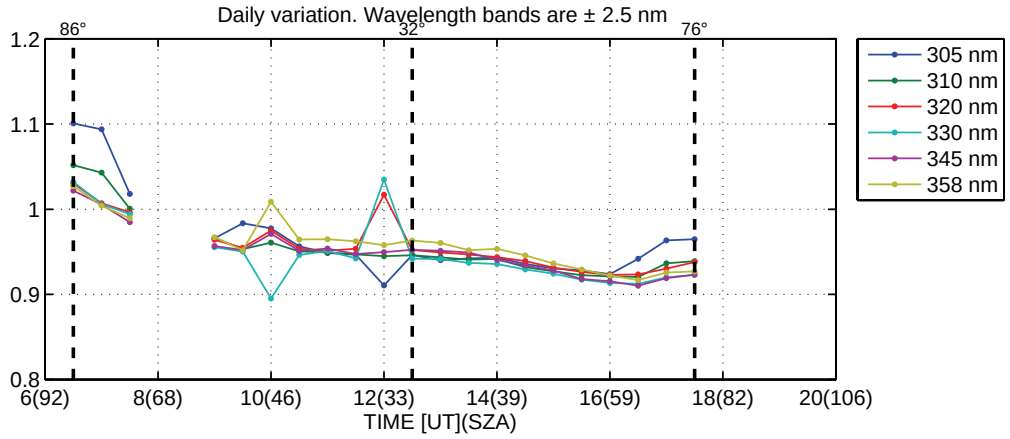
03−Oct−2007 13:33:50



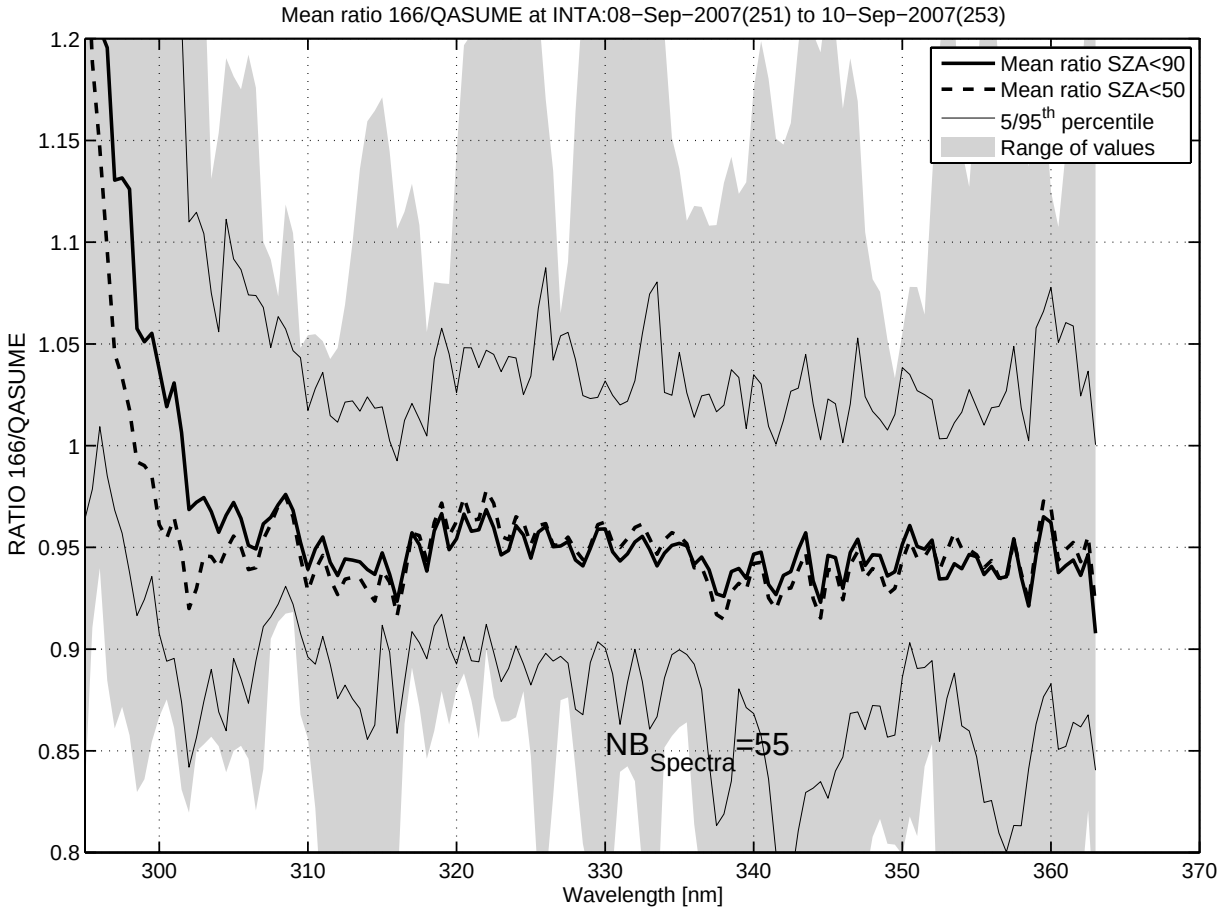


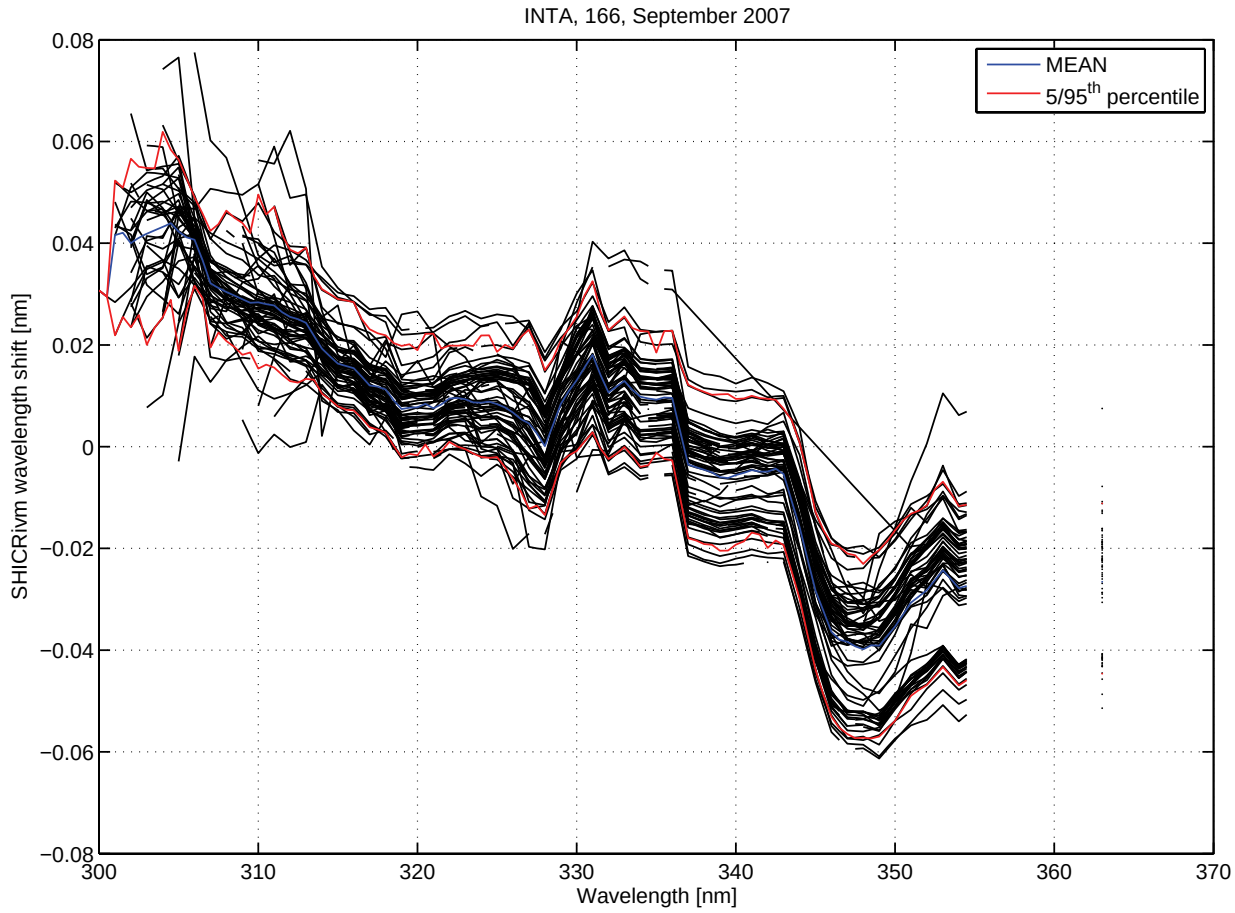
03−Oct−2007 13:33:50

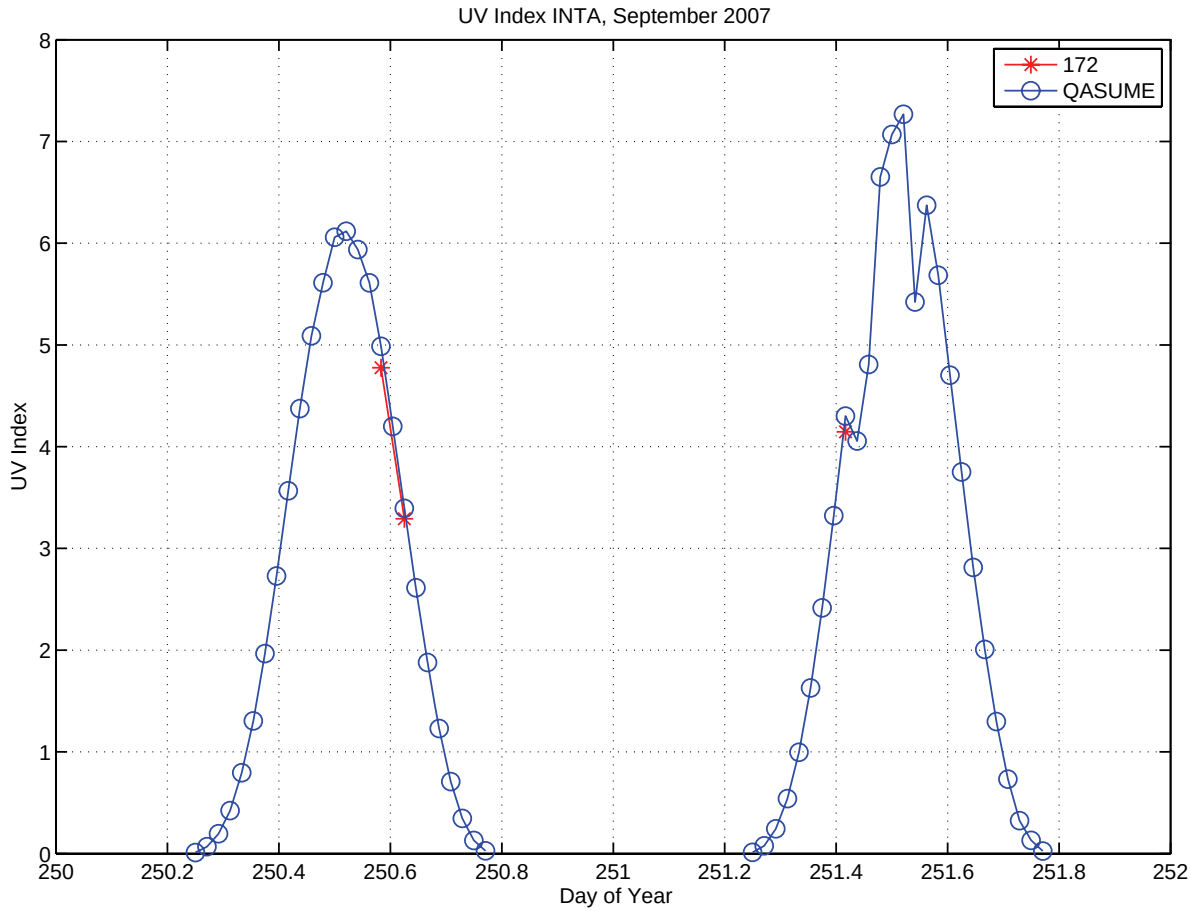


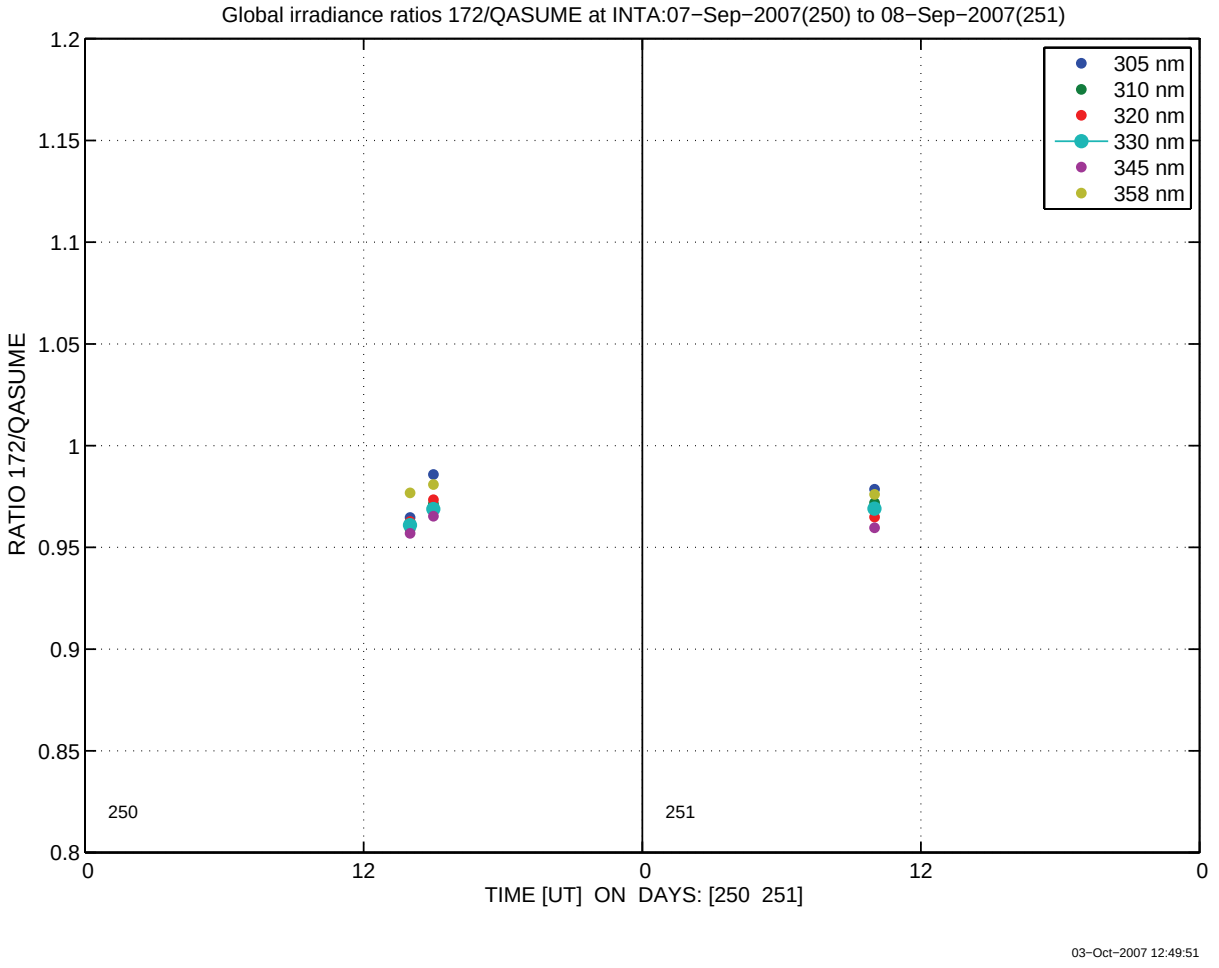


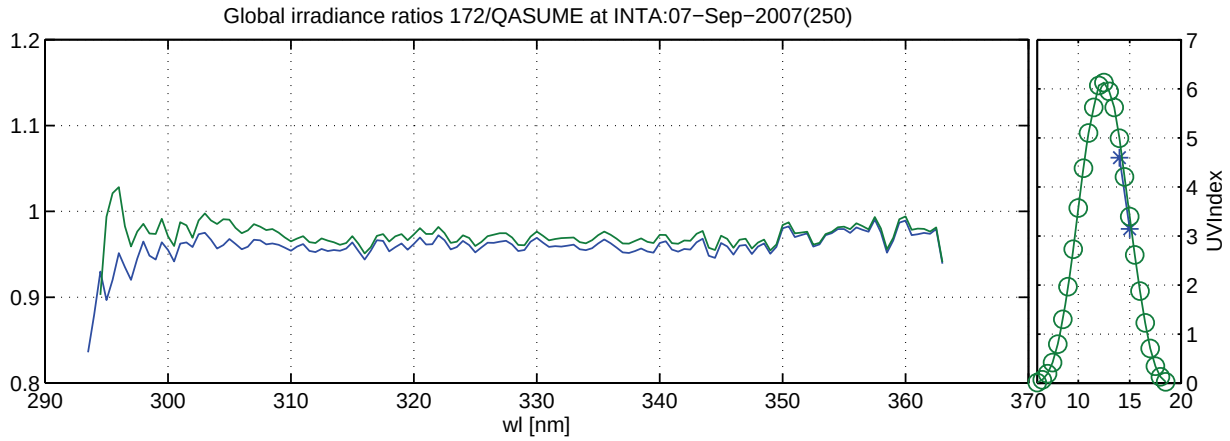
03−Oct−2007 13:33:50

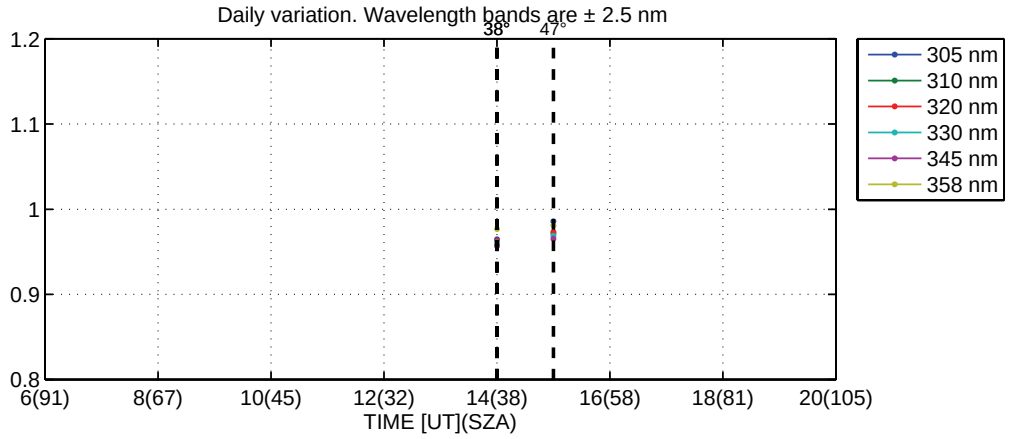



INTA, 166, September 2007
MEAN
5/95th percentile
SHICRivm wavelength shift [nm]
Wavelength [nm]
0.08
0.06
0.04
0.02
0
−0.02
−0.04
−0.06
−0.08
300
310
320
330
340
350
360
370

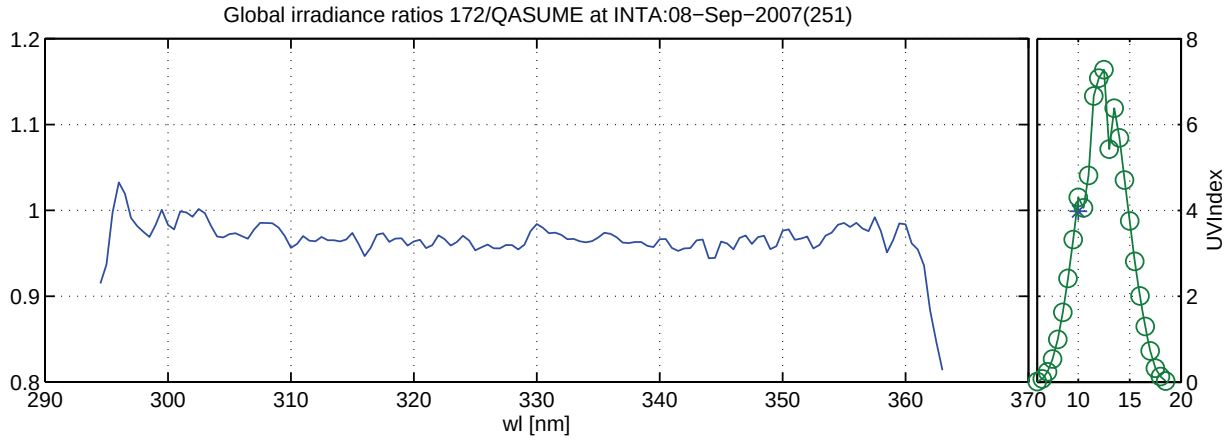

UV Index INTA, September 2007
172
QASUME
UV Index
Day of Year
0
1
2
3
4
5
6
7
8
250
250.2
250.4
250.6
250.8
251
251.2
251.4
251.6
251.8
252

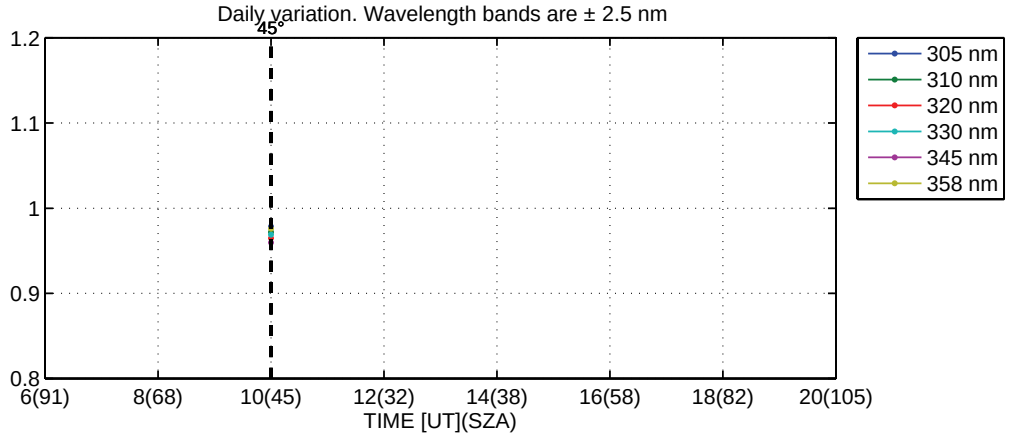

Global irradiance ratios 172/QASUME at INTA:07−Sep−2007(250) to 08−Sep−2007(251)
305 nm
310 nm
320 nm
330 nm
345 nm
358 nm
RATIO 172/QASUME
TIME [UT] ON DAYS: [250 251]
250
251
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
1.2
0
12
0
12
0
03−Oct−2007 12:49:51



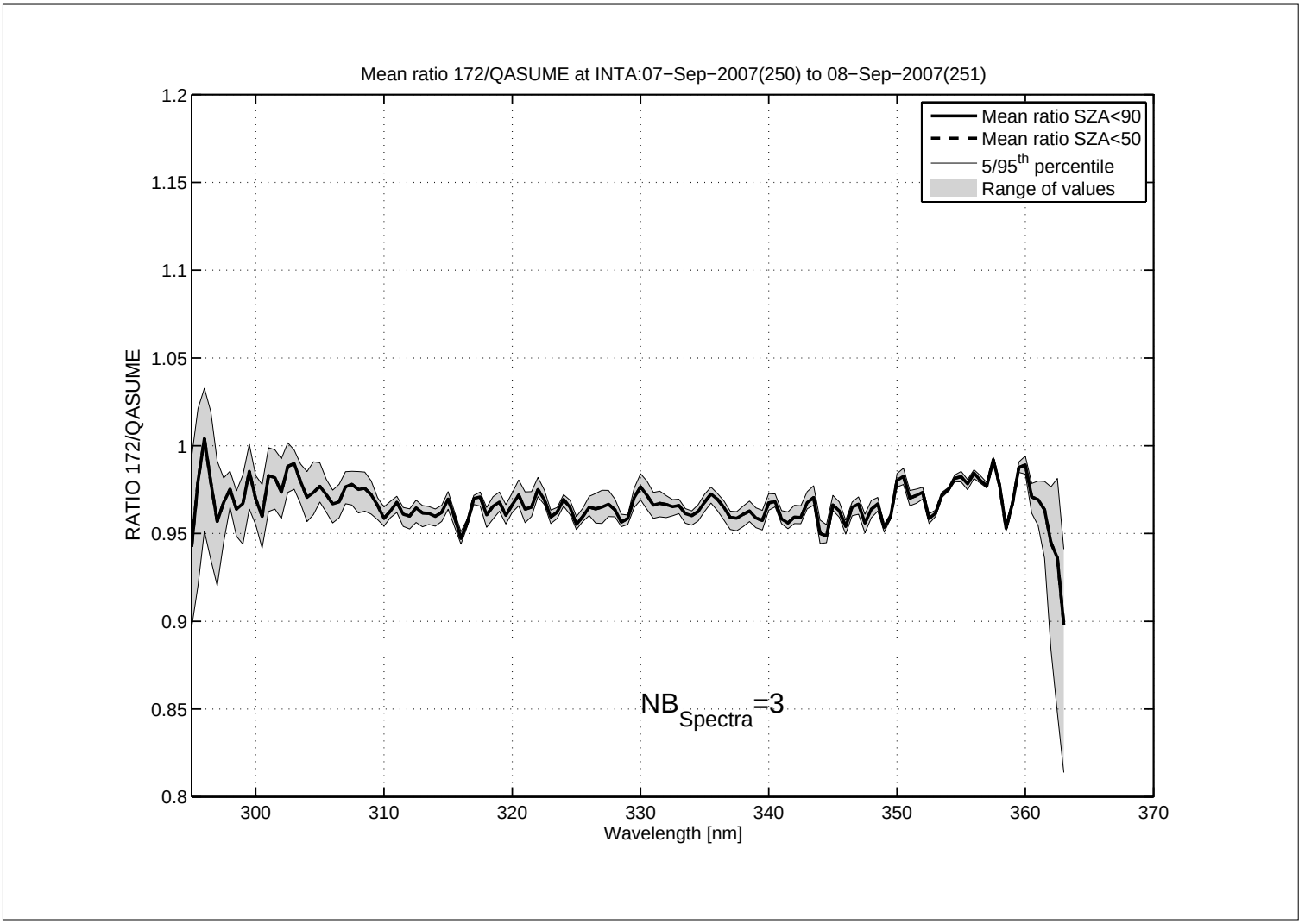


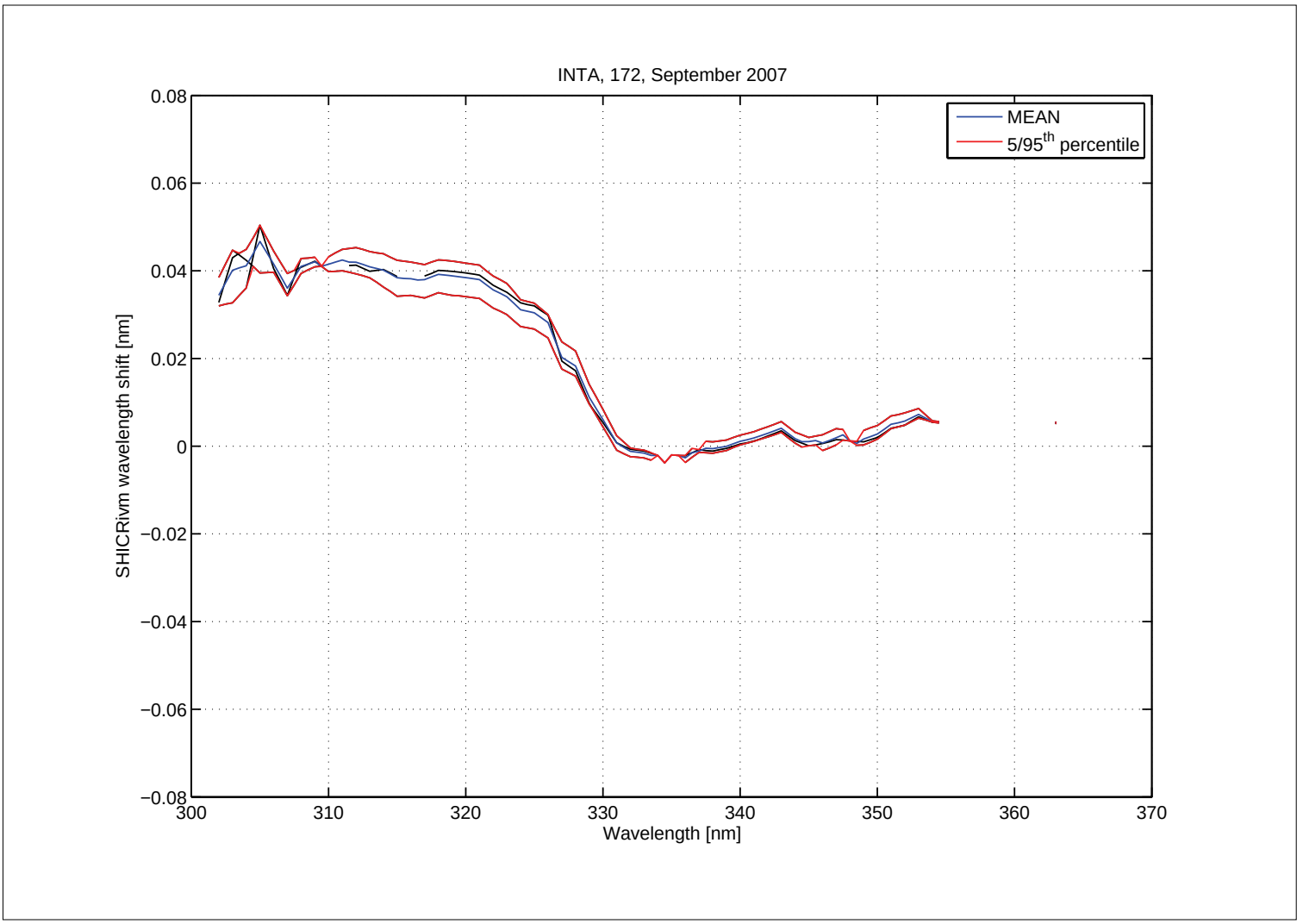
03−Oct−2007 12:49:51

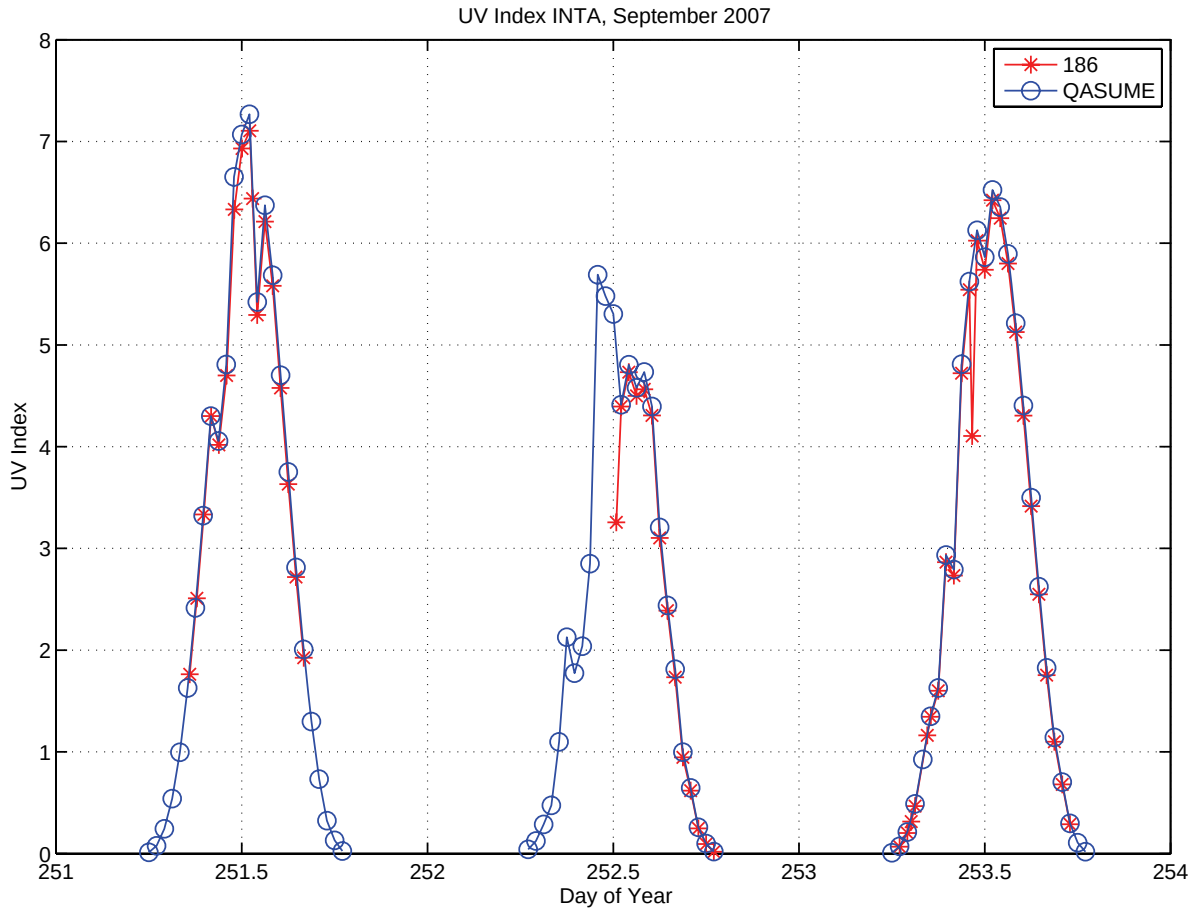


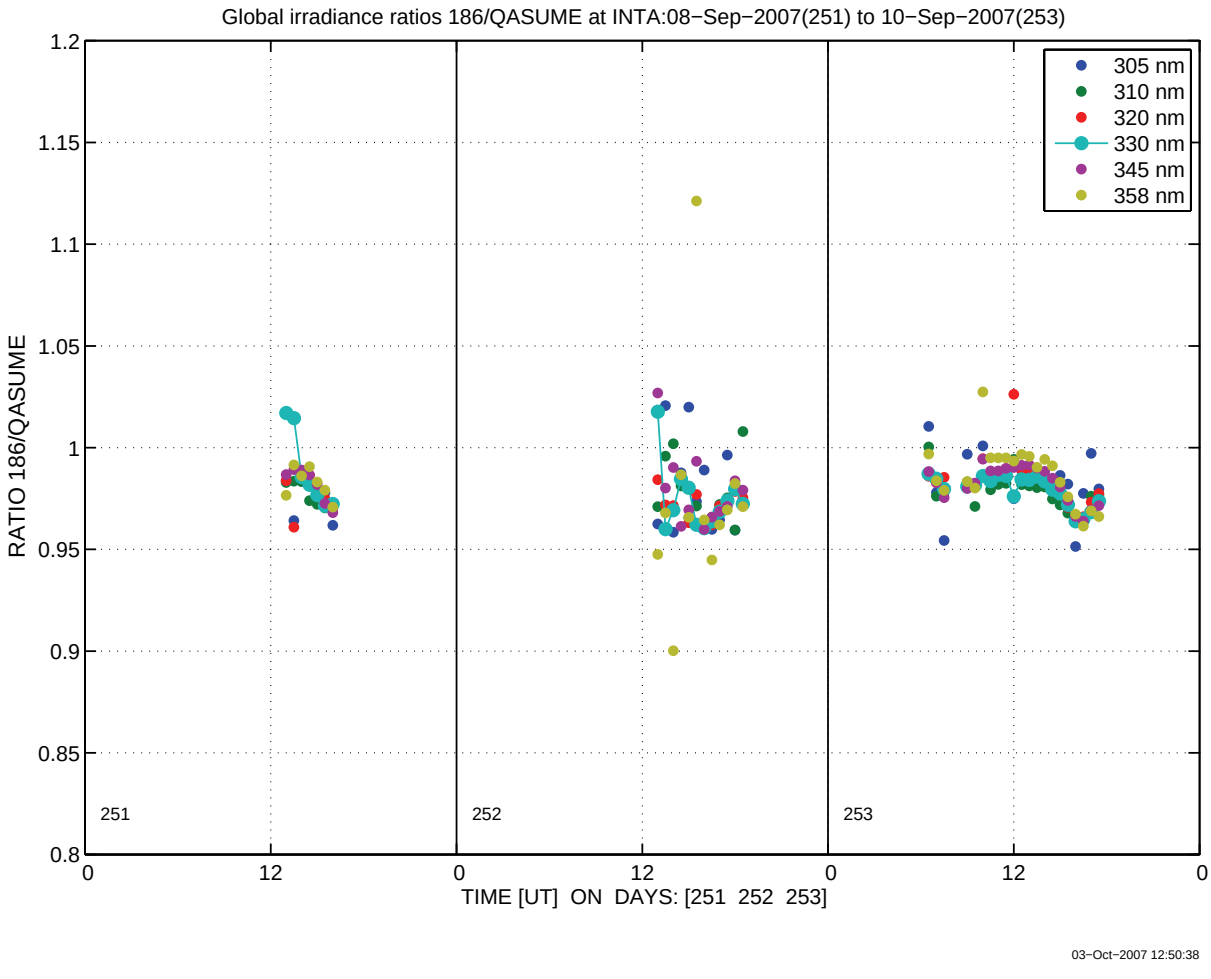


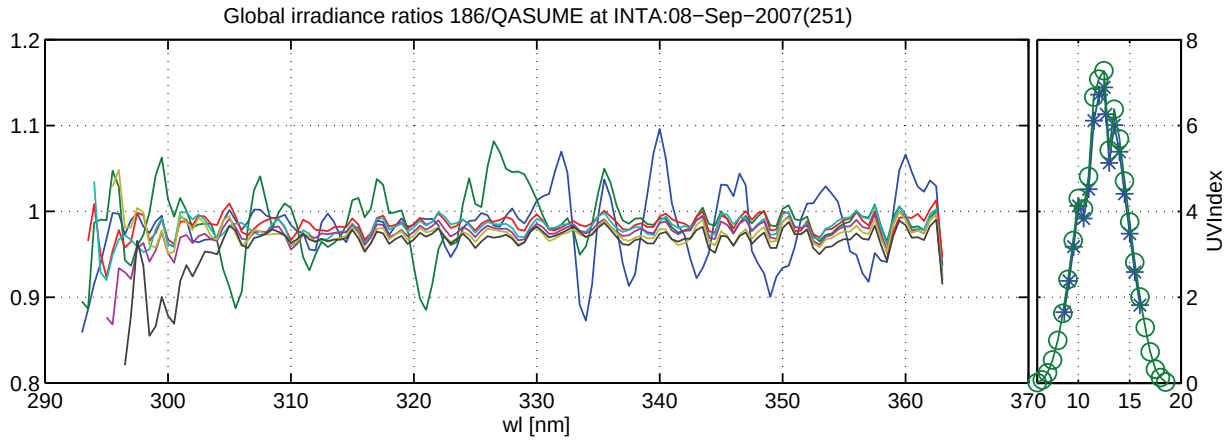
03−Oct−2007 12:49:51

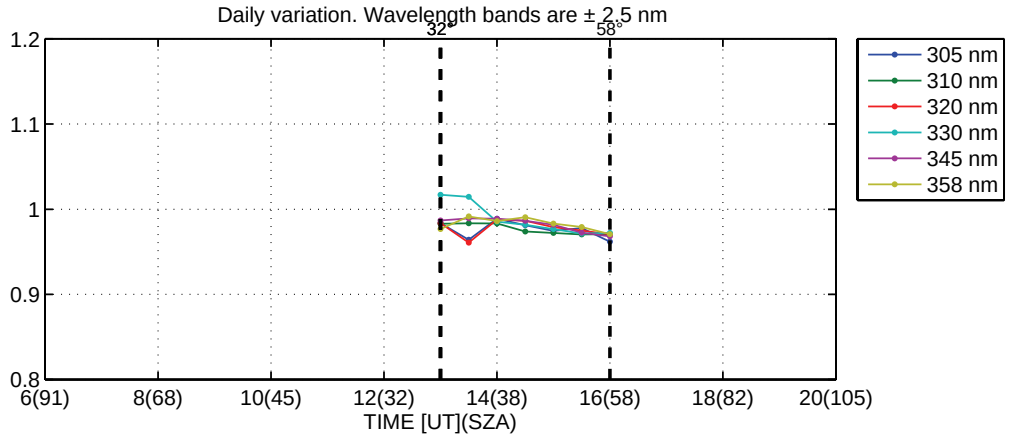

Mean ratio 172/QASUME at INTA:07−Sep−2007(250) to 08−Sep−2007(251)
Mean ratio SZA<90
Mean ratio SZA<50
5/95th percentile
Range of values
RATIO 172/QASUME
NBSpectra=3
Wavelength [nm]


INTA, 172, September 2007
MEAN
5/95th percentile
SHICRivm wavelength shift [nm]
Wavelength [nm]

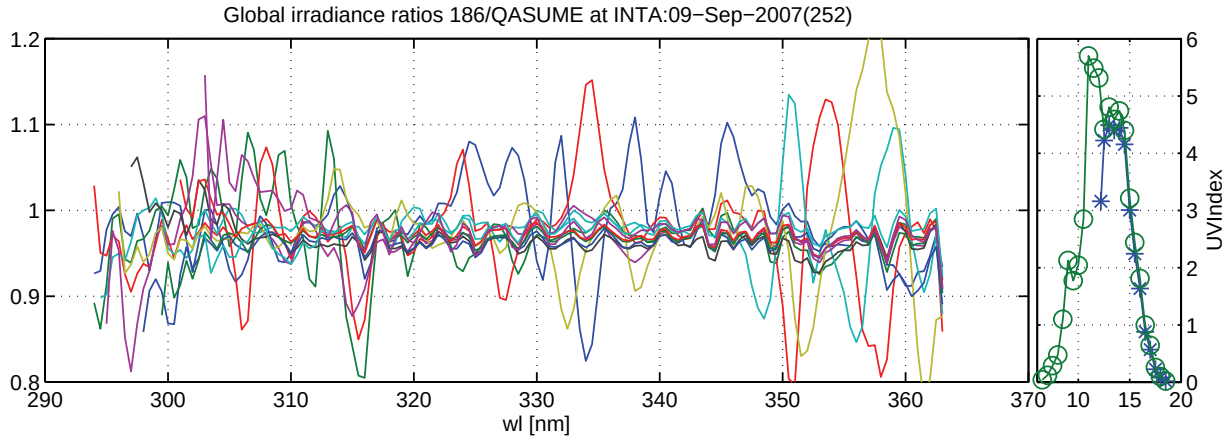

UV Index INTA, September 2007
186
QASUME
UV Index
Day of Year
0
1
2
3
4
5
6
7
8
251
251.5
252
252.5
253
253.5
254

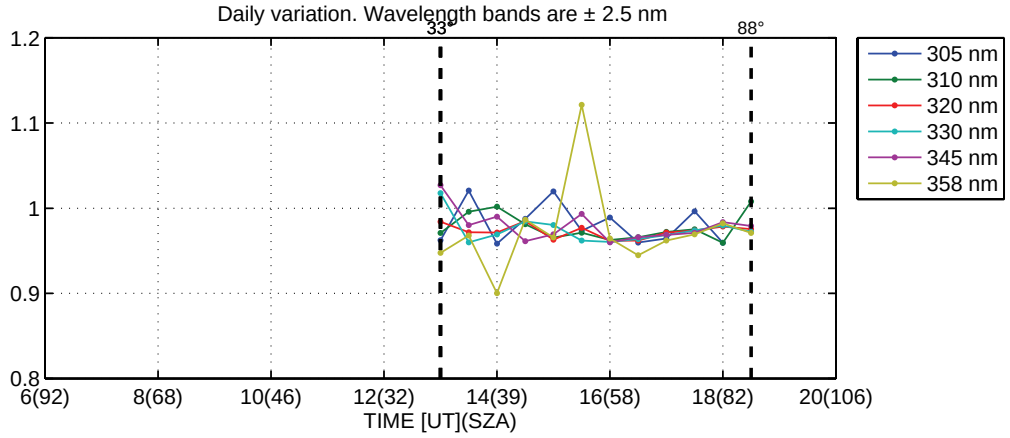

Global irradiance ratios 186/QASUME at INTA:08−Sep−2007(251) to 10−Sep−2007(253)
305 nm
310 nm
320 nm
330 nm
345 nm
358 nm
RATIO 186/QASUME
TIME [UT] ON DAYS: [251 252 253]
251
252
253
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
1.2
0
12
03−Oct−2007 12:50:38



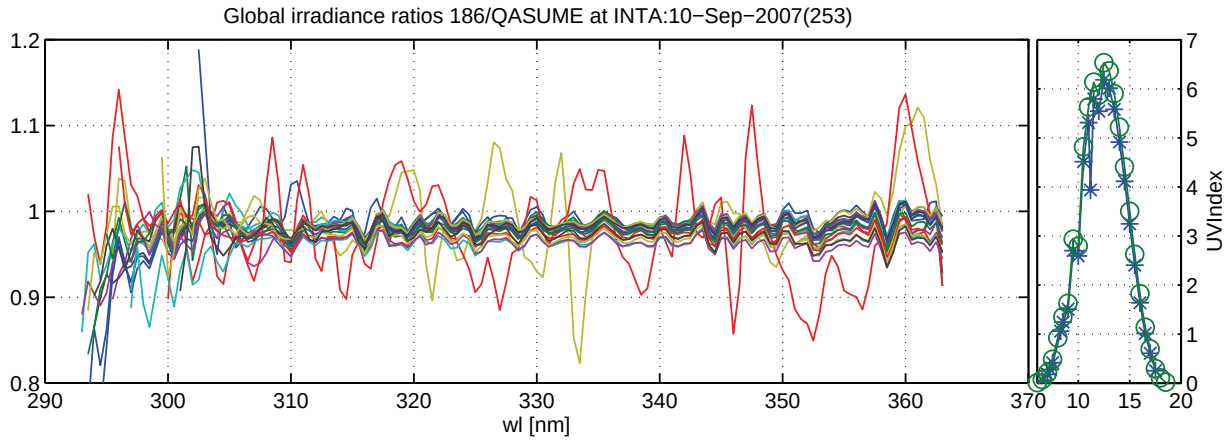


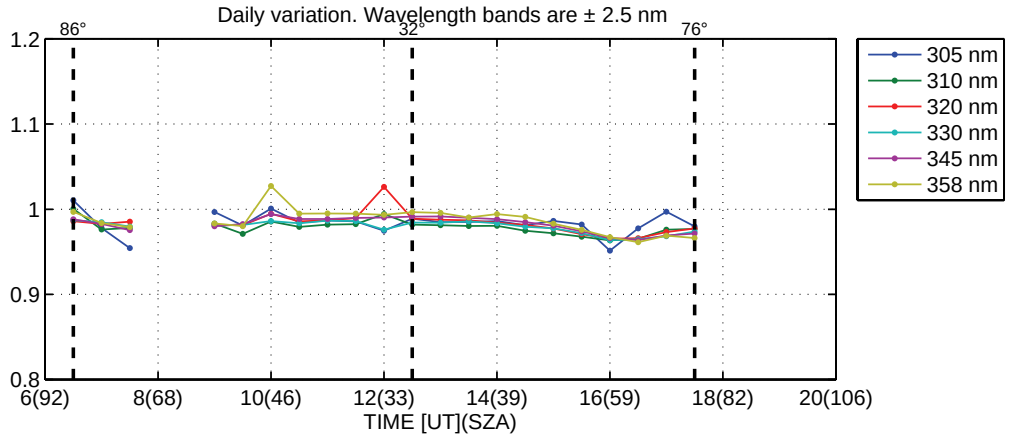
03−Oct−2007 12:50:38



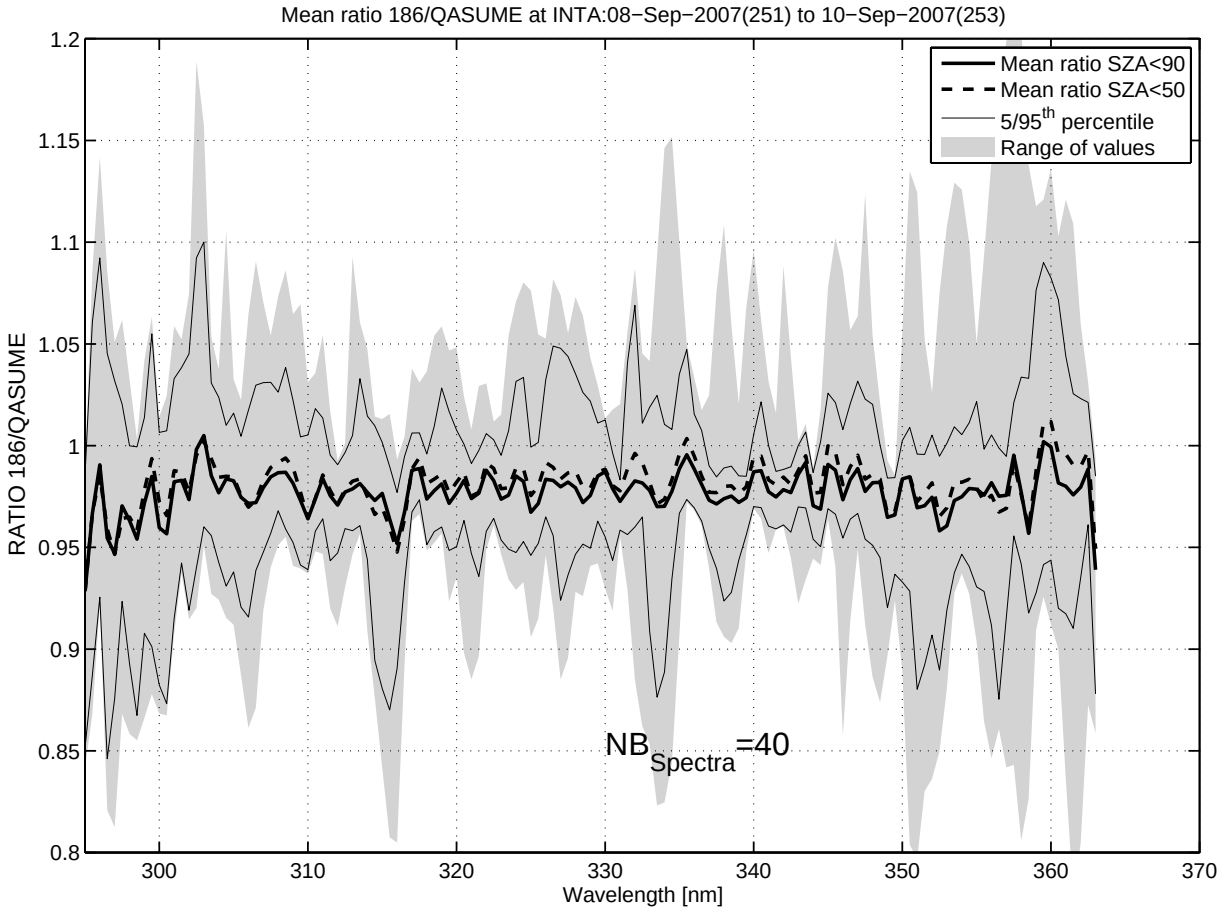


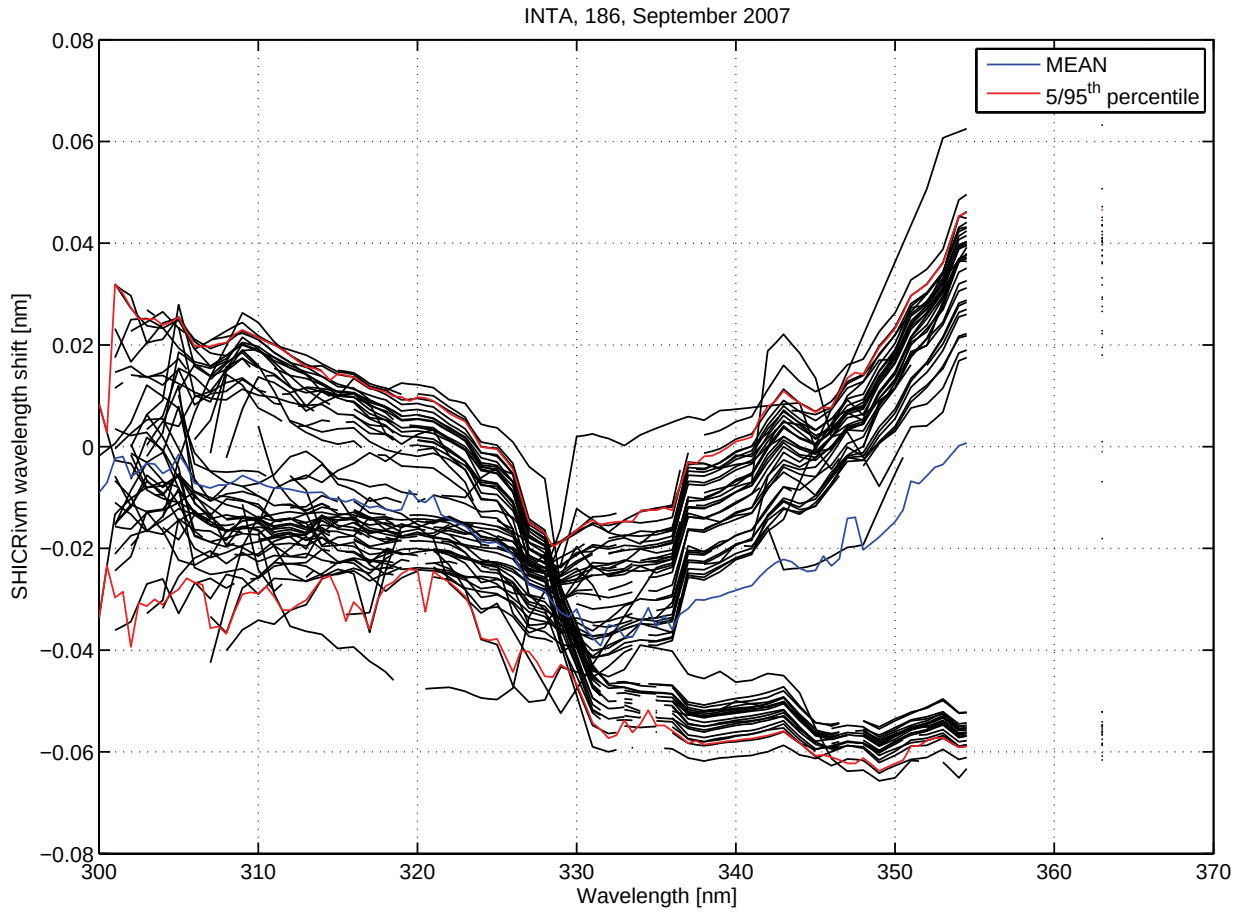
03−Oct−2007 12:50:38

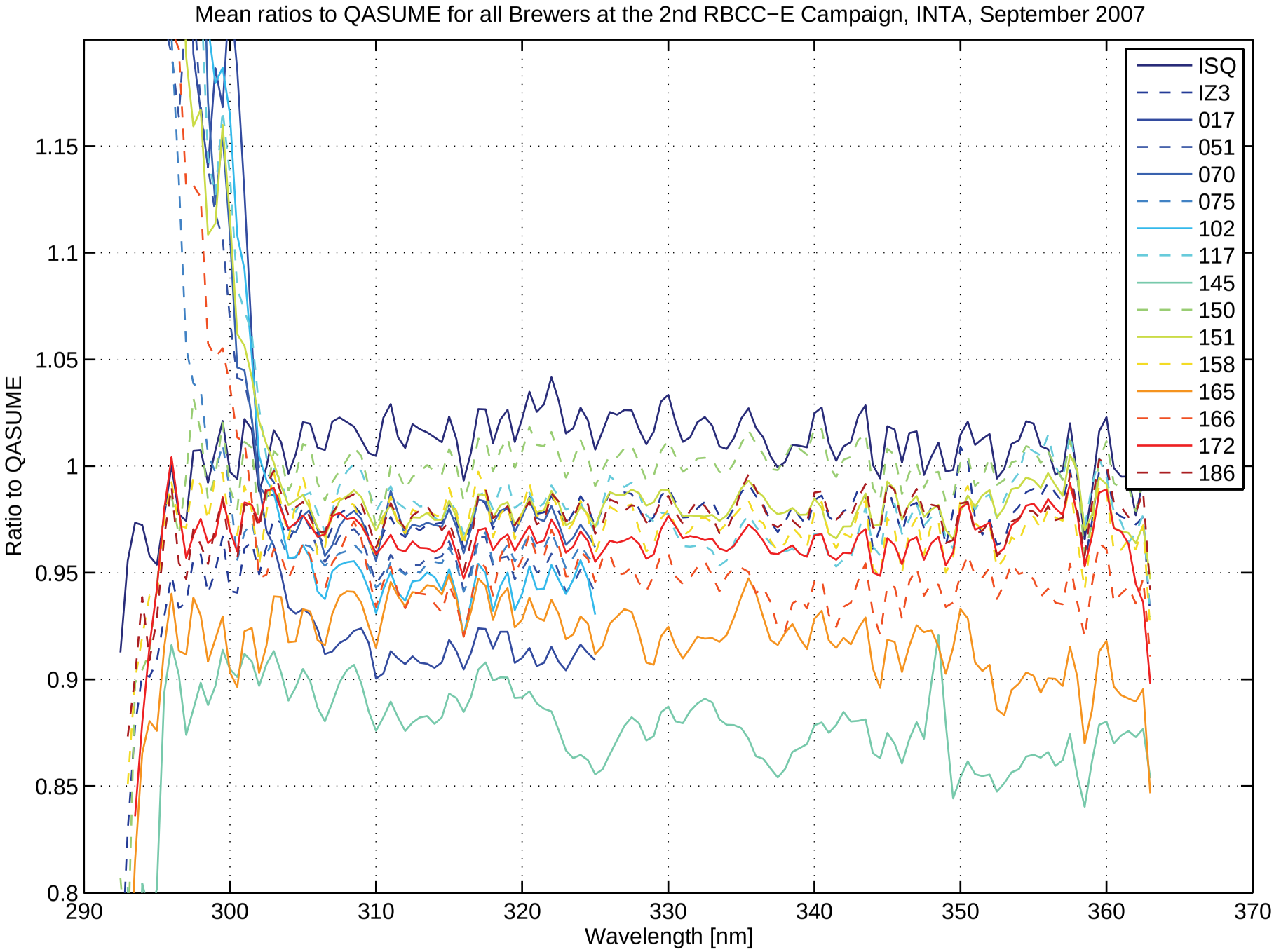


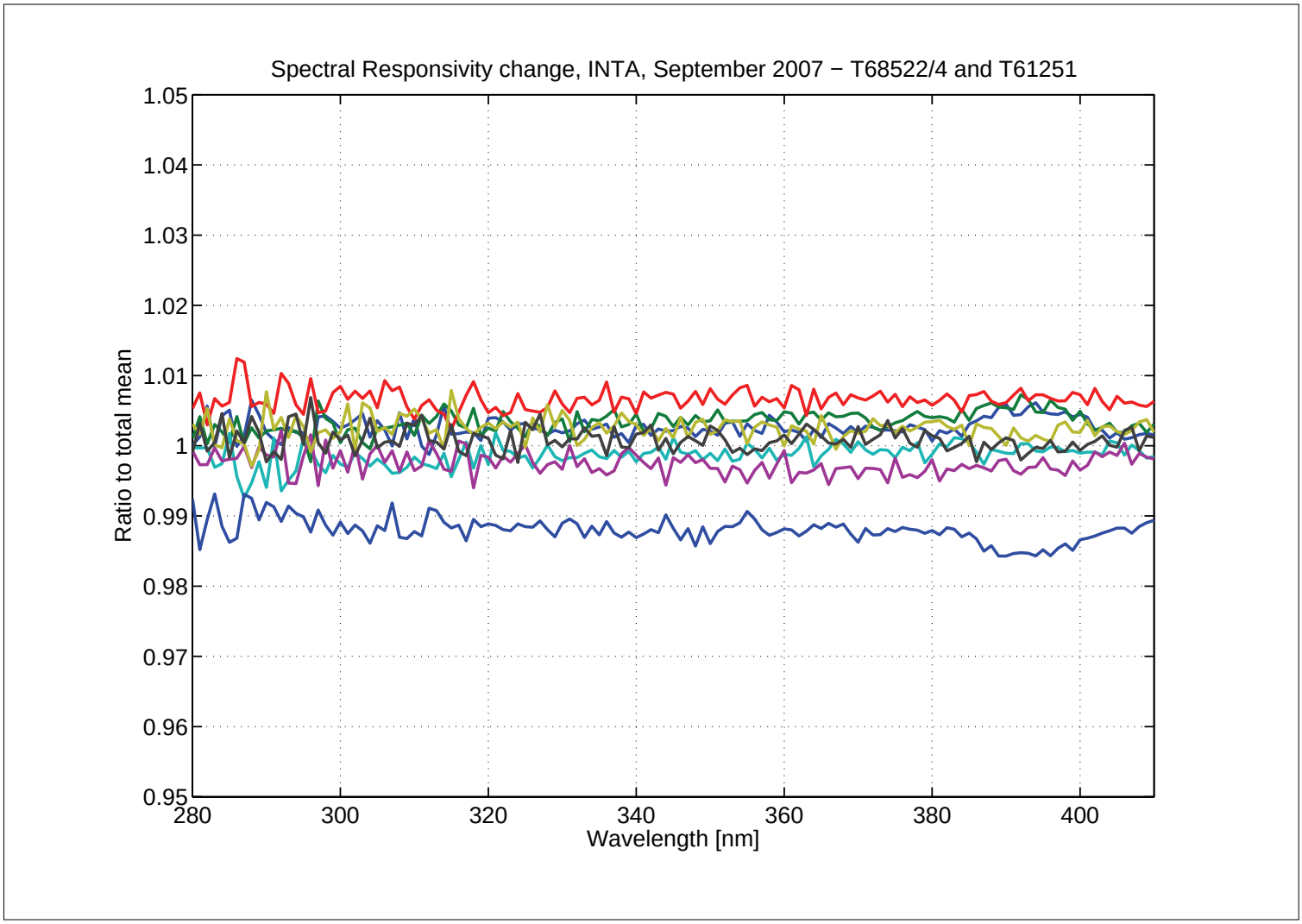


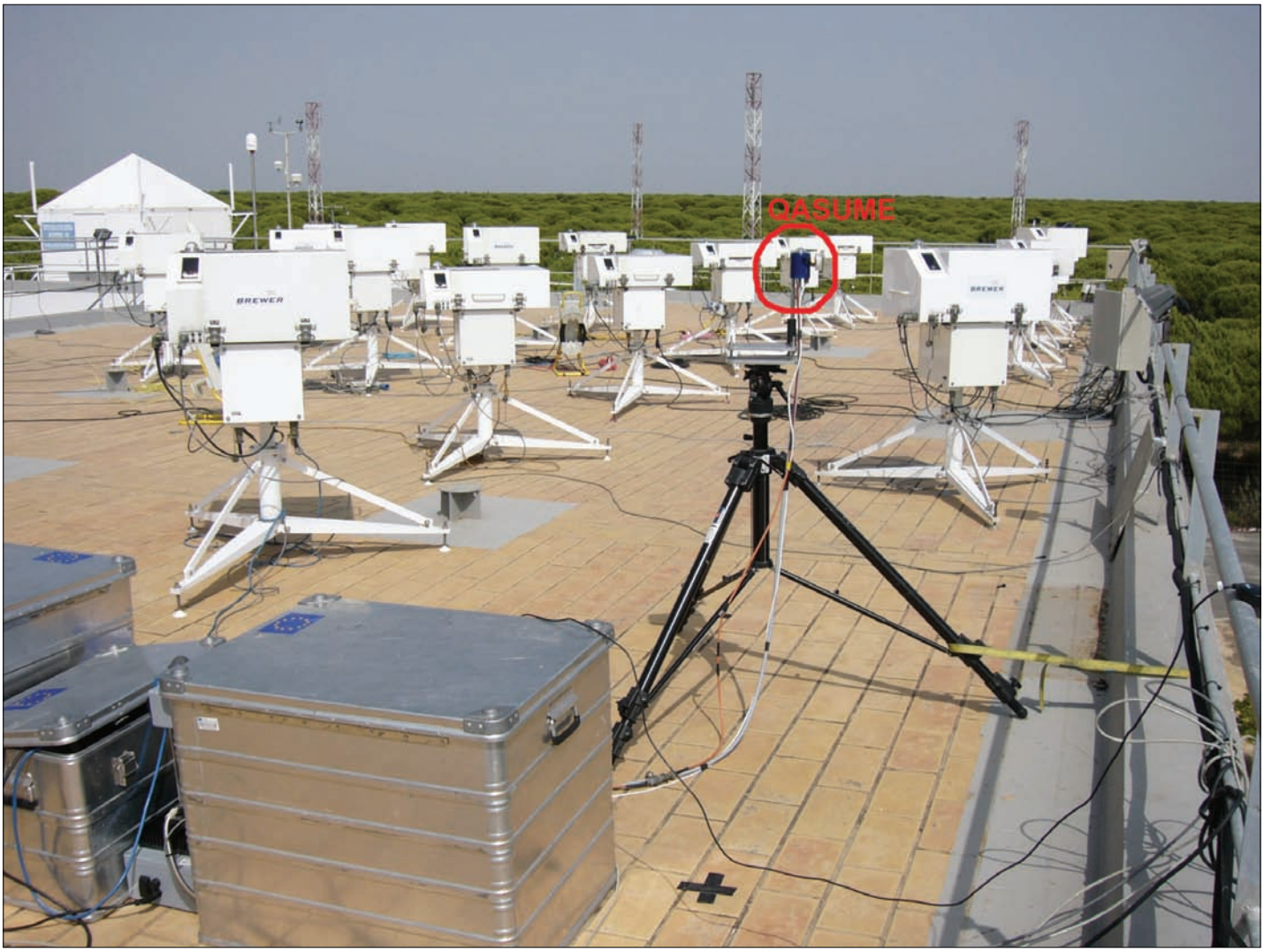
03−Oct−2007 12:50:38




INTA, 186, September 2007
MEAN
5/95th percentile
SHICRivm wavelength shift [nm]
Wavelength [nm]
0.08
0.06
0.04
0.02
0
−0.02
−0.04
−0.06
−0.08
300
310
320
330
340
350
360
370


Mean ratios to QASUME for all Brewers at the 2nd RBCC−E Campaign, INTA, September 2007
Ratio to QASUME
Wavelength [nm]
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
290
300
310
320
330
340
350
360
370
ISQ
IZ3
017
051
070
075
102
117
145
150
151
158
165
166
172
186


Spectral Responsivity change, INTA, September 2007 − T68522/4 and T61251
Ratio to total mean
Wavelength [nm]
1.05
1.04
1.03
1.02
1.01
1
0.99
0.98
0.97
0.96
0.95
280
300
320
340
360
380
400


QASUME
BREWER