

Protocol of the intercomparison at the Polish Geophysical Institute,
Warsaw, Poland, May, 20-22 2004 with the travelling standard
spectroradiometer B5503 from ECUV within the project QASUME

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The purpose of the visit was the comparison of global solar irradiance measurements between the spectroradiometer operated by the Polish Geophysical Institute (PGI) and B5503 within the project QASUME. The measurement site is located at Warsaw; Latitude 52.246 N, Longitude 20.939 E and altitude 100 m.a.s.l.. The usual measurement site of the PGI instrument is at Belsk, some 50 km from Warsaw.

The horizon of the measurement site is free in all directions.

B5503 arrived at Warsaw in the afternoon of May 19, 2004. The spectroradiometer was installed on the roof of the Geophysical Institute. The spectroradiometer in use at PGI is a Brewer #064 MKII single monochromator. The intercomparison between B5503 and the local spectroradiometer lasted three days, from the morning of May 20 to the evening of May 22.

B5503 was calibrated several times during the intercomparison period using a portable calibration system. Three lamps were used to obtain an absolute spectral calibration traceable to the primary reference held at ECUV which is traceable to PTB: T57824 (100 W), T53061 (100W) and T61252 (250 W). The responsivity of the instrument based on these calibrations varied by less than 1% during the intercomparison. The internal temperature of B5503 was stabilised at 24.6°C and varied by less than 0.2°C. The diffuser head was heated to a temperature of 25±1°C.

The wavelength shifts relative to an extraterrestrial spectrum as retrieved from the SHICRivm analysis were between ± 50pm in the spectral range 310 to 400 nm.

Protocol:

The measurement protocol was to measure one solar irradiance spectrum every 30 minutes from 286 to 400 nm, every 0.5 nm, with wavelength increments every 3 sec from 286 to 325 nm and faster afterwards.

The measurements were also used to calibrate a number of broadband instruments installed on the same building roof (Janusz Krzyścin).

May 19 (140):

Arrival and setup of the instrument in the afternoon. Instrument was left to stabilise until the following morning.

May 20 (141):

Synchronised measurements are available from 4:00 to 17:30 UT. B5503 missed the 10:30 UT scan due to calibration. Weather conditions from 5:00 till

09:30 are fully overcast with fast moving low lying clouds. The whole day very strong wind.

B5503 calibrated from 10:17 to 10:47 UT and from 14:35 to 14:50 UT.

May 21 (142):

Synchronised measurements are available from 4:00 to 10:00 UT and from 15:00 to 17:30 UT. The PGI instrument was moved into the laboratory for the slit function measurement using the HeCd Laser at 325 nm and for the directional measurement of the entrance optic (10:07 to 14:50 UT).

Weather conditions were cloudy skies up to 13:00 UT and a mix of sun and clouds afterwards.

May 22 (143):

Synchronised measurements are available from 3:30 to 9:00 UT and from 11:00 to 16:30 UT. B5503 missed the 10:00 and 10:30 UT scan due to calibration. Weather conditions: Rain over night. Cloudy skies from 3:30 up to 9:00. Windy during all the day. Some direct sun conditions after 15:30 UT

B5503 calibrated from 9:35 to 10:31 UT.

Results:

67 synchronised scans are available from the measurement period.

The wavelength shifts of the submitted solar spectra of the PGI spectroradiometer retrieved through the SHICRivm analysis varied by 40 pm.

The absolute wavelength shift relative to the extraterrestrial spectrum used by the SHICRivm software was -50 pm.

The intercomparison of the global irradiance measured by the two instruments can be summarized as follows:

- Global irradiances measured by PGI at wavelengths longer than 305 nm were between -6% and +6% relative to those measured by B5503.
- At wavelengths shorter than 305 nm measurements of PGI are systematically higher than those measured by B5503. This seems to be due to excessive stray light within the single monochromator Brewer. At 300 nm, measurements are on average 18% higher, with a strong SZA dependence.
- Diurnal variations of about 5% are observed between both instruments. On May 22 (143), measurements of PGI decrease during the day by about 4%, independent off wavelength.
- The spectral ratios between PGI and B5503 decrease by about 4% (from 1 to 0.96) between 305 and 325 nm. This also was observed on other single Brewer instruments.
- The directional response measurements are variable due to either lamp source variations of the directional response measurement system, or some misalignments during the measurement itself: normal incidence values varied by 6.5% on successive returns to this nominal position.

Conclusion:

At wavelengths longer than 305 nm, PGI measures global solar irradiance on average 0-3% lower than B5503; a 3% spectral wavelength dependence of the spectral ratios PGI to B5503 is observed. Above 305

nm, the variability between the two spectroradiometers was 4% or less during the three-day measurement period. At 300 nm, PGI overestimates global solar irradiance by a factor between 1.0 to 2.2 dependent on the SZA.

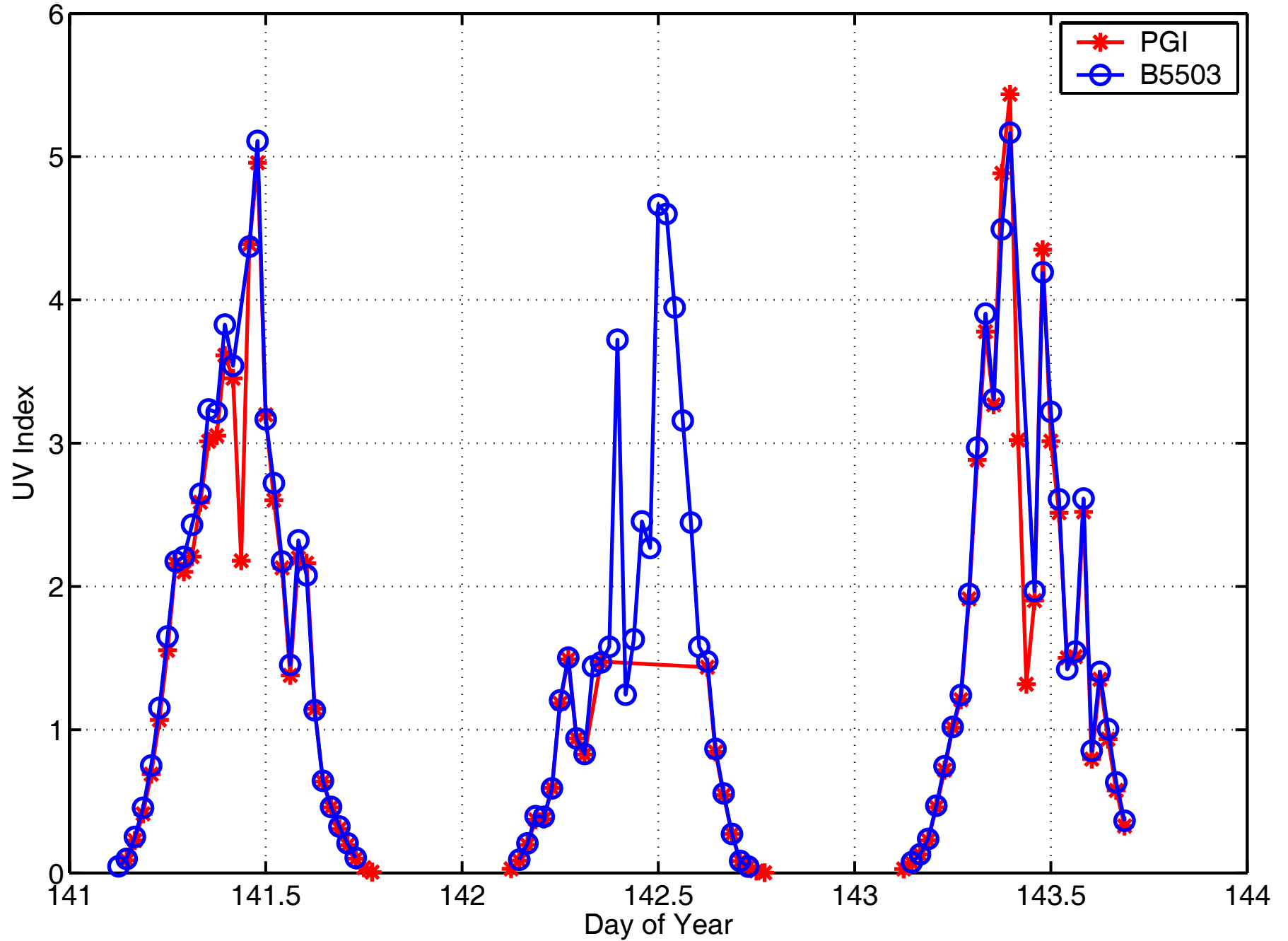
Comments from the local operator:

Brewer No 064 working at Belsk, Poland performs global UV measurements throughout the day at about every 20 minutes which gives 16-40 measurements per day according to the season. Measurements have been started at 1992. Except the routine calibrations with portable set of 50 W lamps instrument is calibrated yearly against 1000 W lamp from IOS (since 2000).

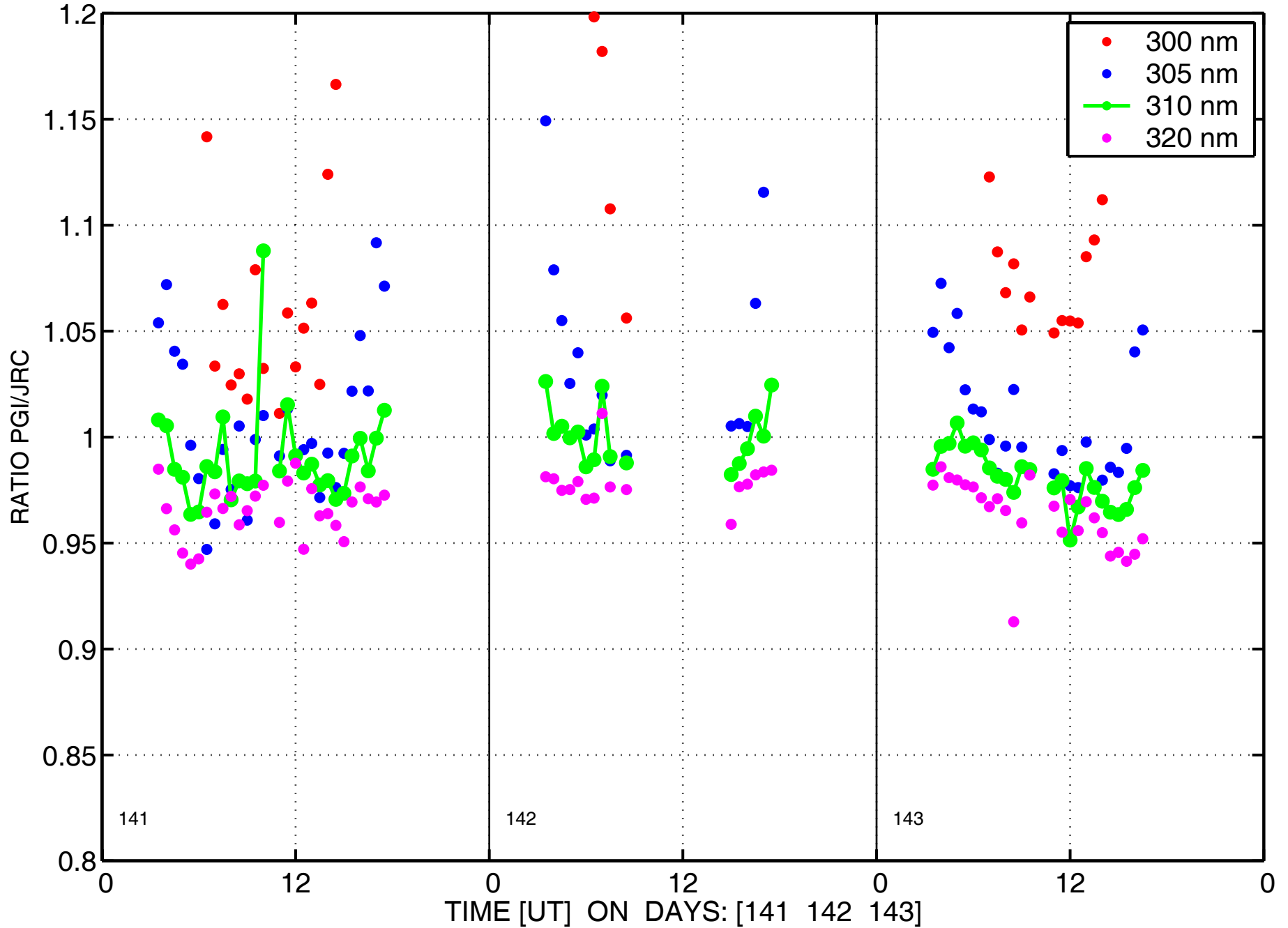
This Brewer is well known Mark II version, so possibly there is no need to describe its technical specifications here.

No temperature or cosine correction is applied to the global UV measurements.

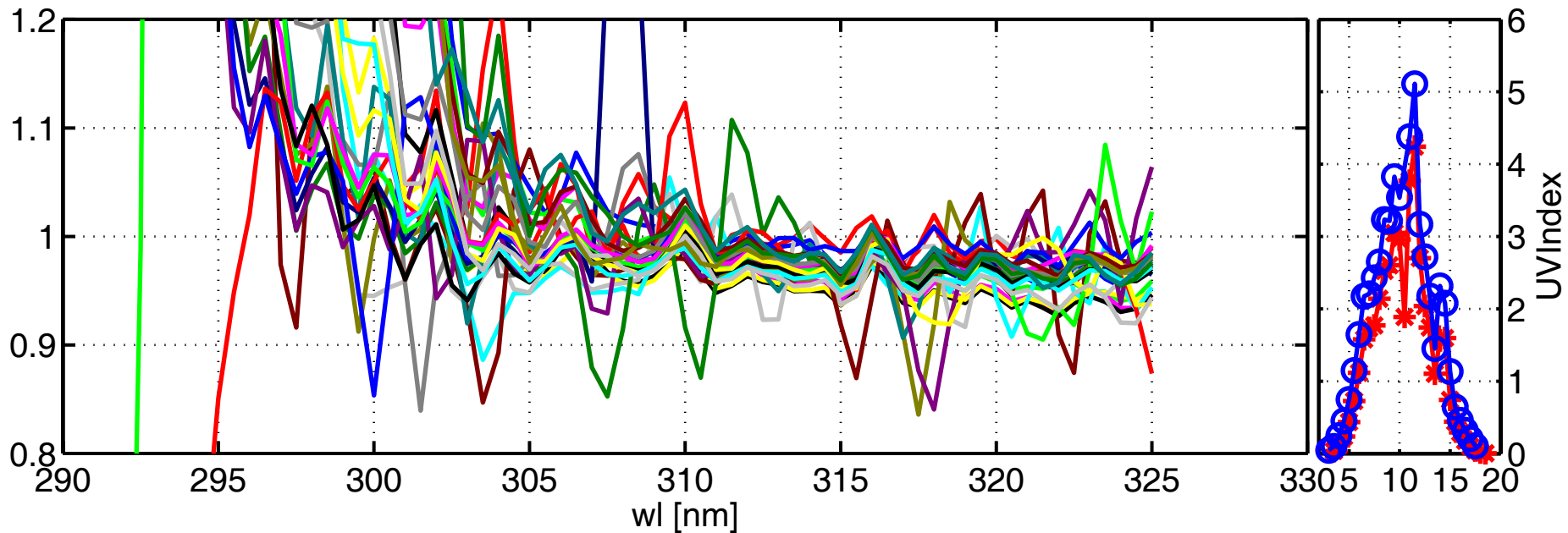
UV Index Warsaw May 20–22 2004



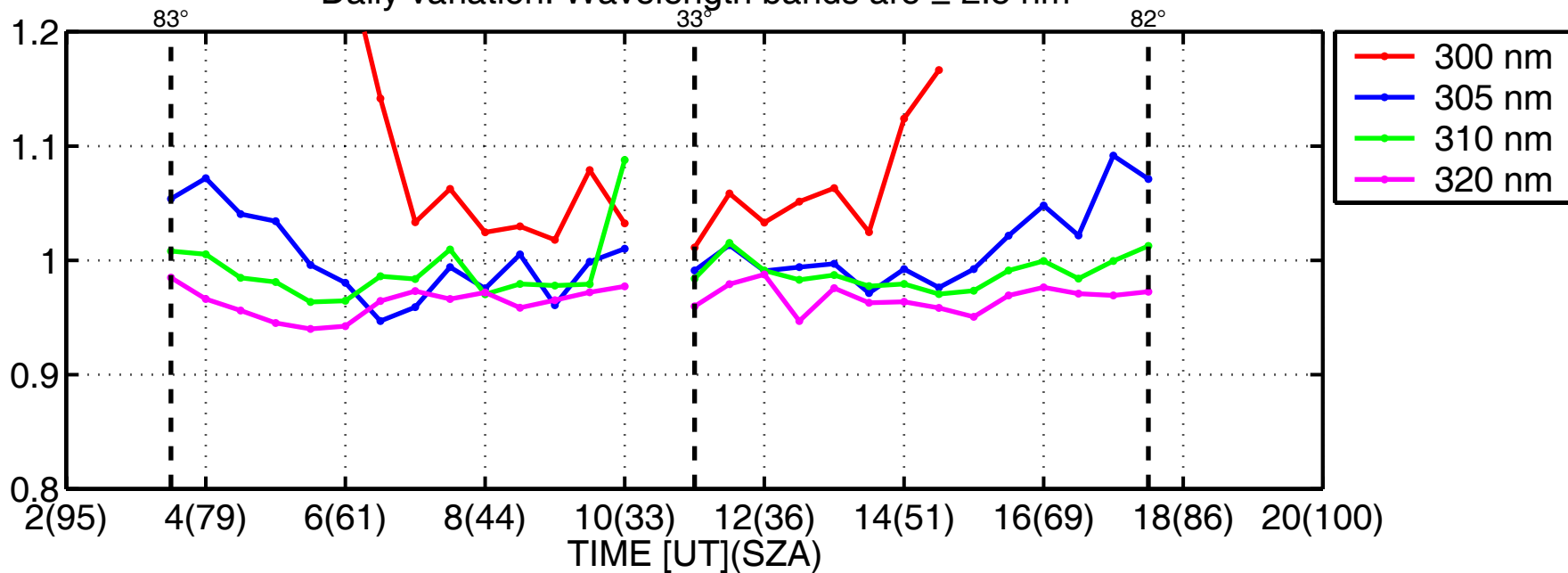
Global irradiance ratios PGI/JRC at Warsaw:20-May-2004(141) to 22-May-2004(143)



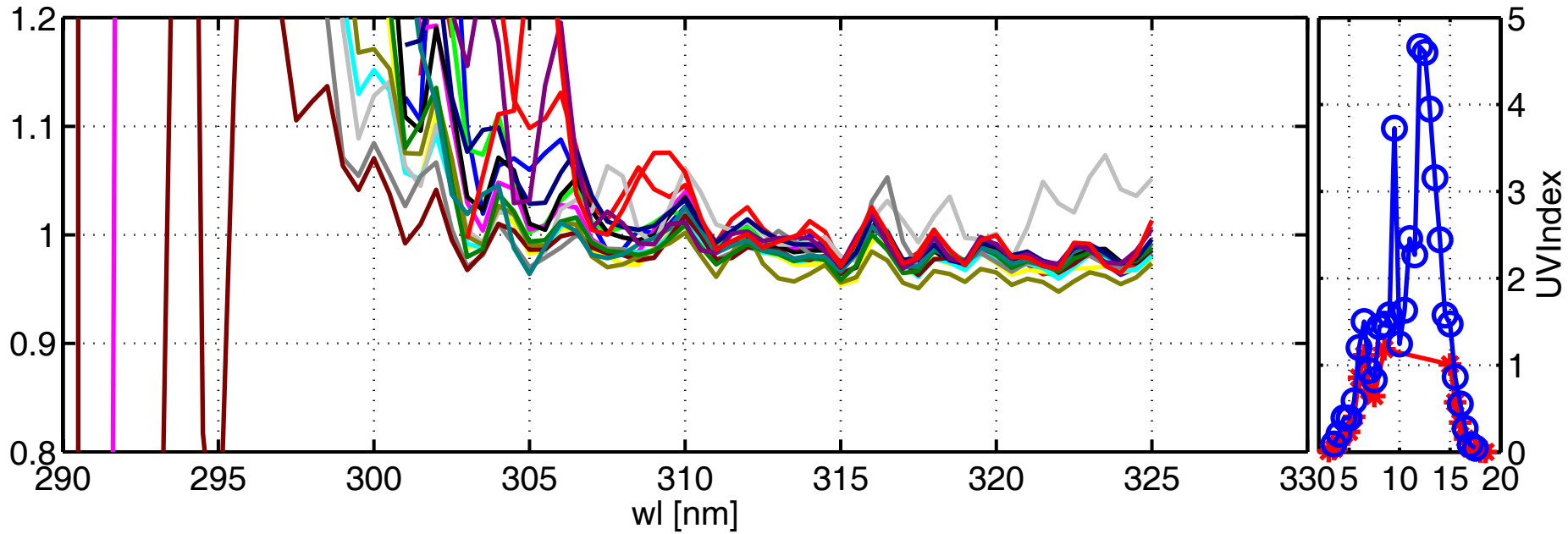
Global irradiance ratios PGI/JRC at Warsaw:20-May-2004(141)



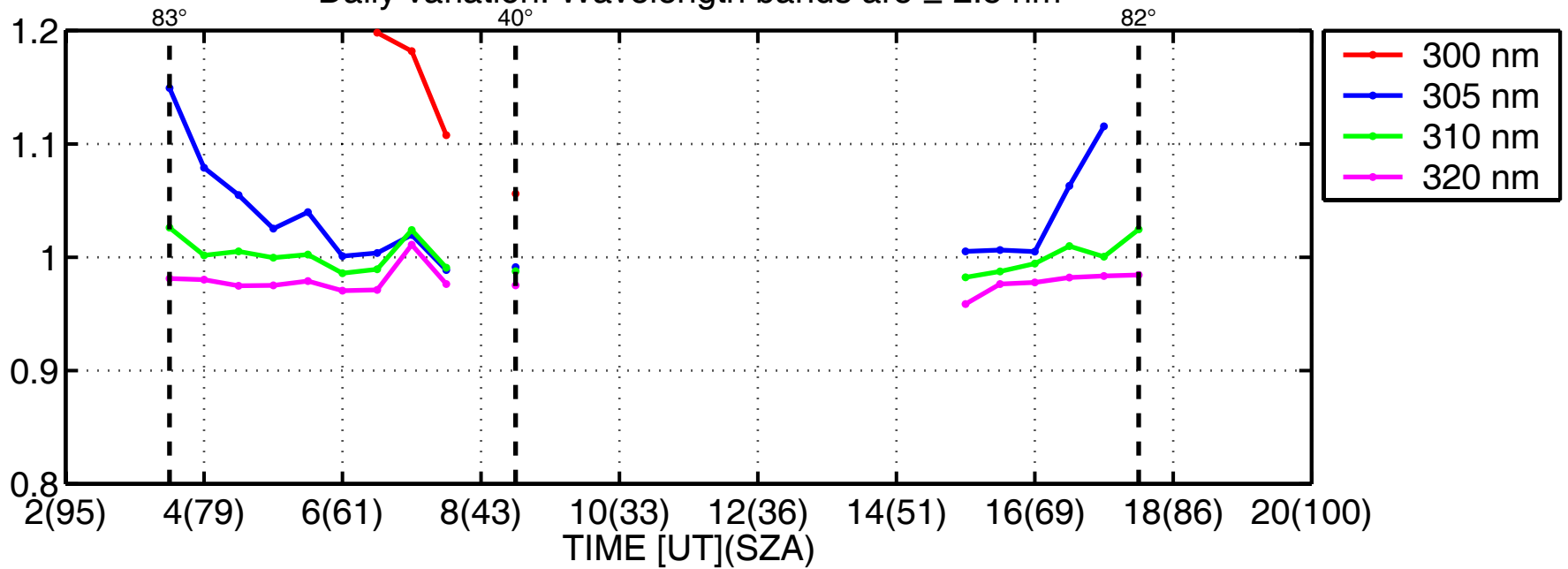
Daily variation. Wavelength bands are ± 2.5 nm



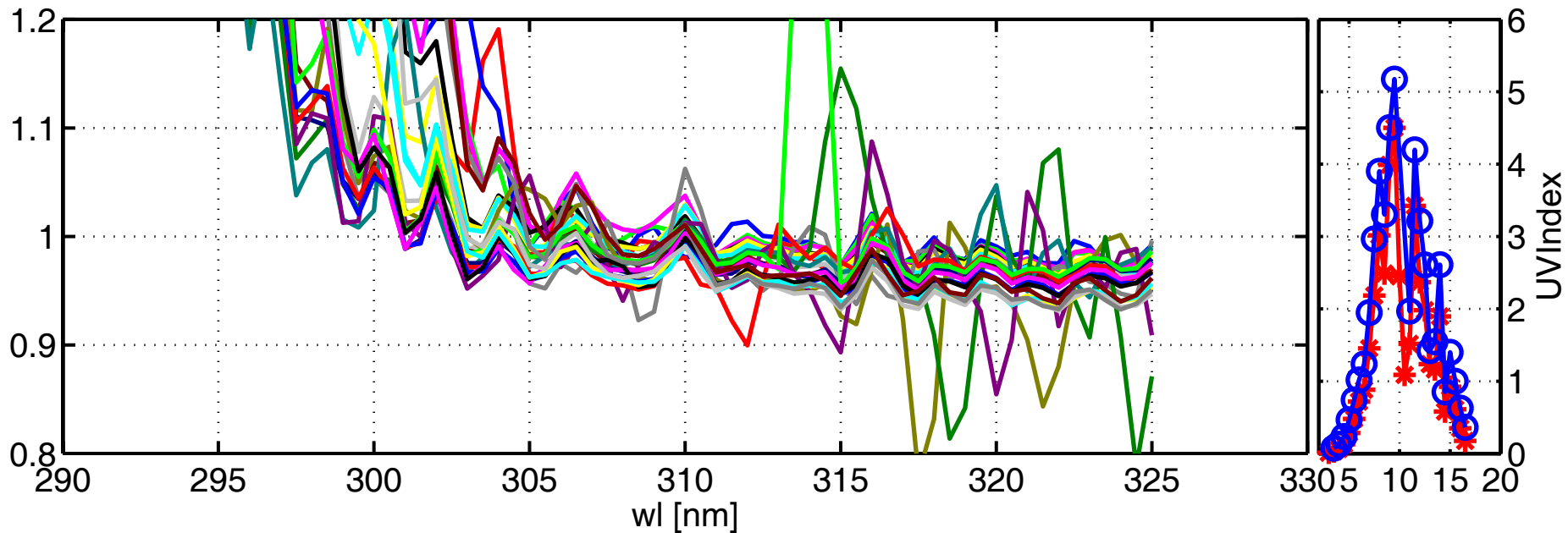
Global irradiance ratios PGI/JRC at Warsaw:21-May-2004(142)



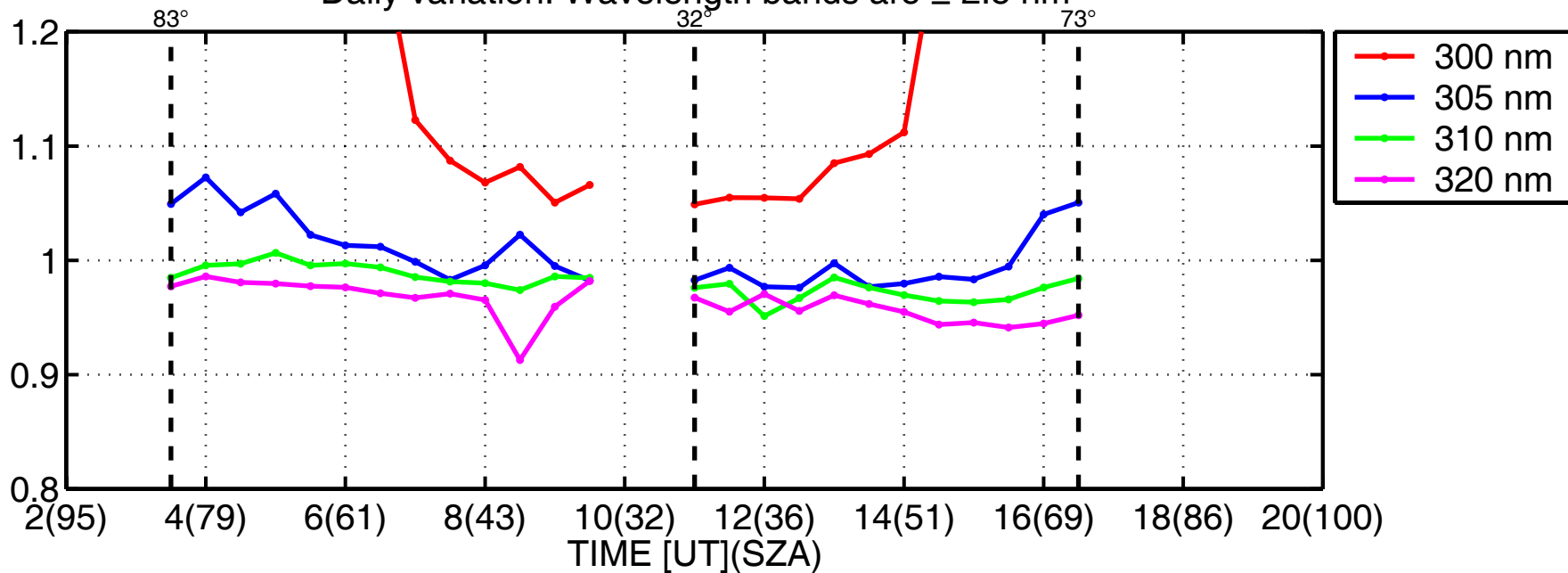
Daily variation. Wavelength bands are ± 2.5 nm



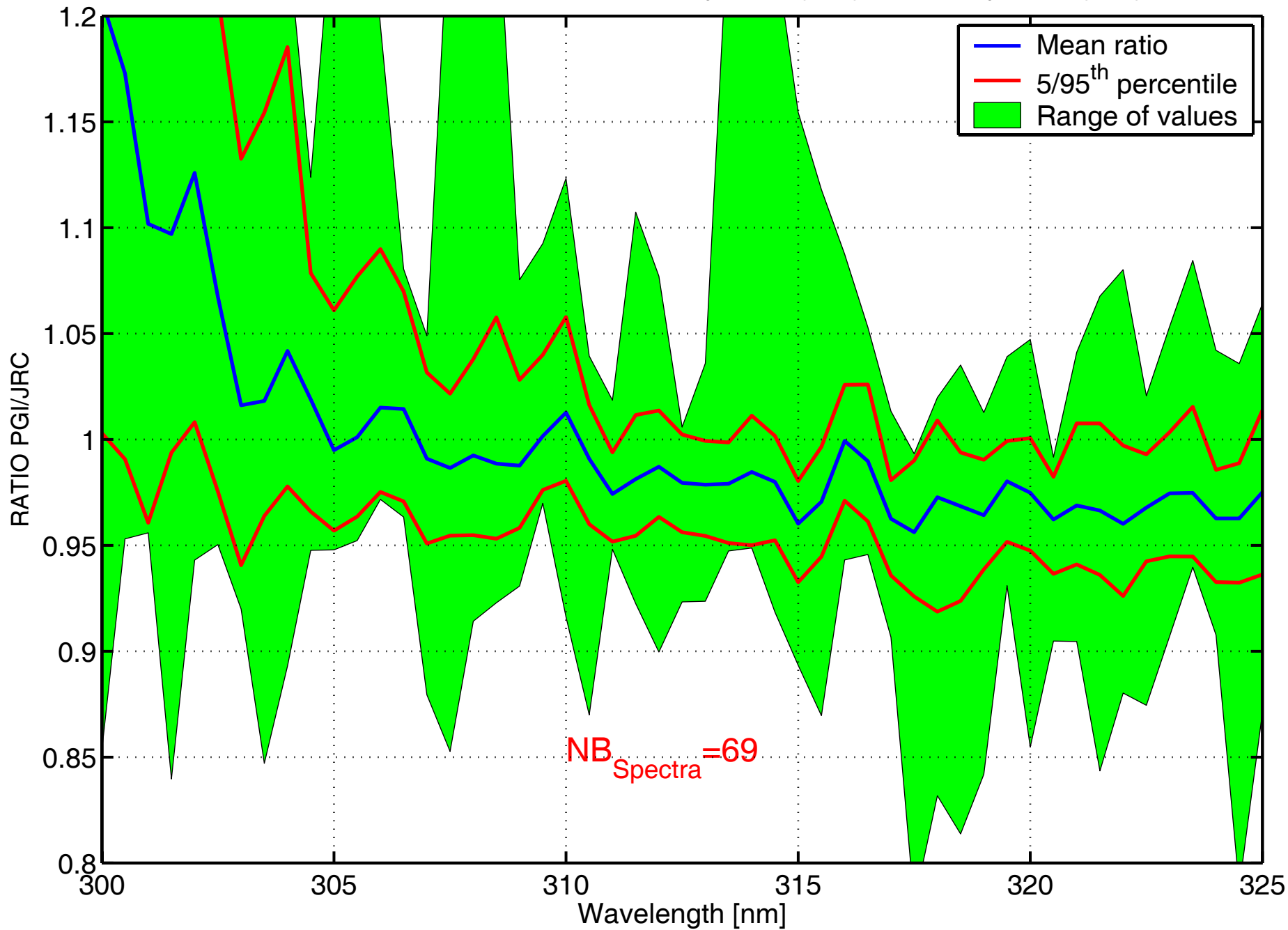
Global irradiance ratios PGI/JRC at Warsaw:22-May-2004(143)



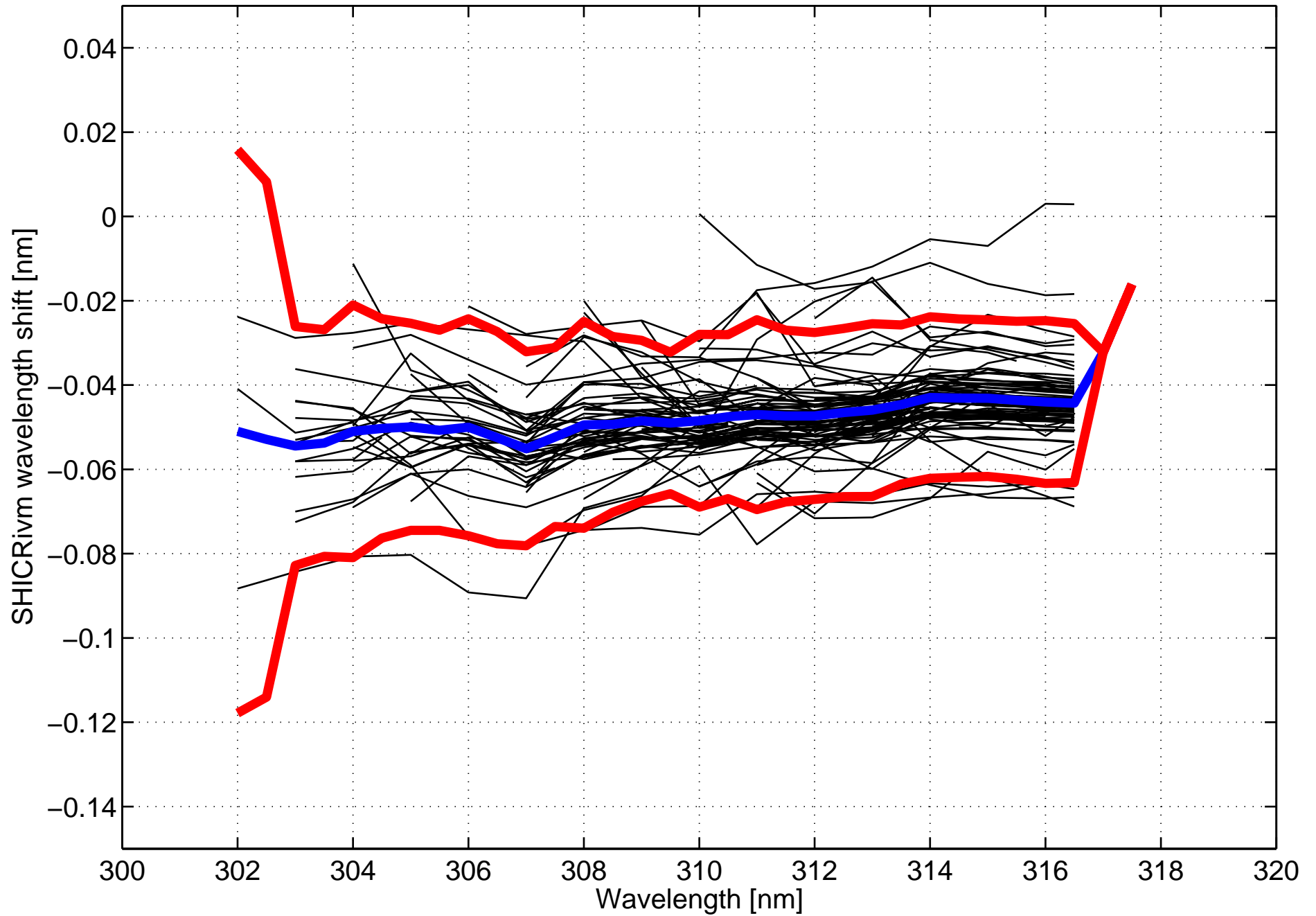
Daily variation. Wavelength bands are ± 2.5 nm



Mean ratio PGI/JRC at Warsaw:20-May-2004(141) to 22-May-2004(143)



PGI – Warshau May 20–22 2004



Directional response Br#064 21/5/2004 Warschau

