

Protocol of the intercomparison at the “El Arenosillo – INTA”
station, Huelva, Spain, on July 12 to 16, 2004 with the travelling
standard spectroradiometer B5503 from ECUV within the project
QASUME

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Operator: Stelios Kazadzis

The purpose of the visit was the comparison of global solar irradiance measurements between the spectroradiometer (AIS) operated by the Instituto Nacional de Técnica Aeroespacial (INTA) and the travel standard B5503. The measurement site is located at El Arenosillo; Latitude 37.10 N, Longitude 6.73 W and altitude 40 m.a.s.l.. The horizon of the measurement site is free in all directions.

B5503 arrived at INTA in the morning of July 12, 2004. The spectroradiometer was installed beside the AIS instrument with the entrance optic of B5503 about 5 m from AIS. The spectroradiometer in use at INTA is a Brewer double monochromator #150. The intercomparison between B5503 and AIS lasted five days, from the afternoon of July 12 to the afternoon of July 16.

B5503 was calibrated several times during the intercomparison period using a portable calibration system. Two lamps (T57824, and T61251) were used to obtain an absolute spectral calibration traceable to the primary reference held at ECUV, 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 B5503 was $28.1 \pm 0.2^\circ\text{C}$. The diffuser head was regulated to a temperature of $28 \pm 4^\circ\text{C}$.

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

Protocol:

The measurement protocol was to measure one solar irradiance spectrum every 30 minutes from 290 to 450 nm, every 0.5 nm, and 3 seconds between each wavelength increment. The upper wavelength limit of the AIS spectroradiometer was 363 nm.

July 12 (194):

B5503 was installed on the measurement site at 8:00 UT. Synchronised measurements are available from 11:30 to 19:30 UT. Weather conditions were clear skies without clouds.

B5503 calibrated at 17:07 and 17:37 UT.

July 13 (195):

Synchronised measurements are available from 5:30 UT to 19:00 UT. Weather conditions were clear skies without clouds.

B5503 calibrated at 18:06 UT.

July 14 (196):

Synchronised scans are available from 5:30 to 19:00 UT. Weather conditions were clear skies without clouds.

B5503 calibrated at 17:45 UT.

July 15 (197):

AIS is moved to the laboratory for the directional response measurement, the slit function, and the spectral responsivity calibration. Some changes were made to the instrument in the laboratory (see operator comments). Synchronised scans are resumed at 16:30 UT till 19:30 UT. Weather conditions were clear skies without clouds.

B5503 calibrated at 18:16 UT and 18:45 UT.

July 16 (198):

Synchronised scans are available from 5:30 UT to 13:00 UT. Weather conditions were clear skies without clouds.

Results:

95 synchronised simultaneous spectra from B5503 and AIS are available from the measurement period. The average wavelength shift relative to the extraterrestrial spectrum used by the SHICRivm software was between – 60 to –10 pm. On July 15 and 16 the wavelength shifts above 310 nm differ by up to 40 pm from the previous days (see graph below).

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

- Global solar irradiances measured by AIS were up to 30% lower than those measured by B5503 for wavelengths between 300 and 363 nm.
- The spectral ratios between AIS and B5503 decrease linearly from 0.98 to 0.9 from 300 to 350 nm. At 350 nm a discrete change in the ratios occurs, with ratios between 350 and 363 nm varying between 0.7 and 0.9.
- 5 spectral ratios during the measurement period show “spikes” at specific wavelengths with an amplitude of up to 5.5. These “spikes” could be traced to the AIS instrument: July 14, 15:30 UT scan at 326.5 nm, 16:30 UT scan at 357.5 nm, July 16, 6:00 UT scan at 350.5 nm, 7:00 UT scan at 360.5 nm, and 10:30 UT scan at 312.5 nm.
- The ratios AIS to B5503 show a decrease of 5 to 6% during the day on July 12, 13, 14 which seems independent of wavelength. On the afternoon of each day the ratios show a 2-3% dip with the minimum at 17:00 UT.

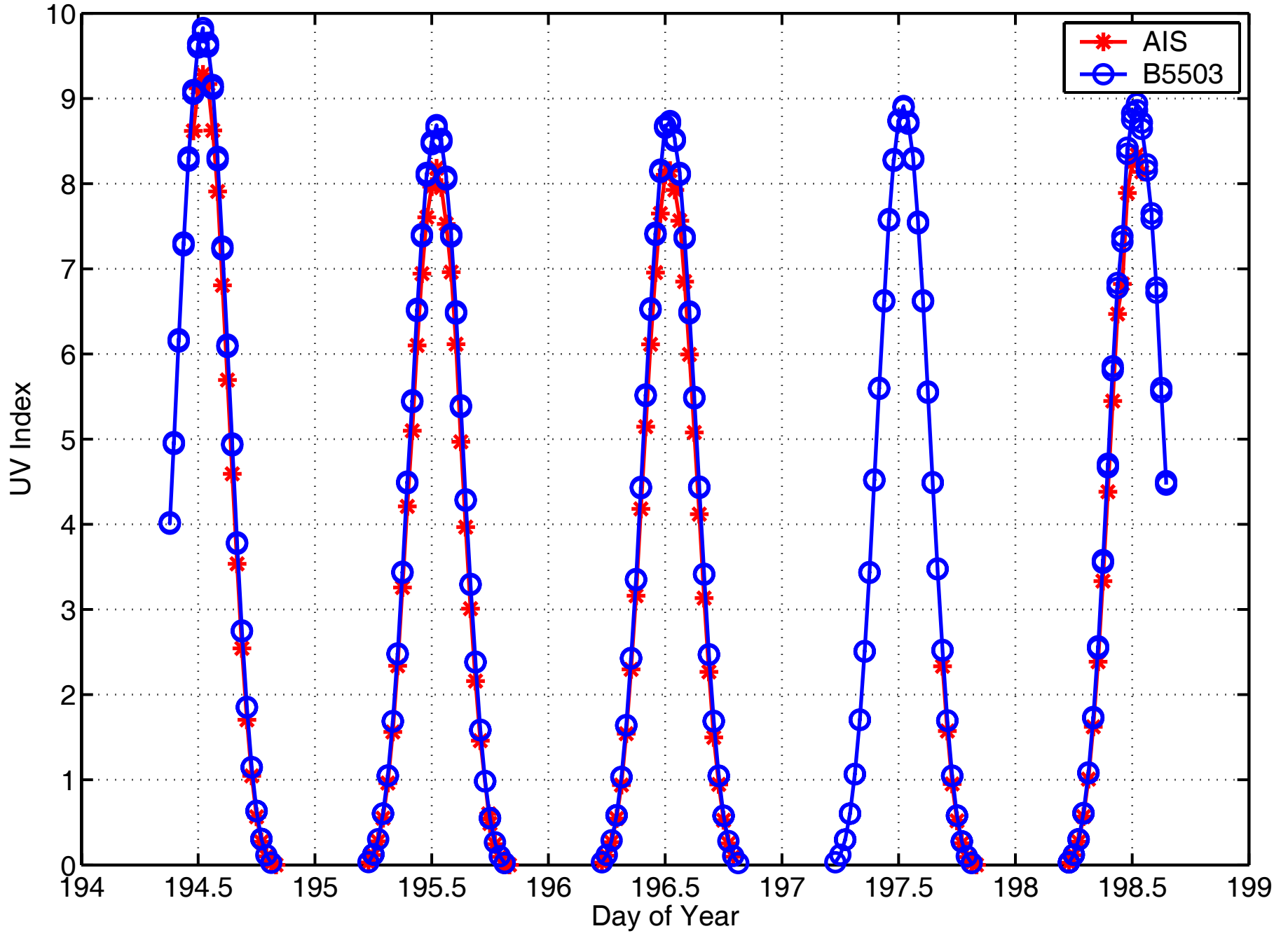
Conclusion:

The global solar irradiance spectra measured by the AIS spectroradiometer are between 2 to 10% lower than those measured by B5503 between 300 and 350 nm. Between 350 and 363 nm AIS measures between 10 to 35% less, with a sharp drop in irradiance at 350 nm. The

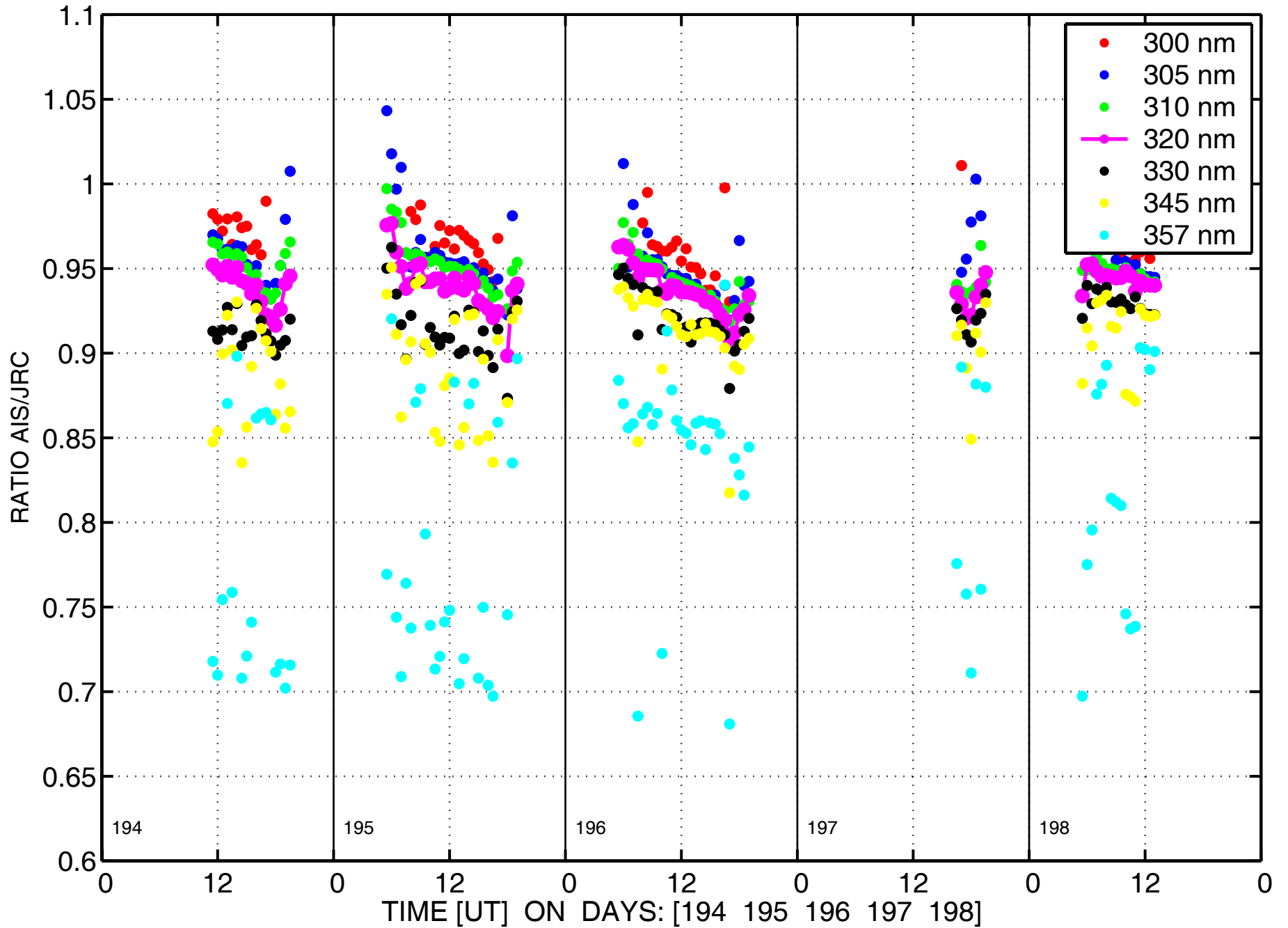
variability between AIS and B5503 is of the order of 6% between 300 and 350 nm, and 25% between 350 and 363 nm.

Comments from the local operator:

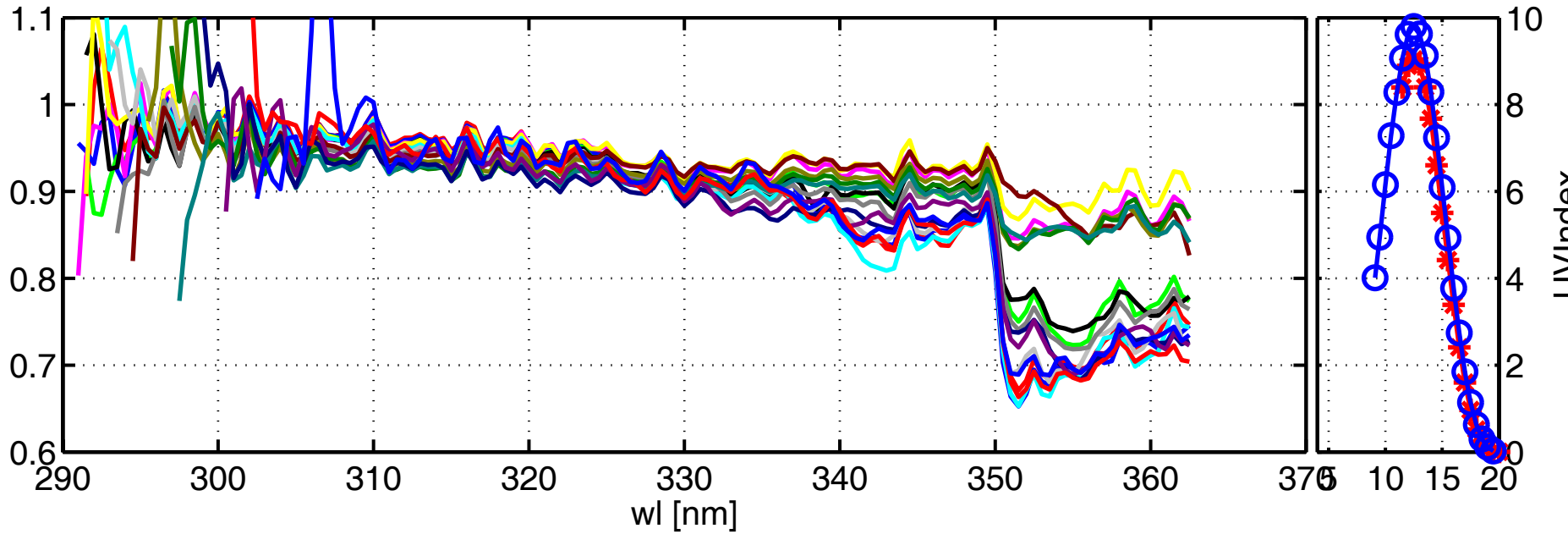
UV Index INTA 12-16 July 2004



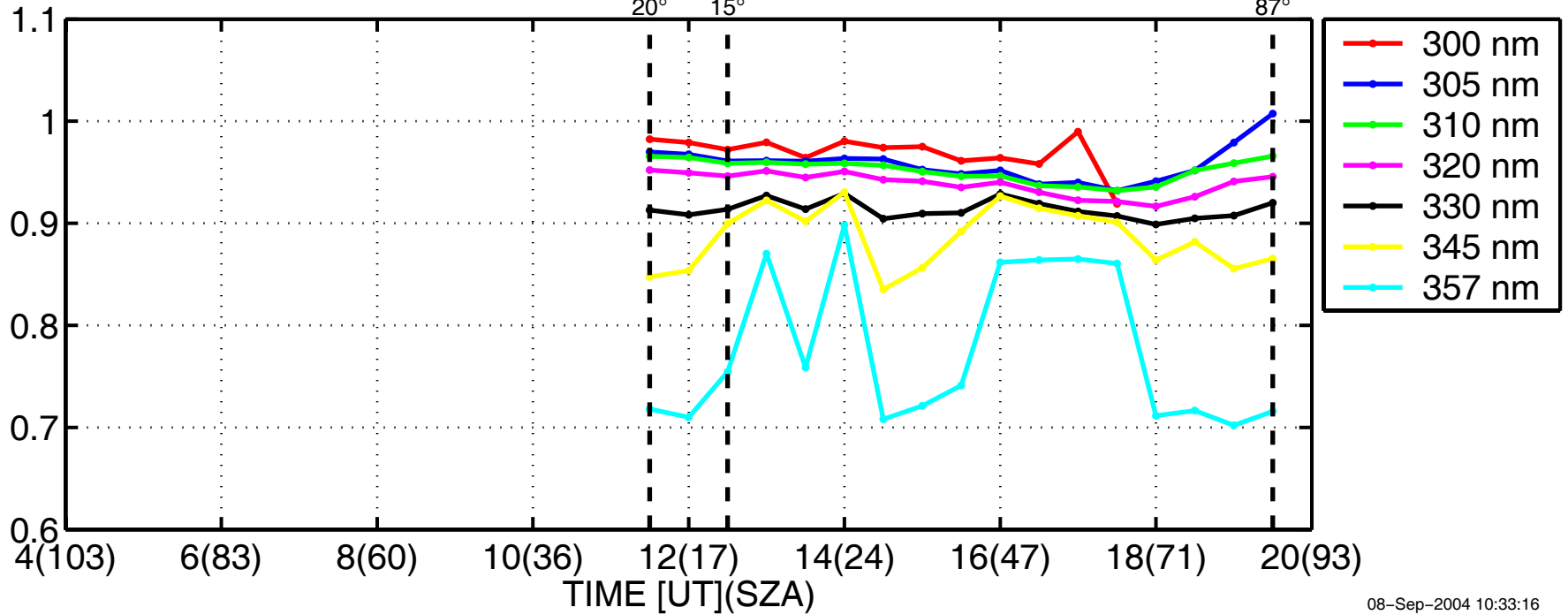
Global irradiance ratios AIS/JRC at El Arenosillo:12-Jul-2004(194) to 16-Jul-2004(198)



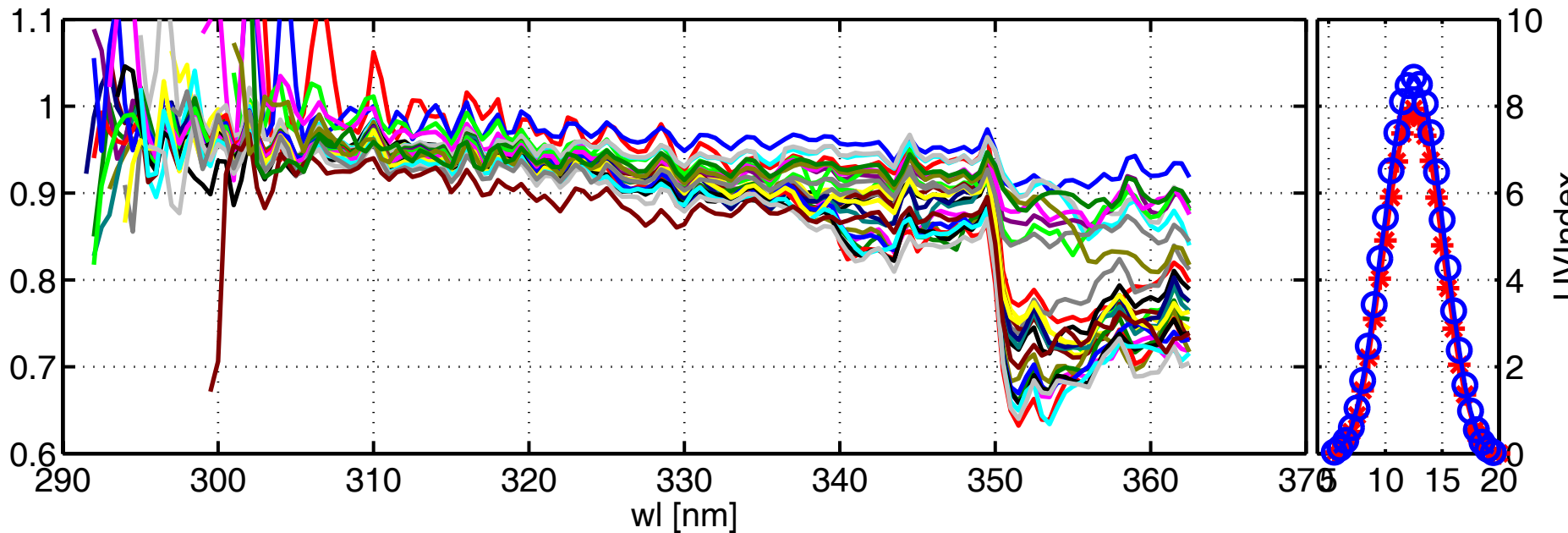
Global irradiance ratios AIS/JRC at El Arenosillo:12-Jul-2004(194)



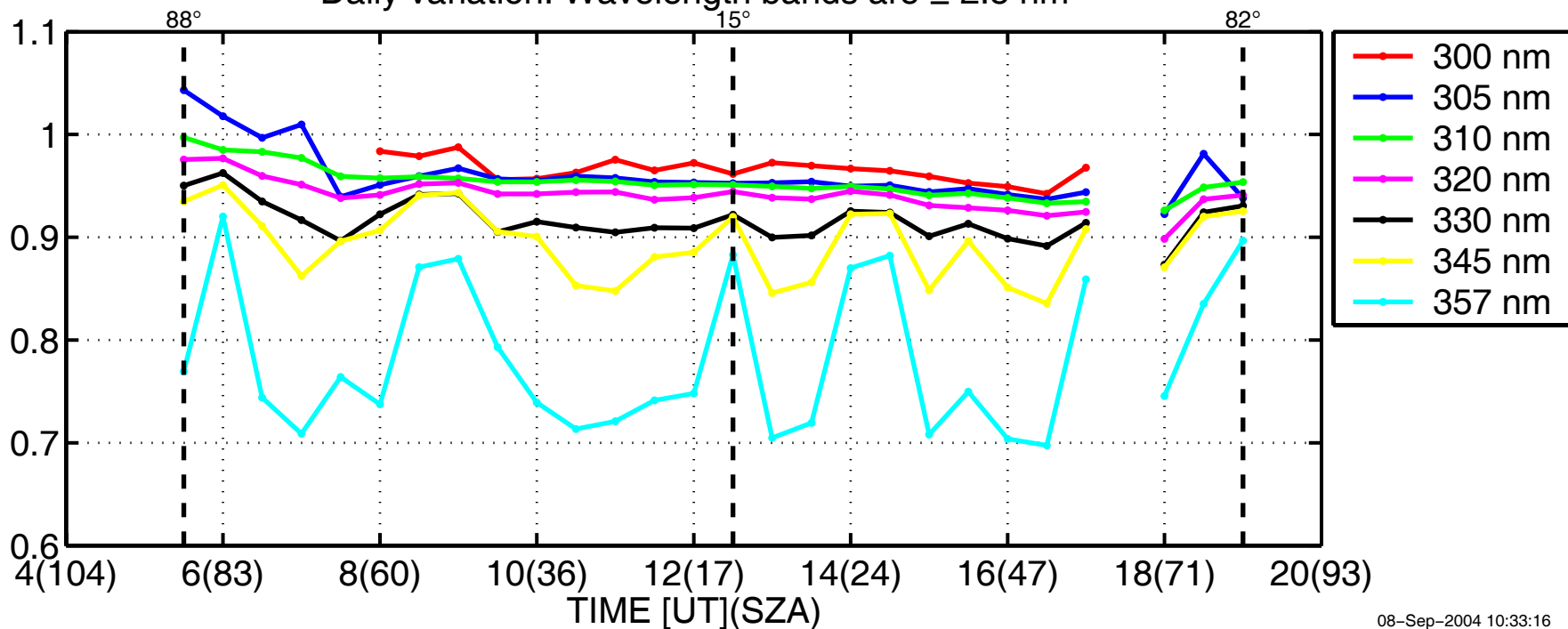
Daily variation. Wavelength bands are ± 2.5 nm



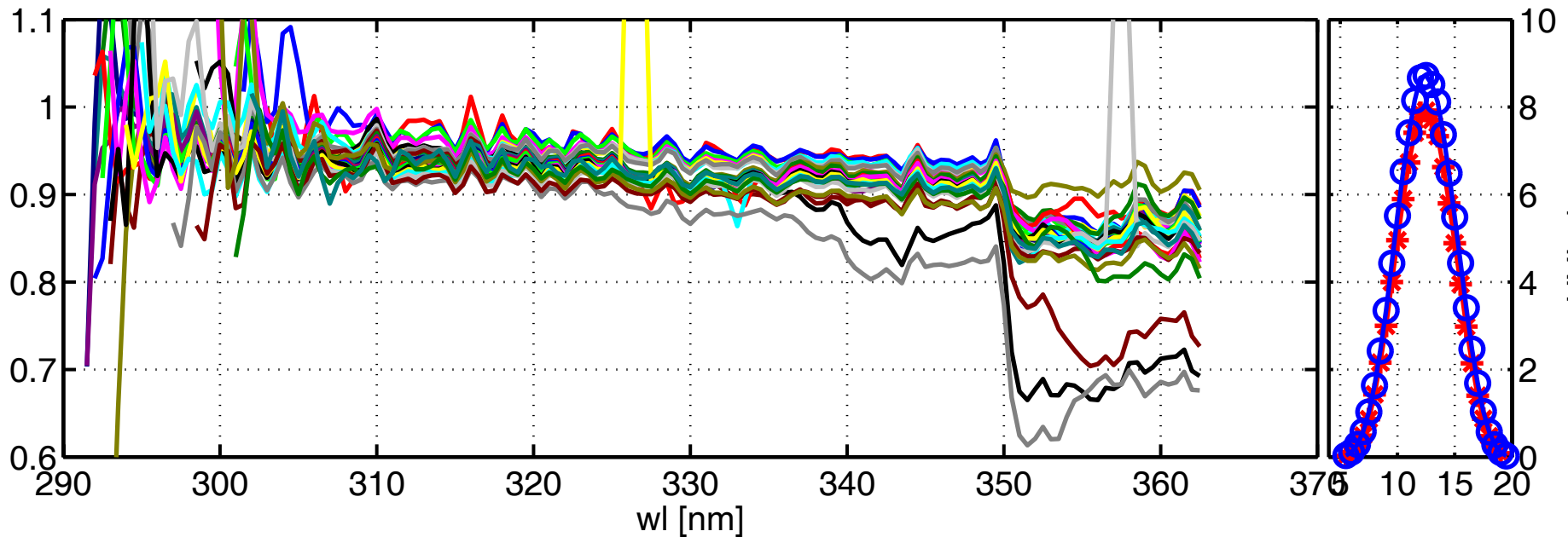
Global irradiance ratios AIS/JRC at El Arenosillo:13-Jul-2004(195)



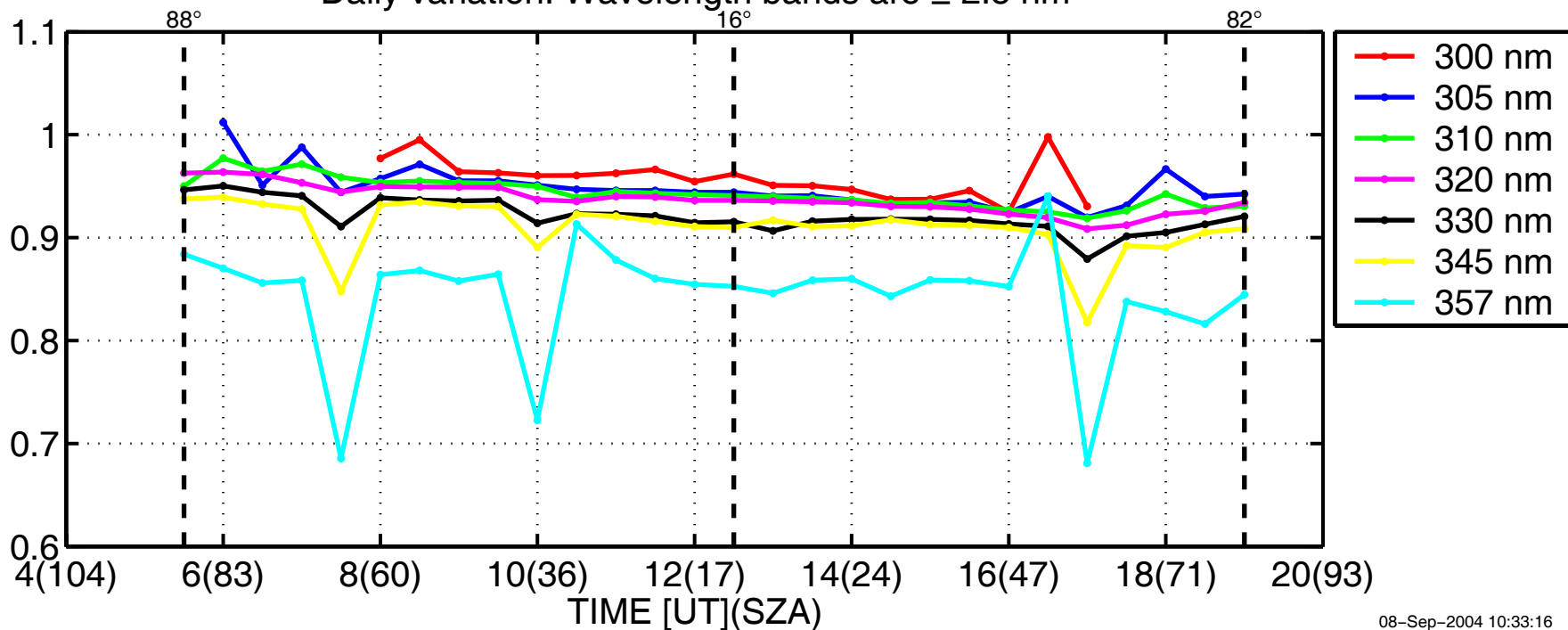
Daily variation. Wavelength bands are ± 2.5 nm



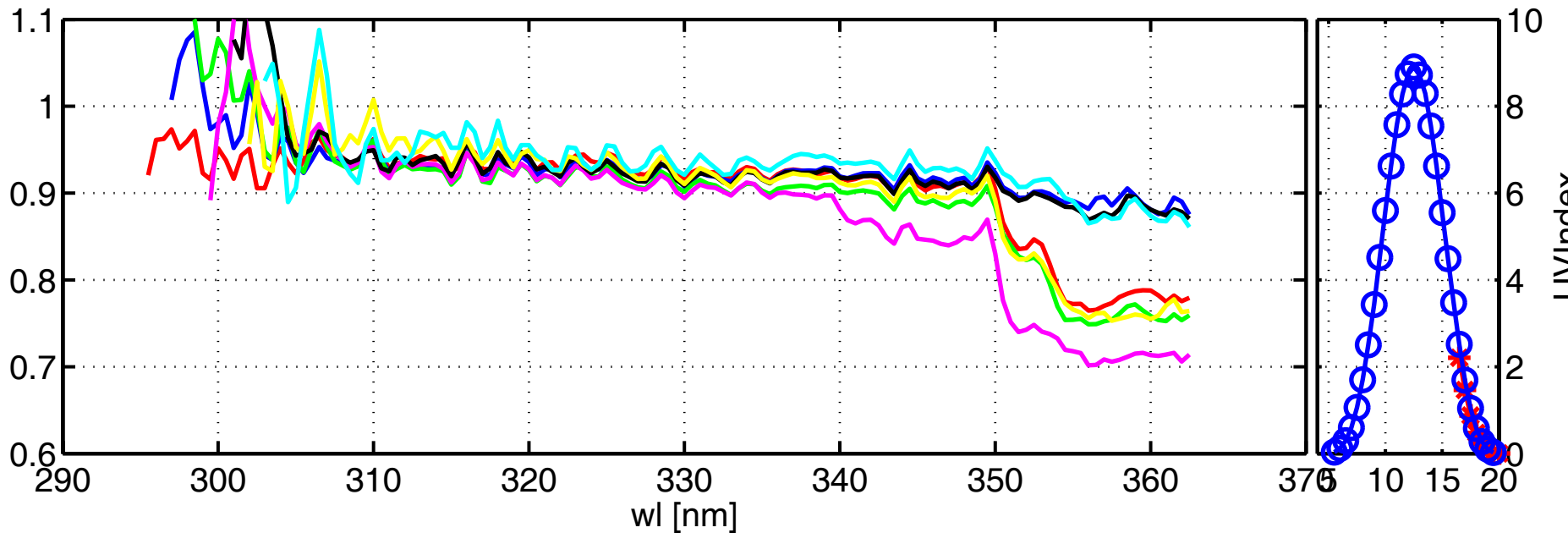
Global irradiance ratios AIS/JRC at El Arenosillo:14-Jul-2004(196)



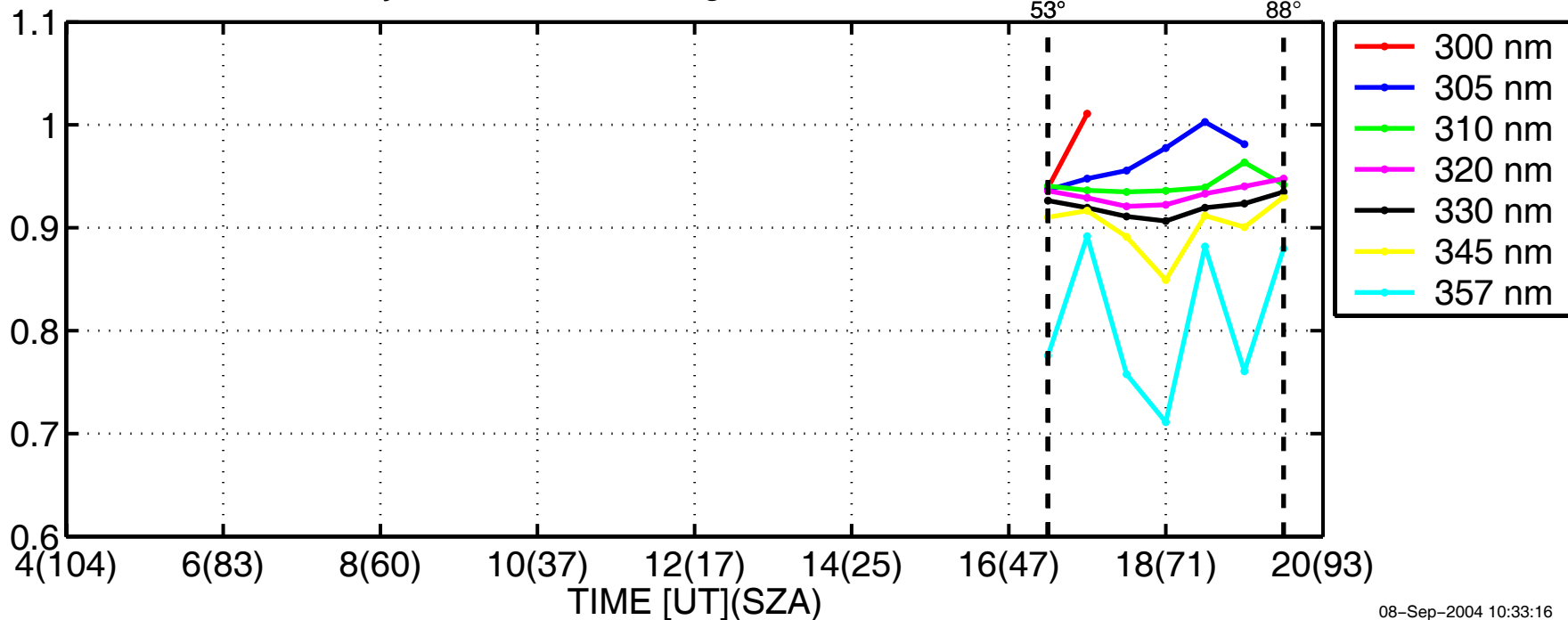
Daily variation. Wavelength bands are ± 2.5 nm



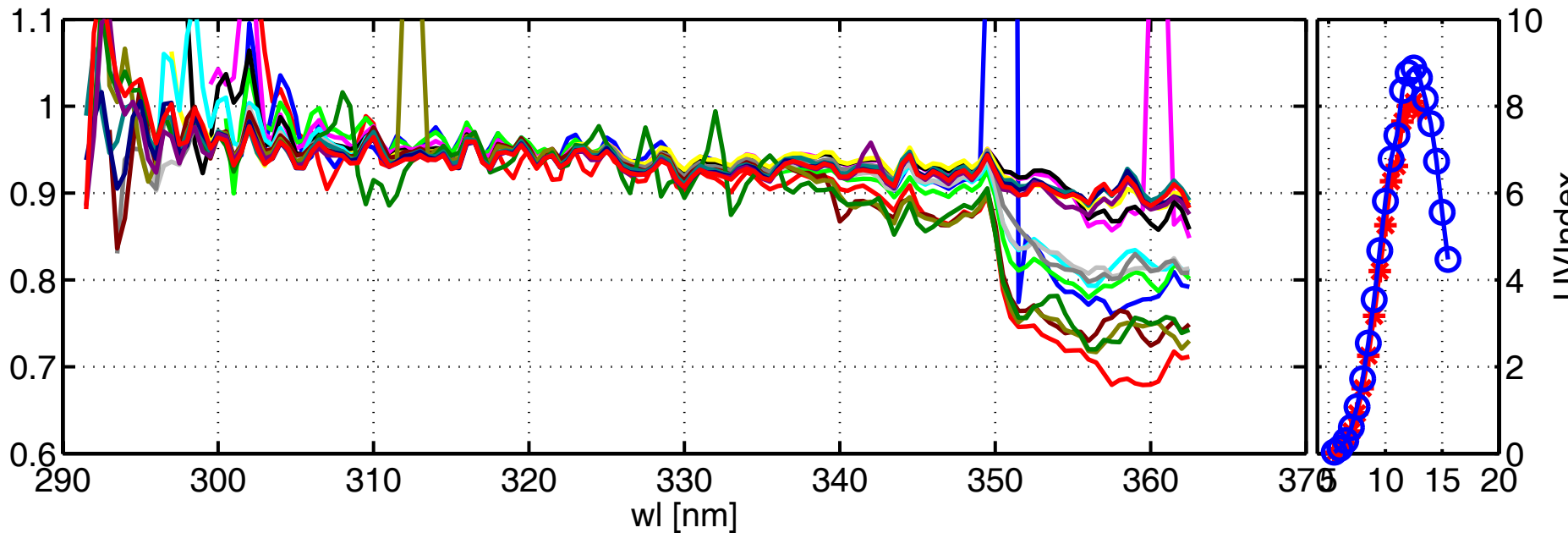
Global irradiance ratios AIS/JRC at El Arenosillo:15-Jul-2004(197)



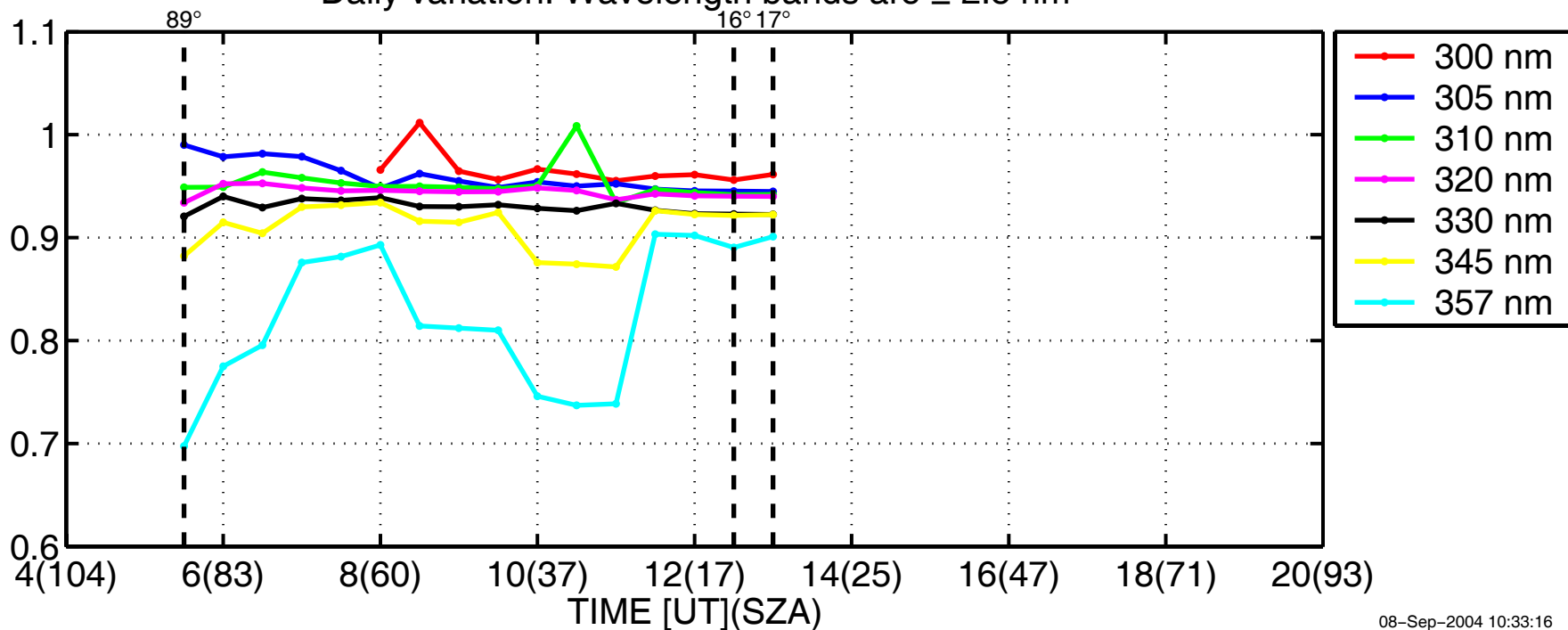
Daily variation. Wavelength bands are ± 2.5 nm



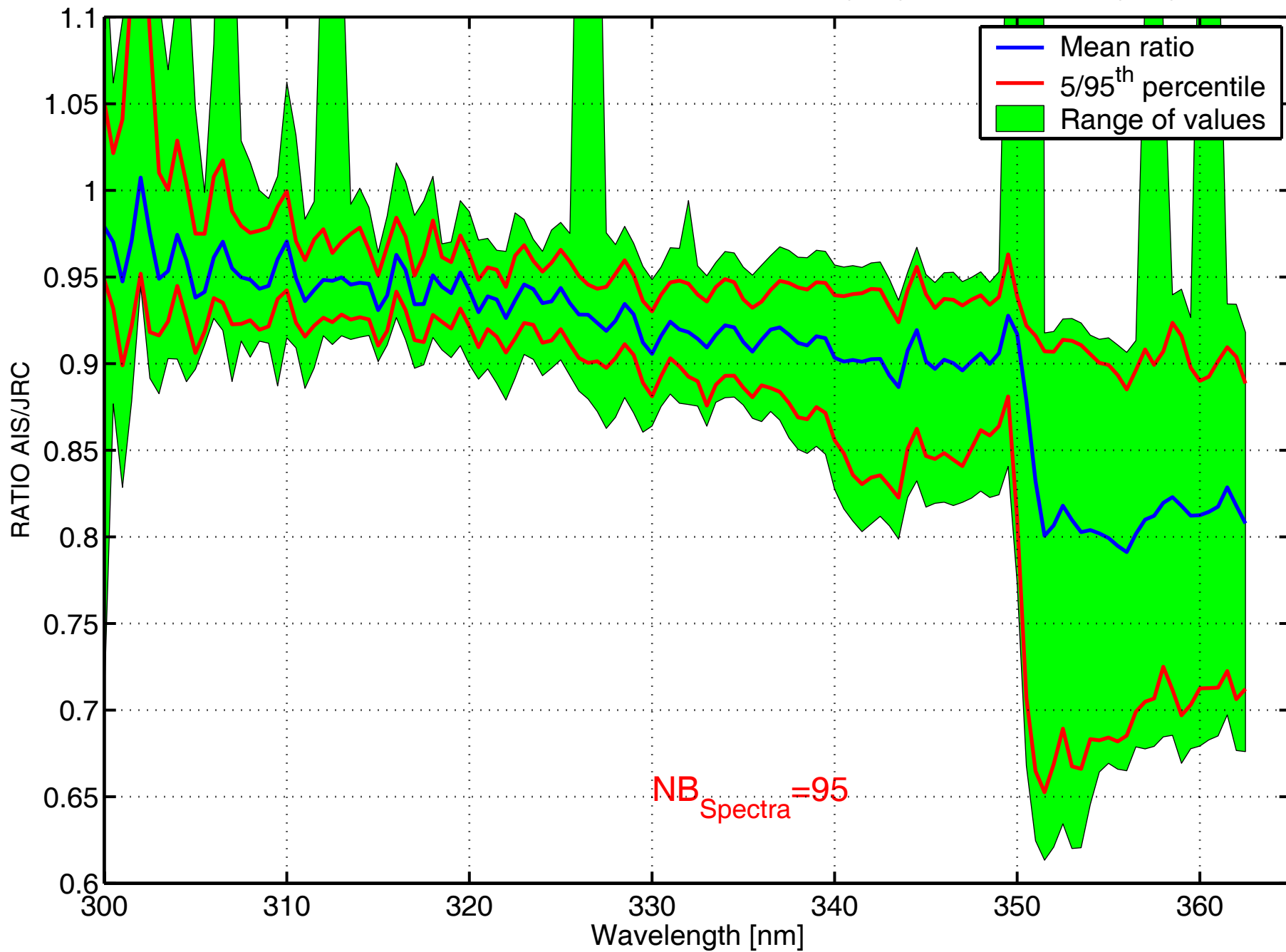
Global irradiance ratios AIS/JRC at El Arenosillo:16-Jul-2004(198)



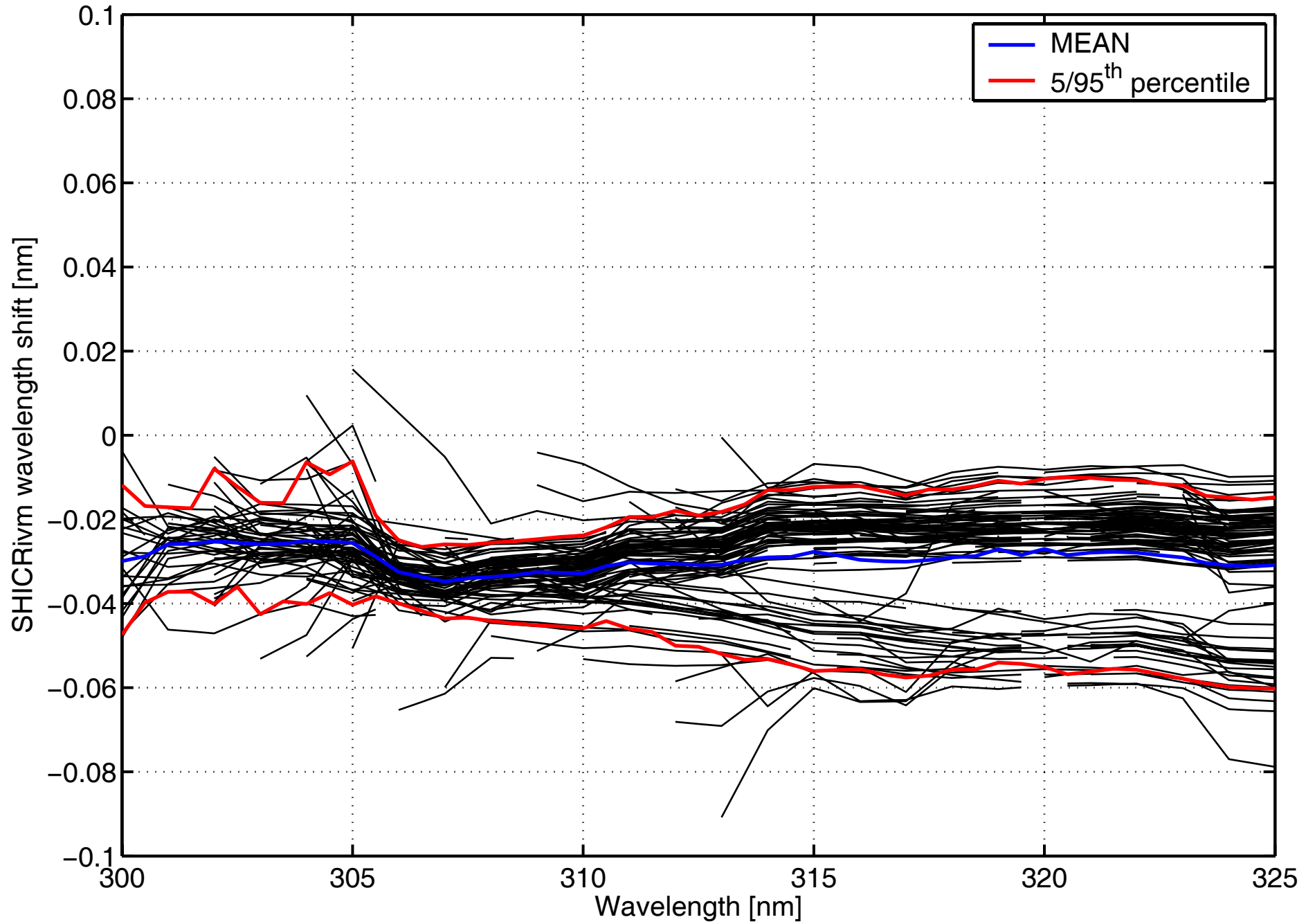
Daily variation. Wavelength bands are ± 2.5 nm



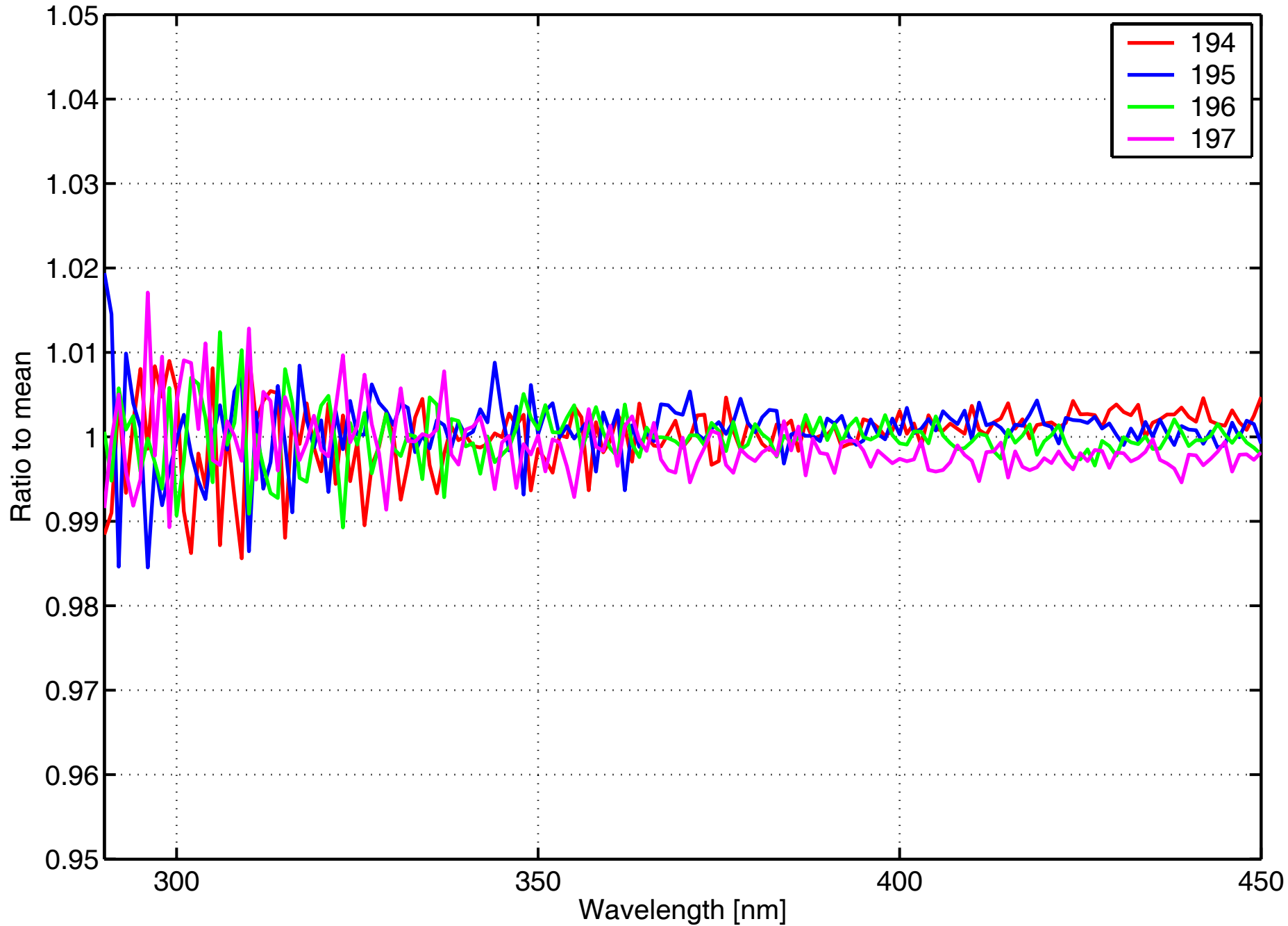
Mean ratio AIS/JRC at El Arenosillo:12-Jul-2004(194) to 16-Jul-2004(198)



AIS - El Arenosillo July 12-16 2004



Spectral responsivity B5503 at El Arenosillo using T57824 – 2004



cosine error of Brewer 150

