Protocol of the intercomparison at Sodankylä, Finland on June 07 to 13, 2007 with the travelling reference spectroradiometer QASUME from PMOD/WRC

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The purpose of the visit was the comparison of global solar irradiance measurements between the spectroradiometer (FIS) operated by the Finnish Meteorological Institute (FMI) and the travel reference spectroradiometer QASUME[†]. The measurement site is located at Sodankylä; Latitude 67.37 N, Longitude 26.63 E and altitude 179 m.a.s.l.
The horizon of the measurement site is free down to at least 85° solar zenith angle (SZA). Measurements between 2:00 UT and 18:00 UT have been analysed.

QASUME arrived at Sodankylä in the evening of June 07, 2007. The spectroradiometer was installed in line to the Br #037 (FIS) with the entrance optic of QASUME within 2 m of FIS. The spectroradiometer in use at Sodankylä is a Brewer #037 single monochromator. The intercomparison between QASUME and the FIS spectroradiometer lasted six days, from morning of June 08 to the morning of June 13.

QASUME was calibrated several times during the intercomparison period using a portable calibration system. Two lamps (T68523 and T68524) 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 19.5±0.2 °C. The diffuser head was heated to a temperature of 25.6±0.8 °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.

Protocol:

The measurement protocol was to measure one solar irradiance spectrum every 30 minutes from 290 to 325 nm, every 0.5 nm, and 3 seconds between each wavelength increment.

June 07 (158) Thursday:

QASUME was installed on the measurement site at 19:00 UT. The internal temperature of QASUME reached its nominal temperature at 22:00 UT.

June 08 (159) Friday:

Synchronised measurements are available from 6:30 to 19:30 UT. Weather conditions were mix of sun and clouds with cirrus and stratus cumulus clouds and haze.

QASUME was calibrated four times at 6:11, 7:41, 12:42 and 17:15 UT.

June 09 (160) Saturday:

Synchronised scans are available from 1:30 to 19:30 UT. Weather conditions were clear sky in the morning starting at 3:30 with a few cirrus clouds and haze. In the afternoon the weather was a mix of sun and clouds.

QASUME was calibrated at 6:42 and 15:11 UT.

June 10 (161) Sunday:

Synchronised scans are available from 1:30 to 19:30 UT. The weather conditions were a mix of sun and clouds with stratus cumulus clouds. There was a long period of clear sky between 9:00 and 17:15 UT with a few cirrus clouds.

QASUME was calibrated at 7:12 and 16:40 UT.

June 11 (162) Monday:

Synchronised scans are available from 1:30 to 19:30 UT. The weather conditions were a mix of sun and clouds with stratus cumulus clouds and rain in the afternoon. The scan at 11:30 UT and scans after 12:30 UT are affected by rain drops.

QASUME was calibrated at 7:41 UT.

June 12 (163) Tuesday:

Synchronised scans are available from 1:30 to 19:30 UT. The weather conditions were cloudy without sun and a few occasional rain drops. Thus the scan at 1:30, 2:00, 2:30, 5:30 and 6:30 UT are affected by rain drops.

QASUME was calibrated at 12:41 UT.

June 13 (164) Wednesday:

Synchronised scans are available from 1:30 to 6:30 UT. The weather conditions were cloudy without sun and a few occasional rain drops. QASUME was calibrated at 6:47 and 7:05 UT.

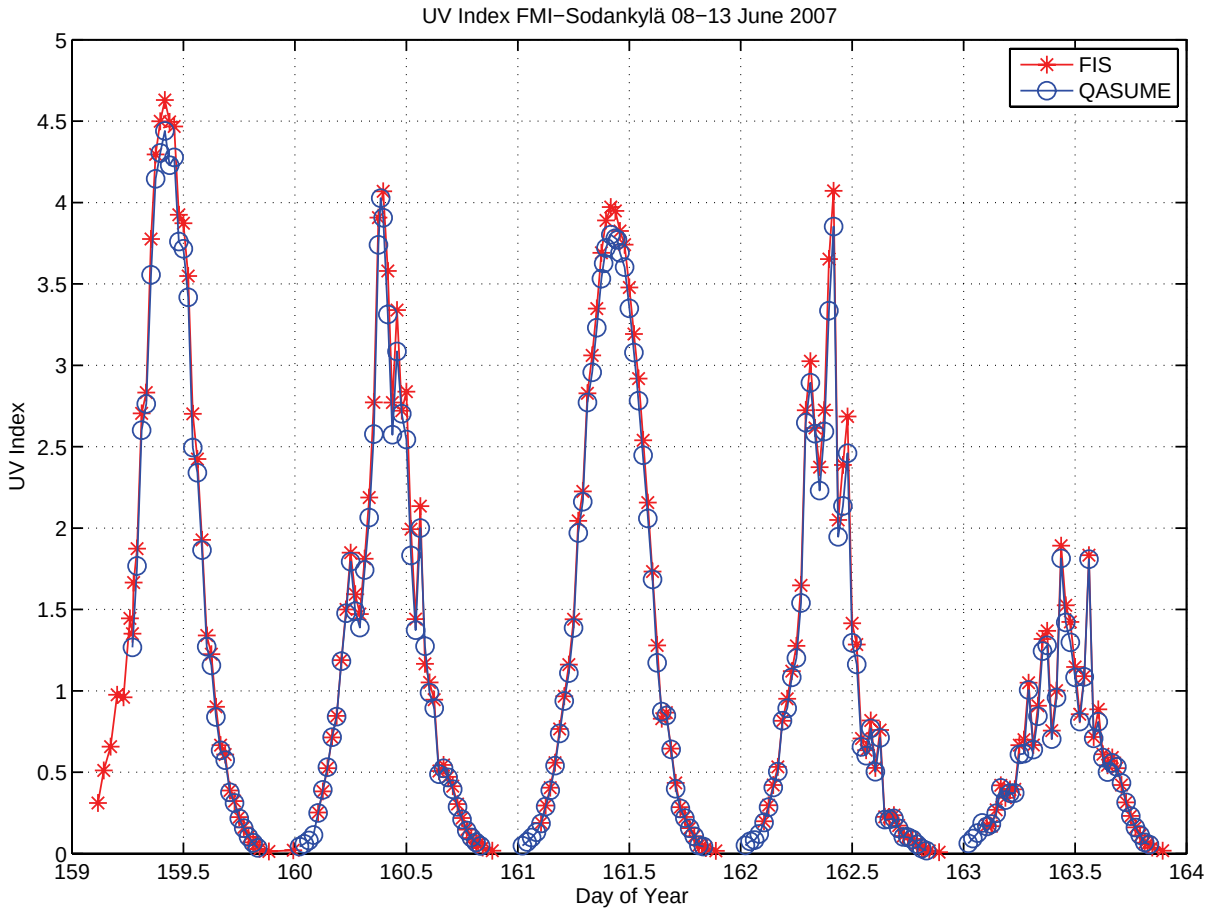
End of the campaign at 7:20 UT.

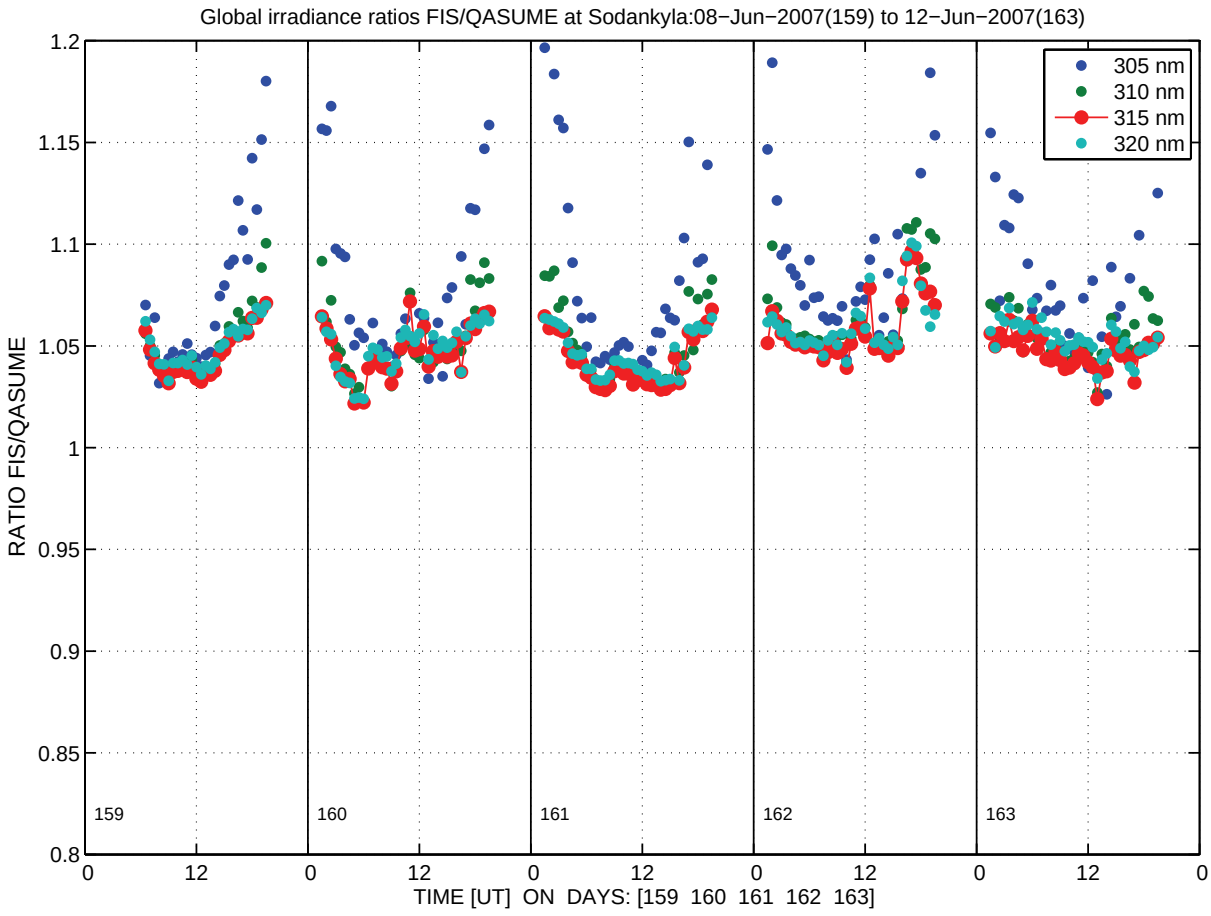
Results:

In total 175 synchronised simultaneous spectra from QASUME and FIS are available from the measurement period. Measurements between 1:30 and 19:30 UT have been analysed (SZA smaller than 85°).

Remarks:

1. The ratios between FIS and QASUME have on average an offset of +5 % for wavelengths longer than 305 nm.
2. Below 310 nm, the measurements of FIS measure too high irradiances which are due to internal stray light of the single monochromator. At 300 nm the irradiances measured by FIS are between 2.0 and 1.1 times higher than those measured by QASUME.
3. The spectrum of FIS on June 09 at 11:00 shows unexplained variability between 311-315 nm.
4. For all solar scans the wavelength shifts of the FIS are below ±75 pm.
5. This comparison between FIS and QASUME is very similar with the last visit in the year 2003.





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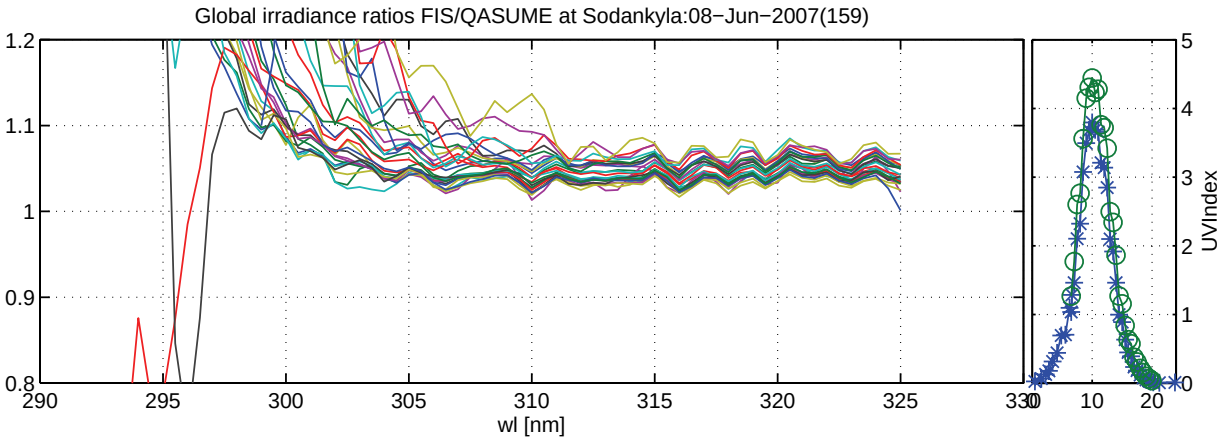

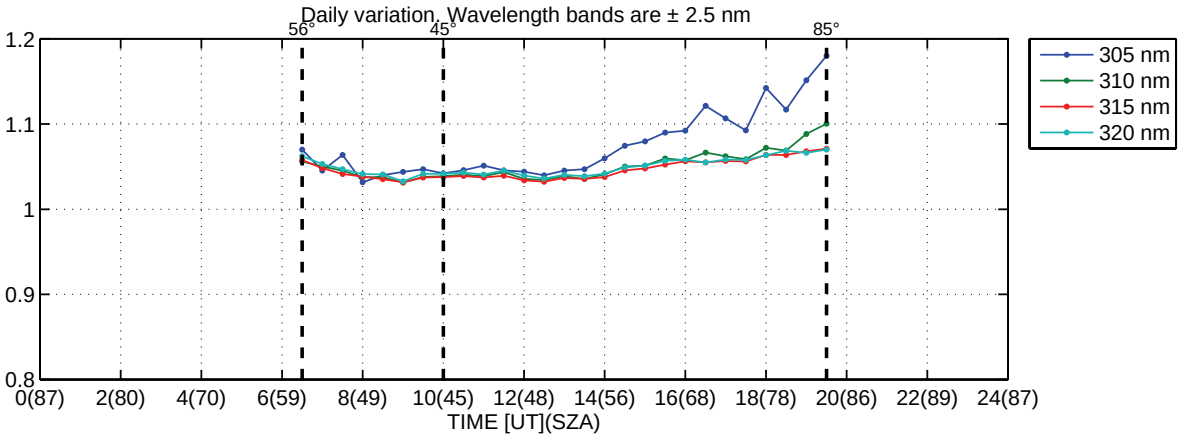

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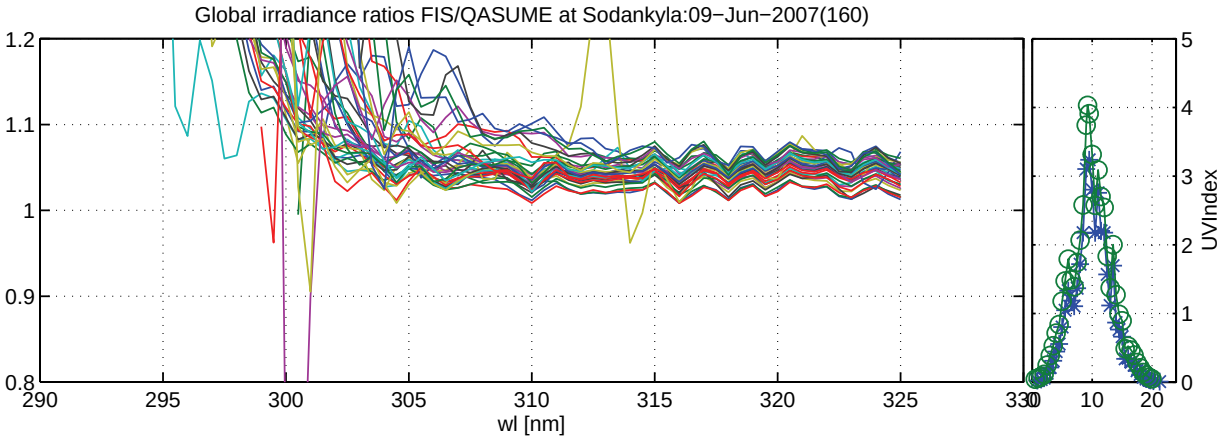

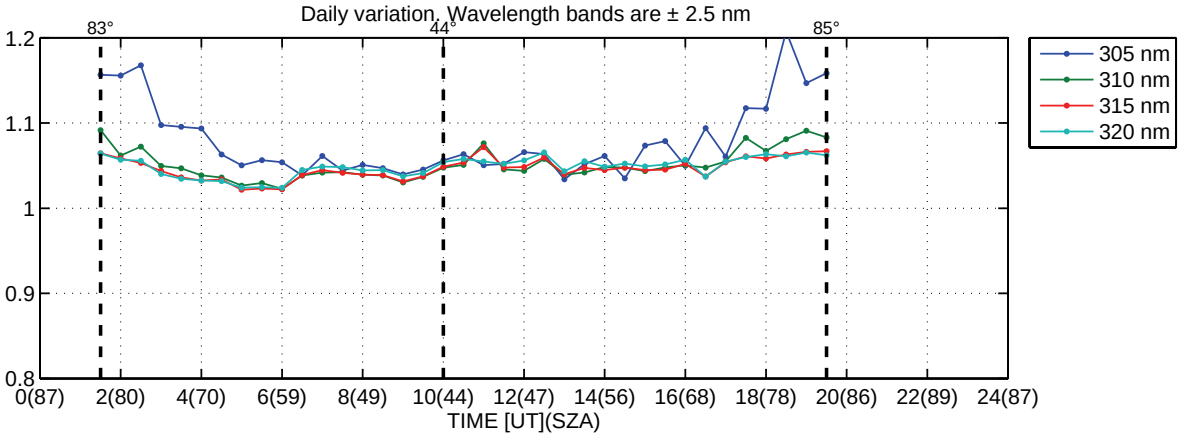

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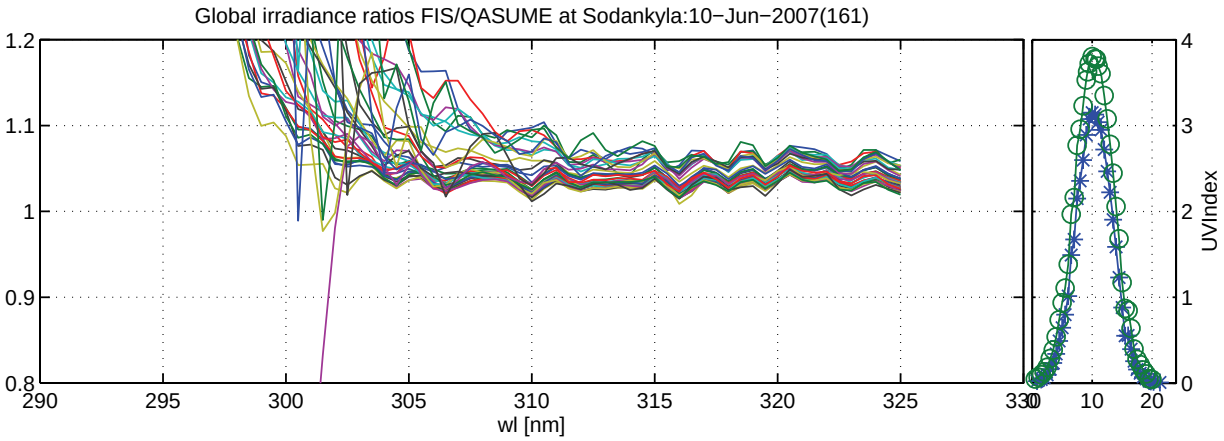

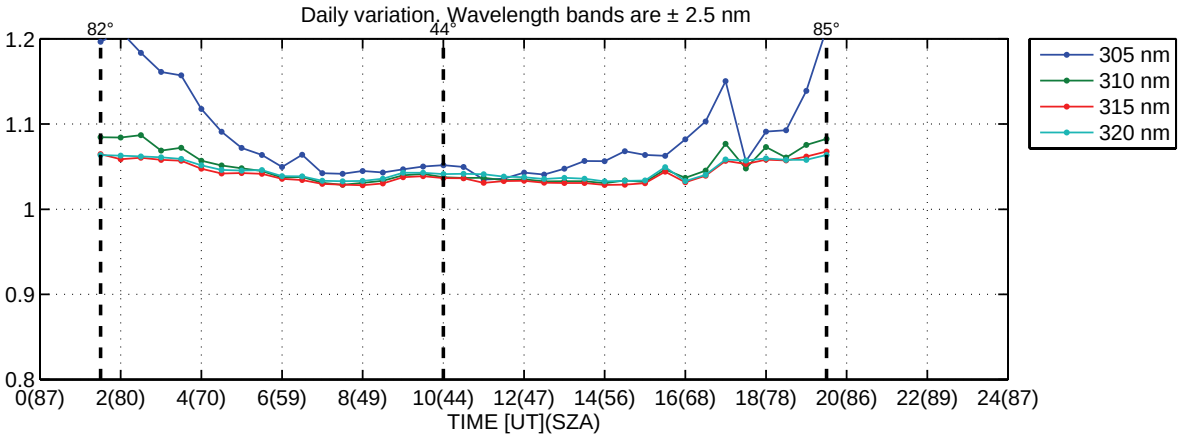

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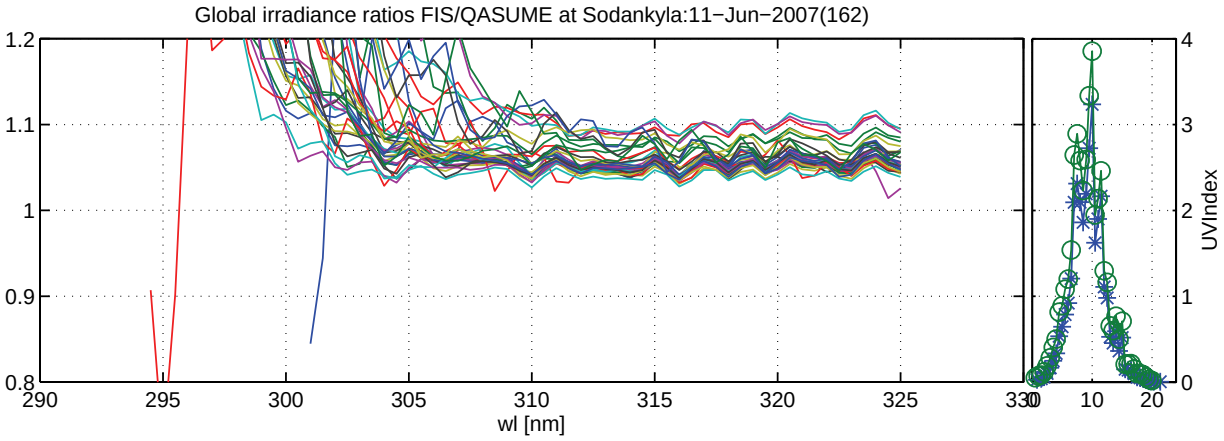

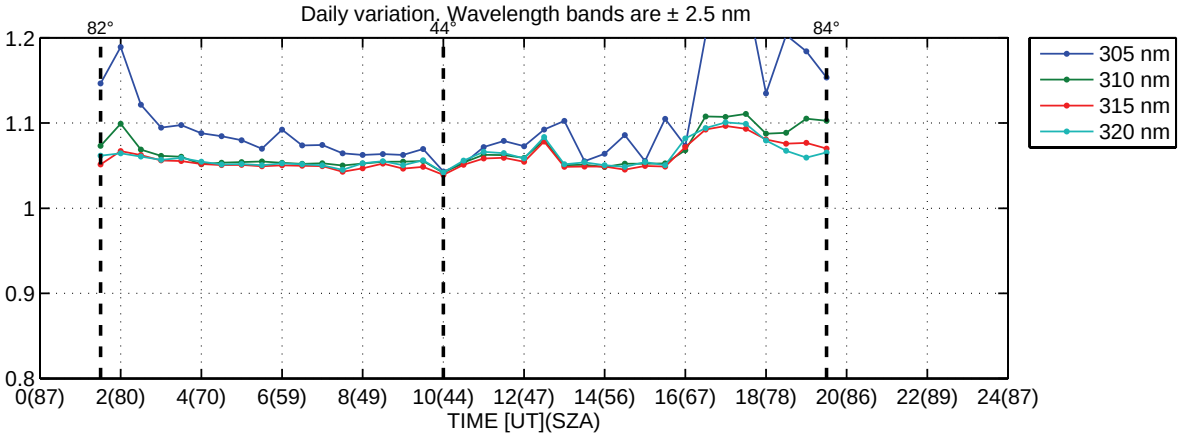

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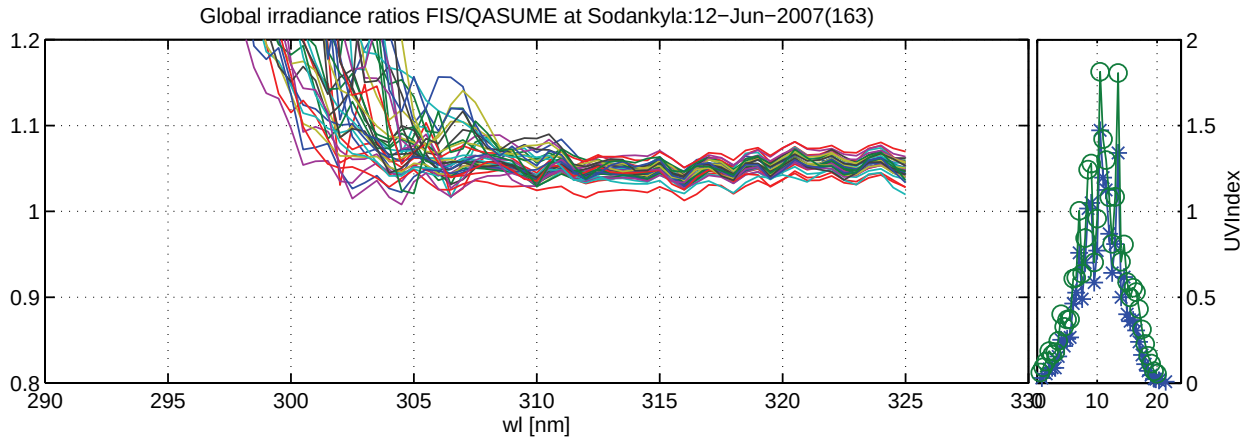

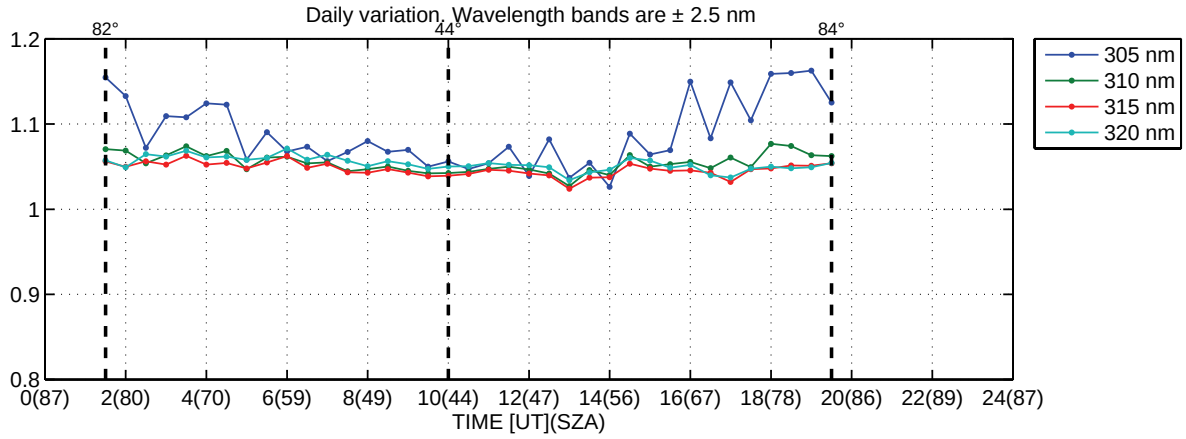

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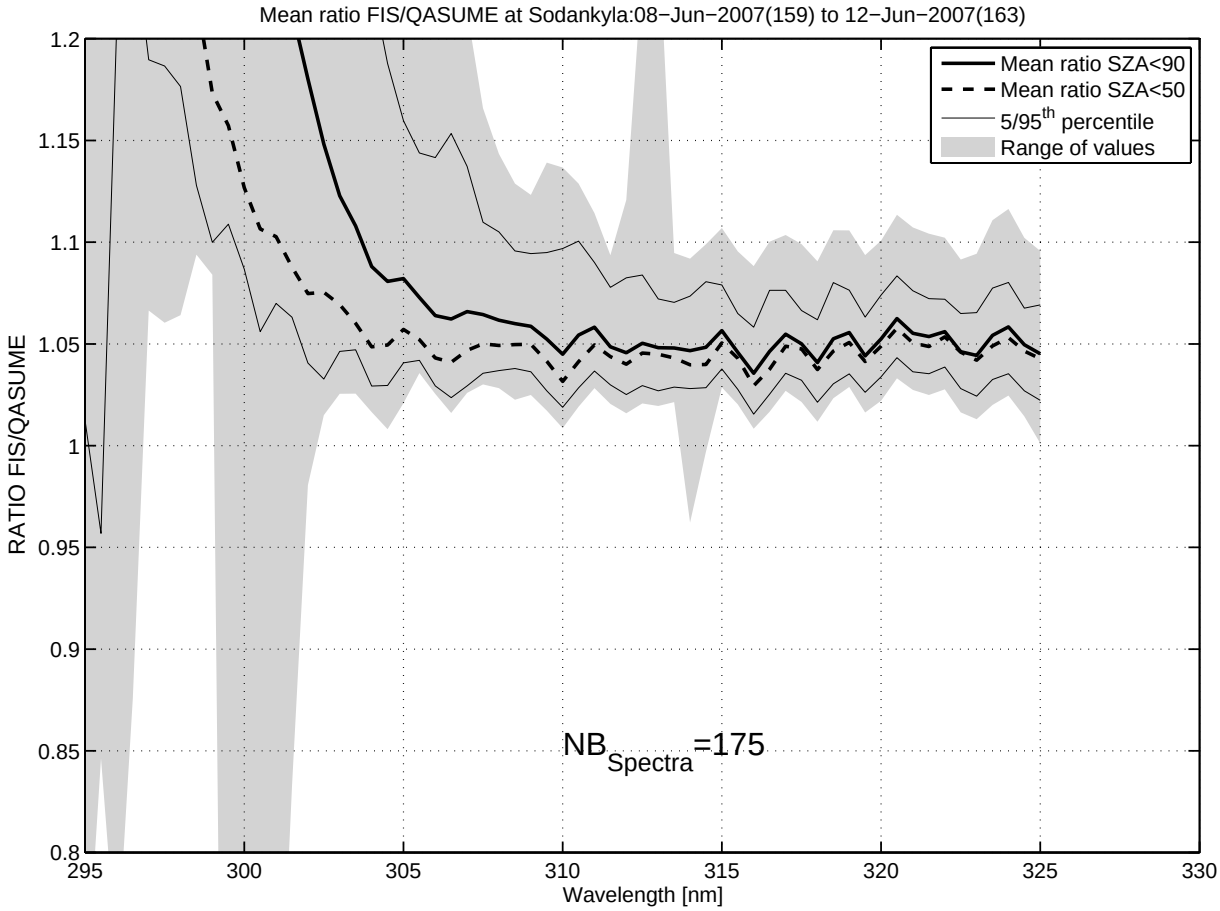
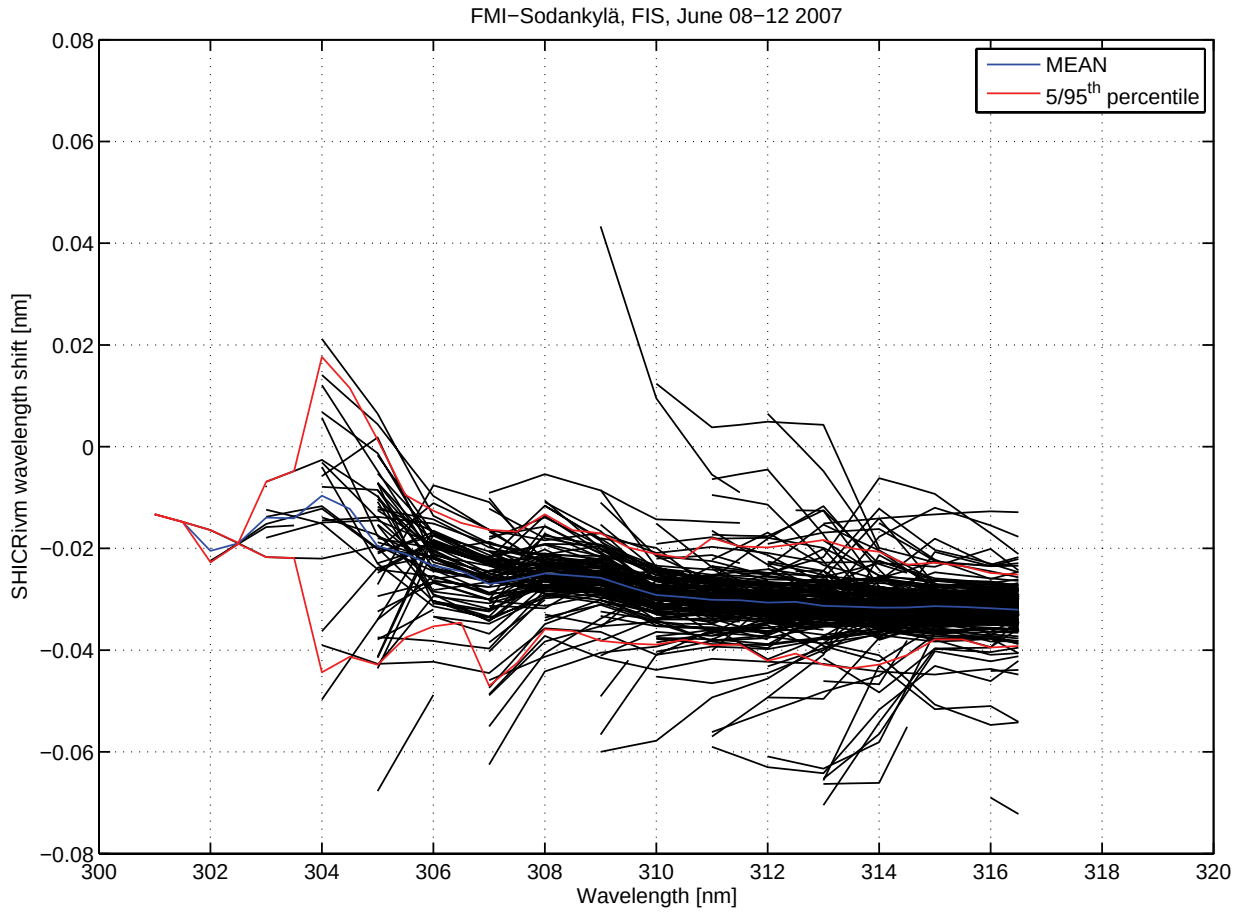
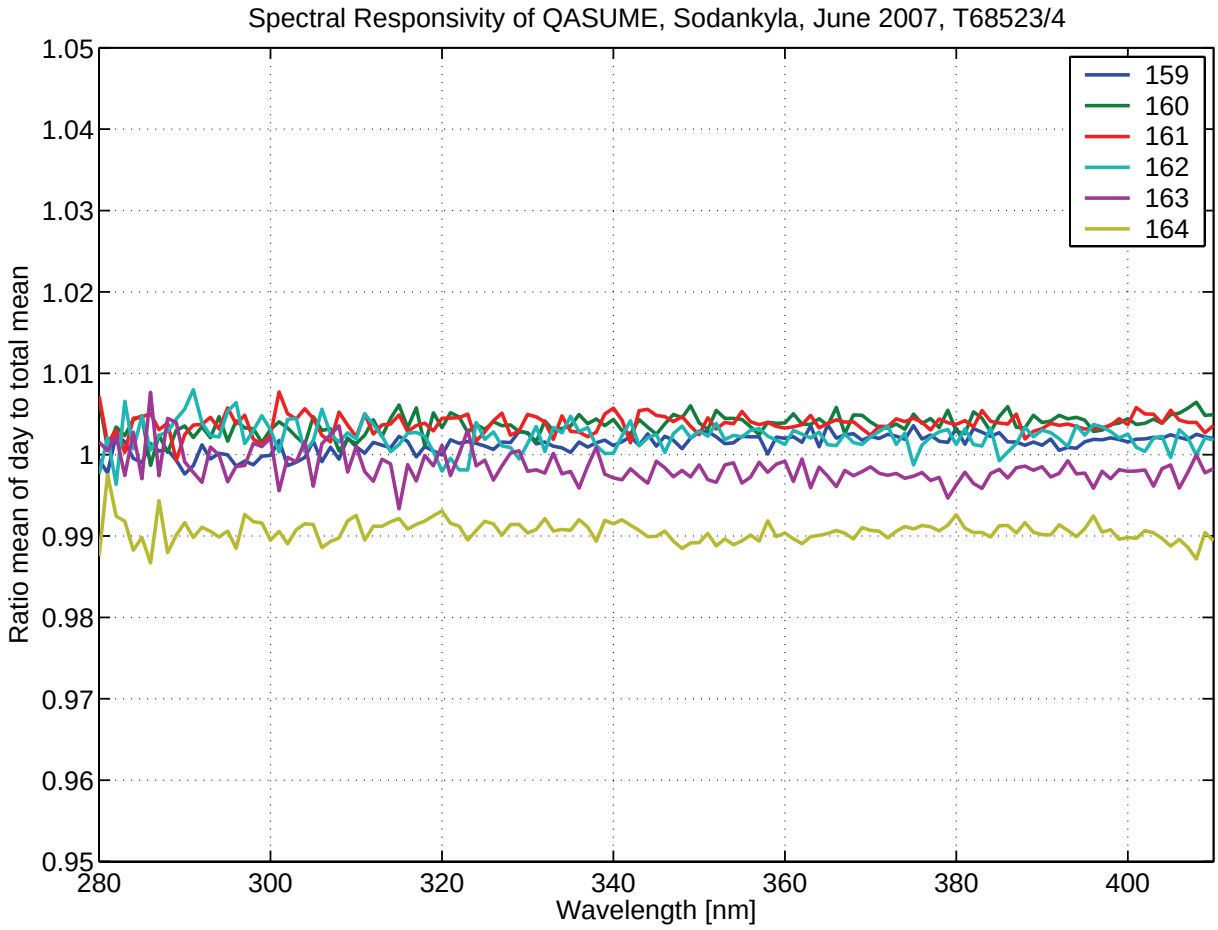
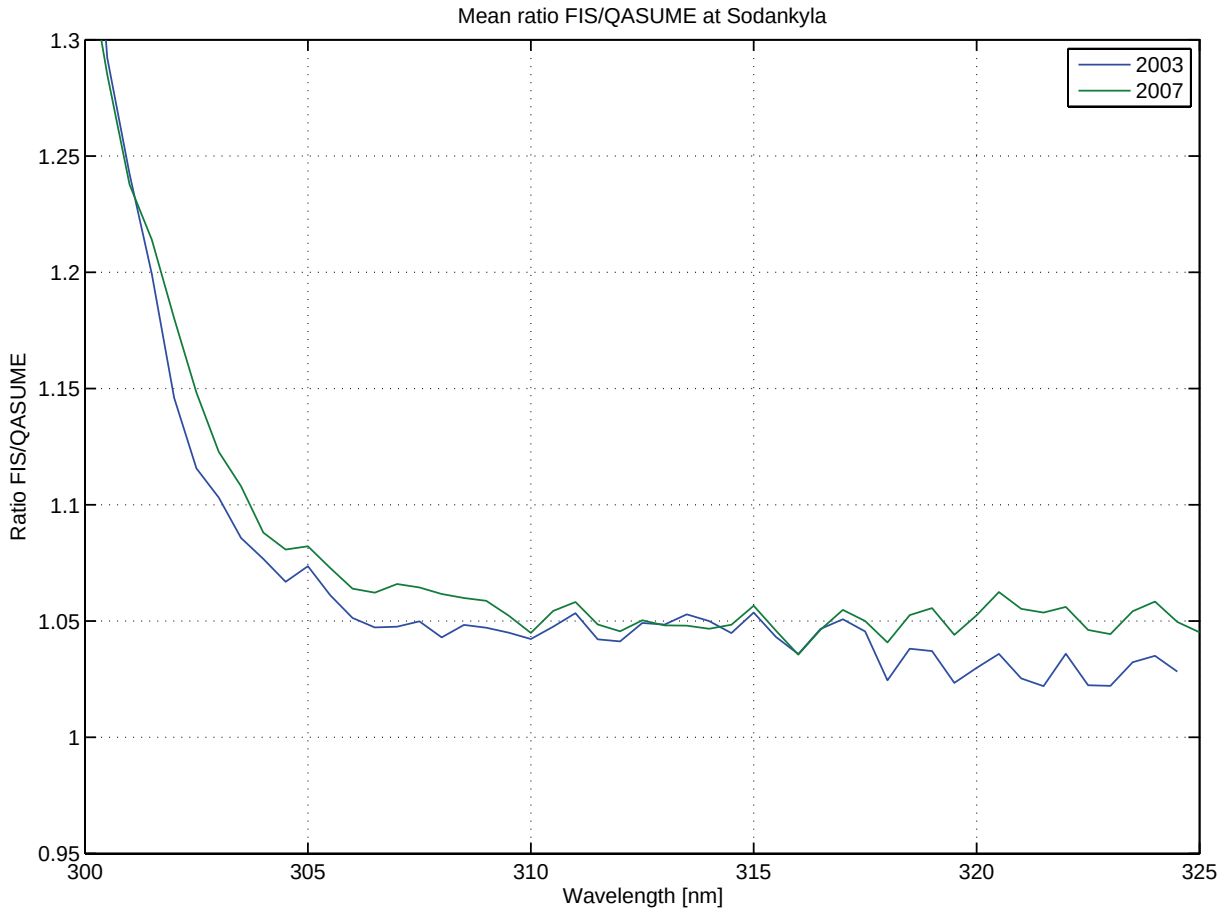
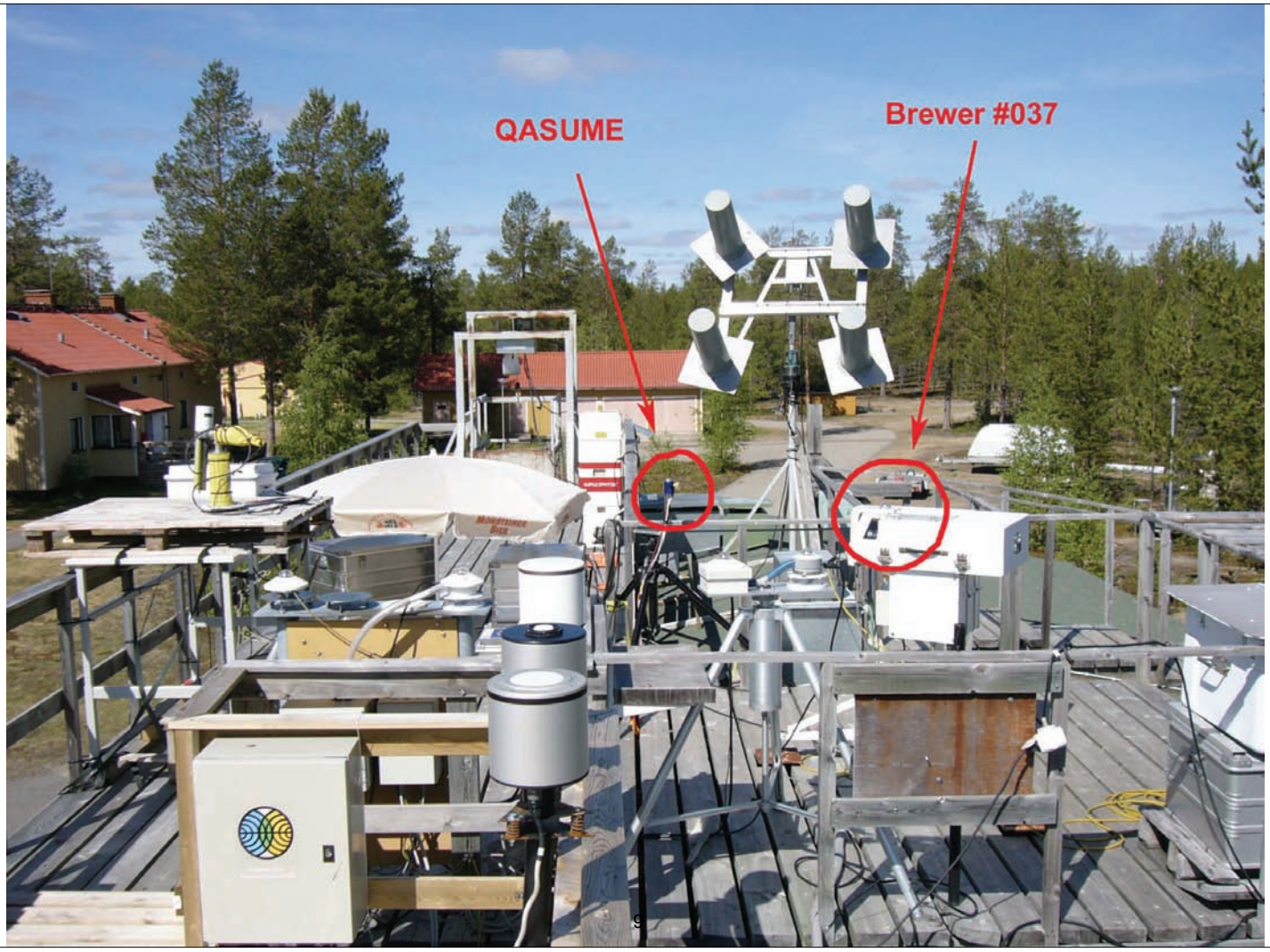



FMI−Sodankylä, FIS, June 08−12 2007
MEAN
5/95th percentile
SHICRivm wavelength shift [nm]
Wavelength [nm]
0.08
0.06
0.04
0.02
0
−0.02
−0.04
−0.06
−0.08
300
302
304
306
308
310
312
314
316
318
320


Spectral Responsivity of QASUME, Sodankyla, June 2007, T68523/4
159
160
161
162
163
164
Ratio mean of day 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


Mean ratio FIS/QASUME at Sodankyla
Ratio FIS/QASUME
Wavelength [nm]
2003
2007
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
300
305
310
315
320
325


QASUME
Brewer #037