

Protocol of the intercomparison at the PMOD/WRC, Switzerland  
on June 09 to 12, 2008 with the travelling reference  
spectroradiometer QASUME<sup>†</sup> from PMOD/WRC

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The purpose of the visit was the comparison of global solar irradiance measurements between the Brewer spectrophotometer and the travel reference spectroradiometer QASUME. The measurement site is located in Davos; Latitude 46.82 N, Longitude 9.85 E and altitude 1610 m.a.s.l.. The horizon of the measurement site is free down to at least 80° solar zenith angle (SZA). Measurements between 4:00 UT and 19:00 UT have been analysed.

QASUME was installed at PMOD/WRC in the morning of June 09, 2008. The spectroradiometer was installed in line to the Brewer with the entrance optic of QASUME within 2 m of the Br #163. The spectroradiometer in use at PMOD/WRC is a Brewer double monochromator (Br #163). The intercomparison between QASUME and the Brewer spectrophotometer lasted four days, from noon of June 09 to noon of June 12.

QASUME was calibrated several times during the intercomparison period using a portable calibration system. Two lamps (T68522 and T68523) 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  $22.3 \pm 1.3$  °C. A failure of the Peltier-Cooling resulted in a slow increase of the temperature to finally 30 °C on the last day. The diffuser head was heated to a temperature of  $25.4 \pm 0.9$  °C.

The wavelength shifts relative to an extraterrestrial spectrum as retrieved from the SHICRivm analysis were between  $\pm 50$  pm in the spectral range 290 to 400 nm.

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<sup>†</sup> 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 363 nm, every 0.5 nm, and 3 seconds between each wavelength increment.

**June 09 (161) Monday:**

QASUME was installed on the measurement site at 10:00 UT. Synchronised measurements are available from 13:00 UT when the internal temperature of QASUME reached its nominal temperature. Weather conditions were a mix of sun and clouds with a few rain drops in the afternoon.

**June 10 (162) Tuesday:**

Synchronised measurements are available from 4:00 to 19:00 UT. Weather conditions were a clear sky in the morning with a few cirrus clouds and a mix of sun and clouds during the day and thunderstorms in the evening.

QASUME was calibrated at 8:42 and 9:11 UT between the scans. The Brewer was calibrated at 9:35. The scan at 10:00 UT is missing because of this calibration.

**June 11 (163) Wednesday:**

Synchronised scans are available from 4:00 to 19:00 UT. The weather condition was mostly overcast sky with a few rain showers in the afternoon.

**June 12 (164) Thursday:**

Synchronised scans are available from 4:00 to 11:00 UT. The weather conditions were a mix of sun and clouds.

QASUME was calibrated at 9:13 UT.

End of the campaign: after the 11:00 UT scan.

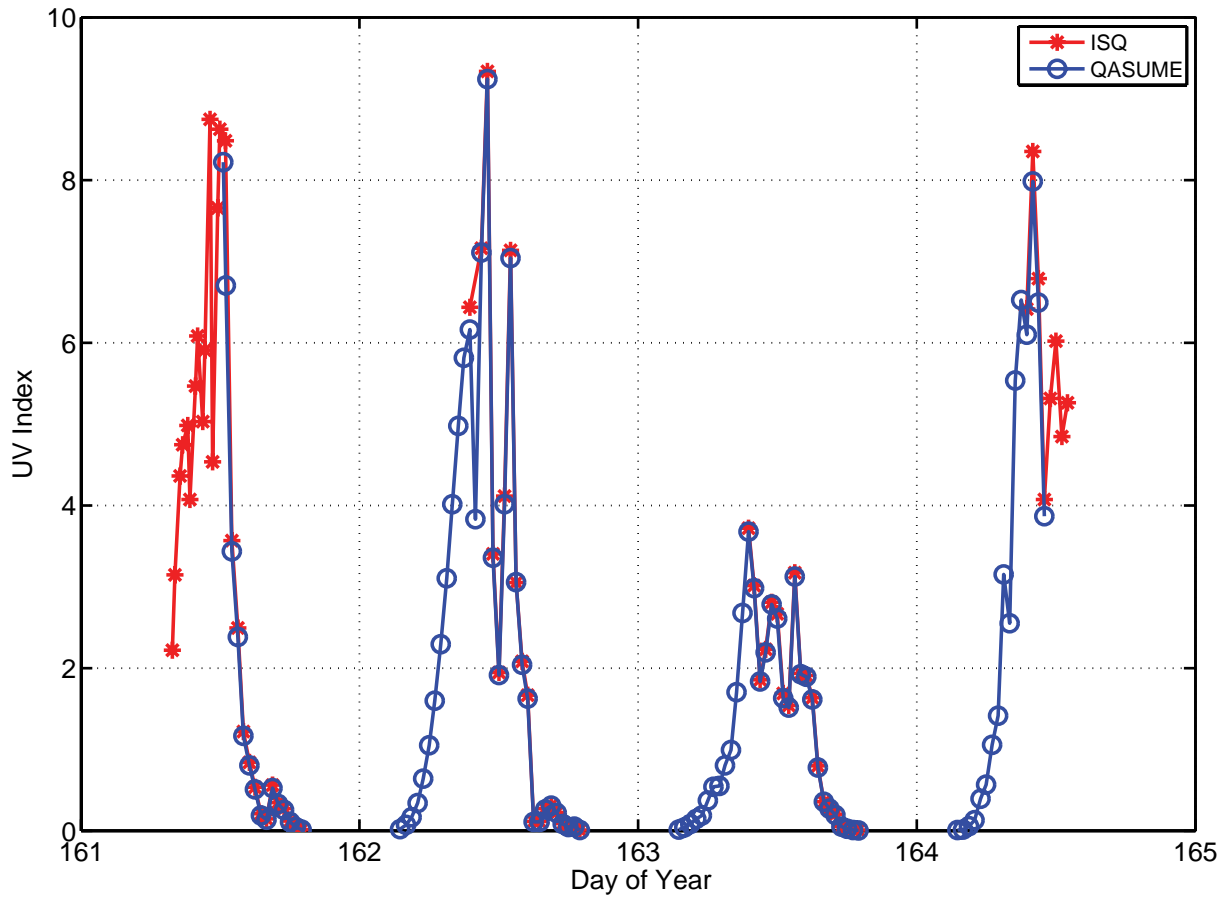
**Results:**

In total 89 synchronised simultaneous spectra from QASUME and Brewer #163 are available from the measurement period. Measurements between 4:00 and 19:00 UT have been analysed (SZA smaller than 90°).

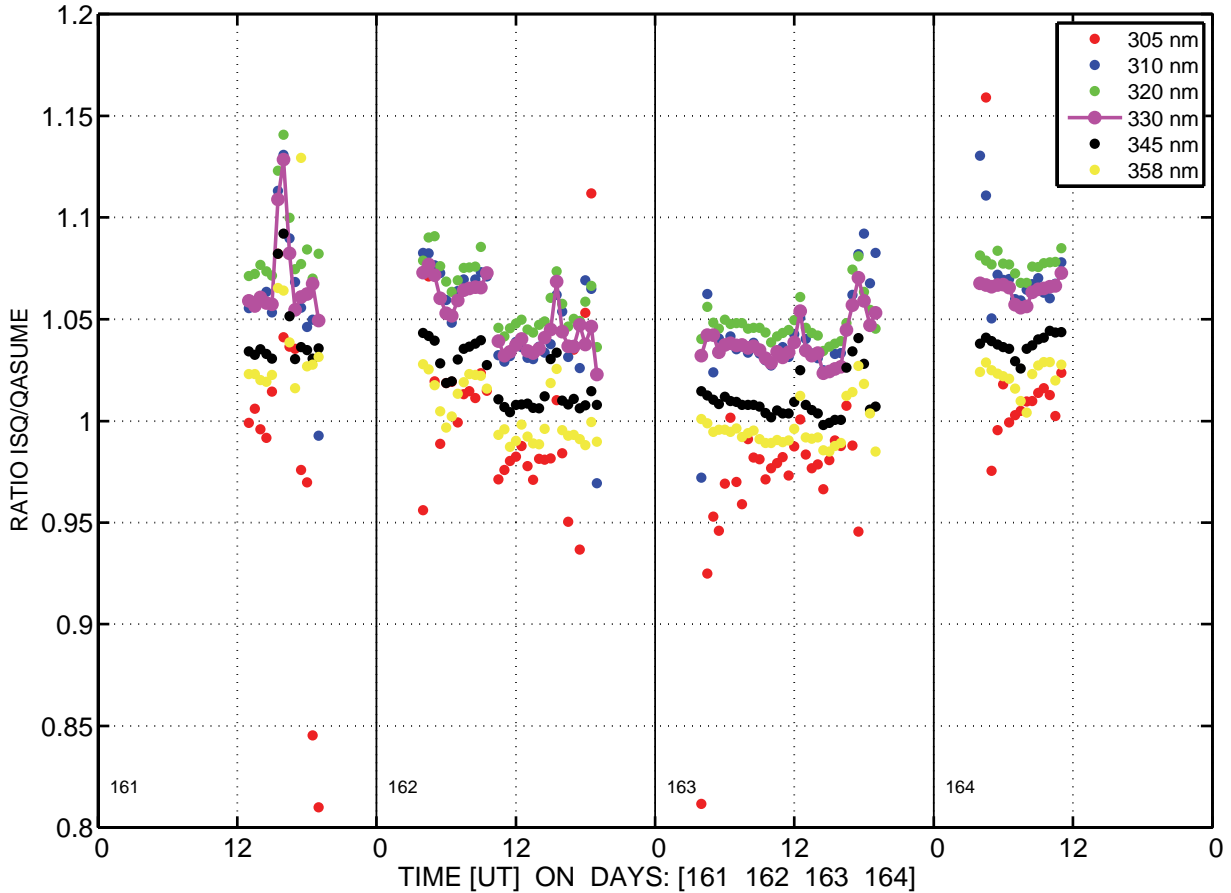
**Remarks:**

1. For all solar scans the wavelength shifts of the Brewer #163 are between -50 and +10 pm.
2. The pronounced spectral variability of the ratio QASUME/Brewer could be due to the insertion of the Depolarizer in Spring 2008.
3. The Brewer data was reprocessed in September 2008 using the recalibrated neutral density filter transmissions and the responsivity derived from a lamp calibration performed on 25 July 2008. The result is shown in the second set of figures (Pages 8 to 10). The spectral variability is not present in the recalibrate dataset and the mean ratio to QASUME is unity.

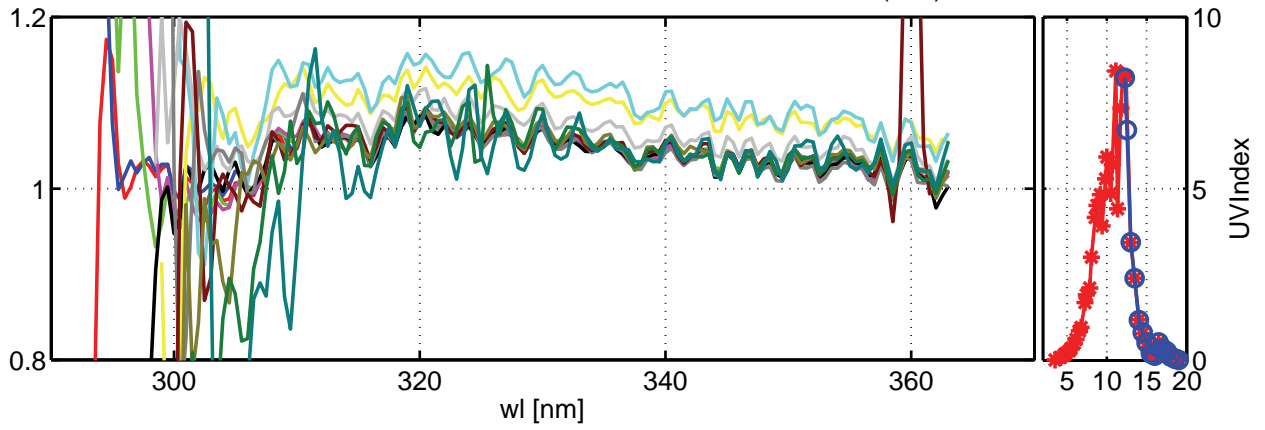
UV Index Davos, June 2008



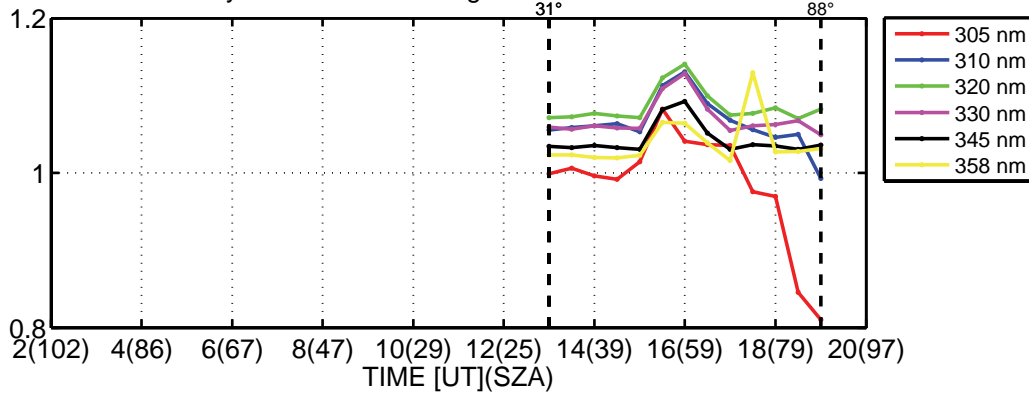
Global irradiance ratios ISQ/QASUME at Davos:09-Jun-2008(161) to 12-Jun-2008(164)



Global irradiance ratios ISQ/QASUME at Davos:09-Jun-2008(161)

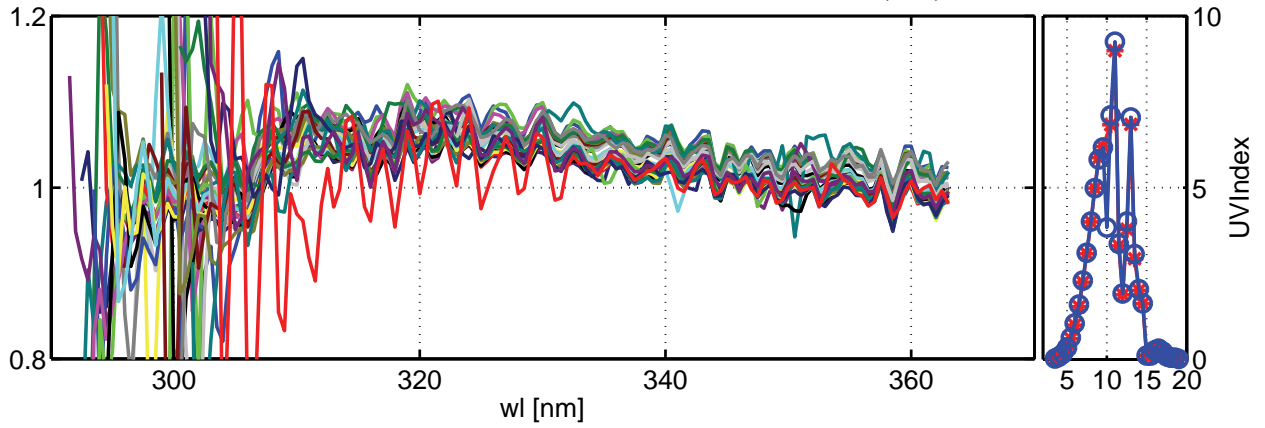


Daily variation. Wavelength bands are  $\pm 2.5$  nm

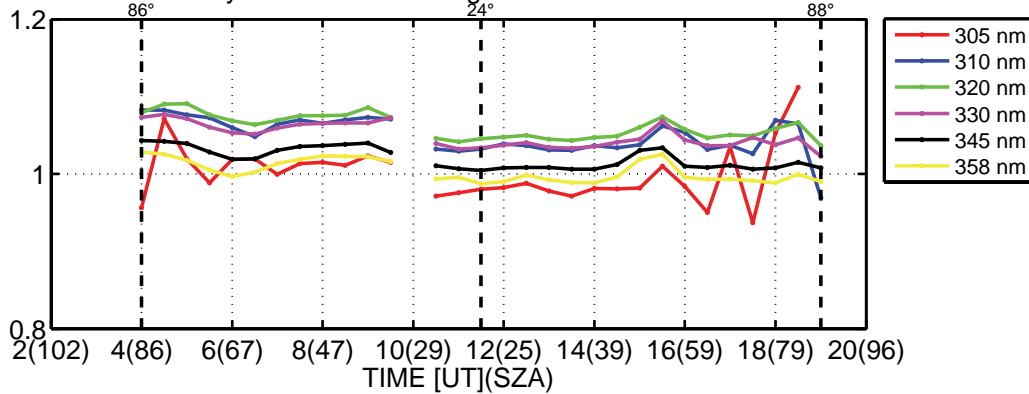


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Global irradiance ratios ISQ/QASUME at Davos:10-Jun-2008(162)

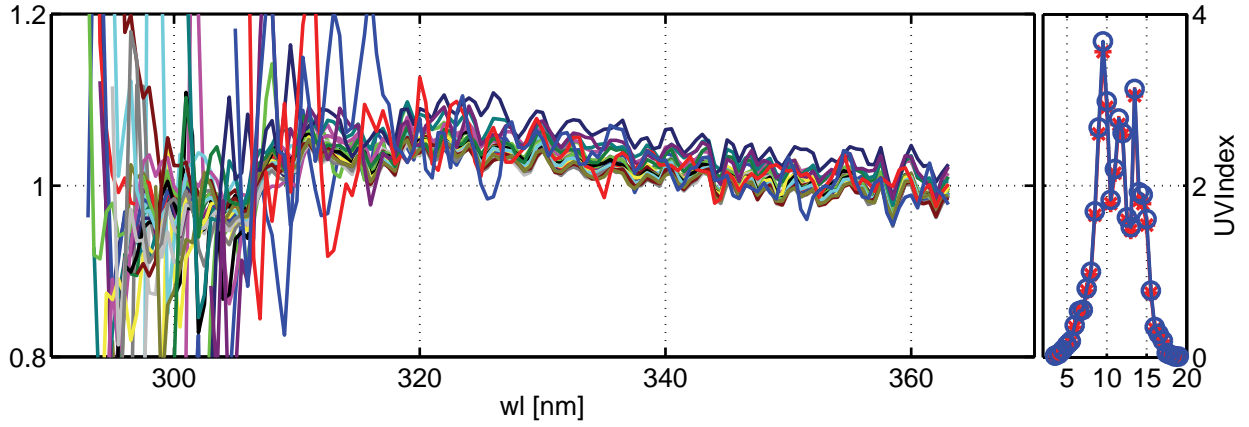


Daily variation. Wavelength bands are  $\pm 2.5$  nm

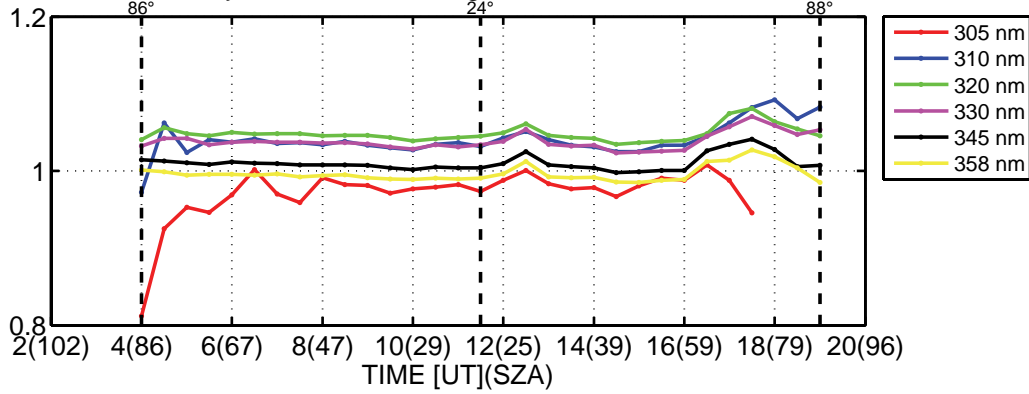


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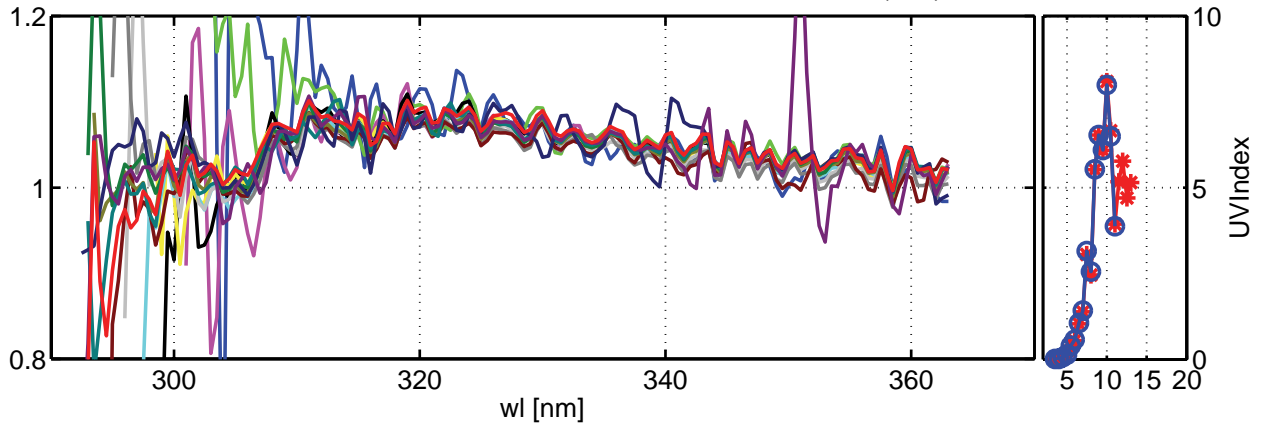


Daily variation. Wavelength bands are  $\pm 2.5$  nm

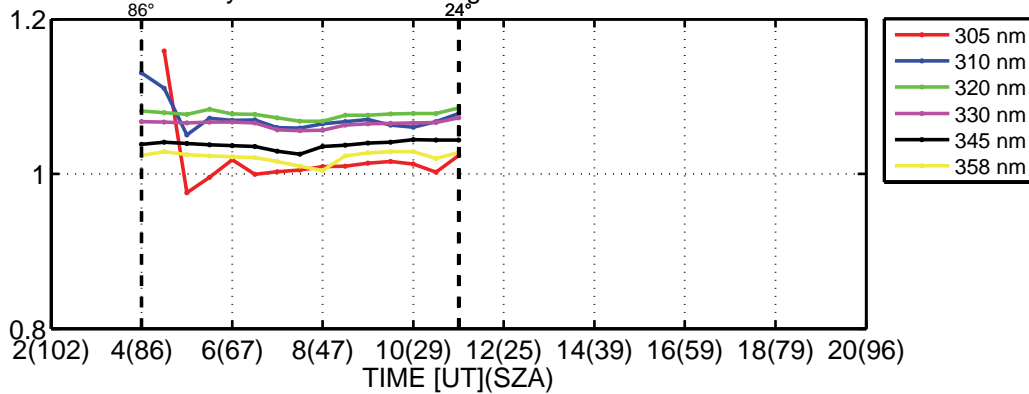


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Global irradiance ratios ISQ/QASUME at Davos:12-Jun-2008(164)

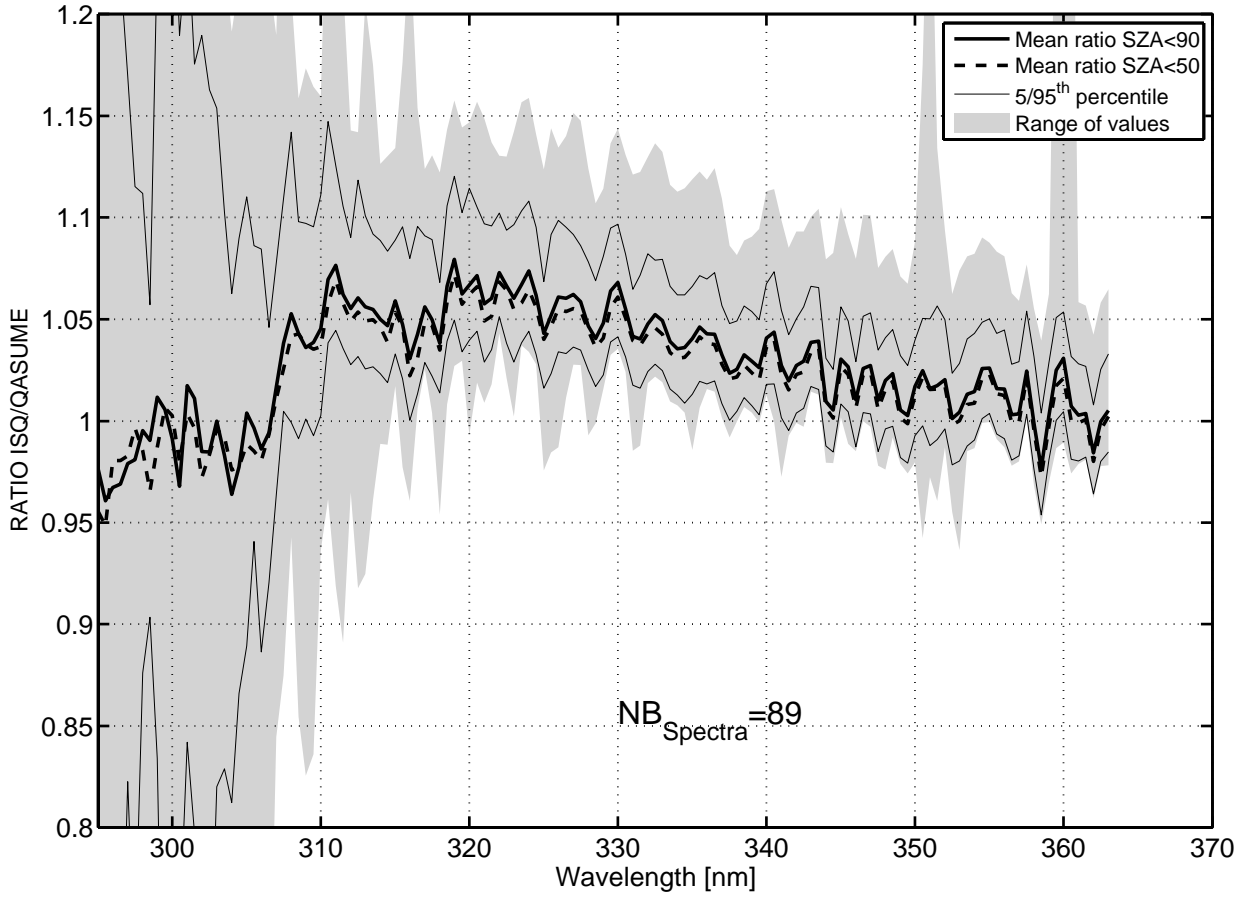


Daily variation. Wavelength bands are  $\pm 2.5$  nm

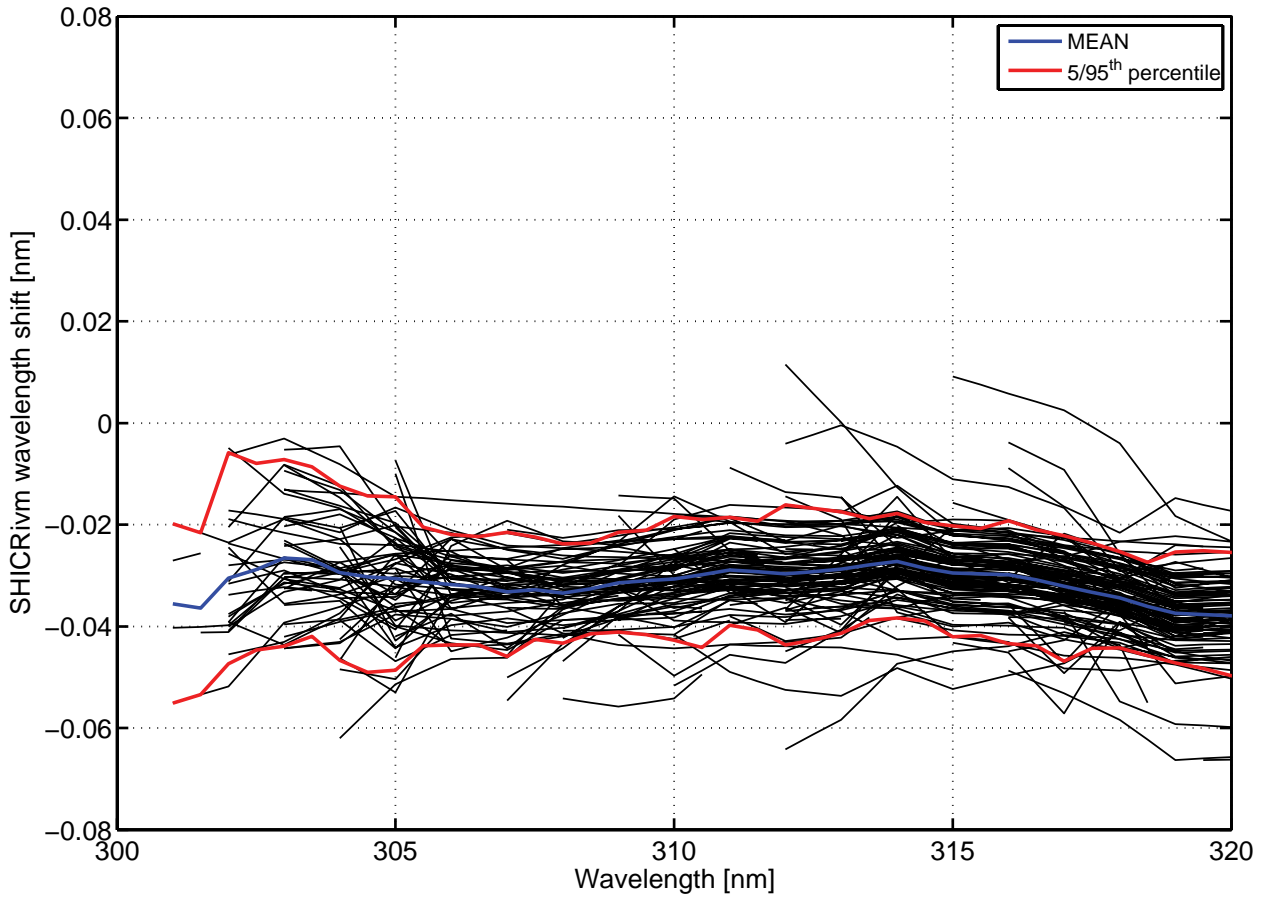


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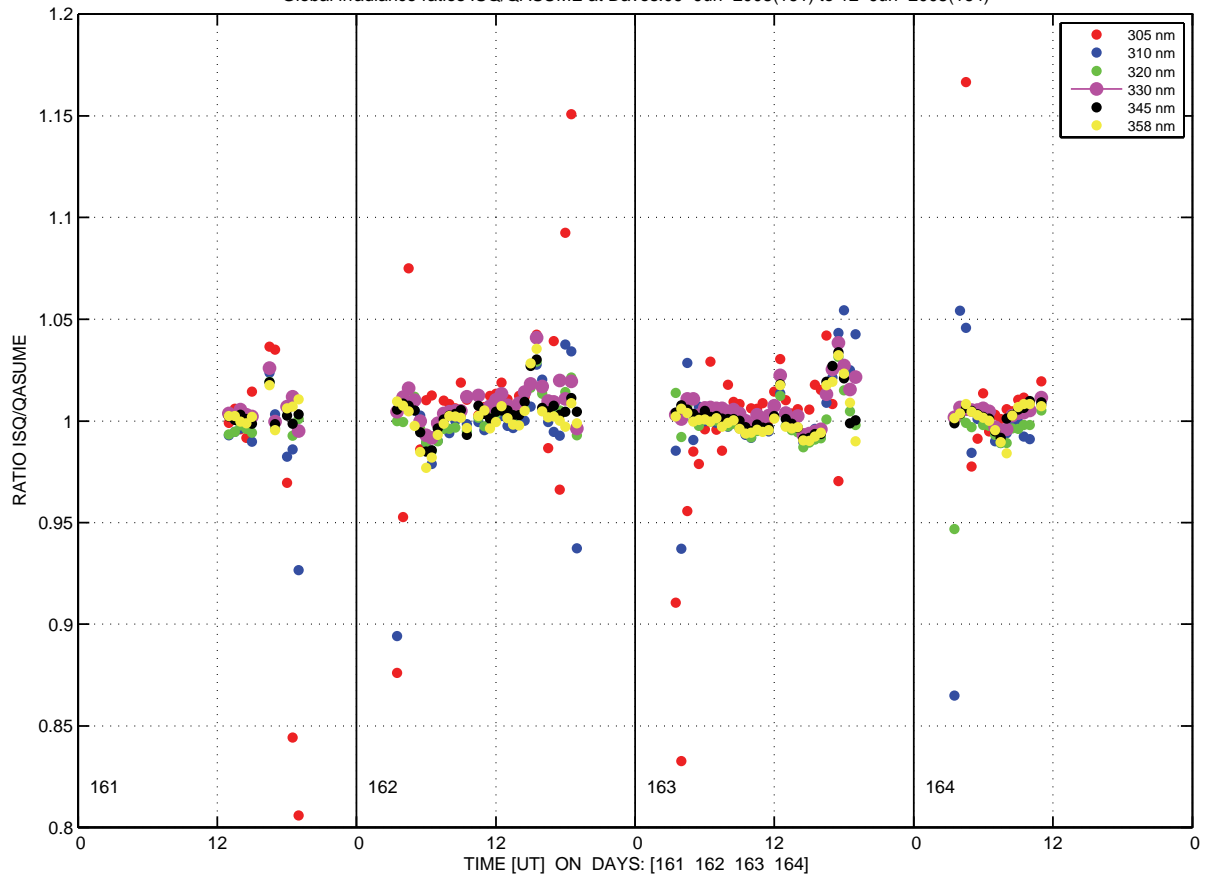
Mean ratio ISQ/QASUME at Davos:09-Jun-2008(161) to 12-Jun-2008(164)



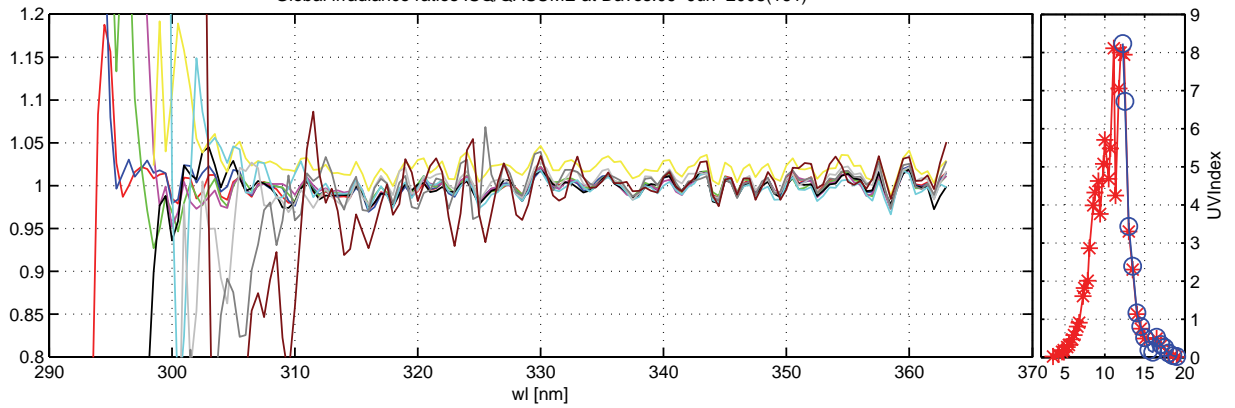
Davos, ISQ, June 2008



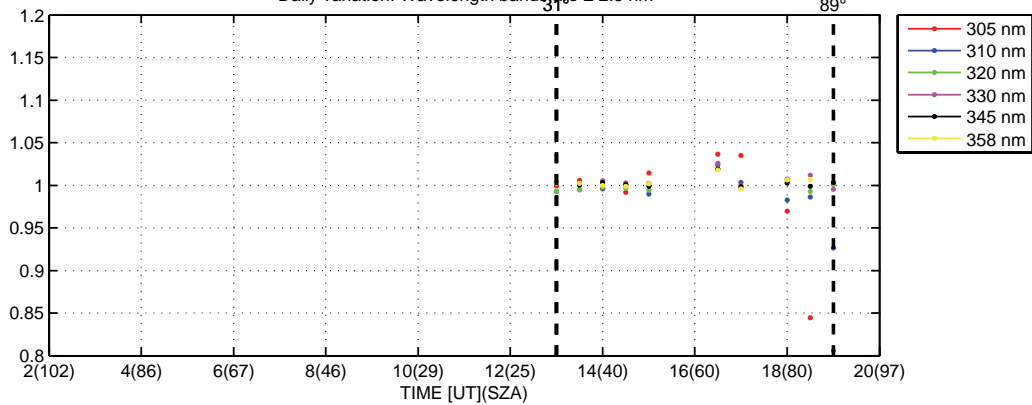
Global irradiance ratios ISQ/QASUME at Davos:09-Jun-2008(161) to 12-Jun-2008(164)



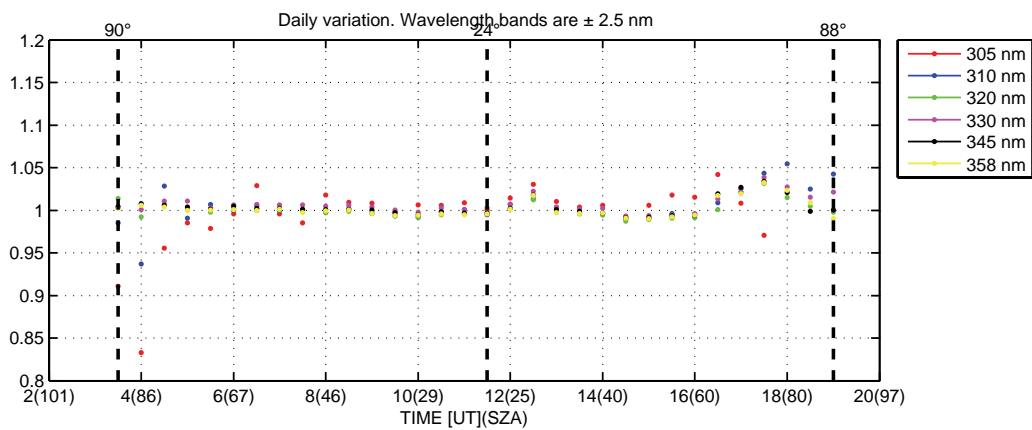
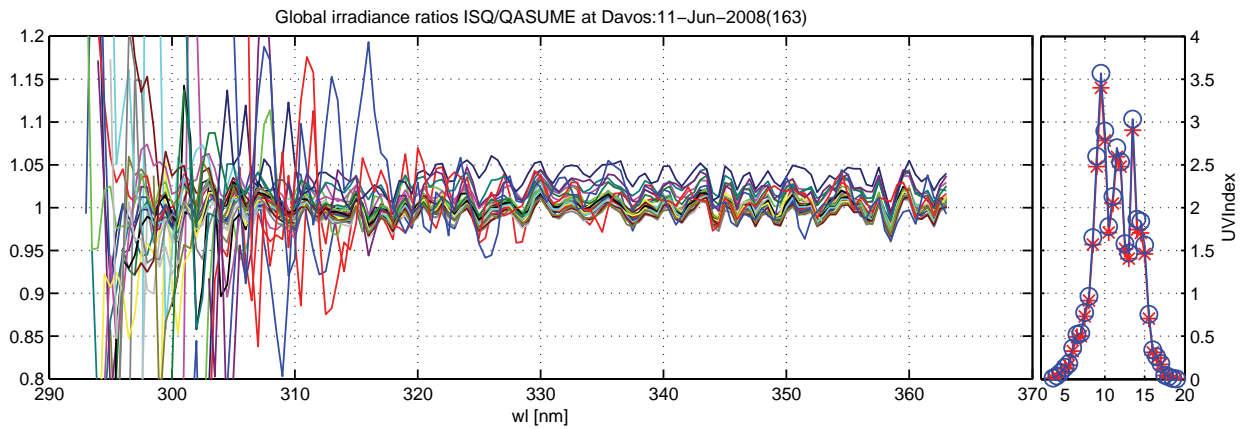
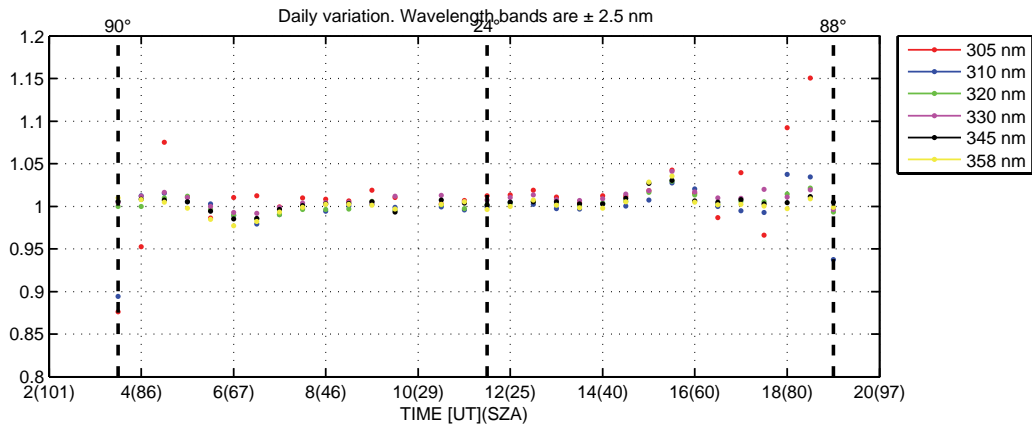
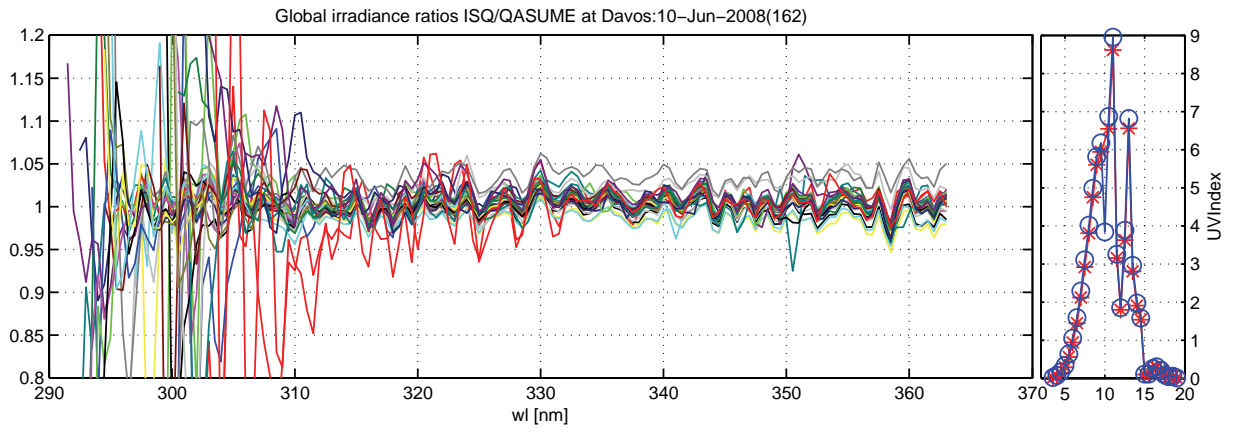
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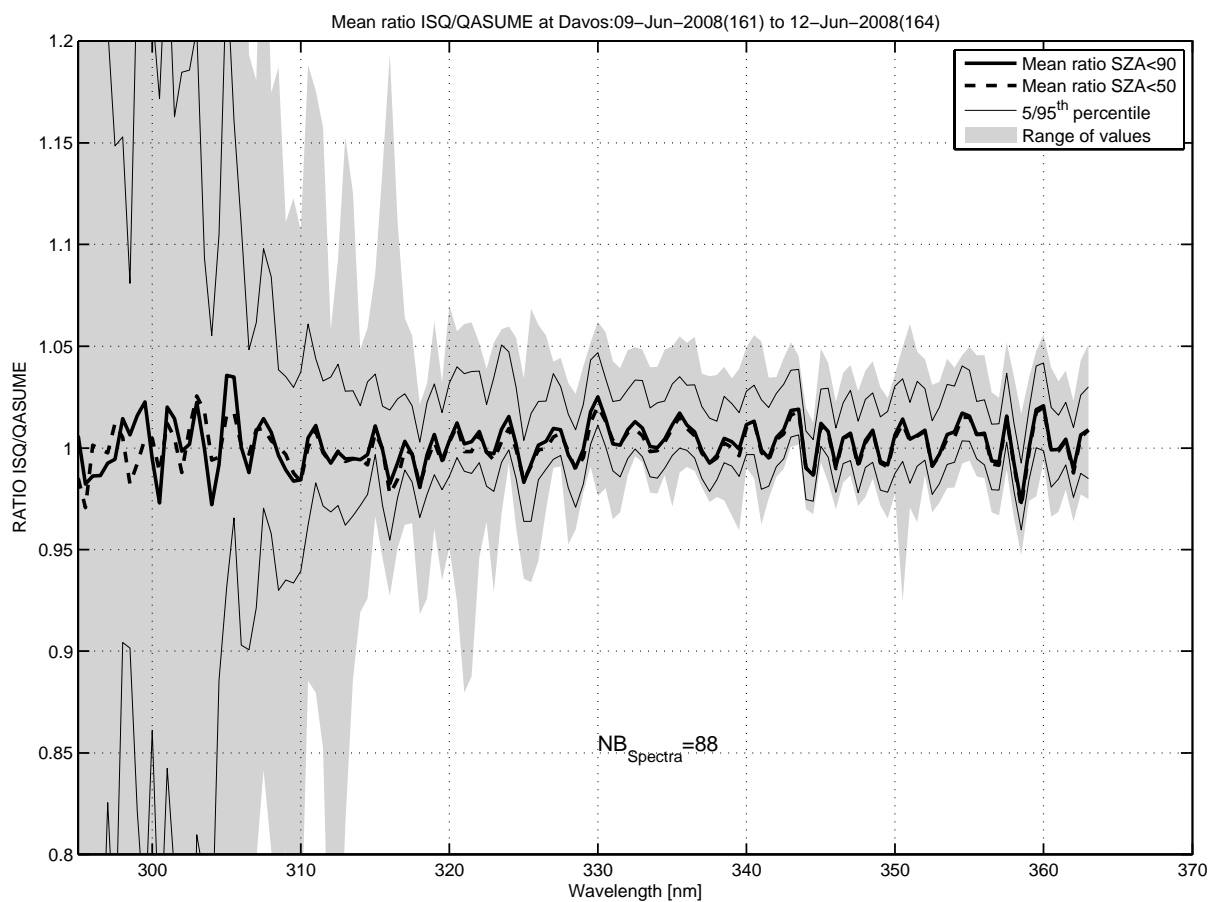
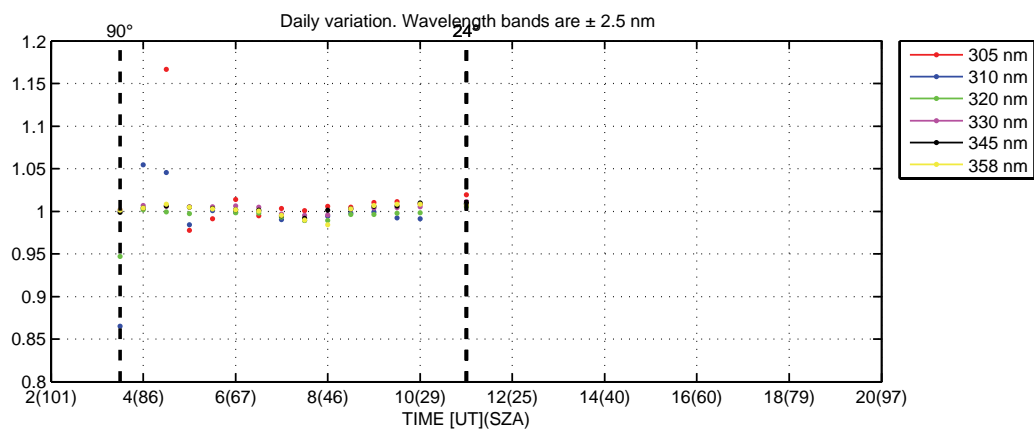
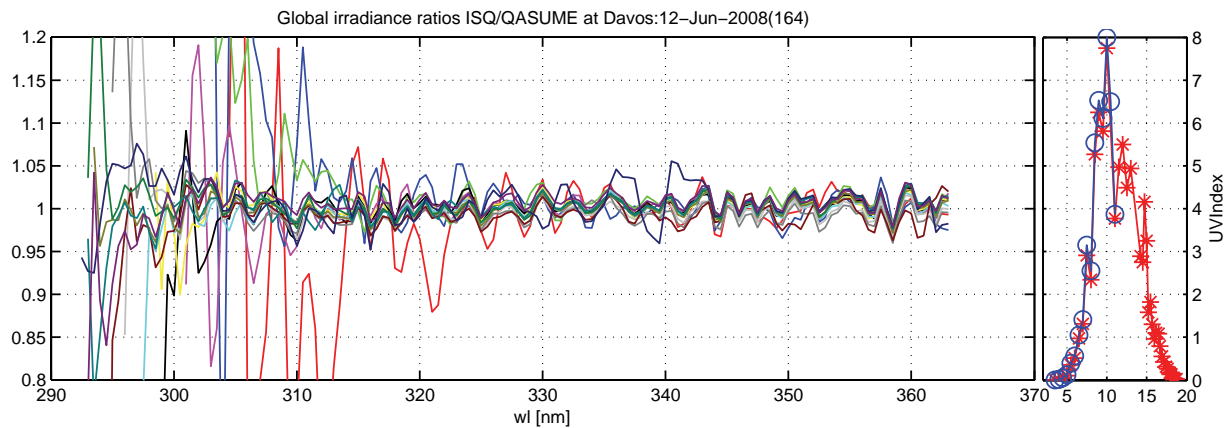


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Spectral Responsivity change of QASUME, June 2008, T68522,T68523

