

Protocol of the intercomparison at PMOD/WRC, Davos, Switzerland on August 14 to 26, 2020 with the travelling reference spectroradiometer QASUME from PMOD/WRC

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The purpose of the action was the comparison of global solar irradiance measurements between the travelling reference spectroradiometer QASUME (JRC), the spectroradiometer QASUMEll (QASII) and the Brewer #163 (ISQ) operated by the WCCUV of PMOD/WRC.

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 4:30 UT and 19:00 UT have been analysed.

QASUME was installed at PMOD/WRC during the summer season and started recording global UV irradiance on 14th August. The spectroradiometer was installed in line to QASUMEll and the Brewer with the entrance optic of QASUME within 2 m of the other two instruments. The spectroradiometer in use at PMOD/WRC is a Brewer double monochromator (Br #163). Both QASUME and QASUMEll are equipped with a Bentham DM150 monochromator. The intercomparison between the instruments lasted 13 days.

QASUME was calibrated during the intercomparison period using a portable calibration system. Four lamps (T68522, T68523, KS025 and KS020) 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 the additional monitor system (SSDS) varied by less than $\pm 0.5\%$ during the intercomparison period. The internal temperature of QASUME was $29.20 \pm 0.55^\circ\text{C}$ and the diffuser head was heated to a temperature of $26.63 \pm 0.31^\circ\text{C}$.

The wavelength shifts relative to an extraterrestrial spectrum as retrieved from the matshic analysis were between ± 50 pm in the spectral range 290 to 550 nm.

Protocol:

The measurement protocol was to measure one solar irradiance spectrum every 30 minutes from 290 to 550 nm, every 0.5 nm, and 3.0 seconds between each wavelength increment. QASUME recorded the spectra with 0.25 nm increments and #163 with 0.5 nm increment.

Date	DOY	Weather	Comment (times are in UT)
14. Aug	227	Mostly overcasted sky	
15. Aug	228	Clear sky with few cumulus clouds	
16. Aug	229	Mix of sun and clouds	
17. Aug	230	Mostly overcasted sky	
18. Aug	231	Mix of sun and clouds	
19. Aug	232	Mix of sun and clouds	Calibration Qasume, Qasumell
20. Aug	233	Clear sky with few cumulus clouds	
21. Aug	234	Clear sky with few cumulus clouds	
22. Aug	235	Mostly overcasted sky	
23. Aug	236	Overcasted sky	
24. Aug	237	Mostly overcasted sky	
25. Aug	238	Mix of sun and clouds	
26. Aug	239	Clear sky with few cirrus clouds	
27. Aug	240		Calibration Brewer #163

Results:

In total 262 synchronised simultaneous spectra from QASUME and QASUMELL (248 between QASUME and Brewer #163) are available from the measurement period. Measurements between 4:30 and 19:00 UT have been analysed (SZA smaller than 90°).

Qasumell (QASII):

1. The ratios between QASII and QASUME have on average an offset of -1%. For wavelength above 500 nm QASII could not catch up with the 1.5 s per increment, leading to a delay of the measurement relative to QASUME. The reason for the delay is unknown.
2. The diurnal variation of the QASII to QASUME ratio is 3% for clear sky day. The reason is probably zero relaxing time of the PMT for the long scan times.
3. The wavelength shifts, dwl, are shown in figures below. Before 19th August now wavelength correction of the raw QASII data was applied leading to a dwl of -220 pm. Afterwards the dwl is stable to better than ± 50 pm.

Brewer #163 (ISQ):

1. The ratios between ISQ and QASUME have on average an offset of -2% with a 2% spectral dependency. The later has been shown in previous intercomparisons.
2. The diurnal variation of the ISQ to QASUME ratio is 4 %.
4. The wavelength shifts dwl are stable to better than ± 50 pm.

































