



Calibration of Erythemally Weighted Broadband Instruments: A Comparison between PMOD/WRC and MSL

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To maintain confidence in data obtained from solar UV monitoring networks gathered over time, it is necessary to ensure instrumentation carries suitable calibration and traceability. The European UV Calibration Center, at Physikalisch-Meteorologisches Observatorium Davos (PMOD) in Switzerland, performs UV instrument calibrations providing traceability to institutes throughout Europe via the portable European reference spectroradiometer QASUME. The Measurement Standards Laboratory (MSL) is New Zealand's national metrology institute and for the past twenty years has conducted annual calibration of a network of six erythemal radiometers across the country. This paper reports on a measurement comparison performed between the two institutes, focusing on the calibration methodology for broadband UV radiometers and the differences between these.

A Yankee Environmental Systems (YES) UVB-1 pyranometer was calibrated at MSL during August 2010, then at PMOD during July and August 2011. Relative spectral and angular response calibration methods were principally the same at both institutes. However, there is a fundamental difference in the method they use to scale this to an absolute calibration. At PMOD an absolute calibration factor is obtained by monitoring solar light with the broadband radiometer situated outdoors next to the QASUME reference spectroradiometer, whereas at MSL the scaling is carried out against a 1 kW reference FEL lamp.

The results show that measurements of the relative spectral and angular response functions at the two institutes are in excellent agreement, thus providing a good degree of confidence in these measurement facilities. However, there is a disagreement in the absolute calibration results. This paper explores the potential systematic errors that could explain this discrepancy between the two methods. Possible sources of error are:

- (1) Different spectral distribution of the sources in the UVB region, though in principle both methodologies should be consistent.
- (2) Differences in the response of the radiometer to 'out of band' light from the two sources.
- (3) The linearity of response of this type of UVB radiometer.

Of the two scaling methods, the solar spectrum used during calibration at PMOD is equivalent to that which the detector observes during field measurements. Therefore, the implication from this work is that laboratories performing such scaling against an FEL lamp may need to perform further characterisation of their instruments or switch to scaling with a solar spectrum by means of a reference spectroradiometer.