Physikalisch-Meteorologisches Observatorium Davos
World Radiation Center

pmod wrc

Calibration Certificate

No. 2019-C-025

Calibration Item

Pyranometer

Manufacturer	Kipp & Zonen
Type	CMP22
Serial Number	160404

Customer

Alfred-Wegener-Institut
Helmholtz-Zentrum für Polar- und Meeresforschung
Am Handelshafen 12
27570 Bremerhaven
Germany

Calibration Mark

2019-C-025

Period of Calibration

2019 May 24, June 4, 5, 7

Davos Dorf, 11 June 2019

R. Soder
In charge of calibration

Dr. W. Finsterle
Head WRC section solar radiometry

CIPM MRA

PMOD/WRC follows the requirements for the competence of testing and calibration laboratories according to ISO/IEC 17025. PMOD/WRC is a designated institute of the Swiss Federal Office of Metrology, the Swiss signatory of the CIPM MRA (International Committee for Weights and Measures - Mutual Recognition Arrangement).

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Calibration procedure

This pyranometer was compared with the sun and sky radiation as source under mainly clear sky conditions using the "continuous sun-and-shade method". The direct solar radiation is determined using the PMO2, member of the World Standard Group (WSG) and the diffuse radiation is measured using the shaded standard pyranometer of the World Radiation Center (WRC). The measurements were performed in Davos (latitude: 46.8143°, longitude: -9.8458°, altitude: 1588m). The readings are referred to the World Radiometric Reference (WRR) as stated in the WMO Technical Regulations. The originally estimated uncertainty of the WRR relative to SI is ±0.3%.
The inclination of the receiver surfaces versus their horizontal position were set to 0 degrees, the instrument signal wire to the north. During the comparisons, the instrument received global radiation intensities ranging from 659 W/m^2 to 1099 W/m^2, with a mean of 908 W/m^2. The angle between the solar beam and the normal of the receiver surface varied from 24.1 degrees to 49.8 degrees, with a mean of 32.7 degrees. The ambient temperature ranged from 12.7 °C to 22.4 °C, with a mean of 19.1°C. The sensitivity calculation and the single measurements deviation (σ) are based on 488 individual measurements. The obtained sensitivity value is valid for similar conditions.

Calibration results

Responsivity: $S = 10.593\ \mu V / (Wm^{-2})$

Uncertainty: $U = \pm 0.069\ \mu V / (Wm^{-2})$

The reported expanded uncertainty of measurements is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Calibrations Remarks

Reference: WRR represented by the absolute pyrheliometer: PMO2
WRR-Factor of PMO2: 0.998189
(from the last International Pyrheliometer Comparison, IPC-2015
Diffuse radiation: Pyranometer CM22 S.N. 020059 with calibration factor: 8.92
(Ventilated with heated air, automatic shading disk, instrument-wire opposite sun)
External calibration: Identifier DMM9, S.N. 0xEB18B0, last calibration 18.4.2013, last validation **20.5.2019**.

Comments

Instrument Condition: The calibration item was received fully functional and did not show any erratic behavior or irregularities during calibration. The dome was cleaned daily.

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