

CERTIFICATE NUMBER 121016121016  
PYRHELIOMETER MODEL CHP 1  
SERIAL NUMBER 121016  
SENSITIVITY 7.89  $\mu\text{V}/\text{W}/\text{m}^2$   
IMPEDANCE 29  $\Omega$   
TEMPERATURE  $22 \pm 2$  °C  
REFERENCE PYRHELIOMETER Kipp & Zonen CHP 1 sn REF1 active from 01 January 2017  
CALIBRATION DATE 03 August 2017

**Calibration procedure**

Exact interchange of test pyrhelimeter and reference pyrhelimeter in a horizontal parallel beam of light from a Xenonlamp. Full collimation angle of beam is 1.0°. Irradiance  $500 \pm 50$   $\text{W}/\text{m}^2$ . Roomtemperature  $22 \pm 2$  °C.

**Hierarchy of traceability**

This reference pyrhelimeter was compared with the reference radiometer PMO2 of the World Radiation Center (WRC) using the sun as source. The reference radiometer is periodically calibrated against the World Standard Group (WSG), maintained at the WRC Davos. 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  $\pm 0.3\%$ . The measurements were performed in Davos (latitude: 46.8143, longitude: -9.8458, altitude: 1588 m above sea level).

During the comparisons, the reference pyrhelimeter received direct solar radiation with intensities ranging from 910 to 1015  $\text{W}/\text{m}^2$ , with a mean of 980  $\text{W}/\text{m}^2$ . The ambient air temperature ranged from +20.5 to +24.9 °C with a mean of +23.6 °C. The sensitivity calculation is based on 456 individual measurements. The sensitivity and its expanded uncertainty (95% level of confidence) are only valid for similar environmental conditions and amount:  $7.95 \pm 0.02$   $\mu\text{V}/\text{W}/\text{m}^2$ .

WRR- factor of PMO2: 0.998189 (from the last international Pyrhelimeter Comparison, IPC-2015).

Dates of measurements: 24-26 August 2016

**Correction applied 0.0%**

No correction to the Davos sensitivity figure has been applied.

**Justification of total instrument calibration uncertainty**

The combined uncertainty of the result of the calibration is the positive "root sum square" of two uncertainties.

1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference CHP 1 as given by the World Radiation Center in Davos is  $\pm 0.02/7.95 = \pm 0.25\%$ . (See traceability text).

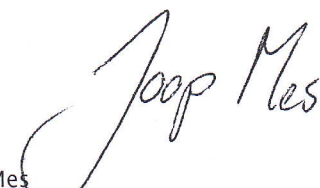
2. Based on experience the expanded uncertainty of the transfer procedure (calibration by non-simultaneous comparison) is estimated to be  $\pm 1.0\%$ .

The estimated combined expanded uncertainty is the positive "root sum square" of these two uncertainties:  $\sqrt{(0.25^2 + 1.0^2)} = \pm 1.03\%$ .

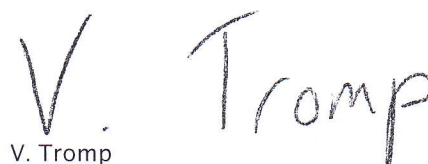
**Notice**

The calibration certificate supplied with the instrument is at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

Delft, The Netherlands, 03 August 2017



J. Mes  
(in charge of calibration facility)



V. Tromp  
(in charge of test)