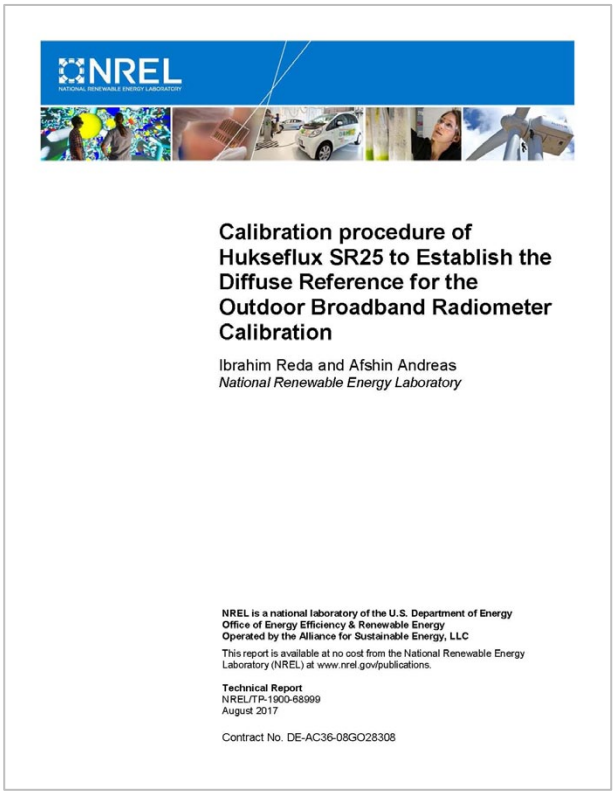
Hukseflux
Thermal Sensors

SR25: diffuse solar radiation reference

Outperforms quartz dome instruments, and is more affordable

Diffuse solar radiation is usually measured using shaded pyranometers. The dominant measurement error is the zero offset a. SR25, equipped with a high thermal conductivity sapphire dome, has very low offsets. SR25 outperforms the traditional quartz dome instruments used for this purpose, at a much lower cost level. SR25 has been tested at NREL National Renewable Energy Laboratory of Golden USA, and has been adopted* by NREL as its diffuse radiation reference sensor.*


NREL

Calibration procedure of Hukseflux SR25 to Establish the Diffuse Reference for the Outdoor Broadband Radiometer Calibration

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NREL is a national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy
Operated by the Alliance for Sustainable Energy, LLC

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Figure 1 *NREL test report of SR25: also available online*

Figure 2 *SR25 pyranometer with sapphire outer dome*

Next level measurement

SR25 pyranometer measures the solar radiation received by a plane surface, in W/m^2, from a 180 ^{o} field of view angle. SR25 offers the best measurement accuracy: the specification limits of two major sources of measurement uncertainty have been greatly improved over competing pyranometers: “zero offset a” and temperature response.

Low zero offset

Using a sapphire outer dome, SR25 has negligible zero offsets. Zero offset a is caused by a temperature difference between domes and detector. The high thermal conductivity of SR25’s sapphire outer dome ensures excellent thermal coupling between body and domes. This results in a nighttime offset of < 1 W/m^2, unheated, unmatched by any pyranometer.

Independent testing

SR25 prototypes and product models were tested outdoor and indoor against competing secondary standard instruments.

SR25’s excellent performance was recently confirmed in an independent test* at NREL: Ibrahim Reda, A. Andreas, 2017, *Technical Report NREL/TP-1900-68999, Calibration procedure of Hukseflux SR25 to Establish the Diffuse Reference for the Outdoor Broadband Radiometer Calibration.* In this calibration experiment, the NREL lab attributed a 0.5 W/m^2 zero offset to the unheated SR25, and was able to determine its sensitivity with an accuracy of around 0.9 %. Using this SR25 to measure Diffuse Horizontal Irradiance, NREL estimates the contribution of the SR25 to the uncertainty of the Global Horizontal Irradiance as ± (0.09 % + 0.5 W/m^2).

* NOTE: the fact that a sensor is used or tested does not constitute a formal endorsement by the user or test institute.

Comparison to quartz dome instruments

The same NREL lab assumes in its BORCAL testing that a double quartz-dome instrument has around 1.5 W/m^2 zero offset (at 200 W/m^2 net irradiance) while double glass-dome pyranometers are typically no better than 5 W/m^2.

BSRN requirements

The SR25 measurement accuracy is sufficient to meet the requirements of the BRSN network for diffuse radiation measurement, which is the larger of 2 % or 3 W/m^2. Bruce McArthur, 2005, *BSRN Operations Manaual Version 2.1, WCRP-121 WMO/TD-No. 1274*

Accuracy

Example: as one of the comparative tests performed at Hukseflux, during a 26 day period the nighttime offset of various pyranometer configurations was monitored. Looking at nighttime offsets, the performance of both the heated and the unheated SR25 is better than that of all other measured pyranometer configurations.

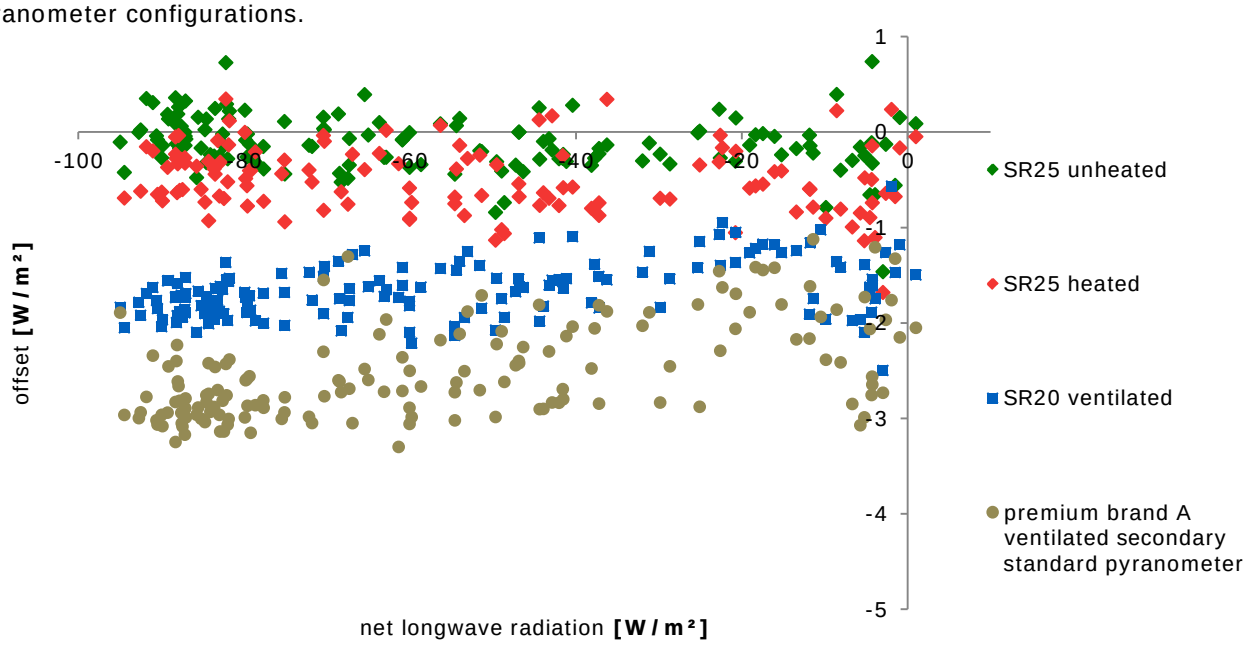

Figure 3 *results at Hukseflux: nighttime offsets of ventilated pyranometers and SR25 versus net longwave radiation. SR25 has lower nighttime offset than the ventilated secondary standard pyranometers both when unheated and when heated*

Individual testing of every instrument

In order to be classified as secondary standard, every pyranometer needs to be tested individually for all critical specifications. Each SR25 is supplied with a product certificate, reporting directional response, temperature response and response time (95 %).

See also

- SR25 brochure
- view our complete product range of solar sensors

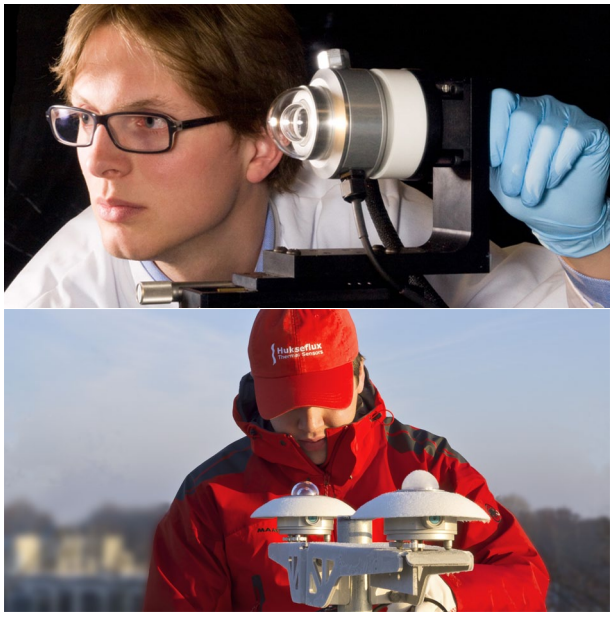

Figure 4 *extensive testing of sensors, here indoors at Hukseflux and outdoors on a frosty morning: clear difference between SR25 (left), versus an unheated pyranometer without sapphire dome (right)*

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Worldwide support

Hukseflux has pyranometer calibration equipment and servicing facilities in the following regions:

- Europe
- United States of America
- China
- Japan
- India
- Brasil

Figure 5 *worldwide calibration and service facilities*

About Hukseflux

Hukseflux Thermal Sensors offers measurement solutions for the most challenging applications. We design and supply sensors as well as test & measuring systems, and offer related services such as engineering and consultancy. With our laboratory facilities, we provide testing services including material characterisation and calibration. Our main area of expertise is measurement of heat transfer and thermal quantities such as solar radiation, heat flux and thermal conductivity. Hukseflux is ISO 9001:2015 certified. Hukseflux sensors, systems and services are offered worldwide via our office in Delft, the Netherlands and local distributors.

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