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Performance validation of a commercial radiometer

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Abstract

In this poster I will describe the thermal validation of a commercial radiometer against calibration blackbodies used for sea surface temperature. These calibration procedures have been well established through the SISTeR instrument operation over the past 30 years. We will apply these techniques to the commercial radiometer and assess its performance.

1 Why do we need to validate radiometers?

Radiometers are usually supplied with a calibration certificate by the manufacturer but how good is this calibration?

By carrying out an in-house calibration against a reference blackbody, we can validate the manufacturer's calibration. This gives increased confidence in manufacturer stated uncertainties.

2 How do we validate radiometers?

1. Expose the radiometer to known brightness temperatures over the SST operational range (-5 to 30°C)
2. Compare to reference blackbody logged values
3. Determine offsets between the radiometer readings and blackbody
4. Uncertainty budget to give overall uncertainty
5. Compare with the factory calibration to validate it

3 SISTeR Overview

Scanning Infrared Sea Surface Temperature Radiometer

- Chopped, self-calibrating infrared filter radiometer
- Measures infrared brightness temperatures
- Typical accuracy of 30mK
- Narrowband filters centred at 10.8µm and 12.0µm
- 2 internal reference blackbodies at ambient and ambient + 20K

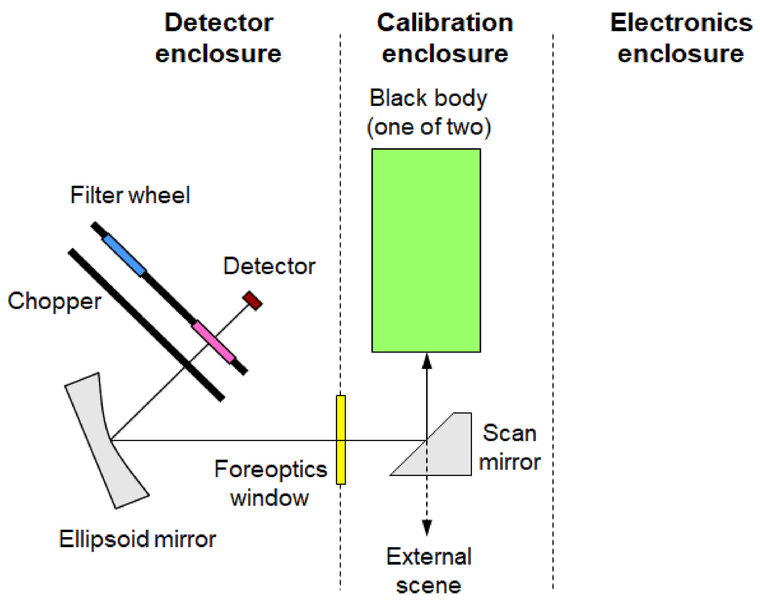

Figure 1: Schematic diagram of the main SISTeR components

Figure 2: The SISTeR radiometer

4 SISTeR Validation

Figure 3: Calibration setup of SISTeR (middle) against the CASOTS blackbody source (right)

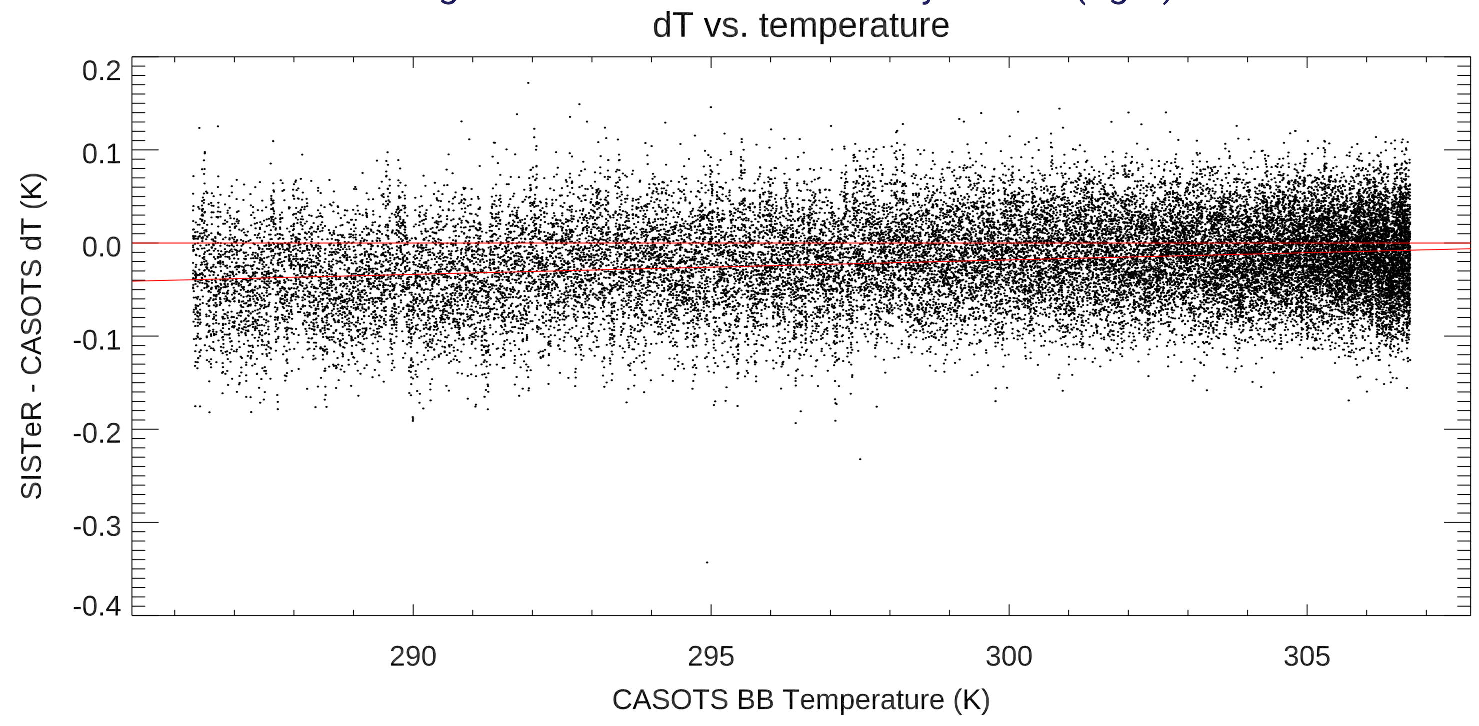

Figure 4: SISTeR Calibration, 15:40 UTC, 2024-05-07

5 Heitronics KT15.85 IIP

KT15.85 IIP Specifications [1]:
Temperature range: -25 to 200°C
Spectral response: 9.6 to 11.5µm
NETD: ~0.25 °C
Uncertainty: ±0.5°C + 0.7 % ΔT between target and KT15
Long-term stability: <0.01 % in K per month

Figure 5: Heitronics KT15 [1]

6 KT15 proposed validation setup

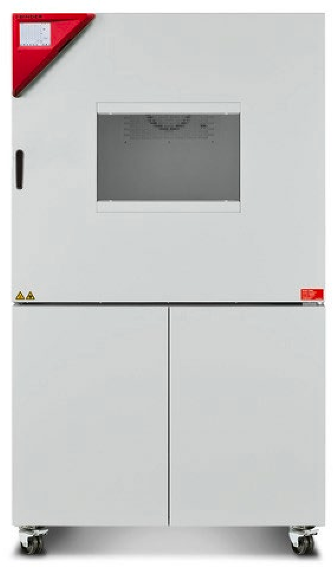

Figure 6: BINDER MKFT 240[2]

Temperature range: -70 to 180°C
Temperature uniformity: 0.2 to 1.8 ±K

Figure 7: Fluke 7008 IR[3]

Stability: ±0.0007°C
Emissivity: 0.9997 ± 0.0003
Temperature range: -5 to 110°C

References

[1] Heitronics (2024) KT15 IIP series, Heitronics. Available at: https://www.heitronics.com/en/product/radiation-thermometer/versatile-specialists/kt15-iip/ (Accessed: 26 November 2024).
[2] BINDER (2024) Model MKFT 240, BINDER. Available at: https://www.binder-world.com/uk-en/products/environmental-testing/dynamic-climate-chambers/product/mkft-240 (Accessed: 26 November 2024).
[3] Fluke (2024) Fluke 7008 IR, Fluke. Available at: https://www.fluke.com/en-us/product/calibration-tools/temperature-calibration/calibration-baths/7008-7040-7037-7012-7011?srsltid=AfmBOoqnGQURxewhscjW-ddFVAVTJjdrXvWKuLxs48YcmHEU6zC2PTJL (Accessed: 26 November 2024).