CEOS comparison of surface instrumentation to support ‘brightness temperature’ of ocean for SST (Miami III): a reminder

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Sea-surface “brightness temperature”: Overview

April/May 2009 key sponsors: ESA and NASA (+ participants)

Hosts: University of Miami & NPL (pilot/coordinator: NPL)

Objective:

- Establish degree of equivalence between participants
- Ensure robust traceability to SI (via NIST and NPL)
- Establish protocols to facilitate future comparisons

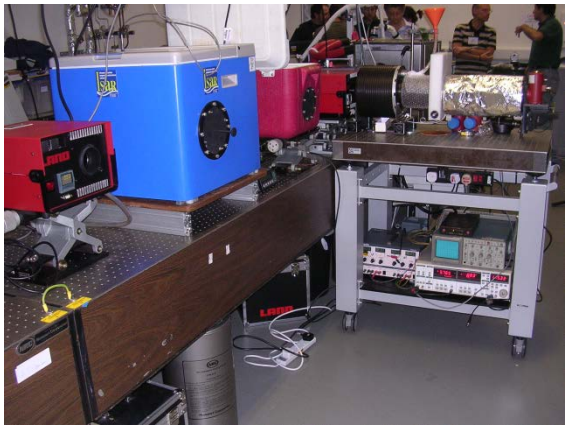
Process: Follow Guidelines of QA4EO …DQK 004

- invitation (facilitate for all)
- protocol
- blind measurements
- results and uncertainties
- analyse and publish

Sea-surface "brightness temperature" Methodology:

- **1/ Compare black bodies to a reference standard black body using SI traceable and characterised radiometer (AMBER NPL and TXR NIST)**
- **2/ Compare radiometers to a reference standard black body**
- **3/ Compare radiometers using a common view of the Ocean**

Task 1 and 2 (lab based) to be carried out in UK (NPL) and USA (Miami) linked by common radiometers.



30 radiometers (lab)

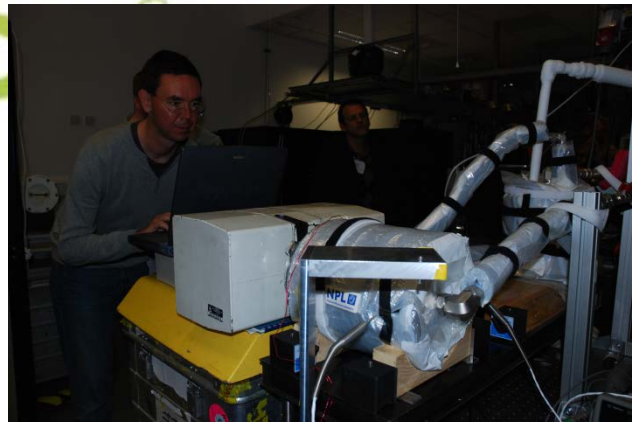
13 Radiometers (Ocean)

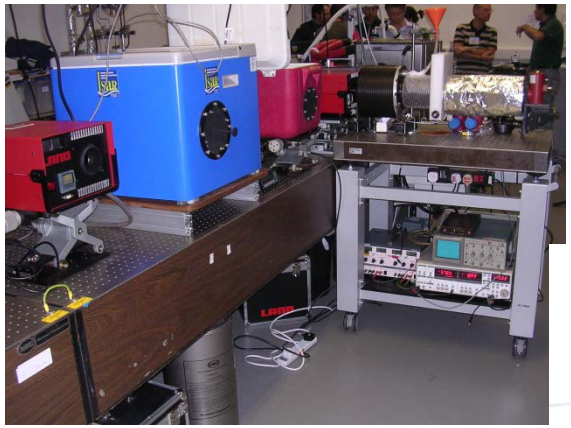
5 black bodies

10 participants plus NPL and NIST for traceability

Participants

Mediterranean Centre for Environmental Studies (CEAM)
Department of Earth Physics and Thermodynamics (DEPT)
Remote Sensing Institute, German Aerospace Centre (DLR)
Grupo de Observacion de la Tierra Y la Atmosfera (GOTA),
Imaging Processing Laboratory (IPL), University of Valencia
Institute of Meteorology and Climate Research (IMK), (KIT)
National Oceanography Centre (NOC), University of Southampton
Ocean Remote Sensing Institute, Ocean University of China (OUC)
Rosenstiel School of Marine and Atmospheric Science (RSMAS),
STFC Rutherford Appleton Laboratory (RAL)





NPL
National Physical Laboratory

QA4EO

CEOS

NPL
National Physical Laboratory

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Protocol for the CEOS WGCV Comparison of techniques/instruments used for surface IR radiance/brightness temperature measurements

Originator: Nigel Fox

Function: Lead Scientist for Earth Observation, National Physical Laboratory and chair of CEOS WGCV IVOS sub-group

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Lab based temps from 5 to 30 ºC (nominal)

Link between UK and US via radiometers

China participated at NPL in June (visa difficulties for US)

Uncertainties: to be declared before seeing results

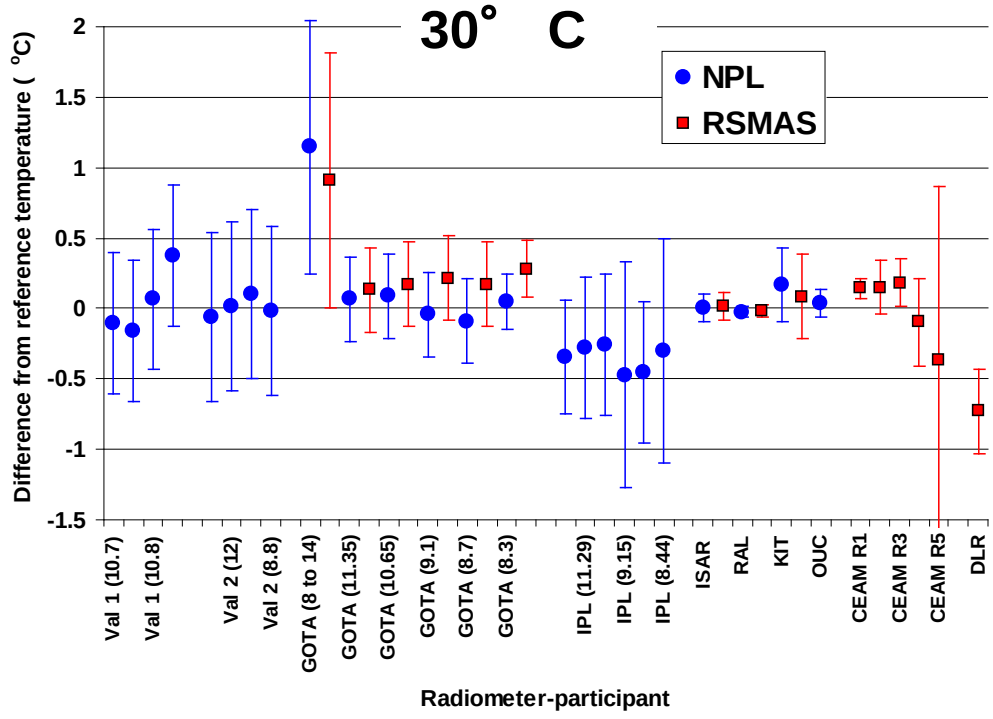
Parameter	Type A Uncertainty in Value / %	Type B Uncertainty in Value / (appropriate units)	Uncertainty in Brightness temperature K
Repeatability of measurement	0.12K / 0.040%		0.12K
Reproducibility of measurement	0.06K / 0.020%		0.06K
Linearity of radiometer		0.10K	0.10K
Primary calibration		0.20K	0.20K
Drift since calibration		-	-
RMS total	0.13K / 0.045%	0.22K	0.26K

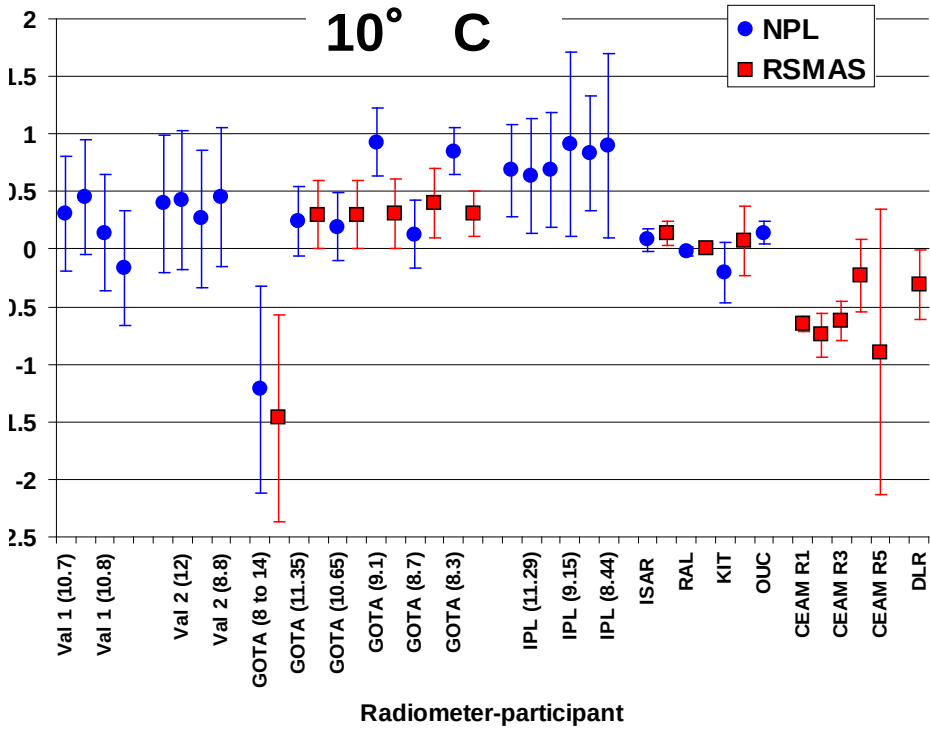
Few provided this level of detail

Results of radiometers to a “standard black body” in Lab (NPL and RSMAS

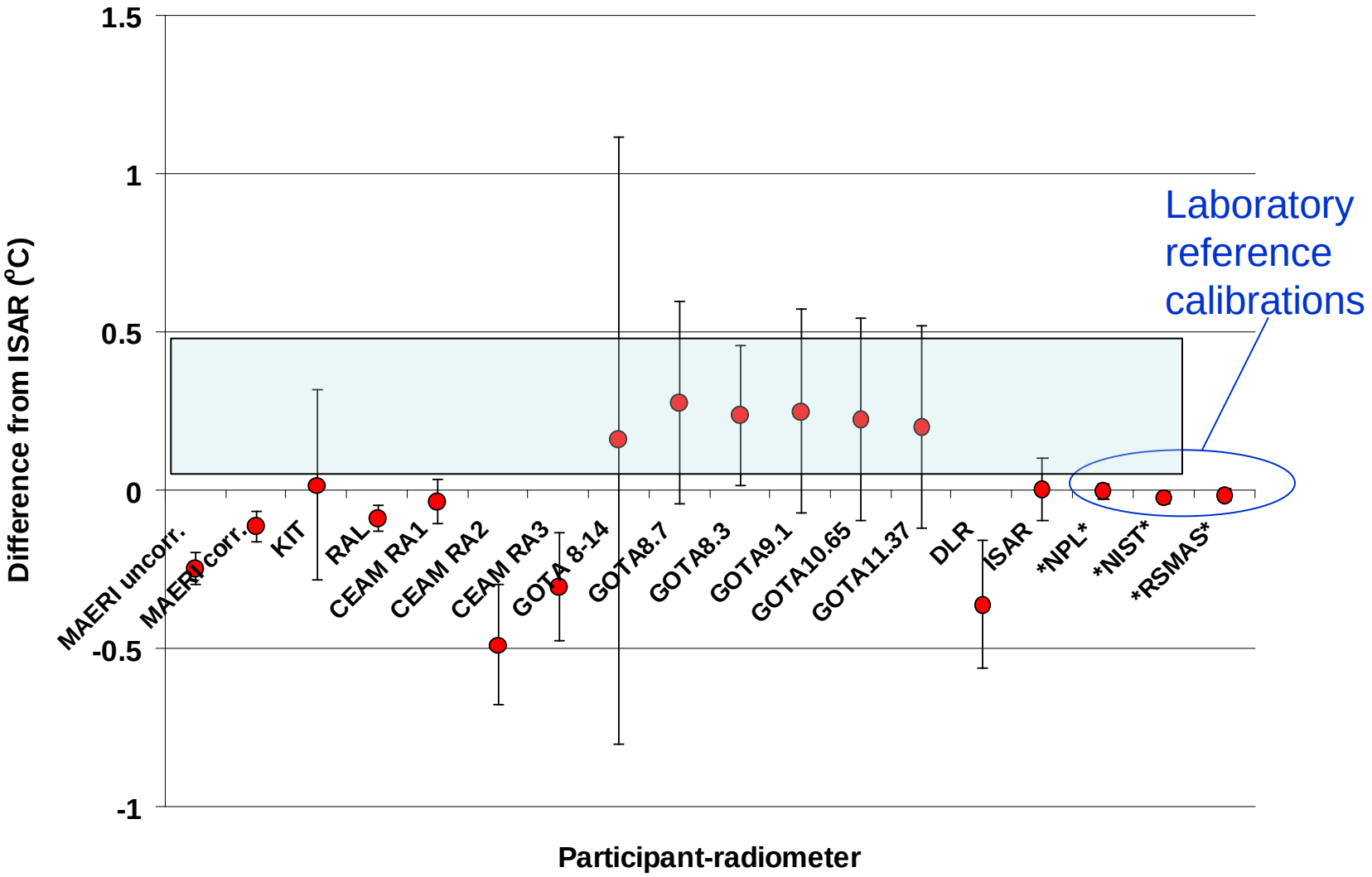
- Excellent agreement near ambient but increased variance between participants at cooler temperatures

- Results in UK and US consistent showing stability of radiometers and also agreement between NPL and NIST

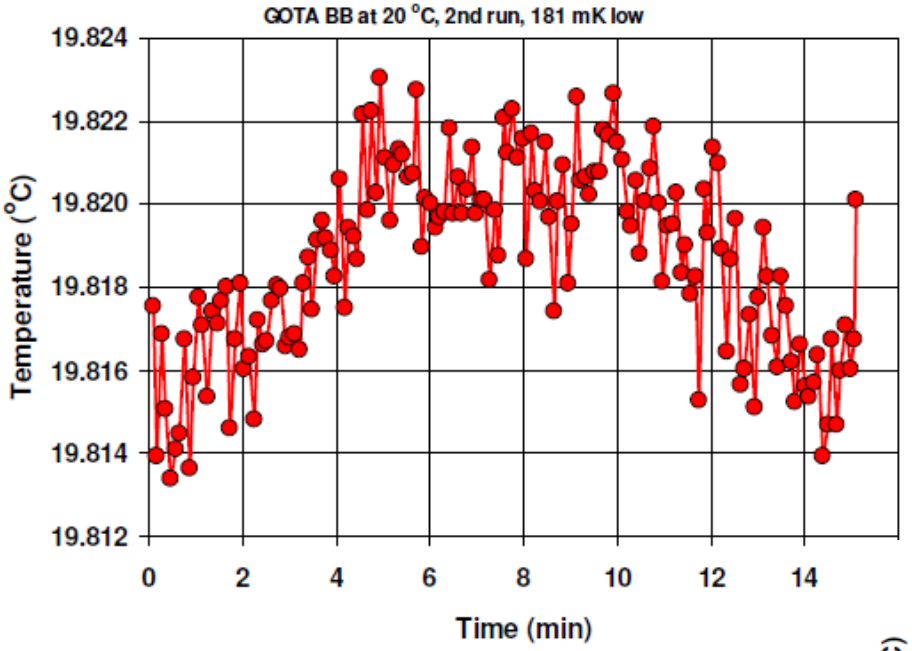




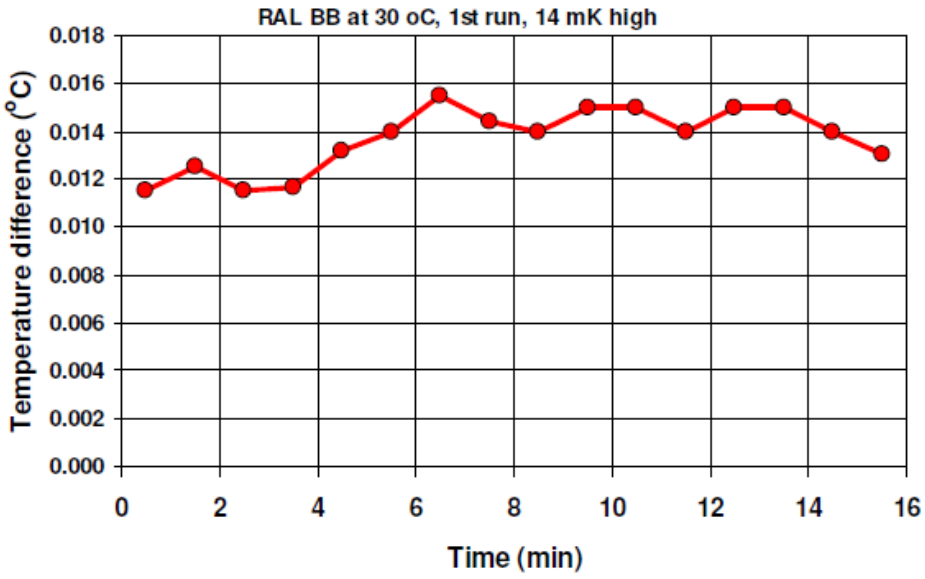
Differences to “selected common radiometer” (ISAR) for simultaneous measurements of Ocean (nominal 28 ° C)



Measurements of participant black bodies



Example results using AMBER
- noise is black body control circuits



BLACK BODY RESULTS

(SI Refs: Uncertainty ~45 mK)

Participant	Set temperature °C	Temperature "error" 21st April run mK	Temperature "error" 22nd April run mK
RAL	30	14	6
SISTeR BB	20	-8	-5
	10	-15	-14
Southampton	30	-7	3
ISAR BB	20	-16	-14
	10	-19	-18
GOTA	30	-176	-188
La Laguna Univ.	20	-152	-181
Canary Island	10	-164	-177
DEPT	30	-167	-185
Valencia University	20	-143	-166
LAND P80P	10	-74	-87

Via AMBER (NPL)

Participant	Set temperature °C	Temperature "error" 1st measurement mK	Temperature "error 2nd measurement mK
Southampton	30	-144	-223
ISAR BB	20	-37	-95

Via TXR (NIST)

RSMAS BB

Nominal temperature (°C)	Difference (mK)
10 °C	0.064
15 °C	0.040
20 °C	-0.025
25 °C	-0.100
30 °C	-0.161

Issues

- Obtaining resource for joint common activities highly challenging
- VISAs
- Getting Results and descriptions quickly
- Uncertainties and their meaning and getting detailed breakdowns
- Cancellations!
- Number of radiometers per participant
- Humidity in Miami

Positives

- Seen as important by community
- Excellent learning opportunity
- Clear knowledge of bias and traceability