



Fiducial Reference Measurements for Sea Surface Temperature (FRM4SST)

D80- CRIC Implementation plan for Laboratory and Field Comparisons of Radiometers and Blackbodies

ESA Contract No. 4000127348/19/NL/IA

Yoshiro Yamada, NPL
Nigel Fox, NPL

APRIL 2022

Reference	FRM4SST: D-80
Issue	1
Revision	1
Date of Issue	11 April 2022
Status	Final
Document Type	CRIC-IP



fiducial reference
temperature
measurements

FRM4SST: D-80-Ver-1-Final

INTENTIONALLY BLANK



Fiducial Reference Measurements for Sea Surface Temperature (FRM4SST)

D80- CRIC Implementation plan for Laboratory and Field Comparisons of
Radiometers and Blackbodies

Yoshiro Yamada & Nigel Fox



© NPL Management Limited, 2022

National Physical Laboratory
Hampton Road, Teddington, Middlesex, TW11 0LW

Extracts from this report may be reproduced provided the source is acknowledged
and the extract is not taken out of context.





DOCUMENT MANAGEMENT

Issue	Revision	Date of Issue/revision	Description of Changes
1	1	11/04/2022	Creation of document

DOCUMENT APPROVAL

Contractor Approval

Name	Role in Project	Signature & Date (dd/mm/yyyy)
Y Yamada	Metrology lead and comparison pilot	 11/04/2022
N Fox	Metrology lead and CEOS WGCV rep	 11/04/2022

CUSTOMER APPROVAL

Name	Role in Project	Signature	Date (dd/mm/yyyy)
C Donlon	ESA Technical Officer		11/04/2022



APPLICABLE DOCUMENTS

AD Ref.	Ver. /Iss.	Title
AD-1		Fiducial Reference Measurements for Sea Surface Temperature (FRM4SST): Technical Report 1 Protocol for FRM4SST CRIC Laboratory Comparison of Radiometers and Blackbodies
AD-2		Fiducial Reference Measurements for Sea Surface Temperature (FRM4SST): Technical Report 2 Protocol for FRM4SST CRIC Field Comparison of Radiometers



CONTENTS

1	SCOPE	1
2	VENUE	1
2.1	LABORATORY-BASED COMPARISONS	1
2.2	FIELD-BASED COMPARISON.....	1
3	EQUIPMENT	2
3.1	BLACKBODIES.....	2
3.2	RADIOMETERS.....	2
4	TRANSPORTATION OF THE EQUIPMENT	2
4.1	TO/FROM NPL.....	2
4.2	TO/FROM THE FIELD-BASED COMPARISON SITE	3
5	TRAVEL	3
5.1	LAB-BASED COMPARISON SITE	3
5.2	FIELD-BASED COMPARISON SITE (PROVISIONAL)	4
6	ACCOMMODATIONS	4
6.1	LAB-BASED COMPARISON SITE	4
6.2	FIELD-BASED COMPARISON SITE (PROVISIONAL)	4
	APPENDIX: FRM4SST – WP40 TIR INTER-COMPARISON FIELD WORK	5



ACRONYMS AND ABBREVIATIONS

CEOS	Committee on Earth Observation Satellites
IR	Infra-Red
NPL	National Physical Laboratory
SST	Sea Surface Temperature
WGCV	Working Group for Calibration and Validation

1 SCOPE

The objective of this document is to provide information relevant to implementation of the activities required by the participants for the 'CEOS WGCV comparison of Infrared (IR) radiometric instrumentation used to support validation of satellite borne sensors measuring sea surface temperature'. The comparison will take place from 13th to 24th June 2022 at the National Physical Laboratory (NPL) in Teddington, UK, and at a seaside pier on the south coast of England. It consists of the following:

- a. Comparison of the blackbody reference standards used for calibration (laboratory based).
- b. Comparison of the radiometer response to common blackbody target (laboratory based).
- c. Evaluation of differences in radiometer response when viewing Sea surface targets in particular the effects of external environmental conditions such as sky brightness (field based).

The first week involves the laboratory-based comparisons (a. and b.), the second week will be devoted to the field-based comparison (c.). For details of the comparisons including comparison scheme, and measurement and reporting details, please refer to the protocols of the comparisons [AD-1. AD-2].

The scope of this document covers the logistics not covered in the protocols, such as information on the venue, travel information, accommodation, and shipping instructions.

2 VENUE

2.1 LABORATORY-BASED COMPARISONS

The laboratory-based comparisons will take place at the NPL, whose location can be found in the following: <https://www.npl.co.uk/find-us/>.

A laboratory room will be made available for the duration of the comparison, whose space is large enough to accommodate both the blackbody comparison and the radiometer comparison simultaneously. Benches will be provided to place the participants' blackbodies side by side. The reference blackbodies for the radiometer comparison will sit in another space in the same lab, where the participants will be invited one by one to set up their radiometers and measure.

Participants can have lunch at the NPL main restaurant during the first week of the comparison. A selection of hot dishes, as well as salads and sandwiches are available throughout the day, at the participants cost. Free tea and coffee will be available to all participants throughout the day. A wide choice of food and restaurants can also be found in Teddington town centre, a short walk from NPL.

The laboratory in which measurements will be performed and a meeting room which participants can occupy while not measuring will have Wi-Fi reception.

2.2 FIELD-BASED COMPARISON

The venue for the field-based comparison is the Boscombe Pier, 2494 Undercliff Dr, Boscombe, Bournemouth BH5 1BL, UK

<https://www.google.com/maps/place/Boscombe+Pier/@50.719797,-1.8454577,17z/data=!3m1!4m5!3m4!1s0x48739f6e8f7bb683:0x3c47f6cda2ad090f!8m2!3d50.719797!4d-1.843269>

See Appendix for more detail.

3 EQUIPMENT

Electrical power (nominally 230 V AC 50 Hz) will be available to all participants, with a local UK plug fitting for the comparisons at NPL and during the sea-surface temperature measurements in the field. Participants whose equipment require other voltages (such as 110 V AC) should provide their own transformers.

3.1 BLACKBODIES

The participants' blackbodies will be placed side by side on a sturdy bench of height approximately 900 mm. The transfer standard radiometer on a tripod will be placed in front of the blackbodies one by one to make measurements. It is requested that the aperture of the blackbodies be at a height of approximately 1100 mm to 1200 mm, although this is not critical. Participants are asked to prepare a means to adjust height. Additional jigs such as spacers can be provided on-site, ideally at prior request.

3.2 RADIOMETERS

For the lab-based comparison, the participants' radiometers must have stands or accompanying tools and equipment to enable them to be optimally placed to view the NPL reference blackbody cavity. The means for alignment, including height adjustment, should be prepared by the participants. The reference blackbody aperture centre height is approximately 1000 mm from the floor. Participants can discuss specific details with the pilot in advance but ideally at least one month before the comparison.

For the field-based comparison, adapters and equipment for installation of the radiometer to view the sea surface must be prepared by the participants. Information on the site at the sea-side and the details on how the radiometers can be attached to the pier is provided in the Appendix.

4 TRANSPORTATION OF THE EQUIPMENT

4.1 TO/FROM NPL

It is the responsibility of all participants to ensure that any equipment required by them is shipped with sufficient time to clear any customs requirements of the host country, in this case the UK. This includes transportation from any port of entry to the site of the comparison and any delay could result in them being excluded from the comparison. Participants should send their equipment to:

Yoshiro Yamada
Room F4-A2
National Physical Laboratory
Hampton Road
Teddington
TW11 0LW
UK

Any queries should be directed to Yoshiro on yoshiro.yamada@npl.co.uk.

It is recommended that, where possible, any fragile components should be hand carried to avoid the risk of damage.

Equipment which are sent to NPL will be stored until Monday 13th June 2022, when their owners can unpack them and assemble them for the lab-based comparisons.



Shipping arrangement must be made by the participants for their equipment to be picked up at NPL on Tuesday 28th June, after the field-based comparison is completed, to be shipped back to their originating countries. All required accompanying documents, for example the CARNET (signed) or the packing list, if necessary, must be in place.

All transportation for the equipment must be arranged and paid for by the participants. It is strongly advised that insurance be in place for the duration of the transport and the comparison. Please note that the pilot has no liability for any loss or damage of the equipment during transportation or whilst in use during the comparison, however all reasonable efforts will be made to aid participants in any security. No fee related to importation/exportation will be borne by the pilot. CARNET should be utilised for tariff-free import and export of the goods, where possible.

4.2 TO/FROM THE FIELD-BASED COMPARISON SITE

After the lab-based comparison, it is expected that the participants will re-pack their equipment ready for it to be picked up in the afternoon of Friday 17th June for transport to the field-based comparison site, or to be kept for shipment later on back to their countries of origin if not required for the field-based comparison. The participants must arrange for all their equipment to be delivered to the field site and made ready for measurement in the morning of Monday 20th June at the site.

After the field-comparison, it is expected that the participants will pack their equipment and arrange for it to be picked-up in the afternoon of Friday 24th June to be delivered to NPL on the same day or on Monday 27th June, unless other arrangement for direct shipment back home has been made.

The participants must arrange and pay for the pick-up and delivery of the equipment themselves. They can alternatively transport them on their own, for instance, if they are driving.

5 TRAVEL

5.1 LAB-BASED COMPARISON SITE

Heathrow airport is the nearest airport to NPL, being about 10 miles away. There is good public transport linking Heathrow airport and NPL. For example, the No. 285 bus starts from Heathrow Central Bus Station and passes outside the NPL main reception. The X26 bus provides a faster service from Heathrow airport but stops in Broad Street in Teddington, a five-minute walk from NPL. Taxis can be used but they are expensive (about £50). It is cheaper to book a minicab to collect you from Heathrow and bring you to NPL or to your chosen hotel. The cost of a minicab to take you from Heathrow airport to Teddington would be around £25. If required we can provide you with contact details of a local company.

Flights are also available to other UK airports but the only other airport which could be considered is Gatwick airport, being some 35 miles away from NPL. However, public transport from Gatwick airport is not as good as from Heathrow. Visitors have to travel from Gatwick airport to Teddington by train, via Clapham Junction. This takes longer, it is more complicated and it is more expensive. A minicab can be booked to bring you to Teddington but the costs is likely to be just over £50.

You can find directions to NPL for different modes of transport (own car, train etc) on the NPL website: <https://www.npl.co.uk/find-us>.



Please note that visitors to the UK from some countries require entry visas. Please check and if you are coming from such a country, you should apply for the visa well ahead of the start of the comparison. You may require supporting documents for your visa application. Please contact the UK Embassy/Visa facilitation centre in your country to find out what you require for your visa application. Alternatively, you can find more information and potentially apply for a UK visa on <https://www.gov.uk/apply-uk-visa>. If you require supporting documents or invitation to the comparison, please contact Yoshiro at NPL (see details above) stating what documents you require. Please note that the Visa processing time may vary depending on your country of application, so please allow sufficient time for the application to be processed.

As of 18th March 2022 all travel restriction related to COVID-19 for entry to the UK has been lifted. Please visit the NPL website for NPL site operation requirements related to COVID-19, such as face covering requirements: <https://www.npl.co.uk/find-us>.

5.2 FIELD-BASED COMPARISON SITE (PROVISIONAL)

From NPL the travel to Boscombe Pier where the field-based comparison site is located is approximately 3 hours by train from Teddington Station by Southwestern Railway via Waterloo Station and involves a short taxi ride from Bournemouth Train Station. By car the travel is approximately 2 hours (150 km) via the M3 motorway, which is toll free. No transportation will be provided to participants by NPL, and participants need to arrange for their own transportation means, with NPL aiding the arrangement where necessary.

6 ACCOMMODATIONS

All sustenance and hotel stay costs will be at the expense of the participants.

6.1 LAB-BASED COMPARISON SITE

Participants can stay in a number of hotels located around NPL during the duration of the comparison. A list of local hotels can be found here: <https://www.npl.co.uk/getattachment/Find-us/NPL-local-hotels-Aug-2021.pdf.aspx?lang=en-GB>.

6.2 FIELD-BASED COMPARISON SITE

Boscombe Pier is located in Bournemouth, a coastal resort town on the south coast of Dorset, England. Numerous hotels can therefore be found in the vicinity of the pier. Please use tools and sites (such as Google Maps, Booking.com, Hotels.com, or Tripadvisor) for information.

APPENDIX: FRM4SST – WP40 TIR INTER-COMPARISON FIELD WORK

This report discusses the suitability of the chosen field site for the TIR inter-comparison in June 2022. The site used for the 2016 SST field TIR inter-comparison, Wraysbury reservoir has access issues, especially for larger instruments as all equipment has to be ferried by small boats to the central pontoon.

Therefore for 2022 a new site was found in Boscombe Pier. The Pier is approximately 200 m long and located near Bournemouth, on the UK South Coast, around 100 miles from NPL. The address is: Undercliff Drive, Bournemouth, BH5 1BN

There are no pier entrance fees and the pier is open from 9 am to 11 pm every day. Parking nearby is quite expensive with GBP 16.80 for 24h, although road parking a bit further from the pier is available and free.

The pier has a wide entrance and a level deck, so larger instruments and equipment can be wheeled to the pier head on trolleys. For the mounting of the instruments' safety harnesses will be needed and a full risk assessment will have to be written.



Figure 1: Boscombe Pier Entrance



Figure 2: Boscombe Pier at the lower tide range.



Figure 3: Boscombe Pier, looking back from the pier head.



Figure 4: Boscombe Pier, pier head.



Figure 5: Boscombe Pier, handrail and anti fall/jump wires. Spacing of the handrail uprights is 100 mm, each field has a span of 2400 mm. The horizontal bars have a diameter of 50.8 mm and the uprights are 10 mm. The upright mounting the handrail to the pier has a diameter of 103 mm.



Figure 6: Boscombe Pier, anti fall/jump fence. The wires are spaced 200 mm apart, start at 380 mm from the pier edge and the outriggers are 1200 mm long. The distance from the handrail centre to the pier edge is 310 mm.

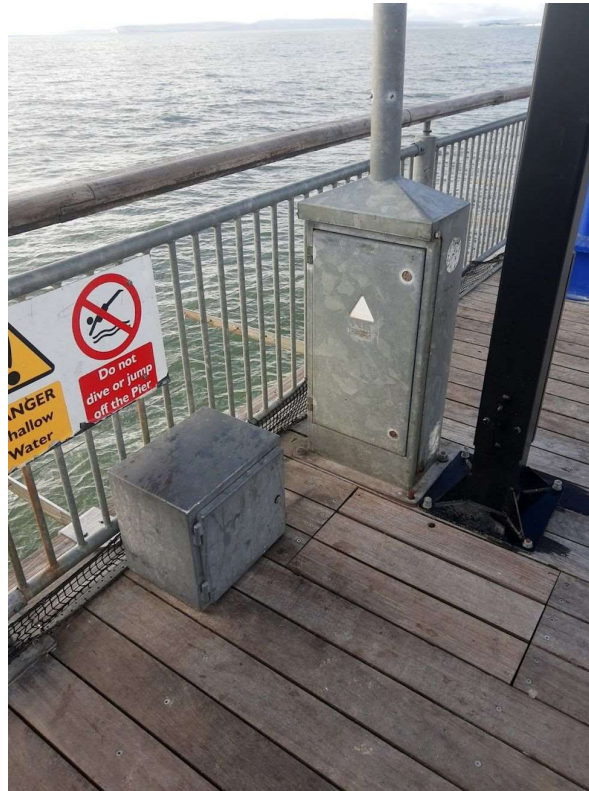


Figure 7: Boscombe Pier, potential power (240V) cabinets at the end of the pier. If we cannot get power from here we need a 200 m cable (or 4x50m extensions) to get power from the pier entrance. This will be provided by the hosts.

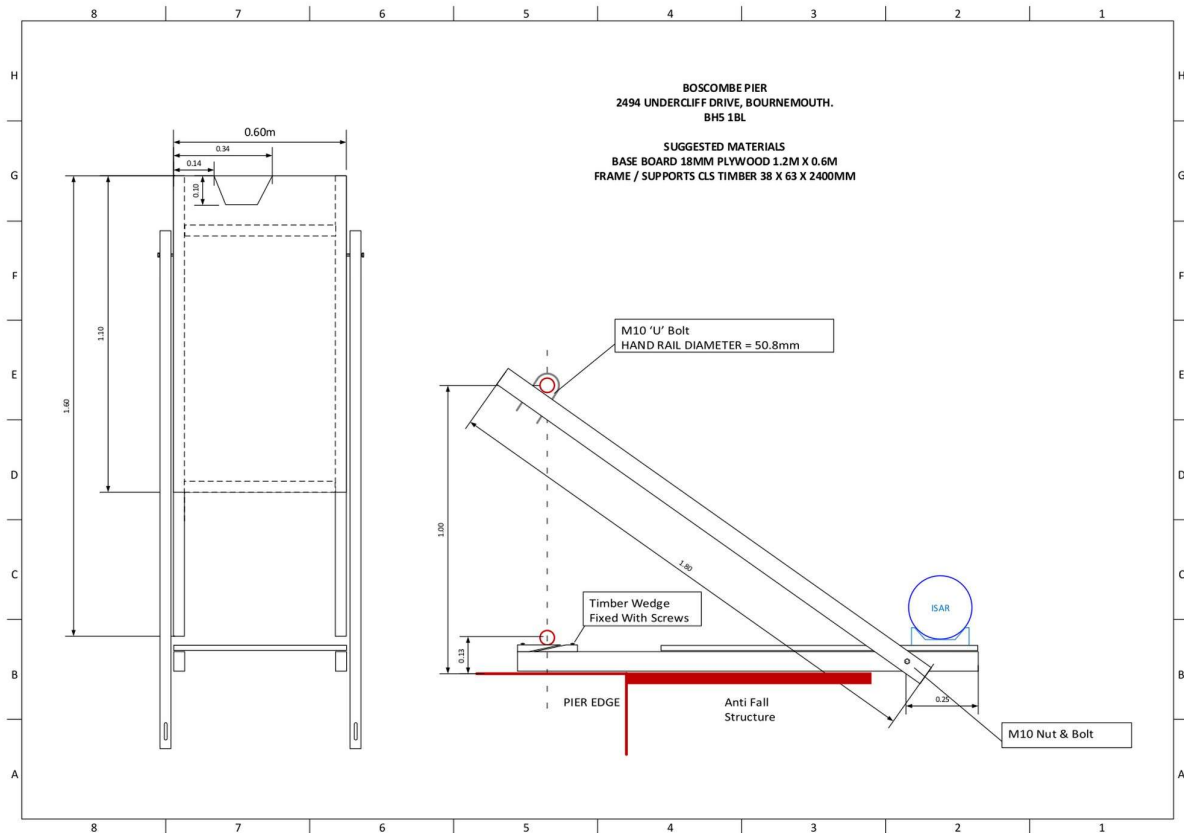


Figure 8: Boscombe Pier, proposed mounting for participants instruments with an ISAR shown in place for TIR. Mounting to the upper and lower horizontal steel bars of the handrail fence in between the uprights. The plywood sheet is attached to the Frame with screws but not drawn in image. The free plywood area can be used to mount junction boxes and data loggers, so they are away from possible interference from people using the pier. All parts necessary for the mounting must be prepared by the participants.