



fiducial reference
temperature
measurements



esa


Fiducial Reference Measurements for validation of Surface Temperature from Satellites (FRM4STS)

ESA Contract No. 4000113848_15I-LG

D-20: FRM4STS web portal

APRIL 2018

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Approval/Acceptance			
ESA Craig Donlon Technical Officer		NPL Andrew Brown Project Manager	 Andrew Brown, NPL
	<i>Signature</i>		<i>Signature</i>

The FRM4STS Website has been developed and maintained by NPL in line with the conditions and parameters as defined within the Project Statement of Work (Ref: p.17):

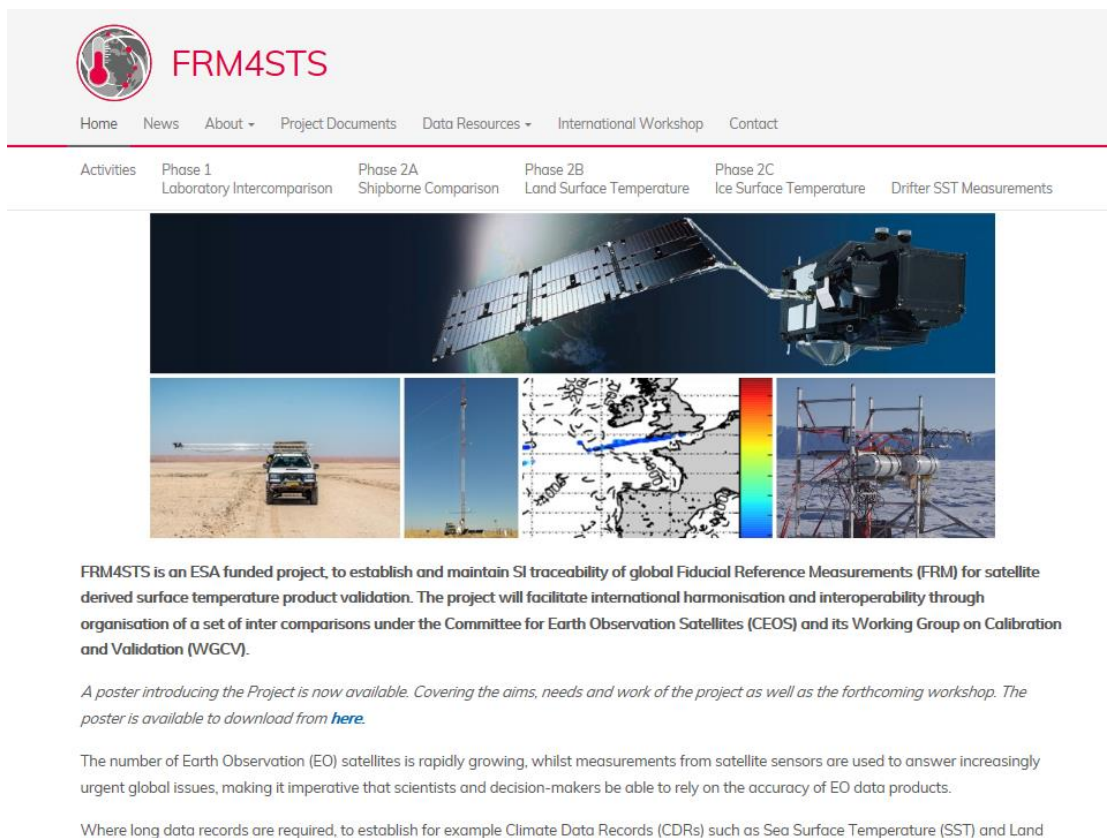
The Contractor shall:

1. Communication:

1.1. **Develop and operate** an open and public *FRM4-CEOS* project web site (referred to as WWW) that will provide a 'communications and study management' portal for the project. The WWW shall be coordinated with the CEOS Cal/Val Portal [URL-9]. Contents of the web site shall be submitted to the Agency for approval before being published. The web portal shall include the following pages and management services:

- i. Homepage with a description of the *FRM4-CEOS* project based on the SoW and Contractor proposal,
- ii. A Gantt chart for all project activities,
- iii. A public list of project deliverables,
- iv. A public calendar of all meetings and events
- v. Contact details of key project staff,
- vi. A project document library that allows on-line access to all study documents in Adobe pdf and/or Microsoft Word format that is cross referenced to the SoW and contract deliverables,
- vii. Pages where documents and presentations required and used during the project meetings can be downloaded at least 1 week before the meeting,
- viii. A means for public users to provide feedback and comments to the project team *using social media tools (e.g. Twitter, Facebook, Google+, Livestream etc)*. All user feedback shall be communicated immediately to the Agency Technical Officer for the study.
- ix. Pages where products and data sets developed during the project data can be accessed and downloaded by public users if required,
- x. Indexed access to all reference documents used by the project,
- xi. A secured password protected area where project management documents can be accessed,
- xii. A set of relevant links to the project and other useful resources.

Please visit: <http://www.frm4sts.org/>



FRM4STS is an ESA funded project, to establish and maintain SI traceability of global Fiducial Reference Measurements (FRM) for satellite derived surface temperature product validation. The project will facilitate international harmonisation and interoperability through organisation of a set of inter comparisons under the Committee for Earth Observation Satellites (CEOS) and its Working Group on Calibration and Validation (WGCV).

A poster introducing the Project is now available. Covering the aims, needs and work of the project as well as the forthcoming workshop. The poster is available to download from [here](#).

The number of Earth Observation (EO) satellites is rapidly growing, whilst measurements from satellite sensors are used to answer increasingly urgent global issues, making it imperative that scientists and decision-makers be able to rely on the accuracy of EO data products.

Where long data records are required, to establish for example Climate Data Records (CDRs) such as Sea Surface Temperature (SST) and Land

Figure 1: The FRM4STS Home Page

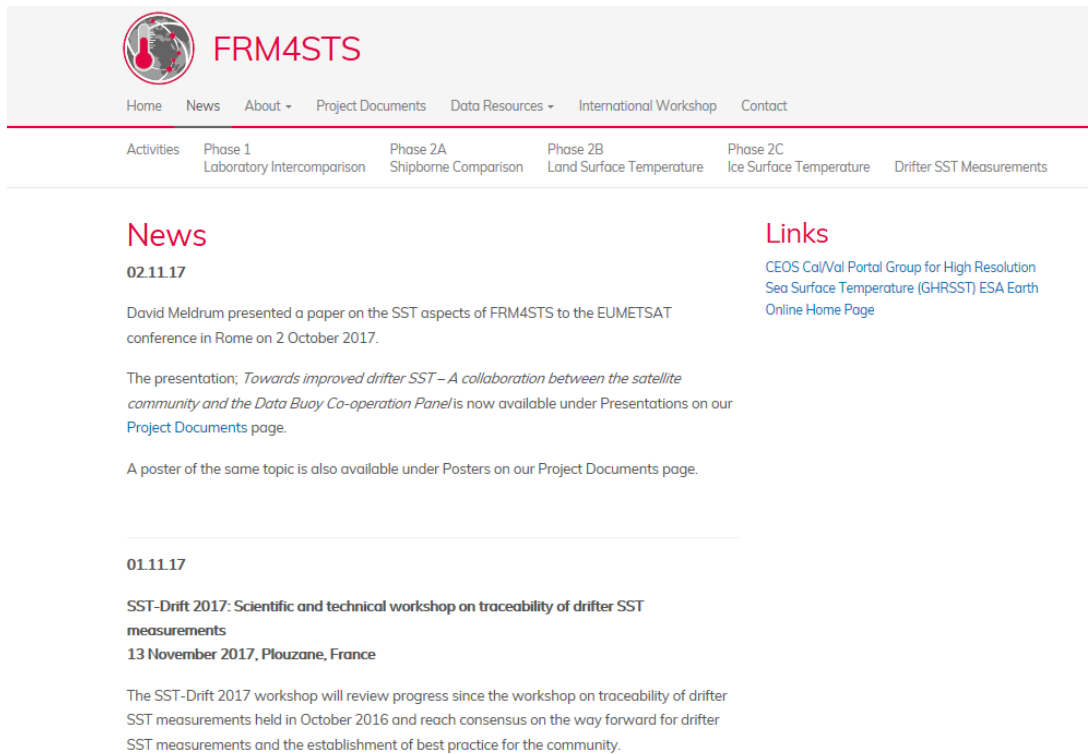


Figure 2: The FRM4STS News Page

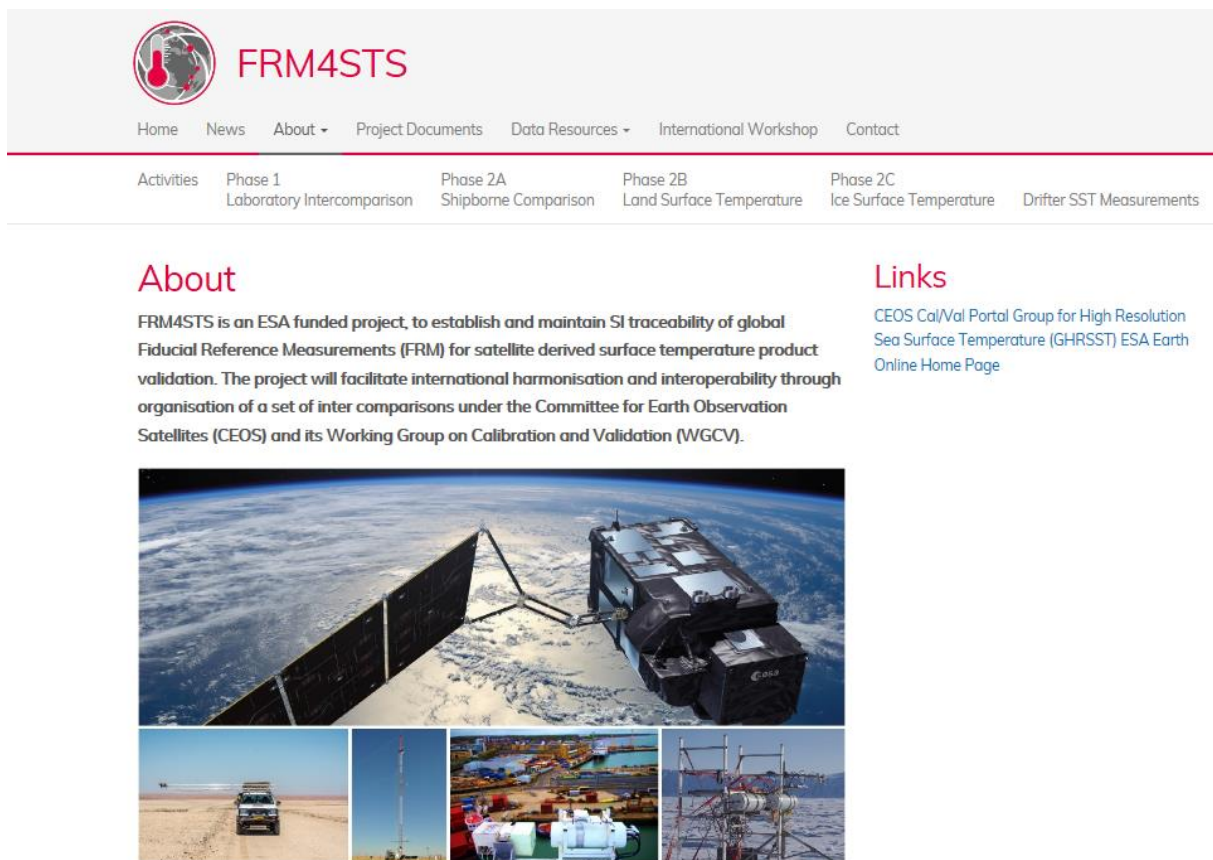


Figure 3: The FRM4STS About Page



FRM4STS

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Activities Phase 1 Laboratory Intercomparison Phase 2A Shipborne Comparison Phase 2B Land Surface Temperature Phase 2C Ice Surface Temperature Drifter SST Measurements

Project Objectives


The project aim is to establish and maintain SI traceability of global Fiducial Reference Measurements (FRM) for satellite derived surface temperature product validation. This will be achieved by:

- Designing and implementing a laboratory-based comparison of the calibration processes for FRM TIR radiometers (SST, LST, IST and others);
- Designing and implementing a laboratory-based comparison to verify TIR blackbody sources used to maintain calibration of FRM TIR radiometers;
- Designing and implementing field inter-comparisons using pairs of FRM TIR radiometers to build a database of knowledge over several years;
- Conducting field-campaigns for TIR FRM in collaboration with CEOS and the international community;
- Conducting a full data analysis, derivation and specification of uncertainties;
- Studying SI Traceability for SST, LST and IST measurements collected using instruments other than FRM TIR radiometers.

The rigorous validation of satellite derived surface temperature measurements through test-sites* enables:

- Quantification of the performance and validity of the atmospheric correction algorithm used in satellite geophysical parameter retrieval;
- Monitoring of any specific satellite instrument performance over the mission lifetime;
- Establishment of independent reference data to bridge the gap between different satellite missions;
- Development and improvement of satellite retrieval algorithms;

Figure 4: The FRM4STS Project Objectives Page



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Project Partners



DMI (Danish Meteorological Institute)

The Danish Meteorological Institute are a world-class meteorological institute. DMI provides meteorological services in the Commonwealth of the Realm of Denmark, the Faroe Islands, Greenland, and surrounding waters and airspace including forecasting and warnings and monitoring of weather, climate and related environmental conditions in the atmosphere, on land and at sea.

www.dmi.dk



David Meldrum Ltd (DML) offers design and consultancy services in support of ocean, polar and telecommunications R&D



ESA (European Space Agency)

The European Space Agency (ESA) is Europe's gateway to space. Its mission is to shape the development of Europe's space capability and ensure that investment in space continues to deliver benefits to the citizens of Europe and the world. ESA's programmes are designed to find out more about Earth, its immediate space environment, our Solar System and the Universe, as well as to develop satellite-based technologies and services, and to promote European industries.

Links

[CEOS Cal/Val Portal Group for High Resolution Sea Surface Temperature \(GHRSSST\) ESA Earth Online Home Page](#)

Links

[CEOS Cal/Val Portal Group for High Resolution Sea Surface Temperature \(GHRSSST\) ESA Earth Online Home Page](#)

Figure 5: The FRM4STS Project Partners Page

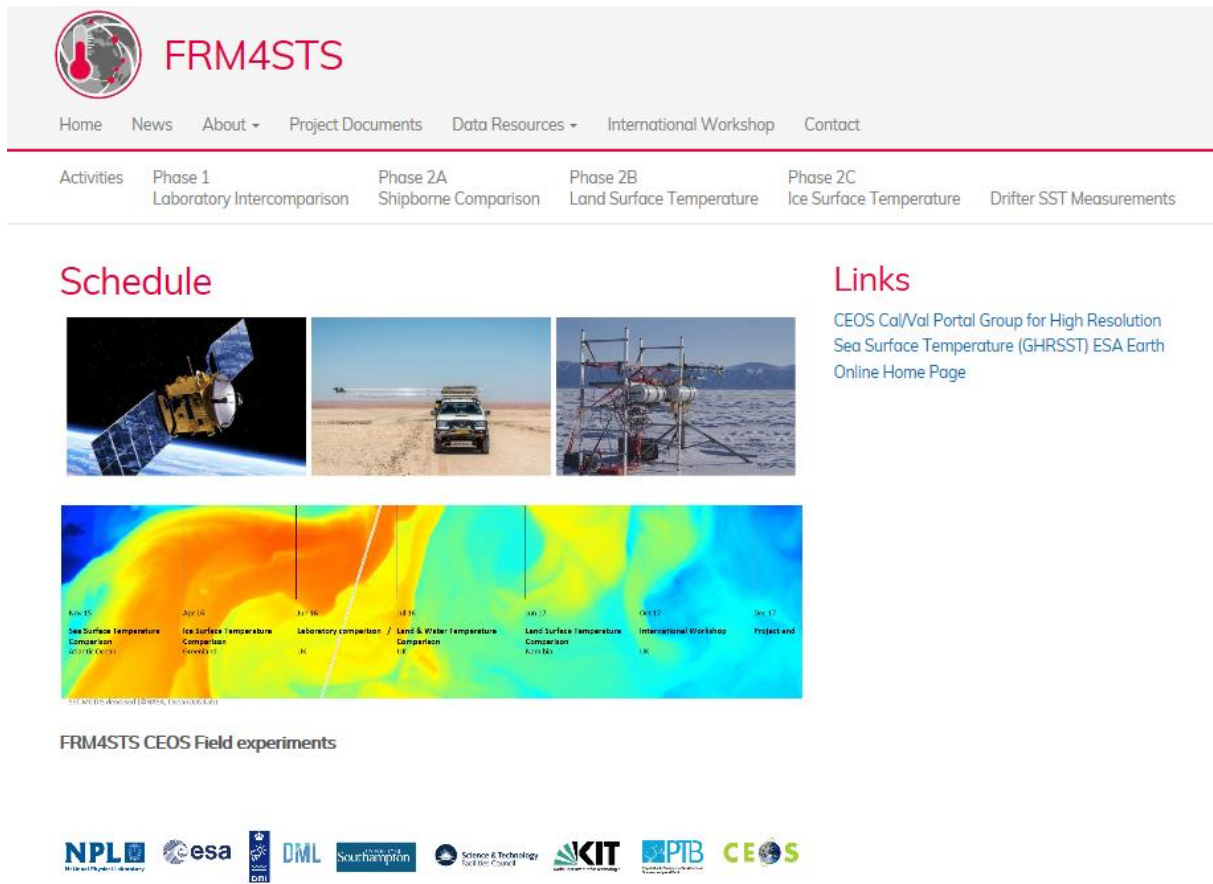


Figure 6: The FRM4STS Schedule Page

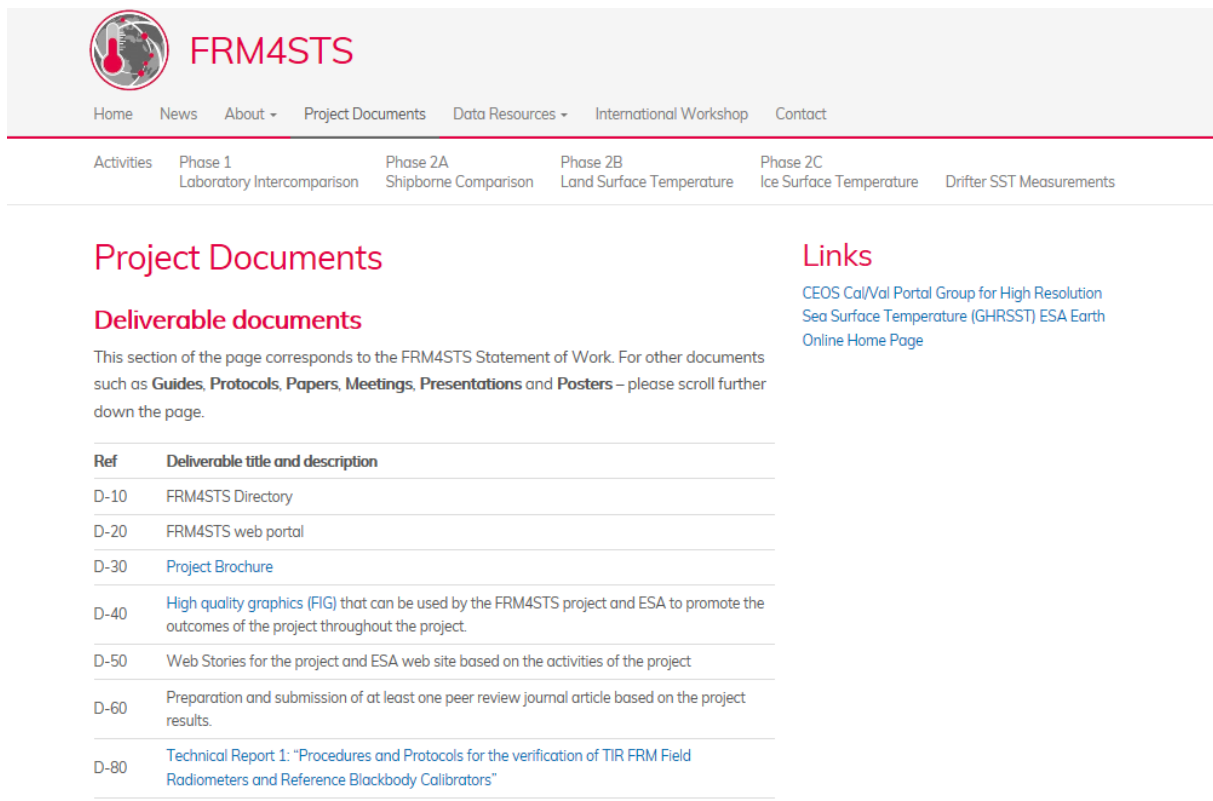


Figure 7: The FRM4STS Project Documents Page

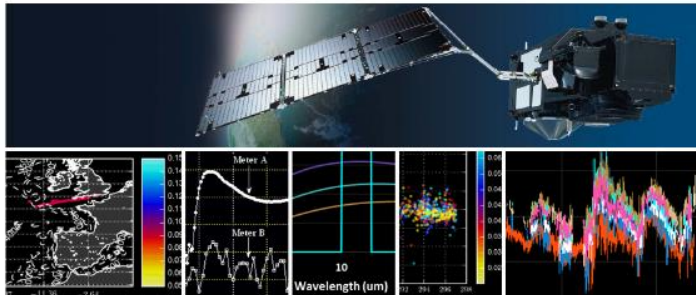


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FRM4STS – Results Database



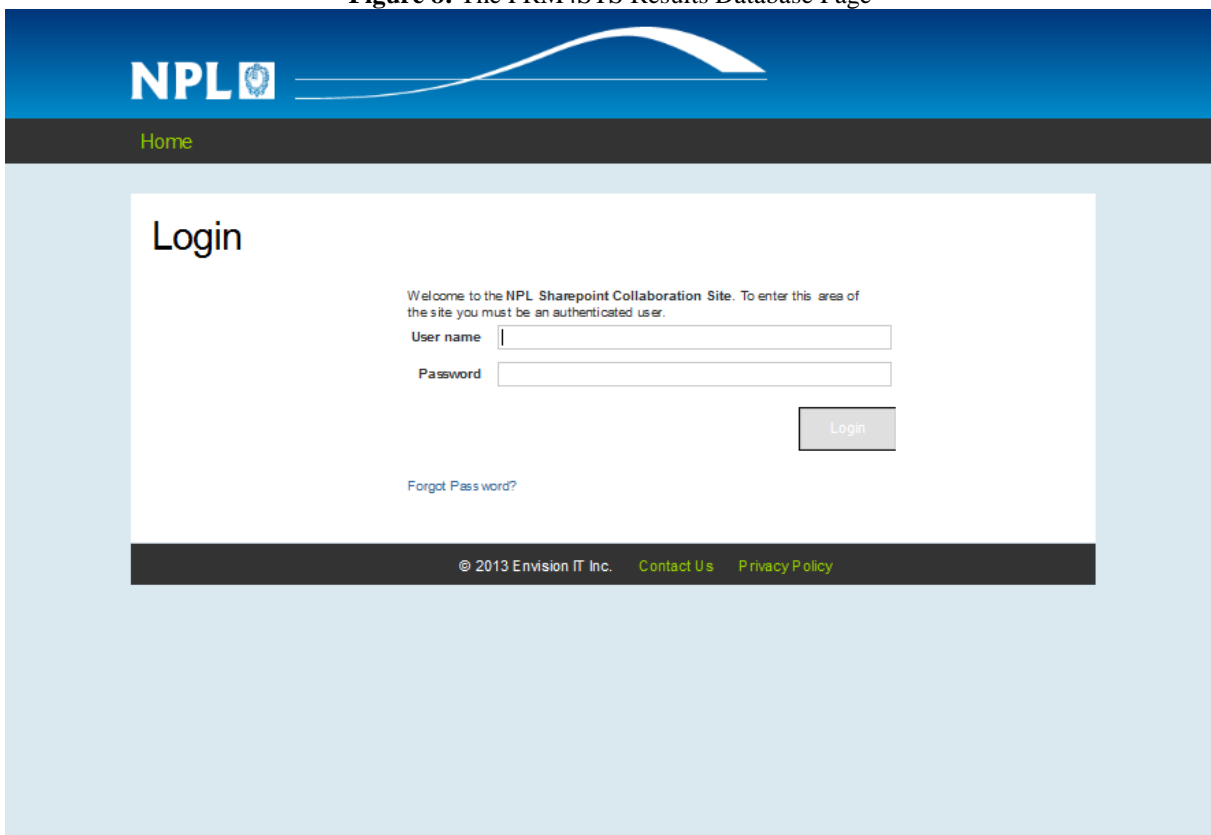
Links

[CEOS Cal/Val Portal Group for High Resolution Sea Surface Temperature \(GHRSS\) ESA Earth Online Home Page](#)

The database will be divided by the main project phases which will initially be populated from the results of the current round of comparisons as below:

- Phase 1: Laboratory Intercomparison
- Phase 2A: Shipborne Comparison – data available
- Phase 2B: Land Surface Temperature
- Phase 2C: Ice Surface Temperature – data available
- Non-Recoverable IST Observations – data available

Figure 8: The FRM4STS Results Database Page



NPL

Home

Login

Welcome to the NPL Sharepoint Collaboration Site. To enter this area of the site you must be an authenticated user.

User name

Password

Login

[Forgot Password?](#)

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Figure 9: The FRM4STS Project Partners Sharepoint Page

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International Workshop, NPL 16-18 October 2017

Links

[CEOS Cal/Val Portal Group for High Resolution Sea Surface Temperature \(GHRSS\) ESA Earth Online Home Page](#)



An international workshop was held at NPL, **16-18 October 2017**. The objective of the ESA sponsored workshop was to bring together the worlds' expertise in Earth surface (Land, Water, Ice) temperature measurements under the auspices of Committee on Earth Observation

Figure 10: The FRM4STS International Workshop Page

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Contact

Your Name (required)

Your Email (required)

Your Message

Send

Nigel Fox

Nigel Fox is the head of Earth Observation and Climate at NPL, and an NPL Fellow. Recently, Nigel has expanded his Earth Observation interests to include associated climate change parameters, with a particular emphasis on satellite observations. This has led to further innovation in both pre-flight and post-launch



Links

[CEOS Cal/Val Portal Group for High Resolution Sea Surface Temperature \(GHRSS\) ESA Earth Online Home Page](#)

Figure 11: The FRM4STS Contact Page



Activities

FRM4STS International Workshop

- 16 – 18 October 2017, FRM4STS International Workshop at NPL
- Free to attend, but registration is essential: [Register online](#)
- Contact: events@npl.co.uk

The deadline for submitting a short extract has been extended. If you would like to submit a short abstract (~300 words) for consideration by the international scientific committee, please contact: events@npl.co.uk by 15 July 2017

For further details, please visit the [International Workshop](#) page.

Links

[CEOS Cal/Val Portal Group for High Resolution Sea Surface Temperature \(GHRST\) ESA Earth Online Home Page](#)



Figure 12: The FRM4STS Activities Page



Phase 1: Laboratory Intercomparison Exercise

Phase 1: CEOS Laboratory IR Intercomparison, NPL, Hampton UK

Links

[CEOS Cal/Val Portal Group for High Resolution Sea Surface Temperature \(GHRST\) ESA Earth Online Home Page](#)



2016 FRM4STS Laboratory/WST/LST Comparison at NPL

What is the need for the comparisons?

The Earth's surface temperature is an essential parameter for climate monitoring. Currently

Figure 13: The FRM4STS Phase 1: Laboratory Intercomparison Exercise Page



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Activities Phase 1 Laboratory Intercomparison **Phase 2A Shipborne Comparison** Phase 2B Land Surface Temperature Phase 2C Ice Surface Temperature Drifter SST Measurements

Phase 2A: Shipborne Comparison

Phase 2A: Ship based Sea Surface Temperature (SST) Comparison

A successful SST inter comparison was carried out on the Cunard Queen Mary 2 between the 11th September to 5th November 2015.

The two instruments participating in the SST Field Inter-Comparison Experiment (FICE) were the Rutherford Appleton Laboratory SISTeR (Scanning Infrared Sea Surface Temperature Radiometer) and the University of Southampton ISAR (Infrared Sea Surface Temperature Autonomous Radiometer).

Images from the comparison are shown below:



Figure 14: The FRM4STS Phase 2A: Shipborne Comparison Page



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Activities Phase 1 Laboratory Intercomparison Phase 2A Shipborne Comparison **Phase 2B Land Surface Temperature** Phase 2C Ice Surface Temperature Drifter SST Measurements

Phase 2B: Land Surface Temperature, Gobabeb

Phase 2B: Land surface Temperature comparison (Gobabeb, Namibia)

Links

[CEOS Cal/Val Portal Group for High Resolution Sea Surface Temperature \(GHRSSST\) ESA Earth Online Home Page](#)



Comparison work in Namibia

Figure 15: The FRM4STS Phase 2B: Land Surface Temperature Page

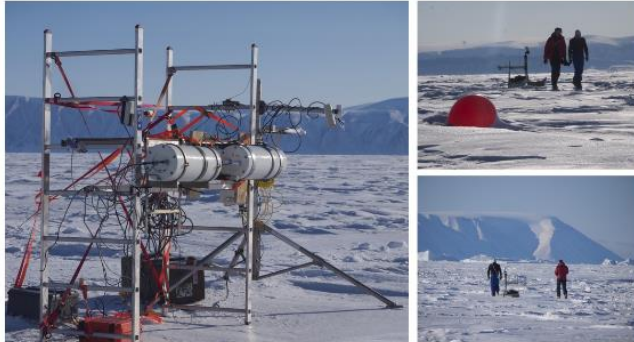

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Drifter SST Measurements

Phase 2C: Ice Surface Temperature, Greenland

Phase 2C: Ice surface Temperature measurements, Greenland, Arctic



Ice surface Temperature measurements taking place in Qaanaq, Greenland

Field Inter-Comparison Experiment (FICE) of Ice surface temperature

A successful field inter-comparison experiment over sea ice was conducted in March-April, 2016

Links

[CEOS Cal/Val Portal Group for High Resolution Sea Surface Temperature \(GHR SST\) ESA Earth Online Home Page](#)

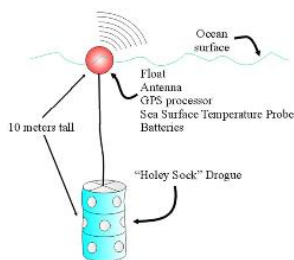
Figure 16: The FRM4STS Phase 2C: Ice Surface Temperature Page


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Drifter SST Measurements

Drifter SST Measurements



Drifter SST Study. Inset: VOS crew deploy an SVP Drifter

Background

Drifting buoy SST observations are essential to validate satellite SST retrievals because FRM Thermal Infrared radiometers are not yet available in sufficient numbers. The much larger number of drifter SST matchups (typically 1300 active globally at any time) compared to other in situ sources allows the inherent resolution and accuracy limitations of historical drifter SST to statistically overcome these limitations.

Links

[CEOS Cal/Val Portal Group for High Resolution Sea Surface Temperature \(GHR SST\) ESA Earth Online Home Page](#)

Figure 17: The FRM4STS Drifter SST Measurements Page