High-resolution Sea-Surface Temperature (HRSST) drifting buoys for satellite SST - Workshop Report

TRUSTED

Issue 1 – 02/04/2021

Open/Public

11 rue Hermès, Parc Technologique du Canal — 31520 Ramonville Saint-Agne, France
Tel +33 (0)5 61 39 47 00 Fax +33(0)5 61 75 10 14
www.cls.fr

1 Introduction

A workshop on high-resolution sea surface temperature (HRSST) drifting buoys for satellite SST took place from the 1st March 2021 to the 4th March 2021. Because of the covid-19 pandemic, the workshop had to take place remotely in digital format with presentations in the form of pre-recorded videos and discussion help via the Microsoft teams. The workshop was organized as part of the European Union's Copernicus-funded TRUSTED project (Towards Fiducial Reference Measurements of Sea-Surface Temperature by European Drifters).

The aim of the workshop was to gather an international independent assessment of HRSST drifting buoys, including those from the TRUSTED project. The meeting presented and discussed the latest developments on HRSST and the TRUSTED project, satellite SST validation activities and results with HRSST drifting buoys, plus data access / availability and quality control. The meeting brought together scientific and operational users of HRSST drifting buoys and drifting buoy data producers, and reviewed progress towards Fiducial Reference Measurement (FRM) standards.

The workshop aimed at getting feedback from the HRSST and Drifting buoys communities on the achievements of the project and agree on the next steps. It was a unique opportunity also for those communities to engage with the Metrology community and the challenges of linking ocean surface measurements from drifting buoy to the SI.

The workshop was broken down into 5 sessions. Each session consisted of a series of presentations followed by questions and answers and a general discussion. There was good attendance, with more than 30 participants at each session, together with lively and productive discussions and contributions.

2 Organisation

The workshop was organized by a steering committee supported by a technical team from the CLS communication team.

The steering committee, responsible for the science aspects of the event was composed of:

- Marc Lucas, CLS, TRUSTED project lead
- Gilbert Emzivat, Météo France, Head of the CMM
- Anne O'Carroll, Eumetsat, TRUSTED project Technical Officer

The technical support team help on the practical and digital side of the event and was composed of

- Marion Ducons, CLS, event organizer
- Mélanie Regis, CLS, Digital officer
- Anna Salsac, CLS communication officer

3 Workshop landing page

In order to enable interested parties to find all the information pertaining to the workshop, a web site was set up by the CLS communication team. This website enabled the organizers to publish the latest updates and information. It was published on the 12/11/2020.

https://www.cls-telemetry.com/workshop-high-resolution-sea-surface-temperature-hrsst-drifting-buoys-for-satellite-sst/

The landing page (see appendix A) also enabled interested parties to register and submit abstracts that could then be reviewed by the organizing committee.

The video recording of each presentation was published on the web page in order to maximize exposure and to enable participants to view the content in their own time, a useful feature for a community that is spread right around the world.

4 Social media activity

In order to give visibility to the event and ensure a maximum of registrations, a social media campaign was set up by the CLS communication team. The following table list all the actions that were implemented.

Date	Media
December	
Friday 4th	Twitter + Linkedin
Wednesday 9th	Twitter
Friday 18th	Twitter
Monday 28th	Twitter + Linkedin
January	
Friday 8th	Twitter
Tuesday 19th	Twitter + Linkedin
Monday 25th	Twitter + Linkedin
Friday 29th	Twitter + Linkedin
February	
Monday 1 feb	Twitter
Tuesday 9	Twitter
Thursday 18th	Twitter + Linkedin
Monday 22nd	Twitter
Thursday 25th	Twitter + Linkedin event
Sunday 28th	Twitter
March	
Monday 1st	Twitter
Thursday 4th	Twitter

Table 1: Social media actions

A sample of the social media content can be found in appendix B.

5 Agenda

The final agenda was published on the landing page on 25th March 2021 and also send to all registered participants.

It can be found in appendix C.

6 Registration

In all, 80 individuals registered for the workshop. Only registered attendees were sent the link to the visio meeting.

Registration details of participants are contained in Appendix D.

7 Attendance

The presentations were available on the workshop landing page so that they could viewed by interested parties at in their own time. They were also played during the workshop itself in their respective sessions and were then followed by a short Q/A and a discussion. The attendance for each session was as follows:

Session 1	Session 2	Session 3	Session 4	Session 5	Session 6
39	32	34	32	33	28

Table 2: Workshop Attendance

8 Sessions Summary

The first 5 sessions were split into 2 parts. In the first part, a series of presentation in video format were played to the participants. This was followed by a short Q/A. The second part was a discussion on topics related to the session and the presentation content.

8.1 Session 1: From HRSST to Fiducial Reference Measurements for drifting buoys

8.1.1 Presentations Overview

Good progress has been made towards FRM and further steps needed are identified within this workshop review, providing a consensual way forward.

A method, Bias Aware Optimal Estimation (BAOE) was presented to propagate the value of in situ reference sensors to the satellite sensors. A maintainable framework would facilitate the introduction of new sensors.

Climate studies require FRM data, and this implies metrology work performed by accredited entities. This leads to specific challenges in the case of non-recoverable instruments such as satellite and drifting buoys sensors.

8.1.2 Discussion

The discussion showed that there was a clear need to differentiate between what is needed for the HRSST community and what is needed in terms of fiducial measurements. FRM from drifting buoys remains challenging as it is not possible to regularly control the sensors as can be done on land. Recovering undamaged buoys as has been done in the TRUSTED project is essential but difficult to achieve on a wider scale as it is particularly costly, however, should continue to be pursued.

It must be noted that there have been substantial improvements in the quality of SST (specifically HRSST) measurements from drifting buoys over the last few years. For the drifting buoy community, the issue is more a question of funding than a technological challenge.

It seems clear that there is a need for a subset of buoys for the FRM requirement as it is not feasible to impose FRM standard to all the drifting buoys. Indeed, the GDP program was not designed to answer the HRSST need, much less the FRM need. However, improvement in technology (sensor, localization and communication via iridium) mean that the HRSST needs as set out a decade ago are now met.

An interesting question is how to use a reference (FRM) subset of buoys and whether or not it would be possible to propagate the measurement uncertainty from the subset to a wider network of drifters.

A paper highlighting the improvements and documenting the sensors used by the drifting buoy community and their performance over time would provide the wider community with the material required to settle the matter. Note that data from tropical moored drifting buoys to investigate sensor stability over time is available and is used for the assessment of Climate Data Records from satellite SST.

8.2 Session 2 - Global drifting buoy network and it's support to HRSST FRM

8.2.1 Presentations Overview

The session began with an overview of the WMO Data Buoy Cooperation Panel (DBCP) highlighting its relevance to society (marine pollution, renewable energy, climate change, marine transport). There has been a huge improvement in quality of Global Drifter Program (GDP) HRSST data in recent years, with accuracy reaching 0.05K.

Note that the GDP was not designed for satellite validation, but the GDP is more than happy to work with the Group for High Resolution Sea-Surface Temperature (GHRSST) community. It needs precise requirements. A subscription approach similar to that for Sea-Level Pressure (SLP) could be envisioned.

Substantial progress on the metadata with OceanOps and the Coriolis GDAC has been made and distributed for some buoys (netcdf files with data and meta data) but more work needs to be done so that all metadata is provided in the data stream.

8.2.2 Discussion

The discussion looked at the specific opportunities & challenges that the Ocean Of Things (OOT) drive will bring. Likely, the networks will head towards a tiering system as has been done on land by the WMO, with the DBCP standard representing the highest quality available. There is an WMO initiative (HMEI) to look at the issue of measurement quality in ocean observations.

It is important to look at the cost of a measurement rather than cost of an instrument, as the cheaper platforms are unlikely to remain operational for very long.

To a certain extent, the size of the ocean means that any extra platform providing data is welcomed but the challenge will be to ensure quality. In fact, in some cases, the measurement of change is more useful that the absolute values so even low-cost instruments may have some benefits, in high losses area such as coastal waters. This is the approach chosen by the Australian Bureau of Meteorology for measurements in an area subject to Typhoons, with the deployment of a moored drifting buoy rather than a standard expensive moored buoy.

Regarding the issue of plastic and Environmental stewardship, the DBCP is working on terms of reference. There is also a need for clear communication on the benefits of the instruments arrays which far outweighs the environmental cost.

NOAA is working on new eco-friendly drifters, with alternatives materials but there is not a lot of information on so called bio plastics and their real environmental footprints which takes into account the whole manufacturing process. It is important also to keep things in perspective and compare the environmental impact of the GDP array against that of 2000 containers lost at sea in storms that the array can help predict.

The NOAA GDP program confirmed that the GDP is very happy to coordinate and work together with the GHRSST community on HRSST progress, and this is very much welcomed and appreciated.

8.3 Session 3 – HRSST applications

8.3.1 Presentations Overview

The presentations demonstrated that HRSST drifting buoys benefit the satellite and oceanographic communities much more than only SST and for those provided by TRUSTED they also provide unique high frequency information.

The data from the buoys are also a vital part of Mean Dynamic Topography (MDT) calculations, necessary for Absolute Dynamic Topography (ADT) data.

The industry has put a lot of effort into improving SST data retrieval with new technologies for the temperature sensor on top of the improvements linked to the switch to the iridium constellation.

Finally, initial analysis of the TRUSTED data shows that the HRSST data fit to a SST temporal model is only marginally better than all HRSST data available.

8.3.2 Discussion

There is a clear need for further sampling by drifting buoys to improve the satellite derived products. Western boundary currents and the high latitudes / polar regions need better coverage as do small and enclosed seas. High spatial and temporal frequencies are not sampled by satellite, further underlining the need for drifting buoy data.

The HRSST community is still not clear on whether the 0.05K accuracy in SST measurement has been achieved. The GDP program manager estimates that 70 to 80% of drifting buoys deployed meet that requirement, with all the data available on request. It is therefore possible to get a listing of GDP buoys which meet the HRSST criteria, however more coordination would be beneficial to clarify this list of high quality HRSST drifting buoys and make this available.

It is worth noting that there is still uncertainty on the sampling depth, which varies as the buoys oscillate. This is important in rare flat ocean conditions, where the upper layer is stratified. It is possible to sample the upper ocean more precisely but at higher cost.

The satellite community needs this type of accuracy for both FRM and HRSST (as per the original GHRSST requests). Once again, the issue here is not to have the whole drifting buoy network meeting FRM stringent requirements (including sensor calibration and traceability) which would be far too costly. Only a limited subset of drifters can be dedicated to that level of requirements, however it is more possible for the wider HRSST network. An interesting question is how if at all the error estimate and Quality Control (QC) from a subset of boys can be transferred to a wider array. Note that as each thermometer is calibrated differently, it is difficult to intercompare individual points.

The representativeness of a buoy measurement is also a complicated issue as the buoys may travel with a specific body of water and thus over sample it. More work needs to be done on the horizontal and vertical dependence of measurements by drifting buoys.

8.4 Session 4 – TRUSTED project

8.4.1 Presentations Overview

TRUSTED project has led to the deployment of 150 SVP-BRST buoys to complement the GDP network with the help of partners all around the world.

Substantial improvements towards FRM have been implemented through a novel removable sensor and a more stringent calibration procedure that has included a verification post deployment of 2 buoys.

8.4.2 Discussion

The issue of traceability to SI is raised and needs clarification in terms of what is needed and what can be applied to drifting buoys networks, which are by nature unrecoverable. It would also be helpful to clarify the technology used on the TRUSTED SST and HRSST sensors and see how it compares to what is done elsewhere.

What the TRUSTED array shows are the benefit of having 2 temperature sensors on a single buoy, in particular to help with the QC.

The TRUSTED project has innovated in its approach to sensor calibration through the development of the removable HRSST sensor which has enabled all 150 sensors to be calibrated in a laboratory independent from the manufacturer. It has also enabled a thorough investigation of the temperature sensor response time.

TRUSTED has also enabled some progress in the metadata management. This is important for the analysis and the metadata needs to propagate alongside the data throughout the processing and analysis chain.

8.5 Session 5 - HRSST evaluation, validation and GHRSST HRSST / MDB Task Team

8.5.1 Presentations Overview

The performance of the TRUSTED HRSST sensor has been evaluated over the AMT-29 cruise with very good results.

A matchup database with substantial flagging and primary diagnostics for the TRUSTED/Sentinel-3 data has been created by Eumetsat and is available on request.

The latest appraisal by GHRSST of the SST data from the GDP confirms the improvements in accuracy and similarities between HRSST and TRUSTED buoy SST quality.

Validation of satellite SST with Argo data suffers from lack of high frequency data which could be alleviated by HRSST data from drifting buoys.

There is a clear gap in in situ Sea-Ice Surface Temperature (IST) sampling which needs to be addressed by the community.

Uncertainties in both Satellite and in situ SST retrievals underline the need to aggregate data and metadata and enriched the latter as much as possible.

Satellite SST validation is a complex issue with many factors contributing to errors such a geophysical terms, skin to depth temperature modelling, orbital considerations and requires (F)RM data to continue.

Issues regarding the availability of TRUSTED data on the GTS (for use in NWP models assimilation schemes) have been identified and need to be addressed.

8.5.2 Discussion

Regarding the use of in situ data, care must be taken when averaging the data as the sensor can be exposed to air and that may lead to a positive bias. Using the median might be better. This is dealt with in satellite validation by using robust statistics.

The HRSST is a concept that predates the FRM & traceability requirements and dates back to the ARC project, and coordination of the GHRSST needs through the DBCP Pilot Project. The TRUSTED project aims to improve drifter FRM for satellite SST validation. As the satellite sensor captures a snapshot and most drifters sensors average data over a sampling period (5 minutes for the SST TRUSTED sensor), direct comparisons are difficult. The question of the sensor response time and the impact of the averaging needs to be looked at. The High frequency data from the TRUSTED project can help provide some answers. Initial analysis shows little variability which is surprising.

Note that the TRUSTED buoys do not have a specific header or way of being identified on the GTS and that may be needed by operational Meteorological forecasters. At the moment, the buoys ID are needed to identify the TRUSTED buoys.

The 0.05K accuracy requirement defined by the GHRSST community is the value above which satellite retrievals are impacted by the drifter sensor accuracy (i.e. half the 0.1K due to geophysical uncertainties). It may be useful to formulate clearly what is expected over the drifter lifetime and over an ensemble of drifters.

The question of quality control and metadata in a consistent archive is important. Currently the full metadata is not accessible in the OceanOps metadata repository. Users must go through the website and this needs to be improved. Coriolis is working with OceanOps on this issue. Centralizing the information for all drifters (such as in OceanOps) is complicated due to the (Global) Data Assembly Centre (DAC/GDAC) system and the need to avoid unnecessary duplication. This is being look at by the DBCP. Currently, the full metadata is with the individual projects. Actually defining what metadata is needed would help as would consulting the DBCP document on metadata.

One aspect that needs to be considered is the need for sub hourly data and varying the transmission time which is set for most buoys at the top of the hour. There is no scientific justification for that, it comes from a meteorological requirement to have SLP at the top of the hour.

Regarding sub hourly sampling and the power budget, it may be worthwhile to work on a more optimized sampling strategy by looking at what is really needed in terms of measurements and GNDSS positioning, bearing in mind that the average movement of a drifter over an hour is 600 meters and comparing it with a SST from satellite pixel size. A sampling frequency of 5 minutes may be excessive but could provide useful information in some specific cases and specific regions. A possibility would be of sampling more frequently over the hour and just sending back the average and the standard deviation. This could help determine how much of the SST variability is being missed with hourly sampling. The SPURS project also has some high frequency data that can be examined.

8.6 Session 6

This session was broken down into 2 sections, starting with a presentation summarizing the presentations for each session and listing the outcomes and next steps recorded over the workshop. This was followed by a discussion with all the participants to ensure all the mains points had been correctly recorded.

8.6.1 Outcomes and next steps

8.6.1.1 Session 1: From HRSST to Fiducial Reference Measurements for drifting buoys.

1. There should be further development of skin/depth/time difference models.
2. Developments towards bias-aware OE techniques to harmonise the complete SST constellation should be continued.
3. Continuation of both HRSST and the smaller subset of FRM activities are important for satellite SST applications and validation.
4. A published paper on global buoy sensor thermistor stability and methodologies would be beneficial for satellite SST uncertainty work.
5. Work towards defining FRM requirements as presented at FRM4STS (including the number of buoys needed) should be continued and consolidated between the GHRSST and DBCP communities.
6. Continuation of FRM activities for satellite SST validation and definition of requirements of these FRM, including what is already met and what is still needed.

8.6.1.2 Session 2: Global drifting buoy network and its support to HRSST FRM

7. The GHRSST community to coordinate feedback and requirements to DBCP community by October 2021. These should be clarified as HRSST and FRM separately.

8. Quality Control, metadata protocols and implementation aspects should be continued and developed further for both low cost, HRSST and FRM sensors.

9. Calibration best practises including pre-deployment calibration and cross-calibration should be developed and maintained by data managers.

8.6.1.3 Session 3: HRSST applications

10. It is important to consider how the QC from FRM is used to improve non-FRM data. Need to consider surface as well as depth and ensure and use the metadata. There are different users, so the generation of raw, post-processed, QCed datasets is important.

11. Further HRSST drifters are needed close to coasts (50-200km), in Western Boundary Currents, and at high-latitudes / Arctic.

12. Clarification is still needed between HRSST and FRM definitions. The original GHRSST request referred to HRSST-2 needs, and this workshop summarises that these have mostly been fulfilled by the GDP since the last couple of years. In addition, the Sentinel-3 SST validation activities, and satellite climate SST record, have needs for Fiducial Reference Measurements, with further steps required on SI-traceability, QC and metadata. The TRUSTED project has built on the HRSST-2 requirements and made good progress on FRM together with metrology and individual sensor calibration.

8.6.1.4 Session 4: TRUSTED Project

13. Metadata is crucial and should be contained with the (netCDF) data file together with a measurement of uncertainty.

14. The continuation of a sub-set of buoys including (at least) 2 sensors enables monitoring of the HRSST sensor quality.

15. Continuation of work towards a metadata database should be continued together with GDP and DBCP colleagues.

16. Calibration certification per sensor shows progress towards FRM but further steps should be clarified for full SI traceability and should be pursued (for those sub-set of buoys designed for FRM).

17. Metrology best practices for drifting buoys FRM needed, taking into account the specificities of the platform.

8.6.1.5 Session 5: HRSST evaluation, validation and GHRSST HRSST / MDB Task Team

18. Further work on metadata accessibility is crucial (and ongoing by GDP/WMO), automatic interrogation of complete OceanOps metadata repository is necessary.

19. TRUSTED HF data (1Hz) needs to be studied to determine the benefit of fast sensor response time to HRSST and upper ocean dynamics studies and refine skin temperature depth model.

20. Sub hourly sampling is of interest if budget available (higher transmission cost). The sampling strategy needs to be defined to meet the need.

21. Set up reflection group to define GHRSST buoy ensemble performance expectations.

22. Extreme (warm and cold) areas need to be sampled.

23. High quality / FRM in situ measurements of sea-Ice surface temperature are needed for satellite sea-IST development and a suitable instrument needs to be designed and deployed.

24. Improvement of the QC procedure is needed including activities on the combination of QC from Coriolis within the existing TRUSTED MDB data stream for online QC by the GHRSST Task Team on HRSST and MDBs, and for comparison to the current offline QC methodology (from the Meteo-France Spreadsheet).

25. The majority of current new drifters are already HRSST quality which began in the last 5-6 years.

26. The continuation of FRM TRUSTED activities is needed and should address evolutions such as the implementation of a full QC procedure including QC, SI traceability, uncertainties.

9 Recommendations

The following priority recommendations are confirmed:

- For the GHRSST and DBCP communities to revisit and revise the GHRSST/DBCP HRSST specification.
- For the GHRSST and DBCP communities to formulate an agreed FRM standard for drifters (e.g. could be HRSST + SI + uncertainty per measurement + metadata)

Additional recommendations are:

- Continuation of metadata repository activities are essential and should include automatic interrogation of the complete OceanOps metadata repository. Progress towards supplying complete metadata information per measurement is important.

- ❑ High quality / FRM in situ measurements of sea-Ice surface temperature are needed for satellite sea-IST development and a suitable instrument needs to be designed and deployed.
- ❑ The continuation of FRM TRUSTED activities is recommended and should address evolutions such as further measurements at high-latitudes and others to be further assessed.

9.1 Summary and final discussion

The final outcomes and recommendations were discussed at the final session of the workshop and endorsed by review of the workshop report.

Final discussion points included whether there is a need for a specific header in the Global Telecommunications System (GTS) for HRSST buoys, as requested by an Numerical Weather Prediction (NWP) center.

It was clarified that if a measurement is given with a quoted uncertainty there should be evidence of that uncertainty, whether it is FRM or not. It remains a challenge to gather evidence of the buoy measurement uncertainties. The evidence stemming from the recovery of deployed buoys on the aging characteristics of the sensors coupled to the demonstration of the community confidence in this evidence is a reasonable scenario. However, it is important to gather enough statistics for this to be analyzed. The uncertainties may also be assessed in a post deployment state.

The technical challenge relating to maintained HRSST and working towards FRM standards is well understood. However, it is still necessary to better clearly define aspects of the FRM definition for drifting buoys, and clarify the definition of HRSST needs for satellite SST validation. This may include aspects such as how many buoys are needed, their costs, and therefore consider funding identified.

There was a discussion on whether one sensor for all HRSST / FRM buoys could be considered, similar to the examples from Argo. However, the consensus was that this would be a risk in case there are issues with a batch of sensor, then the quality would be lost on a large part of the array, and diversity should be retained. It was emphasized that sensors can be multi source and multi supplied but the accuracy must have documented evidence.

Work on the evaluation of the TRUSTED HRSST data is ongoing. But it is very clear that the GHRSST specification must be revisited and include defined needs on sampling time. It is important to make clear the split between HRSST and FRM requirements.

It has been noted than in very cold waters large differences in sensors have been observed in some cases, however, it is not known which sensor is affected. The documentation on metrology important for the whole range of data or just single point.

Regarding the metadata there was a clear consensus on the need for a centralized repository, and much progress has already been made by OceanOps. However, it is important that this is continued, and the metadata should be provided within the data itself, not as information accessible elsewhere. This is crucial for QC methods and maintaining the HRSST and FRM needs and standards.

All participants are thanked for their contributions to a very useful and productive review meeting. It will be useful to continue this detailed coordination over the coming years.

10 Actions

ID	Lead	Description	Due Date
TW-01	M. Lucas	Specification on the TRUSTED low resolution sensor to be provided to Luca	01/05/21
TW-02	M. Le Menn	Coordinate with M.Lucas & N.Fox on Drifter Metrology aspects	01/06/21
TW-03	L. Jiang	to email Gary Corlett with the information on how to access the OceanOps metadata database via FTP.	15/04/21
TW-04	M. Lucas	to send information on the identification of the low resolution SST and the HRSST in the TRUSTED GTS data stream to Martin Lange.	15/04/21
TW-05	I.Tomazic	pass information on accessing the TRUSTED High Frequency data (and the MDB) to D. Meldrum.	15/04/21
TW-06	L. Centurioni	circulate the new metadata document to Gary Corlett (already circulated by the DBCP).	15/04/21
TW-07	I.Tomazic	add (and maintain) the list of TRUSTED WMO numbers to the EUMETSAT diagnostics web-site and alert Martin Lange	15/04/21

Table 3: Action Table

Appendix A - orkshop Landing Page

WORKSHOP: HIGH-RESOLUTION SEA SURFACE TEMPERATURE (HRSST) DRIFTING BUOYS FOR SATELLITE SST

NOVEMBER 10, 2020 | CATEGORY: EVENT

Science Review Workshop on HRSST and TRUSTED

EUMETSAT, CLS and Météo France invite you to an **online event, from 1 to 4 March 2021**.

This workshop is an opportunity to discuss the many issues around the topic of high-resolution sea surface temperature (HRSST) measurements including the benefits brought about by such a network, how it compares to other similar initiatives, the impact of metrology, lessons learnt and recommendations for the future.

The aim of the review workshop is to gather an international independent assessment of HRSST drifting buoys, including those from the TRUSTED project.

The meeting shall present and discuss the latest developments on HRSST and the TRUSTED project, satellite SST validation activities and results with HRSST drifting buoys, and data access / availability and quality control.

The meeting shall bring together scientific and operational users of HRSST drifting buoys and drifting buoy data producers. The review shall assess whether the drifters are able to meet a HRSST-FRM designated standard and recommend a way forward.

About the TRUSTED Project

The European Union's Copernicus-funded TRUSTED project (Towards Fiducial Reference Measurements of Sea-Surface Temperature by European Drifters) has deployed over 100 state of the art drifting buoys for improved validation of Sea Surface Temperature (SST) from the Sentinel-3 Sea and Land Surface Temperature Radiometers (SLSTR).

Who can participate?

The meeting is open to anyone interested in HRSST drifting buoys and their use for satellite SST validation and scientific / operational SST applications. A matchup dataset of SLSTR and TRUSTED buoy SST will be made available to those interested prior to the meeting.

See the agenda

Abstracts

Abstracts are welcome on any aspect of HRSST drifting buoys, and particularly their use with satellite SST. This includes topics covering the Global Drifting Buoy network and HRSST; towards Fiducial Reference Measurements and quality control of drifting buoys; drifting buoy applications in satellite SST; and satellite SST validation with HRSST and TRUSTED sensors.

There will also be a session from the Group for High Resolution Sea-Surface Temperature (GHRSST) on the Evaluation of HRSST drifters.

Abstract submissions and registrations are now closed.

More information on the TRUSTED project can be found here.

See the presentations

Some organization elements of this workshop

Due to the Covid pandemic, it will be held in a virtual format. A limited number of places will be available at the Meteo France Facility in Saint Mandé near Paris for participants wishing to attend in person. Please contact the organisers for more information.

Contacts

Marc Lucas, CLS
mlucas@groupcls.com

Gilbert Emzivat, Meteo-France
gilbert.emzivat@shom.fr

Anne O'Carroll, EUMETSAT
anne.ocarroll@eumetsat.int

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TWITTER

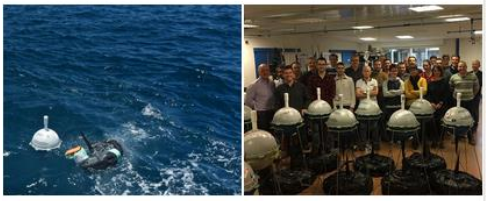
Tweets by @CLS_Group

Appendix B - Social Media samples

CLS Group (Collecte Localisation Satellites)
8,171 followers
3mo •

In collaboration with EUMETSAT, METEO FRANCE and the European program Copernicus, CLS organizes an online workshop about drifting buoys and satellite #SST.
We invite scientifics and operational users to register and submit abstracts:
https://lnkd.in/gKrgHKV

TRUSTED
A Copernicus Project

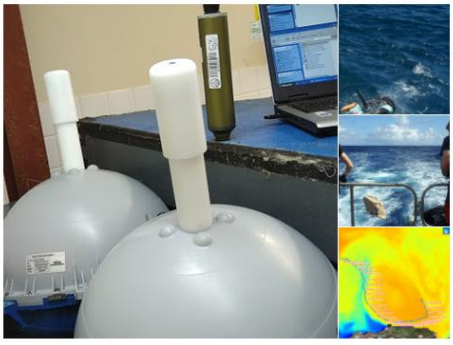


15

CLS Group
January 8, 2021 1:41 PM(UTC+01:00)

Interested in satellite sea surface temperature #SST and drifting #buoys? The TRUSTED virtual #workshop is for you!

With one month left, there is still time to submit your abstract here:
https://t.co/WbhCK4BSM3



1 0 • Retweet

CLS Group (Collecte Localisation Satellit
February 25, 2021 9:37 AM(UTC+01:00)

Today is your last change to register and join us for the virtual TRUSTED Workshop. If you're interested in High Resolution #SST and #drifting buoys, then this workshop could be for you.

Your hosts EUMETSAT, METEO FRANCE and CLS, look forward to meeting you. Sign up here
https://lnkd.in/gKrgHKV

0

ENV TRUSTED

Details

Nov 30 - Dec 6

FRIDAY
04

CLS Group
December 4, 2020 2:19 PM(UTC+01:00)

@eumetsat , @meteofrance and CLS are pleased to organize the HRSST & TRUSTED virtual Workshop.
From 1st to 4th March 2021, join us to learn about High Resolution Sea Surface Temperature and drifting buoys.

Registrations and abstract submissions are open:
https://t.co/OU1855hE9E

https://www.cls-telemetry.com/workshop-high-resolution-sea-surface-temperature-hrsst-drifting-buoys-for-satellite-sst/

4 3 • Retweet

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Details

CLS Group
December 9, 2020 9:40 AM(UTC+01:00)

.@eumetsat, @meteofrance and CLS are pleased to organize the HRSST & TRUSTED virtual Workshop.
From 1st to 4th March 2021, join us to learn about High Resolution Sea Surface Temperature and drifting buoys.

Registrations and abstract submissions are open:
https://t.co/OU1855hE9E

https://www.cls-telemetry.com/workshop-high-resolution-sea-surface-temperature-hrsst-drifting-buoys-for-satellite-sst/

CLS Group
December 18, 2020 6:05 PM(UTC+01:00)

Registrations are now open! Online workshop on high-resolution sea surface temperature #driftingbuoys for satellite #SST from 1st-4th March 2021
Register https://t.co/OU1855hE9E

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CLS Group
February 1, 2021 11:13 AM(UTC+01:00)

Only 1 month until the TRUSTED virtual workshop!
Organized by @eumetsat, CLS & @meteofrance, join us to learn more about linking satellite measurements to SI in the TRUSTED project with @CopernicusEU and High resolution #sst & #driftingbuoys.
Register now

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Appendix C - Agenda

TRUSTED WORKSHOP
Agenda Overview

DAY 1 - Monday 1st March

SESSION 1
14:00 CET – 15:15 CET
From HRSST to Fiducial Reference Measurements from drifting buoys

15:15 CET – 15:45 CET
Discussion topic 1

SESSION 2
21:00 CET – 22:15 CET
Global Drifting Buoy network and its support to HRSST FRM

22:15 CET – 23:00 CET
Discussion topic 2

DAY 2 : Tuesday 2nd March

SESSION 3
14:00 CET – 15:15 CET
HRSST applications

15:15 CET – 16:00 CET
Discussion topic 3

SESSION 4
16:00 CET – 17:00 CET
TRUSTED overview

17:00 CET – 17:30 CET
Discussion topic 4

DAY 3 : Wednesday 3rd March

SESSION 5
14:00 CET – 16:20 CET
HRSST evaluation, validation and GHRSST HRSST / MDB Task Team

16:20 CET – 17:20 CET
Discussion topic 5

DAY 4 : Thursday 4th March

SESSION 6
14:00 CET – 14:30 CET
Summary of workshop

14:30 CET – 15:45 CET
General discussion – recommendations & way-forward

TRUSTED WORKSHOP
Agenda DAY 1

SESSION 1 – Monday 1st March

From HRSST to Fiducial Reference Measurements from drifting buoys

14:00 CET : Welcome, introduction & workshop aims
Marc Lucas, CLS

14:15 CET : Sentinel-3 validation team and the need for Fiducial Reference Measurements
Anne O'Carroll, EUMETSAT

14:30 CET : Reference drifting buoys within a harmonized sea surface temperature observing system
Chris Merchant, University of Reading

14:45 CET : Towards 'fiducial reference measurements' of sea surface temperature to underpin climate action
Nigel Fox, NPL

15:00 CET : Questions & Answers

15:15 CET : Panel discussions on FRM
Anne O'Carroll, EUMETSAT & Marc Lucas, CLS

SESSION 2 – Monday 1st March

Global Drifting Buoy network and its support to HRSST FRM

21:00 CET : The Impact and Value of the Data Buoy Cooperation Panel to the user community and its contribution to the global ocean observing effort
Boris Kelly Gerreyn, Australian Bureau of Meteorology

21:15 CET : The Global Drifter Program
Luca Centurioni, Scripps

21:30 CET : OceanOPS report at EU-funded HRSST TRUSTED drifters workshop
Mathieu Belbeoch & Long Jiang, OceanOPS

21:45 CET : Trusted drifting buoys data processing, a collaborative work from Meteo-France, Ifremer and OceanOPS
Thierry Carval, Ifremer

22:00 CET : Questions & Answers

22:15 CET : Panel discussions on Global Arrays
Anne O'Carroll, EUMETSAT & Marc Lucas, CLS

TRUSTED WORKSHOP
Agenda DAY 3 & DAY 4

SESSION 5 – Wednesday 3rd March

HRSST evaluation, validation and GHRSST HRSST / MDB Task Team

14:00 CET : AMT 29 validation
Werenfrid Wimmer, University of Southampton

14:15 CET : TRUSTED-SLSTR SST multi-mission matchup database and diagnostics
Igor Tomazic, EUMETSAT

14:30 CET : Evaluation of HRSST drifters using Copernicus SLSTR
Gary Corlett, EUMETSAT

14:45 CET : Validation of satellite SST: Shallow vs Deep - Experience with Argo and considerations for HRSST
Andy Harris, University of Maryland

15:00 CET : IST validation
Gorm Dybkjaer, Danish Meteorological Institute

15:15 CET : On the usage of in situ measurements in Satellite to In Situ match-up databases
Jean-François Piollé, Ifremer

15:30 CET : Considerations of HRSST usage
Gary Corlett, EUMETSAT

15:45 CET : Validation of TRUSTED buoy network for use in SST analysis
Martin Lange, Deutscher Wetterdienst

16:00 CET : Questions & Answers

16:20 CET : Panel discussions on HRSST & GHRSST
Gary Corlett & Igor Tomazic, EUMETSAT

SESSION 6 – Thursday 4th March

Summary of workshop

14:00 CET : Summary of workshop, recommendation and way-forward
Marc Lucas, CLS

14:30 CET : Open discussions & final questions
Anne O'Carroll, EUMETSAT & Marc Lucas, CLS

15:30 CET : Conclusion
Anne O'Carroll, EUMETSAT

TRUSTED WORKSHOP
Agenda DAY 2

SESSION 3 – Tuesday 2nd March

HRSST applications

14:00 CET : Using drifting buoys to estimate ocean circulation signal
Hélène Etienne, CLS

14:15 CET : Use of surface drifters to compute Mean Dynamic Topography
Sandrine Mulet, CLS

14:30 CET : Pacific Gyre HRSST
Andy Sybrandy, Pacific Gyre

14:45 CET : On fitting SST temporal evolution models to the TRUSTED HRSST data
Shane Elipot, RSMAS

15:00 CET : Questions & Answers

15:15 CET : Panel discussions on HRSST applications
Anne O'Carroll, EUMETSAT & Marc Lucas, CLS

SESSION 4 – Tuesday 2nd March

TRUSTED overview

16:00 CET : Overview of the TRUSTED project
Marc Lucas, CLS

16:10 CET : Developing and manufacturing the SVP-BRST
Jérome Sagot, NKE

16:20 CET : Contributions of metrology to the TRUSTED project
Marc LeMenn, SHOM

16:30 CET : Buoys deployments, Quality Control and Lifetime
Christophe Guillerm, Meteo France

16:40 CET :Vibration trial with a TRUSTED drifter and long-term comparison of a drifter with the MARNET-Station Northseabuoy-3
Kai Herklotz, BSH.

16:50 CET : Questions & Answers

17:00 CET : Panel discussions on Trusted
Anne O'Carroll, EUMETSAT & Marc Lucas, CLS

Appendix D - Registration list

FIRST NAME	LAST NAME	ORGANIZATION
Prof C J	Merchant	University of Reading
David	Meldrum	Scottish Marine Institute
Chunying	Liu	NCEI
Gary	Wick	NOAA/OAR
Peter James	Minnett	RSMAS. University of Miami
Ajoy	Kumar	Millersville University
Sandra	Castro	University of Colorado
Verena	Hormann	Scripps Institution of Oceanography, UC San Diego
Lance	Braasch	Scripps Institution of Oceanography
Gabriel	Serrato	UFSC
Marc	Le Menn	Shom
FABIENNE	JACQ	European Commission
Nico	Wienders	Florida State University
Hadjati Pulchérie	MAIDAAWE BAHANE	National Departement of meteorology
Kyle	MacInnis	MetOcean Telematics
John	Orcutt	University of California, San Diego
Bruce	McKenzie	Naval Oceanographic Office
Theresa	Paluszkiewicz	Scripps Institute of Oceanography/LDL
Arash		University of Tehran
Captain Dr. Abdulmoneim	Al Janahi	Marine Emergency Mutual Aid Centre
Jordan	Lance	Woods Hole Group
Donlon	Craig	European Space Agency
Luo	Bingkun	RSMAS University of Miami
Mathieu	Belbéoch	OceanOPS
Igor	Tomazic	EUMETSAT
Hadjati Pulchérie	MAIDAAWE BAHANE	National Departement of meteorology
Pallavi	Govekar	Bureau of Meteorology
Ismail	Bessa	INRH
Paul	Hill	MetOcean Telematics
Marco	Bellacicco	ENEA
Ibrahima	Diack	
Andy	Sybrandy	Pacific Gyre
Sung Hyup	You	KMA
Brittany	Herbert	CLS Oceania
Helen	Beggs	Bureau of Meteorology
Luisa	Lamas	Instituto Hidrografico
Mohamed Ibrahim	Abdelmoneil Ibrahim	National Institute of Oceanography and Fisheries

Mohamed	Adel	Ocean Sciences and Techniques Academy
Jean-François	Piollé	IFREMER
Werenfrid	Wimmer	University of Southampton
Matthieu	Chevallier	Météo France
Haifeng	Zhang	NOAA
Rick	Lumpkin	NOAA/AOML
Aline	Duplaa	CLS
Christel	Delmas	CLS
Boris	Kelly-Gerreyn	Australian bureau of meteorology
Luca	Centurioni	GDP Scripps
Thierry	CARVAL	Ifremer
António	Jorge da Silva	Deimos Engenharia
Omada	Friday	A.B.U.
Hélène	Etienne	CLS
Felipe	Serrano Lellis	Centro de Hidrografia da Marinha (Brazilian Navy Hydrographic Center)
Kathryn	Gavira	Satlink
Maria Teresa	Losada Ros	Satlink
Jérôme	Sagot	nke instrumentation
Gorm	Dybkjaer	Danish Meteorological Institute
Srinivas	kolluru	Indian institute of technology Bombay
Daniela	Belén Risaro	University of Buenos Aires
Gary	Corlett	EUMETSAT
Eileen	Maturi	Department of Commerce
Alexander	Ignatov	NOAA STAR
Christophe	Guillerm	Meteo France
Hadjati Pulchérie	MAIDAAWE BAHANE	National Departement of meteorology of Cameroon
Nolwenn	Nano-Ascione	METEO-France
David	arnaud	nke instrumentation
Jeffrey	L Wingenroth	DATA BUOY INSTRUMENTATION LLC
Hassan	Ahmed	Kenya Meteorogical Department
Martin	Lange	Deutscher Wetterdienst
Cécile	Hernandez	Météo-France
Fabien	Lefèvre	CLS
Henery	Garção	PROOCEANO
Emma	Saux Picart	Météo France
Gwenaele	Jan	SHOM
Sébastien	Père	Météo France
Nigel	Fox	NPL
Camilla	Bernal	University of Antioquia
Jean-Maurice	PAYET	Météo France
Jacob	Høyer	Danish Meteorological Insititute
Andrew	Harris	University of Maryland

Sidney	Thurston	NOAA, GDP, RAMA,SAMOS