




fiducial reference measurements for satellite ocean colour

FRM4SOC Laboratory Calibration Exercise 2 (LCE-2):
Verification of Fiducial Reference Measurement Ocean
Colour Radiometers (FRM OCR)

D-140: Implementation plan for LCE-2 (LCE-2-IP)

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Acronyms and Abbreviations


| Acronym | Abbreviation |
|-----------------|---|
| AAOT | Aqua Alta Oceanographic Tower |
| ESA | European Space Agency |
| EO | Earth Observation |
| ESRIN | European Space Research Institute |
| ESTEC | European Space Research and Technology Centre (of ESA) |
| EUMETSAT | European Organisation for the Exploitation of Meteorological Satellites |
| FICE | Field Inter-Comparison Experiment |
| FRM4SOC | Fiducial Reference Measurements for Satellite Ocean Colour |
| LCE | Laboratory Comparison Experiment |
| LOV | Laboratoire d'Océanographie de Villefranche |
| MSI | MultiSpectral Instrument |
| NPL | National Physical Laboratory |
| OC | Ocean Color |
| OLCI | Ocean and Land Colour Instrument |
| PML | Plymouth Marine Laboratory |
| RBINS | Royal Belgian Institute for Natural Sciences |
| SI | Systeme International d'Unites |
| SoW | Statement of Work |
| TO | Tartu Observatory |
| TR | Technical Report |



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1 Scope

The core action of the FRM4SOC project is to ensure that ground-based measurements of ocean colour parameters are traceable to SI standards in support of ensuring high quality and accurate Sentinel-2 MSI and Sentinel-3 OLCI products. The FRM4SOC project contributes directly to the work of ESA and EUMETSAT to ensure Sentinel-3 OLCI and Sentinel-2 MSI instruments are validated in orbit.

LCE-2 links the OC field measurements to the SI-traceable calibration and verifies whether different instruments measuring the same object can provide consistent results within the uncertainty limits.

Involvement of all relevant expertise available in Europe and worldwide is in line with the objectives of the project and in the interest of the EO/ocean colour community. Therefore, it is anticipated that all interested parties in this wider community, but outside the Consortium, should be able to participate in the comparison exercise as external participants. TO will publish a global open invitation for LCE-2 to involve as many active users of Field Ocean Color Radiometers as possible. Information about participating instruments will be gathered and Tartu Observatory will work together with the participants in order to make sure that all the necessary hardware for mounting the instruments in the lab and during the outdoor intercomparison will be available for the time of LCE-2. The OC radiometers participating in the exercise will be gathered to TO prior LCE-2 for absolute radiometric calibration. Participants will join afterwards for comparison measurements. TO will help the participants with all aspects concerning travel, accommodation, customs, shipping of instruments, etc.

2 Introduction

The LCE-2 will serve as a preparation stage for the AAOT-FICE field intercomparison exercise. The LCE-2 can be divided into three sub-tasks:

- a) Provide SI-traceable radiometric calibration for participating radiometers
- b) Organize indoor intercomparison in controlled environment
- c) Organize outdoor intercomparison over terrestrial water surface

It is not feasible to calibrate all parameters (wavelength accuracy, stray light, field of view, temperature stability, linearity, angular response for irradiance sensors, etc.) of all the participating instruments during LCE-2. However, protocols and best practices for all these calibrations will be included in the TR-5 and all participants of LCE-2 are encouraged to have their instruments as well characterised as possible prior to LCE-2. Absolute radiometric calibration will be performed for all the participating radiometers just before the LCE-2.

The LCE-2 will take place before AAOT-FICE on 8-13 May 2017. It will serve as a training session for the participants of AAOT-FICE as well as provide SI-traceable radiometric calibration of participating radiometers. Previous inter-comparison of ocean colour radiometers has shown that the consistency of results improved when all the instruments participating in the inter-calibration were radiometrically calibrated in the same laboratory.

Tartu Observatory will serve as the main organizer for this comparison supported by NPL. TO will be responsible for inviting participants and for the analysis of data, following appropriate processing by individual participants. TO will be the only organisation to have access and to view all data from all participants. This data will remain confidential to the participant and TO at all times, until the publication of the report showing results of the comparison to participants.

3 Participants and Registration

As the maximum number of participants to be handled is 15, then the participants for LCE-2 will be selected by the following criteria in the following order:

- 1) Partnership in FRM4SOC
- 2) Participation in FICE
- 3) Participation in LCE-1
- 4) Fully characterised radiometers of the participant
- 5) For the rest, first come, first served

By their declared intention to participate in this key comparison, the participants accept the general instructions and the technical protocols written down in this document and commit themselves to follow the procedures strictly.

Registration will be opened from 01.11.2016 to 20.12.2016. Registration will be made through online form on the project's website, which will follow the structure seen in appendices 1 and 2. During the registration, the participants have to fill in the description about the radiometers they are bringing to the event. As the site for field measurements is with limited size, only one set of radiometers is allowed per participating institute. The acceptance/rejection on the participation will be sent to all applicants in the beginning of January 2017.

By their declared intention to participate in this laboratory comparison exercise, the participants accept the general instructions and the technical protocols provided by this document and technical report TR-5 (see SoW) and commit themselves to follow the procedures strictly.

Once the protocol (described in TR-5) and list of participants have been reviewed and agreed, no change to the protocol may be made without prior agreement of all participants.

4 Location/Facilities

The radiometric calibration and indoor intercomparison will take place at Tartu Observatory, located in Tõravere, Estonia. Tõravere is about 20 km from Tartu, the second largest city of Estonia. Tartu Observatory has modern, well equipped facilities for research work and an excellent visitor centre. In 2012, a new laboratory complex at the premises of Tartu Observatory has been established for development and testing of new technologies including stations for development, prototyping, and assembly of electronic circuits; facilities for climatic, thermal-vacuum, vibration, and electromagnetic compatibility (EMC) testing; workshops for mechanical construction and repair works of scientific instruments. The laboratories have independent and automatic control for temperature and humidity. Special conditions as electrostatic discharge protected environment (ESD), anechoic chamber, and cleanrooms (EN ISO 14644 Class 8) have been established. Three rooms in cleanroom environment with total area of 100 m² are available for optical measurements. Optical laboratory includes passive damping setup tables, one of them on separately built foundation for vibration-free measurements.


The outdoor intercomparison will take place at Lake Kääriku, Estonia, 58° 0' 5" N, 26° 23' 55" E. Kääriku is a small village located in southeastern Estonia, 40 km south of Tõravere (approximately 45 minutes drive by car). In 1959 a sporting centre was established in Kääriku which has been the main training centre for many Soviet and Estonian top level athletes. Lake Kääriku has a 50 m long pier and a diving platform on the southern coast. The upper level of the platform is 5.7 m above water surface. Depth of water around the diving platform is 2.6 m to 3.6 m, Secchi depth is 1.8 m. Closest trees are 65 m south of the platform, the treetops are less than 20° above the horizon when viewed from the upper level of the platform.

5 Schedule and agenda

Table 1. Comparison activity- Phases

| PHASE 1: PREPARATION | |
|--|-----------------------|
| Release of international invitation to participate | September, 2016 |
| Registration is opened | 01.11.2016-20.12.2016 |
| Participants are announced | January 2017 |
| PHASE 2: MEASUREMENTS & TRAINING | |
| Arrival of the instruments at TO | 24.04.2017 |
| LCE-2 | 08.05.2017-13.05.2017 |
| PHASE 3: ANALYSIS AND REPORTS | |
| TO sends calibration data to individual participants | 08.05.2017 |
| Participants submit measurement data to TO | 23.06.2017 |
| Draft A (results circulated to participants) | December 2017 |
| Final draft report circulated to participants | May 2018 |
| Final Report published | August 2018 |



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|  <p>fiducial reference measurements for satellite ocean colour</p> | <p>ESRIN/Contract No. 4000117454/16/1-SBo</p> <p>Fiducial Reference Measurements for Satellite Ocean Colour (FRM4SOC)</p> <p>D-140 Implementation plan for LCE-2 (LCE-2-IP)</p> | <p>Ref: FRM4SOC-LCE-2-IP</p> <p>Date: 10.02.2017</p> <p>Ver: 1.1</p> <p>Page 7 (11)</p> |
|---|---|--|

Agenda

24.04.2017 – The OC radiometers participating in the exercise have arrived TO for absolute calibration.

08.05.2017-13.05.2017 LCE-2

Sunday 7th – Arrival to Tartu

Monday 8th – Training session

9:00 Transport from Tartu to Tõravere

9:30-18:00 Lectures and training sessions – lunch in Tõravere

- Short overview of the project (TO)
- Description of comparison measurements (TO)
- Uncertainty evaluation (TO+NPL)
- Data processing and reporting of results (TO)

18:00 Joint dinner in Tõravere

After dinner – Transport to Tartu

Tuesday 9th – Laboratory measurements

9:00 Transport from Tartu to Tõravere

9:30-17:00 Group A – irradiance measurements; Group B – radiance measurements

17:00 Transport to Tartu

Wednesday 10th – Laboratory measurements

9:00 Transport from Tartu to Tõravere

9:30-17:00 Group A – radiance measurements; Group B – irradiance measurements

17:00 Transport to Kääriku

Thursday 11th – Field measurements in Kääriku

Friday 12th – Field measurements in Kääriku

In the evening, social event (sauna)

Saturday 13th – Field trip to Setomaa (South-East of Estonia), the tour will end in Tartu

Lunch is available at own expense in Tõravere (cash only payment) and Kääriku (added to accommodation invoice).

6 General information about Estonia

Official name: Republic of Estonia

Area: 45 227 km²


Location: North East Europe

Population: 1.3 million

Capital city: Tallinn

Official language: Estonian

Local time during LCE-2: Eastern European Summer Time, GMT +3 hours.

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Currency: Euro (EUR, or €).

Credit cards: Major credit cards are accepted at hotels, restaurants, shops, and the leading banks.

Telephone: IDD system is available at all hotels. GSM and LTE networks provide nearly complete coverage of Estonia.

Electricity: 230 V AC, 50 Hz, European-style 2-prong plugs (Type F and C) are in use.

Taxi: All licensed taxis charge according to the meter.

Visa: Estonia belongs to EU and Schengen Visa area regulations apply. For further information regarding the visa requirements please visit the website of the Estonian Ministry of Foreign Affairs <http://www.vm.ee/en/node/6978>

For more information please visit <http://www.visitestonia.com/en/>.

7 Travel and accommodation

7.1 Travelling to Estonia by plane

The largest international airport in Estonia is located in Tallinn, the capital of Estonia, with direct flights from many major European cities. Information on airlines, schedules and customs is available on the website of Lennart Meri Tallinn Airport (<http://www.tallinn-airport.ee/en/>).

Tartu can currently be reached by direct flights from Helsinki (for more information see the website of Tartu Airport (<http://www.tartu-airport.ee/eng>)).

One more opportunity is to fly to Riga Airport in Latvia (<http://www.riga-airport.com/>), where you can take the bus to Tartu (<http://ticket.luxexpress.eu/en/trips-timetable/riga-airport/tartu?Currency=CURRENCY.EUR>).

7.2 Travelling to Estonia by ship

Ferries link Tallinn with Stockholm and Helsinki. The main ferry operators are Tallink/Silja Line, Viking Line, and Eckerö Line.

The port of Helsinki, Finland, is 80 km from Tallinn and the journey takes about 2 hours by ferry. During the summer season (from May to September) ferries depart every few hours.

The port of Stockholm, Sweden, is 380 km from Tallinn, and there is a daily ferry (an overnight journey) in both directions. More information is available on the website of the Port of Tallinn (<http://www.portoftallinn.com/>).


7.3 Travelling from Tallinn to Tartu

Tartu can be reached by bus or train. Buses leave directly from Tallinn airport or more frequently from Tallinn bus terminal.

From Tallinn airport to Tartu: At Tallinn airport the bus stops are located on floor 0. Long-distance (incl. Tartu) buses depart and arrive at stop 2. Buses from the Lux Express Estonia AS bus company travelling from Tallinn to Tartu call at the airport every hour. Bus line no. 158 also calls at the airport at 23:05 on its way to Tartu. The tickets can be purchased in advance (<http://www.tpilet.ee/en/timetable/lennujaam/tartu>) or using the terminal at the airport exit. There is also possibility to ask for stop prior to the Tartu bus terminal (Raeplats) if your hotel is close to the Town Hall Square.

From Tallinn airport to Tallinn bus terminal and the city centre: At Tallinn airport the bus stops are located on floor 0. From bus stop 1, bus route no. 2 depart towards the city centre. Tallinn bus terminal is situated quite close to the airport and is readily accessible by taxi or bus. Bus No. 2 from the airport stops close to the bus terminal (the "Autobussijaam" stop), which can be reached by crossing the main road. A ticket on Tallinn public transport costs about 1.60 € if you buy it from the bus driver, please be prepared to have the exact money or at least 2 € coin, that you can change in R-kiosk inside the terminal.

From Tallinn sea port to the bus terminal: It takes a little more time to get to the bus terminal from Tallinn sea port. Tram No. 2 (towards Ülemiste) or bus No. 2 takes you to Tallinn bus terminal (the "Autobussijaam" stop) from the port; alternatively it can be easily reached by taxi. A ticket on Tallinn public transport costs about 1.60 € if you buy it on the bus or tram.

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From Tallinn bus terminal to Tartu: buses leave almost every 30 minutes from 06.10 until 23.00. Tickets cost approximately 12 € and can be purchased from a ticket office inside the bus station or from the bus driver. The trip to Tartu takes 2.5 hours. Buses are comfortable and some provide free WiFi. You can find most Estonian bus lines and timetables on the website <http://www.tpilet.ee/en>.

Getting to Tartu from Tallinn by train. Trains from Tallinn to Tartu operate 3-4 times a day, and take a little more than 2 hours to reach Tartu. The train station is situated just outside the Tallinn Old Town and near the sea port. It can be reached by taxi or tram No. 2 from the sea port ("Balti jaam" stop). Trains are comfortable and you can use WiFi. Tartu train station is situated just outside the city centre.

If you arrive in Tallinn late in the evening you may need to spend the night in Tallinn. The closest hotel to the airport is the Ülemiste Hotel, although there are many other hotels and hostels in Tallinn.

7.4 Accommodation in Tartu

All the participants are responsible for the booking of their accommodation. In case there are some issues or recommendations needed, then TO employees will provide assistance. The main hotels used by TO visitors in the past are:

Hotel Dorpat - <http://www.dorpat.ee/hotel>

Hotel London - <http://london.tartuhotels.ee/>

Hotel Tartu - <http://tartuhotell.ee/en/>

Hotel Pallas - <http://pallas.tartuhotels.ee/>

Villa Margaretha - <http://www.margaretha.ee/?lang=en>

Hektor Design Hostel - <http://hektorhostels.com/>

7.5 Accommodation in Tõravere

There is also a possibility to book a room near Tõravere (1.7 km) in a new pub/guesthouse Vana Jäär. English version of their website is under construction at the moment. Visual overview is available at: <http://www.vapramaepubi.ee/galerii/>

7.6 Accommodation in Kääriku

The field measurements take place at Kääriku. As this is located about 50 km from Tartu, all participants will be accommodated in Hotel Kääriku during the period of 10.05-13.05. TO will book the rooms for all the participants and provide them with necessary invoices.

8 Procedures and Protocols

8.1 Shipping

All the instruments that will participate in the LCE-2 will be transported to TO by 24th of April 2017. The package must include cables, user manuals (printed or electronic), calibration files (electronic) and if existing, also the mounting frames for fieldwork. The address information for shipping is available in section 10.


If the participants are coming outside of the EU, then they will receive additional information from TO prior to the shipment that includes paperwork information for customs.

8.2 Measurements

The technical protocols and procedures used during the field measurements are described in TR-5.

9 Travel grants

The participants of the FRM4SOC events are encouraged to cover their own travel expenses. However, there are limited support funds available for economy class travel and subsistence expenses from ESA, if self-funding is not possible and if this could be a barrier to the participation. The grant can cover the travel costs for one person. Participants needing this kind of support must submit a written application with the specification of costs to be covered to the event organizer

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(section 10.2). The Application Form for travel support is available upon request from riho.vendt@to.ee or joel.kuusk@to.ee. The applications for support will be forwarded to ESA for approval.


10 Contact Data

10.1 Shipping info

TARTU OBSERVATORY
Observatooriumi 1, Tõravere
Nõo parish, 61602 Tartu county
ESTONIA
Phone: +372 696 2510
Fax: +372 696 2555
E-mail: info@to.ee

10.2 Event organizer

Joel Kuusk
E-mail: joel.kuusk@to.ee

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11 Appendices

Appendix 1 Instrument registration form

*Participant institute name:

*Instruments that will be used in LCE-2:

Is the institute participating in FRM4SOC / FICE / LCE-1 ?

*Do instruments need to go through customs (Y/N)?:

*Contact person of the participating institute:

*E-mail:

*Phone:

*Return address of the instrument:

Courier used (if known):

*required field

Appendix 2 Participant registration form

*Name and address of the institute:

*Name of personnel participating:

*E-mail:

*Phone:

*Male/Female:

Do the personnel need visa(s) (Y/N)?:

Dietary restrictions:

*required field