fiducial reference measurements for satellite ocean colour

2016 - 2018

→ FRM4SOC

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The FRM4SOC project, funded by ESA, has been supporting of the evaluation and improvement of the state of the art in ocean colour validation through a series of comparisons under the auspices of the Committee on Earth Observation Satellites (CEOS) Working Group on Calibration & Validation (WGCV) and in support of the CEOS ocean colour virtual constellation. FRM4SOC activities have also contributed to fulfillment of the International Ocean Colour Coordinating Group (IOCCG) in situ ocean colour radiometry white paper objectives and the relevant IOCCG working groups and task forces (e.g. the working group on uncertainties in ocean colour remote sensing and the ocean colour satellite sensor calibration task force).

The aim of the FRM4SOC project has been to establish and maintain SI traceability of Fiducial Reference Measurements (FRM) for satellite Ocean Colour Radiometry (OCR) with accompanying uncertainty budgets.

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WKP-2

5.–6.10.2018 NPL, Teddington, UK

Workshop "The Fiducial Reference Measurement Network for Satellite Ocean Colour"

The major recommendations and findings of the FRM4SOC project were presented. The Scientific and Operational Roadmap for future FRM activities was formulated. See details in SOR and PROC-2.

SOR "FRM4SOC Scientific and Operational Roadmap"

PROC-2 "Special issue of MDPI journal Remote Sensing (ISSN 2072-4292) "Fiducial Reference Measurements for Satellite Ocean Colour"

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MEASUREMENT REQUIREMENTS AND PROTOCOLS

The FRM4SOC consortium reviewed common fiducial reference measurement (FRM) ocean colour radiometers (OCR) used for Satellite OCR validation and worked out requirements and protocols for operating these measurements. The reports were discussed with instrument manufactures and scientist users to arrive at final consensus. See details in TR-1 and TR-2.

TR-1 "Measurement Requirements and Protocols when Operating Fiducial Reference Measurement (FRM) Ocean Colour Radiometers (OCR) for Satellite Validation"

TR-2 "A Review of Commonly used Fiducial Reference Measurement (FRM) Ocean Colour Radiometers (OCR) used for Satellite OCR Validation"

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WKP-1

21.–23.02.2017 ESA/ESRIN, Frascati, Italy

Workshop "Options for future European satellite OCR vicarious adjustment infrastructure for the Sentinel-3 OLCI and Sentinel-2 MSI series"

Consensus on the way forward to ensure the highest Copernicus Ocean Colour products quality through System Vicarious Calibration was reached. See details in PROC-1 and TR-10.

PROC-1 "Proceedings of the international workshop on system vicarious calibration"

TR 10 "Requirements and recommendations for infrastructure required for the long-term vicarious adjustment of the Sentinel-3 OLCI and Sentinel-2 MSI A/B/C and D instruments"

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→ ACHIEVEMENTS

The FRM4SOC consortium organized a set of events to establish and maintain SI traceability of Fiducial Reference Measurements for satellite ocean colour radiometry. The results and findings of these activities were formulated in technical reports (TR), proceedings (PROC) and a roadmap (SOR) available at the webpage **https://frm4soc.org**

FICE AAOT

9.–19.07.2018 Gulf of Venice, Italy

Fiducial Inter-Comparison Experiment for Sentinel-3 at the Acqua Alta Oceanographic Tower (AAOT)

An inter-comparison was conducted at the AAOT to assess differences between eight measurement systems. The preliminary results show that for Ed(0+, lambda), Lsky(Lambda) and Lt(Lambda) there was generally good agreement with differences of <5% between institutes. Differences were greater for Rrs. See details in TR-8 and TR-9.

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LCE-1

3.–7.04.2017 NPL, Teddington, UK

SI-traceable laboratory comparison experiment for FRM OCR. Verification of reference irradiance and radiance sources.

NPL led international comparisons of (a) irradiance sources and (b) the radiance measurement capability of laboratories that calibrate ocean colour radiometers. The irradiance comparison was held at NPL using the Spectral Radiance and Irradiance Primary Scales (SRIPS) facility and the radiance comparison via am international round robin using transfer radiometers. See details in TR-3a, TR-3b and TR-4.

TR-3a,b "Protocols and Procedures to Verify the Performance of Reference Irradiance (a) and Radiance (b) Sources used by Fiducial Reference Measurement Ocean Colour Radiometers for Satellite Validation"

TR-4 "Results from the First FRM4SOC Reference Radiance and Irradiance Source Verification Laboratory Calibration Experiment Campaign"

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FICE AMT

20.09.–04.11.2017
Atlantic Meridional Transect 27

Fiducial Inter-Comparison Experiment at the Atlantic Meridional Transect (AMT)
FICE AMT was conducted on the Atlantic Meridional Transect 27 during which PML, RBINS, and UT compared above water radiometer measurements. See details in TR-8 and TR-9.

TR-8 "Protocols and Procedures for Field Inter-Comparisons of Fiducial Reference Measurement (FRM) Field Ocean Colour Radiometers (OCR) used for Satellite Validation"

TR-9 "Results from the First FRM4SOC Field Inter-Comparison Experiment (FICE) of Ocean Colour Radiometers"

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LCE-2

8.–13.05.2017 TO, Tõravere, Estonia

SI-traceable Laboratory Intercomparison Experiment to verify the performance of FRM field OCR

The LCE-2 exercise consisted SI-traceable radiometric calibration of participating radiance and irradiance spectroradiometers followed by indoor and outdoor intercomparison. The agreement between all the sensors was good in the indoor intercomparison, but the variability between the sensors increased two (radiance) to five (irradiance) times when natural targets such as sky and water were measured in outdoor conditions. See details in TR-5 and TR-6.

TR-5 "Protocols and Procedures to Verify the Performance of Fiducial Reference Measurement (FRM) Field Ocean Colour Radiometers (OCR) used for Satellite Validation"

TR-6 "Results from the First FRM4SOC Field Ocean Colour Radiometer Verification Round Robin Campaign"

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Photos from FRM4SOC project archive by courtesy of the University of Tartu (UT), Plymouth Marine Laboratory (PML), and National Physical Laboratory (NPL). Sentinel-3 scans Earth's colour. Released 06/03/2018 C ESA/ATG medialab.

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