Definition of the system vicarious calibration requirements for the EC's Copernicus programme

Ewa Kwiatkowska

Ocean Colour System Vicarious Calibration (OC–SVC)

- Integral part of Ocean Colour earth observation programmes

- Prerequisite for meeting Ocean Colour mission requirements: accuracy, consistency and stability of data records [S3-MRTD]

- Task in the joint ESA-EUMETSAT Calibration and Validation Plan [S3-CVP] (task OLCI-WLR-CV-200)

- Critical to making the best use of Copernicus Programme assets, i.e. providing quality Ocean Colour Services [CMEMS OC-TAC]

L1B TOA biases: S3A OLCI

L2 water reflectance biases: S3A OLCI
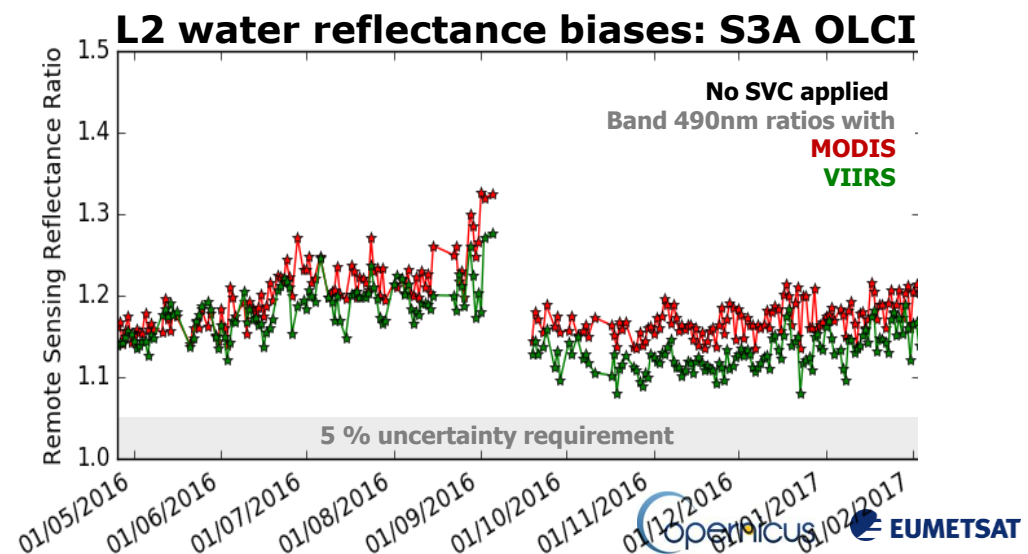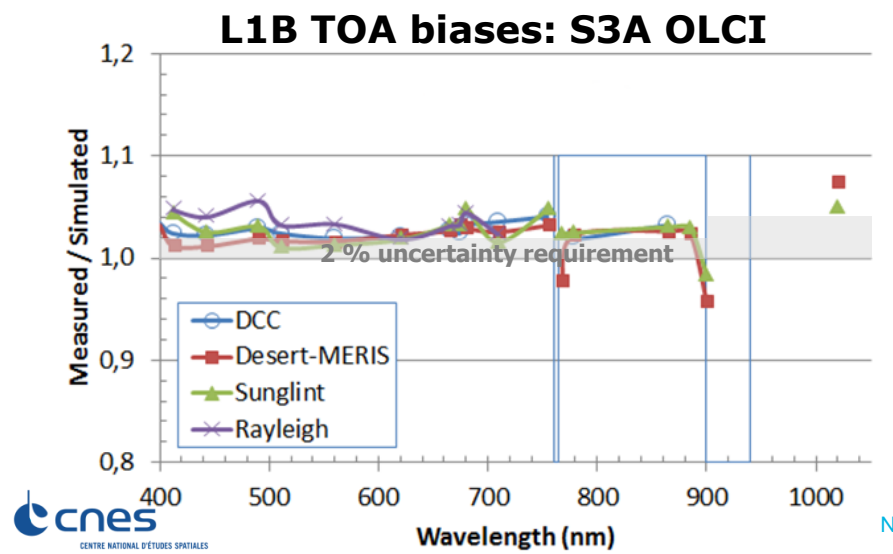
Ocean Colour System Vicarious Calibration needs

- OC–SVC Programme has to satisfy the Copernicus long-term perspective and current/evolving user needs for products & services

- OC–SVC requires minimization of all uncertainties of the "System"

- OC–SVC requires extremely accurate and well characterized FRMs

- OC–SVC FRMs are obtained from specialized infrastructure, typically an instrumented buoy

- Need for sustained and operational OC–SVC infrastructure in Europe

OC–SVC "System"

L_{path}

L_g

L_w

...carious Infrastructure, 21 – 23 February 2017, ESA ESRIN
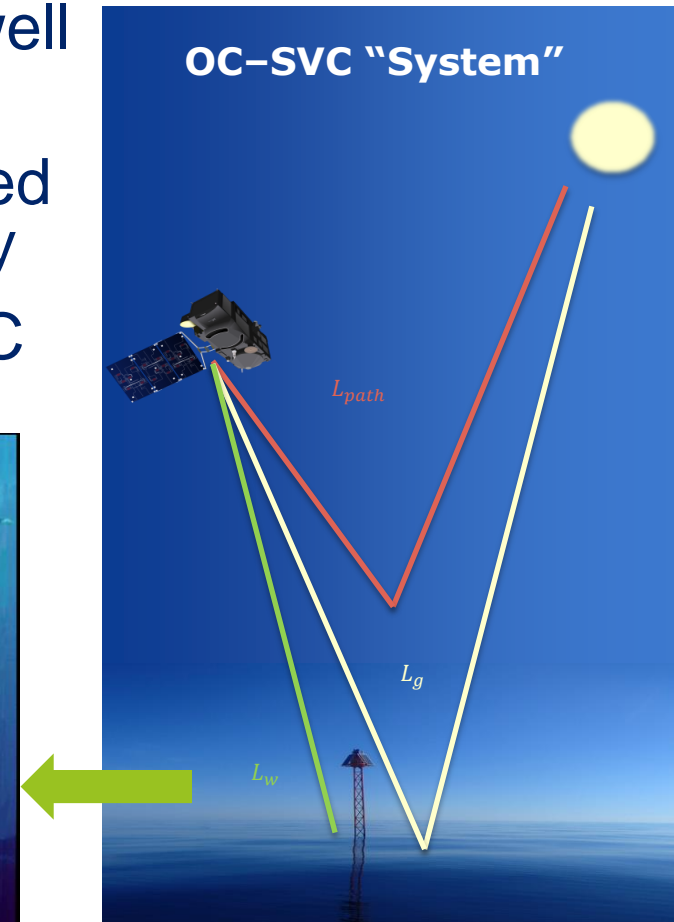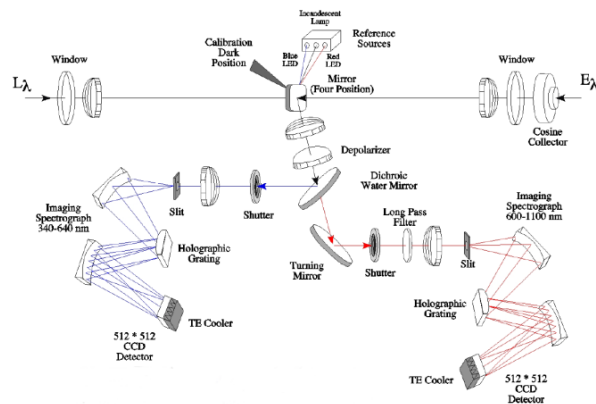
EUMETSAT planning for Copernicus OC–SVC solution

- Planning and development are required for decades of upcoming Copernicus ocean colour operations

- International cooperation is needed to achieve standardization, embedding in existing activities
    - ESA's FRM4SOC
    - BOUSSOLE experience
    - NOAA's Marine Optical Buoy (MOBY) operations and technology refresh
    - NASA's Vicarious Calibration ROSES-14 Call
    - CEOS OCR – VC recommendations
    - EC's JRC papers and reports

- Planned development phases:
    - Step 1: Scientific, Technical and Operational Requirements (pre-phase A)
    - Step 2: Preliminary Design, Project Plan and Costing (phase-A)
    - Step 3: Technical Definition, Specifications, Detailed Design (phase B)
    - Step 4: Development, Testing and Demonstration in the Field (phase C/D)
    - Step 5: Operations (phase E)

Steps 4 and 5 require a wide programmatic approach and significant investment

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Step-1: OC–SVC Requirements

- **Step 1:** Scientific, Technical and Operational Requirements

- EUMETSAT's Copernicus study

- Study deliverables:

  ❶ requirements document

  ❷ document review process

- Requirements document purpose

  - to form the basis for all aspects of the OC–SVC Programme: planning, design, technical definitions, development, testing and long-term operations

  - to justify and outline the OC–SVC Programme for the EC's Copernicus Office

Requirements document to provide

❶ Clear justification of OC–SVC for Copernicus missions

❷ Listing of OC–SVC science and high-level technical requirements

- metric that itemizes error budget categories of the OC–SVC System

❸ Listing of OC–SVC operational and service requirements

- in-depth consideration of current and long-term operations and service needs of the Copernicus space and ground segments

Error budget must be justification for the requirements

OC-VCAL ID	Uncertainty source	rel_unc(400)	rel_unc(412)	rel_unc(443)	rel_unc(490)
	Marine in situ component				
OC-VCAL-RU-xx	Spectral resolution	1.00%	1.00%		
	Spectral calibration	0.10%	0.10%		
	Stray-light	0.75%	0.75%		
	Radiometric calibration & stability	2.00%	2.00%		
	Angular response				
	Thermal stability				
	Dark current				
	Polarisation sensivity				
	Non-linearity response				
	Noise characterisation				
	Shading	0.50%	0.50%		
	Depth-extrapolation	1.00%	1.00%		
	Surface propagation	0.50%	0.50%		
	Data reduction				
	Total uncertainty on in situ Lw	2.66%	2.66%		
	Atmospheric component				
OC-VCAL-RU-xx	Transmittance	1.00%	1.00%		
	Path radiance	3.00%	3.00%		
	Total uncertainty on atmospheric component (Eq. 21, atmospheric term)	57.01%	57.01%		
	Post-processing and gains computation				
OC-VCAL-RU-xx	In situ Lw spectral integration	0.20%	0.20%		
	In situ Lw BRDF correction	1.00%	1.50%		
	Total uncertainty on post-processed in situ Lw	2.84%	3.05%		
OC-VCAL-RU-xx	Individual gains (Eq. 21)	2.85%	2.85%		
	Spatial variability				
	Averaging (Eq. 20)	0.40%	0.40%		

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Step 1 ongoing: Copernicus study OC-SVC reviews

- Two review meetings by a Review Expert Team with the draft document provided in advance

  - 1st review: FRM4SOC workshop (21-23 Feb 2017), 23-24 Feb
  - 2nd review: IOCS'17 breakout workshop

- International Expert Review Team

  - Agnieszka Bialek (cc. Nigel Fox) (NPL) – metrology
  - Bryan Franz (NASA) – vicarious calibration method
  - Carol Johnson (NIST) – metrology, MOBY calibration
  - Craig Donlon (ESA) – FRM4SOC
  - David Antoine (LOV) – in situ infrastructure BOUSSOLE
  - Giuseppe Zibordi (JRC) – in situ infrastructures
  - Hiroshi Murakami (JAXA) – space instruments
  - Menghua Wang (NOAA) – atmospheric correction
  - Vittorio Brando (CMEMS) – Copernicus marine service
  - Young Je Park (KIOST) – operational requirements

Step 1: Copernicus study conclusion

- Final OC–SVC requirement document will be jointly presented to the EC's DG GROW in July 2017 by
  - EUMETSAT
  - ESA
  - JRC
  - CMEMS
- Options for implementation will be discussed

1. Introduction

2. Traceability chain and uncertainty approach

3. Requirements on the SVC process

4. Requirements on field infrastructure

5. Requirements on the data processing

6. Requirements on the operation and service

7. Conclusion

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