VH–RODA 2022 Workshop
7 – 10 November 2022 | ESA-ESRIN | Frascati (RM), Italy

H2020 Copernicus CalVal Solution CCVS

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Scope of the CCVS project

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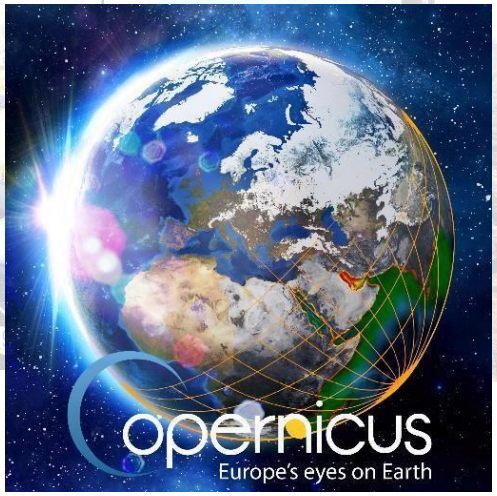
- Objective:

  To define a holistic solution for all Copernicus Sentinel missions (either operational or planned) to overcome current limitations of Calibration and Validation (Cal/Val) activities.

- Project duration: Dec. 2020 to Nov. 2022

- Project website: https://ccvs.eu

- Contact us: contact@ccvs.eu



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Partners

Project lead: ACRI

14 Partners:

ARGANS, BIRA-IASB, CLS Collecte Localisation Satellites, cnes, DLR, NPL National Physical Laboratory, JRC, NORCE, Koninklijk Nederlands Meteorologisch Instituut Ministerie van Infrastructuur en Waterstaat, rayference, University of Tartu Tartu Observatory, ThalesAlenia Space a Thales / Leonardo company, Universiteit Antwerpen

Advisory board:

esa, EUMETSAT, European Environment Agency, Copernicus Europe's eyes on Earth

ACRI ST, ARGANS

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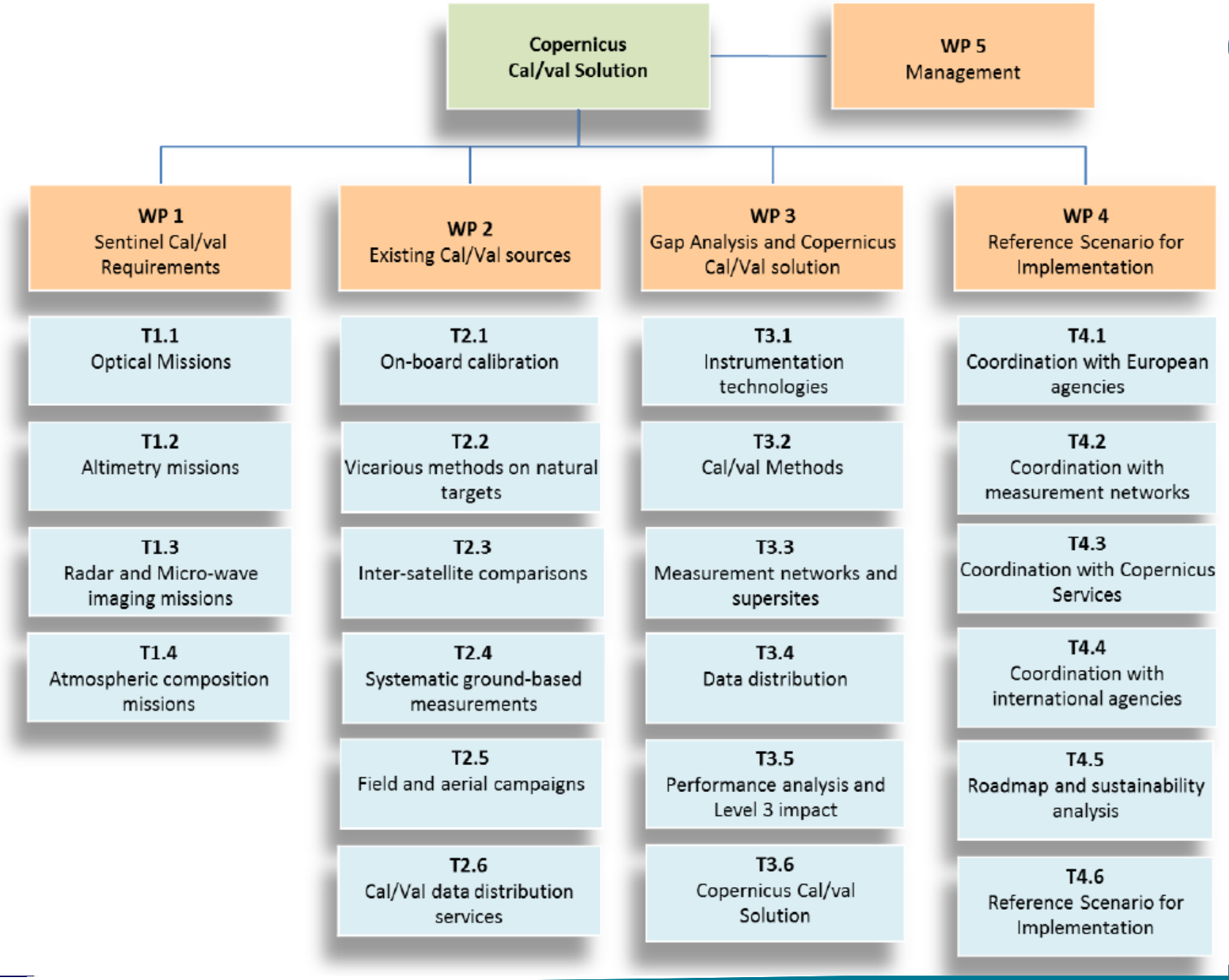
Overview



Sentinel Cal/Val Requirements

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WP 1
Sentinel Cal/val Requirements

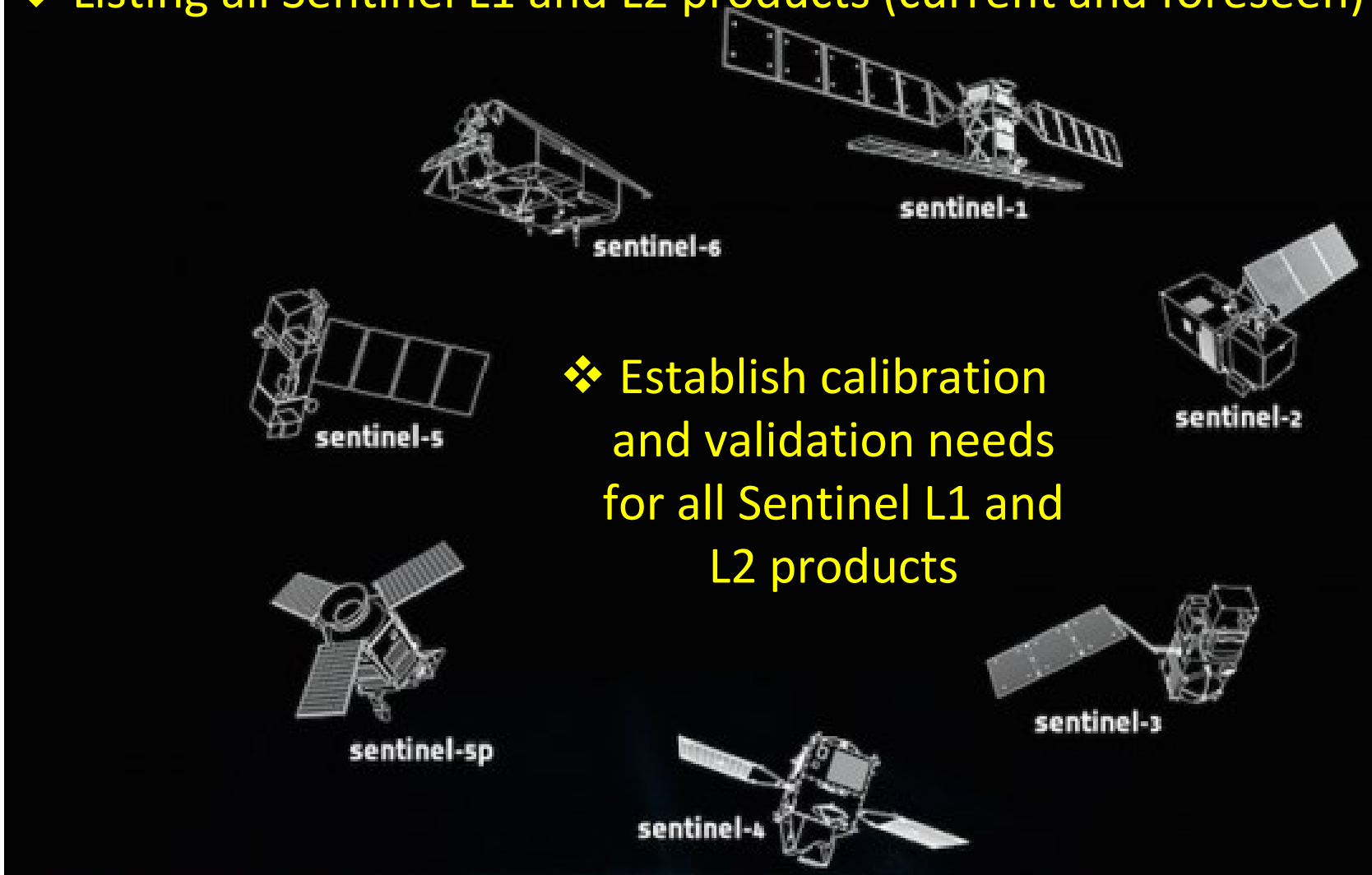
T1.1
Optical Missions

T1.2
Altimetry missions

T1.3
Radar and Micro-wave imaging missions

T1.4
Atmospheric composition missions

- Listing all Sentinel L1 and L2 products (current and foreseen)



- Establish calibration and validation needs for all Sentinel L1 and L2 products

- Series of reports released in 2021

Existing Cal/Val Sources

WP 2
Existing Cal/Val sources

- **T2.1** On-board calibration
- **T2.2** Vicarious methods on natural targets
- **T2.3** Inter-satellite comparisons
- **T2.4** Systematic ground-based measurements
- **T2.5** Field and aerial campaigns
- **T2.6** Cal/Val data distribution services

- Identify currently available Calibration and Validation sources
- Establish constraints and limitations affecting these sources (technical and operational)
- Identify perspectives on methods and emerging technologies

- Series of reports in 2021

Gap Analysis & CCVS

WP 3
Gap Analysis and Copernicus Cal/Val solution

- **T3.1** Instrumentation technologies
- **T3.2** Cal/val Methods
- **T3.3** Measurement networks and supersites
- **T3.4** Data distribution
- **T3.5** Performance analysis and Level 3 impact
- **T3.6** Copernicus Cal/val Solution

- Identify gaps in the current cal/val of Sentinel missions
- Identify synergies and cross-Sentinel harmonization needs
- Define a network of core operational sites for the Sentinel missions
- Define an operational organization and procedures for the cal/val activities of the Sentinel missions (data curation and distribution)
- Analyse expected impact on uncertainty of Sentinel products and downstream products (including Level-3)

fiducial reference measurements for satellite ocean colour

fiducial reference measurements for vegetation

pandonia
Fiducial Reference Measurements for Atmospheric Composition

FRM4STS

FIDUCIAL REFERENCE MEASUREMENTS FOR ALTIMETRY
FRM4ALT

Fiducial Reference Measurements for Greenhouse Gases

+ making existing networks FRM “compliant”

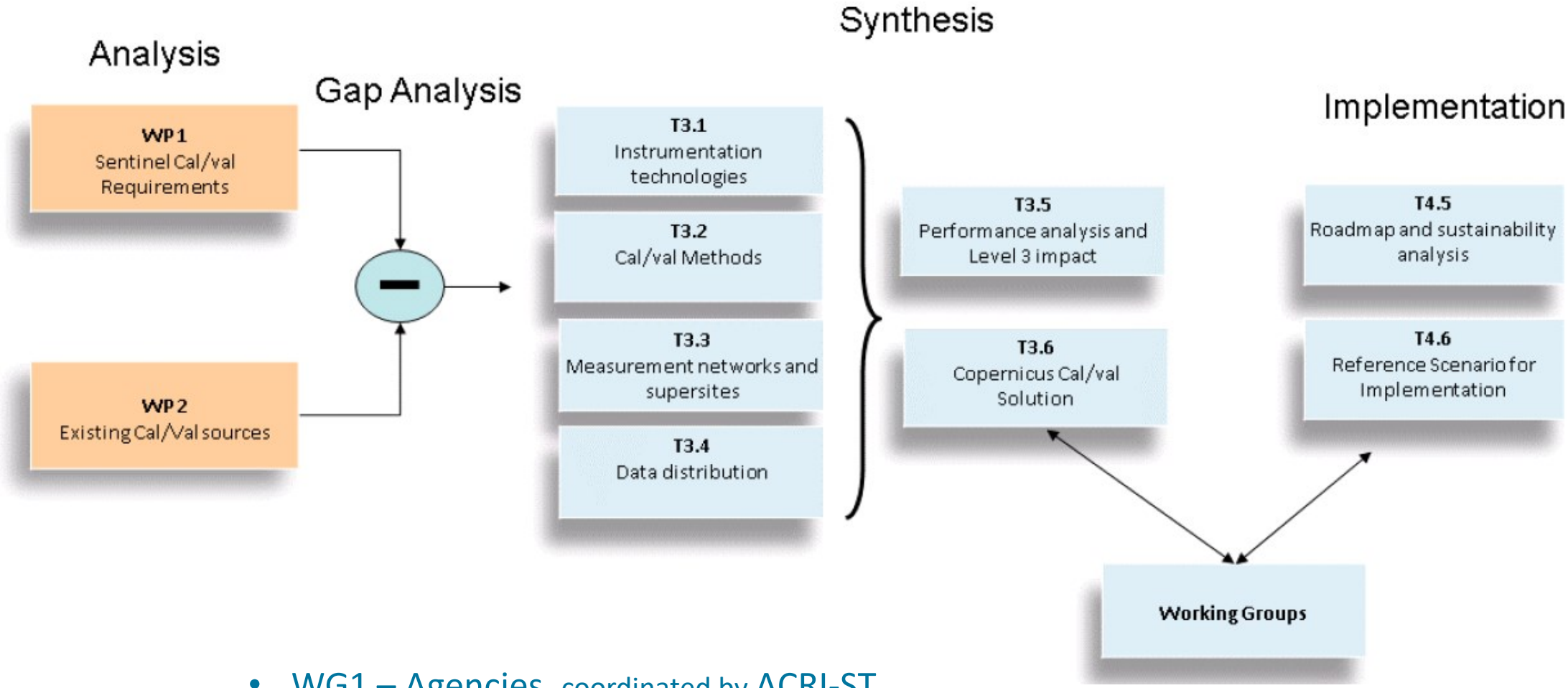
Reference Scenario for Implementation

WP 4
Reference Scenario for Implementation

- **T4.1** Coordination with European agencies
- **T4.2** Coordination with measurement networks
- **T4.3** Coordination with Copernicus Services
- **T4.4** Coordination with international agencies
- **T4.5** Roadmap and sustainability analysis
- **T4.6** Reference Scenario for Implementation

- Define a way forward for the implementation of the Copernicus Cal/Val solution
- Establish roles and responsibilities among Copernicus stakeholders
- Analyse sustainability and identify funding gaps
- Define implementation schedule

Implementation Summary



- WG1 – Agencies, coordinated by ACRI-ST
- WG2 - Measurement Networks, coordinated by University of TARTU
- WG3 - Copernicus Services, coordinated by ACRI-ST
- WG4 - International, coordinated by ACRI-ST

Type of recommendations

- **Actions**
  - E.g. calibration activities/operations to be performed, documentation to be issued…
- **R&D activities**
  - Efforts to be continued/reinforced
- **Need for reference data with uncertainty estimates**
  - Geographic and thematic gaps
- **Challenges to be addressed for the cal/val of future missions**
  - CRISTAL (Ka band), ROSE-L(L Band), CO2M (high accuracy requirements), …
- **Organization and coordination aspects**

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On-board calibration

- **Current approaches based on solar reflectance diffusers shows some limits (OLCI-A marginally compliant, SLSTR-A and B out of spec in the VIS SWIR)**
- **If technology cannot be further improved, need to anticipate a vicarious correction approach**
  - ✓ Tandem phases, harmonization coefficients
  - ✓ Calibration missions (TRUTHS)

Instrument pre-flight characterization

- **Documentation needs to be improved: SI traceability, measurement uncertainties**
- **To be complemented with in-flight characterization or verifications:**
  - ✓ Sun diffuser BRDF from yaw manoeuvers
  - ✓ Straylight from Moon acquisitions (TBC)

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- **Improved models for natural scenes**
  - On-going efforts to improve models must be sustained (DCC, PICS, Moon)
  - Inter-comparisons needs to be continued
  - Develop 3D RTM simulation of complex scenes
- **Atmospheric RTM**
  - Support inter-comparison activities (RAMI4ATM)
  - Establish commonly agreed guidelines for modelling (follow-on of COPA study)
- **Cal/Val methods for surface reflectance**
  - Use of UAVs, BRDF effect assessment, uncertainty validation…

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- **Operational hyperspectral directional surface reflectance network**
  - Needed for validation of L2 data on representative environment
  - A network of operational sites needed (land and water)
  - Sustainability needs to be secured
- **Field campaigns**
  - Regular field campaigns needed, especially for fire products, OTCI, water properties
  - Develop community processors
- **FRM4 fire products**
  - Low maturity in the CEOS LPV assessment => need work on methodologies

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❖ Improvement of geolocation CalVal methods

- ❖ Support open-source GCPs database (e.g. Global Reference Image (GRI))

❖ Improvement of cloud/cloud shadow masks

- ❖ Support new algorithm development
- ❖ Robust confidence level estimates
- ❖ Establish robust validation guidelines: one step beyond CMIX => “FRM4cloud” ?
- ❖ Develop open-source validation database
- ❖ Develop ground-based validation methods

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❖ Uncertainty for Copernicus data products

- **Activity currently in progress, needs to be continued**
- **Uncertainty need to be propagated through the whole processing chain, including L3 and L4 Copernicus services products ideally**
- **Methodologies for assessment of prognostics uncertainties need to be consolidated and generalized**
- **Long-term strategy needs to be discussed:**
  - ✓ Which level of detail is needed ?
  - ✓ How to limit the impact on processing, dissemination and archiving? User-side production? On-demand processing? Rolling archive?

❖ Training / education on uncertainties and advanced validation methods

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Labelling of FRM sites

- CCVS recommends a labelling mechanism for measurement sites
- Based on self reporting (similar to CARD4L certification)
- Ideally an FRM-maturity level with several steps
- CEOS would be in the best position to deliver this “certification”

Campaign coordination

- Announcement of future campaigns (at CEOS level) to foster potential collaboration
- Formatting and archiving of cal/val campaign data

Where/How can VH-RODA assist?

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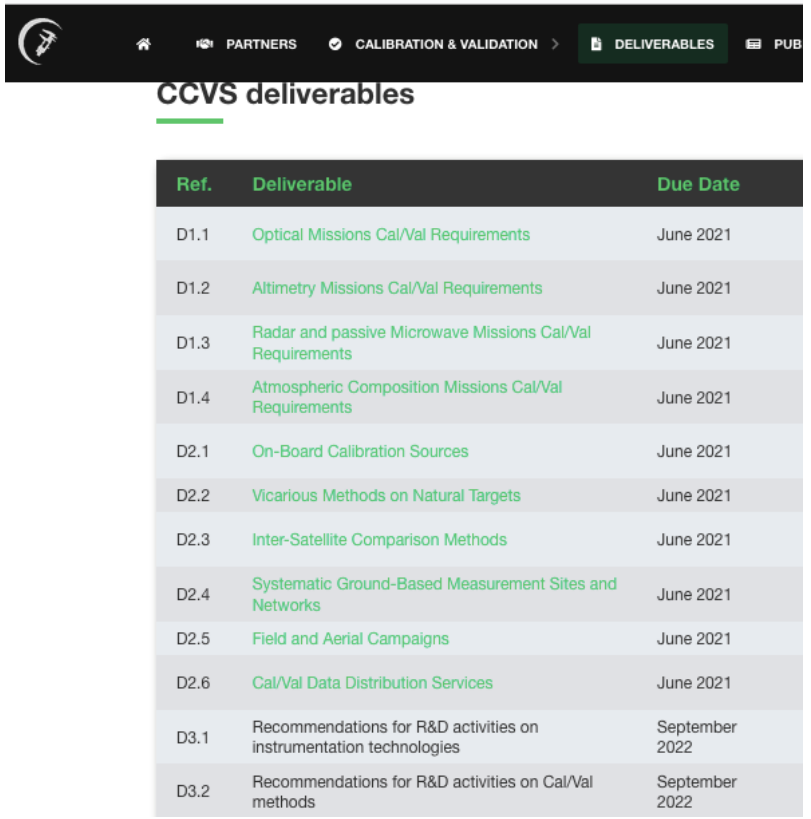
- Be aware that this project is happening

- Know where to look for information:
  https://ccvs.eu
  contact@ccvs.eu

- Get involved! /Join a working group / contact CCVS

- Keep an eye out for follow-on programme funding to implement the CCVS



Ref.	Deliverable	Due Date
D1.1	Optical Missions Cal/Val Requirements	June 2021
D1.2	Altimetry Missions Cal/Val Requirements	June 2021
D1.3	Radar and passive Microwave Missions Cal/Val Requirements	June 2021
D1.4	Atmospheric Composition Missions Cal/Val Requirements	June 2021
D2.1	On-Board Calibration Sources	June 2021
D2.2	Vicarious Methods on Natural Targets	June 2021
D2.3	Inter-Satellite Comparison Methods	June 2021
D2.4	Systematic Ground-Based Measurement Sites and Networks	June 2021
D2.5	Field and Aerial Campaigns	June 2021
D2.6	Cal/Val Data Distribution Services	June 2021
D3.1	Recommendations for R&D activities on instrumentation technologies	September 2022
D3.2	Recommendations for R&D activities on Cal/Val methods	September 2022

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Call for papers

Invitation to submit Manuscript for a Special-Issue of Remote sensing MDPI

MDPI

Special Issues / Copernicus Sentinels Missions Calibration, Validation, FRM and Innovation Approaches in...

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CITESCORE 7.4

remote sensing

Submit to Special Issue

Submit Abstract to Special Issue

Review for *Remote Sensing*

Special Issue "Copernicus Sentinels Missions Calibration, Validation, FRM and Innovation Approaches in Satellite-Data Quality Assessment"

Expected topic areas covered by Copernicus Sentinels missions but are not limited to:

- remote sensing of atmospheric composition, land, ocean, snow and ice surface,
- calibration and sensors' intercomparison,
- validation of geophysical data products,
- innovations to products' retrieval algorithms and Cal/Val techniques,
- Fiducial Reference Measurements (FRM) for satellite data validation.

https://www.mdpi.com/journal/remotesensing/special_issues/J3CYH3OQV0#editors

Guest-Editors:
Dr. B. Alhammoud, Dr. S. Clerc, Dr. S. Dransfeld, Dr. J-C. Lambert, Mr. P. Féménias

Deadline for manuscript submissions:
30 June 2023

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