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JERICO-DS DELIVERABLE

Joint European Research Infrastructure of Coastal Observatories - Design Study

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1. Introduction

In the original description of this Deliverable, it was written that inputs from the stakeholder and user requirements gathering in the JERICO-S3 project were going to be synthesised and archived in the Copernicus In Situ Information Component Information System (CIS^2) database developed by the European Environmental Agency in the framework of the Copernicus In Situ coordination access. The inputs from stakeholders and user requirements are compiled and presented in the JERICO-S3 Deliverable 9.1 'User Requirement and classification', where classification and analysis of the information of a total of 470 potential users of the JERICO-RI, distributed among 11 regions, regarding their use of the JERICO services, i.e.: Physical access, Virtual Access, Access to calibration facilities, access to knowledge and expert advice, were performed. In JERICO-S3 Deliverable 9.1, no quantitative information on in situ requirements for Copernicus Services was collected or presented.

In the CIS^2 database, however, the user in situ data requirements are collected and presented in terms of quantitative information including spatial and vertical resolution, timeliness, accuracy, etc. As this quantitative information on in situ data requirements was not compiled in JERICO-S3, the final content of this report will deviate from what was originally described in DoA Task 4.1.

In this report, we will rather focus on the content of the CIS^2 database and how, taking into account Copernicus as a main user and stakeholder, the definition of Copernicus in situ requirements can help in the future design of the JERICO RI and how JERICO should be considered as an in situ data provider network for the Copernicus Marine Service, especially for its coastal component. A collaboration between JERICO RI and Copernicus is necessary for improving access to in situ coastal observations. An example of this collaboration can be the Coastal high-frequency radar (HFR) aggregated datasets which are available to Copernicus In Situ Thematic Assembly Center thanks to the work performed in the JERICO projects.
(https://insitu.copernicus.eu/news/towards-integrating-a-coastal-radar-network-into-the-copernicus-marine-environment-service).

The JERICO User Committee, which includes various user representatives, can be a good space for the definition of the Coastal in situ requirements for Copernicus which will give feedback information to the design of the JERICO RI taking into account Copernicus Marine requirements. As a final recommendation, it is important that JERICO data is tagged to help their identification in the CIS^2 database and to give credit to JERICO-RI and their role in the Copernicus Marine Service.

In the report, the CIS^2 will be briefly described, together with the justification for why it was not possible to be used with the information on user and stakeholder requirements gathered in JERICO S3. Then, some recommendations on how CIS^2 and Copernicus coastal in situ requirements can help to design Future JERICO RI will follow. The case of the Ocean Colour Thematic Assembly Center (OCTAC), a Copernicus satellite product on ocean colour, is also presented as an example of how Copernicus requires coastal in situ data (work performed in JERICO-S3 WP2). The JERICO virtual access requirements defined in JERICO S3 are also presented together with some conclusions and recommendations to better engage with users and stakeholders.

2. Main report

The Copernicus In Situ Component Information System (CIS²)

It is well known that the quality of Copernicus Marine products, and of Copernicus Satellite component, is highly dependent on the availability of upstream in situ and satellite observations (le Traon et al., 2019). Observations are used both by Copernicus Marine (CMEMS) Thematic Assembly Centers (TACs) to create data products, and by CMEMS Marine Forecasting Centers (MFCs) to validate and constrain their global and regional ocean analysis and forecasting systems. CMEMS critically depends on the near-real-time availability of high-resolution satellite data and in situ data are of paramount importance because they provide information about the ocean interior which cannot be observed from space. In situ observations can also locally sample high-frequency and high-resolution ocean processes, in particular, in the coastal zone that are essential for model and satellite validation activities.

The Copernicus In Situ Coordination Information System CIS² https://cis2.eea.europa.eu/about), a relational database developed and maintained by the European Environmental Agency (EEA), has been designed and established with the main purpose to generate an overview of Copernicus products across all Copernicus Services (including Copernicus Marine Service and Satellite components) and to establish link to in situ data requirements and in situ data availability and the providers. CIS² is, therefore, an open database designed to record the requirements of the Copernicus services, ESA, and EUMETSAT for in situ data, how far they are met, the origin of each dataset, how each dataset is used, their importance, and the barriers to their seamless use. In the end, it provides a clear picture of what data is already available and what would be needed to deliver improved and more reliable products and monitoring services. It has been populated, for each Copernicus Service Product, with the specific technical details of the relevant in situ data requirements and with the relevant available datasets associated with them, their level of compliance with the requirement, and other relevant information.

The in situ requirements gathered in the database are relative to horizontal and spatial resolution (following a gridded approach), timeliness of data availability, and data uncertainties as can be seen in the example below for ocean Surface Currents in situ requirements.

Name	surface currents		
Note			
Dissemination	NRT Service		
Quality Control Procedure	Automatic		
Group	Ocean		
Status	-		
Uncertainty	5cm/s	2cm/s	1cm/s
Update Frequency	7d	5d	1d
Timeliness	3d	2d	1d
Scale			
Horizontal resolution	500km	400km	300km
Vertical resolution			

Fig1: Example of quantitative requirements for Surface Currents as in CIS[2]. This set of requirements is linked to Copernicus marine products. Different colours in the three columns relate with the Threshold, Breakthrough and Goal.

The in situ requirements are associated with available datasets that fill partially, or totally, the requirements. At the last term, comparing the requirements with the data availability will reveal the existing gaps in the present availability of in situ data and observing infrastructure to the Services.

The information derived from this database helps the main players (EU Commission, EEA, Copernicus governance bodies, Member States, etc.) to prioritise actions to further improve the availability, and sustainability of the necessary in situ data and observations. It also provides a basis for dialogue between these players and the Services about the definition of priorities.

As, at the time being, there are no Copernicus marine coastal products in the current Copernicus Marine Service portfolio, there are no specific quantitative in situ data requirements for the coastal area. But, as Copernicus Marine Service is evolving towards the coastal Areas, there is an increasing need of establishing links with JERICO as a data provider network infrastructure improving the access to coastal data and coastal observations. This link can be established thanks to a dialog between Copernicus In Situ project (COINS) managed by the European Environmental (EEA) as the entrusted entity in charge of the cross-cutting coordination of in situ data Access to Copernicus, Copernicus Marine service and JERICO Research Infrastructure.

The Copernicus requirements for in situ observations have been collected in a report compiled after several workshops organised by Mercator Ocean International, EuroGOOS, and CMEMS partners (https://marine.copernicus.eu/sites/default/files/inline-files/CMEMS-requirements-In_Situ_03_2021_VF.pdf). The latest major updates were collected during a dedicated workshop, held in Toulouse on 3 July 2018 and organised by Mercator Ocean International in collaboration with EuroGOOS, which brought together all CMEMS TACs and MFCs, ROOSs representatives, EuroARGO ERIC and EuroGOOS Task Team members. They were further reviewed and published in the OceanObs19 Frontiers in Marine Science special issue (Le Traon 2019). A further update has been made in February 2021 to take into account the

latest developments introduced by CMEMS production centers, and their impact on in situ requirements. A new workshop will take place on 14-15 September 2023 to update the in situ requirements. It is important that JERICO Research Infrastructure is present at that workshop as a main European Coastal Data provider infrastructure.

Requirements for in-situ observations for satellite Ocean Colour remote sensing Copernicus Ocean Colour Thematic Assembly Center (OCTAC)

JERICO has started a dialogue with ESA-ESRIN and with Copernicus Marine Service OCTAC in order to define how JERICO Data can contribute to routine operations such as post-launch system vicarious calibration (SVC) of satellite OC sensors, calibration, evaluation and further development of ocean colour remote sensing algorithms, and validation of the operational OC products distributed by CMEMS.

The requirement is on high quality in situ measurements accompanied with their uncertainties; these data are referenced as Fiducial Reference Measurements (FRM) by the ocean colour community.

SVC makes use of highly accurate in situ measurements of water-leaving radiances. These measurements are the principal source of sea-truth for the vicarious approach.

Development and qualification of ocean colour primary variables

The following FRM observations are used:

- spectral remote-sensing reflectance,
- concentration of chlorophyll a,
- spectral inherent optical properties (light attenuation and backscattering)
- spectral diffuse attenuation coefficients.

The latter observations are presently acquired through a variety of systems and platforms such as:

- Automated **in-water radiometry (Ld, Lu, Kd)** from moored Fixed-Point Observatories (i.e., MOBY and BOUSSOLE until recently)
- Automated **above-water radiometry (Ed, Lw)** from Tower Fixed-Point Observatories (AERONET-OC)
- **In-water radiometry** from profiles acquired during dedicated research cruises
- Inherent Optical Properties (**IOPs**) from profiles acquired during dedicated research cruises.
- **Biogeochemical measurements** (i.e., Chlorophyll, TSM) and IOPs from samples acquired during dedicated research cruises.
- Underway systems for biogeochemical and IOP measurements • Autonomous profiling floats (BGC-ARGO)

Evaluation of OC-TAC products

The parameters that are delivered through the OCTAC (at different resolution of time and space) are the following:

- Water-leaving reflectances (@400, 412, 443, 490, 510, 560, 620, 665, 674, 681, 709 nm)
- Chlorophyll-a surface concentration
- Surface concentrations of Phytoplankton Functional Types(Diatoms, Dinoflagellates, Green Algae, Haptophyts, prokaryotes) of PSD (micro-nano-pico Phytoplankton).
- Vertical attenuation of light (@490nm) Kd490
- Secchi Disk Depth estimates
- Concentration of Suspended Particulate Matter
- Attenuation of Coloured dissolved organic matter (CDOM)
- Backscattering coefficient @443 nm
- Primary production

Many JERICO partners regularly or continuously measure relevant variables, as shown in the table for a subset of partners).

	Lw(λ)	Chl-a	PFT	PSD	Kd490	Secchi depth	SPM	CDOM	Bb443	PP
AZTI		X	X			X	X			
CNR	X	X	X		X	X		X		
CNRS	X	X			X		X	X	X	
FAMRI		X	X							X
HCMR		X								
HEREON		X		X			X	X		
IRB		X	X		X	X		X	X	
NIVA	X	X	X				X	X		
PdE										
RBINS	X	X	X	X	X		X		X	
SOCIB		X						X		
SYKE	X	X	X	X	X	X	X	X	X	X
TALTECH		X					X			
UPC							(X)	X		

However, most of these measurements are not yet regularly used by CMEMS. This may be due to sampling and processing protocols not fully matching the quality requirements for SVC (Lw) and some FRM. JERICO has been working with the H2020 project CCVS in order to identify bottlenecks and possible way forward for increase the relevance of JERICO observations to SVC and FRM processes.

But it is also due to a lack of awareness of JERICO services, especially by the CMEMS-OCTAC actors.

Meetings with the OCTAC are planned in the JERICO-S3 project, as part of WP2, to increase awareness and map specific opportunities that would rise from adjusting soe JERICO procedures for fitting better to Copernicus requirements.

JERICO could decide, as part of its common future implementation, to deploy systematic radiance/irradiance sensors on JERICO platforms (e.g., ferrybox, moored surface platforms) for giving value to the evaluation and validation of satellite products in the highly optically complex (Case-2) coastal waters.

JERICO should aim to be listed, as BGC-Argo is, as an official provider of high-quality measurements for EO CAL/VAL (including FRM: chl-a, Lw, Rrs, Kd) and for evaluation of OCTAC products.

Data providers Organisation and Data providers networks to Copernicus – Role of JERICO-RI and JERICO data tagging

As CIS² database documents the links between the in situ requirements specified by the Entrusted Entities to Copernicus products, in situ datasets, and data providers, it is possible to obtain an overview of all organisations which are providing in situ observations data to support (i.e., in the generation, production or validation) all Copernicus products. This data provider information includes both individual data provider organisations (based in the Country which provide in situ observations data to support Copernicus products) and Data Provider Networks, which are international networks that provide in situ observations data to support Copernicus products. With the information currently included in the database, some Marine Research Infrastructures, such as EMSO ERIC or Euro-ARGO ERIC, and other RIs like ICOS, are represented in the database as data provider networks in various datasets. It is desirable that in the future, JERICO RI will be included as a Data Provider Network to Copernicus. For this to happen it is needed that all JERICO data is tagged as JERICO in such a way that, when Copernicus is using some in situ data from JERICO, this is documented and acknowledged in the Copernicus CIS² database.

JERICO virtual Access user requirements

During the JERICO-S3 project, a series of interviews with different JERICO users and stakeholders have been performed to gather information on their various interests and needs, and requirements for the JERICO virtual access service provided through JERICO-CORE. They are summarised below:

- JERICO-CORE to provide a flexible, easy to use online catalogue providing information on developed and relevant software, Best Practices, instrument and parameter-specific metadata.
- Elevate the current metadata information available, including on the sensor level, and provide guidelines for metadata creation.
- JERICO act as an expert network providing technical guidelines and recommendations via a help desk.
- Provide forums for: sensors, technical support, new technologies, and data management.
- Leverage on what is done elsewhere, avoid duplication of efforts, and not provide another data portal.
- Ensure interoperability with CMEMS INSTAC and EMODnet.
- Provide a metadata/vocabulary translator, visualisation tools, customised end user applications.
- Promote a federated JERICO ERDDAP.
- Provide tools to enable intercomparison between different platforms.
- JERICO to act as a test bed for new sensors.
- Clearly define JERICO platforms and data and identify area covered i.e., "coastal".

- FAIR data.
- More focus on biology and biological Best Practices.
- Identify JERICO users to be able to meet their needs.

Recommendations for the JERICO User Committee

JERICO User Committee could help to define or refine in situ data requirements for the coastal zone. The committee could help to define resolution-frequency-timeliness of the coastal observations required to improve the Copernicus coastal products. In this way, it is recommended that Copernicus has to be included in the Jerico User Committee.

The Terms of Reference of the JERICO User Committee have been finished in the JERICO-S3 project and can be found in Annex 1 at the end of this document.

3. Conclusion and next steps

During the JERICO-S3 project, a database of more than 470 users of JERICO was compiled, and the analysis of their needs and the way they use the Physical and Virtual Access was documented in Deliverable 9.1. Transnational Access in the different JERICO projects was a successful program with a growing number of users and projects (19 in JERICO FP7 and 47 in JERICO-S3). In order to continue engaging with the users and stakeholders, it is important that the JERICO User Committee (JUC), which was established in JERICO-S3 with the Terms of Reference completed in July 2022 (see Annex 1), should have regular meetings to discuss and define user requirements which help to design the future Research Infrastructure. Copernicus Marine Services and EU data initiatives, as EMODnet, should be active members of the JUC. These users can largely benefit from the JERICO in situ data provision in the coastal areas.

Another recommendation is to advance the process of tagging in situ data coming from all JERICO coastal platforms (see the platform catalogue here: https://www.jerico-ri.eu/jerico-ri-catalogue/#/map) as JERICO data in their metadata to give visibility to JERICO as a data provider network when this data reaches the main European data integrators (i.e., EMODnet and Copernicus Marine In Situ) and then can be identified in the CIS[2] database.

4. References

Le Traon P. Y. et al, 2019. From Observation to Information and Users: The Copernicus Marine Service Perspective. Frontiers in Marine Science | www.frontiersin.org 1 May 2019 |Volume 6 | Article 234

JERICO S3 Deliverable 9.1 "User Requirements and Classification" https://www.jerico-ri.eu/download/jerico-s3_deliverables/JERICO-S3_D9.1_User-requirement-and-classification_Final.pdf

CIS[2] database: https://cis2.eea.europa.eu/about

Annex 1 Terms of Reference of the JERICO-User Committee

Article 1. The body

The Parties agree to establish the following body:

1) The JERICO User Committee (JUC), acting as the **advisory committee within the JERICO-S3 and JERICO-DS projects** for the **elaboration of JERICO-RI Services and Products to be delivered to end-users.**

The Parties also agree on the possibility to establish subsidiary and/or temporary bodies (e.g. working groups) as described in Article 3.

Article 2. The JERICO User Committee (JUC)

§2.1: Role

The JERICO User Committee (JUC) is the advisory committee guiding the strategy for the elaboration of Services and Products in the framework of the JERICO-S3 and JERICO-DS projects.

Parties will be consulted to contribute to the actions of their choice among the following tasks of the JUC:

1) To contribute to the long-term strategic vision of JERICO products and services delivery.
2) To suggest to the Coordinator relevant new stakeholders and users to be involved in the JUC.
3) To represent the User Community along the JERICO-S3 and JERICO-DS projects to further design the governance of JERICO-RI.
4) To advise JERICO-S3 and JERICO-DS Partners on the products and services catalogue of the future Infrastructure.
5) To collect and express JERICO user's return after experience on the currently offered services and pilot services as Virtual Access.

§2.2: Resources:

The JERICO consortium recognises the limited resources available for stakeholders and users to compensate for their contribution in the JUC, and is therefore open for variable involvement, based on parties' own possibilities and constraints.

§2.3: Composition and membership

The JUC is composed of selected Users and Stakeholders that have signed this agreement. The modalities of involvement and membership are as follow:

- The Users and Stakeholders invited to sign the agreement are unilaterally chosen by the Steering Committee of the JERICO-S3 project. However the Users and Stakeholders already members of the JUC are legitimate to make any suggestion, as part of their role.
- The signatory Users and Stakeholders are involved in the JUC for the duration of the H2020 JERICO-S3 and JERICO-DS projects (end of last project in january 2024).
- The JUC can start with at least 1 stakeholder and can be further enlarged **to reach a maximum of 10 members.**

- One member of JUC will act as the representative of the Virtual Access Board of International Experts that is in charge of assessing the efforts done under WP11 of JERICO-S3.

The JUC is chaired by a Chairperson and a Deputy Chairperson, both elected among the Users and Stakeholders.

§2.4: The Chairperson

The Chairperson of the JUC leads the JUC meetings and ensures the smooth preparation of the agenda with the leaders of the Work Package 9 of the JERICO-S3 project. During the discussions, the Chairperson is neutral and does not represent any specific entity or business.

The Chairperson is responsible for ensuring that the conclusion of the JUC on (1) Users return after experience, (2) Users expectation, (3) long-term strategic vision for services delivery and (4) potential new stakeholders to be involved in the JUC are transmitted to the JERICO-S3 Steering Committee of the project, for their approval.

The Chairperson represents the JUC towards other stakeholders and users external to the JUC.

The Chairperson can delegate tasks to the Deputy Chairperson.

§2.5 The Deputy Chairperson

The Deputy Chairperson is supporting the Chairperson in their tasks. He/She can substitute the Chairperson in some tasks that have been delegated, and in chairing the JUC meetings. In the latter case, the Deputy Chairperson also leads the discussions in a neutral way and does not represent any specific entity or business.

§2.6 Modality for meeting

The JUC meets at least twice a year: once a year in a plenary session, according to the possibility in relation with the sanitary situation, and once in a virtual meeting session.

A virtual meeting of the JUC can be convened at any time if the majority of the Parties wishes.

§2.7 Decisions

Decision related to the advisory mission of the JUC:

The JUC strives to provide the Partners with conclusions that are based on consensus and that bring benefits for the JERICO User Community and JERICO-S3 Project Partners in all their diversity. However, if no consensus can be reached all constructive views and opinions related to the JUC tasks are welcome and will be duly recorded and transmitted to the WP9 leaders and the Steering Committee of the project.

Decision related to Chairperson and Deputy Chairperson election and Subsidiary and/or temporary bodies :

The JUC strives to reach decisions on Chairperson and Deputy Chairperson election and Subsidiary bodies based on consensus. If no consensus can be reached and a vote is needed, each Stakeholder or User can only express one vote. To be approved, a decision

requires a simple majority, unless the Parties have previously agreed unanimously on a different procedure.

Article 3. Subsidiary and/or temporary bodies

§3.1: Possibility to establish subsidiary and temporary bodies
It is possible to establish subsidiary and/or temporary bodies (e.g. working groups) if they could be helpful to support the work of the JUC. The creation of the relevant bodies and their duration will be decided by the members of the JUC during the yearly meetings.

The establishment of such subsidiary / temporary bodies is particularly expected to collect and express JERICO user's return after experience on the currently offered services and pilot services as Virtual Access, as an International VA Board will be constituted as part of the JUC.

Article 4. Resources

Travel and accommodation costs related to the annual plenary session of the JUC will be covered by the JERICO-S3 budget. No Stakeholders can be forced to any monetary contribution.

Article 5. Miscellaneous

The ToR of the JUC is meant to evolve according to the advancement in the elaboration of the JERICO Research Infrastructure. In particular, some adjustment could be necessary to specify the way the JUC will be embodied in the governance structure of the future JERICO Research Infrastructure.