JERICO-S3 DELIVERABLE

Joint European Research Infrastructure for Coastal Observatories

Science, Services, Sustainability

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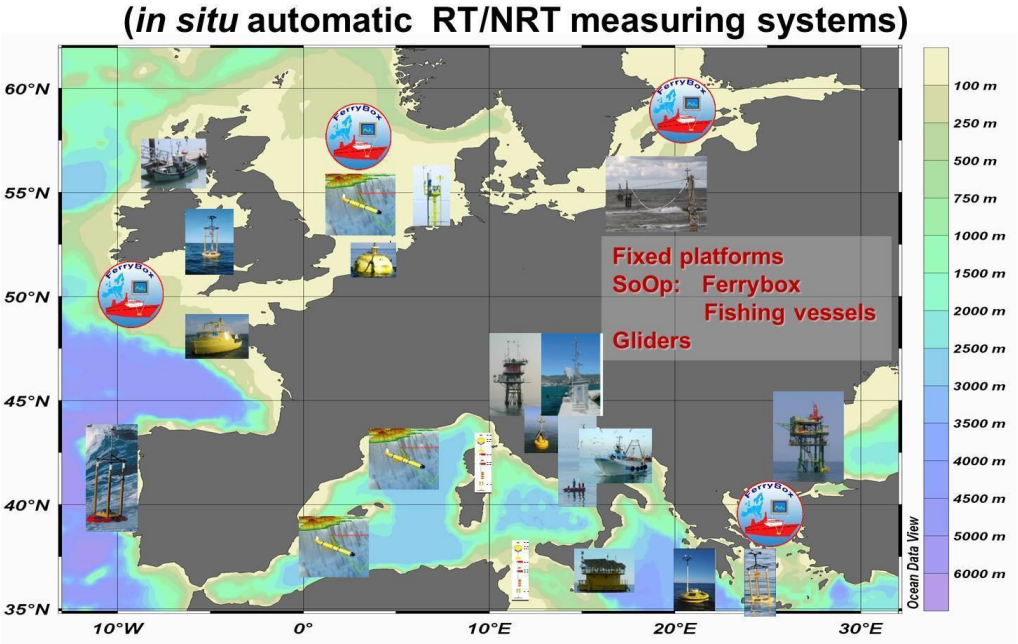
1. EXECUTIVE SUMMARY

This document reports on the development of Key Platform Performance Indicators and Key Integration Performance Indicators for assessing the performances of the observing platforms of the JERICO-RI, including the level of their integration at the network level. The activity forms part of Work Package 5 ("Harmonisation of integrated Multiplatform & Multidisciplinary systems") of JERICO-S3, specifically, Task 5.4 ("Performance Monitoring for the operation and integration of JERICO-RI platforms"), which gathers together the approaches and recommendations of 9 partners of the project.

2. THE JERICO-RI AND ITS MAIN OBSERVING PLATFORM TYPES

The JERICO RI (Research Infrastructure) is a network of coastal observatories - assemblages of distributed sensor systems covering extensive areas of Europe's coastal seas - capable of assuring timely, continuous and sustainable delivery of high-quality environmental data and information products for research, industry, ecosystem health and resource management, and coastal hazards forecasting purposes. It targets the coastal component of Europe's seas principally, a critical compartment that is not specifically covered by any of the other ongoing European in situ marine observing infrastructure initiatives. The RI, therefore, complements the fledgling idea of the European Ocean Observing System, an integrated and sustained European system of systems for delivering high quality, trusted marine information and knowledge to underpin environmental policy and management that can also serve to support a globally integrated ocean observing system.

At present, four types of mature observing platforms (Figure 1) have been identified in the JERICO-RI landscape: fixed or station-keeping structures (e.g., instrumented buoys), Ships of Opportunity (e.g., vessels running Ferryboxes), instrumented gliders and HF-radar systems.



(from Sparnocchia et al., 2016)

Figure 1. The main platform types of the JERICO-RI network.

In a number of cases, operators manage complex systems incorporating more than one platform, sometimes partly or fully interlinked to ensure a discrete level of holistic functionality. The platforms support sensors or measuring instruments containing sensors which can differ widely in their number, kind, scope, and technical configuration from platform to platform, and from operator to operator. To be clearly identifiable as a JERICO element and truly useful, all the types of platforms in the network are converging towards the use of common standard operating procedures and best practices in the observing and data creation steps. There are also several

ongoing efforts to try to provide adequate customer/client support when issues of data quality and consistency are raised by data aggregators and end users.

The sets of variables monitored by individual platforms differ considerably across the network, though salinity, temperature and pressure (depth) are nearly always measured. Table 1 categorises the core variables selected by the JERICO-RI for consideration in its networking effort at the end of the JERICO-NEXT project which preceded JERICO-S3.

Table 1. JERICO RI: list of observables.

Physical Oceanography	Biological Oceanography/Marine Biogeochemistry	Other measured variables
Pressure	Fluorescence (Chlorophyll a)	Underwater noise
Temperature	Turbidity	Vibration/motion (Seismometry)
Conductivity (salinity)	Photosynthetically Active Radiation (PAR)	CDOM (Coloured Dissolved Organic Matter)
Currents	Nitrates	EC (Eddy Correlation) flux
	Phosphates	Air temperature
	Silicates	Atmospheric pressure
	Ammonia	Relative humidity
	Dissolved oxygen	Wind speed and direction
	pH	CO_2 concentration in air
	pH_T (pH on the total hydrogen ion concentration scale)	Fluorescence (Phycocyanin and phycoerythrin)
	Total Alkalinity	
	pCO2 (partial pressure of CO2)	
	TCO2 (DIC - Dissolved Inorganic Carbon)	
	DOC (Dissolved Organic Carbon)	
	TOC (Total Organic Carbon)	
	POC (Particulate Organic Carbon)	

(from JERICO-NEXT-WP2-D2.7-090919-V1.0, 2019)

3. EVALUATING PLATFORM PERFORMANCE

From an infrastructure perspective, the JERICO-RI can be viewed as a coherent set of valuable assets that provide a broad range of services ensuring continuous, timely access to coastal marine observations, data products and information on different usage levels: transnational, national and local, both public and private. In many ways, its workings can be compared to the well-established "client-server" model in Web architecture with the observing platforms carrying the sensors and instrument systems used for making environmental measurements constituting the first tier in the overall structural hierarchy.

All the JERICO-RI observing platforms share a common goal: to monitor coastal processes as continuously as possible and provide high quality data for marine science, environmental planning, assessment and mitigation, including model validation and assimilation purposes. However, taken singly, the platforms present a striking heterogeneity. Many aspects like operational objectives, geographical settings and coverages, types of parameters handled and frequency of measurements, maintenance practises, and the quality assurance schemes and standard methods employed for sensors and data often vary from one platform to another, which makes assessing platform performances from the network standpoint particularly challenging.

Evaluating the performance of an observing platform implies the prior existence of some kind of system for measuring it. This is essentially a "technical" component, devised to support a platform's operator and, more broadly, the RI coordination in making informed decisions concerning the development, running, and maintenance of the asset. To this end, a system composed of two groups of performance indicators is proposed; Key Platform Performance Indicators (KPPIs) and Key Integration Performance Indicators (KIPIs).
Following the ESFRI Monitoring Report (2019) all KPIs should be aligned with the objectives of the infrastructure and fulfil RACER criteria:

- **R**elevant,
- **A**ccepted,
- **C**redible,
- **E**asy to monitor,
- **R**obust.

Each KPI should be accompanied by a reference sheet that provides a definition, data source(s), method of calculation, and other issues concerning calculation or applicability.

The two sets of indicators, distinguishable from each other, are described in the sub-sections below.

3.1. Key Platform Performance Indicators (KPPIs)

KPPIs (Table 2) are those indicators intended to capture in some way the degree of accomplishment of the tasks set for a platform by its operator/manager and in case that a platform is part of a wider network (OceanSITES, etc.) then these KPPIs will also reflect the performance of the platform within the network. They express platform performance in terms of three criteria: effectiveness, reliability, and cost.

Table 2. Key Platform Performance Indicators (KPPIs) proposed for the JERICO-RI.

	Description	***Attribute expressed***	***Proposed metric***
KPPIs: Criterion #1 **Effectiveness**	The ability of the platform to provide the services expected of it.	Capacity and delivery of services (platform).	a) Downtime (number of days)/Time deployed (total number of days/year); b) Total number of observations or data points handled (one observation or data point is one measurement of a variable at a given time and place) per year; c) Process conformance to SOPs.
		Quality of services delivered (platform subsystems).	For each platform subsystem (variable monitored): a) Time to final data delivery for Real Time (RT) data; b) Time to final data delivery for Delayed Mode (DM) data; c) Number of non-zero Quality Flags delivered / Number of data delivered d) Quality process conformance to JERICO-RI BPs.
		Impact (usefulness to stakeholders).	Contribution to European programmes (e.g., the Copernicus Marine Service, EMODnet, EuroGOOS, SDN etc.): a) Total number of observations delivered to Data Aggregators per year; b) Total number of users through the Data Aggregators programmes.
			Contribution to monitoring programmes, national or otherwise: a) Total number of observations delivered to monitoring programmes per year; b) Number of reported variables; c) Total data delivered per year; d) Total data delivered per year per variable handled/Total data delivered per year; e) Total number of users.

			Contribution to research activities: a) Number of citations in peer-reviewed papers per year; b) Number of research teams (different filiation) having cited data from the observing platform per year.

KPIs: Criterion #2 **Reliability**	***Description***	***Proposed metric***
	The likelihood that the effectiveness of the platform will be maintained over an extended period of time (or the probability that service will be available at least at specified levels throughout its design life).	a) Effected number/duration of maintenance stops (n)/Expected (planned) number/duration of maintenance stops (n); b) Effective uptime (number of days/year)/Expected uptime (number of days/year); c) Number of outage reports per year/Number of outages; d) Number of successes in on-site resolution of reported problems/Number of problem reports per year.

KPIs: Criterion #3 **Cost**	***Description***	***Proposed metric***
	Recurring expenditures for operations and maintenance required throughout the platform's service life.	a) Per year operating cost of platform; b) Percentage of regular funding (e.g., from permanent national programmes or an institute's annual budget) in the per year operating cost of platform; c) Percentage of intermittent funding (e.g., from projects) in the per year operating cost of platform; d) Per year maintenance cost of platform; e) Average cost per datum (Attention: Cost/Benefit of the system must be taken in to account).

3.2.Key Integration Performance Indicators (KIPIs)

KIPIs (Table 3) refer to indicators describing the degree to which a platform is integrated in the JERICO "system of systems" linking European coastal observatories nationally, transnationally, regionally, and globally.

Table 3. Key Integration Performance Indicators (KIPIs) proposed for the JERICO-RI.

	Description	***Proposed metric***
KIPIs	#1. Comparability of the services offered by the platform with respect to RI requirements.	For each platform subsystem (variable monitored): a) Compatibility with the JERICO-RI norm (e.g., the JERICO label requirements) from the standpoint of the technology used (pass/fail/provisory acceptance, subject to review); b) Compatibility with the JERICO-RI norm from the standpoint of the reference materials used (pass/fail/provisory acceptance, subject to review); c) Compatibility with the JERICO-RI norm from the standpoint of the calibration methodologies used (pass/fail/provisory acceptance, subject to review); d) Level of adherence to available JERICO-RI Best Practices as compiled or endorsed in JERICO Best Practices documentation (pass/fail/provisory acceptance, subject to review); e) Level of compliance/compatibility with established target measurement goals for JERICO RI observables (pass/fail/provisory acceptance, subject to review); f) Level of acceptance of data delivered to international databases (pass/fail/provisory acceptance, subject to review) - e.g., for a specific database, the percentage of data supplied that do not meet the "acceptance criteria" for that database. (to be checked : Relevance toward KPI *"Number of non-zero Quality Flags delivered / Number of data delivered")*

	#2. Level of integration of the platform's observations of EOVs/EBVs in the definition of JERICO-RI products/indicators at the regional level.	a) Number of JERICO-RI regional products/indicators resulting from the integration of observations of two or more EOVs/EBVs from the considered platform; b) Number of JERICO-RI regional products/indicators resulting from the integration of observations of two or more EOVs/EBVs coming from both the considered platform as well as other platforms in the network; c) Number of JERICO-RI regional products/indicators resulting from the integration of observations of EOVs/EBVs from the considered platform and platforms belonging to other RIs; d) Number of products/indicators of other RIs integrating observations of at least one EOV/EBV from the considered platform; e) Geographical coverage of the JERICO-RI regional products/indicators resulting from the integration of the EOV/EBV observations furnished by the considered platform (spatial extension over more than one region).
	#3. Contribution of the platform's observations of EOVs/EBVs to inter-calibrations/validations improving the quality of JERICO-RI regional products/indicators.	a) Number of intercalibrations/validations performed employing the observations provided by the considered platform for at least one EOV/EBV; b) Number of EOVs/EBVs for which the considered platform provides inputs from the standpoint of intercalibrations/validations; c) Number of intercalibrations/validations enabled by the considered platform's EOV/EBV observations when supported by relevant inputs from other RIs; d) Number of intercalibrations/validations carried out by other RIs employing the observations provided by the considered platform for at least one EOV/EBV; e) Geographical extension of the effect of the intercalibrations/validations enabled by the considered platform's EOV/EBV inputs on regional products/indicators (spatial coverage involving more than one region).

4. CLOSING REMARKS

The presented scheme of performance indicators lays down the groundwork for a workable, transparent system for the assessment and oversight of observing platforms within the JERICO-RI. It is an attempt to respond to the needs of the RI as regards its observing platforms in the networking context and from a stakeholder point of view that includes the end-users also. However, given the varied and complex objectives of the RI and the multiplicity of its stakeholders, no adequate, single measure of performance has been identified, nor should there be an expectation that one will emerge. Moreover, performance assessment requires high quality data. Therefore, any useful benchmarking will demand continuing, coordinated monitoring of these indicators and the collection of relevant data. As such, further review and the final definition of the indicators will also take into account the outputs of the JERICO-S3 deliverable, D5.2, on Best Practices for Mature Platforms.

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