Joint European Research Infrastructure network for Coastal Observatory – Novel European eXpertise for coastal observaTories - **JERICO-NEXT**	
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1. Executive Summary

According the Commission definition, Virtual Access means:

> *"access to resources needed for research through communication networks without selecting or even identifying the researchers to whom access to resources is provided. Examples of virtual access activities are databases available via Internet, or data deposition services"*

The JERICO-NEXT partners are providing a large number of in-situ monitoring and numerical modelling infrastructures, with numerous marine observations and forecasting products for the coastal zone. These data are usually collected, processed, qualified, used to make products, stored and made available via a virtual (research) infrastructures (VIs), e.g. web infrastructure with high capacity and performance for big data processing and state-of-the-art web visualisation services.

VIs make use of standards for wide interoperability, whilst respecting user privacy and differences in data policies. The (virtual) access to research infrastructure is of fundamental importance for making science, new discoveries, new developments, and new assessment and disseminate new knowledge.

In this framework, one specific scope of the WP5 – Data Management is to suggest actions and recommendations that better connect the Virtual Infrastructure (VI) and JERICO-NEXT systems to make data easy accessible and visible and create the basis for building synthetic products based on original data.

The infrastructures presently included in JERICO-NEXT VIs are already providing (or can provide in the future) a wide range of products aimed to support a much broader community comprising researchers, nautical communities, maritime and port authorities, local decision agents, economical agents, schools and general public. These products include real-time or archived data, operational forecasts or information about the marine environment and processes. These products are used to support, among others, the planning of daily operations at sea (fishing activities, nautical sports …), the management of coastal environment, crisis at sea, management of marine resources.

The role of the VI providers is to make their data available, the JERICO-NEXT WP5 role is to make these data visible and accessible. The specific goal of the Task 5.8 is to provide an extended review of the existing Virtual Access platforms/systems in order to find out to what extent the JERICO-NEXT activities could be supported.

To this end, the VIs listed in the WP6 where evaluated adopting an approach similar to the methodology proposed by the EMODnet Med Sea Check Point [1], and in particular to the "availability" indicators (AI).
More specifically the AIs indicate the degree to which the datasets are discoverable, accessible, ready for use, and obtainable (either directly or indirectly) from the JERICONEXT VIs.

To obtain datasets, information is needed on the data provider (visibility), how to access them (accessibility), and how fast the process is to take possession of them (performance).

The availability indicators (AIs) provide then, an understanding of the readiness and service performance of the infrastructure providing access to data.

[1] http://www.emodnet-mediterranean.eu/wp-content/uploads/2015/06/D11.2-revised-V11.pdf

The main results from the survey can summarized in the following points:

- A non-expert user can easily identify the proper Virtual Infrastructure landing page by means of a simple Google search, and, in general, Google is pointing to a more recent link than the one indicated in the WP6 JERICONEXT DOW. More specifically, usually, the VI landing page is in the first page of the Google search and is listed within the first 4- 5 links.

- A non-expert user cannot easily identify interoperability services on the VIs pages, ROOSs data portal page, but all of the ROOSs data portal are integrated into the infrastructure that deliver data to CMEMS and EMODnet Physics. If a dataset is not downloadable from the ROOSs data portal, it is available and downloadable from both CMEMS and EMODnet Physics (without restrictions for past 60 days and with authentication for older data).

- The JERICO-NEXT data portal, which resides under the EMODnet Physics data portal, is missing many of the VIs and VI datasets, and in particular it is missing more VIs and VIs datasets than CMEMS and EMODnet Physics.

- JERICO-NEXT VIs are not (easily) identifiable into the CMEMS products catalogue

- EMODnet Physics is missing the following VIs: NIVA NorFerry: MS Oslofjord (OF), MS Norønna (NO); FMI UTO: Uto; SMHI MOS: HFRadar; SYKE Alg@Line: Silja Victoria; NIVA NRS: NRS; IOBAS: Galata, Pomos.

- All of the ROOSs data portal (but the Arctic ROOS one) are showing data plots.

The results of the task 5.8 analysis may represent a valuable input to JERICO-NEXT partners as it is providing a (neutral) benchmark for their virtual services. The study offers interesting hints to increase the quantity and diversity of the web based traffic of the JERICO-NEXT VIs and JERICO-NEXT data portal.

More specifically the results of the JERICO-NEXT Task 5.8 can be summarized in the following recommendations:

1. JERICONEXT data portal (and EMODnet Physics) are making available platforms page with a unique URL and they both track visits on that URL: the JERICOPARTNER to use these PLATFORM URLs as formal link and citation

2. All of the infrastructures have to share a common way to track (unregistered) users and make this data available to providers and VIs.

3. VI providers have to keep their VIs link updated and visible at both their institute page and integrators level (e.g. JERICO-NEXT project, EuroGOOS ROOSs data portal, EMODnet Physics, etc)

4. “Term of use/citation” has to be more visible and linked with the virtual data

5. Access to Virtual Infrastructure means access to data, VIs have to provide the user with some exploitable data (e.g. csv/text file). Visualization tools are very important but they are limiting further use and exploitation of already recorded and qualified data

6. Integrators have to update their catalogues and make visible underlying/connected VIs

7. JERICO-NEXT portal and EMODnet Physics have to ingest the missing VIs: NIVA NorFerry: MS Oslofjord (OF), MS Norønna (NO); FMI UTO: Uto; SMHI MOS: HFRadar; SYKE Alg@Line: Silja Victoria; NIVA NRS: NRS; IOBAS: Galata, Pomos.

8. EuroGOOS ROOSs data portal would benefit from a more homogeneous user experience

2. Introduction

The JERICO-NEXT project aims at extending the EU network of coastal observations developed in JERICO (FP7) by adding new innovative infrastructures while integrating biogeochemical and biological observations. The main target of JERICO-NEXT is to provide the researchers with continuous and more valuable coastal data coupling physical and biological information.

In particular, WP5 has the main objective of enabling free and open access to data, by integrating all relevant coastal data and by facilitating their management through the JERICO Portal, EMODnet data systems (physical, chemical and biogeochemical) as well as other data management infrastructures, e.g. Copernicus Marine or EuroGOOS ROOSs data portal.

In this framework, the JERICO-NEXT partners will provide a large number of in-situ monitoring and numerical modelling infrastructures, with numerous marine observations and forecasting products for the coastal zone.

In WP5, a number of homogenization activities will enable a more efficient data flow from the different monitoring platforms. However, there is also a need for the JERICO-NEXT activities to be connected to a Virtual Infrastructure system that will provide not only the required interconnections but also the necessary background for building synthetic products based on original data.

In this task, an extended review of the existing Virtual Access platforms/systems has been carried out in order to find out to what extent the JERICO-NEXT activities could be supported. Apart from the specific requirements of the JERICO-NEXT products that will be gathered taking also into account the WP6 services, the study will also examine the technical background of each infrastructure and its ability to efficiently support a multi-node distributed system. Furthermore, suggestions for the full support of the JERICO-NEXT activities has been made together with a proposal for the suggested actions and adaptations

This document, i.e. D.5.16 Adapting JERICO NEXT activities to a Virtual Access Infrastructure: Survey on the existing technologies – needs and requirements for the adaptation, is presenting the basic definitions for Virtual Infrastructures, Virtual Access, JERICONEXT VIs and the main European ocean data integrators (i.e. EuroGOOS ROOSs, CMEMS and EMODnet Physics), the methodology of the study, the results and the conclusions.

3. Background and Definitions

3.1. Research Infrastructures (RI)

The term 'research infrastructures' refers to **facilities, resources and related services** used by the scientific community to conduct top-level research in their respective fields, ranging from social sciences to astronomy, genomics to nanotechnologies.

According the EU Commission[2], Research Infrastructures (RIs) are a key instrument in bringing together a wide diversity of stakeholders to look for solutions to many of the problems society is facing today.
RIs offer **unique research services** to users from different countries, attract young people to science, and help to shape scientific communities and play an increasingly important role in the advancement of knowledge and technology.

RIs help to create a new research environment in which all researchers - whether working in the context of their home institutions or in national or multinational scientific initiatives - have shared access to unique or distributed scientific facilities (including data, instruments, computing and communications), regardless of their type and location in the world.

RIs are at the center of the **knowledge triangle** of research, education and innovation, producing knowledge through research, diffusing it through education, and applying it through innovation.
Examples of RIs are: research installations, collections, special habitats, libraries, databases, biological archives, clean rooms, integrated arrays of small research installations, high-capacity/high speed communication networks, highly distributed capacity and capability computing facilities, data infrastructure, research vessels, satellite and aircraft observation facilities, coastal observatories, telescopes, synchrotrons and accelerators, networks of computing facilities, as well as infrastructural centers of competence which provide a service for the wider research community based on an assembly of techniques and know-how.

RIs may be '**single-sited**' (a single resource at a single location), '**distributed**' (a network of distributed resources), or '**virtual**' (the service is provided electronically).

A recent EC survey[3] showed that the European RIs are very recent (less than 10 years). These RIs have some common characteristics: the average construction costs (including recent upgrades) per facility amounts to 60 M€. Construction costs vary greatly from domain to domain, but there seems to be a minimum construction cost around 20 M€. The most widespread yearly operational cost (including administrative personnel and maintenance) of an RI in each and every domain is located in the 1-10 M€ range, equivalent to about 10% of the construction cost. More than 25 500 permanent scientists (lower estimate) are working in the 598 surveyed RIs, which represents typically 40 permanent scientists per facility without great variation between domains.

[2] http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=what

[3] Trends in European Research Infrastructures – report July 2007

3.2. Virtual Research Environment

Nothing can be created out of nothing" — Lucretius, De Rerum Natura

Europe has a long-standing tradition of excellence in research and innovation and European teams continue to lead the progress in many fields of science and technology. However, Europe's centres of excellence often fail to reach critical mass due to the absence of adequate networking and cooperation. Therefore, there is a need to **bring resources together** and build a research and innovation area equivalent to the EU's common market for goods and services.

Europe should guarantee **European researchers** access to the infrastructures they require to conduct their research – irrespective of the location of the infrastructure – and that the European approach to the development of new research infrastructures at the regional and transregional level, as well as the operation and enhancement of existing infrastructures, is supported.
To this end, Virtual Research Environments (VREs) have emerged as a way to match user (researcher) needs.
Starting from the FP7 the EU supported 429 Research Infrastructures, 173 are Virtual ones (e-infrastructures (http://observatory.rich2020.eu/rich/projects/browse)

VREs are designed to facilitate collaborative and individual research from public, academic and private institutes concerning using, handling, analysing and processing data into value-added data products, which can be integrated, visualised and published using common standards (e.g. OGS) and high-level visualisation services.

VREs offers a number of services that can connect in a common virtual space the data and dataset from different sources. There virtual environments offer an easy accessible place where data can be subset, extracted, displayed, integrated and augmented by individual researchers and groups of researchers to give added-value products and new insights.

VREs are usually based on infrastructure with high capacity and performance for big data processing and state-of-the-art web visualisation services. VREs make use of standards for wide interoperability, whilst respecting user privacy and differences in data policies

3.3. Virtual Access

"We live at a time when innovations present remarkable opportunities for new forms of education"
Jane den Hollander,Vice-Chancellor (President) Deakin University

New knowledge and, by implication, innovation, can only emerge from high-quality and accessible RIs, and so the (virtual) access to research infrastructure is of fundamental importance for making science, new discoveries, new developments, new assessment and disseminate new knowledge.

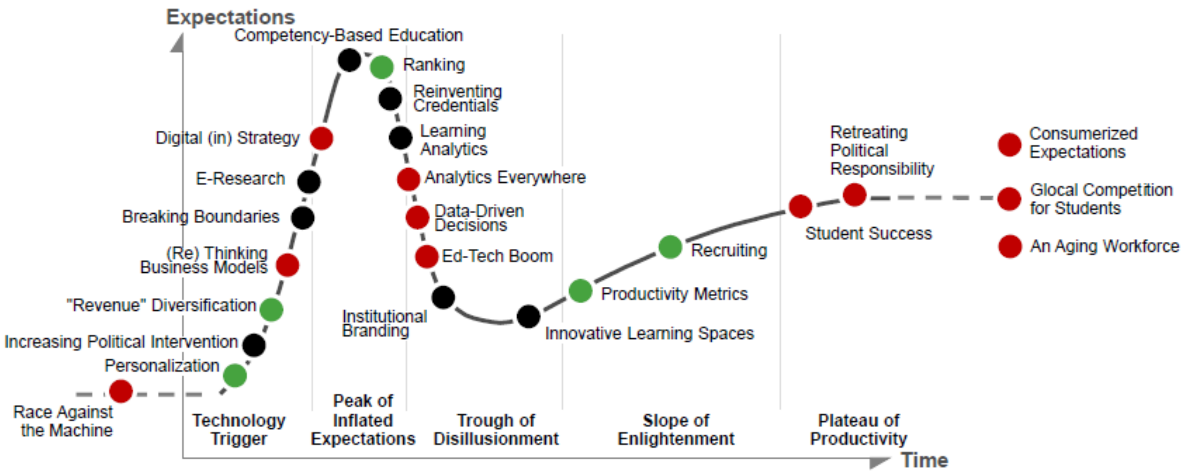

Figure 1. Hype cycle for higher education (science) tools/business

According the UE Commission definition, Virtual Access means:

> *"access to resources needed for research through communication networks without selecting or even identifying the researchers to whom access to resources is provided. Examples of virtual access activities are databases available via Internet, or data deposition services"*

Virtual Access ensures free of charge access to e-infrastructure, namely to:

- Sophisticated computer services;
- Powerful computers, networks, grids, repositories, databanks;
- Safely storing large quantities of scientific data;
- Participation in virtual research communities;
- World-class operational communication and computing infrastructure to facilitate scientific research.
- etc

3.4. Virtual Research Infrastructure in Europe

The RICH2020 is the Research Infrastructures Consortium for H2020, it promotes the effective implementation of the RI programme, supports transnational and virtual access to RIs and highlights the opportunities offered by Research Infrastructures - at the European and international level.

One specific scope of the action is to ensure that the RI programme becomes known and readily accessible to all potential applicants, irrespective of sector or discipline.

The RICH2020 host a database of the RIs projects, RIs, Organizations etc and it represents a key place for the visibility of a RI.

JERICONEXT is one of the 57 projects in the Environmental Science domain[4].

3.5. Rules for providing virtual access to research infrastructure

Access providers must provide access to research infrastructure or installations in accordance with the following conditions:

(a) Access which must be provided: The access must be free of charge, virtual access to research infrastructure or installations. ‘Virtual access’ means open and free access through communication networks to resources needed for research, without selecting the researchers to whom access is provided;

(b) Other conditions: The access provider must have the virtual access services assessed periodically by a board composed of international experts in the field, at least half of whom must be independent from the beneficiaries.

For further details on rules for providing virtual access to research infrastructure see JERICONEXT D.8.9.

3.6. Virtual Access to JERICONEXT Infrastructures

The JERICO-NEXT partners are providing a large number of in-situ monitoring and numerical modelling infrastructures, with numerous marine observations and forecasting products for the coastal zone. These data are usually collected, processed, qualified, used to make products, stored and made available via a virtual (research) environment (VRE), e.g. web infrastructure with high capacity and performance for big data processing and state-of-the-art web visualisation services.

VREs make use of standards for wide interoperability, whilst respecting user privacy and differences in data policies. The (virtual) access to research infrastructure is of fundamental importance for making science, new discoveries, new developments, new assessment and disseminate new knowledge.

In this framework, one specific scope of the WP5 – Data Management is to connect JERICONEXT to Virtual Infrastructure (VI) systems to make its data easy accessible and visible and create the basis for building synthetic products based on original data.

[4] http://observatory.rich2020.eu/rich/domains/view/Environmental%20Sciences

The infrastructures presently included in JERICO-NEXT VIs are already providing (or can provide in the future) a wide range of products aimed to support a much broader community comprising researchers, nautical communities, maritime and port authorities, local decision agents, economical agents, schools and general public. These products include real-time or archived data, operational forecasts or information about the marine environment and processes. These products are used to support, among the others, the planning of daily operations at sea (fishing activities, nautical sports, …), the management of coastal environment, crisis at sea, management of marine resources.

4. Survey on the JERICONEXT VIs

A digital ecosystem is a distributed, adaptive, open socio-technical system with properties of self-organization, scalability and sustainability inspired from natural ecosystems. - Wikipedia, 2016

In this section, an analysis of the JERICONEXT VAIs in terms of accessibility and usability is going to be presented and discussed. For this assessment, the methodology implemented by the EMODnet Mediterranean Check Point was adopted, adapted and applied.

4.1. Methods of the Survey

The specific goal of the Task 5.8 is to provide an extended review of the existing Virtual Access platforms/systems in order to find out to what extent the JERICO-NEXT activities could be supported.

To this end, the VIs listed in the WP6 where evaluated adopting an approach similar to the methodology proposed by the EMODnet Med Sea Check Point [5], and in particular to the "availability" indicators (AI).
More specifically the "availability" indicates the degree to which the datasets are ready for use and obtainable from the JERICONEXT Vis.

Apart from the specific requirements of the JERICO-NEXT products that will be gathered taking also into account the WP6 services, the study also examines the technical background of each infrastructure and its ability to efficiently support a multi-node distributed system (see AC indicator).

To obtain datasets, information is needed on the data provider (visibility), how to access them (accessibility), and how fast the process is to take possession of them (performance).

The availability indicators (AIs) provide an understanding of the readiness and service performance of the infrastructure providing access to data. The three classes of availability indicators are:

1) **Visibility (VI)**. This is the ability to get quickly on the appropriate site delivering the desired datasets and/or to reach the data provider when needed especially for a non expert. Visibility indicator also considers the possibility of identifying and quick accessing the appropriate site for the required data sets. According JERICO-NEXT DOW, the VA providers (will) make data more easily accessible, publicising availability of the data as well as broadcasting information through professional networks e.g. EuroGOOS Regional Observing Systems, EMODnet portals, etc. the VI indicator will then consider the EuroGOOS ROOS portals, Copernicus Marine Environmental Marine Service, the EMODnet portals, and other infrastructure if pertinent. This indicator also provides important information to JERICO-NEXT WP8 that has to develop the appropriate mechanism to publicize the offered VAIs services.

2) **Accessibility (AC)**. Accessibility conditions play a fundamental role in the capacity of an infrastructure to support efficiently a multi-node distributed system, as well as to feed different VREs/VIs. These include:
    - the services made available: manual ordering, on-line downloading, on-line downloading + advanced services (services or software to download for processing and viewing data)
    - the data policy: restricted, accessible under moratorium, unrestricted/open and free

[5] http://www.emodnet-mediterranean.eu/wp-content/uploads/2015/06/D11.2-revised-V11.pdf

- the cost basis
- the formats and semantic conventions : proprietary or standards and de facto standards
- (eg ODV), ISO/OGC compliant (WMS, WFS, WCS, NetCDF CF…) avoiding preliminary
- processing
- the interoperability of the on-line services (OGC standards…).

This indicator also considers the possibility, for non expert users, to understand the retrieval model status

3) **Performance (PE)**. This is the ability of a system to keep operating over time and to meet real time operational conditions. This is related to service performance and includes:
    - ***Reliability***: i.e. the ability of a system to keep operating over time. It means the service Website giving access to the services and the service (to request data) operates correctly and either does not fail or reports any failure to the service user for compensation. This quality element would require tests through time difficult to organize in sufficient numbers for all the sites in the framework of this study. Other approaches are highly dependent on the user perception of information such as the credibility of the data provider. We propose to base this evaluation on the existence of a service contract (Service Level Agreement) or commitment or charter.
    - ***Responsiveness***: It is related to response time (how long it takes to process a request), throughput (how many requests overall can be processed per unit of time), or timeliness (ability to meet deadlines, i.e., to process a request in a deterministic and acceptable amount of time). Based on previous studies (SeaDataNet, EMODnet Mediterranean Sea Check Point), distinction must be done between: immediate i.e. < 15mn (on-line downloading), less than 3 hours, less than 24 hours, less than 1 week, more. Note the degree of satisfaction can vary from one application to another and from one parameter to another.

For each AI class more sub-specific-indicators were defined as follow:

4.1.1. *Visibility Indicators*

Visibility is the ability to identify and quick access the appropriate site delivering the desired data sets. It is the ability for the user (not expert user as well) to perform data source into the web and the identified integrators of the VIs infrastructure. More specifically the evaluation is going to consider if the (data from the) VIs are:

1. Present into the JERICO-NEXT web page/data portal
2. listed into the first page of a google search
3. present into the EuroGOOS ROOS data portal
4. present into the EMODnet Physics
5. present into CMEMS

For each of the listed points two indicators will be considered:

AI.VI.1	VI and VI data Visibility
Meaning	Can VI or VI datasets be found easily?
evaluation	0/Low - dataset are not listed in the catalogue - dataset are not available in the infrastructure 1/Medium - listed generically, - no specific link to the VI data (either the VI or the data) 2/High - clearly listed and easily accessible (VI is mentioned, VI data are clearly available)
AI.VI.2	Term of use and citation
Meaning	Is the VI presenting a “term of use” and “citation info” of the original provider or VI?
	0/Low - the VI is not presenting any information 1/Medium - information available but incomplete (e.g. the integrating infrastructure is not clearly citing the VI or the provider) 2/High - information available and refers to either the VI or the provider

4.1.2. Accessibility Indicators

Accessibility is the ability of users, including non-experts, to understand how to retrieve/download data from either the VI or the integrating infrastructure.

AI.AC.1	Data Access
Meaning	Is the data accessible? Is any restriction applied?
	0/Low - data restricted, partially restricted 1/Medium - open and free data - accessible under authentication 2/High - open, free and unrestricted
AI.AC.2	Data Format
Meaning	Which data format are available?
	0/Low - custom format 1/Medium - csv file with comments and labels 2/High - netcdf, ODV, other standard formats
AI.AC.3	Interoperability Services
Meaning	Which interoperability service are available?
	0/Low - no interoperability service 1/Medium - file list on request, web table on request 2/High - Web services, OGC WFS, OGC WMS, THREDDS,

4.1.3. Performance Indicators

Performance indicates the ability of the system to keep operating over time (Reliability) and the timing of service delivery (Responsiveness). For the study, only the Responsiveness was considered.

AI.PE.1	Ability to access and download data in a given time window
Meaning	How responsive is the delivery service?
evaluation	0/Low - Data is not found, timeout problems, system is not completing the download 1/Medium - Data is found and delivered in near real time or less than 2 days 2/High - Real time data access (data view) and fast downloading service (a few hours)

4.1.4. Summary of the Indicators

The following table summarizes the defined indicators.

AI.VI.1	VI and VI data Visibility
AI.VI.2	Term of use and citation
AI.AC.1	Data Access
AI.AC.2	Data Format
AI.AC.3	Interoperability Services
AI.PE.1	Ability to access and download data in a given time window

4.2. Representation of Indicators for JERICONEXT VIs

Indicators provide both an overview of the situation at a high level of aggregation as well as detailed information about trends and links. The challenge is to find an appropriate balance between simplification and completeness.

To provide an easy and straightforward representation of indicators, allowing a non expert to easily assess the result of the analysis, the following "score table" was adopted:

- 0 – actions are suggested/required,
- 1 – limited actions are suggested/required,
- 2 – services are fit for use

When possible and pertinent, the results was integrated and given in percentage.

4.3. The JERICONEXT VIs

The JERICO-NEXT WP6 is aimed at providing free of charge "virtual access" to data and information from in situ systems such as HF radar, ferrybox and fixed platforms.

A user will access an infrastructure listed in the WP remotely via the internet to gain access to a service that delivers data or information and access can be shared simultaneously with more than one user.

Providers of Virtual Services will carry out their own outreach activities that include; improving visualization of data and information, making data more easily accessible, broadcasting information through professional networks (e.g. EuroGOOS Regional Observing Systems, EMODnet portals) and highlighting topical aspects of potential services (e.g. transboundary data sets).

Access to Virtual Services will be via the established web links. However, the disparate services will be grouped based on the EuroGOOS ROOS (Regional Operational Oceanographic Systems) regions. The ROOS portals will provide links to those Virtual Access services in their region. The JERICO-NEXT website will point users of Virtual Services to the ROOS's in order to access virtual services.

The JERICO-NEXT Vis included in WP6 and in the study are:

4.3.1. Arctic ROOS

Short name of participant: **NIVA**
Name of the infrastructure: NorFerry
Location: Baltic, North Sea, Atlantic Sea and Arctic areas.
Web site address: http://www.niva.no

Description of the infrastructure: The NorFerry infrastructure covers a network of 5 Ferrybox-systems in the Baltic, North Sea, Atlantic Sea and Arctic areas:

- MS Color Fantasy (FA), S Baltic Sea and North Sea
- MS Trollfjord (TF), N Atlantic and Barents Sea,
- MS Norbjørn (NB), Arctic Sea - Barents Sea
- MS Oslofjord (OF), North Sea, N Skagerrak

- MS Norønna (NO), North Sea and N Atlantic Sea

The infrastructure is used for physical, pelagic biodiversity, chemical (contaminants) and biogeochemical (marine acidification) studies, in particular it manages the following parameters: all FB systems have core sensors with thermosalinograph, inlet temperature sensor, oxygen, Chl-a fluorescence, turbidity and systems for water sampling.
FA has the additional fluorescence sensor of PAH, Pycocyanin and cDOM and a passive sampling system.
FA, TF, NB will have spectrophotometric pH and a membrane based pCO2 system end of 2014,
FA, TF has radiometers
TF has true wind sensors for improving the calculation of marine reflectance of the sea surface.

The measuring frequencies for the same area are daily for FA and OF, weekly for NO and NB and biweekly for TF (11 days return trip). With 1 minute datalogging approximately every 3-500 m along the ship track are measured.

Data will be uploaded from daily (near real-time) to weekly access on some of the ships.

Services currently offered by the infrastructure: The users will be given access to sensor data measured on-board and that are on-line after the QC has been performed (temp., salinity, oxygen, Chl-a Fluorescence, turbidity) and biogeochemical data when available).

Support offered under this proposal*:* The user can access support from NIVA researchers or technical staff, and data will be quality controlled.

4.3.2. NOOS

Short name of participant: **HZG**
Name of the infrastructure: COSYNA
Location: North Sea
Web site address: www.cosyna.de

Description of the infrastructure: The coastal observing system COSYNA includes three FerryBox systems in Southern North Sea, plus a stationary FerryBox in the Elbe Estuary (Cuxhaven), which are equipped with sensors for T, C/S, turbidity, DO, pCO2, pH, chlorophyll-a-fluorescence, nutrients (NOx, NO2, PO4, SiO2) and cooled water samplers. Three HF radar stations (WERA system) in the German Bight are operating at 10.8 MHz (Sylt and Büsum) and 12.2-13.5 MHz (Wangerooge).

Services currently offered by the infrastructure: The moving FerryBox systems and the stationary FerryBox (Cuxhaven) are delivering data in real or near-real time to the COSYNA data server which is offers open access to the data via internet connection.
All underway FB data are delivered in near-real-time to CMEMS services including data quality flags.

Support offered under this proposal*:* For ferrybox final physical data including statistical information and quality flags are accessible in real-time or near-real-time on the COSYNA database via internet. For all offered platforms users will be supported by interpretation and analysis of the data including raw data.

Short name of participant: **Cefas**
Name of the infrastructure: Jerico Datatool (JDT)
Location: Lowestoft UK
Web site address: http://www.jerico-fp7.eu/datatool/

Description of the infrastructure: coastal observatories include a wide range of sampling platforms (buoys, ferries, gliders, shore stations) that collect a range of different data types (mainly physical but also chemical and biological) over a wide range of time and space scales. The data is returned from platforms in delayed mode and also in some cases in real time via telemetry. Data is made available from some of these platforms to the Jerico Datatool.

Services currently offered by the infrastructure: The Jerico Datatool is a web application that enables integration of data from multiple platforms in order to provide a range of information for end users. Outputs include maps and graphs (e.g. time series) as well as data download in different formats (e.g CSV, KML) for use in other software packages.

4.3.3. BOOS

Short name of participant: **FMI**
Short name of participant: FMI
Name of the infrastructure: Utö

Description of the infrastructure: Uto Atmospheric and Marine Research Station is one of FMI's main marine and atmospheric observing sites. Atmospheric observations cover a wide range of meteorological, climate, sea-atmosphere gas exchange and air quality parameters. Marine observations include under-water flows, waves, physical state (T, S, ice cover) of the sea, algae, and nutrients. It is also the only fixed platform in the project frequently covered by sea ice, with online underwater observations. All atmospheric and most marine measurements (except some biological
observations to be completed in 2015) are operational.

Services currently offered by the infrastructure: Users will be given virtual access to data collected with instruments already installed.

Support offered under this proposal: Users are provided with quality ensured data, in monthly/daily files as soon as it is available. All data will be documented and available in simple ASCII format with read-me descriptions. Data and metadata is delivered through FMI open data portal (http://catalog.fmi.fi/geonetwork/srv/en/main.home) according to EU Inspire directive standards and procedures.

Short name of participant: **SMHI**
Name of the infrastructure: MOS (Marine Observation System)
Location: Gothenburg and Norrköping, Sweden
Web site address: www.smhi.se

Description of the infrastructure: The infrastructure consists of one ferrybox going from the Gulf of Bothnia, Baltic Proper to the southern Baltic; two advanced oceanographic off shore buoys, one in the Skagerrak and one in the Baltic Proper and6 advanced coastal buoys operated in cooperation with Swedish Universities.

Services currently offered by the infrastructure: Data access will be provided in near real time and in delayed mode. Parameters include salinity, temperature, chlorophyll fluorescence, turbidity, oxygen, pH, pCO2, wave height and direction, current speed and direction and also in air data on temperature, irradiation and air pressure. Also data from laboratory analyses of water samples are included, e.g. chlorophyll, salinity, CDOM, coloured dissolved organic matter, phytoplankton abundance and biodiversity. Data is distributed through the Baltic Operational Oceanographic System, BOOS, Copernicus MEMS and through the Swedish Oceanographic Data Centre at SMHI. Data is accessible through download and through web services. Data and metadata is delivered through SMHI systems for distributing oceanographic data, e.g. http://sharkdata.smhi.se according to EU standards and procedures.

Support offered under this proposal: Advice on the quality of data and answers to other questions will be offered through requests by e-mail. Users are provided with documented, quality ensured data.

Short name of participant: **SYKE**
Name of the infrastructure: SYKE-Alg@line
Location: BOOS. Baltic Sea – Helsinki, Finland -> Travemünde, Germany; Helsinki, Finland -> Stockholm, Sweden
Infrastructure type: Ferrybox
Web site address: http://www.itameriportaali.fi/en/tietoa/algaline_seuranta/en_GB/algaline_seuranta/

Description of the infrastructure: SYKE Alg@line project in the Baltic Sea monitors the state of the sea and detects algal blooms. Several millions of data points are collected annually from the Baltic Sea, using a fleet of 5-7 ferries. Ferries are equipped with a flow-through system with a thermosalinograph, chlorophyll, phycocyanin and CDOM fluorometers, turbidity meter and refrigerated sampling unit providing discrete water samples for laboratory analyses (e.g. microscopy, flowCAM, nutrients, optical analysis etc.). Additional sensors e.g. for primary production (FRRF) and light reflectance are used periodically, and new sensors for light absorption and pCO2 will be soon implemented. Data can be retrieved in real time using satellite or GSM connection (basic sensors) or downloaded during harbour visits (additional sensors).

Services currently offered by the infrastructure: Alg@line data is available through the CMEMS data portal and has also been delivered to users based on mutual cooperation via ftp. Data can be visually inspected on the project website.

Support offered under this proposal: Users will be assisted in data analysis and data interpretation.

Short name of participant: **NIVA**
Name of the infrastructure: NIVA Research Station - NRS
Location: Oslofjord, Norway.
Web site address: www.niva.no

Description of the infrastructure: The NIVA Research Station at Solbergstrand performs large-scale experiments in marine ecology, sediment research, biogeochemistry, and aquaculture, and tests technology for treating ballast water. Facilities at Solbergstrand covers e.g. hard-bottom and soft-bottom mesocosoms, brackish water systems, seaweed and kelp communities, pelagic communities from the upper water depths and continuous water supply from surface and 60 meter with measurements on temperature and salinity. From 2015 new biogeochemical sensors will be implemented (pH, pCO_2 and different fluorescence sensors).

Services currently offered by the infrastructure: The research station hosts visiting researchers to do research on marine ecology, marine biology, biogeochemistry and testing of advances carbon systems sensor. Many national and international projects have taken advantage of the station, and research groups have visited the stations for instance to study the effects of hard-bottom communities for oil exposure and eutrophication and effects on soft bottom organisms on high CO_2 and variable pH systems. In early 2015 the research station will also offer virtual access to sensor data from water intakes from the Oslo fjord from surface to 60 meters depth including salinity, temperature and new
biogeochemical data for climate studies.

Support offered under this proposal*:* NIVA staff will support via data QC and setup of remote data access.

4.3.4. MONGOOS

Short name of participant: **CNR-ISMAR**
Name of the infrastructure: LiSO-HFR (Ligurian Sea HF Radar Observing Network)
Location: Ligurian Sea (presently situated in Adriatic Sea, to be relocated in the Ligurian Sea within 2015)
Web site address: http://radarhf.ismar.cnr.it

Description of the infrastructure: 4 SeaSonde CODAR HF radar system, used to monitor surface currents and transport in coastal areas with extensive spatial coverage (30-100km) and high temporal resolution (30 minutes).

Services currently offered by the infrastructure: The system currently provides map visualisation and animation for a quick insight into the evolution of currents. Data access services are presently under implementation and they will be available within JERICO.

Support offered under this proposal: Support for data access and download: example scripts will be provided to the interested users. Algorithm description and scripts will be provided together with test cases to assess algorithm setup.

Short name of participant: **HCMR**
Name of the infrastructure: POSEIDON
Location: Aegean Sea, Cretan Sea
Web site address: http://poseidon.hcmr.gr/

Description of the infrastructure: POSEIDON system is a monitoring, forecasting and information system for the Greek Seas. The coastal observing part of the system consists of three oceanographic stations that are deployed in Saronikos gulf. A series of atmospheric parameters such as the wind speed and direction, the atmospheric pressure and the air temperature are recorded in all stations together with a number of surface marine parameters such as waves, sea surface temperature and salinity, current speed and direction. In the Northern Aegean and the Cretan Sea, temperature and salinity recordings are collected for the first hundred meters while in the Cretan Sea biochemical data (chlorophyll-A, dissolved oxygen) down to the same depth are also collected. The last two years, a ferrybox system has been installed in a high-speed ferry in the Piraeus-Heraklion route, providing data about the sea surface temperature and salinity, chlorophyll-A, dissolved oxygen and turbidity of the Southern Aegean Sea. The forecasting module of the POSEIDON system consists of four numerical models that provide in daily basis forecasts regarding the atmospheric, sea state, hydrodynamic and ecological conditions of the Greek Seas.

Services currently offered by the infrastructure: The POSEIDON Database that contains the physical, chemical and biological data recorded by the oceanographic stations is available online, offering also downloading functions for the whole data set. The data are released both in real-time and delayed modes, providing data in different level of processing. The POSEIDON Live Access Server (LAS) is a friendly-to-use graphical interface for accessing the results of all the POSEIDON forecasting models for the last five years. Using this advanced service, the user can select specific areas for a certain period of time and display or download the model results, plot vertical transects over a period of time, produce time-series for specific points in the model's domain area, etc. This service is advancing the use of the numerical model outputs by providing the online tools for efficient processing.

Support offered under this proposal: Information about data collection and processing will be available. The implementation of the different level of Quality Control procedures will be highlighted and explained: The real-time time QC procedures, the delayed mode analysis and the validation procedures with reference to the recent climatology will be explained in order to be evident the different level of processing and the production of different data sets. Regarding the online processing of numerical model results, detailed instructions will be available to users in order the variety of options
that are offered for the analysis of the models data to be efficiently applied. Furthermore, a helpdesk service will be introduced that will be able to answer the user's queries offering guidance and support both in scientific and technical issues.

Short name of participant: **SOCIB**
Name of the infrastructure: SOCIB Multi-Platform Ocean Observing and Forecasting System
Location: Balearic Islands
Web site address: www.socib.es

Description of the infrastructure: SOCIB operates a multi-platform coastal to open ocean observing system in the Balearic Islands in the Western Mediterranean Sea. The SOCIB Data Centre Facility provides access to the observations and sensors available from the different SOCIB Facilities within the observing network, including: HF radar, gliders, drifting buoys and profilers, fixed stations (sea level, coastal stations, weather stations, oceanographic deep and coastal moorings), beach monitoring stations (images from real time cameras, beach morphology and weather variables).
SOCIB provides free and open access to all the observing and modeling facilities data, for example:

- The HF Radar Ibiza Channel: provides surface currents on a 3 km-resolution grid at hourly intervals, with a range up to 74~km (40 nautical miles).
- The Ibiza Channel Fixed Station/mooring located in a biodiversity international hot spot: made up of a weather station, a wave recorder, a multi-parameter probe (oxygen, chlorophyll, turbidity) at 1 m, a current profiler at 5 m, a temperature recorder at 5 m, and three conductivity and temperature recorders at 20, 60 and 95 m.
- The Bay of Palma Buoy located in a key touristic area: made up of a weather station, a wave recorder, a multiparameter probe (oxygen, chlorophyll, turbidity) at 1 m, a current meter at 1 m, and a current profiler at 2 m.

Services currently offered by the infrastructure: the SOCIB Data Centre Facility undertakes the provision of different types of data from the multiplatform observing systems to scientists and society (e.g. Search and Rescue Operators such as SASEMAR (HF radar hourly data)). Specific products and services (e.g. Seaboards http://seaboard.socib.es) have been designed and are made available for specific end users.

Support offered under this proposal: the SOCIB Data Centre Facility will make available quality controlled data in a standard format (NetCDF CF-compliant), also support is provided for discovery, cataloguing, visualization and download of the corresponding data files.

Short name of participant : **CNRS**
Name of the infrastructure : Environment Observable Littoral
Location : Ligurian Sea
Web site address : http://www.obs-vlfr.fr/Innovations/EOL/

Description of the infrastructure : This autonomous platform is deployed at the mouth of the bay of Villefranche-sur-mer, (43°40'54.16"N; 07°19'10.48"E). It is moored over rocky bottom depth of 90 m. As no continental platform is present in this area, this site is under offshore influences, for physical parameters as well as for biological ones. Its equipment comprises: a meteorological station (station Vaisala WXT 520), a winch dedicated to ctd (temperature and salinity at the moment, extension to others sensors in the future) profiles. Core oceanographic parameters (temperature, salinity, fluorescence, dissolved oxygen) are acquired with a SeaBird SBE19 on an hourly basis at a fixed depth (1.5 m). A fixed pH sensor is deployed in a developmental phase of validation.

Services currently offered by the infrastructure: This structure, newly deployed, contributes to the network SOMLIT within its "High Frequency Acquisition" part. Validated time series data will be provided to the user community (scientists, policy makers, etc.). As this platform is closed to a historical sampling site (Point B site, weekly sampling since 1957 of physical, chemical and biological parameters), it provides high frequency data that continue a long multi-parametric time series. This infrastructure is available for researchers to conduct projects on ecosystems dynamics as well as on the evolution of the Mediterranean Sea within the context of climatic changes and/or anthropogenic forcing.

Support offered under this proposal: The data will be available on line according to a data access policy. Information about data collection, processing, etc. will be made available.

4.3.5. Black Sea GOOS

Short name of participant: **IO-BAS**
Name of the infrastructure: Bulgarian National Oceanographic Marine Observing System (NOMOS)
Location: Western Black Sea
Web site address: http://www.bgodc.is-bas.bg

Description of the infrastructure: NOMOS is a system designed to allow the real-time assessment of weather and marine conditions in the western part of Black Sea. It consists of several subsystems. The main goal of NOMOS is to support sustainable development of the Bulgarian Black Sea coast and EEZ. The proposed NOMOS's installations within JERICO-NEXT project are:

- Installation 1, Galata platform is located in western part of the Black Sea on the Bulgarian shelf 26 km east from the city of Varna. The measuring system comprises a weather station, water temperature, conductivity, DO, pH, chlorophyll sensors and ADCP.
- Installation 2, Port Operational Marine Observing System is a network of distributed sensors and centralized data collecting, processing and distributing unit. The parameters measured by POMOS are: wind speed and direction, temperature, humidity, atmospheric pressure, visibility, solar radiation, water temperature and salinity, sea level, currents speed and direction, significant wave height.
- Installation 3, Shkorpilovci coastal station is located about 40 km south from Varna. The measuring system consists of weather station, sea level gauge, UV radiation, total solar radiation sensors and ADCP on 18 depth. Installation 4, BulSel is the Bulgarian sea level service. The system is equipped with MIROS and VEGA plus altimeters.

Services currently offered by the infrastructure: The service that we offer for the VA is a real time access to data of all or selected platforms and sensors. The majority of in situ data that are commonly used for monitoring of the Black Sea are based on near-shore monitoring programmes or irregular cruises that provide either non-synoptic, coarse resolution realizations of large scale processes or detailed, but time and site specific snapshots of local features. These gaps can be filled in by data obtained from real time observing infrastructures that provide information with sufficiently high temporal frequency.
Data is freely available thought the NASA web site http://aeronet.gsfc.nasa.gov. Parts of the NOMOS data are distributed thought the CMEMS and SeaDataNet data portals.

Support offered under this proposal: Data quality control, data analysis.

4.3.6. IBI ROOS

Short name of participant: **AZTI**
Name of the infrastructure: BHFR (Basque HF Radar)
Location: SE Bay of Biscay
Web site address:
http://www.euskalmet.euskadi.net/s075853x/es/meteorologia/selsensorR.apl?e=5&cod_esta=R096

Services currently offered by the infrastructure: Access through WMS/WFS and web services and through European data infrastructure (EuroGOOS). This infrastructure offers many benefits for the Basque Operational Oceanography Network such as: the improvement of the knowledge about surface currents and their forcing physical processes, marine safety, search and rescue, pollution response, validation and calibration of both hydrodynamic and pollutant drift forecasting models, data assimilation on progress, etc.

Support offered under this proposal: The access to raw radial data and processed 2D surface currents will be offered to the users for scientific and applied purposes (Coastal processes, marine safety, search and rescue, pollution response, etc).

Outreach to new users: Diffusion in European data Infrastructure through ROOSs structure: EMODnet Physics.

Short name of participant: **CNRS**
Name of the infrastructure: SPI-S (Sediment Profile Imagery Software)

Location:Arcachon, France
Web site address: http://spiarcbase.epoc.u-bordeaux1.fr/

Description of the infrastructure: Sediment Profile Imagery (SPI) provides a sound and cost effective alternative to classical fauna analysis in assessing the ecological quality of benthic habitats composed of cohesive sediments (Labrune et al 2012). These characteristics confer to this technique a high potential in the development of long term monitoring project over large spatial scales such as requested by the WFD and even more so by the MSFD. This technique however still suffers from the complexity and the nature which is derived from images, which makes it highly operator-dependent. Along this lines, the CNRS has developed a software (i.e., SPIArcBase) specifically designed for the semi-automated analysis of SPI during the I3 project JERICO (Romero et al 2013).

Services currently offered by the infrastructure: Within JERICONext, we will go one step further and will make the software available online, together with a technical assistance to its use, as a virtual access service. The objectives by doing so are to: (1) enlarge the community of SPIARcBase users, (2) in return pursuing the improvement of the software by improving its components based on "learning" approaches (eg computation of the apparent Redox Potential Discontinuity), and (3) provide a complete and comprehensive service offer regarding SPI in relation with the TNA that JERICO Next is also providing to new field deployments of the SPI hardware (cf. WP7).

Support offered under this proposal: Assistance in use of software, image interpretation and computation of ecological quality indices.

Short name of participant: **IH**
Name of the infrastructure: MONICAN (Monitoring of Nazare Canyon)
Location: Nazare, Portugal
Web site address: http://monican.hidrografico.pt/

Description of the infrastructure: Fixed point observing system comprised of:

- MONICAN 1 - a real-time multiparametric buoy moored over bottom depths of 2100m and equipped with a wave sensor, a 3m height meteorological mast (anemometer, air pressure, air temperature and relative humidity), sensors for temperature, fluorescence-chlorophyll, dissolved O2 and oil-spill at 1m below surface, sensors for temperature at 20m, 50m,100m and 200m below surface, ADCP with currents at 32 bins depths from 12m to 105m (3m resolution);
- MONICAN 2 - a real-time multi-parametric buoy moored over bottom depths of 90m and equipped with a wave sensor, a 3m height meteorological mast (anemometer, air pressure, air temperature and relative humidity), sensors for temperature, fluorescence-chlorophyll, turbidity, dissolved O2 at 1m below surface, ADCP with currents at 32 bins from 12m to bottom (3m resolution); 2 radar tide gauges (type Vegapuls61), one installed in the port of Nazare and the second one installed in the port of Peniche, each one measuring sea level with a sampling interval of 1 minutes.

Services currently offered by the infrastructure: Real-time data from 4 fixed platforms, derived products (6 hourly observations and forecasts), archived reprocessed data (for each 6 month periods). Data available via IH webpage, presently in graphic and table form but formats will be extended as part of the proposed service.

Support offered under this proposal: a) Reports with information about real-time data for each platform (types of sensors, existing processing, existing QC) b) For archive data, reports on processed data; c) helpdesk for users.

Short name of participant: **Ifremer**
Name of the infrastructure: Eulerian observatory network data service
Location: Brest, FRANCE
Web site address: http://www.coriolis.eu.org/Data-Services-Products/View-Download/Eulerian-networks-fixed-buoys

Description of the infrastructure: The infrastructure relies on the CORIOLIS data management system which gathers expertise on IT technologies, marine data management and quality control for both open ocean (e.g. ARGO, MYOCEAN now CMEMS) and shallow water (JERICO1, RECOPESCA, PREVIMER) observations. The observatories currently managed by the data service infrastructure sea level, river flows and ocean physics (temperature, salinity).

Services currently offered by the infrastructure: The Eulerian observatory network data service provides to operators of observatories and data users:

- ingestion (collection and integration) of the raw data flows from the transmission system of the platform and long term archive in CORIOLIS database
- quality control by automated and manned visual processes by experts managing various water column observations in sismer/coriolis team at Ifremer.
- Advanced web interface for near real time dissemination with subsetting of the controlled datasets with visualisation and download (csv and netcdf) function. Users need to be authenticated to download datasets

Support offered under this proposal*:* The SISMER/CORIOLIS team will consider the new observatories to be managed by the infrastructure so that their data are collected and loaded (ingested) in real time or near real time in the CORIOLIS database. The new data flow will be qualified in real time through automated procedure. The observations may also be visually qualified by an expert in near real time or delayed mode depending on the requirement for the user's observatory. The data are disseminated (visualization, download) through the web interface.

4.4. Summary of the JERICONEXT VIs

The following table summarizes the Vis

Id	VI provider	VI Name	VI Primary Link
1	NIVA	NorFerry	http://www.niva.no
2	HZG	COSYNA	www.cosyna.de
3	CEFAS	JDT	http://www.jerico-fp7.eu/datatool/
4	FMI	UTO	http://catalog.fmi.fi/geonetwork/srv/en/main.home
5	SMHI	MOS	http://sharkdata.smhi.se
6	SYKE	SYKE-Alg@line	http://www.itameriportaali.fi/en/tietoa/algaline_seuranta/en_GB/algaline_seuranta/
7	NIVA	NIVA Research Station - NRS	www.niva.no
8	CNR-ISMAR	LiSO-HFR	http://radarhf.ismar.cnr.it
9	HCMR	POSEIDON	http://poseidon.hcmr.gr/
10	SOCIB	SOCIB	www.socib.es
11	CNRS	Environment Observable Littoral	http://www.obs-vlfr.fr/Innovations/EOL/
12	IO BAS	NOMOS	http://www.bgodc.is-bas.bg
13	AZTI	BHFR	http://www.euskalmet.euskadi.net/s075853x/es/meteorologia/selsensorR.apl?e=5&cod_esta=R096
14	CNRS	SPI-S (Sediment Profile Imagery Software)	http://spiarcbase.epoc.u-bordeaux1.fr/
15	IH	MONICAN	http://monican.hidrografico.pt/
16	IFREMER	Eulerian observatory network data service	http://www.coriolis.eu.org/Data-Services-Products/View-Download/Eulerian-networks-fixed-buoys

5. Indicator Results and Conclusions

As described in the previous section the survey evaluated the JERICO-NEXT VIs by means of the defined indicators. Indicators were built for the link provided within the DOW, google search, JERICO-NEXT portal, the specific EuroGOOS ROOS data portal, Copernicus Marine Environment Monitoring Service, and EMODnet Physics. This section presents the main results and discussion.

5.1. Web Search

A not expert user is likely to search the VI by means of a web search. In our study, we only considered a Google search. The input line was the full name of the Virtual Infrastructure as described in the JERICO-NEXT DOW, e.g. for the NorFerry we asked Google to search "NIVA NorFerry".
The purpose of this specific exercise was to answer to:

- "Is the Virtual infrastructure listed in the first result page of a google search?"
- "Is this link, linking to the proper VI page?"

The result was AV.VI.1 = 84%, meaning that a not expert user can almost easily be redirected to the proper Virtual Infrastructure landing page. One result is that Google provides very updated links (see next section).
In some cases, the Google search also provided direct link to the VI data AV.AC.1 = 38%

5.2. VI Primary link.

AI.VI.1	VI and VI data Visibility	72%
AI.VI.2	Term of use and citation	41%
AI.AC.1	Data Access	59%
AI.AC.2	Data Format	100%
AI.AC.3	Interoperability Services	28%
AI.PE.1	Ability to access and download data in a given time window	41%

When user is looking for the VI, the "primary link" should be the easiest and fastest means to identify and access the Virtual Infrastructure.

AI.VI.1 indicates that some of the links are not correctly linking the VI. In some cases we found the provided link to open the institute page (e.g. in case of NIVA – NorFerry the proper link would be: http://www.niva.no/en/miljoedata-paa-nett/ferrybox-og-satellittdata), some links are not working (e.g. http://www.jerico-fp7.eu/datatool/), some links maybe updated to point more recent and updated pages (e.g. https://www.finmari-infrastructure.fi/field-stations/uto-fmi/).

AI.VI.2 indicates if and how easy is to find the "term of use" and/or "citation" for the given VI. The result suggest that many of the VI are missing/hiding this information.

AI.AC.1 indicated that VI have to work to make data more accessible. To note that most of the VI are providing plots, some are providing both plots and data (data download may require authentication), some (41%) neither plots nor data.

AI.AC2 is only considering the VIs that made data downloadable. All the VI are supplying data in a common format or standard.

AI.AC 3 indicates that it is not easy to identify interoperability services on the VI page. To note that most of the VI are providing data to EuroGOOS ROOS data portal[6] (63%), CMEMS (81%) and EMODnet Physics[7] (88%) so the interoperability services[8] exist and are properly working. The indicator also suggests that VIs pages have to make more evident the presence of interoperability services and how - where user can access them.

AI.PE.1 indicates that if the user tries to download, often (58%) data are not found/available for download. To note that, as indicated for AV.AC.3, the JERICO-NEXT data are available and downloadable from both CMEMS and EMODnet Physics (without restrictions for past 60 days and with authentication for older data).

5.3. JERICO-NEXT data portal (under the EMODNET Physics data portal).

AI.VI.1	VI and VI data Visibility	28%
AI.VI.2	Term of use and citation	50%
AI.AC.1	Data Access	53%
AI.AC.2	Data Format	100%
AI.AC.3	Interoperability Services	34%
AI.PE.1	Ability to access and download data in a given time window	100%

Although the JERICO-NEXT data portal is based on the EMODnet Physics infrastructure, the number of the available VIs and VI datasets is very limited: AI.VI.1 = 28% and AI.AC.1 = 53% indicate that most of the JERICO-NEXT VI datasets are missing (i.e. they have not the JERICO-NEXT label).

Visibility would increase if the VI were listed in the selection filters of the JERICO-NEXT data portal.

AI.VI.2.JERICO-NEXT is cited when accessing the dataset, term of use and citation are more difficult to be identified. AI.AC.2 and AI.PE.1 were evaluated on the available datasets.

Only expert user can find the JERICO-NEXT data portal interoperability services (AI.AC.3 = 34%)

[6] To note that in some ROOS (e.g. ARCTIC) the data portal is under development. EuroGOOS ROOS data portals, CMEMS and EMODnet Physics are sharing the same backbone infrastructure and so the same data

[7] EMODnet Physics is alredy integrating HFR data that are not in the CMEMS yet. CMEMS is now running a Service Evolution project (INCREASE) to integrate and validate the HFR data flow infrastructure developed under a EuroGOOS and EMODnet Physics pilot for HFR

[8] ftp data transfer

5.4. EMODnet Physics.

AI.VI.1	VI and VI data Visibility	72%
AI.VI.2	Term of use and citation	38%
AI.AC.1	Data Access	75%
AI.AC.2	Data Format	100%
AI.AC.3	Interoperability Services	75%
AI.PE.1	Ability to access and download data in a given time window	100%

AI.VI.1. EMODnet Physics is listing the provider or the VI dataset (e.g. platform) but the VI itself is not evident (e.g. user cannot find the NorFerry or Alg@line VIs, the user can easily find the ferryboxes belonging and operating for that VIs). The SPI-S is out of EMODnet scope. To note that EMODnet Physics is making available some CEFAS datasets but they are likely to be a subset of the JDT.

AI. VI.2. If a platform is participating to JERICO-NEXT, EMODnet Physics is acknowledging the project. The user would benefit from an easier link to the "term of use/citation" information: this information is presented in the EMODnet Physics landing portal, and it should be available/linked in the platform and plots pages.

AI.AC.1. Some of the WP6 listed platforms are missing in EMODnet Physics:
NIVA NorFerry: MS Oslofjord (OF), MS Norønna (NO); FMI UTO: Uto; SMHI MOS: HFRadar; SYKE Alg@Line: Silja Victoria; NIVA NRS: NRS; IOBAS: Galata, Pomos.

AI.AC.2 and AI.PE.1 were evaluated on the available datasets only. If a dataset is available in EMODnet Physics, it is in a standard format and downloading services take a few minutes (at most) to deliver data.

AI.AC.3 EMODnet Physics provides full set of interoperability services (Web services, WMS, WFS, etc.). Not-expert user may take a while to find information as it is only presented and linked in the EMODnet Physics landing page.

VI provider	VI Name	EMODnet Physics links to the VI
NIVA	NorFerry	http://www.emodnet-physics.eu/map/DefaultMap.aspx?sessionid=636205967719309831
HZG	COSYNA	http://www.emodnet-physics.eu/map/DefaultMap.aspx?sessionid=636202679892496894
CEFAS	JDT	http://www.emodnet-physics.eu/map/DefaultMap.aspx?sessionid=636202699737611970 links to CEFAS platforms and not to JDT
FMI	UTO	Supposed to be: http://www.emodnet-physics.eu/map/DefaultMap.aspx?sessionid=636202712340062789
SMHI	MOS	http://www.emodnet-physics.eu/map/DefaultMap.aspx?sessionid=636202726193455158
SYKE	SYKE-Alg@line	http://www.emodnet-physics.eu/map/DefaultMap.aspx?sessionid=636202728285234800
NIVA	NIVA Research Station - NRS	Supposed to be: http://www.emodnet-physics.eu/map/DefaultMap.aspx?sessionid=636205967719309831

CNR-ISMAR	LiSO-HFR	http://www.emodnet-physics.eu/map/DefaultMap.aspx?sessionid=636205968959300755
HCMR	POSEIDON	http://www.emodnet-physics.eu/map/DefaultMap.aspx?sessionid=636205969743435605
SOCIB	SOCIB	http://www.emodnet-physics.eu/map/DefaultMap.aspx?sessionid=636241611363960224
CNRS	Environment Observable Littoral	http://www.emodnet-physics.eu/map/DefaultMap.aspx?sessionid=636204231112611610
IO BAS	NOMOS	http://www.emodnet-physics.eu/map/DefaultMap.aspx?sessionid=636205976312761349
AZTI	BHFR	http://www.emodnet-physics.eu/map/DefaultMap.aspx?sessionid=636205972756817960
CNRS	SPI-S (Sediment Profile Imagery Software)	http://www.emodnet-physics.eu/map/DefaultMap.aspx?sessionid=636205977105386684
IH	MONICAN	http://www.emodnet-physics.eu/map/DefaultMap.aspx?sessionid=636205971474834635
IFREMER	Eulerian observatory network data service	http://www.emodnet-physics.eu/map makes the EONDS available but a specific filter would facilitate to identify it

5.5. CMEMS

AI.VI.1	VI and VI data Visibility	-
AI.VI.2	Term of use and citation	-
AI.AC.1	Data Access	56%
AI.AC.2	Data Format	100%
AI.AC.3	Interoperability Services	100%
AI.PE.1	Ability to access and download data in a given time window	100%

AI.VI.1 JERICO-NEXT VIs are not easily identifiable into the CMEMS products catalogue. It presents a general acknowledgement: "data provided by EUROGOOS regional systems and national data providers"
AI.VI.2 CMEMS portal is presenting and describing the CMEMS "term of use"/"citation"
AI.AC.1 CMEMS is not integrating HFRadar yet, and it is missing the same WP6 datasets as EMODnet Physics

AI.AC.2, AI.AC.3 and AI.PE.1 were evaluated on the available datasets only. If a dataset is available in CMEMS, it is in a standard format and downloading services take a few minutes (registered users) to deliver data. To note that CMEMS offers service desk to support not-expert users with their queries.

VI provider	VI Name	CMEMS links to the VI
NIVA	NorFerry	http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&view=details&product_id=INSITU_ARC_NRT_OBSERVATIONS_013_031
HZG	COSYNA	http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&view=details&product_id=INSITU_NWS_NRT_OBSERVATIONS_013_036
CEFAS	JDT	
FMI	UTO	Supposed to be: http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&view=details&product_id=INSITU_BAL_NRT_OBSERVATIONS_013_032
SMHI	MOS	http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&view=details&product_id=INSITU_BAL_NRT_OBSERVATIONS_013_032
SYKE	SYKE-Alg@line	http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&view=details&product_id=INSITU_BAL_NRT_OBSERVATIONS_013_032
NIVA	NIVA Research Station - NRS	Supposed to be: http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&view=details&product_id=INSITU_ARC_NRT_OBSERVATIONS_013_031
CNR-ISMAR	LiSO-HFR	
HCMR	POSEIDON	http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&view=details&product_id=INSITU_MED_NRT_OBSERVATIONS_013_035

SOCIB	SOCIB	http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&view=details&product_id=INSITU_MED_NRT_OBSERVATIONS_013_035
CNRS	Environment Observable Littoral	Supposed to be: http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&view=details&product_id=INSITU_GLO_NRT_OBSERVATIONS_013_030
IO BAS	NOMOS	http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&view=details&product_id=INSITU_BS_NRT_OBSERVATIONS_013_034
AZTI	BHFR	
CNRS	SPI-S (Sediment Profile Imagery Software)	
IH	MONICAN	http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&view=details&product_id=INSITU_IBI_NRT_OBSERVATIONS_013_033
IFREMER	Eulerian observatory network data service	http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&view=details&product_id=INSITU_GLO_NRT_OBSERVATIONS_013_030

5.6. EuroGOOS ROOS data portal

The study considered the following EuroGOOS data portal:

- Arctic ROOS: http://webprod1.nodc.no/arctic-roos/arctic-roos.html
- BOOS: https://www.google.com/maps/d/viewer?mid=1QIxOHN5wkZBBg5UZPKIyv7TCeIw&hl=en&usp=sharing
- NOOS: http://nwsportal.bsh.de/
- MONGOOS: http://www.mongoos.eu/data-center
- IBI ROOS: http://www.ibi-roos.eu/Access-to-data

For the EuroGOOS ROOSs data portal it was difficult to apply the indicators as they are working and presenting data in very different ways.

The Arctic ROOS data portal is only showing the position of datasets but it is not providing neither the provider details nor data plots. The NOOS data portal offers features to search for a specific platform and once identified, it offers full metadata description, plots and downloads (authentication is required). The MONGOOS data portal provides plots and full information about data provider, but does not provide download services. The IBI ROOS data portal offers plots and redirect to CMEMS to download data.

All of the ROOSs data portal (but the Arctic ROOS one) are showing data plots.

A not-expert user cannot easily identify interoperability services on the ROOSs page, but all of the ROOSs data portal are integrated into the infrastructure that deliver data to CMEMS and EMODnet Physics. If a dataset is not downloadable from the ROOSs data portal, it is available and downloadable from both CMEMS and EMODnet Physics (without restrictions for past 60 days and with authentication for older data).

To note that EuroGOOS has initiated a process to facilitate cooperation in the Black Sea region. Bringing together all main oceanographic institutes in the Black Sea, EuroGOOS works towards gaining an understanding of the current Black Sea observing system and forecasting capability, evaluating the sustainability of the systems, and jointly considering next steps to address challenges and strengthen cooperation in the Black Sea. Data portal is provided by EuroGOOS in cooperation with EMODnet Physics and CMEMS.

5. Discussion

At European level, the concept of virtual access was introduced because "***only virtual services widely used[1] by the community of European researchers will be supported***".

Task 5.8 and the developed analysis may represent a valuable input to JERICO-NEXT partners as it is providing a (neutral) benchmark for their virtual services.

One specific goal of task 5.8 was to provide feedback to WP6 and VI providers:

The WP6 VIs are eligible for funding under the JERICO-NEXT remit for supporting the dissemination of web based, easily accessed information for European waters. Whilst the value of all the virtual access sites are recognised and are a key component in the delivery of a European wide observatory network, the scale of the funds is going to be assessed and reported using a set of evaluation criteria. Among the others, an evaluation criterion is going to assess "the quantity and diversity of the web based traffic".

To this end, the VIs listed in the WP6 where evaluated adopting an approach similar to the methodology proposed by the EMODnet Med Sea Check Point [9], and in particular to the "availability" indicators (AI).
More specifically the AIs indicate the degree to which the datasets are discoverable, accessible, ready for use, and obtainable (either directly or indirectly) from the JERICONEXT VIs.

To obtain datasets, information is needed on the data provider (visibility), how to access them (accessibility), and how fast the process is to take possession of them (performance).

The availability indicators (AIs) provide then, an understanding of the readiness and service performance of the infrastructure providing access to data.

The main results from the survey can summarized in the following points:

- A not expert user can almost easily be redirected to the proper Virtual Infrastructure landing page by means of a simple Google search, and, in general, Google is pointing to a more recent link than the one indicated in the WP6 JERICONEXT DOW.

- A not-expert user cannot easily identify interoperability services on the VIs pages, ROOSs data portal page, but all of the ROOSs data portal are integrated into the infrastructure that deliver data to CMEMS and EMODnet Physics. If a dataset is not downloadable from the ROOSs data portal, it is available and downloadable from both CMEMS and EMODnet Physics (without restrictions for past 60 days and with authentication for older data).

- The JERICO-NEXT data portal is missing many of the VIs and VI datasets, and in particular it is missing more VIs and VIs datasets than CMEMS and EMODnet Physics.

[9] http://www.emodnet-mediterranean.eu/wp-content/uploads/2015/06/D11.2-revised-V11.pdf

- JERICO-NEXT VIs are not (easily) identifiable into the CMEMS products catalogue
- EMODnet Physics is missing the following VIs: NIVA NorFerry: MS Oslofjord (OF), MS Norønna (NO); FMI UTO: Uto; SMHI MOS: HFRadar; SYKE Alg@Line: Silja Victoria; NIVA NRS: NRS; IOBAS: Galata, Pomos.
- All of the ROOSs data portal (but the Arctic ROOS one) are showing data plots.

The results of the task 5.8 analysis may represent a valuable input to JERICO-NEXT partners as it is providing a (neutral) benchmark for their virtual services. The study offers interesting hints to increase the quantity and diversity of the web based traffic of the JERICO-NEXT VIs and JERICO-NEXT data portal.

5.7. Recommendations

The results of the task 5.8 analysis offers interesting hints to increase the quantity and diversity of the web based traffic of the JERICO-NEXT VIs and JERICO-NEXT data portal. More specifically the results of the JERICO-NEXT Task 5.8 can be summarized in the following recommendations:

1. JERICONEXT data portal (and EMODnet Physics) are making available platforms page with a unique URL and they both track visits on that URL: the JERICOPARTNER to use these PLATFORM URLs as formal link and citation
2. All of the infrastructures have to share a common way to track (unregistered) users and make this data available to providers and VIs.
3. VI providers have to keep their VIs link updated and visible at both their institute page and integrators level (e.g. JERICO-NEXT project, EuroGOOS ROOSs data portal, EMODnet Physics, etc)
4. “Term of use/citation” has to be more visible and linked with the virtual data
5. Access to Virtual Infrastructure means access to data, VIs have to provide the user with some exploitable data (e.g. csv/text file). Visualization tools are very important but they are limiting further use and exploitation of already recorded and qualified data
6. Integrators have to update their catalogues and make visible underlying/connected VIs
7. JERICO-NEXT portal and EMODnet Physics have to ingest the missing VIs: NIVA NorFerry: MS Oslofjord (OF), MS Norønna (NO); FMI UTO: Uto; SMHI MOS: HFRadar; SYKE Alg@Line: Silja Victoria; NIVA NRS: NRS; IOBAS: Galata, Pomos.
8. EuroGOOS ROOSs data portal would benefit from a more homogeneous user experience

6. Annexes and references