Framework Service Contract EEA/IDM/15/026/LOT 1 for Services supporting the European Environment Agency's (EEA) implementation of cross-cutting activities for coordination of the in-situ component of the Copernicus Programme Services

Thematic Report

Research Infrastructures and Copernicus

Issue: 1.0
Date: 31/10/2017

BACKGROUND AND SCOPE OF TASK

European Research Infrastructures (who are part of the ENVRI Community[1]) provide critical data to Copernicus services, in particular CMEMS and CAMS, but C3S is also supposed to require data from RIs in the future. Likewise the Copernicus space component needs high quality in situ data to do CAL/VAL activities, and some of these are delivered through RIs as well.

The overarching purpose of this task:

- Compile a cross-service picture of current contributions from some Research Infrastructures (members of the ENVRI community, TBC) to Copernicus with a view to identifying and analysing data and governance related risks, challenges, and gaps;
- Summarise the expected short-term (1-3 years) evolution of the current situation (RIs and Copernicus) and associated risks, challenges, and gaps;
- Propose mitigating measures that potentially may help overcoming (selected) risks, challenges, and gaps;

1. METHODOLOGY

A series of questions were formulated for respondents in the various marine, terrestrial ecosystem, solid earth and atmospheric research infrastructures in the following topic areas:

1: Mapping current RI contributions to Copernicus services:
2: Identifying main gaps, risks, and challenges and propose mitigating measures;
3: Describing the expected evolution of RIs with respect to Copernicus Services, e.g. will the Copernicus services' requirements change? Will new requirements be added? Will the RI landscape change?
4: Status of Governance in RIs

A detailed questionnaire was formulated based on the above topic areas to gain an understanding of RI linkages to Copernicus Services. Face to face interviews were possible in most cases. Some responses were provided by email following a briefing on the background to the EEA cross-cutting in-situ project. We also benefit from the ENVRI-Copernicus meeting held in Prague in November 2016 during which a number of Environmental RIs exposed the status of their relationship with Copernicus.

Direct responses were received from EMBRC, EuroArgo, SeaDataNet, Eurofleets, and JERICO-NEXT, ACTRIS, IAGOS, ICOS (Atmospheric Domain), IS-ENES, eLTER. The response from EMSO is considered representative of the EMSO, FixO3 and ESONET communities. The response from ACTRIS is considered integrating responses from EUROCHAMP-2020.

---

[1] The ENVRI community is a community of environmental research infrastructures (RI), projects, networks and other diverse stakeholders interested in environmental research infrastructure matters.

This report is not totally inclusive of all RIs participating to the Board of Environmental Research Infrastructures (BEERI) organized within the ENVRIPlus project (officially gathering 27 RIs). No interviews were made for design studies (ARISE) and other IA activities that recently joined BEERI (DISSCO, AQUACOSM) or for those not belonging to the Environmental domain (ELIXIR). Other RIs were shortly interviewed but clearly appeared not relevant to any Copernicus Services, either because they are not producing Copernicus relevant data (i.e. EISCAT-3D, LIFEWATCH) or because mainly oriented towards physical access provision-thus not relevant to this report (i.e. INTERACT, SIOS, EUFAR) or because experiment-oriented and not suited yet to connect to any service of Copernicus (AQUACOSM, ANAEE). EPOS is also very specific considering the very wide scope of this RI and its direct relationship with civil protection agencies and their responses are not included in this report, being too divergent from those of other RIs.

2. CURRENT RESEARCH INFRASTRUCTURE CONTRIBUTIONS TO COPERNICUS

2.1.1. A brief description of each Research Infrastructure consulted follows.

JERICO-NEXT

The objective of JERICO-NEXT consists in strengthening and enlarging a solid and transparent European network in providing operational services for the timely, continuous and sustainable delivery of high quality environmental data and information products related to the marine environment in European coastal seas. Further, JERICO-NEXT will support European coastal research communities, enable free and open access to data, enhance the readiness of new observing platform networks by increasing the performance of sensors, showcase of the adequacy of the so-developed observing technologies and strategies, propose a medium-term roadmap for coastal observatories through a permanent dialogue with stakeholders.

EMSO

The European Multidisciplinary Seafloor and water-column Observatory (EMSO) is a large scale, distributed, marine Research Infrastructure (RI) of fixed-point observatories serving marine science researchers, marine technology engineers, policy makers, and the public. EMSO consists of ocean observation systems for sustained monitoring of environmental processes end their interactions. The variables address natural hazards, climate change, and marine ecosystems. EMSO observatory nodes have been deployed at key sites around Europe, from the Arctic to the Atlantic, through the Mediterranean, to the Black Sea. At present it focuses on the open ocean beyond the continental shelf but strongly collaborates and complements shallow-water initiatives.

EuroArgo

Euro-Argo is the European infrastructure for argo floats. With the help of EuroArgo its partners have the capacity to procure and deploy about 250 floats per year, monitor these floats and ensure all the data can be processed and delivered to users. With a mean float lifetime of 4-5 years, such European contribution would support approximately 1/4 of the global array and provide an additional 50 floats per year for enhanced coverage in the European and marginal seas. Euro-Argo brings together 25 organisations from 12 countries enhancing the collective ability of the European nations to contribute to the global array while improving the coverage in sea areas of particular European interests.

SeaDataNet

As an Integrated Research Infrastructure Initiative (I3), SeaDataNet carries out different types of interrelated activities to reach its objectives. SeaDataNet is a distributed Marine Data Infrastructure for the management of large and diverse marine in situ datasets. SeaDataNet is a standardised system of data archival to compile the large amounts of data collected from oceanographic cruises or automated observation systems. This infrastructure, which relies on an international network, also contributes to the development of excellency in European research.

EMBRC

The European Marine Biological Research Centre, EMBRC-ERIC, is a pan-European Research Infrastructure for marine biology and ecology research. With its services, it aims to answer fundamental questions regarding the health of oceanic ecosystems in a changing environment, enable new technologies to further our investigation capabilities, support life-science breakthrough discoveries with the use of marine biological models, and continue long-term marine monitoring efforts.

Eurofleets

Eurofleets aims at bringing together the European research fleets owners to enhance their coordination and promote the cost-effective use of their facilities. It supports research services for the monitoring and the sustainable management of the Regional Seas and the Oceans, and organise a common access to all European scientists on sole condition of scientific excellence. This would enable the EU to reach its ambitious goals about maintaining the ocean biodiversity or understanding climate change.

IS-ENES

IS-ENES is a project of the distributed e-infrastructure of models, model data and metadata of the European Network for Earth System Modelling (ENES). This network gathers together the European modelling community working on understanding and predicting climate variability and change. IS-

ENES combines expertise in climate modelling, computational science, data management and climate impacts.

ACTRIS

ACTRIS is the European Research Infrastructure for the observation of Aerosol, Clouds, and Trace gases. ACTRIS is composed of observing stations, exploratory platforms, instrument calibration centres, and a data centre. ACTRIS serves a vast community of users working on atmospheric research, climate and Earth system and air quality models, satellite retrievals, weather analysis and forecast systems by offering high quality data and research infrastructure services for atmospheric aerosols, clouds, and trace gases

ICOS

ICOS, the European Integrated Carbon Observation System is a distributed international research infrastructure dedicated to measure, analyze and understand fluxes of greenhouse gases (GHGs) in the atmosphere, over the ocean and at the ecosystem level. In the framework of this report, only the atmospheric component of ICOS (the only one with established relationship with Copernicus) is considered. Atmospheric measurements of GHG are used to validate and reduce uncertainties in climate models. They feed inversion or assimilations data fusion systems to produce GHG budget at regional and global levels

IAGOS

IAGOS the 'In-service Aircraft for a Global Observing System' project, aims at establishing a sustainable distributed research infrastructure for the global observation of atmospheric composition. It is setting up a network of commercial aircraft that will carry out observations on a scale and in numbers that would be impossible to achieve using research aircraft and for which other measurement methods (e.g. satellites) have technical limitations.

eLTER

LTER-Europe is the umbrella network for Long-Term Ecosystem Research (LTER) in Europe. Long-Term Ecosystem Research (LTER) is an essential component of world-wide efforts to better understand ecosystems. Through research and monitoring, LTER seeks to improve our knowledge of the structure and functions of ecosystems and their long-term response to environmental, societal and economic drivers.

More complete information on Environmental Research Infrastructures can be found at the following site: http://www.envriplus.eu/

2.1.2. Summary: Formal links with Copernicus of ENVRIs

Of the six marine research infrastructures interviewed two (EuroArgo and SeaDataNet) have a formal link in place with the Copernicus Marine Service (CMEMS) while one (JERICO-NEXT) has an open dialogue with CMEMS. The three remaining RIs (EMBRC, EMSO and Eurofleets) are not currently linked to any Copernicus Service.

Of the six atmospheric research infrastructures interviewed (ICOS is considered part of the atmospheric domain for the scope of this report), one of them has established contract with Copernicus (IAGOS), and two of them are in the process of establishing the contracts (expected 2018).

None of the 3 RI interviewed in the ecosystem domain have formal established links with Copernicus. Only eLTER is today in the situation, through some of its partners, to provide information to Copernicus land service.

EPOS is the unique RI in the Solid Earth Domain. It has established responsibility agreement with civil protection in some countries with specific clauses related to emergency situations (Earthquakes, Volcanic Eruptions, etc…), but not formal links with Copernicus

Data and product delivery

For the Marine Domain, several RIs (4) provide data or products to CMEMS but the delivery is quite heterogeneous when comparing RIs. EuroArgo provides raw data and reprocessed products via the Coriolis data centre to CMEMS. JERICO-NEXT provides data to CMEMS via the In-situ Thematic Assembly Centre (INSTAC). SeaDataNet actually receives near real time data via the INSTAC and proceeds to quality control the data to produce a best copy of the data sets that are used for climatologies in some cases used by CMEMS (provided through a Sextant catalogue and a data portal). Data collected on European Research vessels (managed by Eurofleets) are provided via National Oceanographic Data Centres (NODCs) and likely via SeaDataNet to CMEMS. EMSO and EMBRC to not currently provide data directly to the Copernicus Services.

For the Atmospheric domain, the three RIs are more similar in the kind of information provided (or to be provided) to CAMS: level 1 or 1.5 (quality controlled) atmospheric concentrations of chemical species or their properties (physical), provided in RT, NRT or delayed mode. It should be noted that for ICOS and IAGOS, partners have been developing modalities for transferring to Copernicus within the CAMS84 bid. The modalities are often similar, with RIs mostly using the RI hub for data reduction to level 1 or 1.5 before transferring directly to Copernicus. Most data are (or will be) used for forecast and re-analysis. It is important to note that ICOS and ACTRIS are finalizing contracts with Copernicus CAMS and are expected to start operations in 2018.

The situation for the other domains is currently very simple with none of the RIs officially providing data or products to the corresponding Copernicus services. Note however, the specific case of EPOS, directly brokering with Civil Protection agencies for data transmission and early warning systems.

Links to DIAS and GEOSS

Four RIs have established some link to GEOSS at national level (EMBRC, EMSO, SeaDataNet and JERICO-NEXT). For SeaDataNet, the link to GEOSS is primarily at the metadata level at present. EMSO partners provide critical geohazard information at national level within the scope of GEOSS.

The awareness of the Data Information Access Service (DIAS) was low among RI respondents. It should be noted that the DIAS is at an early evolution stage at present with low awareness generally within the community. EuroArgo foresees interaction on the DIAS primarily through Mercator Ocean, the delegated entity responsible for CMEMS. Eurofleets have no links currently to either DIAS or GEOSS.

eLTER is heavily involved in GEO initiatives (although no formal transfer of data to DIAS or GEOSS is currently in operation. It is however to be noted that eLTER partners are heavily involved in GEO projects.

For the atmospheric domain, ICOS is involved as key partner in GEO Carbon initiative and ACTRIS is involved in the NEXT-GEOSS and INTAROS projects that are all developing the links between the ACTRIS DC hub and DIAS/GCI. However, work is just starting and no data flow to DIAS GEOSS is currently operational.

Criticality of data to Copernicus

EuroArgo data are deemed critical to the Copernicus Marine Service (CMEMS). Several impact studies have been conducted for Argo through the E-AIMS EC project where the impact is quantified. JERICO-NEXT data are deemed critical to CMEMS within the project at present and the visibility of these data sets to Copernicus Services is likely to increase when the Services focus on Coastal applications in the future.

EMBRC has not formally established the criticality of data sets they are responsible for in a Copernicus context but given that EMBRC data holdings are primarily biological and in many cases collected in near-shore environments they are likely to be necessary for several existing or emerging Copernicus Services.

Geohazard data collected by the EMSO community are critical to early warning systems in European member states. The link between EMSO members and Copernicus Services directly e.g. EMS has still to be formalized.

Two RIs are not in a position to establish whether data they collect are critical for Copernicus Services at the present time (SeaDataNet and Eurofleets).

IAGOS data are already widely used in Copernicus reanalysis and forecast activities. They are unique in providing O3 and CO concentration profiles during ascent and descent and capacity to test model performances Worldwide.

Data policy

Five Research Infrastructures have a free and open data policy at present (ACTRIS, IAGOS, ICOS EuroArgo and JERICO-NEXT). eLTER, EMBRC and EMSO are currently developing data policies. EMSO intends to have open access to their data holdings. The Eurofleets data sets are in some cases subject to a moratorium to allow scientific publication before open release. In the coming years Eurofleets hopes to make data freely and openly available (no moratorium). SeaDataNet are fully compatible with INSPIRE, IOC, ICES, WMO, GCOS, GEOSS and CLIVAR data sharing principles. Atmospheric research infrastructures data sharing principles are INSPIRE, WIS and GEOSS compatible.

All responses are summarized in table 1 and included in full format in Annex 1

Recommendations:
- Dialogue between EMBRC, EMSO, Eurofleets and Copernicus Services should take place to establish areas of common interest;
- Three RIs in the atmospheric domain have established strong links with CAMS but without strong interactions between the 3. Better share of knowledge and good practice is recommended;

- C3S is still in its development phase and, to some extend, lags behind what IS-ENES can potentially offer as a service. It is expected that RI-C3S links will improve in the near future with the preparation of the next IPCC report.

3. EXPECTED SHORT-TERM EVOLUTION

EMBRC, EMSO and Eurofleets expressed a willingness to engage with the Copernicus Services in an open dialogue. EMBRC provides services that supports access to ecosystems often through time series from very coastal locations. These time series could be of high importance to the Copernicus Services. EMSO provides many data sets covering the water column, seafloor and sub-seafloor that may be relevant to Copernicus Services. The RI recognizes the important role of Copernicus and will seek to engage with the Services in the coming months and years.

EuroArgo has already established a working relationship with CMEMS though no formal agreement exists between the entities at present. The RI foresees interaction with C3S in the coming months.

JERICO-NEXT has an existing link to CMEMS via the INSTAC. Given the wide variety of data sets available from the JERICO-NEXT community the RI (project for now) foresees additional interaction with C3S and CLMS to complement existing activity with CMEMS.

The Eurofleets community plans a wider engagement with the Copernicus community through the evolving Eurofleets consortium. This RI has considerable capacity to deliver data and services to the Copernicus Services in due course.

SeaDataNet foresees continued cooperation and data/product provision to the Copernicus Marine Service in particular.

With respect to Marine domain, the 3 RIs of the atmospheric domain have reached a more homogeneous level of maturity with many technical aspects related to data transfer to Copernicus already solved, and a clear plan for providing additional services and data.

ACTRIS, IAGOS and ICOS-Atmosphere will significantly enhance the products and the kind of data submitted to Copernicus in the next 2-4 years

Links to C3S are most advanced with the IS-ENES RI. However, this done mostly through projects funded either by member states or the EU not officially involving the infrastructure. It is expected that contribution to C3S will be fundamental in the framework of the next IPCC report.

All responses are summarized in table 1 and included in full format in Annex 1

Recommendations:
- Dialogue between EMBRC and Copernicus should take place to establish areas of common interest;
- The levels of awareness of requirements from the Copernicus Services are low with respect to the Research Infrastructures consulted. A joint meeting of the Research Infrastructures and the Copernicus Services should be considered.

4. MITIGATION STEPS TO OVERCOME RISKS, CHALLENGES AND GAPS

Coverage

Globally, there is a low level of awareness in the RIs of the requirements from the Copernicus Services in terms of coverage (spatially and temporally) required. It is perhaps worth noting that many RIs have engaged to Copernicus limiting data provision to those with wider coverage which is not always all that essential for Copernicus.

The current EuroArgo contribution to the global Argo array stands at ca. 20% compared to a target contribution of 25% of the global array. Biogeochemical (BGC) floats are still a relatively low proportion of the overall number of deployed floats resulting in sub-optimal coverage in parameters as well as spatial-temporal density of the BGC element of the network.

JERICO-NEXT is currently compiling recommendations for the optimal observation of multidisciplinary coastal processes.

The research vessel community (Eurofleets) generally provides comprehensive spatial and temporal coverage of European seas but still encounter issues with bandwidth availability on research vessels to deliver the collected data in near real time to appropriate data centres (linked to the Copernicus Services). The absence of a common software and standards for such data sharing remains an obstacle.

The current coverage of Atmospheric domain, IAGOS is global coverage, and perhaps the unique ENVRI that can be defined as such. ICOS and ACTRIS are contribution to Global atmosphere Watch (WMO) representing more than 50% of the observations for ACTRIS and slightly less for ICOS.

For eLTER, the European node of ILTER, the metrics for defining coverage is not straightforward but it is clearly representing a substantial part of the activity. The definition does not apply to IS-ENES, nor to EPOS

Sustainability of observations

Sustainability and robustness of services is key to establishing develop the usage of RI data. Very much progress has been made in the last 10 years to engage many RIs in sustainable legal entities. Yet, provision of data remains underfunded with some risks at some institutes, in case of unexpected events, to stop the provision. Many RIs are facing important investments in the future for which the financial plan is not secured yet.

With ambitious plans to populate marginal and polar seas with Argo floats and to enhance both biogeochemical observations and those made in the deep ocean >2,000 meters significant investment is required in floats. Funding of coastal observations using a combination of member state and EC investment remains a major challenge. Maintaining the network of coastal infrastructure operators through collaborative actions remains a priority.

EMSO ERIC also identify continued funding as a major challenge in the maintenance and evolution of fixed and cabled observing systems.

IAGOS is planning to extend the instrumentation set-up on board the aircraft fleet and that will require significant investments although not questioning sustainability of current observations.

9

ACTRIS is in the process of preparing the application for a legal entity and faces strong financial needs for establishing its central facilities. The situation is more or less identical for eLTER.

All responses are summarized in table 1 and included in full format in Annex 1

Recommendations:
- Continue to enhance and expand the number of countries contributing to the RIs to sustain investment in the existing and planned future system;
- Continue to lobby the European Commission to fund elements of the network, complimenting the contribution of member states;
- Consider a mechanism whereby Copernicus could contribute to the funding of key critical observations to underpin the services;
- Make available the recommendations on inter-RI/multi-parameter observation strategy making use of the ENVRI framework (i.e. analysis performed by the terrestrial ecosystem domain);
- Some technical work on mobile platforms (feasibility of increased bandwidth from research vessels for example) should be considered as well as continued work on data sharing standards and best practice;
- Explore whether the 20% limit on for-profit activities in an ERIC can be relaxed to provide stronger revenue streams for RI activities.

5. GOVERNANCE AND FUNDING

Governance model in use.

Four of the Research Infrastructures consulted for this report are already established as legal entities (EuroArgo ERIC, ICOS ERIC, IAGOS AISBL and EMSO ERIC) with centralized funding for management/secretariat functions contributed by member countries. In three other RIs the ERIC process is likely to mature in the coming months (EPOS, EMBRC and SeaDataNet). A few others are either in the implementation or the preparation phases (ACTRIS, ANAEE). The other RIs consulted are still in a project consortium phase (eLTER, IS-ENES, Eurofleets and JERICO-NEXT) but have funded work-packages dealing with governance models meaning that they have the potential to evolve into legal entities in the coming years.

Funding

Most of the RIs consulted make use of member state's funds to run the research infrastructure. For those on the ESFRI Roadmap (PPP and Landmarks), targeted funding mechanisms (INFREDEV) are also significantly contributing to the RI, especially in preparation, implementation and early operational phases. Many RI have also taken advantage of European Commission H2020, I3, design studies, INFRADEV, COST and preparatory actions associated with the ESFRI roadmap to gradually build the networks of operators of each respective RI. It should also be noted that some of the RIs are also participating to H2020 projects with specific funding aimed at constructing the European Observing System (or system of systems), making a complete mapping of the status of the links with Copernicus somewhat difficult. This is the case for ATLANTOS (Marine Domain), INTAROS (Marine and Atmospheric domains), Next-GEOSS (Atmospheric Domains), and ECOPOTENTIAL (Ecosystem/Biodiversity domain) projects for example, which have established links with some RI partners or, even with the corresponding ERIC.

EuroArgo has used a combination of member state investments and some EC money (DG-RTD and MARE) to support the RI. EMBRC has accessed member state funds and funds associated with the ESFRI Roadmap. EMSO uses the contributions of member countries to fund a central management office and is supported through several H2020 and ESFRI projects. SeaDataNet has utilized funds from both DG-RTD and DG-MARE in support of their activities.

Substantial resource is drawn from the member state investment in data collection and management through National Oceanographic Data Centres, in some cases supported by European Union Structural Funds e.g. ERDF. Research vessel time is funded at member state level primarily. Support has been possible from the European Commission via the Eurofleets suite of projects. The evolution of the JERICO and JERICO-NEXT projects has been funded through Framework Programme 7 and Horizon 2020 with a substantial member state ongoing investment in the coastal observing system in European seas. ICOS and IAGOS as established ERIC/IASBL receive direct funding from member states both through the legal entity and through direct national contributions. ACTRIS relies on EU funding and national contributions as for eLTER and IS-ENES (and many non-legal entity RIs not interviewed in the report).

There are no cases (from the RIs consulted) where direct support is provided by the Copernicus Services to underpin the sustainability of a particular research infrastructure at the present time. Some RIs expressed the view that support from the Copernicus Services, where appropriate would be a welcome contribution to sustaining such research infrastructures in the future.

All responses are summarized in table 1 and included in full format in Annex 1.

Recommendations:
- Sustainability and robustness of data provision schemes are key to the users. It is important to address these issues whenever implementing data provision contracts with Copernicus;
- While the general organization of RIs are not supported by Copernicus, it is clear that it is important to evaluate the feasibility of Copernicus Service funding contribution to the maintenance of specific services of European Research Infrastructures.

Authors: Glenn Nolan, Patrick Gorringe, Paolo Laj
RI Contributions: Nicolas Pade and Ilaria Nardello (EMBRC), Sylvie Pouliquen (EuroArgo ERIC), Juanjo Danobeita, Paolo Favali, Laura Beranzoli, John Picard (EMSO), Serge Scory (SeaDataNet), Dominique Durand (JERICO-NEXT), Aodhan Fitzgerald (Eurofleets), Michael Mirtl (eLTER), Leonard Rivier (ICOS-Atmosphere), Francesca Guglielmo (IS-ENES), Valérie Thouret (IAGOS) Andreas Petzold (IAGOS), Massimo Cocco (EPOS)

Date: 15 November 2017

Table 1 Summary of responses from Marine RIs links to Copernicus

Research Infrastructure	Direct Copernicus link in place	Engagement foreseen	Data/ products provided	Linked to DIAS/GEOSS	Criticality of data provided	Gaps identified	Data Policy	Governance	Funding
EuroArgo	Link with CMEMS	Foreseen with C3S	Raw data and reprocessed products provided	Mainly through Mercator Ocean	Data deemed critical to CMEMS. E-AIMS studies show impact	Mainly in provision of BGC Argo and in marginal seas	Argo open and free data policy applied	ERIC established	Member states and some EU
EMBRC	No	Willing to engage	No	Some through GEOSS	N/A at present but collect critical coastal biological data sets	N/A	Under development	Move to ERIC in planning	ESFRI and member states
EMSO	Not at present	Recognise importance and willing to engage	Not at present	Some through GEOSS at country level	Geohazard data collected by EMSO platforms are critical	Not enough knowledge of requirements to comment	Draft policy includes open access	ERIC established	Member states and some EU
SeaDataNet	Link with CMEMS	Yes	Provides high quality controlled climatologies through catalogue and data through portal	Link to GEOSS at metadata level	No	N/A	Fully compatible with INSPIRE, IOC, ICES, WMO, GCOS, GEOSS and CLIVAR principles	Legal entity to be established in 2018	EU RTD and MARE funds and member state structural funds

Eurofleets	Not at present	Yes through Eurofleets +	Research vessel data provided via NODCs	Not at present	N/A	Not enough knowledge of requirements to comment	Includes moratorium to allow publication; may be full open access soon	Project consortium	Member state funds; no reliance on Copernicus
JERICO-NEXT	Dialog ongoing with CMEMS	Hope to strengthen link with CMEMS, CLMS and C3S	Data delivered through CMEMS INSTAC	Links to GEOSS at country level	Deemed critical despite CMEMS not having coastal focus at present	Project has produced recommendations to observe critical coastal gaps	Free and open access to all data	Under consideration in project	National funds and some EU
ACTRIS	Contract with CAMS in preparation (through partners)	Yes, contracts to be initiated in 2018	RT and NRT atmospheric profiles of O3 (UTLS) and aerosol properties	Contribution to Next-GEOSS data hub	Data critical for Validation of CAMS forecast and validation	RT/NRT data provision of reactive trace gases not yet implemented	ACTRIS open and free data policy applied	ESFRI project, work towards ERIC engaged	National and EU funds
ICOS	Contract with CAMS signed	yes	NRT (24h) Atm concentration data of GHG	Not at present	Data critical for Validation of CAMS forecast	N/A	ICOS open and free data policy applied	ERIC established	Member states and some EU
IAGOS	Operational with CAMS	Already implemented	Delayed T. Data transmitted after landing of aircraft	Not at present	Data critical for CAMS forecast and validation, in particular for data provided during aircraft ascent and descent near airports	Work towards NRT transmission during aircraft journey	IAGOS open and free data policy applied	AISBL established	Member states and some EU funds

13

IS-ENES	Not official Link to C3S But links established through IS-ENES partnership in projects	Through IS-ENES (3rd phase) and possible further longer-term structure for the European data infrastructure part.	climate model projects on global regional scales	None.	European expertise in Earth System Grid Federation and in climate projections.	Not yet identified.	Open access.	Project consortium and investigation for a longer-term structure.	EU and member state funds.
eLTER	No	Not in the short term but contacts are established with Copernicus Land services	Not at present	eLTER Involved in many GEO initiatives : GEO ECOPOTENTIAL	Critical in many aspects for environmental management	Gaps are in the capacity to maintain a sustainable service	Open access	ESFRI application made	Member states and EU funding

ANNEX 1: Full responses from Research Infrastructures

1. European Marine Biological Resource Center (EMBRC)

1: Map current RI contributions to Copernicus services:

Has your Research Infrastructure (RI) any links with any of the Copernicus Services i.e CAMS, CLMS, CMEMS, C3S (Climate), Emergency or Security?
No direct links between the European Marine Biological Resource Center (EMBRC) and Copernicus Services are currently established.

Is there any short-term plan for establishing a link with Copernicus?
Do you foresee any future interaction with Copernicus?
No direct interaction between EMBRC and Copernicus Services are foreseen, but EMBRC is willing to engage. There is existing data transfer of some of the EMBRC marine stations towards (European) Ocean Biogeographic Information System, Pangaea and other GEOSS contributors and we will work on intensifying this data transfer in the framework of ongoing projects.

Does your RI provide products or services to any of the Copernicus Services?
No

How is your data provided to Copernicus (direct transfer from data producers, use of central data provider hub, …) ?
See above

What is the level of interaction with the DIAS/GEOSS infrastructure (if any) ?
No interaction with DIAS. For interaction with GEOSS, see above.

What type of data do you provide to the Copernicus Services? (or will provide ?)
EMBRC stations collect a broad range of data: Biodiversity data, Genomic data, Imaging data, Biogeochemical data, Experimental data, Physical data, Chemical data, Meteorological data, Modelling data.

Have you identified the level of criticality of the data you provide to Copernicus Service(s) i.e. have any impact studies been conducted or have testimonials been sought from Services?
No.

Has your RI established a data policy for data users? How is this policy compatible with Copernicus data policy, in particular regarding use of data for for-profit activities?
The EMBRC Data policy is currently under development.

2: Identify main gaps, risks, and challenges and propose mitigating measures;
Are there gaps (e.g. temporal, spatial, parameter) in terms of your RIs ability to provide data to the Copernicus Services that you are aware of?
Not clear.
Are there other risks or challenges that limit your ability to provide such data or services to the wider community?
Not clear.

15

Can you suggest actions that can be taken to mitigate some of these risks and address the challenges you have outlined?
Not clear.

3: Describe the expected evolution, e.g. will the Copernicus services' requirements change? Will new requirements be added? Will the RI landscape change?

If you are not already engaged with the Copernicus Services do you anticipate any formal involvement with Copernicus Services in the future?
EMBRC is willing to open up dialogue and discuss possible contributions.

What is the likely nature of this future activity?
Among others, EMBRC provides services that support access to ecosystems. Often time series are collected for very coastal environments. These could be of importance to Copernicus.

Are there changes anticipated in the evolution of your RI e.g. move to establish legal entity, expansion/contraction of RI?
EMBRC will move towards an established ERIC in the coming months.

4: Governance:

Is your RI established as a legal entity? If not, what governance model pertains to your RI?
EMBRC will move towards an established ERIC in the coming months.

Is there a formal agreement in place between your RI and any Copernicus Service e.g. Service Level agreement, service contract, Memorandum of Understanding?
No

How is your RI currently funded and do you have any reliance on Copernicus Services for funding?
No reliance, RI is funded through ESFRI contributions of member states and regions.

2. EuroArgo ERIC

1: Map current RI contributions to Copernicus services:

Has your Research Infrastructure (RI) any links with any of the Copernicus Services i.e CAMS, CLMS, CMEMS, C3S (Climate), Emergency or Security?
Yes, primarily the CMEMS. Plan to also provide product to C3S in next phase of INSTAC

Is there any short-term plan for establishing a link with Copernicus?
Link already established

Do you foresee any future interaction with Copernicus?
Yes Link with CMEMS is in the Statutes of the Euro-Ago ERIC

Does your RI provide products or services to any of the Copernicus Services?
Euro-Argo delivers data from profiling floats to CMEMS via the in-situ TAC. These data are assimilated in operational models and reanalysis products. The reprocessed products that cover long period (more than 50 years for some parameters) aim to also serve C3S

How is your data provided to Copernicus (direct transfer from data producers, use of central data provider hub, …) ?
The INSTAC integrates the data from providers and provide integrated products on FTP site both at global scale through Coriolis data centre and at Eurogoos ROOS level through IMR, SMHI, BSH, PdE, HCMR and IOBAS . These data are provided directly to CMEMS via FTP.

What is the level of interaction with the DIAS/GEOSS infrastructure (if any) ?
This will be done through Mercator Ocean that has separated in situ product generation from product distribution in the new tender

What type of data do you provide to the Copernicus Services? (or will provide ?)
Profiles of physical and biogeochemical variables gathered by Argo floats around the globe.

Have you identified the level of criticality of the data you provide to Copernicus Service(s) i.e. have any impact studies been conducted or have testimonials been sought from Services?
Argo float data are identified as critical to CMEMS in terms of improving and constraining both forecasts and ocean reanalysis. Impact studies specifically on Argo have been published by within the E-Aims projects and through OSE/OSSE presently going on in the AtlantOS H2020 project
Has your RI established a data policy for data users? How is this policy compatible with Copernicus data policy, in particular regarding use of data for for-profit activities?
Euro-Argo follows the Argo data policy of free and open access to float profile data globally.

2: Identify main gaps, risks, and challenges and propose mitigating measures;

Are there gaps (e.g. temporal, spatial, parameter) in terms of your RIs ability to provide data to the Copernicus Services that you are aware of?
Euro-Argo contributes to the global Argo array providing approximately 20% of the 4,000 floats. The Euro-Argo goal is maintain 25% of the global network . While the initially designed float density for Argo (3,000 floats) has been met, there are ambitious plans to maintain the array and to

17

enhance it to abyssal ocean as well as adding the collection of biogeochemical data in the network. There are also plans to extend the network into marginal and polar seas.

Are there other risks or challenges that limit your ability to provide such data or services to the wider community?
Continued funding remains a challenge to implementing the Euro-Argo objectives, in particular funds for developing abyssal and biogeochemical floats.

Can you suggest actions that can be taken to mitigate some of these risks and address the challenges you have outlined?
Continue to build the Euro-Argo ERIC by involving more countries in the ERIC.
Continue to lobby the EC to fund elements of the float network and complement the Euro-Argo ERIC members and observers funds

3: Describe the expected evolution, e.g. will the Copernicus services' requirements change? Will new requirements be added? Will the RI landscape change?

If you are not already engaged with the Copernicus Services do you anticipate any formal involvement with Copernicus Services in the future?
N/A (already engaged)

What is the likely nature of this future activity?

Are there changes anticipated in the evolution of your RI e.g. move to establish legal entity, expansion/contraction of RI?
Legal entity established; new members continuously sought.

4: Governance:

Is your RI established as a legal entity? If not, what governance model pertains to your RI?
Yes; European Research Infrastructure Consortium (ERIC)

Is there a formal agreement in place between your RI and any Copernicus Service e.g. Service Level agreement, service contract, Memorandum of Understanding?
CMEMS is identified as one important user of Euro-Argo in the ERIC statutes but so far nothing is formalized between the ERIC and CMEMS .

How is your RI currently funded and do you have any reliance on Copernicus Services for funding?
Funded through member state funding of float deployments and processing and ERIC Central Infrastructure in Brest, France.

3. JERICO-NEXT

1: Map current RI contributions to Copernicus services:

Has your Research Infrastructure (RI) any links with any of the Copernicus Services i.e CAMS, CLMS, CMEMS, C3S (Climate), Emergency or Security?
JERICO-NEXT interacts with CMEMS through different channels:
- Through activities in WP1 (strategy, governance and sustainability), JERICO-NEXT has engaged a dialog with CMEMS as a key stakeholder. The main interactions are about the planning of data requirement for supporting model development and product validation in the coastal ocean.
- Through our contribution in ENVRIplus, JERICO-NEXT is contributing in the overarching discussion on collaboration between CMEMS and marine research infrastructures.

Is there any short-term plan for establishing a link with Copernicus?
Recognise importance and hope to act in future. Short-term plans are related to both strengthening the dialog with CMEMS on coastal products and services, and establishing a direct link to ESA on the satellite component and upstream products.

Do you foresee any future interaction with Copernicus?
Yes. JERICO-NEXT aims at strengthening the dialog with CMEMS on coastal products and services. Interaction with C3S and later on with CLMS would be considered with regards to JERICO-NEXT contribution to carbon systems in coastal regions and land-coastal interactions, respectively.

Does your RI provide products or services to any of the Copernicus Services?
JERICO-NEXT delivers part of its data to CMEMS through the in-situ TAC.

How is your data provided to Copernicus (direct transfer from data producers, use of central data provider hub, …) ?
JERICO-NEXT data are provided directly by data producers but through harmonization and protocols agreed in the consortium

What is the level of interaction with the DIAS/GEOSS infrastructure (if any) ?
GEOSS at country level.

What type of data do you provide to the Copernicus Services? (or will provide ?)
Multi parametric data (physical and biogeochemical variables) from our platforms such as Gliders, FerryBox, Buoys etc around the European Coastal Seas

Have you identified the level of criticality of the data you provide to Copernicus Service(s) i.e. have any impact studies been conducted or have testimonials been sought from Services?
JERICO-NEXT data are identified as critical to CMEMS in terms of improving and constraining both forecasts and ocean reanalysis. However, coastal regions is not the focus of CMEMS for the time being. The interaction with CMEMS is therefore rather targeted on planning for the future development of Copernicus.

Has your RI established a data policy for data users? How is this policy compatible with Copernicus data policy, in particular regarding use of data for for-profit activities?
JERICO-NEXT follows a free and open access to all data.

2: Identify main gaps, risks, and challenges and propose mitigating measures;

Are there gaps (e.g. temporal, spatial, parameter) in terms of your RIs ability to provide data to the Copernicus Services that you are aware of?
JERICO-NEXT provides a high proportion of the coastal data to CMEMS. A study on the existing requirements has not been yet done. However, JERICO-NEXT has a significant activity on defining how to best observe multidisciplinary coastal processes in space and time, and intends to provide recommendation in this respect that will be of high value for the development of high-quality and high-impact products for CMEMS, in the future
Are there other risks or challenges that limit your ability to provide such data or services to the wider community?
Coastal observatories are funded through national funds while EU funds are important in keeping the network together. Continued funding from both sources remains a major challenge.
Can you suggest actions that can be taken to mitigate some of these risks and address the challenges you have outlined?
Continue to build the network working on issues such as future governance and management. Moreover, to work towards services and products integrating/developing related coastal activities. An appropriate financial compensation from Copernicus services to the RIs that provide the necessary data to deliver products and services should be considered, as a mechanism for reaching sustainability.

3: Describe the expected evolution, e.g. will the Copernicus services' requirements change? Will new requirements be added? Will the RI landscape change?

If you are not already engaged with the Copernicus Services do you anticipate any formal involvement with Copernicus Services in the future?
Coastal regions are expected to be where economic growth will most take place in the future. The needs for coastal products and services will increase in the near future. CMEMS has a strong potential to develop towards coastal services. However the needs for high-quality coastal data will be paramount for developing and validating these new products and services. This would only be achieved by an appropriate coordination and collaboration between CMEMS and the JERICO RI.

What is the likely nature of this future activity?
The JERICO-NEXT can provide multiparametric and multi temporal and spatial data for the coastal ocean in line with the Copernicus objectives and aims. Moreover, it can provide the necessary data for the Cal/Val of the satellite products in the coastal area.
JERICO-NEXT has the following strategic objectives towards CMEMS:
- JERICO-RI aims at being the main provider of operational coastal data
- Provision of consistent physical-biogeochemical-biological datasets at local and regional scales
- Delivery of continuous Essential Coastal Variables adapted to describing complex and coupled coastal processes
    – Data for validation of coastal satellite data
    – Support to development of coastal models
    – Operational data in support of model forecasting

- Value creation through downstream services
    - Target: Service-based SMEs

Are there changes anticipated in the evolution of your RI e.g. move to establish legal entity, expansion/contraction of RI?
We are at the stage that we are considering the possibility of establishing a legal entity and it is in our plans to expand the RI provided that more funds will be available.

4: Governance:

Is your RI established as a legal entity? If not, what governance model pertains to your RI?
No it is not. Currently it is under an EU project structure. The future governance of the JERICO-RI is strongly addressed in the consortium and within the appropriate landscape at present.

Is there a formal agreement in place between your RI and any Copernicus Service e.g. Service Level agreement, service contract, Memorandum of Understanding?
Not yet, but interested to.

How is your RI currently funded and do you have any reliance on Copernicus Services for funding?
Funded through national funds and EU infrastructure projects. There is no funding through Copernicus, yet.

4. EMSO ERIC

1: Map current RI contributions to Copernicus services:

Has your Research Infrastructure (RI) any links with any of the Copernicus Services i.e CAMS, CLMS, CMEMS, C3S (Climate), Emergency or Security?
None at present.

Is there any short-term plan for establishing a link with Copernicus?
Recognise importance and hope to act in future

Do you foresee any future interaction with Copernicus?
Yes

Does your RI provide products or services to any of the Copernicus Services?
Not at present

How is your data provided to Copernicus (direct transfer from data producers, use of central data provider hub, …) ?
n/a

What is the level of interaction with the DIAS/GEOSS infrastructure (if any) ?
GEOSS at country level.

What type of data do you provide to the Copernicus Services? (or will provide ?)
None at present

Have you identified the level of criticality of the data you provide to Copernicus Service(s) i.e. have any impact studies been conducted or have testimonials been sought from Services?
Geohazard data are collected now and potential is recognised.
Has your RI established a data policy for data users? How is this policy compatible with Copernicus data policy, in particular regarding use of data for for-profit activities?
Draft generic data policy; open access

2: Identify main gaps, risks, and challenges and propose mitigating measures;

Are there gaps (e.g. temporal, spatial, parameter) in terms of your RIs ability to provide data to the Copernicus Services that you are aware of?
Not enough knowledge of requirements to know if gaps are present.
Are there other risks or challenges that limit your ability to provide such data or services to the wider community?
Continued funding remains a challenge to implementing the system.
Can you suggest actions that can be taken to mitigate some of these risks and address the challenges you have outlined?
Limits on for profit activities (20% max). need to revisit funding mechanism (increased subs)
3: Describe the expected evolution, e.g. will the Copernicus services' requirements change? Will new requirements be added? Will the RI landscape change?

If you are not already engaged with the Copernicus Services do you anticipate any formal involvement with Copernicus Services in the future?
Plan engagement

What is the likely nature of this future activity?
Take advantage of growing env mon market combined with RI. Complimentarity with satellites and other systems.

Are there changes anticipated in the evolution of your RI e.g. move to establish legal entity, expansion/contraction of RI?
Legal entity established; new members continuously sought. Plans to enhance capability within CMO and links with other networks and RIs. Establish MoUs with other entities e.g. EuroGOOS, ICOS.

4: Governance:

Is your RI established as a legal entity? If not, what governance model pertains to your RI?
Yes; European Research Infrastructure Consortium (ERIC)

Is there a formal agreement in place between your RI and any Copernicus Service e.g. Service Level agreement, service contract, Memorandum of Understanding?
Not as yet.

How is your RI currently funded and do you have any reliance on Copernicus Services for funding?
Funded through member state fees and EC projects. No reliance on Copernicus at the moment. of float deployments and ERIC Secretariat in Brest, France.

5.   SEADATANET

1: Map current RI contributions to Copernicus services:

Has your Research Infrastructure (RI) any links with any of the Copernicus Services i.e CAMS, CLMS, CMEMS, C3S (Climate), Emergency or Security?
Yes, the CMEMS.

Is there any short-term plan for establishing a link with Copernicus?
Link already established

Do you foresee any future interaction with Copernicus?
Yes

Does your RI provide products or services to any of the Copernicus Services?
SeaDataNet provides T,S-climatologies based on highly quality-controlled datasets. These climatologies are used as initial conditions for computer simulations. SeaDataNet is the delayed-mode backbone for the CMEMS data collected in (near-)real-time, providing services for further quality control, dissemination and long-term archival.

How is your data provided to Copernicus (direct transfer from data producers, use of central data provider hub, …) ?
SeaDataNet provides products through its Sextant catalog. Data are available through the SeaDataNet portal.

What is the level of interaction with the DIAS/GEOSS infrastructure (if any) ?
Interoperability has been established at metadata level with the GEOSS portal, giving access through it to aggregated data sets.

What type of data do you provide to the Copernicus Services? (or will provide ?)
Basically, the data flows the other way round: (near-) real-time data collected by Copernicus needs to be provided in delayed mode to the SeaDataNet infrastructure for further processing and validation, in order to create reference historical dataset.

Have you identified the level of criticality of the data you provide to Copernicus Service(s) i.e. have any impact studies been conducted or have testimonials been sought from Services?
No.

Has your RI established a data policy for data users? How is this policy compatible with Copernicus data policy, in particular regarding use of data for for-profit activities?
SeaDataNet has indeed a data policy. Quoting its introduction: "The SeaDataNet data policy is intended to be fully compatible with the Directive of the European Parliament and of the Council on public access to environmental information, the INSPIRE Directive, IOC, ICES, WMO, GCOS, GEOSS and CLIVAR data principles."

2: Identify main gaps, risks, and challenges and propose mitigating measures;

Are there gaps (e.g. temporal, spatial, parameter) in terms of your RIs ability to provide data to the Copernicus Services that you are aware of?
N/A

Are there other risks or challenges that limit your ability to provide such data or services to the wider community?
No.

Can you suggest actions that can be taken to mitigate some of these risks and address the challenges you have outlined?
N/A

3: Describe the expected evolution, e.g. will the Copernicus services' requirements change? Will new requirements be added? Will the RI landscape change?

If you are not already engaged with the Copernicus Services do you anticipate any formal involvement with Copernicus Services in the future?
N/A (already engaged)

What is the likely nature of this future activity?

Are there changes anticipated in the evolution of your RI e.g. move to establish legal entity, expansion/contraction of RI?
Legal entity will be established early in 2018.

4: Governance:

Is your RI established as a legal entity? If not, what governance model pertains to your RI?
Not yet. It will established as an International Non-for-Profit Association under the Belgian Law.

Is there a formal agreement in place between your RI and any Copernicus Service e.g. Service Level agreement, service contract, Memorandum of Understanding?
There is indeed a Memorandum of Understanding

How is your RI currently funded and do you have any reliance on Copernicus Services for funding?
Funded through EU RTD projects, EU DG-MARE contracts and structural funds at country level (National Oceanographic Data Centres)

6. Eurofleets

1: Map current RI contributions to Copernicus services:

Has your Research Infrastructure (RI) any links with any of the Copernicus Services i.e CAMS, CLMS, CMEMS, C3S (Climate), Emergency or Security?
None at present.

Is there any short-term plan for establishing a link with Copernicus?
Within the evolving Eurofleets + proposal there are plans to enhance synergies with existing infrastructures and to develop services (reflected in the H2020 call text). Plans to engage via a dedicated work package on stakeholder engagement.

Do you foresee any future interaction with Copernicus?
Yes

Does your RI provide products or services to any of the Copernicus Services?
Vessel data is provided through Member State programmes (indirectly through National Oceanographic data centres in most cases)

How is your data provided to Copernicus (direct transfer from data producers, use of central data provider hub, …) ?
Through NODCs and SeaDataNet to OGC standards; There is a dedicated Data workpackage in both Eurofleets 2 and Eurofleets +with links to the Ocean Data Information Portal (ODIP)>. A dedicated system (EARS) is being developed for the whole European research vessel fleet.

What is the level of interaction with the DIAS/GEOSS infrastructure (if any) ?
Not at present.

What type of data do you provide to the Copernicus Services? (or will provide ?)
Via Member States NODCs; all forms of oceanographic data generated from research vessels, primarily in delayed-mode.

Have you identified the level of criticality of the data you provide to Copernicus Service(s) i.e. have any impact studies been conducted or have testimonials been sought from Services?
Has your RI established a data policy for data users? How is this policy compatible with Copernicus data policy, in particular regarding use of data for for-profit activities?
Data policy includes moratorium to allow data to be published; new data activity planned in Eurofleets+ including open access (no moratorium).

2: Identify main gaps, risks, and challenges and propose mitigating measures;

Are there gaps (e.g. temporal, spatial, parameter) in terms of your RIs ability to provide data to the Copernicus Services that you are aware of?
Not enough knowledge of requirements to know if gaps are present.

26

Are there other risks or challenges that limit your ability to provide such data or services to the wider community?
Bandwidth issues from some vessels and no common software at present (harmonisation). Moratoria effect live data availability.

Can you suggest actions that can be taken to mitigate some of these risks and address the challenges you have outlined?
Standardise processes across fleet, procedures and agreements at EU level.

3: Describe the expected evolution, e.g. will the Copernicus services' requirements change? Will new requirements be added? Will the RI landscape change?

If you are not already engaged with the Copernicus Services do you anticipate any formal involvement with Copernicus Services in the future?
Plan engagement through the Eurofleets + project.

What is the likely nature of this future activity?
Plan to deliver additional data sets to wide range of users.

Are there changes anticipated in the evolution of your RI e.g. move to establish legal entity, expansion/contraction of RI?
This will be reviewed in Eurofleets+. Possibilities include a transition towards a US UNOLS system from the present European Research Vessel Operators system. We plan to establish MoUs with other entities e.g. EuroGOOS, ICOS.

4: Governance:

Is your RI established as a legal entity? If not, what governance model pertains to your RI?
Not at present; project consortium

Is there a formal agreement in place between your RI and any Copernicus Service e.g. Service Level agreement, service contract, Memorandum of Understanding?
Not as yet.

How is your RI currently funded and do you have any reliance on Copernicus Services for funding?
Funded through member state funds; no reliance on Copernicus.

7. ACTRIS

1: Map current RI contributions to Copernicus services:

Has your Research Infrastructure (RI) any links with any of the Copernicus Services i.e CAMS, CLMS, CMEMS, C3S (Climate), Emergency or Security?
Links with CAMS

Is there any short-term plan for establishing a link with Copernicus?
Yes, contracts being prepared

Do you foresee any future interaction with Copernicus?
Yes, Direct contracting for provision of RT or NRT data

Does your RI provide products or services to any of the Copernicus Services?
ACTRIS currently provides RT data (Level 1,5) on aerosol properties and NDACC profile of reactive gases from a few observation sites

How is your data provided to Copernicus (direct transfer from data producers, use of central data provider hub, …) ?
Directly through the ACTRIS DC data hub, and for some stations, directly though Station-Copernicus data flow

What is the level of interaction with the DIAS/GEOSS infrastructure (if any) ?
Not at present.

What type of data do you provide to the Copernicus Services? (or will provide ?)
Atmospheric aerosol

Have you identified the level of criticality of the data you provide to Copernicus Service(s) i.e. have any impact studies been conducted or have testimonials been sought from Services?
Not specifically but some studies have been done showing the added-value of constraining models with ACTRIS data (re-analysis)

Has your RI established a data policy for data users? How is this policy compatible with Copernicus data policy, in particular regarding use of data for for-profit activities?
Open access. Compatibility with Copernicus policy being discussed

2: Identify main gaps, risks, and challenges and propose mitigating measures;

Are there gaps (e.g. temporal, spatial, parameter) in terms of your RIs ability to provide data to the Copernicus Services that you are aware of?
Only a fraction of the ACTRIS data are currently provided. Pilot studies necessary to develop the QA/QC systems for additional data

Are there other risks or challenges that limit your ability to provide such data or services to the wider community?

Directly linked to the establishement of ACTRIS ERIC for sustainability

Can you suggest actions that can be taken to mitigate some of these risks and address the challenges you have outlined?
Sustainibility of the RI

3: Describe the expected evolution, e.g. will the Copernicus services' requirements change? Will new requirements be added? Will the RI landscape change?

If you are not already engaged with the Copernicus Services do you anticipate any formal involvement with Copernicus Services in the future?
Plan engagement through ACTRIS ERIC in the future

What is the likely nature of this future activity?
As of today + potential delivery of additional products and data

Are there changes anticipated in the evolution of your RI e.g. move to establish legal entity, expansion/contraction of RI?
ERIC in preparation expected 2021

4: Governance:

Is your RI established as a legal entity? If not, what governance model pertains to your RI?
Not at present; project consortium but in the ESFRI PPP phase

Is there a formal agreement in place between your RI and any Copernicus Service e.g. Service Level agreement, service contract, Memorandum of Understanding?
In preparation

How is your RI currently funded and do you have any reliance on Copernicus Services for funding?
no reliance on Copernicus.

8. ICOS (Atmosphere)

1: Map current RI contributions to Copernicus services:

Has your Research Infrastructure (RI) any links with any of the Copernicus Services i.e CAMS, CLMS, CMEMS, C3S (Climate), Emergency or Security?
Links with CAMS

Is there any short-term plan for establishing a link with Copernicus?
Yes, contracts is signed

Do you foresee any future interaction with Copernicus?
Yes, Direct contracting for provision of NRT data

Does your RI provide products or services to any of the Copernicus Services?
Products to CAMS

How is your data provided to Copernicus (direct transfer from data producers, use of central data provider hub, …) ?
Directly through the ACTRIS DC data hub, and for some stations, directly though Station-Copernicus data flow

What is the level of interaction with the DIAS/GEOSS infrastructure (if any) ?
Not at present but links to GEO CARBON

What type of data do you provide to the Copernicus Services? (or will provide ?)
Greenhouse gases concentration in atmosphere

Have you identified the level of criticality of the data you provide to Copernicus Service(s) i.e. have any impact studies been conducted or have testimonials been sought from Services?

Has your RI established a data policy for data users? How is this policy compatible with Copernicus data policy, in particular regarding use of data for for-profit activities?
Open access. Data remain under ICOS data policy

2: Identify main gaps, risks, and challenges and propose mitigating measures;

Are there gaps (e.g. temporal, spatial, parameter) in terms of your RIs ability to provide data to the Copernicus Services that you are aware of?
Work with IAGOS for NRT provision of GHG onboard aircraft

Are there other risks or challenges that limit your ability to provide such data or services to the wider community?
Not identified

30

Can you suggest actions that can be taken to mitigate some of these risks and address the challenges you have outlined?
Sustainibility of the RI

3: Describe the expected evolution, e.g. will the Copernicus services' requirements change? Will new requirements be added? Will the RI landscape change?

If you are not already engaged with the Copernicus Services do you anticipate any formal involvement with Copernicus Services in the future?
Plan engagement through ACTRIS ERIC in the future

What is the likely nature of this future activity?
As of today + potential delivery of additional products and data

Are there changes anticipated in the evolution of your RI e.g. move to establish legal entity, expansion/contraction of RI?
ERIC already established

4: Governance:

Is your RI established as a legal entity? If not, what governance model pertains to your RI?
Yes, ERIC

Is there a formal agreement in place between your RI and any Copernicus Service e.g. Service Level agreement, service contract, Memorandum of Understanding?
Contract established with Copernicus CAMS

How is your RI currently funded and do you have any reliance on Copernicus Services for funding?
no relying on Copernicus.

9. IAGOS

1: Map current RI contributions to Copernicus services:

Has your Research Infrastructure (RI) any links with any of the Copernicus Services i.e CAMS, CLMS, CMEMS, C3S (Climate), Emergency or Security?
Established links with CAMS through CAMS 84 contract

Is there any short-term plan for establishing a link with Copernicus?
Yes, contracts is signed and delayed time data transfer operational

Do you foresee any future interaction with Copernicus?
Already in place but extension of data and service provision being discussed with CAMS

Does your RI provide products or services to any of the Copernicus Services?
Yes, direct data provision CAM84

How is your data provided to Copernicus (direct transfer from data producers, use of central data provider hub, …) ?
Data is transferred from Aircraft after landing to IAGUS data hub. Copernicus gets data from IAGOS data hub after validation procedures 3 days later

What is the level of interaction with the DIAS/GEOSS infrastructure (if any) ?
No links

What type of data do you provide to the Copernicus Services? (or will provide ?)
NRT profile O3 CO and H2O during ascent and descent of aircraft in delayed time

Have you identified the level of criticality of the data you provide to Copernicus Service(s) i.e. have any impact studies been conducted or have testimonials been sought from Services?
IAGOS delayed time data provision is critical to validation of Chemistry-Transport models. Data set is unique

Has your RI established a data policy for data users? How is this policy compatible with Copernicus data policy, in particular regarding use of data for for-profit activities?
Open access. Data remain under IAGOS data policy

2: Identify main gaps, risks, and challenges and propose mitigating measures;

Are there gaps (e.g. temporal, spatial, parameter) in terms of your RIs ability to provide data to the Copernicus Services that you are aware of?

H2O operational but in CAMS 84
CO2 CH4 not installed
RT in development

32

Are there other risks or challenges that limit your ability to provide such data or services to the wider community?
Risks linked to technical failures of instruments (repairs can take a long time posing problems to Delayed time provision)

Can you suggest actions that can be taken to mitigate some of these risks and address the challenges you have outlined?
More reliable instrumentation

3: Describe the expected evolution, e.g. will the Copernicus services' requirements change? Will new requirements be added? Will the RI landscape change?

If you are not already engaged with the Copernicus Services do you anticipate any formal involvement with Copernicus Services in the future?
Already involved but evolution of services provided is foreseen. Operation towards RT data provision in development and quasi in operational phase (tests on one aircraft of the fleet)

What is the likely nature of this future activity?
Delayed time delivery of additional compounds (H20 and cloud properties in the short term, GHG in the medium term)
RT delivery is being tested on one aircraft: delivery of information after ascent and before descent, transferred via aircraft SAT-COM to EUMETNET.
Specific IAGOS – CAMS contract to be established

Are there changes anticipated in the evolution of your RI e.g. move to establish legal entity, expansion/contraction of RI?
AISBL already established

4: Governance:

Is your RI established as a legal entity? If not, what governance model pertains to your RI?
Yes, AISBL

Is there a formal agreement in place between your RI and any Copernicus Service e.g. Service Level agreement, service contract, Memorandum of Understanding?
Contract not established with AISBL but with IAGOS partner. Future contracts with AISBL

How is your RI currently funded and do you have any reliance on Copernicus Services for funding?
AISBL does not rely on Copernicus funding but establishing RT provision does

10. IS-ENES

1: Map current RI contributions to Copernicus services:

Has your Research Infrastructure (RI) any links with any of the Copernicus Services i.e CAMS, CLMS, CMEMS, C3S (Climate), Emergency or Security?
Yes, C3S
Is there any short-term plan for establishing a link with Copernicus?
Not directly with the RI (not legal entity) but through partners of IS-ENES

Do you foresee any future interaction with Copernicus?
Yes, Direct contracting for provision of NRT data

Does your RI provide products or services to any of the Copernicus Services?
Products to CAMS

How is your data provided to Copernicus (direct transfer from data producers, use of central data provider hub, …) ?
Directly through partners

What is the level of interaction with the DIAS/GEOSS infrastructure (if any) ?
Not at present

What type of data do you provide to the Copernicus Services? (or will provide ?)
On global climate projections:
- Deploying and maintaining a ESGF node (CP4CDS)
- Multi-model analyses(MAGIC)
- Roadmap to a reference set of projections (CRECP).
On regional climate projections:
- Deploying and maintaining a ESGF node (CORDEX4CDS)New set of regional simulations for Europe (PRINCIPLES).
  None.   European expertise in Earth System Grid Federation and in climate projections. Not yet identified.   Open access.

Have you identified the level of criticality of the data you provide to Copernicus Service(s) i.e. have any impact studies been conducted or have testimonials been sought from Services?
No identified

Has your RI established a data policy for data users? How is this policy compatible with Copernicus data policy, in particular regarding use of data for for-profit activities?
Open access.

2: Identify main gaps, risks, and challenges and propose mitigating measures;

Are there gaps (e.g. temporal, spatial, parameter) in terms of your RIs ability to provide data to the Copernicus Services that you are aware of?
Not identified
34

Are there other risks or challenges that limit your ability to provide such data or services to the wider community?
Directly linked to the establishment of a more official IS-ENES consortium

Can you suggest actions that can be taken to mitigate some of these risks and address the challenges you have outlined?
Sustainability of the RI

3: Describe the expected evolution, e.g. will the Copernicus services' requirements change? Will new requirements be added? Will the RI landscape change?

If you are not already engaged with the Copernicus Services do you anticipate any formal involvement with Copernicus Services in the future?
Yes, but through individual partners of IS-ENES in the framework of the IPCC

What is the likely nature of this future activity?
IS-ENES expect an increase of activity with the preparation of IPCC report, with strong links to C3S

Are there changes anticipated in the evolution of your RI e.g. move to establish legal entity, expansion/contraction of RI?
Not the RI itself but many projects are relying on Copernicus fundings.

4: Governance:

Is your RI established as a legal entity? If not, what governance model pertains to your RI?
Project consortium and investigation for a longer-term structure which can be the ESFRI application or another type of consortium EU

Is there a formal agreement in place between your RI and any Copernicus Service e.g. Service Level agreement, service contract, Memorandum of Understanding?
No

How is your RI currently funded and do you have any reliance on Copernicus Services for funding?
Not the RI itself but many projects are relying on Copernicus fundings.

11. eLTER

1: Map current RI contributions to Copernicus services:

Has your Research Infrastructure (RI) any links with any of the Copernicus Services i.e CAMS, CLMS, CMEMS, C3S (Climate), Emergency or Security?

Is there any short-term plan for establishing a link with Copernicus?

Do you foresee any future interaction with Copernicus?

Does your RI provide products or services to any of the Copernicus Services?

How is your data provided to Copernicus (direct transfer from data producers, use of central data provider hub, …) ?

What is the level of interaction with the DIAS/GEOSS infrastructure (if any) ?

What type of data do you provide to the Copernicus Services? (or will provide ?)

Have you identified the level of criticality of the data you provide to Copernicus Service(s) i.e. have any impact studies been conducted or have testimonials been sought from Services?

Has your RI established a data policy for data users? How is this policy compatible with Copernicus data policy, in particular regarding use of data for for-profit activities?

2: Identify main gaps, risks, and challenges and propose mitigating measures;

Are there gaps (e.g. temporal, spatial, parameter) in terms of your RIs ability to provide data to the Copernicus Services that you are aware of?

Are there other risks or challenges that limit your ability to provide such data or services to the wider community?

Can you suggest actions that can be taken to mitigate some of these risks and address the challenges you have outlined?

3: Describe the expected evolution, e.g. will the Copernicus services' requirements change? Will new requirements be added? Will the RI landscape change?

If you are not already engaged with the Copernicus Services do you anticipate any formal involvement with Copernicus Services in the future?

What is the likely nature of this future activity?

Are there changes anticipated in the evolution of your RI e.g. move to establish legal entity, expansion/contraction of RI?

4: Governance:

Is your RI established as a legal entity? If not, what governance model pertains to your RI?

Is there a formal agreement in place between your RI and any Copernicus Service e.g. Service Level agreement, service contract, Memorandum of Understanding?

How is your RI currently funded and do you have any reliance on Copernicus Services for funding?