



**EUROPEAN COMMISSION**  
**DIRECTORATE-GENERAL RESEARCH & INNOVATION**  
Research infrastructure



## **ANNEX 1 (part A)**

**Research and Innovation action**

**NUMBER — 654182 — ENVRI PLUS**

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# 1.1. The project summary

Project Number <sup>1</sup>	654182	Project Acronym <sup>2</sup>	ENVRI PLUS
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**One form per project**

**General information**

Project title <sup>3</sup>	Environmental Research Infrastructures Providing Shared Solutions for Science and Society
Starting date <sup>4</sup>	The first day of the month after the signature by the Commission
Duration in months <sup>5</sup>	51
Call (part) identifier <sup>6</sup>	H2020-INFRADEV-1-2014-1
Topic	INFRADEV-4-2014-2015 Implementation and operation of cross-cutting services and solutions for clusters of ESFRI and other relevant research infrastructure initiatives
Fixed EC Keywords	NATURAL SCIENCES
Free keywords	Environment, Climate Change, Society, Observations

**Abstract <sup>7</sup>**

ENVRIPLUS is a cluster of research infrastructures (RIs) for Environmental and Earth System sciences, built around ESFRI roadmap and associating leading e-infrastructure and Integrating Activities together with technical specialist partners. ENVRIPLUS is driven by 3 overarching goals: 1) favoring cross-fertilization between infrastructures, 2) implementing innovative concepts and devices across RIs, and 3) facilitating research and innovation in the field of environment to an increasing number of users outside the RIs. ENVRIPLUS organizes its activities along a main strategic plan where sharing multi-disciplinary expertise will be most effective. It aims to improve Earth observation monitoring systems and strategies, including actions towards harmonization and innovation, to generate common solutions to many shared information technology and data related challenges, to harmonize policies for access and provide strategies for knowledge transfer amongst RIs. ENVRIPLUS develops guidelines to enhance trans-disciplinary use of data and data-products supported by applied use-cases involving RIs from different domains. ENVRIPLUS coordinates actions to improve communication and cooperation, addressing Environmental RIs at all levels, from management to end-users, implementing RI-staff exchange programs, generating material for RI personnel, and proposing common strategic developments and actions for enhancing services to users and evaluating the socio-economic impacts. ENVRIPLUS is expected to facilitate structuration and improve quality of services offered both within single RIs and at pan-RI level. It promotes efficient and multi-disciplinary research offering new opportunities to users, new tools to RI managers and new communication strategies for environmental RI communities. The produced solutions, services and other project results are made available to all environmental RI initiatives, thus contributing to the development of a consistent European RI ecosystem.

## 1.2. List of Beneficiaries

Project Number <sup>1</sup>	654182	Project Acronym <sup>2</sup>	ENVRI PLUS
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### List of Beneficiaries

No	Name	Short name	Country	Project entry date <sup>8</sup>	Project exit date
1	INTEGRATED CARBON OBSERVATION SYSTEM EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM	ICOS ERIC	Finland	01/01/2017	
2	EURO-ARGO ERIC	EURO-ARGO	France		
3	EISCAT SCIENTIFIC ASSOCIATION	EISCAT	Sweden		
4	CONSIGLIO NAZIONALE DELLE RICERCHE	CNR	Italy		
5	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	CNRS	France		
6	INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER	IFREMER	France		
7	FORSCHUNGSZENTRUM JULICH GMBH	FZJ	Germany		
8	ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA	INGV	Italy		
9	UNITED KINGDOM RESEARCH AND INNOVATION	NERC	United Kingdom		
10	Euro-Mediterranean Seismological Centre	EMSC	France		
11	EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH	ETHZ	Switzerland		
12	UNIVERSITAET BREMEN	UniHB	Germany		
13	UNIVERSITEIT VAN AMSTERDAM	UvA	Netherlands		
14	UNIVERSITA DEL SALENTO	UNILE	Italy		
15	INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE	INRA	France		
16	UMWELTBUNDESAMT GESELLSCHAFT MIT BESCHRANKTER HAFTUNG (UBA GMBH)	EAA	Austria		
17	GOETEBORGS UNIVERSITET	UGOT	Sweden		
18	MARINE BIOLOGICAL ASSOCIATION OF THE UNITED KINGDOM	MBA	United Kingdom		
19	THE UNIVERSITY COURT OF THE UNIVERSITY OF ST ANDREWS	USTAN	United Kingdom		
20	DEUTSCHES KLIMARECHENZENTRUM GMBH	DKRZ	Germany		

## 1.2. List of Beneficiaries

No	Name	Short name	Country	Project entry date <sup>8</sup>	Project exit date
21	NORGES FORSKNINGSRAD	RCN	Norway		
22	EUROPEAN MOLECULAR BIOLOGY LABORATORY	EMBL	Germany		
23	UNIVERSITETET I TROMSOE	UiT	Norway		
24	EUROGOOS	EuroGOOS	Belgium		
25	CONSORCIO PARA EL DISEÑO, CONSTRUCCIÓN, EQUIPAMIENTO Y EXPLOTACION DE LA PLATAFORMA OCEANICA DE CANARIAS	PLOCAN	Spain		
26	KOBENHAVNS UNIVERSITET	UCPH	Denmark		
27	ILMATIETEEN LAITOS	FMI	Finland		
28	LUNDS UNIVERSITET	LU	Sweden		
29	UNIVERSITA DEGLI STUDI DELLA TUSCIA	UNITUS	Italy		
30	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	CEA	France		
31	HELMHOLTZ ZENTRUM FUR OZEANFORSCHUNG KIEL	GEOMAR	Germany		
32	NORSK INSTITUTT FOR LUFTFORSKNING STIFTELSE	NILU	Norway		
33	CARDIFF UNIVERSITY	CU	United Kingdom		
34	THE UNIVERSITY OF EDINBURGH	UEDIN	United Kingdom		
35	CSC-TIETEEN TIETOTEKNIKAN KESKUS OY	CSC	Finland		
36	CINECA CONSORZIO INTERUNIVERSITARIO	CINECA	Italy		
37	STICHTING EGI	EGI.eu	Netherlands		
38	HELSINGIN YLIOPISTO	UHEL	Finland		
39	EUROPEAN MULTIDISCIPLINARY SEAFLOOR AND WATER COLUMN OBSERVATORY - EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM (EMSO ERIC)	EMSO ERIC	Italy	01/01/2018	

## 1.3. Workplan Tables - Detailed implementation

### 1.3.1. WT1 List of work packages

WP Number <sup>9</sup>	WP Title	Lead beneficiary <sup>10</sup>	Person-months <sup>11</sup>	Start month <sup>12</sup>	End month <sup>13</sup>
WP1	New sensor technologies: innovation and services	6 - IFREMER	129.00	1	48
WP2	Metrology, quality and harmonization	4 - CNR	126.00	1	47
WP3	Improving measurement networks: common technological solutions	5 - CNRS	103.00	1	48
WP4	Joint operations across the RI domains	30 - CEA	97.50	6	50
WP5	Reference model guided RI design	13 - UvA	188.00	1	36
WP6	Inter RI data identification and citation services	28 - LU	65.00	1	48
WP7	Data processing and analysis	4 - CNR	97.00	7	46
WP8	Data curation and cataloguing	9 - NERC	161.00	1	42
WP9	Service validation and deployment	37 - EGI.eu	131.50	13	48
WP10	Governance for sustainable and adjustable access to RIs	5 - CNRS	60.50	1	50
WP11	New Concepts and Tools for Physical Access	15 - INRA	28.70	1	48
WP12	A Framework for Environmental Literacy	11 - ETHZ	36.00	1	48
WP13	Developing an Ethical Framework for RIs	8 - INGV	36.00	1	48
WP14	Citizen Observatories and Participative Science	8 - INGV	46.00	1	48
WP15	Training, e-Learning and courses	13 - UvA	63.80	1	48
WP16	Staff Exchange	12 - UniHB	10.00	1	46
WP17	Coordination of RI communication, development and implementation of the ENVRI strategy	27 - FMI	93.00	1	50
WP18	Dissemination, Liaison and Collaboration	9 - NERC	57.00	1	51
WP19	Project Management	38 - UHEL	66.00	1	51
WP20	Ethics requirements	1 - ICOS ERIC	N/A	1	51
<b>Total</b>			1,595.00		

### 1.3.2. WT2 list of deliverables

<b>Deliverable Number<sup>14</sup></b>	<b>Deliverable Title</b>	<b>WP number<sup>9</sup></b>	<b>Lead beneficiary</b>	<b>Type<sup>15</sup></b>	<b>Dissemination level<sup>16</sup></b>	<b>Due Date (in months)<sup>17</sup></b>
D1.1	Roadmap for the emergence of European industry providers and market landscape analysis	WP1	30 - CEA	Report	Public	24
D1.2	Specification report of common test protocols and inter-comparison methodologies	WP1	2 - EURO-ARGO	Report	Public	30
D1.3	Final prototype of ARGO float with pCO <sub>2</sub> and pH launched	WP1	2 - EURO-ARGO	Demonstrator	Public	33
D1.4	Report on integration across networks: common strategy and common sensors for lidar and aerosol extinction measurements	WP1	7 - FZJ	Report	Public	18
D1.5	Report on opportunities and applications of unmanned observatories for usage across RI	WP1	4 - CNR	Report	Public	48
D1.6	Results and recommendations from the comparison exercise of sensor embedded processing practices	WP1	4 - CNR	Report	Public	36
D1.7	Report on technological choices for dense networks of small sensors	WP1	6 - IFREMER	Report	Public	42
D2.1	Report on standardization in RIs and tree of metrology references (from international reference labs to RI collected data)	WP2	30 - CEA	Report	Public	42
D2.2	Methodology report for handling of data heterogeneity	WP2	8 - INGV	Report	Public	24
D2.3	Harmonization strategy report toward support to space mission and	WP2	4 - CNR	Report	Public	47

<b>Deliverable Number<sup>14</sup></b>	<b>Deliverable Title</b>	<b>WP number<sup>9</sup></b>	<b>Lead beneficiary</b>	<b>Type<sup>15</sup></b>	<b>Dissemination level<sup>16</sup></b>	<b>Due Date (in months)<sup>17</sup></b>
	assimilation systems based on RI data					
D3.1	Report on application of energy-unit in extreme environments and communication to SMEs	WP3	5 - CNRS	Report	Public	48
D3.2	New set of standards for the qualification of instruments towards extreme conditions	WP3	4 - CNR	Other	Public	30
D3.3	Report for best practices on robust telecom/data transmission	WP3	12 - UniHB	Report	Public	24
D3.4	Report on improved robustness in extreme conditions	WP3	4 - CNR	Report	Public	36
D3.5	Demonstrating robust data provision - data transmission and near real-time QC - employing a use case in a remote ocean region	WP3	12 - UniHB	Demonstrator	Public	43
D4.1	Report on cross-cutting issues, associated existing monitoring capacities and selected open case studies resulting from the Interdisciplinary workshop	WP4	15 - INRA	Report	Public	18
D4.2	Achievements report on open interdisciplinary case studies highlighting the common operation of networks	WP4	15 - INRA	Report	Public	42
D4.3	Reference document for methane harmonized monitoring	WP4	8 - INGV	Report	Public	46
D4.4	Report on intercalibration with Green repeater initiative	WP4	6 - IFREMER	Report	Public	42
D5.1	A consistent characterisation of existing and planned RIs	WP5	34 - UEDIN	Report	Public	12



<b>Deliverable Number<sup>14</sup></b>	<b>Deliverable Title</b>	<b>WP number<sup>9</sup></b>	<b>Lead beneficiary</b>	<b>Type<sup>15</sup></b>	<b>Dissemination level<sup>16</sup></b>	<b>Due Date (in months)<sup>17</sup></b>
D5.2	A definition of the ENVRIPLUS Reference Model	WP5	33 - CU	Other	Public	18
D5.3	A definition of the ENVRIPLUS Semantic linking framework at conceptual and formal levels.	WP5	13 - UvA	Other	Public	36
D5.4	A development plan for common operations and cross-cutting services based on a network of data managers and developers	WP5	9 - NERC	Report	Public	18
D5.5	A model architecture for new RIs to adopt and to act as a guide for existing RIs in their development	WP5	9 - NERC	Report	Public	24
D6.1	A system design for data identifier and citation services for environmental RIs projects to prepare an ENVRIPLUS strategy to negotiate with external organisations	WP6	28 - LU	Report	Public	20
D6.2	A report on negotiations with publishers, providers of existing data citation systems and other scientific organisations on implementing a global data citation system.	WP6	28 - LU	Report	Public	36
D6.3	Report on identification and citation service case studies	WP6	28 - LU	Report	Public	46
D7.1	Interoperable data processing for environmental RI projects: system design	WP7	4 - CNR	Report	Public	20
D7.2	Interoperable data processing services for environmental RI projects: prototype.	WP7	4 - CNR	Demonstrator	Public	42
D7.3	Performance optimisation for	WP7	13 - UvA	Report	Public	20

<b>Deliverable Number<sup>14</sup></b>	<b>Deliverable Title</b>	<b>WP number<sup>9</sup></b>	<b>Lead beneficiary</b>	<b>Type<sup>15</sup></b>	<b>Dissemination level<sup>16</sup></b>	<b>Due Date (in months)<sup>17</sup></b>
	environmental RI projects: system design					
D7.4	Performance optimisation services for environmental ESFRI projects: prototype	WP7	13 - UvA	Demonstrator	Public	42
D8.1	Data curation in system level sciences: system design	WP8	9 - NERC	Report	Public	18
D8.2	Data curation in system level sciences: prototype and deployment.	WP8	9 - NERC	Demonstrator	Public	42
D8.3	Interoperable cataloguing and harmonisation for environmental RI projects: system design	WP8	6 - IFREMER	Report	Public	18
D8.4	Interoperable cataloguing and metadata harmonisation for environmental RIs: prototype	WP8	6 - IFREMER	Demonstrator	Public	42
D8.5	Data provenance and tracing for environmental sciences: system design	WP8	16 - EAA	Report	Public	36
D8.6	Data provenance and tracing for environmental sciences: prototype and deployment	WP8	16 - EAA	Demonstrator	Public	42
D9.1	Service deployment in computing and internal e-Infrastructures Version1	WP9	37 - EGI.eu	Report	Public	28
D9.2	Service deployment in computing and data e-Infrastructures Version2	WP9	37 - EGI.eu	Demonstrator	Public	40
D9.3	Serving key data service stakeholders and policy initiatives version 1	WP9	28 - LU	Report	Public	30
D9.4	Serving key data service stakeholders and policy initiatives version 2	WP9	28 - LU	Demonstrator	Public	46

<b>Deliverable Number<sup>14</sup></b>	<b>Deliverable Title</b>	<b>WP number<sup>9</sup></b>	<b>Lead beneficiary</b>	<b>Type<sup>15</sup></b>	<b>Dissemination level<sup>16</sup></b>	<b>Due Date (in months)<sup>17</sup></b>
D10.1	Guidelines on access to Ris	WP10	4 - CNR	Report	Public	46
D10.2	Master plan to facilitate and encourage access to Ris	WP10	5 - CNRS	Report	Public	50
D10.3	Description of performance criteria for open access and list of performance indicators	WP10	5 - CNRS	Report	Public	30
D10.4	RI strategy for for flexibility and sustainability	WP10	5 - CNRS	Report	Public	50
D11.1	Report on planning and implementing physical access across disciplines	WP11	5 - CNRS	Report	Public	18
D11.2	Plan for sustained multi-year planning of oceanographic vessels for the environment European Ris	WP11	6 - IFREMER	Report	Public	18
D11.3	Whitepaper on improving access across to RIs disciplines	WP11	15 - INRA	Report	Public	40
D11.4	Report on interdisciplinary integration capacity, end-user needs TNA implementation requirement and added-value for the scientific community	WP11	5 - CNRS	Report	Public	48
D12.1	Report describing the relation between challenges of human systems and environmental information generated in RIs as documented module of the ENVRPLUS Reference Model updated based on the experiences from Tasks 33 and 34	WP12	16 - EAA	Report	Public	36
D12.2	White paper on general guidelines, recommendations, and best practices	WP12	11 - ETHZ	Report	Public	32

<b>Deliverable Number<sup>14</sup></b>	<b>Deliverable Title</b>	<b>WP number<sup>9</sup></b>	<b>Lead beneficiary</b>	<b>Type<sup>15</sup></b>	<b>Dissemination level<sup>16</sup></b>	<b>Due Date (in months)<sup>17</sup></b>
	on communication and decision-making under uncertainty for environmental hazards and natural disasters					
D12.3	White paper on further integration of RIs related to terrestrial ecosystem research including recommendations on co-locating research sites on national and international level	WP12	1 - ICOS ERIC	Report	Public	32
D12.4	Prototyping a distributed site catalogue	WP12	16 - EAA	Report	Public	48
D13.1	Questionnaire to analyse the ethical and social issues and assessment report on questionnaire answers	WP13	8 - INGV	Other	Public	24
D13.2	Template of the Ethical labels for deliverables and its adoption	WP13	8 - INGV	Report	Public	36
D13.3	Ethical Consensus Guidelines for Ris	WP13	8 - INGV	Report	Public	42
D13.4	Contents for Websites, social media appearance, printed matter on ethical & societal issues for general public	WP13	11 - ETHZ	Websites, patents filling, etc.	Public	48
D14.1	Prototype of a web-based annotation tool for user testing. This will demonstrate an example of participative science early in the project, allowing access, testing, and cross-cutting developments for the ENVRIPLUS consortium	WP14	6 - IFREMER	Demonstrator	Public	15
D14.2	Report describing image annotation results	WP14	6 - IFREMER	Report	Public	30

<b>Deliverable Number<sup>14</sup></b>	<b>Deliverable Title</b>	<b>WP number<sup>9</sup></b>	<b>Lead beneficiary</b>	<b>Type<sup>15</sup></b>	<b>Dissemination level<sup>16</sup></b>	<b>Due Date (in months)<sup>17</sup></b>
D14.3	Report on development and implementation of a citizen seismology sensor observatory and education platform	WP14	10 - EMSC	Report	Public	20
D14.4	Guidelines for developing citizen sensor observatories and education platform	WP14	10 - EMSC	Report	Public	26
D14.5	Test version of a EMBRC citizen observatory system	WP14	17 - UGOT	Demonstrator	Public	18
D14.6	Review of existing Citizen Science tools	WP14	8 - INGV	Report	Public	15
D14.7	Citizen observation training program, training delivery and evaluation, and impact assessment report	WP14	18 - MBA	Report	Public	44
D14.8	Collection Training sessions/presentations	WP14	18 - MBA	Websites, patents filling, etc.	Public	44
D14.9	Summary report of WP14	WP14	8 - INGV	Report	Public	48
D15.1	Training materials, suitable for both classroom and e-learning use	WP15	33 - CU	Websites, patents filling, etc.	Public	30
D15.2	Materials from the second time-series conference including tutorial and hand-book on the second time-series conference	WP15	5 - CNRS	Websites, patents filling, etc.	Public	48
D15.3	Joint plan of action between the INFRASUPP-3-2014 project and ENVRI-PLUS	WP15	13 - UvA	Report	Public	24
D15.4	Report on available training/courses on the use of data processing tools from the existing RI's and the priorities for using these in a transversal platform	WP15	37 - EGI.eu	Report	Public	18
D15.5	EeTP E – Learning, description of	WP15	14 - UNILE	Report	Public	36

<b>Deliverable Number<sup>14</sup></b>	<b>Deliverable Title</b>	<b>WP number<sup>9</sup></b>	<b>Lead beneficiary</b>	<b>Type<sup>15</sup></b>	<b>Dissemination level<sup>16</sup></b>	<b>Due Date (in months)<sup>17</sup></b>
	implementation of new functionalities					
D15.6	Training course for teachers	WP15	8 - INGV	Report	Public	24
D16.1	Eligibility criteria document	WP16	12 - UniHB	Report	Public	6
D16.2	Synthesis report on staff exchange and how this service can be sustained by RIs?	WP16	12 - UniHB	Report	Public	46
D17.1	Report of domain WGs on domain-specific development needs and actions	WP17	38 - UHEL	Report	Public	36
D17.2	Updated version of the ENVRI strategy	WP17	27 - FMI	Report	Public	50
D17.3	Landscape analysis of the environmental RI community in Europe	WP17	38 - UHEL	Report	Public	46
D17.4	Summary report on policy communication actions	WP17	4 - CNR	Report	Public	46
D17.5	ENVRIPLUS sustainability plan	WP17	13 - UvA	Report	Public	50
D17.6	White paper on further integration of RIs in the environmental field including recommendations on co-locating research sites on national and international level	WP17	1 - ICOS ERIC	Other	Public	48
D18.1	Dissemination strategy	WP18	9 - NERC	Report	Public	4
D18.2	Establishment of the ENVRIPLUS website and first set of promotional material	WP18	38 - UHEL	Websites, patents filling, etc.	Public	6
D18.3	Report on user community workshops	WP18	13 - UvA	Report	Public	46
D18.4	Synthetic report on best practices of linking RIs and societal needs, economics and policy	WP18	15 - INRA	Report	Public	48
D18.5	Developing a common approach to fostering innovation partnerships between	WP18	39 - EMSO ERIC	Report	Public	50

<b>Deliverable Number<sup>14</sup></b>	<b>Deliverable Title</b>	<b>WP number<sup>9</sup></b>	<b>Lead beneficiary</b>	<b>Type<sup>15</sup></b>	<b>Dissemination level<sup>16</sup></b>	<b>Due Date (in months)<sup>17</sup></b>
	the environmental RI s and the private sector					
D18.6	Stakeholders (economics) and consultation group feedbacks on ENVRPLUS Strategy and Sustainability Plan	WP18	15 - INRA	Report	Public	44
D19.1	Organization of project Kick-off meeting, including a Steering Committee and a General Assembly meeting	WP19	38 - UHEL	Websites, patents filling, etc.	Public	1
D19.2	Overview report of all annual meetings, General Assembly and Steering Committee meetings	WP19	38 - UHEL	Report	Public	48
D19.3	Project internal communication (intranet, email-lists, telephone connections) operational	WP19	38 - UHEL	Websites, patents filling, etc.	Public	6
D19.4	Initial Data Management Plan (DMP)	WP19	38 - UHEL	Report	Public	6
D19.5	1st Updated DMP	WP19	38 - UHEL	Report	Public	13
D19.7	Final DMP	WP19	38 - UHEL	Report	Public	44
D20.1	H - Requirement No. 1	WP20	1 - ICOS ERIC	Ethics	Confidential, only for members of the consortium (including the Commission Services)	2
D20.2	POPD - Requirement No. 2	WP20	1 - ICOS ERIC	Ethics	Confidential, only for members of the consortium (including the Commission Services)	2

### 1.3.3. WT3 Work package descriptions

<b>Work package number</b> <sup>9</sup>	WP1	<b>Lead beneficiary</b> <sup>10</sup>	6 - IFREMER
<b>Work package title</b>	New sensor technologies: innovation and services		
<b>Start month</b>	1	<b>End month</b>	48

#### Objectives

The scientific observations made in the RIs rely on measurement instrumentation. High performance instrumentation development is a highly innovative domain, intensive and extensive parameters ranging from atmospheric concentration and column amount of trace gases and aerosols to ocean salinity to Earth crust motions. While technologies evolve, only a few fundamental physical principles underlie all measurements. There is ample opportunity for collaborative work across disciplines to share development and application efforts and generate innovation. The objectives of this WP are the following:

- 1) Consolidating RI requirements for new sensors and the associated market
- 2) Defining common approaches for sensor requirements across disciplines
- 3) Defining modalities for use of common technical unmanned platforms and application
- 4) Promoting the use of Network-enabled sensors across the RIs

#### Description of work and role of partners

##### **WP1 - New sensor technologies: innovation and services** [Months: 1-48]

**IFREMER, EURO-ARGO, CNR, CNRS, FZJ, INGV, UniHB, INRA, EAA, MBA, PLOCAN, CEA, GEOMAR**

Evolution of the monitoring strategy will have to consider emerging sensors and their suitability to respond to the needs. Four aspects of sensors are important: their metrological performances (accuracy, resolution, etc.), their robustness, their size (easier deployment) and their cost. Environmental RIs need to further benefit from currently emerging technologies that match against these four dimensions. Collaboration in this WP will greatly benefit to the RIs as 1) they develop a common set of specifications, and 2) they stimulate developments in the private sectors by opening larger markets than individual RI. WP1 tackles the issue of marketability of innovative high performance instrumentation by investigating how common needs from different RIs can stimulate SMEs for developing new products enabling new applications. WP1 also addresses the different approaches for defining sensor requirements in the different communities and, focussing in specific use-cases, will contribute to cross-fertilization across RIs.

Task 1.1: Emerging technologies, emerging markets: fostering the innovation potential of research infrastructures

Task leader: CEA[ICOS] (6), Participants: CNR[SIOS] (3), FZJ[IAGOS] (2), IFREMER[EURO-ARGO] (2), EURO-ARGO (1), EAA[LTER] (1), INRA[ANAEE] (1),

The scientific and technical requirements of the European environmental RIs may appear complex and heterogeneous to European SMEs. This task consolidates the needs of RIs especially in terms of common high performance instrumentation needs. It is a first approach to establishing a market landscape of the environmental research infrastructures and supporting potential SME providers.

Specification, development and test of sensors for parameters of interest will be roadmapped. A study will identify the scientific measurements needs crucial for the RIs and matching them with emerging technologies (including new CO<sub>2</sub>, pCO<sub>2</sub>, pH monitoring at sea, spectro-optical instrumentation for atmospheric monitoring, advanced airborne sensors, remote nucleotide sequencing, etc.). Our overarching objective is to stimulate the industry innovation by opening new market opportunities. The work will be a service to both SMEs (identification of emerging markets), and to the RIs (to program their efforts to integrate potential innovations).

We will mobilize instrumentation experts within infrastructures, analyse and identify useful technologies and services, define state of the art, define TRL and help shape market prospection to build better industrial fabric serving RIs needs. In addition, innovative processes to support key SMEs partners will be identified (EC, national, regional).

The task will start by identifying opportunities, progressively filtering only the techniques with high potential for European SMEs provision to RIs. Work will include extensive liaison with key industry partners and laboratories. We will organize an Environmental RIs industry forum event with side workshops, concluded by a white paper in which we explore the challenges, barriers (technical and market) and initial activities in this area.

Task 1.2: Common methodologies for inter-comparisons and joint field tests

Task leader: EURO-ARGO (3), Participants: GEOMAR[ICOS] (24), CNRS[FIXO3] (6), CNR[ACTRIS] (10), CEA[ICOS] (8), FZJ[IAGOS] (10),



This task will develop common approach to instrumentation testing and intercomparisons. This will enable uptake of common sensor technologies and systems across RI, with potential for scientific and technical cross fertilization. It relies on use-cases regarding 2 different techniques (CO<sub>2</sub> sensors and lidars) that will define requirements and propose solutions ('off-the-shelf', prototype, etc..)

- Use-case 1 Common sensors – case of carbon-dioxide marine measurement

This use-case will define a common roadmap (technologies, sensor specifications, spatial coverage, costs) to define the technical requirements for installing CO<sub>2</sub> sensors on floats to be used by ICOS and other Marine RIs EuroARGO, FixO<sub>3</sub>/OceanSITES/EMSO and GROOM. This is a key issue for future evolution of Argo floats as well as for extending information relevant to ICOS in the marine domain. A common evaluation of available sensors will be performed (using results of FixO<sub>3</sub> and similar international experiments) in order to specify the payload and operating cycles of a new ARGO float including pCO<sub>2</sub> and pH measurement. The use-case will define the requirement and developments needed. From this, a procedure of integration of the glider infrastructure (GROOM project) in Euro-ARGO will be defined.

- Use-case 2: Common sensors – case of aerosol lidar and in-situ light extinction measurements

Lidars and in situ light extinction provide atmospheric information relevant to ACTRIS, ICOS and IAGOS. Definition of common needs will permit selection of appropriate technologies and robustness requirements. This will support the cross fertilization of the three RIs for the application of lidar and complementary in-situ technologies to key parameters: aerosol vertical distribution, boundary layer height, and atmospheric dynamics. The includes deployment and test of final prototype based on commercial lasers and optics including multi-purpose raw data processing and harmonized instrument selection criteria. Constraints associated to coastal/ocean/arctic regions will be considered. Potential cross-benefits of combining observations between RIs will be assessed.

Task 1.3: New common observation platform prototyping: the case of drones

Task leader: CNR[ANAE] (10), Participants: EURO-ARGO (1), CNRS[GROOM] (2),

Use of unmanned vehicles (UV) increases. While marine infrastructures are dedicated to UVs (EURO-ARGO, GROOM), aerial UVs are yet to be deployed in RIs. ANAE has been investing in developing a drone platform, suitable for a range of applications (earth, ecosystems, atmosphere and ocean sciences). New innovative perspectives of scientific monitoring also arise from the development of light-weight sensors or samplers that will meet requirements of other RIs. Experience of operating UV in Marine RIs will be transferred to other RIs. The task will elaborate a best practice report for design, integration and tests across RIs. For this purpose a workshop will allow sharing scientific and technical experience. In a second phase, sensors will be implemented on-board the CNR/TECNAM platform addressing needs of other RIs including integration of sensors and flight tests. A report on potential future application of UVs will be issued.

Task 1.4: Network-enabled sensors

Task leader: CNR[ANAE] (5), Participants: CNRS[FIXO<sub>3</sub>] (6.0), PLOCAN[FIXO<sub>3</sub>] (10), UniHB[EMSO] (5), IFREMER[EURO-ARGO] (11),

Distributed infrastructures require efficient data transmission through a more strict effort on standards for sensor registration, sensor web enablement, sensor-embedded treatment capacities. Network-enabled sensors offer a strong potential. We will coordinate these activities amongst RIs and evaluate how technological choices can be transferred to other RI and to the market. The task integrates ongoing initiatives and proves the maturity and security of the smart sensor techniques applied at large scale.

Sensor interface standards and software/hardware development practices - The practices of the various RIs will be analysed: are the sensor markets linked between RIs? What science resources are dedicated to sensor drivers? Can we easily access to these descriptions through sensor registries? What are the relevant standards? A road map for improvements by homogenization will be established and implemented. The choice of relevant sensor interface standards will be promoted as a service to the RIs.

Web enablement - An ENVRIPLUS working group will promote the Sensor Web Enablement (SWE) suite of standards defined and governed by the Open Geospatial Consortium (OGC) through a recommendation document suited for the distributed RIs. From a study of the ENVRIPLUS landscape in the marine domain, it will estimate the benefits for the RIs and propose an implementation plan. It will contribute to the next evolution of SWE specifications.

Sensor embedded data analysis capacities - Data analysis at the sensor level lacks standards for a wide scale use. Short experiments will be performed and documented across domain to compare existing practices (triggering in seismology, data processing in subsea currentmeters or acoustics, decision making for pollution sampling...). Recommendation will be issued from this experiment on the improved data quality, reduced dataflow, and improved cost effectiveness at RI level.

Large number of miniature sensors - The lowered cost, miniaturization and connectivity of some sensors now allows much denser networks. An inter-comparison of such networks of sensors will be performed as a benchmark by PLOCAN and CNRS LabSTICC corresponding at least to EMSO, JERICO, ANAE and EPOS real conditions. The results of this deployment and other best practices will result in the determination of support to technological choices to be made at RIs. It will constitute a service of ENVRI+ to the RIs.

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### Participation per Partner

Partner number and short name	WP1 effort
2 - EURO-ARGO	5.00
4 - CNR	28.00
5 - CNRS	0.00
ENSTA	14.00
6 - IFREMER	13.00
7 - FZJ	12.00
8 - INGV	1.00
12 - UniHB	5.00
15 - INRA	1.00
16 - EAA	1.00
18 - MBA	1.00
25 - PLOCAN	10.00
30 - CEA	14.00
31 - GEOMAR	24.00
<b>Total</b>	<b>129.00</b>

### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D1.1	Roadmap for the emergence of European industry providers and market landscape analysis	30 - CEA	Report	Public	24
D1.2	Specification report of common test protocols and inter-comparison methodologies	2 - EURO-ARGO	Report	Public	30
D1.3	Final prototype of ARGONET float with pCO <sub>2</sub> and pH launched	2 - EURO-ARGO	Demonstrator	Public	33
D1.4	Report on integration across networks: common strategy and common sensors for lidar and aerosol extinction measurements	7 - FZJ	Report	Public	18

### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D1.5	Report on opportunities and applications of unmanned observatories for usage across RI	4 - CNR	Report	Public	48
D1.6	Results and recommendations from the comparison exercise of sensor embedded processing practices	4 - CNR	Report	Public	36
D1.7	Report on technological choices for dense networks of small sensors	6 - IFREMER	Report	Public	42

### Description of deliverables

D1.1 : Roadmap for the emergence of European industry providers and market landscape analysis [24]  
D1 Roadmap for the emergence of European industry providers and market landscape analysis

D1.2 : Specification report of common test protocols and inter-comparison methodologies [30]  
D2 Specification report of common test protocols and inter-comparison methodologies

D1.3 : Final prototype of ARGO float with pCO<sub>2</sub> and pH launched [33]  
Final prototype of ARGO float with pCO<sub>2</sub> and pH launched

D1.4 : Report on integration across networks: common strategy and common sensors for lidar and aerosol extinction measurements [18]  
Report on integration across networks: common strategy and common sensors for lidar and aerosol extinction measurements

D1.5 : Report on opportunities and applications of unmanned observatories for usage across RI [48]  
Report on opportunities and applications of unmanned observatories for usage across RI

D1.6 : Results and recommendations from the comparison exercise of sensor embedded processing practices [36]  
Results and recommendations from the comparison exercise of sensor embedded processing practices

D1.7 : Report on technological choices for dense networks of small sensors [42]  
Report on technological choices for dense networks of small sensors

### Schedule of relevant Milestones

Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS18	Meeting on sensor inter-comparison methodologies	6 - IFREMER	14	Meeting held
MS24	Meeting to assess drones potentialities for common observations	6 - IFREMER	18	Meeting held

<b>Work package number</b> <sup>9</sup>	WP2	<b>Lead beneficiary</b> <sup>10</sup>	4 - CNR
<b>Work package title</b>	Metrology, quality and harmonization		
<b>Start month</b>	1	<b>End month</b>	47

### Objectives

Delayed or real time observations performed by networks of instruments are generally used in conjunction with other data, including data from other observatories, in situ or from space, or from long time series. Introducing heterogeneous data that are not directly comparable with each other commonly generate biases in the results of scientific users. Harmonization serves the fundamental purpose of enabling the unbiased usage of data. Data flowing from observation networks has to be harmonized in a scientific and metrological sense. There is a crucial need to improve comparability between RI networks and traceability to standard (SI) units and metrological norms. In addition, all RIs are facing difficulties with using long time-series lacking harmonized calibration and change in instrumentation. The WP will also address strategies to cope with existing non-harmonized data sets, in particular regarding the issue of satellite validation. The objective of this WP is to:

- 1) Address the needs for standardization of measurements and methods across the RIs
- 2) Develop new services to promote use of heterogeneous time series produced by RIs
- 3) Develop new services to meet requirements for using heterogeneous networks for satellite validation

### Description of work and role of partners

#### **WP2 - Metrology, quality and harmonization** [Months: 1-47]

**CNR, EURO-ARGO, CNRS, IFREMER, FZJ, INGV, NERC, UvA, EAA, UiT, EuroGOOS, UNITUS, CEA, NILU**

This WP will strongly focus on key user needs including the provision of well-calibrated measurements and sampling procedures, near real time applications, calibration and validation of space mission, models, and the need for long homogeneous time series. The last task highlights the impact of harmonization for users.

#### Task 2.1: Metrology & national institutes-standards

Task leader: CEA[ICOS] (10), Participants: CNR[SIO] (7), FZJ[AGOS] (2), IFREMER[EURO-ARGO] (2), UNITUS[ICOS] (3)

Addressing the climate and environmental challenges require scientific observations of ever increasing accuracy and homogeneity. This increases demand on the traceability of measurement results to internationally agreed units of measurement and standards with well-characterized uncertainties and well-monitored and maintained stabilities. Activities in this task will be devoted to make an assessment of actual status of RIs on these issues, addressing the need for standardization of key parameters common to different RIs such as CO<sub>2</sub> concentration, Eddy covariance, radiation, water vapour measurements, etc. This will be the topic of a first series of workshop.

Standardization efforts will have to be made in strong connection with environmental metrological projects of the European Metrology Research Programme (EMRP), and facilitate transfer of their results and progress to RIs, helping link to international metrological scales on essential variables. Large efforts will be devoted to reinforce traceability chain, promoting implementation of calibration labs and secondary standards along the observational networks for key parameters. Examples from different infrastructures such as ICOS can be transferred to others.

In this task we will link RI's efforts to establish strong measurements quality in the best current international metrological scales to the on-going developments in national metrological institutes (NMIs) on identified essential variables derived from enlarged assessment and discussion with users (RIs) and relevant actors. We will identify proxies related to SI units through dialogue with RIs and metrological Institutes. We will establish a roadmap for norms and standards that are needed by RIs and industry and for which there is an interest from NMIs in EURAMET or standardization organizations. Potential benefits from using existing test capabilities within the RIs for tests of instruments will be assessed.

#### Task 2.2: Heterogeneity in time series: innovative user services

Task leader: INGV[EMSO] (5), Participants: IFREMER[EURO-ARGO] (2), UiT[ESONET-VI] (1), UvA[LIFEWATCH] (2), NERC[FixO3] (8),

Data streams provided to users by RIs usually show a high level of homogeneity due to internal standardization. However a large number of sources of heterogeneity remain, in particular deriving from past operations at RIs: these include gaps in time series, gaps induced by differences in technologies across networks, the use of data from « research » networks, and the technology changes within time series. Addressing heterogeneities and facilitating the use of heterogeneous data series is a common issue for many RIs. Selecting/elaborating methods to detecting anomalies in interdisciplinary time series and dealing with the anomalies to develop products that are suited for scientific usage is not trivial and require

specific expertise. Work in this task will start from results of past and on-going projects dealing with homogenization of climate series and development of climate services, (e.g. HOPME, ECLISE). It will also benefit from advances in numerical ecology to solve biological time series issues. Common solution will be proposed to RIs in strong association to users, i.e. workshop organized on time series in Theme 5.

Task 2.3: Observation continuum: enhancing use of RIs for satellite validation from and to assimilation and services  
 Task leader: CNR[ACTRIS] (10), Participants: IFREMER[EURO-ARGO] (8), FZJ[IAGOS] (9) , EURO-ARGO (3), INGV[EMSO] (1), NERC[FixO3] (16), CNRS[GROOM] (17), EuroGOOS (12), CEA[ICOS] (4),

Identifying how in-situ research infrastructures can be fit for the purpose of satellite calibration and validation, and validation of assimilation systems is essential and a transversal issue for many RIs. A network performance assessment is necessary which may require to address methodologies (including harmonization or technical implementation), network configuration and data for assimilation procedures, development of higher-level products facilitating the work of space and assimilation users, etc. A series of workshops will be organized to share experience of RIs and identify strategies and demonstrate the full potential of research infrastructures for product validation. This will be done for 2 use-cases, one in the atmospheric domain focussing on in situ need of Copernicus (atmosphere, Climate change) by assessing harmonization needs for the calibration and validation of selected upcoming Sentinel and ESA Earth Explorers satellites. A second use-case will be addressing how the implementation strategy of new sensors in a marine RI shall be organized for rapid use by space-users and modelling communities. The implementation of biology measurements on board Argo floats will assess the interest of such data for process studies as well as satellite calibration/validation and their utility in ecosystem modeling.

Conclusions from case studies will support recommendations toward RI harmonization to enhance better specifications with respect to satellite and assimilation activities.

#### Participation per Partner

Partner number and short name	WP2 effort
2 - EURO-ARGO	3.00
4 - CNR	17.00
5 - CNRS	17.00
6 - IFREMER	12.00
7 - FZJ	11.00
8 - INGV	6.00
9 - NERC	24.00
13 - UvA	2.00
16 - EAA	2.00
23 - UiT	1.00
24 - EuroGOOS	9.00
SMHI	3.00
29 - UNITUS	3.00
30 - CEA	14.00
32 - NILU	2.00
<b>Total</b>	<b>126.00</b>

### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D2.1	Report on standardization in RIs and tree of metrology references (from international reference labs to RI collected data)	30 - CEA	Report	Public	42
D2.2	Methodology report for handling of data heterogeneity	8 - INGV	Report	Public	24
D2.3	Harmonization strategy report toward support to space mission and assimilation systems based on RI data	4 - CNR	Report	Public	47

### Description of deliverables

D2.1 : Report on standardization in RIs and tree of metrology references (from international reference labs to RI collected data) [42]  
 Report on standardization in RIs and tree of metrology references (from international reference labs to RI collected data)

D2.2 : Methodology report for handling of data heterogeneity [24]  
 Methodology report for handling of data heterogeneity

D2.3 : Harmonization strategy report toward support to space mission and assimilation systems based on RI data [47]  
 Harmonization strategy report toward support to space mission and assimilation systems based on RI data Change of delivery date of deliverable D2.3 "Harmonization strategy report toward support to space mission and assimilation systems based on RI data" from M36 to M47. Justification: The deliverable need to be postponed in order to provide an updated report on the status of the different RIs respect to the support to satellite and modelling communities. There are no actions following this deliverable so this extra time will be used to prepare a more updated and accurate report available as one of the results at the end of the project.

### Schedule of relevant Milestones

Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS11	First workshop on use cases for satellite/assimilation validation	4 - CNR	12	Meeting held
MS27	Report on traceability and standards in Environmental RIs: actual status, best practices, recommendations	4 - CNR	24	Internal report

<b>Work package number</b> <sup>9</sup>	WP3	<b>Lead beneficiary</b> <sup>10</sup>	5 - CNRS
<b>Work package title</b>	Improving measurement networks: common technological solutions		
<b>Start month</b>	1	<b>End month</b>	48

## Objectives

### Objectives

A number of Environmental RIs comprise a distributed infrastructure with cascading networks of in situ observatories from large-scale networks of platforms or sites to local networks of various sensors. Network operation is usually a cumbersome aspect of these RIs facing specific technological problems related to operations in remote areas, maintenance of the network, transmission of information, etc. The burden increases with remoteness of the station, which is a common feature here. Existing RIs have developed ad-hoc solutions to overcome specific problems and we expect that common activities toward network integration are anticipated to generate important cross fertilization across the infrastructures. In addition, robust inter-connexion within and across these networks is still in an infancy level and various innovative technologies are becoming available. Specific objectives of this WP are:

- 1) To review the existing technologies addressing energy production at remote sites, data transmission and adaptation of technologies to extreme conditions used by RIs,
- 2) To propose innovative solutions including testing of components, subsystems, materials, techniques and dedicated software to improve networking at distributed RIs
- 3) Evaluate potential for improved standardization of transmission technologies among RIs and benefits for the cluster

## Description of work and role of partners

### **WP3 - Improving measurement networks: common technological solutions** [Months: 1-48]

**CNRS, CNR, IFREMER, FZJ, INGV, UniHB, EAA, UNITUS, CEA**

#### Description of work

**Task 3.1: Enhancing observing capacity from remote sites: improving energy production units** Task leader: CNRS[EPOS] (11), Participants: CNRS[ACTRIS] (10), CNR[SIOS] (2), CNRS[ANAEE] (8),

The different technologies used for energy production, storage and use as well as methodologies for data transmission used by RIs will be summarized and reviewed for their advantage and limitation. Based on requirements expressed by RIs, and new technologies available, test equipment will be designed for production, storage of energy or transmission technologies. Whatever the technology used, its innovative approach focuses on mastering the adaptation toward RI requirements (Simplicity, modularity, robustness, reliability, unmanned operation, extreme conditions, extended range of powers). The test equipment will be installed in the field under conditions relevant to those of interest to at least 3 domains as for example EPOS (links with volcanoes, testing in warm/tropical conditions), ACTRIS (testing unit under cold/ice cloud conditions for aerosol measurements), ANAEE (tests for eco-climatic studies), SIOS (testing for use in cold environments).

**Task 3.2: Testing robustness towards extreme conditions**

Task leader: CNR[SIOS] (10), Participants: IFREMER[EURO-ARGO] (3), CNRS[ACTRIS] (8), INGV[EMSO] (4), FZJ[IAGOS] (8), UNITUS[ICOS] (3)

The instruments and technologies to monitor environmental parameters have to face extreme conditions. RIs are operating in polar (SIOS), high mountains (ACTRIS, ICOS), deep sea (EMSO) conditions and on-board floating infrastructures (EURO-ARGO) and planes (IAGOS). Military testing standards often result in very elevated costs while the absence of testing before implementation induces low reliability of the RIs. Operating platforms under extreme conditions have developed solutions that required strong adaptation/innovation efforts. ENVRI[PLUS] will foster common practices and propose a harmonized service of the RIs for the testing procedures and standards. The standards will build upon existing ones (such as NF X 10 812) and specialized RIs such as I3 HYDRALAB. ENVRI[PLUS] will review adaptation technologies among RIs and organize the standard reference groups with balanced representation from RI representatives, industrial customers and manufacturing SMEs.

**Task 3.3: Robust data provision: data transmission and near real time QC**

Task leader: UniHB[EMSO] (12), Participants: FZJ[IAGOS] (4), NILU[ACTRIS] (2), CNR[ACTRIS] (8), INGV[EMSO] (4), IFREMER[EURO-ARGO] (3), CEA[ICOS] (2)

Near-Real-Time (NRT) data transmission on site with several instruments and from site/node to data processing centre is a common feature shared by almost all ENVRI+ RIs. NRT data transmission is also more and more used for rapid quality checking for the benefit of RI operators. SO far, NRT procedures have been left to independent choices of

the RIs responding to their specific needs while a common approach to NRT technologies would be extremely useful to coordinate response of RIs in case of environmental crisis. The work of this task will focus on the use of non-geophysical housekeeping data in measurements systems and sensors for the automation of QC. It will first review NRT transmission procedures at RIs, including mapping of NRT quality checking procedures across RIs. It will organize best practice workshops on key aspects of remote data transmission, wireless on site, and practices on NRT Quality Assurance checking. This will enable achieving NRT data stream through easy automation of data QC. Finally, a demonstration action will be organized to highlight added value and benefits of selected best practices in simulated environmental crisis. Participation of SMEs to the WP will be strongly encouraged

#### Participation per Partner

Partner number and short name	WP3 effort
4 - CNR	20.00
5 - CNRS	26.60
IFSTTAR	4.20
UJF	6.20
6 - IFREMER	6.00
7 - FZJ	12.00
8 - INGV	8.00
12 - UniHB	12.00
16 - EAA	3.00
29 - UNITUS	3.00
30 - CEA	2.00
<b>Total</b>	<b>103.00</b>

#### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D3.1	Report on application of energy-unit in extreme environments and communication to SMEs	5 - CNRS	Report	Public	48
D3.2	New set of standards for the qualification of instruments towards extreme conditions	4 - CNR	Other	Public	30
D3.3	Report for best practices on robust telecom/data transmission	12 - UniHB	Report	Public	24
D3.4	Report on improved robustness in extreme conditions	4 - CNR	Report	Public	36



### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D3.5	Demonstrating robust data provision - data transmission and near real-time QC - employing a use case in a remote ocean region	12 - UniHB	Demonstrator	Public	43

### Description of deliverables

D3.1 : Report on application of energy-unit in extreme environments and communication to SMEs [48]  
 Report on application of energy-unit in extreme environments and communication to SMEs

D3.2 : New set of standards for the qualification of instruments towards extreme conditions [30]  
 New set of standards for the qualification of instruments towards extreme conditions

D3.3 : Report for best practices on robust telecom/data transmission [24]  
 Report for best practices on robust telecom/data transmission

D3.4 : Report on improved robustness in extreme conditions [36]  
 Report on improved robustness in extreme conditions

D3.5 : Demonstrating robust data provision - data transmission and near real-time QC - employing a use case in a remote ocean region [43]  
 Plan to develop a hardware prototype, which is capable to support standardised data collection and transmission as a proof of concept. We will build a radically Open Source (both software and hardware) sensor data harmonisation and communication module which will transform manufacturer specific, proprietary outputs into standardised formats and will enable data transmission via the recognized ENVRI transmission methods in an open, standardized way. To support marine domain RIs we will provide this module robustly boxed in order to survive harsh, marine environments. We are convinced that this will be a piece of RI key technology in the future. The work will be carried out in close cooperation with a SME from Spain, SENSORLAB S.L., <http://www.sensorlab.es> who has been partner on similar tasks in the past. The actual demo mission as described in task 3.3 of the DoA (...to highlight added value and and benefits of selected best practices...) will be carried out in the area of Canary Islands where PLOCAN will provide logistic support.

### Schedule of relevant Milestones

Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS9	Report reviewing technologies currently used at research infrastructures for unmanned operation (power and transmission technologies)	5 - CNRS	12	Internal report

<b>Work package number</b> <sup>9</sup>	WP4	<b>Lead beneficiary</b> <sup>10</sup>	30 - CEA
<b>Work package title</b>	Joint operations across the RI domains		
<b>Start month</b>	6	<b>End month</b>	50

### Objectives

Common activities toward network integration are anticipated to generate important cross fertilization across the infrastructures. Moreover, some important scientific questions can only be answered by clustering the observations of several RIs. In this work package, through different use-cases, we aim at developing common network design, sharing of methodologies and protocols, instrumentation deployment, including the development and field-testing of integrated observatories. More integrated networks also offer potential to increase the spatial coverage of each individual network by putting in common several sites and participate to opportunities launched by international organization and industry (e.g. “green repeater” initiative). Therefore this WP is strongly linked to the ACCESS component of the proposal. The objective of this WP is:

- 1) To address strategies for enhancing common RI field operations
- 2) To perform 2 proof-of-concept experiments joining expertise from several RIs

### Description of work and role of partners

#### **WP4 - Joint operations across the RI domains** [Months: 6-50]

CEA, EURO-ARGO, CNR, CNRS, IFREMER, INGV, NERC, INRA, EAA, MBA, GEOMAR

Task 4.1. Deployment and common management of a network of observatories

Task leader: INRA[ANAEE] (12), Participants: CNRS[ACTRIS] (6), CEA[ICOS] (3), CNR[SIOS] (3), MBA[EMBRC] (6), NERC/NOC (2), EURO-ARGO (1.5), EAA (3)

The integration of distributed RI's observatories holds a large potential for science. Joint operations at collocated platforms/sites will reduce the cost and improve the coverage of the observations. This task will identify and support potential for common field operations, including common network design and mutual performance optimization across RIs.

We will aim at combining different networks focusing on a few timely scientific issues (case studies). The starting point for this task is an initial open workshop to identify valuable use cases considering together the science impact, the technical feasibility and the data management issues (Theme 2). The workshop will draw a landscape of the challenges to be addressed and associated monitoring capacities. The work will also cover common network design and performance gain from commonalities. Potential, pre-identified open use cases include:

- Characterization of the Nitrogen cycles in agriculture intensive areas,
- Extending Atmospheric observations in the Marine domain,
- Long Term Ecological Research and Monitoring across marine/ecosystem infrastructures.

The workshop will be followed by an implementation phase in parallel of Tasks 4.2 and 4.3 in which all use cases of common operation will be documented, and recommendations will be issued for future common operations between distributed RIs.

Task 4.2. Marine-atmosphere common operation of platforms - Case study on methane from seafloor to atmosphere

Task leader: INGV[EMSO] (2), Participants: IFREMER[EUROFLEETS] (8), GEOMAR[ICOS] (9.5), CEA[ICOS] (8), CNRS[ACTRIS] (6)

Methane seeps discoveries are dramatically increasing with the improved detection capacities of the multi-beam acoustic sounders: gas hydrates, multiple small pockmarks, plumes from active faults, and from industrial production or storage sites. Their time variations due to climate change, seismic triggering and mud volcanoes need to be monitored. The task is organized around a joint pilot experiment on a RI platform at a site of interest (defined in Task 4.1). The pilot study experiment will include measurements from seismicity, seafloor gas bubbles, dissolved methane, sea surface, to atmosphere. Sensing technology will be compared and range from active acoustics, seismology, chemical and spectro-optical sensors, reference analysis of isotopes, etc. Monitoring of methane fluxes at the water-atmosphere interface will be addressed.

Joint monitoring strategies for methane at seafloor interface and water column.

Innovative sensors on the seabed or along the water column (acoustic bubble counters, optical sensors for dissolved gas) will be selected, improved and integrated to meet user needs (lower the cost and wider range). Improvement involves calibration, accurate modelling of the signals, processing and inversion strategies, and well-controlled ground-truthing operations. The chemical sensors need also improvements to follow the dissolution processes of the methane plumes.

Associated biofauna habitat mapping will be advanced by defining statistical relationships between the biological information and the acoustic descriptors.

A Pilot experiment will involve design and implementation of a site experiment including measurements at all levels from seismicity, seafloor gas bubbles, dissolved methane, sea surface, fluxes to the atmosphere. Sensing technologies will be compared within active acoustics, seismology, chemical sensors, analysis of isotopes,... Sensitivity of atmospheric networks to sea-air fluxes will be assessed through sensitivity modelling and analysis of measurements. Overall this task will better link discoveries of methane seeps and time series analysis of their variability with overall estimation of their impact on the global change. The outcome of Task 4.2 in ENVRIPLUS is

- 1) a problem-solving demonstration of the 'agile' joint deployment and operation of several RIs toward a particular scientific issue and
- 2) to provide recommendations on the joint refinement to scientific and technical observation and analysis protocols across RIs.

Task 4.3: Solid Earth-marine common operation of platforms – benthic stations

Task leader: IFREMER[ESONET Vi] (7.5), Participants: INGV[EMSO] (2), CNRS[EPOS] (7)

This task is based on miniature benthic stations and "green" repeaters to measure acceleration, temperature and pressure. It to validate for extended use the new generation of benthic stations for seismic measurement developed in FP7 MARSITE and I3 FixO3 projects. It will realize a scientific analysis of spatial coverage around Europe (European plate) of EMSO sites and various hypothesis of the implementation during the next decade of subsea telephone cable repeaters equipped with acceleration, temperature and pressure sensors. A focus is to determinate the priorities and opportunities according to EPOS criteria for the acceleration measurements. A presentation to the EPOS community and decision makers is also planned in this purpose. ENVRIPLUS will allow a European participation by EPOS and EMSO to the Global "green repeater" specifications (<http://www.itu.int/en/ITU-T/climatechange/task-force-sc/Pages/default.aspx>) including a data flow compatible with European RI standards. It will also participate to the legal discussions (liability to be addressed in WP13) and promotions of opportunities around Europe with cable owners. As a final step, an inter-calibration of green repeater sensors with EMSO benthic stations will be organized according to EPOS rules.

#### Participation per Partner

Partner number and short name	WP4 effort
2 - EURO-ARGO	2.00
4 - CNR	3.00
5 - CNRS	19.00
6 - IFREMER	16.00
8 - INGV	14.00
9 - NERC	2.00
15 - INRA	12.00
16 - EAA	3.00
18 - MBA	6.00
30 - CEA	11.00
31 - GEOMAR	9.50
<b>Total</b>	<b>97.50</b>

### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D4.1	Report on cross-cutting issues, associated existing monitoring capacities and selected open case studies resulting from the Interdisciplinary workshop	15 - INRA	Report	Public	18
D4.2	Achievements report on open interdisciplinary case studies highlighting the common operation of networks	15 - INRA	Report	Public	42
D4.3	Reference document for methane harmonized monitoring	8 - INGV	Report	Public	46
D4.4	Report on intercalibration with Green repeater initiative	6 - IFREMER	Report	Public	42

### Description of deliverables

D4.1 : Report on cross-cutting issues, associated existing monitoring capacities and selected open case studies resulting from the Interdisciplinary workshop [18]

Report on cross-cutting issues, associated existing monitoring capacities and selected open case studies resulting from the Interdisciplinary workshop

D4.2 : Achievements report on open interdisciplinary case studies highlighting the common operation of networks [42]

Achievements report on open interdisciplinary case studies highlighting the common operation of networks

D4.3 : Reference document for methane harmonized monitoring [46]

Reference document for methane harmonized monitoring

D4.4 : Report on intercalibration with Green repeater initiative [42]

Report on intercalibration with Green repeater initiative

### Schedule of relevant Milestones

Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS10	Review of critical methane sensing technologies and gaps at interfaces	30 - CEA	12	Internal report
MS12	Interdisciplinary workshop held and open case studies selected	30 - CEA	12	Meeting held

**Schedule of relevant Milestones**

<b>Milestone number<sup>18</sup></b>	<b>Milestone title</b>	<b>Lead beneficiary</b>	<b>Due Date (in months)</b>	<b>Means of verification</b>
MS23	Validation of newbenthic stations and scientific analysis of spatial coverage around Europe in scenarii of green repeaters implementation	6 - IFREMER	18	Internal report

<b>Work package number</b> <sup>9</sup>	WP5	<b>Lead beneficiary</b> <sup>10</sup>	13 - UvA
<b>Work package title</b>	Reference model guided RI design		
<b>Start month</b>	1	<b>End month</b>	36

### Objectives

The objectives of this work package are:

- 1) To promote interoperability among RIs by providing a novel ENVRIPLUS Reference Model which should be developed not only based on the existing ENVRI RM but should also include the latest development insights from other successful RIs.
- 2) To provide an ontological framework based on the ENVRIPLUS RM to describe the requirements and system architecture of RIs, and to link these descriptions with the technologies provided by data and computing infrastructures.
- 3) To provide a design and implementation plan for common operations and abstract but customisable research environments among RIs by engaging RI developers from different domains and using the ENVRIPLUS RM.

### Description of work and role of partners

#### **WP5 - Reference model guided RI design** [Months: 1-36]

UvA, ICOS ERIC, EURO-ARGO, EISCAT, CNR, CNRS, IFREMER, FZJ, INGV, NERC, ETHZ, UniHB, INRA, EAA, MBA, USTAN, EMBL, UCPH, LU, CU, UEDIN, EGI.eu, UHEL

The work package will update the requirement analysis and technology review performed in the ENVRI project to reflect the progress many RIs have made in their architecture design and system implementation; in particular several new ESFRIs and I3s are to be included. Using the ENVRIPLUS RM, developers from different RIs will collaboratively design common operations and services with consideration of interoperation inside and among domains. Concrete implementation plans for identified common operations will be made. Finally, an interoperable abstract research environment that can couple those common services with a customisable interface for specific RIs will be designed and prototyped. The actions in this WP will be thus organised into four tasks:

Task 5.1: Review of existing RIs: requirements, technologies, achievements and gaps leading to characterisation

Task leader: UEDIN[EXP] (12), participant: CNR[EXP, SIOS] (3), CNRS[IAGOS, IS-ENES] (3), CU[EXP] (3), UHEL[ICOS] (2), IFREMER[JERICO] (2), ETHZ[EPOS] (2), NERC[EPOS] (2), INGV[EPOS] (2), EISCAT (2), EURO-ARGO (2), UvA[EXP] (2), EAA[LTER] (2), INRA[ANAEE] (2), UCPH[INTERACT] (2), EMBL[ELIXIR] (2), EGI[EXP] (1), FZJ[IAGOS] (1), M1-M12

Re-analyse the status of involved RIs in ENVRI[PLUS] along the dimensions of data, users, software services and resources in order to update the requirement study performed in the early phase of ENVRI. Together with interoperability requirements (based on use-cases in WP6-8) and the review of data and computing infrastructure such as EGI, Helix Nebula and EUDAT such analysis will point to: (a) commonalities between RIs; (b) differences between RIs; (c) interoperability between RIs; and (d) the state-of-the-art of RI technologies. The characterisation of RIs under a common documentation method which may employ vocabulary defined in existing ENVRI RM allows comparison and discussion leading to best practice and consistent development plans for RI improvement and also RI interoperation.

This task will take actions to:

- a) Update requirements from all involved RIs;
- b) Define common documentation methods for describing the current status of RIs; this should include any data management issues that affect the RI internally, or affect interoperation.
- c) Perform a consistent characterisation of existing and planned RIs, and their user requirements (within their principal community and in interoperation with other RIs);
- d) Review the state-of-the-art of technologies provided by data and computing infrastructures;
- e) Recommend suitable design and engineering approaches for common operations between RI projects by maximally reusing existing industrial standards and existing tools.

Task 5.2: RI characterisation and ENVRI[PLUS] Reference model

Task leader: CU[EXP](18), participant: UEDIN[EXP](8), EAA[EXP](6), INGV[EPOS](6), NERC[EPOS](2), UvA[EXP](2), CNRS[FIXO3](2), MBA[EMBRC](2), M7-M30

The ENVRIPLUS RM will be developed to be able to describe architectures at both the conceptual level (using Semantic Web/LOD) and at the data performance level with the former being generated from the latter (to preserve integrity) as demonstrated in the ENGAGE project. The current ENVRI RM focuses on the design of small set of RIs and was produced at a time when most of them were in their preparatory phase. During the ENVRI project, RIs made significant

progress; partly exceeding the expressiveness of the existing ENVRI RM. The ENVRIPLUS Reference Model takes input not only from the existing ENVRI RM but also from the characterisation of RIs derived from Task 5.1, as well as from the contribution by Task 12.1. embedding the HES approach and from developments in EGI, Helix Nebula and EUDAT.

This task will take actions to:

- a) Develop the ENVRIPLUS RM based on the existing ENVRI RM, and results from Task 5.1.
- b) Connect the ENVRIPLUS RM with other successful reference models adopted by existing RIs or related projects;
- c) The Marine Biological Association coordinates the DASSH Data Archive Centre, which is a national facility for the archival of species and habitat data. It needs to be integrated with other European marine biological data (e.g. data curated by EMSO, SeadataNet, JERICO and EMBRC) as a joint contribution to EMODNET Biology, the COPERNICUS provider. This is a typical test case and will help improve the Reference Model.

Task 5.3. Semantic description and linking between RI architecture and technologies

Task leader: UvA[EXP](18), participants: EAA[EXP](6), NERC[EPOS](2), MBA[EMBRC](2), M7-M36

This task promotes semantic linking between architecture descriptions from different RIs, and services from the data and computing infrastructures. It will: (a) establish a common semantic framework for ENVRIPLUS RIs, abstracting and harmonizing the models and Knowledge Organization Systems (KOS) already available in different domains; (b) provide tools for semantically describing data, services and technologies; (c) provide flexible mechanisms to keep the descriptions adaptable when the technical details change; and (d) provide tools to interlink and map between high level data and services from different RIs to bridge any gaps – all at both conceptual representation level and at data processing level.

This task will take actions to:

- a) Incorporate the ENVRIPLUS Reference Model into a semantic linking framework at both the conceptual and the data processing / integrity / performance levels as described in 5.2.
- b) Provide tools for describing RI architecture requirements and for semantic linking among federated semantic descriptions of different RIs. The objective of merger with COPERNICUS, GEOSS, EEA and IPBES will be specifically investigated.
- c) Provide searching and browsing facilities, including faceted search that allows an understanding of how different semantic descriptions and schemas are used by different communities.

Task 5.4: Interoperation based architecture design

Task leader: NERC[EPOS] (8), participants: UvA[EXP] (8), CNR[EXP,SIOS] (6), CNRS[IAGOS, IS-ENES] (2), UEDIN[EXP] (4), INRA[ANAEE] (4), ETHZ[EPOS] (4), IFREMER[EUROFLEETS, JERICO, SEADATANET] (3), EURO-ARGO (3), LU[ICOS] (3), UniHB[EMSO] (3), EAA[EXP] (3), USTAN[EMBRC] (3), EMBL[ELIXIR] (3), CU[EXP] (3), EGI[EXP] (3), EISCAT (2), INGV[EPOS] (2), M7-M36

The design of RIs should aim at maximal reuse of services provided by underlying e-Infrastructures (such as EGI), data infrastructures (such as EUDAT), or other similar RI projects. Using the results of Task 5.1, the RI will be based on the latest distributed computing and storing technologies provided for instance by the Grid and the Cloud (Including IoT and FI) for maximum flexibility in implementation including elastic scaling and optimal use of computing and storage resources. The design will re-use results from EGI, Helix Nebula and EUDAT as well as the work of the ENVRIPLUS RIs. The architecture design for RIs and common operations will depend critically on a metadata catalogue describing the characteristics (data, users, software services, computing and storage resources) of existing and planned RIs. Such catalogues will be based on the ENVRIPLUS RM and the semantic linking framework produced in Task 5.2 and Task 5.3.

This task will take actions to:

- a) Use the tools developed in 2.1.3 (b) to document the architecture of the distributed sites. Together with the results of action (b) in Task 5.1, this action will provide documentation for the distributed research infrastructure sites.
- b) Provide a model architecture for new RIs to adopt and to act as a guide for existing RIs in their development.
- c) Collaboratively work with developers from WP6-8 to define a development plan for each common operation to allow interoperation with other RIs.
- d) Use the ENVRIPLUS landscape of RIs, which is already multidisciplinary, international and distributed, to propose a network of data managers and developers maximizing the participation of EU member states and associated states (the example of SeaDataNet will be expanded thematically).
- e) Analyse the case of the EURO-ARGO data management extension to GROOM (RI under design) and the case of common developments of Euro-Argo and ICOS on CO<sub>2</sub> and pH data (Subtask 1.2.2).

Determine available interfaces at each RI to retrieve metadata, data and data products. The interface to integrate all common operations developed in this Theme will also be defined.

### Participation per Partner

Partner number and short name	WP5 effort
1 - ICOS ERIC	1.00
2 - EURO-ARGO	5.00
3 - EISCAT	4.00
4 - CNR	9.00
5 - CNRS	5.00
UPMC	1.00
UPS	1.00
6 - IFREMER	5.00
7 - FZJ	1.00
8 - INGV	10.00
9 - NERC	14.00
11 - ETHZ	6.00
12 - UniHB	3.00
13 - UvA	30.00
15 - INRA	6.00
16 - EAA	17.00
18 - MBA	4.00
19 - USTAN	3.00
22 - EMBL	5.00
26 - UCPH	2.00
28 - LU	3.00
33 - CU	24.00
34 - UEDIN	24.00
37 - EGI.eu	4.00
38 - UHEL	1.00
<b>Total</b>	<b>188.00</b>

### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D5.1	A consistent characterisation of existing and planned RIs	34 - UEDIN	Report	Public	12
D5.2	A definition of the ENVRIPLUS Reference Model	33 - CU	Other	Public	18



### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D5.3	A definition of the ENVRIPLUS Semantic linking framework at conceptual and formal levels.	13 - UvA	Other	Public	36
D5.4	A development plan for common operations and cross-cutting services based on a network of data managers and developers	9 - NERC	Report	Public	18
D5.5	A model architecture for new RIs to adopt and to act as a guide for existing RIs in their development	9 - NERC	Report	Public	24

### Description of deliverables

D5.1 : A consistent characterisation of existing and planned RIs [12]

A consistent characterisation of existing and planned RIs including requirements, user requirements, extension and transfer of achievements, (within the community and in interoperation), technologies and gaps and an initial version of ENVRIPLUS Reference Model

D5.2 : A definition of the ENVRIPLUS Reference Model [18]

A definition of the ENVRIPLUS Reference Model

D5.3 : A definition of the ENVRIPLUS Semantic linking framework at conceptual and formal levels. [36]

A definition of the ENVRIPLUS Semantic linking framework at conceptual and formal levels.

D5.4 : A development plan for common operations and cross-cutting services based on a network of data managers and developers [18]

A development plan for common operations and cross-cutting services based on a network of data managers and developers

D5.5 : A model architecture for new RIs to adopt and to act as a guide for existing RIs in their development [24]

A model architecture for new RIs to adopt and to act as a guide for existing RIs in their development

### Schedule of relevant Milestones

Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS19	Reference model defined	13 - UvA	18	Deliverable D20
MS20	A development plan for common operations and cross-cutting services	13 - UvA	18	Deliverable D22

<b>Work package number</b> <sup>9</sup>	WP6	<b>Lead beneficiary</b> <sup>10</sup>	28 - LU
<b>Work package title</b>	Inter RI data identification and citation services		
<b>Start month</b>	1	<b>End month</b>	48

### Objectives

This work package will focus on implementing data tracing and citation functionalities in environmental RIs and develop tools for the RIs if they are not otherwise available. In close cooperation with the successful consortia in call EINFRA-7-2014, the overarching objective of this work package therefore is to improve the efficiency of data identification and citation by providing convenient, effective and interoperable identifier management and citation services.

### Description of work and role of partners

#### **WP6 - Inter RI data identification and citation services** [Months: 1-48]

LU, EISCAT, CNR, CNRS, IFREMER, UniHB, INRA, EAA, MBA, DKRZ, NILU, CINECA

Environmental research infrastructures are often built on a large number of distributed observational or experimental sites, run by hundreds of scientists and technicians, financially supported and administrated by a large number of institutions. If this data is shared under an open access policy it becomes therefore very important to acknowledge the data sources and their providers. There is also a strong need for common data citation tracking systems that allow data providers to identify downstream usage of their data so as to prove their importance and show the impact to stakeholders and the public. This work package highlights identification and citation in environmental RIs, reviews available technologies and develops common services for these operations.

#### Task 6.1. Inter RI data identification and citation services

Task leader LU[ICOS] (24), participants: EISCAT (6), UniHB[EMSO] (6), NILU[ACTRIS] (6), CINECA[EUDAT] (3), CNR[SIOS] (3), CNRS[IS-ENES] (4), IFREMER[SEADATANET] (3), INRA[ANAEE] (3), MBA[EMBRC] (2), DKRZ[IS-ENES] (3), EAA[LTER] (2), M1-M48

This task aims at implementing common policy models for persistent identifiers for publishing and citing data. Moreover, the services for assigning and handling identifiers and for retrieving data content based on identifiers will also be provided. This task will build on existing approaches (e.g. DataCite, EPIC) and further developments by up-coming activities. It will be, furthermore, operated in close cooperation with existing initiatives (e.g. Research Data Alliance, ICSU WDS) and will elaborate a common data citation solution for the involved RIs. This task will take actions to:

- a) Analyse the latest statuses of these existing technologies and business models in the mentioned initiatives, and transfer the best and most common solutions to the RIs. Data citation has progressed during recent years and important steps have already been made, such as the development of PANGAEA and data citation services in the DKRZ.
- b) Define test-bed requirements for the software and services, and identify conditions for operating final software and services inside a domain, and among multiple domains.
- c) Promote the needs of environmental RIs in the global context. Once the RIs have decided their priorities, these should be addressed to initiatives targeting pan-European Digital Identifier e-infrastructures as well as global initiatives such as the Belmont Forum and the Research Data Alliance. The goal of respective agreements should be a widely accepted and supported model.
- d) Support negotiations on collaboration and contracts with important publishers. Publishers are an important partner in developing a functioning system of data citation. There are different models already available (journals for data description, direct citation via DOI, and data citation systems). Since environmental RIs provide large amounts of important data they can efficiently support respective negotiations.
- e) Run case studies with environmental RIs that implement DOI and get experience with data citation by implementing data citation systems. This will assist in understanding details and will provide valuable feedback. Therefore, attention will be paid to developing case studies of existing research infrastructures. The respective RIs should have a developed internal data infrastructure and data should be standardised in a way that makes provision of DOI easy.
- f) Optimize the identification and citation model based on practice. The WP should be finalized by a task that summarises the work, and transfers experiences and further needs to cooperating e-infrastructures – thus optimizing the permanent international solution for data citation.
- g) Use-case study 1:

g1) Develop a full data lifecycle model for biological data linked to the standards developed and promoted through GBIF and the experience of EMSO, EMBRC and SeaDataNet, involving a taxonomy for known and new species, biodiversity

with geo-positioning potentially coupled with physical environment data and genomic data. The resources of the UK marine biodiversity data centre (DASSH) and the National Marine Biological Library will provide the infrastructure to ensure data are captured alongside the peer-reviewed publication and made available through the GBIF community.

g2) Establish GBIF Integrated Publishing Toolkit for the publication of data from the Marine Biological Records journal.  
g3) Define workflows for the research community to facilitate the provision of DOIs and the archiving of data in compliance with international standards.

h) Use-case study 2:

h1) Implement a full and integrated DOI and related metadata system for ICOS as an example of a distributed RI with very heterogeneous data. International cooperation with other infrastructures on GHG will also be part of this.

h2) Test citation tracking models. ICOS has a well-defined internal data workflow and already existing data transfers to global user networks and is therefore an ideal test case.

i) Define policy models for persistent identifiers, publishing and citation. Optimally reuse EPIC and related work on EUDAT. It will also expose the EUDAT PID service to ENVRI testing and avail EUDAT services B2SAFE, B2SHARE and B2FIND as test beds for data publishing and referencing.

### Participation per Partner

Partner number and short name	WP6 effort
3 - EISCAT	6.00
4 - CNR	3.00
5 - CNRS	2.70
UPMC	1.30
6 - IFREMER	3.00
12 - UniHB	6.00
15 - INRA	3.00
16 - EAA	2.00
18 - MBA	2.00
20 - DKRZ	3.00
28 - LU	24.00
32 - NILU	6.00
36 - CINECA	3.00
<b>Total</b>	<b>65.00</b>

### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D6.1	A system design for data identifier and citation services for environmental RIs projects to prepare an ENVRIPLUS strategy to	28 - LU	Report	Public	20

### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
	negotiate with external organisations				
D6.2	A report on negotiations with publishers, providers of existing data citation systems and other scientific organisations on implementing a global data citation system.	28 - LU	Report	Public	36
D6.3	Report on identification and citation service case studies	28 - LU	Report	Public	46

### Description of deliverables

D6.1 : A system design for data identifier and citation services for environmental RIs projects to prepare an ENVRIPLUS strategy to negotiate with external organisations [20]

A system design for data identifier and citation services for environmental RIs projects to prepare an ENVRIPLUS strategy to negotiate with external organisations

D6.2 : A report on negotiations with publishers, providers of existing data citation systems and other scientific organisations on implementing a global data citation system. [36]

A report on negotiations with publishers, providers of existing data citation systems and other scientific organisations on implementing a global data citation system

D6.3 : Report on identification and citation service case studies [46]

Use-case study reports: (a) an online, standards-based publication mechanism for marine biological data; (b) workflow and guidance for tested citation tracking models

### Schedule of relevant Milestones

Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS31	Global data citation negotiations with publishers organized	28 - LU	30	Meeting organized

<b>Work package number</b> <sup>9</sup>	WP7	<b>Lead beneficiary</b> <sup>10</sup>	4 - CNR
<b>Work package title</b>	Data processing and analysis		
<b>Start month</b>	7	<b>End month</b>	46

### Objectives

This work package will focus on the demands of RIs for data processing that existing e-Infrastructures do not provide. The work package will follow the output from the e-Infrastructure calls (EINFRA-1,2,4,5,7,9) and the related engagement of Environmental RIs, summarize the outcome and develop specific functionalities to develop further strategies for co-operation between RIs and e-Infrastructures. The high level objectives of this theme therefore include:

- 1) Improving the efficiency of data processing by providing system-level optimisation to select, provision and use interoperable infrastructure services for data integration, processing and storage.
- 2) Improving the performance of the research infrastructures by providing system-level optimisation among data, processing, and underlying services, including their digital networks.

### Description of work and role of partners

#### **WP7 - Data processing and analysis** [Months: 7-46]

**CNR, EURO-ARGO, EISCAT, INGV, ETHZ, UniHB, UvA, DKRZ, UNITUS, CSC, CINECA**

The work package is related to services for data processing, including computing management, monitoring, diagnosis, and performance optimisation.

#### Task 7.1. Interoperable Data Processing, Monitoring and Diagnosis

Task leader: CNR[EXP] (20), participants: UNITUS[ICOS] (17), INGV[EPOS9] (6), EURO-ARGO (3.5), DKRZ[IS-ENES] (3), CSC[EUDAT] (3), ETHZ[EPOS] (3), M7-M42

Data processing services make it significantly easier for scientists to aggregate data from multiple sources and to conduct a range of experiments and analyses upon those data. Expanding the common data processing workflow modelled in the ENVRI project, this task focuses on the engineering and technological aspects of managing the entire lifecycle of computing tasks and application workflows for the efficient utilisation of underlying e-Infrastructures. In particular, the service enables scientists to enrich the data processing environment by easily injecting new algorithms to be also reused by others. Algorithms can be produced by using programming languages (e.g. Java) or scripting languages scientists are familiar with (e.g. R scripts). The object of this task is to provide common and cost-effective data processing service for environmental RIs with consideration of existing technologies in e-Infrastructures, data infrastructures and other relevant RIs, building on recent advances in data-intensive computation. The task has been closely discussed with other relevant consortiums such as DIRAC. This task will take action to:

- a) Provide data processing facility to deal with the RIs' requirements by reusing when possible tools developed in the environmental RIs. In particular, this includes the enhancements of the mechanisms to add algorithms to the data processing environment and the enlargement of the set of computing platforms potentially exploited during algorithms execution via dedicated adaptors;
- b) Support environmental RIs and scientists to adapt their algorithms for data processing to be executed via the ENVRIPLUS data processing environment;
- c) Provide flexible monitoring and diagnosis services for data processing in environmental RIs. This task will also carry out actions linked to Tasks 2.2 and 15.2 on time series.
- d) Review the latest well-established data-intensive computational methods and the facilities available at existing computing platforms, storage systems and data transport mechanisms in current e-Infrastructures and identify how these may be combined to deliver the functionalities that RI projects require.
- e) Review the work performed within the EUDAT Dynamic Data WG and the related Joint Research Activities, and identify relevant methods, technologies, algorithms for that particular scenario in ENVRIPLUS RIs.
- f) Define test-bed requirements for the software and services, and identify conditions for operating final software and services inside -domain, and among multiple -domains.
- g) Consolidate and enhance the ENVRI Data Processing facility to adapt it to the needs emerging from the ENVRIPLUS RI projects, including handling Real Time Data, and notifying events in dedicated data processing chains for each RI and delivering them to the public.
- h) Provide data processing monitoring and notification services by maximally reusing existing computing platforms and tools as short-term solutions for RI projects. Prototyping missing components using standardised technologies building on the existing software services and working with those service providers will be considered a longer-term solution.

Task 7.2. Performance optimisation for big data sciences

Task leader: UvA[EXP] (18), participants: EISCAT(6), UniHB[EMSO] (6), ETHZ[EPOS] (4), CSC[EUDAT](3), CINECA[EUDAT] (2), INGV[EPOS] (2), M7-M42

The environmental sciences at system-level involve large quantities of data; data produced by most ESFRI projects (e.g. EISCAT\_3D) are large and qualify as Big Data. Furthermore there are many different kinds of data commonly in small datasets and the velocity of data gathering is very large – commonly streamed data from detectors/instruments. Such data driven experiments require not only access to distributed data sources, but also parallelization of computing tasks for processing data. The performance of these applications determines the productivity of scientific research and the optimisation of system-level performance is going to be urgently needed by the RI projects in ENVRIPLUS, in particular as they enter production.

This task identifies characteristics of RIs and develops the common services that are needed for optimising performance of the experiments defined in the RI projects on the underlying e-Infrastructures. The model of the Service Level Agreement (SLA) and mechanisms on controlling the system-level quality of service (QoS) will be investigated and developed. This task focuses on the high-level optimisation mechanisms for making decisions on resources, services, data sources and potential execution infrastructures, and on scheduling the execution. The semantic linking framework developed in Task 5.3 on linking data, infrastructure and in particular network-level messages will be used for the decision procedures. This task will focus on the environmental application specific characteristics, and closely discuss with the relevant proposals that target at generic computing platforms such as DIRAC to use their potential results as input.

The task will take actions to:

- a) Provide effective mapping between application-level quality attributes about system performance and user experience onto the infrastructure-level QoS attributes on computing, storage and network services provided by underlying e-Infrastructures.
- b) Define test-bed requirements for the software and services, and identify conditions for operating final software and services inside each domain, and among multiple domains.
- c) Extend and customise existing optimisation mechanisms for computing and storage resources, and provide an effective control model between processes of data analysis and the underlying e-Infrastructure resources, making the application performance easy to control at runtime.
- d) The optimisation component will be applied in optimising data movement RIs such as EISCAT-3D and processing flows in EPOS.
- e) Optimization in big data analysis tools, e.g. Hadoop, Apache Spark or Storm for large-scale datasets. Conversely to data movement in e-Infrastructures, the EUDAT analytics framework will leverage the existing data infrastructure reducing the complexity of executing large and distributed analysis on data.

**Participation per Partner**

Partner number and short name	WP7 effort
2 - EURO-ARGO	4.00
3 - EISCAT	6.00
4 - CNR	20.00
8 - INGV	8.00
11 - ETHZ	7.00
12 - UniHB	6.00
13 - UvA	18.00
20 - DKRZ	3.00
29 - UNITUS	17.00
35 - CSC	6.00
36 - CINECA	2.00
<b>Total</b>	<b>97.00</b>

### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D7.1	Interoperable data processing for environmental RI projects: system design	4 - CNR	Report	Public	20
D7.2	Interoperable data processing services for environmental RI projects: prototype.	4 - CNR	Demonstrator	Public	42
D7.3	Performance optimisation for environmental RI projects: system design	13 - UvA	Report	Public	20
D7.4	Performance optimisation services for environmental ESFRI projects: prototype	13 - UvA	Demonstrator	Public	42

### Description of deliverables

D7.1 : Interoperable data processing for environmental RI projects: system design [20]  
 Interoperable data processing for environmental RI projects: system design

D7.2 : Interoperable data processing services for environmental RI projects: prototype. [42]  
 Interoperable data processing services for environmental RI projects: prototype.

D7.3 : Performance optimisation for environmental RI projects: system design [20]  
 Performance optimisation for environmental RI projects: system design

D7.4 : Performance optimisation services for environmental ESFRI projects: prototype [42]  
 Performance optimisation services for environmental ESFRI projects: prototype

### Schedule of relevant Milestones

Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS25	System designs for data processing and optimization	4 - CNR	20	Deliverables D27 D29

<b>Work package number</b> <sup>9</sup>	WP8	<b>Lead beneficiary</b> <sup>10</sup>	9 - NERC
<b>Work package title</b>	Data curation and cataloguing		
<b>Start month</b>	1	<b>End month</b>	42

## Objectives

### Objectives:

This work package will focus on providing data curation, interoperable data cataloguing and provenance tracking that existing tools provided by RIs and e-Infrastructures do not offer. The high level objectives of this work package therefore include:

- 1) Improving the efficiency and quality of user experience for data curation by providing automatic but self-adaptable curation and semantic annotation services.
- 2) Improving catalogue interoperability among different RIs.
- 3) Improving the efficiency of data provenance and tracing by providing convenient, effective and interoperable standards-based data provenance services.

## Description of work and role of partners

### **WP8 - Data curation and cataloguing** [Months: 1-42]

**NERC, EISCAT, CNR, CNRS, IFREMER, INGV, UvA, INRA, EAA, MBA, USTAN, DKRZ, LU, CEA, NILU, CSC, CINECA**

#### Description of work

Data integrity is an important pragmatic issue for RIs since errors, mismanagement or manipulation can cause harmful consequences to researchers, users and society. This work package focuses on technical services to support RIs in keeping the highest standards of data curation and documentation of data processing chains. It will be closely related to the EINFRA-1-2014 call.

#### Task 8.1. Self-adaptable data curation for system level sciences

Task leader: NERC[EPOS] (15), Participants: INGV[EPOS], EMSO (15), CNRS[IAGOS] (9), NILU[ACTRIS] (6), CEA[ICOS] (6), USTAN[EMBRC] (5), EISCAT (3), INRA[ANAEE] (3), DKRZ[IS-ENES] (3), CSC[EUDAT] (2), M7-M42

This task develops data control services commonly required by RIs with a specific focus on self-adapting and (semi)automatic quality control processes applied to both large quantities of data and nearly real-time sensor data. In the ENVRI Reference Model, data quality control and annotation are modelled as basic curation services although in fact they have different (but related) requirements. The curation services provided by this task will cover different levels of data and comply with standards such as OASIS (Advancing Open Standards for the Information Society). Metadata standards such as INSPIRE will be covered by rich, interoperable metadata for geospatial semantic annotation. The quality of user experience when checking the quality of data and when annotating different data using these metadata standards will be explicitly modelled and taken into account when developing the curation services.

This task will take actions to:

- a) Study the process of data curation, in particular data quality checks and metadata annotation from different ESFRI projects, and model the key qualities of the user experience.
- b) Review the existing technologies in relevant e-Infrastructures, such as EGI, and data infrastructures, such as EUDAT (specifically the B2SAFE service), that may be used to implement data curation services.
- c) Define test-bed requirements for the software and services, and identify conditions for operating final software and services.
- d) Support RIs to further develop their data curation tools, in particular by prototyping self-adaptable mechanisms for automating the curation of large quantities of distributed data and nearly real-time data.
- e) Examine novel analytical methods that cope with the unusual nature of sensor data (over-dispersion, zero-inflation, detection thresholds, spatial structure). Coupled with the investigation of methods would be an optimisation exercise contrasting different spatio-temporal sampling designs (sensor deployment schemes) leading to designs that are best able to detect various types of change scenarios.
- f) Incorporate additional data (e.g. depth, accelerometer data), possibly recorded (e.g. at different temporal scales; hierarchical models including random effect models (across individuals and/or species).
- g) Harmonized air mass based flagging system for representativeness of times series measurement in atmospheric domain. This is a central question among these RIs producing fixed point or line (e.g. with airborne sensor platforms



or research vessels) time series. This representativeness can be characterized by a flagging information system that is added to the time series record. A common flag translator system will be developed to increase interoperability of the data across RIs using such flagging systems. More specific to, but common to atmospheric time series measurements, air mass based flagging systems will be harmonised and rationalized. The use of common air mass footprint analyses will be developed in near real time (NRT) or delayed mode. In “delayed” mode, these analyses enable the identification of air masses, and the geographical contribution to the measurements. In a NRT or even forecast mode it can be used as a “sampling strategy tool” in a campaign based event-monitoring setup.

#### Task 8.2. Interoperable data cataloguing and metadata harmonisation

Task leader: IFREMER[SEADATANET, EUROFLEETS](16), Participants: INGV[EMSO] (9), LU[ICOS] (6), CNRS[IAGOS] (6), NILU[ACTRIS] (6), INRA[ANAEE] (6), CNR[EXP, SIOS] (4), MBA[EMBRC] (4), NERC[EPOS] (3), EISCAT (3), EAA[LTER] (2), CINECA[EUDAT] (2), M7-M42

To perform complex data-driven experiments, scientists want simple but effective approaches to search data from various catalogues, and to integrate data into computing processes. Interoperable data cataloguing and metadata harmonisation are important services that should be provided by research infrastructures to enable such kinds of experiments. This task aims to improve data catalogue interoperability and metadata harmonisation between ENVRI PLUS RIs. The task will extend the open search tools developed in the ENVRI project by reusing latest technologies. It will investigate key issues in interoperable cataloguing and metadata harmonisation with consideration of other on-going initiatives. The task will take actions to:

- a) Define test-bed requirements for the software and services, and identify conditions for operating final software and services inside each domain, and among multiple domains.
- b) Provide interoperable data cataloguing between atmospheric and oceanographic RIs. The action will start with the connection between catalogues from EMSO, ICOS, IAGOS, and ACTRIS data holdings. This task will be aligned with initiatives in the GAW, MACC, GEO communities concerning metadata harmonisation (e.g., use of the ISO 19115 standard for metadata formatting) and ensure INSPIRE directive compatibility. Common controlled vocabulary for metadata profile keywords will be implemented; catalogue harmonization will give the opportunity for RI portals to be fully discoverable through a well-identified and widely used process of serving collections of metadata.
- c) Investigate cross-database data harvesting. By using a common standard to describe data within catalogues at RI-level, we offer the possibility to aggregate datasets from different RIs. Catalogue services such as OAI-PMH or OGC CSW will allow users to harvest metadata of interest from several RIs. Harvesting from different remote sources will be transparent for users (the WCS solution in particular will be investigated). This action will include work on a simplified data flagging scheme common to all participating RIs to facilitate easier data use. This work will be aligned with ongoing corresponding efforts in WMO, ICSU WDS and MACC.
- d) Produce common rules/guidance for workflow documentation and metadata. Within the UK the Marine Environmental Data and Information Network (MEDIN) have developed a widely used discovery metadata standard for the marine community, utilising the vocabularies and term lists maintained by SeaDataNet. Less progress has been made in the standardization and development of keywords and controlled vocabularies for laboratory, mesocosm or other non-spatially referenced datasets. In this action, we will review the current suite of metadata standards, data guidelines and controlled vocabularies widely in use across Europe and ensure community-specific needs are met and fit in with national and EU open data initiatives. Additional actions will also focus on coherent archiving and documentation of algorithms, codes, metadata and data processing workflows.
- e) Harmonise, implement and validate marine observatory services and standards. Harmonise data management approaches and architectures of marine observatory infrastructures such as FixO3, EMSO and Euro-Argo in order to improve access to marine observatory data by harmonising data management standards and workflows covering the complete life cycle of data from real time data acquisition to long-term archiving. Further, this task aims to harmonise data management and standardisation efforts with other European and international marine data and observatory infrastructures; thus data and metadata shall be harmonised with EDMONET, SEADATANET, PANGAEA, EuroSITES (European contribution to JCOMMP OceanSITES programme), EUROGOOS and MyOcean (EMODNET/COPERNICUS) infrastructures. Another goal is to improve standardisation, interoperability and compliance with major international initiatives such as OOI, OceanSITES and NEPTUNE Canada.
- f) Harmonise marine metadata and data exchange standards. Despite a variety of standards existing, the interpretation and implementation of these standards has resulted in serious incompatibilities within the marine observatory community. Using the COOPEUS framework for infrastructure integration, this task will assess the interoperability maturity of involved infrastructures, will analyse the suite of data formats and standards currently used by EMSO and Euro-Argo and will identify common data and metadata standards such as NetCDF, ISO19115 or SensorML and harmonise the implementation of these formats among marine observatory networks, culminating towards EMODNET (COPERNICUS). Where no common standard yet exists, this task will further work towards the integration of new standards – for example for provenance tracking.

g) EMODNET geology convergence with solid earth domain is essential and the need to have common developments between EPOS and EMSO. Harvest metadata from interested ENVRI communities (via OAI-PMH) and make it available and discoverable through the EUDAT B2FIND metadata catalogue, and define appropriate standards and mappings for greater interoperability between metadata models and catalogue. EMODNET geology convergence with solid earth domain is essential as is the need to have common developments between EPOS and EMSO.

**Task 8.3. Inter RI data provenance and trace services**

Task leader: EAA[LTER] (6), Participants: UvA[EXP] (4), INRA[ANAEE] (3), DKRZ[IS-ENES] (3), CNRS[IS-ENES] (4), INGV[EPOS](3), LU[ICOS] (2), CINECA[EUDAT] (2), M25-M42

Higher-level data products provided by RIs have to be clearly reproducible. Therefore, provenance services that record the evolution of data by tracking each operation processed have to be further developed, harmonized and integrated in existing RIs. This task reviews latest technologies of data provenance and adapts existing services for data provenance and tracking that best fit the needs of the different RI projects. The provenance services take common requirements of RIs throughout the entire data lifecycle into account: from acquisition, curation, to processing. Standardised interfaces for querying, accessing and integrating provenance data will be realized. The implementation will use the semantic linking framework developed in Task 5.3 as basis for harmonising metadata standards used in the provenance system, and for handling the query facilitates. The task aims at common provenance services required by ENVRIPLUS RIs:

- a) Investigate arising provenance services of possible e-Infrastructure projects.
- b) Recommend common standards for collecting, annotating and querying provenance;
- c) Define test bed requirements for the software and services, and identify conditions for operating final software and services inside domain, and among multiple domains.
- d) Optimally reuse existing standards, such as W3C's PROV-O for possible general interoperability.
- e) Provide common provenance service for ENVRI[PLUS] RIs with emphasis on the collection, query, and semantic linkage of provenance data, metadata and data.

**Participation per Partner**

Partner number and short name	WP8 effort
3 - EISCAT	6.00
4 - CNR	4.00
5 - CNRS	15.30
UPMC	1.70
UPS	2.00
6 - IFREMER	16.00
8 - INGV	27.00
9 - NERC	18.00
13 - UvA	4.00
15 - INRA	12.00
16 - EAA	8.00
18 - MBA	4.00
19 - USTAN	5.00
20 - DKRZ	6.00
28 - LU	8.00
30 - CEA	6.00
32 - NILU	12.00
35 - CSC	2.00

Partner number and short name	WP8 effort
36 - CINECA	4.00
<b>Total</b>	161.00

### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D8.1	Data curation in system level sciences: system design	9 - NERC	Report	Public	18
D8.2	Data curation in system level sciences: prototype and deployment.	9 - NERC	Demonstrator	Public	42
D8.3	Interoperable cataloguing and harmonisation for environmental RI projects: system design	6 - IFREMER	Report	Public	18
D8.4	Interoperable cataloguing and metadata harmonisation for environmental RIs: prototype	6 - IFREMER	Demonstrator	Public	42
D8.5	Data provenance and tracing for environmental sciences: system design	16 - EAA	Report	Public	36
D8.6	Data provenance and tracing for environmental sciences: prototype and deployment	16 - EAA	Demonstrator	Public	42

### Description of deliverables

D8.1 : Data curation in system level sciences: system design [18]  
Data curation in system level sciences: system design

D8.2 : Data curation in system level sciences: prototype and deployment. [42]  
Data curation in system level sciences: prototype and deployment.

D8.3 : Interoperable cataloguing and harmonisation for environmental RI projects: system design [18]  
Interoperable cataloguing and harmonisation for environmental RI projects: system design

D8.4 : Interoperable cataloguing and metadata harmonisation for environmental RIs: prototype [42]  
Interoperable cataloguing and metadata harmonisation for environmental RIs: prototype

D8.5 : Data provenance and tracing for environmental sciences: system design [36]  
Data provenance and tracing for environmental sciences: system design

D8.6 : Data provenance and tracing for environmental sciences: prototype and deployment [42]  
Data provenance and tracing for environmental sciences: prototype and deployment

Schedule of relevant Milestones

<b>Milestone number<sup>18</sup></b>	<b>Milestone title</b>	<b>Lead beneficiary</b>	<b>Due Date (in months)</b>	<b>Means of verification</b>
MS22	System designs for data curation and cataloging	9 - NERC	18	Deliverables D31 D33

<b>Work package number</b> <sup>9</sup>	WP9	<b>Lead beneficiary</b> <sup>10</sup>	37 - EGI.eu
<b>Work package title</b>	Service validation and deployment		
<b>Start month</b>	13	<b>End month</b>	48

### Objectives

Environmental RIs are embedded in manifold regional and global Earth Observation systems and therefore need support to optimise interfaces, data and metadata streams, and general cooperation with these key data users. This work package therefore concludes the line of action on data deployment of the tools developed in the earlier work packages, acting to:

- 1) Improve the usability of developed services in their intended environment. The results will be demonstrated, validated and refined via use cases.
- 2) Improve the deployment of the developed results. Services and environment will be deployed in the research infrastructure, possibly via resources of the e-Infrastructure and data infrastructures.

### Description of work and role of partners

#### **WP9 - Service validation and deployment** [Months: 13-48]

**EGI.eu**, ICOS ERIC, EURO-ARGO, EISCAT, CNR, CNRS, IFREMER, FZJ, INGV, NERC, EMSC, ETHZ, UniHB, INRA, EAA, UiT, UCPH, LU, UNITUS, CEA, NILU, CSC, CINECA

#### Description of work

This work package will validate the results via test cases, deploy the developed software onto computing and data infrastructure, and investigate how to operate developed services within RIs.

#### Task 9.1. Validation and integration of developed services

Task leader: EGI[EXP](18), Participants: UniHB[EMSO](6), CSC[EXP](4), CINECA[EXP](4), NERC[EPOS](3), ETHZ[EPOS](3), INRA[ANAEE](3), LU[ICOS](2), INGV[EPOS](2), M13-M48

In this task the different services developed will be analysed from the point of view of their integration into the different e-infrastructures required. A complete use-case will be defined and its full implementation analysed and validated. The use-case will be selected to preferably involve several research infrastructures, have the interest and participation of active scientific communities, and have a clear impact. An example of such a use-case could be the study of the mechanisms of carbon sequestration in the biosphere, but will finally be selected between M 13 and 18 also considering first results of WP12. This use-case analysis will be described following the Reference Model produced in WP5. Well-defined success criteria for this use-case will be assigned and tracked alongside validation. The analysis will be prepared in iteration with WP6-8 defining specific services, and with the e-Infrastructures involved, will specify the standards involved and the required interoperability points. The resources available or required on e-Infrastructures will be identified, from network connectivity to data storage and processing capabilities. To enable the final usage of developed results, services and research environments from WP5-8 will be tested and deployed in RIs, possibly via computing and data infrastructures such as EGI and EUDAT.

The objective of this task is thus to focus on the technical issues of software validation, integration, and release management, and of deploying developed results on computing and data infrastructures. This task will carry out actions to:

- a) Negotiate as required dedicated transnational test-bed resources at different development levels (pre-production, production) and capability levels (Grid HTC resources, Federated Cloud resources, Data Services) with e-Infrastructure providers, including EGI and EUDAT.
- b) Review the technical state of computing and data infrastructure, and any software constraints imposed by the developed software.
- c) Deploy the services in computing and data infrastructure provided by EGI and EUDAT, and test their compatibility. Bring feedback to the relevant technical development WP when revision is required.
- d) Deliver necessary training to user communities after deployment. This action can be jointly carried out in the training WP15.

#### Task 9.2. From research to operational

Task Leader: LU[ICOS](10), Participants: CEA[ICOS](6), EMSC[EPOS](3), EGI[EXP](4), CNR[ACTRIS](4), IFREMER[JERICO](1), EISCAT(3), INGV[EPOS](3), UniHB[EMSO](3), EURO-ARGO(3), EAA[LTER](3), UCPH[INTERACT](3), INRA[ANAEE](3), UiT[ESONET-VI](3), UHEL[ICOS](3), UNITUS[ICOS](8), FZJ[IAGOS](2), CNRS[IAGOS](4.5), CSC[EUDAT](8), CINECA[EUDAT](1), NILU[ACTRIS](1), M13-M48

This task will track the usability and operational issues of the services deployed, starting as a first example with the use-case defined in Task 9.1.

A list of different technical issues, potential and from experience in operation, will be defined and the corresponding results will be provided according to the metrics defined in Task 9.1 for tracking a use-case success. This task will also tightly cooperate with those in WP6-8. This is a task where EGI has already a significant experience with several of the RIs participating in proposals for Competence Centres and thematic Virtual Teams. It must be remarked that among the set of specific services that will be developed and/or integrated, some of them pose a challenge on the potential resources needed, the level of integration or the complexity for deployment and operation, and they will require closer tracking. For example, the setup of Earth Observation systems requires data from the environmental RIs as well as data obtained from Copernicus satellite services. Data delivery to stakeholders should be optimized, and as an specific first test actions will be taken to:

- a) Deepen and further develop integration of RIs in various domains to generic initiatives such as COPERNICUS, GEOSS, EEA, IPBES and other similar ones.
- b) Jointly explore optional solutions to facilitate data access, replication or transfer between the identified key stakeholders and environmental infrastructures. Not all infrastructures need to provide data to these stakeholders. The exploration in a few workshops will initially be for each stakeholder separately with the involved infrastructures.
- c) Design generic mechanisms to facilitate data access, replication or transfer, in such a way that these are technology and platform independent.
- d) Review the designed mechanisms with the stakeholders together. Environmental infrastructures from other continents will be invited in a workshop to consider also global interoperability.
- e) Describe the functionalities of the concluded generic mechanisms. Frame these in manuals for actual implementation. Transfer results to the WP on Validation and Implementation.
- f) Provide operation support for RIs at both levels of computing and data infrastructure and of RI.

#### Participation per Partner

Partner number and short name	WP9 effort
1 - ICOS ERIC	3.00
2 - EURO-ARGO	3.00
3 - EISCAT	3.00
4 - CNR	4.00
5 - CNRS	2.50
UPS	1.00
UJF	1.00
6 - IFREMER	3.00
7 - FZJ	2.00
8 - INGV	5.00
9 - NERC	3.00
10 - EMSC	6.00
11 - ETHZ	3.00
12 - UniHB	9.00
15 - INRA	6.00
16 - EAA	3.00
23 - UiT	3.00
26 - UCPH	3.00
28 - LU	12.00

Partner number and short name	WP9 effort
29 - UNITUS	8.00
30 - CEA	6.00
32 - NILU	1.00
35 - CSC	14.00
36 - CINECA	5.00
37 - EGI.eu	22.00
<b>Total</b>	131.50

#### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D9.1	Service deployment in computing and internal e-Infrastructures Version1	37 - EGI.eu	Report	Public	28
D9.2	Service deployment in computing and data e-Infrastructures Version2	37 - EGI.eu	Demonstrator	Public	40
D9.3	Serving key data service stakeholders and policy initiatives version 1	28 - LU	Report	Public	30
D9.4	Serving key data service stakeholders and policy initiatives version 2	28 - LU	Demonstrator	Public	46

#### Description of deliverables

D9.1 : Service deployment in computing and internal e-Infrastructures Version1 [28]

Service deployment in computing and internal e-Infrastructures Version1

D9.2 : Service deployment in computing and data e-Infrastructures Version2 [40]

Service deployment in computing and data e-Infrastructures Version2

D9.3 : Serving key data service stakeholders and policy initiatives version 1 [30]

Serving key data service stakeholders and policy initiatives version 1

D9.4 : Serving key data service stakeholders and policy initiatives version 2 [46]

Serving key data service stakeholders and policy initiatives version 2

**Schedule of relevant Milestones**

<b>Milestone number<sup>18</sup></b>	<b>Milestone title</b>	<b>Lead beneficiary</b>	<b>Due Date (in months)</b>	<b>Means of verification</b>
MS29	Service deployment in computing and internal e-Infrastructures	37 - EGI.eu	28	Deliverable D37



<b>Work package number</b> <sup>9</sup>	WP10	<b>Lead beneficiary</b> <sup>10</sup>	5 - CNRS
<b>Work package title</b>	Governance for sustainable and adjustable access to RIs		
<b>Start month</b>	1	<b>End month</b>	50

### Objectives

Develop governance tools to facilitate common, fair, and scientific merit based virtual, remote and physical access to environmental research infrastructures and to the data that they provide. Ensure that the tools are sustainable and adjustable.

### Description of work and role of partners

#### **WP10 - Governance for sustainable and adjustable access to RIs** [Months: 1-50]

**CNRS, EISCAT, CNR, INGV, ETHZ, INRA, RCN, UiT, FMI, EGI.eu**

Based on an assessment of the present access policies, user needs and other requirements imposed by the community, the project will develop a set of guidelines (Task 10.1) and a master-plan (Task 10.2) to facilitate open access. This will serve as a basis for RI to include in their governance and to adjust for individual needs. A strategy (Task 10.3) will be developed to support the operation of RI and to promote an open expanding and changing user community for the individual RIs. The work relies heavily on communication and media like video and phone conferences will be used in addition to physical meetings. Findings from WP11 activities will be included and several participants provide links to the societal theme and the data theme. All participating RIs will be asked to identify a contact person to communicate their special needs and to channel back information.

#### Task 10.1. Develop Guidelines on access to RIs

Task Leader: CNR[ACTRIS] (8), participants: EISCAT (2), INRA[ANAEE] (1), RCN[SIOS] (1), INGV[EMSO] (1), FMI[ICOS] (1), CNRS[ACTRIS] (1), ETHZ[EPOS] (1), INGV[EMSO] (1),

Based on the existing policies in ESFRI and other RIs, research institutions and international projects we will prepare a synthesis including new aspects that are not included at the moment and relevant in view of commercial use, intellectual property rights, and ethical considerations. The guidelines will address the usage of data beyond basic research: commercial use and usage for services with societal relevance. These include e.g. space debris observations, tsunami warning, earthquake and weather predictions where aside from the possibly arising ethical issues, scientific, legal, and organisational aspects will be taken into account.

#### Task 10.2. Develop Master plan to facilitate and encourage access

Task Leader: CNRS[ACTRIS] (6), EISCAT (7), participants: CNR[ACTRIS] (1), INGV[EMSO] (1), INRA[ANAEE] (1), ETHZ[EPOS] (2), RCN[SIOS] (1), EGI[EXP] (2), FMI[ICOS] (1)

Scientific publications in peer-reviewed journals are a primary tool to communicate scientific results, to ensure high quality of research and to attract potential new users. Easy access to scientific publications that are produced based on RI data products, as well as to the computing codes and data underlying those publications is important. Hence RIs need to offer adequate dissemination tools (e.g. Green open access) and install the processes and policies to promote their use, including incentives for users to offer access to computing codes and additional documentation. Performance criteria on documentation, communication and access will be prepared and a list of performance indicators for the individual users and for the RIs. Strategies will be developed to improve recognition of those who work within and develop the RI and enable and facilitate the research process. The environmental RIs also provide several types of data of great societal relevance connected to long-term hazards (climate change) and also hazardous events like earthquakes, tsunamis, volcanic eruptions and space weather events, so that misuse needs to be prevented. In this context conditions and data levels for remote versus virtual access will be clarified. The collaboration is made through series of phone conferences and a round table discussion with the task contributors and other experts is organized.

#### Task 10.3. Develop RI strategy for flexibility and sustainability

Task Leader: CNRS[ACTRIS] (5.5), EISCAT (7), participants: CNR[ACTRIS] (1), INGV[EMSO] (1), INRA[ANAEE] (1), ETHZ[EPOS] (1), RCN[SIOS] (2), EGI[EXP] (2), FMI[ICOS] (1), UiT[ESONET] (1)

In order to reach continuity in data archiving, sustainability for RI operation and flexibility for research activities an internal workflow is needed to update master plans and guidelines over the lifetime of the RIs, to adjust to needs of a developing user community and to develop and revise financial models. The requirements will be summarized in a RI strategy. For the RI strategy this task will develop tools for users to report their scientific activities and to feed experiences and future needs back to the RI. The strategy will also address how to secure operational funding

through access for service providers and commercial users. The access to RIs for teaching can support operational costs and strengthen links to university institutions. The open access to RIs is enhanced through mobility of researchers and as part of their strategy RIs need to contribute to making mobility attractive to and beneficial for the individual scientist. The overall strategy will also address engagement of RIs in exploitation and preservation of legacy data. Solutions need to be developed who will take over the data toward the end of the lifetime of the RI. Co-locating data with computing capabilities can be cost-efficient and approaches including pan-European e-Infrastructures will be considered, though flexibility for bottom-up development needs to be ensured. Frameworks will be developed for procurement from commercial providers and for contributions in-kind vs. procurements from publicly funded providers. To sustain RI operation commercial availability of specific system parts, like detectors or specific electronics is an issue and for this the opportunities for common use of system elements and negotiating common specifications will be explored. Participants will organize a round table discussion for exchange of experience and will present the draft strategy plan in a workshop.

#### Participation per Partner

Partner number and short name	WP10 effort
3 - EISCAT	16.00
4 - CNR	10.00
5 - CNRS	12.00
UJF	0.50
8 - INGV	3.00
11 - ETHZ	4.00
15 - INRA	3.00
21 - RCN	4.00
23 - UiT	1.00
27 - FMI	3.00
37 - EGI.eu	4.00
<b>Total</b>	<b>60.50</b>

#### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D10.1	Guidelines on access to Ris	4 - CNR	Report	Public	46
D10.2	Master plan to facilitate and encourage access to Ris	5 - CNRS	Report	Public	50
D10.3	Description of performance criteria for open access and list of performance indicators	5 - CNRS	Report	Public	30
D10.4	RI strategy for for flexibility and sustainability	5 - CNRS	Report	Public	50

### Description of deliverables

D10.1 : Guidelines on access to Ris [46]

Guidelines on access to Ris

D10.2 : Master plan to facilitate and encourage access to Ris [50]

Master plan to facilitate and encourage access to Ris

D10.3 : Description of performance criteria for open access and list of performance indicators [30]

Description of performance criteria for open access and list of performance indicators

D10.4 : RI strategy for for flexibility and sustainability [50]

RI strategy for for flexibility and sustainability

### Schedule of relevant Milestones

Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS30	First version of RI Guidelines for access and RI access prepared	3 - EISCAT	30	Guideline and strategy drafts

<b>Work package number</b> <sup>9</sup>	WP11	<b>Lead beneficiary</b> <sup>10</sup>	15 - INRA
<b>Work package title</b>	New Concepts and Tools for Physical Access		
<b>Start month</b>	1	<b>End month</b>	48

### Objectives

Improve access to environmental RIs through exploring and promoting synergies of joint observation sites, cross-cutting research, and trans-national access programmes. Identify related requirements for the governance tools of RIs, and explore best possible methods and procedures to provide cross-disciplinary access to sites.

### Description of work and role of partners

#### **WP11 - New Concepts and Tools for Physical Access** [Months: 1-48]

**INRA, EISCAT, CNRS, IFREMER, INGV, RCN, UHEL**

To promote the use of RI platforms and to explore and promote synergies of joint observation sites the WP will address the challenges that are connected to physical access (Task 11.1.) and to the access across disciplines also outside the RI communities and including e.g. SME (Task 11.2.), and in Task 11.3. the suggested methods and procedures for future access. The project has identified 4 platforms operated by ENVRIPLUS partners that can be particularly suitable for performing innovative research at the frontier between different domains. This will be used for test cases to implement access across disciplines within Task (11.2):

- The HYYTIÄLÄ boreal forest site (SMR) including its ICOS, ACTRIS, ANAEE components. The SMR represents a background boreal forest site consisting of a main site and additional sites for flux measurements in wetland fen and boreal lake environments. SMR is operational since 1995 and provides in-situ, photometric, radar and LIDAR instruments for measurements of aerosols, cloud condensation nuclei, trace gases, volatile organic compounds, ammonia, greenhouse gases, as well as instruments to measure forest growth, forest physiology and micrometeorology. (UHEL[ICOS])
- The LA REUNION Island multi-disciplinary platform (OSUR-R) is a research infrastructure located at La Réunion (southwestern Indian Ocean, French overseas department). It comprises 4 geophysical stations: i) the Maïdo observatory (2160 m asl) on the northwestern part of the island for atmospheric observations, ii) the marine station on the western coast for observations of the reef zone, the coast line, and coastal aquifers, iii) the forest station on the southern coast for forest ecological observations, and iv) the hydrological station in a drainage basin over the northern coast. (CNRS[ACTRIS])
- The Mt. ETNA INGV Observatory is a multi-disciplinary RI, contributing to the EPOS-ESFRI project and managed by INGV. The main observatory is located on the flank of Mt. Etna and equipped with a broad range of instruments to physically and chemically characterize the structure of the volcano and its dynamics. The “Pizzi Deneri” Observatory located at 2800 m of altitude, near the active summit craters of the volcano is suitable for temporary installations. The observatory also supports fieldwork by providing computing facilities, 4WD vehicles and the use of the analytic laboratories. (INGV[EMSO])
- The SOERE-ACBB multidisciplinary platform. SOERE ACBB is a multidisciplinary set of platforms involving experiments initiated in 2005. As part of the SOERE-ACBB, the Lusignan platform is designed to characterize the trajectories of key variables such as carbon, phosphorus, potassium and nitrogen and the diversity of plants and organisms in the soil. The platform’s instrumentation continuously quantifies a broad range of physical, chemical and biological variables: climate forcing variables, physical conditions in soil, water fluxes and quality, carbon and nitrogen storage in soil, greenhouse gas emissions, floral, faunal and microbial diversity. (INRA[ANAEE])

Task 11.1. Assess the existing paths of physical access to RIs

Task leader: CNRS[ACTRIS] (2), participants: INRA[ANAEE] (1), EISCAT (1), IFREMER[EUROFLEETS](3), RCN[SIOS] (1), UHEL[ICOS] (1)

Making use of the experience among the partners ENVRI-plus will evaluate physical access to fixed and mobile platforms and approach issues with the current access procedures. The task is organized through a series of workshops, preferably organized together with user community meetings of WP18.

1) Implementing physical access to multi-disciplinary fixed platforms. This task is based on contributions from the operators of different platforms, representing different domains and different management-types, including representatives of platforms contributing to Task 11.2. It will identify end-user needs, research gaps and possible synergies to enhance research within the domains covered by ENVRIPLUS. Workshops will analyse current rules and constraints for multidisciplinary access (e.g. cost calculation, methods of and deliver a road-map of future access

protocols. By evaluating the user needs and finding user group interest during the workshops, the task will then design the physical access case studies for one or several of the Task 11.2 sites.

2) Implementing physical access to Research vessels. The oceanographic vessels of the EC are not all integrated inside one infrastructure. The I3 EUROLLEETS2 is actively promoting such integration. Separately, the ESFRI projects need a multi-year plan for their use of the fleet. This task will build a common plan, taking into account EMSO deployment and maintenance, EUROARGO deployment, SIOS cruise plan, ICOS/marine needs, EMBRC stations plans and needs of other ESFRI projects outside the environment domain such as KM3Net. Scenarios from this multi-year planning and spatial coverage will be proposed for a more cost efficient cruise plan. This will include oceanographic vessel infrastructures and ships of opportunities already volunteering. A sustainable planning procedure will be negotiated during regular meetings with ship owners ERVO (European Research Vessels Operators) and fleet planning bodies.

Task 11.2. Explore conditions for access to RIs across disciplines in fixed platforms

Task leader: CNRS[ACTRIS] (5), participants: INRA[ANAEE] (4), EISCAT (1), UHEL[ICOS] (1), INGV[EMSO] (1), RCN[SIOS] (1)

Use-case on implementing physical access to one or several of the 4 infrastructures. This use-case will permit implementation of physical-access to identified multi-disciplinary platforms suited for hosting research across the scientific disciplines as designed in Task 11.1. They will be used as test case to evaluate applicability of the current and/or Task 11.1. proposed new methods of access: What are the experienced benefits of this new access to users and to the providing infrastructures? Are the cost calculations realistic, how to define actual access costs? Are there unforeseen complications or benefits? Partner CNRS will be allocated 360 k€ for supporting these selected test cases according to the plan developed in Task 11.1.

Task 11.3. Assess the use of governance tools and TNA within clusters of RIs to promote inter-disciplinary research

Task leader: INRA[ANAEE] (1), participants: CNRS[ACTRIS] (3.5), INGV[EMSO] (1)

Task 11.3. is built on outcome from Tasks 11.1. and 11.2. and will propose a model to facilitate efficient access to environmental RIs, including modalities of future multidisciplinary TNA, cost models for multidisciplinary platforms, including an assessment of its added-value, and scientific cross-fertilization potential for the community.

#### Participation per Partner

Partner number and short name	WP11 effort
3 - EISCAT	3.00
5 - CNRS	9.00
UR	1.00
UJF	0.50
6 - IFREMER	3.00
8 - INGV	3.00
15 - INRA	6.00
21 - RCN	1.20
38 - UHEL	2.00
<b>Total</b>	<b>28.70</b>

### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D11.1	Report on planning and implementing physical access across disciplines	5 - CNRS	Report	Public	18
D11.2	Plan for sustained multi-year planning of oceanographic vessels for the environment European Ris	6 - IFREMER	Report	Public	18
D11.3	Whitepaper on improving access across to RIs disciplines	15 - INRA	Report	Public	40
D11.4	Report on interdisciplinary integration capacity, end-user needs TNA implementation requirement and added-value for the scientific community	5 - CNRS	Report	Public	48

### Description of deliverables

D11.1 : Report on planning and implementing physical access across disciplines [18]  
 Report on planning and implementing physical access across disciplines

D11.2 : Plan for sustained multi-year planning of oceanographic vessels for the environment European Ris [18]  
 Plan for sustained multi-year planning of oceanographic vessels for the environment European Ris

D11.3 : Whitepaper on improving access across to RIs disciplines [40]  
 Whitepaper on improving access across to RIs disciplines

D11.4 : Report on interdisciplinary integration capacity, end-user needs TNA implementation requirement and added-value for the scientific community [48]  
 Report on interdisciplinary integration capacity, end-user needs TNA implementation requirement and added-value for the scientific community

### Schedule of relevant Milestones

Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS7	Definition of the case studies of access	5 - CNRS	12	Definitions available
MS26	First case study on access finalized	15 - INRA	24	Access successfully done

<b>Work package number</b> <sup>9</sup>	WP12	<b>Lead beneficiary</b> <sup>10</sup>	11 - ETHZ
<b>Work package title</b>	A Framework for Environmental Literacy		
<b>Start month</b>	1	<b>End month</b>	48

### Objectives

- To implement a practical approach to link Earth observation data provided by European RIs to human systems by questionnaires and use cases.
- To develop a module for the ENVRIPLUS Reference Model that enables RIs to describe their data impact within a common approach.
- To develop an efficient feedback system to adjust their data generation to the evolving needs of the human system, including efficient funding mechanisms.
- To improve connections with other ESFRI domains (Culture, BMS) and to the economy in its broader sense.

### Description of work and role of partners

#### **WP12 - A Framework for Environmental Literacy** [Months: 1-48]

**ETHZ, ICOS ERIC, IFREMER, INRA, EAA**

The core issue of this WP is to address and optimize the information flow between the environmental system and the human systems (Scholz 2011) when using data and information collected and produced by RIs. Clarifying these interactions between the two systems would help to better assess the capacity of environmental RI data to be used to meet the grand challenges. Based on two test cases a generalization will be elaborated. This WP aims to provide operative indications that can feed into best practices of environmental RI development to assist programme managers and policy makers to make informed decisions on the further development of RIs.

Task 12.1. Template for a ENVRIPLUS Reference Module embedding the HES approach

Task leader EEA[LTER] (4), participants: UHEL[ICOS] (2), IFREMER[EXP] (2), ETHZ[EPOS] (2), M1-M27

A general framework for describing the interconnection between social and economic challenges of human systems and research in environmental RIs will be developed based on interviews with core people in RIs and Themes of ENVRI[PLUS]. The task aims to promote awareness, new skills and enhanced professional expertise in a technological-based scientific environment. It will introduce additional criteria into the design of RIs to avoid existing gaps in research development. These will also comprise measures to assess the socioeconomic impacts of environmental RIs, e.g. in terms of gain in competitiveness. This requires analysing: a) upstream processes whereby the development of RIs permits to acquire know-how and technical experience in key industries, and enables the build-up of “basic” knowledge as based on raw data generation and provision; b) feedback processes whereby environmental impact forecasting can help assess damage prevention and mitigation costs and can also influence technological improvement in human activities; and c) downstream processes whereby “innovation and knowledge transfer” is generated through the improvement of forecasting techniques and the competitiveness of the data processing industry. The ENVRI[PLUS] reference model will constitute a knowledge repository. The concept will be deepened by the following test cases.

Task 12.2: Operational forecasting, communication and decision-making in crisis situations

Task leader ETHZ[EPOS] (6), M1-M24

The environmental sciences RIs collected in this consortium are involved at very different levels in aspects related to environmental hazards and natural disasters. It is a common experience that their expertise and opinion may be called upon by the public, media, and politicians once a disaster strikes or becomes imminent. As natural disasters often evolve rapidly with little warning, they require fast decision-making and communication under high uncertainty. Especially problematic in this context are low-probability / high-consequence events, recent examples from seismology include evolving earthquake sequences (e.g., L'Aquila), as well as anthropogenic events such as induced earthquakes due to deep geothermal Energy exploitation (e.g. St. Gallen) or gas extraction (e.g. Groningen). Operational forecasting and decision-making needs to take into account a wide range of information, including scientific knowledge and uncertainties, legal and societal implications, economical implications etc.

This task will survey the existing best practice in operational forecasting, communication and decision-making in crisis situations across the various hazards and risks of relevance for the RIs (Environmental, Meteorological, Hydrological, Geological). We will analyze the experience with existing cross-disciplinary natural hazard warning danger levels and information portals, such as the recently released Swiss national portal (<http://www.natural-hazards.ch>). From this survey, we will compile general guidelines and recommendations for hazard and risk related activities of the RI.

Task 12.3. Operational framework for RIs terrestrial ecosystem research related to biogeochemical cycles

Task leader UHEL[ICOS] (4), participants: EEA[LTER] (10), INRA[ANAEE] (6), M1-M15

Based on earlier documents (e.g. GEO essential carbon variables) a strategical operational framework for the interoperability of terrestrial RIs involved in biogeochemical research will be developed. This involves a revision of the different national roadmaps in terms of concepts of interoperability and an inventory of ecosystem research sites across Europe. This inventory will be based on the existing webservice of the DEIMS system. The metadata set will be enhanced to enable documentation across RIs. Based on the distribution across Europe, individual site locations and characteristics a concept for ideal co-locations and integrated installations will be suggested.

Moreover, the task will focus on better Integration and discovery of site information across environmental RIs. Providing a description of the site network is a core service of many site-based RIs (e.g. eLTER, ICOS). The integration and harmonisation of the information is still a challenge as standards and tools are missing. With the DEIMS-SDR platform, a web-based tool for the documentation of observation and experimentation facilities exists which allows to expose INSPIRE EF compliant metadata about the sites linking available metadata.

#### Participation per Partner

Partner number and short name	WP12 effort
1 - ICOS ERIC	4.00
6 - IFREMER	2.00
11 - ETHZ	8.00
15 - INRA	6.00
16 - EAA	16.00
<b>Total</b>	<b>36.00</b>

#### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D12.1	Report describing the relation between challenges of human systems and environmental information generated in RIs as documented module of the ENVRIPLUS Reference Model updated based on the experiences from Tasks 33 and 34	16 - EAA	Report	Public	36
D12.2	White paper on general guidelines, recommendations, and best practices on communication and decision-making under uncertainty for environmental hazards and natural disasters	11 - ETHZ	Report	Public	32



### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D12.3	White paper on further integration of RIs related to terrestrial ecosystem research including recommendations on co-locating research sites on national and international level	1 - ICOS ERIC	Report	Public	32
D12.4	Prototyping a distributed site catalogue	16 - EAA	Report	Public	48

### Description of deliverables

D12.1 : Report describing the relation between challenges of human systems and environmental information generated in RIs as documented module of the ENVRIPLUS Reference Model updated based on the experiences from Tasks 33 and 34 [36]  
 Report describing the relation between challenges of human systems and environmental information generated in RIs as documented module of the ENVRIPLUS Reference Model updated based on the experiences from Tasks 33 and 34

D12.2 : White paper on general guidelines, recommendations, and best practices on communication and decision-making under uncertainty for environmental hazards and natural disasters [32]  
 White paper on general guidelines, recommendations, and best practices on communication and decision-making under uncertainty for environmental hazards and natural disasters

D12.3 : White paper on further integration of RIs related to terrestrial ecosystem research including recommendations on co-locating research sites on national and international level [32]  
 White paper on further integration of RIs related to terrestrial ecosystem research including recommendations on co-locating research sites on national and international level

D12.4 : Prototyping a distributed site catalogue [48]  
 The work will consist of the following activities: (a) review mapping of local site models to INSPIRE EF; (b) implement harvesting mechanisms from distributed site catalogues based on standard interfaces (e.g. web-accessible-folder, OAI-PMH); (c) create a common search index based on Solr; and (d) create prototype discovery interface for site information. The results of the work will be compared to existing metadata harvesting based on ISO19139.

### Schedule of relevant Milestones

Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS15	Work on reference model embedding the HES approach started successfully	11 - ETHZ	12	Report by 12 on the WP progress

<b>Work package number</b> <sup>9</sup>	WP13	<b>Lead beneficiary</b> <sup>10</sup>	8 - INGV
<b>Work package title</b>	Developing an Ethical Framework for RIs		
<b>Start month</b>	1	<b>End month</b>	48

### Objectives

- Increasing the awareness on the importance of ethical aspects in Earth sciences as a whole, by both the scientists and the public.
- Establishing shared ethical reference framework adopted by RIs governing bodies, including management guidelines for Ethical Boards in RIs.
- Increasing the awareness of RIs management and operational levels and the individual involved scientists on their social role in conducting research activities and research work environment.
- Assessing the ethical and social aspects related to project results achieved and deliverables released.

### Description of work and role of partners

#### WP13 - Developing an Ethical Framework for RIs [Months: 1-48]

INGV, ETHZ

Description of work

Task 13.1. State of art/reconnaissance of ethical issues

Task leader INGV[EMSO/EPOS], participants: ETHZ[EPOS] (with the contribution of all partners)

A general framework for describing ethical aspects environmental RIs will be developed based on interviews with core people in RIs and Themes of ENVRIPLUS. Some of the considered problems concern data integrity and truthful research conduction, communication of research results and uncertainties (e.g., about modelling), public safety communication, workplace safety, role of scientist in the decision making process (vs. regulatory bodies, civil protection, other authorities). On short timescales (disaster response) as well as long timescales (environmental impact of human activities). The results of WP12 will be a strong base of this task.

Task 13.2. Ethics Guidelines for RIs

Task leader INGV[EMSO/EPOS], participants: ETHZ[EPOS] (with the contribution of all partners)

Elaboration of consensus guidelines including Ethics principles and recommendations for the RI Governing Bodies according to the Geoethics goals (<http://www.iapg.geoethics.org/home/what>) and terms of reference (e.g., Montreal Statement 2013). Aspects related to Intellectual Property Rights will be also considered. An ethical label template will be designed to accompany each project deliverable in order to highlight the ethical implication of the project achievements. Information for the project participants will be made available on the project website about social values of reference for the project (in collaboration with the WP5.)

Task 13.3. Development of public education & dissemination material on the ethical and social issues

Task leader ETHZ[EPOS], participants: INGV[EMSO/EPOS] (with the contribution of all partners)

The results of Tasks 13.1. and 13.2. will be translated into material that is suitable for and accessible by the lay public, using both electronic and classical media and distribution channels (in close collaboration with WP6). The materials will specifically focus on the following aspects:

- increasing transparency and credibility of individual scientists and of the scientific work carried out at the RIs;
- promoting a better understanding and acceptance of the role that science and scientists play in the public discussion and policy making;
- explaining the inherent uncertainties and limitations in scientific results.

### Participation per Partner

Partner number and short name	WP13 effort
8 - INGV	30.00
11 - ETHZ	6.00
<b>Total</b>	<b>36.00</b>

### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D13.1	Questionnaire to analyse the ethical and social issues and assessment report on questionnaire answers	8 - INGV	Other	Public	24
D13.2	Template of the Ethical labels for deliverables and its adoption	8 - INGV	Report	Public	36
D13.3	Ethical Consensus Guidelines for Ris	8 - INGV	Report	Public	42
D13.4	Contents for Websites, social media appearance, printed matter on ethical & societal issues for general public	11 - ETHZ	Websites, patents filling, etc.	Public	48

### Description of deliverables

D13.1 : Questionnaire to analyse the ethical and social issues and assessment report on questionnaire answers [24]  
 Questionnaire to analyse the ethical and social issues and assessment report on questionnaire answers

D13.2 : Template of the Ethical labels for deliverables and its adoption [36]  
 Template of the Ethical labels for deliverables and its adoption

D13.3 : Ethical Consensus Guidelines for Ris [42]  
 Ethical Consensus Guidelines for Ris

D13.4 : Contents for Websites, social media appearance, printed matter on ethical & societal issues for general public [48]  
 Contents for Websites, social media appearance, printed matter on ethical & societal issues for general public

### Schedule of relevant Milestones

Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS14	Questionnaire to analyse the ethical and social issues prepared	8 - INGV	12	Questionnaire prepared
MS32	Ethical Consensus guidelines report plan	8 - INGV	36	Draft report by WP13 leader

<b>Work package number</b> <sup>9</sup>	WP14	<b>Lead beneficiary</b> <sup>10</sup>	8 - INGV
<b>Work package title</b>	Citizen Observatories and Participative Science		
<b>Start month</b>	1	<b>End month</b>	48

**Objectives**

A necessary component of environmental RI's is and will increasingly become participative or "citizen" science. This is for two key reasons: 1) it raises societal awareness and engagement about environmental change and 2) provides data that is otherwise logistically inaccessible for monitoring change on our planet. This work package develops and summarizes resources for environmental R.I.'s to engage with the public in citizen science, an area providing innovative solutions for data or sample collection, management, processing, curation, annotation, and deposition. In particular it will move beyond a review of status quo to targeted test cases in leading areas of citizen science to develop 1. resources and best practices for public contributions to the annotation of imagery (a charismatic form of scientific information with which to engage the public, while also being a resource-intensive information source for RI's) and 2. a framework for distributed networks of observers and sensors who collect data and can perform response actions. In all cases, engaging, training, and maintaining active citizen scientists is required; as are data systems for the acquisition, assessment, access, and analysis of distributed data sources.

Leading Area 1. Imagery Annotation: Taking image samples and turning them into data.  
Remote environments are not conducive to the kind of distributed observations that can be made in populated terrestrial settings, therefore remotely operated image systems are deployed to provide time-series samples of poorly characterized environments (e.g. EMSO, ONC oceannetworks.ca). However the challenge is to turn these complex samples into data, a time and resource-intensive process. Therefore, this test case will help develop citizen supported image analysis. It will initially be based on imagery from deep-sea ecosystems, build on early experience from Zooniverse (zooniverse.org) and Digital Fishers (digitalfishers.net), and address further issues .

Leading Area 2. Distributed observers and sensors.  
Engaged citizens can provide a unique opportunity for the distribution of observations and sensors, permitting targeted spatial and temporal coverage of key environmental data.

A) Virtual citizen seismological observatory - The main motivation of this test case is to drastically change the way the seismological community interfaces with the public and answer its demands to improve earthquake preparedness and augment data collection. Citizen seismological observatories will not only allow volunteers to contribute data, but will empower them to analyse and map the collected open-access data. In society, it will raise earthquake awareness, develop trust in the seismology community by improved exchanges, and contribute to a better public preparedness. The seismological community will benefit as it will augment at little cost data collection, especially in urban environments where risk is high and spatially heterogeneous.

B) Marine biodiversity citizen participative science programme - The objective of this test case is to develop a marine citizen observatory able to generate harmonized information on the spatio-temporal distribution of coastal species and habitats in Europe to monitor change, and to quickly react to impacts in coastal environments. The platform will be built from technology and know-how of existing RI's and be used for citizen data acquisition as well as for citizen education, including functions for visualisation, scientist-citizen feedback, crowdsourcing, event response, long-term engagement, and social media integration (e.g. with Google Oceans).

**Description of work and role of partners**

**WP14 - Citizen Observatories and Participative Science** [Months: 1-48]  
INGV, IFREMER, EMSC, UGOT, MBA, EMSO ERIC

Description of work

Task 14.1. Imagery Annotation: Taking complex scientific images and turning them into data  
Task leader IFREMER[EMSO] (13)

This task requires:

- a tool that can automatically extract images from the videos in a common format and feed them into the annotation software
- an online interface that will allow users to perform defined tasks on the images
- tasks that can be performed by a broad public from children to senior citizens
- a data model to archive information (e.g. EMSO database) following ENVRI + standards

- a unique display and educational products to communicate the excitement and complexity of real-time imagery from remote environments with a wide population.

Task 14.2. Citizen virtual seismological observatory

Task leader: EMSC[EPOS] (12)

This task requires:

- distribution of inexpensive sensors (below 100€) turning a desktop in a seismic station to establish dense urban seismic networks (ongoing pilot projects in Thessaloniki and Patras)
- an open platform for data sharing and analysis
- crowdsourcing tools (websites, smartphone applications) to collect information on earthquake effects (pics, questionnaires)
- webinars to develop ownership and earthquake preparedness

Task 14.3. Marine biodiversity citizen participative science programme

Task leader: MBA[EMBRC] (8), participants: UGOT[LIFEWATCH] (6)

This task includes/requires:

- development EMBRC citizen science platform from the Swedish Species Observation System (i.e. www.artportalen.se) which has established important standards, formats, and ontologies advocated within LIFEWATCH RI's informed by European as well as global projects
- functions to submit, store, share, and process data on marine species and habitats associated with geo-temporal, pictorial, and environmental information
- quality control and data validation, as well as functions for data aggregation, exploration, and visualization (e.g. www.analysisportal.se/ and EMBRC related sites)

Task 14.4. RI Citizen Science Toolkit – Best Practices augmented by Leading Area test cases

Task leader INGV[EMSO/EPOS] (8), EMSO ERIC (2)

This task includes/requires:

- tools for the RI operators on how to effectively engage, train, and maintain Citizen Scientists
- data systems for acquisition, assessment, access, and analysis of distributed data sources

For all tasks this is including:

Community Online Platform: websites, social networks, discussion forums.

Crowdsourcing Tools: image acquisition, web and smartphone applications, surveys/questionnaires

Information and Training Resources: webinars, public lectures, websites, public/museum displays

Citizen Mobilization: rapid response observations to events (e.g. earthquakes, oil spills)

#### Participation per Partner

Partner number and short name	WP14 effort
6 - IFREMER	13.00
8 - INGV	8.00
10 - EMSC	9.00
17 - UGOT	6.00
18 - MBA	8.00
39 - EMSO ERIC	2.00
<b>Total</b>	<b>46.00</b>

**List of deliverables**

<b>Deliverable Number<sup>14</sup></b>	<b>Deliverable Title</b>	<b>Lead beneficiary</b>	<b>Type<sup>15</sup></b>	<b>Dissemination level<sup>16</sup></b>	<b>Due Date (in months)<sup>17</sup></b>
D14.1	Prototype of a web-based annotation tool for user testing. This will demonstrate an example of participative science early in the project, allowing access, testing, and cross-cutting developments for the ENVRIPLUS consortium	6 - IFREMER	Demonstrator	Public	15
D14.2	Report describing image annotation results	6 - IFREMER	Report	Public	30
D14.3	Report on development and implementation of a citizen seismology sensor observatory and education platform	10 - EMSC	Report	Public	20
D14.4	Guidelines for developing citizen sensor observatories and education platform	10 - EMSC	Report	Public	26
D14.5	Test version of a EMBRC citizen observatory system	17 - UGOT	Demonstrator	Public	18
D14.6	Review of existing Citizen Science tools	8 - INGV	Report	Public	15
D14.7	Citizen observation training program, training delivery and evaluation, and impact assessment report	18 - MBA	Report	Public	44
D14.8	Collection Training sessions/presentations	18 - MBA	Websites, patents filling, etc.	Public	44
D14.9	Summary report of WP14	8 - INGV	Report	Public	48

**Description of deliverables**

D14.1 : Prototype of a web-based annotation tool for user testing. This will demonstrate an example of participative science early in the project, allowing access, testing, and cross-cutting developments for the ENVRIPLUS consortium [15]

Prototype of a web-based annotation tool for user testing. This will demonstrate an example of participative science early in the project, allowing access, testing, and cross-cutting developments for the ENVRIPLUS consortium

D14.2 : Report describing image annotation results [30]

Report describing image annotation results. First tests will be focused on videos already processed by experts, allowing for ground-truthing of data acquired by citizens. The report will describe the tool's limitations and to what extent the resulting data can help to answer our scientific questions

D14.3 : Report on development and implementation of a citizen seismology sensor observatory and education platform [20]

Report on development and implementation of a citizen seismology sensor observatory and education platform

D14.4 : Guidelines for developing citizen sensor observatories and education platform [26]

Guidelines for developing citizen sensor observatories and education platform

D14.5 : Test version of a EMBRC citizen observatory system [18]

Test version of a EMBRC citizen observatory system

D14.6 : Review of existing Citizen Science tools [15]

Review of existing Citizen Science tools

D14.7 : Citizen observation training program, training delivery and evaluation, and impact assessment report [44]

Citizen observation training program, training delivery and evaluation, and impact assessment report

D14.8 : Collection Training sessions/presentations [44]

Collection Training sessions/presentations

D14.9 : Summary report of WP14 [48]

Summary report of WP14

#### Schedule of relevant Milestones

<b>Milestone number<sup>18</sup></b>	<b>Milestone title</b>	<b>Lead beneficiary</b>	<b>Due Date (in months)</b>	<b>Means of verification</b>
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<b>Work package number</b> <sup>9</sup>	WP15	<b>Lead beneficiary</b> <sup>10</sup>	13 - UvA
<b>Work package title</b>	Training, e-Learning and courses		
<b>Start month</b>	1	<b>End month</b>	48

### Objectives

This WP has as main objective to organize and develop concrete training programs. It focusses on the development of training modules, e-learning environments and specific courses for the main stakeholders in the Environmental RI community, being the RI operators (technical, administrative, management), the scientific and possible industry users of the RI's and special outreach to secondary school students.

### Description of work and role of partners

#### **WP15 - Training, e-Learning and courses** [Months: 1-48]

UvA, CNRS, INGV, UNILE, UiT, NILU, CU, EGI.eu

Description of work

Task 15.1. Teaching RI operators key skills

Task leader: CU[EXP] (6), Participant: EGI[EXP] (9)

This task will focus on two key technical topics to be taught to the technical operators of the RIs involved in ENVRIPLUS.

1) The ENVRI Reference Model:

The ENVRI Reference Model is used to establish both common grounds for communication, and to provide a framework for a common way to build / integrate environmental research infrastructures. In collaboration with Theme 2 (Reference Model development), a series of training sessions and virtual training packages will be developed for ESFRI RI and I3 staff members to help understanding the practical application of the Reference Model. The task aims to prepare combined training materials, suitable for both classroom and distance learning use (i.e., write once).

2) Building E-infrastructure environments:

o Develop and deliver training about methodologies, infrastructures, tools and services for those who want to build environments for big data. The content and training can benefit those tool developers who want to create new environments for scientists, for the users of ENVRIPLUS Research Infrastructures. The topics covered in this area include:

Methodologies, tools and e-infrastructures for high-throughput, high-performance and cloud computing

Application porting and integration approaches to clouds and grids

Approaches, tools and online services for data storage, organisation, transfer and processing

Workflows and pipelines - organising and sharing multi-stage simulations at community level

Scientific gateways - integrate applications, data and services into web-based portals

Developing PaaS systems for application developers

Developing SaaS systems for scientific end users

o Develop and deliver training about building e-infrastructures, federated infrastructures for scientific communities.

The content and training can benefit the IT operators of RIs, those who need to build and operate IT infrastructures to support environmental sciences data, applications, tools and environments. The topics covered in this area include:

Deploying clusters and desktop infrastructures for high-throughput or high-performance computing

Deploying virtualisation and hypervisor technologies to build IaaS clouds

Federating cloud systems into multi-organisational and multi-national Virtual Organisations (including connecting clouds to monitoring, accounting, user management and resource allocation systems)

o Facilitate harmonisation of e-infrastructure training content and events among the European e-infrastructures to maximise benefits for ENVRIPLUS RIs.

Training will be delivered in face-to-face events, Remote content for Webinars, Online content for self-paced learners or MOOCs, whatever is most appropriate in given circumstances.

Task 15.2. Training workshops on Time series analysis

Task leader: UiT[ESONET] (4), Participant: CNRS[EMSO] (5) NILU (1,8)

Times-series analysis is the future for environmental sciences to understand natural processes and their dynamics. Tasks 2.2. and 8.1. address these issues in the technical workpackages of this proposal.

To support these technical developments, workshops will be organized, with the objective of promoting transfer of knowledge between researchers from various environmental fields. These objectives will be achieved by both training



courses and conference presentations based on application examples and actual case studies from field experiments. The organizers will cooperate with the responsible persons in WP1 and WP2.

Two time-series analysis events of international level will be open to European RI users, including industrial companies and eastern European beneficiaries, in all environmental fields (marine, solid earth, biodiversity and atmosphere fields), in order to promote exchanges and collaborations. Each conference will issue tutorials on the web and a collection of time-series manuals and hand-books.

It will build on one side upon the “Time-series analysis in marine science and application for industry” conference organized in September 2012 in France by ESONET-Vi (EMSO) and published in a special issue in the Journal of Marine Systems, Volume 130, February 2014 and constituted of a virtual community with core interest in marine time-series and on the other side, upon the work engaged by the atmospheric domain community for analysis of time series within the framework of WMO and EMEP (TFMM conference 2013).

#### Task 15.3. RI management training

Task leader: UvA[EXP] (4)

The successful RAMIRI project has during the years set the scene for training of managers of RI's. It is acknowledged that RI management is a new profession, different from running a regular company or institute. Often, the people in management roles in RI's are trained in research and do not have much experience in RI management. In cooperation with the management training project as called for in INFRASUPP-3-2014 and by in-house development based on established best practices, ENVRI will offer a full RI management program directed towards RI management and leadership. The main focus is on management and organization of an RI in the area's of Project Management, Financial issues, Legal and Governance, Human Resource Policies and the Life Cycle of and RI. The program will be offered to beginning and senior staff. Particular focus groups are the staff of newly built and in-development RIs (I3s), but other RI personnel are accepted.

#### Task 15.4: Development of training packages for the use of Environmental Research Infrastructure products

Task leader: UNILE[LIFEWATCH] (12), Participant: INGV[EPOS] (3)

The task is aimed at the development/customisation of the ENVRI[PLUS] e-Training Platform (EeTP) and the development of training products and packages for the optimising access to ERIs and use of ERIs products. It includes the following actions:

- Implementation of the ENVRI[PLUS] e-Training Platform (EeTP), which incorporates platforms and contents developed in tasks 15.5. (Secondary School education), and 15.1. (training course on ENVRI Reference Model), and is open to RIs e-training programmes;
- Realisation of e-training courses targeting scientists and science stakeholders on the use of ERIs products, covering types of products common to most ERIs as well as areas of interests and products characteristics of the RIs contributing to ENVRIPLUS. These include and e-training course on the use of EeTP itself;
- Implementation of user-friendly tools and products complementing the e-training course through:
  - o Online support system for EeTP users;
  - o TED-like seminars on the core areas of interests of the ERIs, on ERIs products and societal benefits from ERIs activities;
- In situ and hands on courses, limited to small number of key user groups (defined in Theme 6) integrating the e-training activities and being supported by all material made available on the EeTP. Courses on modelling web-services, targeting early career scientists, are an example of the products realised within this sub-task.

This task will develop advanced, state of the art course materials and webinars, where appropriate, in close cooperation with the RIs, making available on the e-Training Platform, deepening and extending or adapting already existing materials, whenever it will be possible.

The EeTP is based on the open source Moodle technology, which requires relatively easy procedures for sustainability beyond the project lifetime. Together with task 17.5., this task will ensure the availability of the EeTP and the developed courses for the Environmental RIs beyond the project life-time, defining opportunities and conditions for sustainability.

#### Task 15.5: Secondary School level education on environmental issues related to the RIs

Task leader: INGV[EMSO] (15), participant: UNILE[LIFEWATCH] (4)

The task is aimed at improving the ENVRI[PLUS] e-Training Platform for multimedia education of Secondary School level teachers and students on environmental issues dealt through the RIs. Main activities are:

- Identification of good practices and tools for teachers and students to increase the awareness of the Earth System complexity and Environmental challenges for its preservation and sustainability. (3 pm)
- Requirements definition and implementation of the scientific contents of additional hosting kits (apps, videos, interactive games) developed in Task 15.4. suitable for secondary schools and addressing major thematic research areas and challenges dealt within Research Infrastructures (i.e., Biodiversity and Ecosystem Services, Greenhouse effect and Earth Warming, Ocean acidifications, environmental sustainability). Functionality test and validation will be performed.

- Training of Secondary Schools teachers to use of the EeTP taking also advantage of the GIFT framework (<http://www.egu.eu/education/gift/>) during the EGU annual General Assembly.  
 - Elaboration of a long-term sustainability plan for the new components of EeTP.  
 The use of ICT allows the extension of the courses to Secondary Schools by using interactive participatory approaches to learning on the key RIs research areas. The platform is provided in the main languages of the EU.

#### Participation per Partner

Partner number and short name	WP15 effort
5 - CNRS	1.00
UJF	4.00
8 - INGV	18.00
13 - UvA	4.00
14 - UNILE	16.00
23 - UiT	4.00
32 - NILU	1.80
33 - CU	6.00
37 - EGI.eu	9.00
<b>Total</b>	<b>63.80</b>

#### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D15.1	Training materials, suitable for both classroom and e-learning use	33 - CU	Websites, patents filling, etc.	Public	30
D15.2	Materials from the second time-series conference including tutorial and hand-book on the second time- series conference	5 - CNRS	Websites, patents filling, etc.	Public	48
D15.3	Joint plan of action between the INFRASUPP-3-2014 project and ENVRI-PLUS	13 - UvA	Report	Public	24
D15.4	Report on available training/courses on the use of data processing tools from the existing RI's and the priorities for using these in a transversal platform	37 - EGI.eu	Report	Public	18

### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D15.5	EeTP E – Learning, description of implementation of new functionalities	14 - UNILE	Report	Public	36
D15.6	Training course for teachers	8 - INGV	Report	Public	24

### Description of deliverables

D15.1 : Training materials, suitable for both classroom and e-learning use [30]  
 Training materials, suitable for both classroom and e-learning use

D15.2 : Materials from the second time-series conference including tutorial and hand-book on the second time- series conference [48]  
 Materials from the second time-series conference including tutorial and hand-book on the second time- series conference

D15.3 : Joint plan of action between the INFRASUPP-3-2014 project and ENVRI-PLUS [24]  
 Joint plan of action between the INFRASUPP-3-2014 project and ENVRI-PLUS

D15.4 : Report on available training/courses on the use of data processing tools from the existing RI's and the priorities for using these in a transversal platform [18]  
 Report on available training/courses on the use of data processing tools from the existing RI's and the priorities for using these in a transversal platform

D15.5 : EeTP E – Learning, description of implementation of new functionalities [36]  
 EeTP E – Learning, description of implementation of new functionalities

D15.6 : Training course for teachers [24]  
 Training course for teachers

### Schedule of relevant Milestones

Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS8	First RM training sessions completed	33 - CU	12	First sessions completed
MS21	Training course for teachers delivered	8 - INGV	36	Means of verification: signed attendee list
MS33	e-Training material and TED-like seminars	14 - UNILE	40	Material available

<b>Work package number</b> <sup>9</sup>	WP16	<b>Lead beneficiary</b> <sup>10</sup>	12 - UniHB
<b>Work package title</b>	Staff Exchange		
<b>Start month</b>	1	<b>End month</b>	46

### Objectives

The main objective of this WP is to facilitate the exchange of knowledge among staff working in RI's or related to the implementation of new RI's. This will help disseminating the know-how of RI specialists, and get practical hands-on experience on the operation procedures.

### Description of work and role of partners

#### **WP16 - Staff Exchange** [Months: 1-46]

**UniHB, UiT**

Description of work

Task 16.1. Experience sharing symposia for RI staff

Task leader: UiT[ESONET] (1), Participant: UniHB[EMSO] (4)

A series of virtual and physical symposia will be organized for sharing experiences and best practices in terms of data access, understanding and usage, also with the help of Themes 1 and 2. These symposia are mainly organized for technical staff in RIs. The symposia should raise the awareness of opportunities in other, cross domain RIs to learn and adopt these best practices, experiences or ways of working.

Task 16.2: Staff exchange program

Task leader: UniHB[EMSO] (4), Participant: UiT[ESONET] (1)

A series of staff exchange positions will be organized based on 2 open calls launched during the lifetime of the ENVRiplus project. The exchange will take the form of short stays in the RI, organized either on a bilateral basis (between two RIs involving 1 person in each RI), or on a triangular basis (involving 3 institutes and 3 staff persons in total). Unilateral proposals can be submitted, but preference will be given to proposals for cross exchange. All ENVRiplus beneficiaries can apply for this staff exchange, as well as organizations outside the ENVRiplus partnership that have a clear and established relationship with the participating RI's in ENVRiplus. The Executive Board of ENVRiplus will decide on the eligibility of such related organizations. The principal activity of the exchanged personnel during his/her stay at the RI should not aim at data acquisition or fundamental research.

This task will formulate the eligibility criteria for personnel and costs as well as the selection procedures, in accordance with the involved domains, RIs and I3's. These will be laid down in a deliverable early in the project (M6) and will act as guide for staff exchange proposers within the project. To ensure broad acceptance, the deliverable will require final approval by the Steering Committee of the overall ENVRiPLUS project.

### Participation per Partner

<b>Partner number and short name</b>	<b>WP16 effort</b>
12 - UniHB	8.00
23 - UiT	2.00
<b>Total</b>	<b>10.00</b>

### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D16.1	Eligibility criteria document	12 - UniHB	Report	Public	6
D16.2	Synthesis report on staff exchange and how this service can be sustained by RIs?	12 - UniHB	Report	Public	46

### Description of deliverables

D16.1 : Eligibility criteria document [6]

Eligibility criteria document

D16.2 : Synthesis report on staff exchange and how this service can be sustained by RIs? [46]

Synthesis report on staff exchange and how this service can be sustained by RIs?

### Schedule of relevant Milestones

Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS3	Eligibility criteria document for Staff exchange	12 - UniHB	6	Deliverable D71
MS17	First staff exchange call finalized	12 - UniHB	14	Call finalized

<b>Work package number</b> <sup>9</sup>	WP17	<b>Lead beneficiary</b> <sup>10</sup>	27 - FMI
<b>Work package title</b>	Coordination of RI communication, development and implementation of the ENVRI strategy		
<b>Start month</b>	1	<b>End month</b>	50

### Objectives

The objectives of the WP17 are to 1) coordinate the internal (within the project) and external communication and 2) further develop and implement long-term ENVRI strategy. These action are needed to overcome fragmentation in the environmental RI landscape and to enhance the operational efficiency and provision of RI services for the users by seeking the optimal economy of scale and suitable common guidelines and operations.

### Description of work and role of partners

**WP17 - Coordination of RI communication, development and implementation of the ENVRI strategy** [Months: 1-50]

**FMI**, ICOS ERIC, EURO-ARGO, EISCAT, CNR, CNRS, IFREMER, FZJ, INGV, NERC, UvA, INRA, EAA, MBA, RCN, EMBL, UiT, EuroGOOS, UCPH, EGI.eu, UHEL

The WP will establish efficient operational and organisational means for the coordination and communication at the domain level, across the cluster, and for overall environmental RI community that goes beyond the ENVRI[PLUS] project partnerships. WP17 will organise the communication and knowledge transfer of the joint ENVRIPLUS policies and strategies in the environmental RI community and to other relevant clusters and initiatives. National, European and international policy dialogs with other RI clusters, strategy platforms (e.g. ESFRI) and funding organisations will also be established to ensure that the planned developments in the ENVRI[PLUS] are aligned with the national and international RI developments. In addition, WP6.1 will seek most suitable means to sustain collaborative cluster work of environmental RIs beyond the project life-time.

Task 17.1. Facilitation of the communication and coordination at the domain level on the ENVRI strategy

Task leader: UHEL[ICOS] (12), participants: IFREMER[EURO-ARGO] (0.5), FZJ[IAGOS] (1), UvA[LIFEWATCH] (1), INRA[ANAEE] (1), NERC[EPOS](0.5), FMI[ICOS] (2), ICOS ERIC (M1-M48)

The task 17.1. will take care that common ENVRIPLUS vision, strategies and aims toward interoperability, common operations and services are developed and materialized taking account different development levels, needs and interests of participating research infrastructures, RI networks and RI related projects within the domains. The task will establish four working groups, one for each domain (marine, atmospheric, biodiversity/ecosystem and solid Earth) to focus on domain specific development needs and issues which need to be overcome on the way to achieve the aim of higher level interoperability and joint strategy targets. The working groups will run throughout the project duration and will have several virtual and physical meetings per year. The working groups are responsible for developing and operating smooth communication means in their domain.

Task 17.2: Facilitation of the communication and coordination of the cluster level integration in the frame of ENVRI strategy

Task leader: FMI[ICOS] (8), participants: EURO-ARGO (1), EISCAT (1), CNR[ACTRIS] (1), NRS[IS-ENES] (1), IFREMER[EUROFLEETS)/ IFREMER[JERICO]/IFREMER[SEADATANET] (0.5), FZJ[IAGOS] (1), INGV[EMSO] (1), NERC[EPOS] (0.5), NERC[FIX03] (1), UvA[LIFEWATCH] (1), INRA[ANAEE] (1), EAA[LTER] (1), MBA[EMBRC] (1), RCN[SIOIS] (1), EMBL[ELIXIR] (1), EUROGOOS (1), UiT[ESONET] (1), UCPH[INTERACT] (1), M1-M50

In the times of the first ESFRI roadmaps, the environmental research landscape was fragmented with a poor collaboration and communication across the env RIs and disciplines. A lot of progress have been achieved during the last ten years – awareness of the Env RIs have increased, several ERICs have (or will be) established and many of the environmental RIs are entering in their operational phase. ENVRIPLUS will also benefit from the ENVRI project deliverables (ENVRI cluster project, project number 283465) that initiated the collaborative work of RIs towards common RI solutions and operations. To further facilitate the planning, developing and implementing of the joint collaborative activities, the good experiences of the ESFRI environmental RI Stakeholder Advisory Board (ENVRI SAB) that was held in the context of ENVRI project will be continued. ENVRI SAB gathered ESFRI env. RIs together to discuss on the common challenges and to share best practices in the planning, constructing and operating the env. RIs. The SAB also provided a forum for ESFRI env RIs to discuss and develop joint environmental research questions, common environmental RI vision, strategy, and planning of joint actions in the field of environmental research. In the current project, the

forum of SAB will be further developed and extend to cover wider environmental RI communities. The ENVRIPLUS research infrastructures will form a Board of European Environmental Research Infrastructures (BEERi) that follows the work of the ENVRIPLUS, validate the deliverables of the ENVRIPLUS project and further develop common environmental ENVRI strategy and its implementation actions. The Board is managed by the executive committee, which is composed of one domain representative and the task leader. The committee prepares the BEERi agendas and follows the implementation of agreed actions after the BEERi meetings. The BEERi will have at least two meetings per year. Board members are also committed to work on the agreed actions between the BEERi meetings. The Board consists of the RI directors or RI project coordinators. The Board seeks balance between the common implementation needs of the infrastructure cluster and the specific implementation needs of individual research infrastructures and domain level.

Task 17.3: Environmental research infrastructure community platform

Task leader: UHEL[ICOS] (3), participants: INGV[EMSO] (3), EAA[LTER] (2), EGI[EXP] (2), FMI[ICOS] (2), CU[EXP] (0,3) M6-M48

The environmental research infrastructure and network landscape is evolving constantly and it is foreseen that during the lifetime of the ENVRIPLUS projects new RI projects are emerging and reorganisations in the current RIs and networks may happen (e.g. new RIs supported by H2020 IA calls and new RIs via ESFRI roadmap update process). To ensure that the ENVRIPLUS is serving the entire environmental RI community - also the new RIs - a dedicated virtual Environmental Research Infrastructure Community Platform will be established. In addition to the virtual platform the Task 17.3. will organise annual gathering of all the environmental RIs, EC funded I3 and IAs, and other relevant RI networks and scientists/science communities interested in environmental RI matters. The open community platform meeting enables the presentation of the ENVRIPLUS outcomes, facilitates the dialogs and interactions on the future needs, challenges and developments in the environmental RI community (incl. technical, data, access, training, strategy and policy topics). Specific budget will be reserved to host these meetings and to support the meeting participation expenses of those RI projects/networks which are not ENVRIPLUS beneficiaries. This activity is targeted to the RI communities not for the RI users as the Task 18.3. on Liaison and Collaborative Action with Users and Stakeholders.

Task 17.4: Policy communication and strategic collaboration with other RI communities, national, regional and international key actors

Task leader: CNR[ACTRIS] (6), FMI[ICOS] (6), participants: EURO-ARGO (1), EISCAT (1), CNR[ACTRIS] (1), CNRS[IS-ENES] (1), IFREMER[EUROFLEETS, JERICO, SEADATANET] (0.5), FZJ[IAGOS] (1), INGV[EMSO] (1), NERC[EPOS] (0.5), NERC[FIX03] (1), UvA[LIFEWATCH] (1), INRA[ANAE] (1), EAA[LTER] (1), MBA[EMBRC] (1), RCN[SIOS] (1), EMBL[ELIXIR] (1), EUROGOOS (1), UiT[ESONET] (1), UCPH[INTERACT] (1), M1-M48

The ENVRIPLUS represent the key European environmental research infrastructures and RI networks and therefore it acts as a node for national, regional, European and international collaborative RI communication. ESFRI Research infrastructures are funded mainly by Member State funding and thus the European RI landscape is partially a reflection of the national RI roadmaps and priorities. It is crucial that the ENVRIPLUS communicate the joint strategic visions and actions to the national level funding bodies and stakeholders. In addition to the national level, also the regional level is important, especially in terms of funding opportunities, local socio-economic impacts and to promote specific regional scientific needs. ENVRIPLUS will participate in the regional RI discussions and share best practices related to the regional level RI developments. ENVRIPLUS as the environmental cluster will also participate in any needed collaborative work and dialogs with other cluster projects funded by the INFRADEV-4 call. Importantly, this task will promote policy and strategy communication with European and international strategy and funding bodies, such as dialogs with ESFRI forum and its working groups, EC, Joint Programming Initiatives and Belmont Forum. More operational (e.g. data, services and technology) and user related liaison and communication actions are done in the WP18. The Task 17.4. focus is on policy and strategy communication with the funding organisations and parallel cluster actions.

Task 17.5: ENVRIPLUS Sustainability plan

Task leader: UvA[LIFEWATCH] (5), UHEL[ICOS] (3), participants: IFREMER[EURO-ARGO] (0.5), FZJ[IAGOS] (1), INRA[ANAE] (1), NERC[EPOS] (0.5), M24-M50

The task will analyse the most suitable, long-term operational and organisational model for maintaining the cluster level common operations, services and collaborative bodies, boards and community platform beyond the ENVRIPLUS project life-time. The ENVRIPLUS sustainability plan will include means how to maintain the common operations and services provided during the projects. Plan also address the future development needs and actions for pilot and test cases and how to sustain the technological, data, management related project outcomes in a feasible organizational framework. The organizational framework should also ensure the continuation of the dissemination, training and communication actions of the cluster.

**Participation per Partner**

Partner number and short name	WP17 effort
1 - ICOS ERIC	12.00
2 - EURO-ARGO	2.00
3 - EISCAT	2.00
4 - CNR	7.00
5 - CNRS	2.00
6 - IFREMER	2.00
7 - FZJ	4.00
8 - INGV	6.00
9 - NERC	4.00
13 - UvA	8.00
15 - INRA	4.00
16 - EAA	4.00
18 - MBA	2.00
21 - RCN	2.00
22 - EMBL	2.00
23 - UiT	2.00
24 - EuroGOOS	2.00
26 - UCPH	2.00
27 - FMI	18.00
37 - EGI.eu	4.00
38 - UHEL	2.00
<b>Total</b>	<b>93.00</b>

**List of deliverables**

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D17.1	Report of domain WGs on domain-specific development needs and actions	38 - UHEL	Report	Public	36
D17.2	Updated version of the ENVRI strategy	27 - FMI	Report	Public	50
D17.3	Landscape analysis of the environmental RI community in Europe	38 - UHEL	Report	Public	46



### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D17.4	Summary report on policy communication actions	4 - CNR	Report	Public	46
D17.5	ENVRIPLUS sustainability plan	13 - UvA	Report	Public	50
D17.6	White paper on further integration of RIs in the environmental field including recommendations on co-locating research sites on national and international level	1 - ICOS ERIC	Other	Public	48

### Description of deliverables

D17.1 : Report of domain WGs on domain-specific development needs and actions [36]  
 Report of domain WGs on domain-specific development needs and actions

D17.2 : Updated version of the ENVRI strategy [50]  
 Updated version of the ENVRI strategy

D17.3 : Landscape analysis of the environmental RI community in Europe [46]  
 Landscape analysis of the environmental RI community in Europe

D17.4 : Summary report on policy communication actions [46]  
 Summary report on policy communication actions

D17.5 : ENVRIPLUS sustainability plan [50]  
 ENVRIPLUS sustainability plan

D17.6 : White paper on further integration of RIs in the environmental field including recommendations on co-locating research sites on national and international level [48]  
 A white paper providing a broader perspective of integration and RI to RI cooperation.

### Schedule of relevant Milestones

Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS6	First BEERi meeting held	27 - FMI	6	Meeting held
MS13	RI Policy connections established with the relevant collaborators	4 - CNR	12	Policy connections reported to coordination
MS16	First Community platform session held	38 - UHEL	12	Session held

<b>Work package number</b> <sup>9</sup>	WP18	<b>Lead beneficiary</b> <sup>10</sup>	9 - NERC
<b>Work package title</b>	Dissemination, Liaison and Collaboration		
<b>Start month</b>	1	<b>End month</b>	51

### Objectives

Organisation of dissemination and outreach for ENVRI[PLUS] including the provision of a strategy for engagement with current and potential users of the ENVRI[PLUS] framework both within the cluster RIs and across the wider community.

### Description of work and role of partners

#### **WP18 - Dissemination, Liaison and Collaboration** [Months: 1-51]

**NERC, ICOS ERIC, EURO-ARGO, CNRS, INGV, UvA, INRA, UiT, EuroGOOS, UHEL, EMSO ERIC**

ENVRIPLUS seeks to integrate the activities and services of the environmental RIs for the benefit of a range of current and potential users. There is significant scope to increase the awareness and wider use of discipline/domain specific scientific data and associated services both within the cluster of environmental research infrastructures and across the wider user communities. Trust and understanding are the main cultural capitals that are needed for wider cross-disciplinary/domain usage of the data and services developed by the research infrastructures.

This work package will focus on dissemination and promotion of the ENVRIPLUS objectives and outcomes across a range of stakeholders using various dissemination, promotion and collaboration techniques. In addition, it will seek to develop an active dialogue with the various user communities to ensure that ENVRIPLUS remains up to date with the current needs, challenges and user requirements within the environmental field.

A robust strategy for dissemination and communication of the project activities, outcomes and deliverables including promotional materials, webpages and social media will be established during the early stages of the project. This dissemination strategy will also outline the internal liaison activities within the environmental cluster and externally with European and international initiatives which have similar objectives and activities e.g. GEOSS, COPERNICUS, ESA, Research Data Alliance (RDA), CODATA, COOPEUS etc.

Several collaborative actions will be made to promote ENVRIPLUS across a range of current and future scientific users of environmental RIs and key stakeholders which include: decision/policy makers, users outside the research communities including potential industry partners, and public organisations. These collaborative actions include establishment of annual ENVRIPLUS scientific user event in the European Geoscience Union General Assembly, organising several tailor made user and stakeholder workshops, seeking opportunities to organise sessions/side events next to Research Data Alliance plenary meetings, EUDAT forums etc. This task will also establish a ENVRI[PLUS] consultation groups to guide ENVRIPLUS on the future societal and industry needs.

The impact of the dissemination, liaison and collaboration activities will be monitored through a number of impact indicators (web usage statistics, user and stakeholder feedback, attendance at workshops etc.) and will be evaluated as part of the project outputs.

#### Task 18.1: Outlining of ENVRI[PLUS] dissemination strategy

Task leader: NERC[EPOS] (2), participants: UHEL[ICOS] (2), M1-M4

Establishment of a robust dissemination strategy for the ENVRI[PLUS] project to include promotion of the initiative, dissemination of the project deliverables, tools, services, best practice etc. developed/adopted by the project to the wider user community and planned coordination/alignment with other related infrastructure initiatives especially those within the ESFRI framework. The dissemination strategy also outlines the objectives and the planned actions for user communities, stakeholder interactions, and liaison actions with the European and international initiatives.

The dissemination strategy outlines:

1. Target audiences (scientific communities, policy makers, funding agencies/funders, industry partners, other projects/initiatives)
2. ENVRIPLUS project identity (logo, templates for documents/slides etc.)
3. Promotional material (posters/leaflets, newsletters, website, social media -Facebook, LinkedIn, Twitter)
4. Journal articles and other publications
5. User and Stakeholder engagement (user and stakeholder workshops, external consultation group, conference presence - booths/stands)
6. Impact assessment: metrics for assessment

Task 18.2: Promotional materials, publications, website and social media

Task leader: UHEL[ICOS] (8), participants: NERC[EPOS] (2), INRA[ANAE] (2), INGV (2), M1-M51

The task 18.2. focus is on implementing the ENVRI[PLUS] dissemination strategy via promotional materials, publications, website and social media.

Printed materials (posters, leaflets etc)

To maximise opportunities for outreach a range of promotional materials will be produced (posters/leaflets/newsletter) which can be distributed at a range of events e.g. conferences, workshops etc. This resource will include information on the concept and strategy of ENVRI[PLUS] initiative. This task will also promote ENVRI[PLUS] across related initiatives in Europe e.g. EUDAT, COPENICUS, ESA, eIRG, etc. as well at an international level e.g. RDA, Belmont Forum's e-infra and data management action.

Newsletter

A project newsletter will be produced bi-annually to provide updates on relevant project activities and outcomes. The newsletter will be disseminated using the mailing list that will be set-up as part of the ENVRIPLUS website.

Journal Articles

The objectives, activities and outcomes of the ENVRIPLUS project will be disseminated as widely as possible in relevant journals and other publications. These papers will include details of those aspects of ENVRIPLUS which are relevant to the target audience for the selected publication. The papers will communicate the BEERi outcomes and ENVRI strategy issues, such as identifying synergies, bottlenecks and barriers between RIs and RIs' current capabilities to meet the grand challenges.

ENVRIPLUS website

An ENVRIPLUS website will be set-up which will include project information (activities, deliverables, details of the consortium, diary of events etc.). It will also be used as a tool for user community development through a mailing list etc. Functionality will include a discussion forum and a diary of events including those of other initiatives relevant to ENVRIPLUS.

Social media

The ENVRIPLUS project will use social media for the purposes of outreach and community building. Special interest groups will be established on Facebook and LinkedIn. A dedicated Twitter account will also be established to promote informal dialogue with stakeholders and the wider community

Task 18.3. Liaison and collaborative action with RI users

Task Leader: UvA[LIFEWATCH] (6), participants: NERC[EPOS] (4), UHEL[ICOS] (2), CNRS[IS-ENES] (2), EUROGOOS (1), UIt[ESONET] (1), M1-M48

Mapping of the wider cross-disciplinary user communities and targeted actions with these RI user communities are vital for ensuring that the full potential of the high-quality cross-disciplinary/domain data and RI services that are being made available by the ENVRIPLUS initiative will be used. Targeted liaison and collaborative actions also increase the trust and understanding on the other domain's data products and RI services and therefore enhance the multidisciplinary in the environmental research to tackle the environmental grand challenges. To contribute to these increased collaboration efforts, this task will organize 8 user workshops and meetings, including 4 annual ENVRIPLUS scientific user events held in association with European Geoscience Union General Assembly. Besides these major events, 4 other user workshops and events will be organized in connection of existing science conferences. In addition, ENVRIPLUS is planning to organise a session/booth in the COP21 meeting in Paris (Dec 2015). The sessions in the user workshops and meeting will include information and demonstrations of new products from the RIs, advanced user experiences and methodologies, and discussion of common issues within the Environmental sciences. These sessions will be developed in cooperation with Theme 5 and the relevant RIs. The user events will be open to all interested parties including also interested RI personnel to promote cross-fertilisation. This task will provide an opportunity to engage wider user communities and also gain feedback on the project objectives, activities and outcomes. This task will work closely with WP5 Knowledge Transfer.

Task 18.4: Linking the environment to economics: relevance of environmental research infrastructures for society

Task Leader: INRA[ANAE] (8), participants: NERC[EPOS] (2), M1-M48

Bridging the gap between public research and private sector, which are driven by different objectives and cultures, is a challenge for many domains. This is due in part to commercial companies and the RIs tending to consider each other as potential clients. A specific challenge for environmental research infrastructures (ERIs) is the under use of their services (physical access etc.) and products (data, models etc.) by policymakers, the private sector, and even the environmental science research community.

This task aims to identify suitable mechanisms to support environmental research infrastructures (ERI) in establishing collaborative relationships with various stakeholders, while at the same time maximizing their socio-economic impact. The core mission of selected mature ERIs will be examined to determine how best to refine and empower them to tackle both the current and future challenges that potentially hinder their engagement with various stakeholder groups. The

results of this initial analysis will be used to promote and strengthen the awareness and preparedness across the entire ENVRI RI cluster.

Task 18.5: Developing a common approach to fostering innovation partnerships between the environmental RIs and the private sector

Task Leader: EMSO ERIC (7.2), participants: NERC[EPOS] (2), UHEL[ICOS] (1), EURO-ARGO (1), INRA[ANAEE] (1), INGV (0,8) M6-M50

Stakeholders underuse the environmental research infrastructures (ERIs) represented in ENVRIplus, and their interaction with private sector partners is especially limited despite the knowledge that they build being a fundamental element of maintaining a sustainable economy. Increased integration of environmental RIs with other relevant stakeholders, including private sector partners, would lead to their improved sustainability, and at the same time ensure their continued contribution to the global sustainable development goals (SDGs).

This task aims to develop a strategy and implementation plan for an RI Innovation-Partnering Readiness Roadmap that will create a common support framework to assist ENVRI RIs in actively pursuing key innovation and industry partnerships. The roadmap will be developed using the previous experience of those ENVRI RIs that maintain existing partnerships with the private sector.

The implementation plan for the roadmap will include preparatory activities to validate the proposed approach that will initially be undertaken by selected ENVRI RIs that have existing collaborative relationships with commercial partners. The implementation plan will also outline the requirements for establishing an ENVRIplus RI Innovation-Readiness Services Network (ISN) comprising:

- a core Working Group/Task Force to act as a central advisory service and lead on RI innovation, industry partnering and technology transfer/ commercialisation issues and initiatives
- a network of supporting Industry Liaison Officer and a Communications Specialists

The ISN will provide comprehensive support for the RI Innovation-Partnering Readiness Roadmap that includes establishing a number of key strategic partnerships with existing relevant European bodies including the European Institute of Innovation and Technology (EIT) among others.

#### Participation per Partner

Partner number and short name	WP18 effort
1 - ICOS ERIC	2.00
2 - EURO-ARGO	1.00
5 - CNRS	2.00
8 - INGV	2.80
9 - NERC	12.00
13 - UvA	6.00
15 - INRA	11.00
23 - UiT	1.00
24 - EuroGOOS	1.00
38 - UHEL	11.00
39 - EMSO ERIC	7.20
<b>Total</b>	<b>57.00</b>

**List of deliverables**

<b>Deliverable Number<sup>14</sup></b>	<b>Deliverable Title</b>	<b>Lead beneficiary</b>	<b>Type<sup>15</sup></b>	<b>Dissemination level<sup>16</sup></b>	<b>Due Date (in months)<sup>17</sup></b>
D18.1	Dissemination strategy	9 - NERC	Report	Public	4
D18.2	Establishment of the ENVRIPLUS website and first set of promotional material	38 - UHEL	Websites, patents filling, etc.	Public	6
D18.3	Report on user community workshops	13 - UvA	Report	Public	46
D18.4	Synthetic report on best practices of linking RIs and societal needs, economics and policy	15 - INRA	Report	Public	48
D18.5	Developing a common approach to fostering innovation partnerships between the environmental RIs and the private sector	39 - EMSO ERIC	Report	Public	50
D18.6	Stakeholders (economics) and consultation group feedbacks on ENVRIPLUS Strategy and Sustainability Plan	15 - INRA	Report	Public	44

**Description of deliverables**

D18.1 : Dissemination strategy [4]

Dissemination strategy

D18.2 : Establishment of the ENVRIPLUS website and first set of promotional material [6]

Establishment of the ENVRIPLUS website and first set of promotional material

D18.3 : Report on user community workshops [46]

Report on user community workshops

D18.4 : Synthetic report on best practices of linking RIs and societal needs, economics and policy [48]

Synthetic report on best practices of linking RIs and societal needs, economics and policy

D18.5 : Developing a common approach to fostering innovation partnerships between the environmental RIs and the private sector [50]

Stakeholders underuse the environmental research infrastructures (ERIs) represented in ENVRIplus, and their interaction with private sector partners is especially limited despite the knowledge that they build being a fundamental element of maintaining a sustainable economy. Increased integration of environmental RIs with other relevant stakeholders, including private sector partners, would lead to their improved sustainability, and at the same time ensure their continued contribution to the global sustainable development goals (SDGs).

D18.6 : Stakeholders (economics) and consultation group feedbacks on ENVRIPLUS Strategy and Sustainability Plan [44]

Stakeholders (economics) and consultation group feedbacks on ENVRIPLUS Strategy and Sustainability Plan

**Schedule of relevant Milestones**

<b>Milestone number<sup>18</sup></b>	<b>Milestone title</b>	<b>Lead beneficiary</b>	<b>Due Date (in months)</b>	<b>Means of verification</b>
MS2	Dissemination strategy	9 - NERC	2	Dissemination strategy
MS5	Establishment of the ENVRIPUS website and first set of promotional material	38 - UHEL	6	Material available
MS28	Report on user community workshops	13 - UvA	24	Report

<b>Work package number</b> <sup>9</sup>	WP19	<b>Lead beneficiary</b> <sup>10</sup>	38 - UHEL
<b>Work package title</b>	Project Management		
<b>Start month</b>	1	<b>End month</b>	51

### Objectives

The project management Work Package concentrates on day-to-day management activities of the project. It is responsible of project internal coordination structure, financial and administrative management, governance, project reporting coordination and risk management.

### Description of work and role of partners

#### **WP19 - Project Management** [Months: 1-51]

**UHEL, ICOS ERIC**

Description of work

Task 19.1. Project financial and administrative management

Task leader: UHEL[ICOS](36)

M1-M51

Overall financial and administrative management of the project, including reporting, financial issues, periodic review of financial and human resource use, maintaining communications to partner organization administration and to the Commission services, and preparation of administrative documents of the project. This task also includes organization of the annual General Assembly of ENVRIPLUS, project reviews and annual project internal meetings.

Task 19.2: Project scientific and progress management

Task leader: UHEL[ICOS](24)

M1-M51

General overview and day-to-day management of project scientific and product development progress, including maintaining direct communication between partners, WP and Theme leaders, RIs, coordinators and the Commission services. Control over project time management, deliverable quality and timely submission, and project milestones. The project management also includes interaction between project Steering Group and the rest of the project and will prepare the Steering Group meetings agenda, and is responsible on the communication and followup of the Steering Group, General Assembly and Coordinator decisions within the project. This task also includes all travel costs associated to project management and coordination.

Task 19.3: Project Internal communications

Task leader: UHEL[ICOS](3)

M1-M51

Building of project internal communication channels: Intranet site, email-lists, a project newsletter and teleconference facilities. This task also includes practical meeting organization of project Steering Group and Coordination Group. Note: project external communications are handled in WP17 and this task provides support for task 18.2.

Task 19.4: Organization of Data Management Team and Theme leadership support

Task leader: UHEL[ICOS](3)

M1-M48

Practical organization of Data Management Team meetings. Drafting and finalizing the Data Management Plans during project progress. The Theme leaders provide middle-management level coordination for the project as explained in the Management of the Consortium part of the proposal. This task handles meeting and management support costs.

### Participation per Partner

<b>Partner number and short name</b>	<b>WP19 effort</b>
1 - ICOS ERIC	28.00
38 - UHEL	38.00
<b>Total</b>	<b>66.00</b>

**List of deliverables**

<b>Deliverable Number<sup>14</sup></b>	<b>Deliverable Title</b>	<b>Lead beneficiary</b>	<b>Type<sup>15</sup></b>	<b>Dissemination level<sup>16</sup></b>	<b>Due Date (in months)<sup>17</sup></b>
D19.1	Organization of project Kick-off meeting, including a Steering Committee and a General Assembly meeting	38 - UHEL	Websites, patents filling, etc.	Public	1
D19.2	Overview report of all annual meetings, General Assembly and Steering Committee meetings	38 - UHEL	Report	Public	48
D19.3	Project internal communication (intranet, email-lists, telephone connections) operational	38 - UHEL	Websites, patents filling, etc.	Public	6
D19.4	Initial Data Management Plan (DMP)	38 - UHEL	Report	Public	6
D19.5	1st Updated DMP	38 - UHEL	Report	Public	13
D19.7	Final DMP	38 - UHEL	Report	Public	44

**Description of deliverables**

D19.1 : Organization of project Kick-off meeting, including a Steering Committee and a General Assembly meeting [1]  
 Organization of project Kick-off meeting, including a Steering Committee and a General Assembly meeting

D19.2 : Overview report of all annual meetings, General Assembly and Steering Committee meetings [48]  
 Overview report of all annual meetings, General Assembly and Steering Committee meetings

D19.3 : Project internal communication (intranet, email-lists, telephone connections) operational [6]  
 Project internal communication (intranet, email-lists, telephone connections) operational

D19.4 : Initial Data Management Plan (DMP) [6]  
 Initial Data Management Plan (DMP)

D19.5 : 1st Updated DMP [13]  
 1st Updated DMP

D19.7 : Final DMP [44]  
 Final DMP

**Schedule of relevant Milestones**

<b>Milestone number<sup>18</sup></b>	<b>Milestone title</b>	<b>Lead beneficiary</b>	<b>Due Date (in months)</b>	<b>Means of verification</b>
MS1	Kick off organized	38 - UHEL	1	Kick off organized
MS4	First data management plan ready	38 - UHEL	6	Deliverable D87



<b>Work package number</b> <sup>9</sup>	WP20	<b>Lead beneficiary</b> <sup>10</sup>	1 - ICOS ERIC
<b>Work package title</b>	Ethics requirements		
<b>Start month</b>	1	<b>End month</b>	51

### Objectives

The objective is to ensure compliance with the 'ethics requirements' set out in this work package.

### Description of work and role of partners

**WP20 - Ethics requirements** [Months: 1-51]

**ICOS ERIC**

This work package sets out the 'ethics requirements' that the project must comply with.

### List of deliverables

<b>Deliverable Number</b> <sup>14</sup>	<b>Deliverable Title</b>	<b>Lead beneficiary</b>	<b>Type</b> <sup>15</sup>	<b>Dissemination level</b> <sup>16</sup>	<b>Due Date (in months)</b> <sup>17</sup>
D20.1	H - Requirement No. 1	1 - ICOS ERIC	Ethics	Confidential, only for members of the consortium (including the Commission Services)	2
D20.2	POPD - Requirement No. 2	1 - ICOS ERIC	Ethics	Confidential, only for members of the consortium (including the Commission Services)	2

### Description of deliverables

The 'ethics requirements' that the project must comply with are included as deliverables in this work package.

D20.1 : H - Requirement No. 1 [2]

Details on the procedures and criteria that will be used to identify/recruit research participants must be provided  
Detailed information must be provided on the informed consent procedures that will be implemented.

D20.2 : POPD - Requirement No. 2 [2]

Copies of ethical approvals for the collection of personal data by the competent University Data Protection Officer / National Data Protection authority must be submitted. Justification must be given in case of collection and/or processing of personal sensitive data. Detailed information must be provided on the procedures that will be implemented for data collection, storage, protection, retention and destruction and confirmation that they comply with national and EU legislation. Detailed information must be provided on the informed consent procedures that will be implemented.

### Schedule of relevant Milestones

<b>Milestone number</b> <sup>18</sup>	<b>Milestone title</b>	<b>Lead beneficiary</b>	<b>Due Date (in months)</b>	<b>Means of verification</b>
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### 1.3.4. WT4 List of milestones

Milestone number <sup>18</sup>	Milestone title	WP number <sup>9</sup>	Lead beneficiary	Due Date (in months) <sup>17</sup>	Means of verification
MS1	Kick off organized	WP19	38 - UHEL	1	Kick off organized
MS2	Dissemination strategy	WP18	9 - NERC	2	Dissemination strategy
MS3	Eligibility criteria document for Staff exchange	WP16	12 - UniHB	6	Deliverable D71
MS4	First data management plan ready	WP19	38 - UHEL	6	Deliverable D87
MS5	Establishment of the ENVRIPUS website and first set of promotional material	WP18	38 - UHEL	6	Material available
MS6	First BEERi meeting held	WP17	27 - FMI	6	Meeting held
MS7	Definition of the case studies of access	WP11	5 - CNRS	12	Definitions available
MS8	First RM training sessions completed	WP15	33 - CU	12	First sessions completed
MS9	Report reviewing technologies currently used at research infrastructures for unmanned operation (power and transmission technologies)	WP3	5 - CNRS	12	Internal report
MS10	Review of critical methane sensing technologies and gaps at interfaces	WP4	30 - CEA	12	Internal report
MS11	First workshop on use cases for satellite/ assimilation validation	WP2	4 - CNR	12	Meeting held
MS12	Interdisciplinary workshop held and open case studies selected	WP4	30 - CEA	12	Meeting held
MS13	RI Policy connections established with the relevant collaborators	WP17	4 - CNR	12	Policy connections reported to coordination
MS14	Questionnaire to analyse the ethical and social issues prepared	WP13	8 - INGV	12	Questionnaire prepared
MS15	Work on reference model embedding the	WP12	11 - ETHZ	12	Report by 12 on the WP progress