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Deliverable 1.1.12 - Twelfth Technical Progress Report including description of the performed activities, released deliverables, IO achieved, and risks analysis.

Deliverable number:	D 1.1.12
Work package:	WP1 – Coordination and management
Intermediate Objective:	IO1.12
Deliverable type:	X Document, report
	☐ Websites, Share Point, patent filings, videos, etc.
	☐ Other: please specify
Dissemination level:	X Public
	☐ Restricted
Estimated delivery (bimester):	B12
Actual delivery date:	September 2024
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Note:	At the time of preparation of the proposal this report was thought as the results of the management and coordination activities necessary to report the technical progresses. The same content has been requested by the MUR to be reported directly on the platform GEA. Therefore, this deliverable was prepared by the coordination office, after reporting on the GEA monitoring platform the technical progresses pointed out by the project participants.

IR0000032 – ITINERIS, Italian Integrated Environmental Research Infrastructures System - CUP B53C22002150006 (D.D. n. 130/2022) Funded by EU - Next Generation EU
Mission 4 "Education and Research" - Component 2: "From research to business" -
Investment 3.1: "Fund for the realization of an integrated system of research and innovation infrastructures"

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NATIONAL RECOVERY AND RESILIENCE PLAN (NRRP) – MISSION 4 COMPONENT 2 INVESTMENT 3.1 – FUND FOR THE CREATION OF AN INTEGRATED RESEARCH AND INNOVATION INFRASTRUCTURE SYSTEM – NOTICE N. 3264 OF 28 DECEMBER 2021

INTRODUCTION

The Technical Report is drawn up and submitted bimonthly by the Implementing Entity, based on a comparison with each Work Package Leader responsible for the collection of data and physical progress documentation for each Work Package.

The Report consists of four sections:

SECTION 1 – GENERAL PROJECT PROGRESS, in which the user provides information relating to the general progress of the project and the compliance with the NRRP, Open Science and FAIR conditionalities;

SECTION 2 –WORK PACKAGE AND ACTIVITIES PROGRESS, in which the user, based on the information provided to him by the operational units involved in the Work Package, describes the activities carried out in the bimester during the performance of the individual activities. If a Work Package does not proceed as expected, the difficulties encountered should be highlighted.

SECTION 3 - INTERMEDIATE OBJECTIVES PROGRESS, in which the user provides information relating to the progress of the individual Intermediate Objectives, loads the expected Deliverables into the system and provides updates on the listed indicators.

SECTION 4 – FORECAST ANALYSIS AND FINAL COMMENTS, in which the user describes the forecast scenario for the evolution of the project and enters the final comments.

PROJECT DETAILS

- Project ID - *IR0000032*
- Starting Date of the project - *01/11/2022*
- CUP – *B53C22002150006*

- Technical Report ID – *IR0000032_FIS12*
- Bimester – *12*

SECTION 1 - GENERAL PROJECT PROGRESS

General progress of the project; information relating to the compliance with PNRR, Open Science and FAIR conditionalities.

1) Is the project proceeding as originally planned, including any changes submitted?

yes, although with changes which, however, do not affect its validity

If option c) is selected, please provide a detailed description of the ongoing critical issues, indicating their nature and possible solutions to ensure the success of the project within the planned timeframe:

2) Update of the indicator RRFCI 08 - Researchers working in supported research centres, as described in the methodological guidelines recently issued by the MEF in circular 34/2022 of October 17, 2022.

PLANNED VALUES

Description of EU common indicators	I Semester	II Semester	III Semester	IV Semester	V Semester	VI Semester	Total
Researchers working in supported research centres - Men	202	276	312	324	336	340	1790
Researchers working in supported research centres - Women	156	226	251	264	271	275	1443
Total	**358**	**502**	**563**	**588**	**607**	**615**	**3233**

REALISED VALUES

Description of EU common indicators	I Semeter	II Semeter	III Semeter	IV Semeter	V Semeter	VI Semeter	Total
Researchers working in supported research centres - Men	169	243	265	286	0	0	963
Researchers working in supported research centres - Women	119	198	213	240	0	0	770
Total	**288**	**441**	**478**	**526**	**0**	**0**	**1733**

3) Description of the modalities by which the Implementing Entity ensures compliance with all the NRRP requirements and conditionalities, specifically:

- contribution to the common indicator and to environmental and digital tagging;

- generational and gender equal opportunities;
- information and advertising;
- Open science and FAIR Data principles.

ITINERIS is committed to adopting the most innovative solutions possible, introducing technological advances, non-invasive methodologies, and practices to make a concrete contribution to climate and digital goals.
A system for continuous monitoring has been implemented, with periodic reports to ensure transparency and traceability of results.

In line with the "full digital" requirements established by the PNRR, ITINERIS is investing in expanding the digital capabilities of the Research Infrastructures, enhancing connectivity, and promoting the digitalization and innovation of processes. This is being pursued through the acquisition of digital equipment (e.g., storage systems, communication technologies) and the use of outsourced ICT services (e.g., cloud computing).
These investments are designed not only to strengthen the technological competitiveness of the infrastructures but also to enable a deeper integration between digital and environmental monitoring systems, supporting advanced environmental modelling, and enabling informed decision-making for climate adaptation and sustainability policies,. In this way, ITINERIS contributes to the dual green and digital transition objectives of the PNRR by promoting advanced data-driven research, enhancing environmental modelling capabilities, and supporting decision-making processes for sustainability and climate resilience.

Throughout the project, continuous efforts are dedicated to strengthening the commitment to environmental protection and its sustainable use, particularly in terms of reducing environmental and climate impact. The activities carried out during the two-month period, as verified through the documentation provided by the Implementing Entities involved in the project, do not cause significant harm to any of the six environmental objectives and are compliant with the DNSH (Do No Significant Harm) principle and with additional requirements set out in the Environmental Code.

As part of the commitment to ensuring full compliance with the PNRR requirements, the Implementing Entity has activated a dedicated monitoring system for the evaluation and reporting of the common indicator "RRDCI 08 – Researchers working in research centers receiving support."

Equal opportunities, generational and gender: The totality of recruitments has been successfully completed, ensuring full compliance with ITINERIS commitments to gender neutrality, gender balance, and the valorisation of young talent through intergenerational knowledge exchange..

Open science principles and FAIR Data: The project aims to improve access management and data FAIRness by developing the conditions necessary to harmonise standards, metadata, and policies among the participating RIs. Making research data openly available is a fundamental step towards Open Science. In this regard, during the bimester, specific activities have been carried out within WP2 to promote and coordinate actions: this includes the development of the ITINERIS cataloguing and metadata frameworks, and the onboarding of resources to ensure their discoverability, interoperability, and compliance with FAIR principles. These efforts aim to create a unified and accessible data ecosystem that enhances the value and impact of research outputs generated by the ITINERIS community.

Information and advertising: ITINERIS ensures compliance with the communication and information obligations set out in art. 34 of Regulation (EU) 2021/24 and with the guidelines for information and communication released by the MUR.
The project's communication kit and the related guidelines have been adopted all the participants and to ensure that explicit reference to European Union funding and the Next Generation EU initiative is reported in the project documentation.

4) Activities adherence to the field of intervention 055

• It is declared that the activities carried out by the Implementing Entity are relevant to the field of intervention 055 identified pursuant to Reg. (EU) 2021/241 annexes VI and VII, provided for by Notice No. 3264 of 28 December 2021

- ☑ Yes
- ☐ No

SECTION 2 - WORK PACKAGE AND ACTIVITIES PROGRESS

Information on ongoing activities. If a Work Package does not proceed as expected, the difficulties that have emerged and the corrective actions must be highlighted.

Work Package N° WP4

Work Package Leader - 'Lucia Mona - Senior Researcher - CNR-IMAA'

1) Is the Work Package in compliance with the planned schedule for the achievement of the intermediate objectives, including any submitted changes?

yes, there are no reported delays in achieving the intermediate objectives

Please provide a detailed description of the ongoing critical issues, indicating their nature and possible solutions to ensure the success of the project within the planned timeframe:

Activity N° WP4.1

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IMAA,

- Planned Activity description – This activity strongly contributes to the integration and harmonization of the Italian Network of Environment RIs through different tasks: coordination of the WP4; link with transversal WPs; increasing the digital connectivity and capabilities of the observatory; enhancing synergistic capability of CNR-IMAA atmospheric observatory.
  CNR-IMAA coordinates the WP4 and will implement a system for monitoring the activities of all the OUs and the progresses of the WP. Meetings with all the OUs will be organized. CNR-IMAA will also act as link toward the WP2, WP3 and WP8 activities.
  CNR-IMAA connectivity will be enhanced for guarantying a stable, fast and protected connection of all the instruments to the respective European Research infrastructure but also to the digital resources to be developed in ITINERIS like the VRE and the ITINERIS HUB. This requires a large investment in digital devices and infrastructural adaptations, and it is crucial being CNR-IMAA a node of ACTRIS DC and acting in ITINERIS as central node for the provision of the atmospheric data products.
  From the observational point of view, CNR-IMAA runs one of the most advance atmospheric observatories in the Mediterranean, involved both in ACTRIS and ICOS. Potentials for the synergistic approach between these 2 RIs will be enhanced in ITINERIS providing data related to gas species at the surface and as columnar content. Some back-up instruments and main instruments components will be acquired for supporting the effective data provision of ACTRIS aerosol remote sensing stations on the Country. Portable instruments will be used by CNR-IMAA additionally as a tool for synergies with the other RIs and for application in specific locations as of interest for the purposes of activities 4.11-4.16 and for potential interested users. Instrument for testing and complementing lidar systems will improve the quality of data provided and will be also a support for the Italian atmospheric observational network.
  ,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP4.11

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IMAA,

- Planned Activity description – This activity aims to provide advanced data products about the aerosol classification into different types, as of interest to understand aerosol sources and their effects, and as a tool for improving the accuracy of satellite retrievals. The lidar technique is a robust tool to classify aerosols with its capability of polarization-sensitive and multi-wavelength measurements (e.g. Burton et al., 2012; Papagiannopoulos et al., 2018). However, the determination of aerosol type by remote sensing is still a challenging task which needs for specific actions.
  In this activity, we aim to employ the available instrumentation of the RIs for a thorough characterization, through the following specific actions:
  - Automated typing procedures: use of existing stand-alone automated techniques for lidars and photometers to provide a homogeneous aerosol characterization.
  - Synergistic aerosol lidar - photometer products: new novel products fusing aerosol lidar data and aerosol volume distribution, complex index of refraction, and single scattering albedo, determined by photometer.
  - Desert dust products: data products like desert dust extinction and concentration profiles will be provided as relevant for air quality and socio-economic sectors like solar plants. The activity aims also to provide further information available at RI during the occurrence intense desert dust events because potentially relevant for the impacts of health conditions.
  - Marine aerosol characterization: study marine aerosols with deployment of instrumentation in pristine coastal regions for filling the gap of information about marine aerosol properties in the ACTRIS/EARLINET lidar-stand alone typing method (Papagiannopoulos et al., 2018).
  - Bioaerosol integrated products: bioaerosol/pollen data will be provided thanks to automatic pollen monitors. Further products making use of remote sensing available at the RIs (like multiwavelength depolarization and fluorescence lidars) will be exploited.
  ,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP4.15

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IMAA,

- Planned Activity description – The aim of the activity is the assessment and the optimization of MIPA a morphological image processing approach algorithm for the retrieval of atmospheric boundary layer height (ABLH) from lidar data. The following main tasks are planned:
  -algorithm assessment for both high-power lidar and ceilometers (low-power lidar)
  -unattended algorithm usage on lidar and ceilometer observations available at the atmospheric Italian RI sites

  Up to now only a partial assessment of the algorithm has been performed against ABLHs retrieved from temperature and pressure vertical profiles provided by high-resolution global numerical weather predictions. The comparisons show that, on average, the MIPA was the algorithm delivering the closest values to the assumed reference among all the considered ones. This result proves MIPA big potentialities but, at the same time, the usage of more reliable reference would be preferable. To fill this gap, a measurement campaign will be organized at CNR-IMAA making use of an extensive set of atmospheric sensors suitable for ABLH determination and investigation. During the measurement campaign (at least 2 weeks long), all the CIAO sensors relevant for the study of the ABLH will be operative 24/7 and at least 4 soundings per day will be launched. Such experimental set-up will ensure a quite dense reference and a quite representative dataset for the characterization of ABLH using different techniques under distinct atmospheric conditions. Additionally, the measurement campaign will provide the opportunity to optimize the algorithm also for ceilometers.

  The second main activity will be focused on extending the unattended usage of the optimized MIPA algorithm to atmospheric Italian stations considering both the available lidar and ceilometer observations. In this way it will be possible to deliver ABLH in near real time at aerosol lidar and ceilometer stations available at the atmospheric Italian RI sites.
  ,

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP4.2

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-ISACBO,

- Planned Activity description – The activity aims to implement a data production chain for the harmonisation and integration of the atmospheric observations carried out by the OU in the proposed network. The implementation of this activity foresees the realization of data production streams for: in-situ measurements of aerosol physical and chemical properties, mixing state; in-situ measurements of cloud properties; in-situ gaseous concentration (NOx, VOC, GHG, ..) and isotopes (13C in CO2 and CH4); ground in-situ and remote sensing of the PBL; remote-sensing ground based measurements for aerosol profiling; remote-sensing ground based measurements for trace gases (GHG and reactive gases, ..) columnar amount and profiling; remote-sensing ground-based measurements for cloud profiling. The main focus will be on instruments, data, and products related to on-line measurements with possibility of remote access to data in near-real-time and to laboratory instruments. Connection with European RIs for data traceability and intercomparison with reference systems. The OU will care about customization, installation, development of data acquisition programs, integration of the instruments up to their final full operability in the network. The new data set will be integrated with products and measurements already available at the facilities of the OU, in compliance with the international operational specifications of the ACTRIS and ICOS RIs. This will include the actions necessary for a full integration in the network: development of specific inlets for gases and aerosol and the construction of specialized technical systems for calibration/tests. It will be carried out a general upgrade of the laboratories that houses the instrumentation, including a performant uninterruptible power supply, new containers, pressurised air and vacuum supplies, data storage and platforms for data analysis and web visualization. ,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP4.5

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-ISACBO,

- Planned Activity description – The activity aims to enhance the country's participation in the EUFAR consortium. It is an international non-profit association that coordinates the operation of European instrumented aircraft and exploit the skills of environmental and geo-sciences experts in airborne measurements. Italy, with the CNR, participates in this network of infrastructures with airborne scientific instrumentation. In order to strengthen this participation, in the course of this project we intend to acquire scientific instrumentation that can be mounted on piloted aircraft. In particular, given the general aims of the WP in which this activity is inserted, this instrumentation will be usable for the in-situ characterization of atmospheric particulate.
  The OU responsible for this activity will select a set of particulate detectors for the measurement of its optical and microphysical properties, with a view to being able to use this instrumentation on an aircraft owned by the National Institute of Oceanography and Experimental Geophysics, a PA - 34 twin-engine Seneca II turbocharged with an operating altitude of 8 km, or on a platform with similar performance should it become available in the evolution of activities.
  During the project, the instrumentation will be acquired, its customization for avionic use, and the feasibility studies for its implementation on the aircraft will be carried out. The mechanical interfaces for assembly inside the cockpit and possibly on the fuselage of the aircraft will be studied, electrical consumption and thermal conditioning will be sized, and the particulate collection lines will be defined. Moreover, the airplane will be modified and certified for the installation of the new acquired instrumentation. The project will end with having obtained an instrumental suite for the characterization of atmospheric particulate, mountable on piloted aircraft.
  ,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP4.14

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-ISACBO,

- Planned Activity description – This activity will be devoted to the integration of data related to concentration of atmospheric constituents with atmospheric variables describing the atmospheric dynamics, such as the height of Atmospheric Boundary Layer. The vertical extension of ABL regulates the portion of atmosphere in which pollutants and atmospheric components of anthropogenic origin mix and is therefore a key parameter for interpreting air quality-relevant levels of pollutants measured at the surface. In fact, the interplay between atmospheric emissions and atmospheric vertical mixing (height of the ABL) has an impact on the well-being of citizens. The observational activity includes measurements able to estimate the ABL height, with associated uncertainty, at the sites where aerosol and gas remote sensing are operative. It aims at investigating how much this variable, used as proxy of vertical mixing, shapes the temporal evolution of in-situ concentrations measured at the surface and at different altitudes.
  In particular, data related to greenhouse gases, reactive gases and atmospheric aerosol provided by the environmental RIs will be integrated to provide a suite of data products able to describe the impact of PBL high on aerosol and trace gases concentration at ground, and at high altitude sites.
  Then a scientific and technical assessment will be carried out to evaluate the optimal strategy for developing specific tools to connect dynamics of the atmosphere and air quality. In this regard, a particular attention will be devoted to characterize the data available for the ABL height and more in general on the vertical concentrations of atmospheric constituents on the national territory. A special case study will be focused in Bologna as pilot city to investigate the influence of the urban environment on PBL, by coupling the main instruments FTIR in urban environment with the portable one, deployed in the rural measurement site of San Pietro Capofiume.
  ,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP4.3

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-ISACLT,

- Planned Activity description – The goal of the activity is the harmonisation and integration of the atmospheric observation facilities of the OU through equipment acquisition and software and pre-processing analysis of collected data.
  The activity is mainly focused to increase the existing required ICOS Atmospheric instrumentation focused on open fires detection tracers. Together with measurement with C14, C13 isotope sampler/analyser and 222Rn measurement improvement a reorganization of logistic of ICOS hub located at the OU and related services, and an external area preparation also for hosting for the future campaigns for open fire tracer detection.
  To integrate green house gases and gaseous pollutant concentration some particulate matter concentration and sampler are planned to be integrated together with equipment allowing to improve measures such as dryers or deep freezer refrigetory.
  In order to integrate and collect existing and planned new collected data, related to open fires, the action aims to an optimal hosting of the existing hub, local data center and open external experimental site. This will be possible through the realization of some civil infrastructure and related technological solutions considering small external shelter and better adaptation of some existing facilities.
  Activity will be oriented to a full integration of on-line measurements in the network, in compliance with the international operational specifications of the ICOS network. To reach the goal of integration of harmonisation of data, in order to create the collection link between local data center and VRE, a specialised external realization of a tool/software platform will be pursued together with station hardware/software suite necessary for data acquisition, quality check, local storage of the data.
  ,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP4.16

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-ISACLT,

- Planned Activity description – This activity will be devoted to the integration of data related to atmospheric tracers emitted by open fires. In particular, data related to greenhouse gases, reactive gases and atmospheric aerosol provided by the environmental RIs will be integrated to provide a suite of data products able to detect the occurrence of open fire plumes. The detection of the plumes will represent the basis for the assessment of the impact of open fire emissions to the variability of key-atmospheric trace gases and aerosols. Data related to the different observation techniques carried out within the atmospheric environmental RIs will be synergistically used to identify the plumes and provide impact assessment of the emissions. The activity will be organised in different steps. Firstly, a survey will be carried out among the atmospheric environmental RIs to select the already-available observational data which are most suitable/promising to trace open fire emission plumes (i.e. scientific fitness-for-purpose analysis). Then a scientific and technical assessment will be carried out to evaluate the optimal strategy for integrating the identified tracers. In this regard, a particular attention will be devoted to characterising the data available for the identified fire tracers in terms of available documentation, time and spatial resolution, spatial/vertical/temporal coverage, dataset accessibility, dataset update, adopted data model, data usage policy. The evolution of RIs during the project timeframe will be continuously monitored to integrate new available and usable data into the activity. The usability of the proposed data products will be evaluated by analysing specific test cases. A local integration technological infrastructure will be realised at ISAC Lamezia Terme. Data acquisition procedures and the connection to the VRE will be implemented. Finally, the data products will be integrated in the VRE for common usage and extended to longer time frames. ,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP4.4

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-ISACLE,

- Planned Activity description – The activity aims to the acquisition of equipment and development of software and pre-processing analysis for the harmonisation and integration of the atmospheric observation facilities of the OU in the proposed network. The implementation of this activity foresees the acquisition and commissioning of equipment focused on: in-situ measurements of aerosol physical and chemical properties; in-situ measurements of gaseous (pollutants and greenhouse gases) concentration; ground in-situ and remote sensing of the planetary boundary layer and turbulence measurements. The main focus will be on instruments, data, and products related to on-line measurements with possibility of remote access to data in near-real-time and to laboratory instruments used mainly for calibration/comparison with the on-line instruments with reference measurements.
  The OU will care about customization, installation, and integration of the instruments up to their final full operability in the network, together with the products and measurements already available at the facilities of the OU. This will include the actions necessary for a full integration in the network: development of specific inlets for gases and aerosol and the construction of specialized technical systems for calibration/tests of gases and atmospheric aerosol measurement systems in compliance with the international operational specifications of the ACTRIS and ICOS networks; the update of stabilisation of electrical, pressurised air and vacuum supplies; the development of the station hardware/software suite necessary for data acquisition, quality check, local storage of the data, and usability in the network.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP4.12

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-ISACLE,

- Planned Activity description – The activity is based on integration of in-situ physical (i.e. optical properties, number and size distribution concentrations, fraction of bioaerosol) measurements with chemical composition of aerosols. The goal is to develop innovative and integrated methods to identify the main anthropogenic (combustions, transport, and industrial) and natural sources from of local and long-range transport nature (such as sea spray, soil, dust, fires, eruptions). The first step will be the development of a semi-automatic method of analysis of number concentrations and size distributions in the sub-micrometric range, and ancillary data such as meteorology and gaseous concentrations, to identify new particle formation events and to characterize their strength and duration. A second step will be to develop a method to use high temporal resolution measurements of physical aerosol properties (i.e. scattering and absorptions at different wavelengths including concentrations of equivalent lack carbon) to individuate and characterize combustions sources, differentiating between biomass burning and combustions of fossil fuels, and natural sources. A third step will be to integrate offline data of physical and chemical properties of aerosol using advanced multivariate statistical analysis (such as multi-linear regressions, factor analysis, and principal component analysis), and receptor models (such as Positive Matrix Factorization – PMF) to identify and characterize aerosol sources and their inter-annual and intra-annual trends. This will allow to identify the "fingerprints" of the main natural and anthropogenic sources, with adaptation of the site-dependent characteristics of the different stations of the network. This information will be used to develop a product applied to online, high temporal resolution, combinations of measured physical and chemical properties of aerosol that will have potentiality for near-real-time identification of anthropogenic and natural sources.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP4.6

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNRISMARRM,

- Planned Activity description – The activity assigned to the CNR-ISMAR-Roma OU allows increasing the integration and harmonization of the ACTRIS National Facilities for the atmospheric aerosol characterization. This activity is based on the achievement of two sub-objectives: i) Enhancing the ACTRIS Italian National Research Infrastructure through the development of an Aerosol Remote Sensing facility at the Aqua Alta Oceanographic Tower (AAOT, http://www.ismar.cnr.it/infrastrutture/piattaforma-acqua-alta). ii) Maintaining and improving the Lidar measurement capabilities of the Rome ACTRIS Aerosol Remote Sensing (ARS) National Facilities (NF).
  The first sub-objective concerns the definition/design, installation, commissioning, and networking of an innovative aerosol-marine scanning lidar system at the AAOT. This will allow not only the production of ACTRIS compliant aerosol products but also the development of new atmospheric and marine synergetic lidar products for regular monitoring of relevant atmospheric and marine variables as well as for innovative air-sea interaction studies taking full advantage of the existing equipment in the AAOT.
  The second sub-objective foresees the upgrade of the Technology Readiness Level of the Lidar system of the Rome ARS NF. This consists firstly, in the implementation of new acquisition channels to improve the capability in providing aerosol characterisation and typing data products, and, secondly, in the semi-automation of the system to provide Near Real Time data products. The achievements of this activity will be connected to WP2 and WP8 tools.
  ,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP4.10

- Implementing Entity, Acronym and Operational Unit Name -UNIVE - Università Ca' Foscari Venezia, UNIVE-DAIS,

- Planned Activity description – The activity is targeted to the development, online release, and network connection of a digital platform for CeTrA infrastructure. The work will unfold through two phases: 1. Integration and 2. Harmonization. The Integration phase (1st-10th bimester) will consist of the following tasks: 1.1 development of an integrated and accessible digital platform architecture for CeTrA; 1.2 dedicated upgrade of data generation throughput (n. of variables, temporal resolution, consistency) and QA from the Col Margherita atmospheric observatory (MRG); 1.3 update/upgrade of current data generation/elaboration/management resources related to the scientific instruments afferent to CeTrA at the OU local site (Venice) to achieve full internal cross-connectivity; 1.4 connection of CeTrA scientific resources (Venice and MRG) to the digital platform, and implementation of a comprehensive management system (reservation and remote access; electronic lab notebooks; metadata, data and methods repository, laboratory management system); 1.5 online release of CeTrA digital platform (beta yet complete – all modules - version; 1.6 integration of CeTrA platform in ITINERIS. The Harmonization phase (11st-15th bimesters) will consist of two main tasks: 2.1 monitoring of CeTrA node performances within the ITINERIS network, with particular focus on information (data) and access (physical, virtual) fluxes, and identification of criticalities for long-term sustainability planning; 2.2 iterative and adaptative harmonization of CeTrA platform architecture to improve the bandwidth and throughput of services (potential and actual exchanges of information, competencies and access) to/from partner RIs within ITINERIS, specifically oriented to the activities 4.11-4.16 (e.g. implementation of a sub-platform for dedicated aerosols characterization services). Both Integration and harmonization phases will be driven by FAIR data principles to converge in WP9. ,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP4.9

- Implementing Entity, Acronym and Operational Unit Name -INFN - Istituto Nazionale di Fisica Nucleare, INFN - GE,

- Planned Activity description – The atmospheric simulation chamber ChAMBRe (Chamber for Aerosol Modelling and Bioaerosol Research) is a national facility of the ACTRIS Ri. ChAMBRe has the scientific mission to make possible a large spectrum of studies on phenomena related to atmospheric aerosols, with an approach complementary to in situ observatory stations and platforms. The facility does not perform continuous observations on the atmospheric medium but instead offers to the scientific community the opportunity to perform targeted and unique experiments to disentangle single parts of complex phenomena. The integration and harmonization activity foresees the purchase of laboratory instrumentation to complete the present equipment. The goal is a comprehensive characterization of aerosol samples produced inside ChAMBRe, with a focus on the elemental composition and the classification of carbonaceous species. The deployment of equipment to improve the aerosol injection and extraction into/from ChAMBRe completes the instruments upgrade. Part of the budget is devoted to the renewal of some technological plants to guarantee a flexible and reliable distribution of several technical gases, easily accessible and controllable to/by ChAMBRe external users. The implementation of the FAIR principle is two-fold: the development of a spare data acquisition system to avoid possible data losses during the experiments performed at the facility and the empowerment of data processing and storage capability. Atmospheric simulation chamber are peculiar facilities (ChAMBRe is the sole in Italy and with unique features in the international landscape) which need specific skills: part of the budget is devoted to train a PhD student to perform experiments at an atmospheric simulation chamber.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP4.13

- Implementing Entity, Acronym and Operational Unit Name -INFN - Istituto Nazionale di Fisica Nucleare, INFN - GE,

- Planned Activity description – The objective of the activity is two-fold: the set-up of experimental procedures to characterize the time evolution of the formation, composition, modification and deposition of different aerosol species inside the ChAMBRe atmospheric simulation chamber; the production of a dataset of compositional and optical features of specific aerosol types. Inorganic, organic and biological components will be resolved as well as optical properties in the IR-UV range. The development of standard procedures to be implemented and made available to external users and the dataset production will require the hiring of a fixed term technologist. The instrumental equipment to reach the goal is composed of specific items to manage, inject and collect viable aerosol species at ChAMBRe and to measure their aerodynamic behaviour and evolution. The production/injection of combustion and organic aerosols/gases is already possible at ChAMBRe and the possibility to maintain controlled dust concentration values will now be added. Optical properties of atmospheric aerosols are of outstanding importance to understand the on-going climate change phenomena. State-of-the-art instruments will be purchased and deployed to make ChAMBRe a unique facility to study the multi-wavelength scattering and absorption features of different aerosol species. The formation and evolution of the secondary component of the aerosol inside ChAMBRe will be monitored by a dedicated chemical speciation instrument. Besides the dataset on aerosol properties, the procedures to study different aerosol species and mixtures will be categorized, standardized and offered as services both to the scientific and social (i.e. industries, environmental agencies, etc.) communities in the frame of the ACTRIS RI.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP4.7

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-ISP-BO,

- Planned Activity description – This activity will develop, in parallel, along two lines strictly connected:
  - further improve Italian polar repositories, NADC (National Antarctic Data Centre) and IADC (Italian Arctic Data Centre), with the aim to increase their overall FAIRness and fully integrate and harmonize with the network of environmental RIs;
  - strength and secure data flow, focusing on NRT, extend ECVs observed/at disposal in relation to the atmospheric domain, improve capability to extract added value from integration of large data sets.

  About an integrated polar repository, planned macro-actions include: fully implementation of ERDDAP data server for data handling; development of a VRE based on Jupyter Notebook; tools for data visualization and simple analysis/integration/comparison; services for the assignment of the DOI; explore Machine Learning / AI potential on selected sub-set of data; acquisition of a new platform and Geonetwork Enterprise connection; integration of webGIS solutions to manage, organise and present data; develop/implement technical solutions necessary to secure machine-to-machine functionalities and integration/harmonization with the Italian RIs network as well as with international polar data landscape (organizing around the Polar Data Forum initiative).

  About observations and data management, planned macro-actions include: strengthening of data flow, including automatic QA/QC and pre-analysis procedures; increase/enhancement of observation capabilities, primarily in NRT key; recovery and digitization of previous data of interest, development of automatic procedures to derive advanced products from data integration (like height of highly stratified atmospheric boundary layer, columnar ozone and surface UV maps, coverage and state of the snow mapping, etc.).
  Cross-cutting activities will include contribution to a TNA programme and development of a front-end desk to present opportunities/services relate to polar infrastructures to potential users.
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- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP4.8

- Implementing Entity, Acronym and Operational Unit Name -INFN - Istituto Nazionale di Fisica Nucleare, INFN - FI ,
- Planned Activity description – The activity of INFN-FI will be focussed to increase the digital datasets availability with enhanced propensity for reuse according to the FAIR principles. This aim will be reached through an upgrade of the analytical performances of the LABEC accelerator laboratory ("Laboratorio di Tecniche Nucleari per l'Ambiente e i Beni Culturali") for elemental in-situ analysis of atmospheric aerosol sample for the Italian Network of Environmental RIs. This will be accomplished by improving both the offline, laboratory-based measurements (PIXE, EC/OC) and the online, near-real time measurements. For laboratory-based measurements the major activity will involve the upgrade of computer control systems including software for the existing 3.0 MV Tandetron accelerator at LABEC to increase accuracy and reliability of PIXE and other ion beam analysis measurements performed at LABEC for automatic high-throughput analysis of particulate matter samples to meet user requests. The upgrade of the instrumentation for the analysis of elemental and organic carbonaceous components (EC/OC) with autosampler is aimed to increase as well the capability for automatic high-throughput analysis of particulate matter samples. For near-real time measurements, the INFN FI will deploy in field campaigns a new XACT 625i Ambient Metal Monitor for automatic online analysis of particulate elemental matter, such as metals and dust. These incremental upgrades will be made available to users through access to LABEC facilities and instrumentation on the basis of the evaluation of experiment proposals.
  The reduced funding is affecting the planned upgrade of the existing 3D-optics XRF spectrometer for automatic elemental analysis of particulate matter samples and the sensibility improvement of elemental analysis for high-Z elements (metals) in aerosol samples in PIXE measurements for that could have been accomplished by installing the 2 mm thick Silicon Drift Detectors.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Work Package N° WP8

Work Package Leader - 'Antonello Provenzale - Institute Director CNR-IGG'

1) Is the Work Package in compliance with the planned schedule for the achievement of the intermediate objectives, including any submitted changes?

yes, there are no reported delays in achieving the intermediate objectives

Please provide a detailed description of the ongoing critical issues, indicating their nature and possible solutions to ensure the success of the project within the planned timeframe:

Activity N° WP8.5

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IMAA,
- Planned Activity description – The atmospheric component of ITINERIS provides a large amount and wide variety of atmospheric data products, obtained and handled by RIs with different levels of maturity and complexity. The AERO VRE component aims to take the most from these observations for developing interactive tools of interest for the users. The AERO VRE component will be developed on dedicated empowerment of the computational IMAA capabilities. An HPC cluster based on NVIDIA GPUs will be implemented to standardize on a single system that can speed through any type of AI/Machine Leering task at any time and dynamically adjust to changing compute needs over time. This feature is essential for handling the large amount of atmospheric RIs data provided within the ITINERIS timeframe, but also long-term series already collected by the Italian facilities. Additionally, the AERO VRE node should have the capability for exploiting in situ data with satellite observations.
  The interactive tools to be developed will be focused on, but not exclusively devoted to, the advanced products produced in activities 4.11-4.16. A dedicated unit of personnel will be dedicated to these efforts. Based on the expertise gained by the CNR-IMAA in developing data products and tools in a user-centric way, the AERO VRE will interactively provide tools for visualizing among the others: climatological charts of the aerosol types occurred at the different sites; indicators of the occurrence of the desert dust presence; statistical plots of the atmospheric boundary layer height and of the atmospheric properties near the surface properties. The CNR-IMAA expertise in satellite validation and exploitation will be capitalized for designing interactive tools for supporting 1:1 comparison with satellite observations and for their climatological investigation. Finally, this activity will support the development of the AERO VRE in the cross-domains field.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP8.4

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IBE,

- Planned Activity description – The activity will develop the Essential Variables VRE (EV VRE), with services and tool for data analysis, data visualisation, and collaboration among researchers, focused on the global frameworks provided by Essential Biodiversity Variables (EBV) and Essential Climate Variables (ECV) and based on the results of WP6.
  The EV VRE will be an interactive web app, built by a Shiny package within R environment. A dashboard will allow interaction with data, by selecting, analysing and visualising them according to specific outlines. Through connection with standard geographical web services (preferably OGC type, e.g. Sensor Web Enablement – SWE for measurements and observations), data can be harvested by the EV VRE.
  The features of the EV VRE will be:
  - "Data analysis": specific tools will allow to aggregate different raw datasets from various RIs, in order to obtain EVs. Indeed, most of the EBVs (e.g. physiology, morphology) and a number of ECVs (e.g. snow water equivalent), are derived from different raw data.
  - "Data visualization": this tool will allow the visualization of raw and aggregated EVs through charts or maps. Standard data representation typical of each domain will be used.
  - Within the VRE, the researchers will be able to collaborate, sharing their expertise in creating dataflows towards EVs and visualizing them for different purposes.
  For the EV VRE mandatory starting point will be a list of interoperable resource(es), from which the VRE can retrieve data (repositories of different involved RIs, data collected by ITINERIS empowering activities, data released by third-parties). The observations used in the EV VRE will be both from in-situ and remote systems, with in-situ measurements used also to validate remote ones.,

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP8.1

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IGG,
- Planned Activity description – The Critical Zone (CZ) is the thin layer between the unweathered bedrock and the top of vegetation canopy where "rock meets life" and it includes freshwater, both surface and groundwater. The CZ includes soil, water, microbiota, vegetation and fauna and it harbours all processes supporting terrestrial ecosystems, soil-vegetation-water-atmosphere interactions and terrestrial ecosystem services. As such, it is a fully trans-disciplinary topic which needs to be collectively addressed by an ensemble of observatories and shared models in full communication among them. This activity will focus on establishing a VRE for all information from CZ observatories active in Italy, participating in the various RIs or from outside RIs and including both purely terrestrial and freshwater systems such as lakes, ponds, streams and aquifers. It will allow an open and FAIR approach to the CZ data, information, analysis methods and simulation models, helping to fill the gaps in the CZ observation network and establishing cross-RI links. The VRE will allow data distribution and analysis and it will support CZ analyses in other locations, helping the scientific and user communities to describe CZ processes relevant to concrete applications and linking with LifeWatch ERIC and fostering interactions between different research communities and end users such as environmental managers. Parallel to the implementation of the CZ VRE services, Activity 8.1 will complete the CZ observational network focusing, during the project, on mountain and coastal regions, to provide the needed information for a full assessment of the state and changes in the Critical Zone and related components. The observational network will include participation from the scientific and applied community participating in the various RIs, contributing to eLTER, ICOS, AnaEE, ACTRIS, Atlas and others, and also open to the participation from external initiatives, linking for example to the GLORIA network.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP8.9

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IGG,
- Planned Activity description – Variations of isotope composition are crucial ways to trace the origin of the elements and the processes in which they were involved. The use of different isotopic systematics on the same sample allows identifying and quantitatively tracing the mass exchanges related to natural processes. In the last thirty years, isotope systematics has expanded for several stable isotopes, such as light elements (B, Li, H, O, C, N, S) and others (Mg, Ca, Si, Cr, Zn, Mn, Fe, Hg and many others) that require highly sensitive instruments. Isotope fractionation of "non-traditional stable isotopes" (for example Mg, Ca, Si, Cr, Zn, Mn, Fe, Hg) are now providing further relevant information on environmental processes in the biosphere, geosphere, atmosphere (e.g. aerosols) and marine domains. However, a national database on environmental stable isotopes is still missing, and the data and information are scattered across various sources and institutions, generating difficulties in the data and information recovery. The isotope database Virtual Research Environment (ISOTOPE VRE) will establish a new complete national Virtual Research Environment service on stable isotopes, the first of its kind in Italy. Isotope data from the different matrices will be collected and harmonized together with the metadata, and analysis, interpretation and modelling tools will be implemented in the ISOTOPE VRE service. Parallel to this endeavour, the identified gaps in the national ability to measure and analyse isotopic properties in different matrices of environmental interest will be addressed, by implementing new laboratory instrumentations. The laboratory system will be made available to the scientific and applied community from the RIs and from extra-RI initiatives, supporting both in-presence and from-remote access. The results will support the Italian scientific community to take a leading international role in environmental isotopic biogeochemistry.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP8.3

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IRETFI,

- Planned Activity description – The Crop, Plants and Pests VRE (CPP VRE) will contribute to the system by making accessible an array of cross-platform distributed modelling solutions, data transformation tools, and cloud hosted computational facilities, allowing users of the cross-RI integrated VRE system to perform scenario analysis and digital twin components in an interactive way. Proposed modelling solutions will include well established process-based models for crop production, water use, plant phenology, pest and disease spread, pathogens dynamics and impact, and cropping system management as well as advanced statistical methods for image classification and time series analysis, and they will be published with the SaaS paradigm, enabling researchers to integrate them into different technological stacks, including VREs. Such models are built in the BioMA framework, which is currently adopted by the JRC of the European Commission and widely regarded as a gold standard in agroecological modelling. This activity will include two main lines of action: modelling solution development and publication, and data tools development and publications; both activities will build on top of existing internal tools and know-how and will represent the largest knowledge and expertise transfer activity ever undertaken within AnaEE. The CPP VRE will also make available a second set of cloud services meant for data access, retrieval, and quality control, that following the SaaS paradigm will be actionable also from any other VRE. Meteorological and satellite data and related utilities for data processing will be made available, allowing researchers from different domains and RIs as well to access curated data transformation pipelines and fostering the development of Big Science practices in the environmental domain. All data resources comply to FAIR principles as developed in ENVRI-FAIR project of the EU.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP8.2

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IRETLE,

- Planned Activity description – Deepening knowledge on ecosystem responses to climate change is a fundamental step to reduce uncertainty of taxonomic and functional biodiversity scenario of change in the next decades. Addressing ecosystem responses to climate change requires integration of laboratory and field studies, field observations and monitoring and modelling approaches accounting for both abiotic and biotic drivers of the involved ecologic processes. Virtual Research Environments are new eScience equipment designed to address scientific questions requiring huge effort in data harmonization, analysis, modelling and computational power. The activity is planned to design, realize and validate a VRE on aquatic ecosystem, responses to climate change, based on earlier LifeWatch ERIC developments, through a use case on standing biomass responses to climate change in aquatic ecosystems by integrating data resources, services and modelling tools of different RIs pertaining to two/three sub-domains (biosphere, marine, atmosphere). The use case is of great scientific and socio-economic interest, since allowable standing biomass affects the release of supporting, provisioning, regulating and cultural ecosystem services. The VRE is planned with a modular structure with semantic services for data discovery, harmonization and interoperability, data analysis and modelling services and workflows. The VRE will be integrated in the Hub through the LifeWatch ITALY webportal. The use case works in synergy with the WP6 activities on metabolism and space use behavior responses of acquatic plant and animal organisms to global warming and the WP6 activity on museum collection data resources and with data resources, linking with WP4 and WP5 activities in the marine and atmosphere sub-domains.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP8.6

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IRETRM,

- Planned Activity description – The CARBON VRE services will consider the main C reservoirs (atmosphere, ocean, terrestrial biosphere and geosphere) and direct anthropogenic emissions. Several approaches will be considered, including local measurements, flux networks, regional-scale measurements, stable isotope approach and data-driven models. New flux measurement sites to fill the gaps on key terrestrial ecosystems will be established, and existing sites will be completed. C fluxes will be measured in at least six new sites, particularly vulnerable to climate changes, delivering high quality data in real time. A complex laboratory system to provide key data with new analytical protocols will be implemented, to fill gaps related to the processes regulating the C balance in different domains. All the data will be used, together with the ones produced by ICOS and the others RI performing activities on the C Cycle (e.g. LifeWatch, LTER, Atlas, ECORD, etc.), to provide a service for the comprehensive assessment of the national C budget and of its spatial and temporal trends. We will establish a protocol to transfer all datasets with their own metadata to the ICOS IT platform, where they will be harmonized and made widely available. Models for temporal and spatial variations of the carbon budget will be implemented and tested in the new implemented sites and in those belonging to the RI involved. The previous steps will be the framework to set up a service able to provide spatial and temporal resolved carbon budget data. Thanks to the CARBON VRE service, the users will have the possibility to visualize and use maps, yearly updated, at different spatial and temporal scales where are present the data for their specific purposes. Moreover, the service will be useful for government agencies such as ISPRA with the possibility to validate their official inventories.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP8.7

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNRISMARSP,

- Planned Activity description – Activity 8.7 will develop and implement a Virtual Research Environment to gather all the climatic variables from the RIs of the different domains with the aim of identifying indicators and downstream effects of climate change. This CLIMA VRE will represent a collaborative place where specific climatic datasets and tools will be made available, enabling users to: a) collaborate for identifying the climatic indicators; b) run codes; c) share materials and d) communicate in various ways. Following well-established frameworks, the CLIMA VRE will be made up of two areas: the "Workspace" area where users can organize and share digital materials like datasets, notebooks, codes; and the "Social Networking" area where users can discuss and exchange information through usual social networking concepts like threads, posts, hashtags, mentions, etc. The CLIMA VRE will also consider extra-RI datasets coming from other EU initiatives like both the Copernicus Climate Change and the Copernicus Marine Services for the identification of the indicators. The Activity is organized as follows:
  1) During the first year the call for tenders for the development of the CLIMA VRE will be carried out and specific software licences will be acquired. At the end of the first year a gap analysis on the existing information and possible data gaps for the definition of climate indicators will be provided;
  2) Technical realization and implementation of the Virtual Research Environment dedicated to climate indicators. At the end of the second year the CLIMA VRE Manual of use will be delivered;
  3) climate indicators will be identified and listed in a final report, also providing codes and notebooks for their calculation.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP8.8

- Implementing Entity, Acronym and Operational Unit Name -OGS - Istituto Nazionale di Oceanografia e di Geofisica Sperimentale , OGS_OCE,

- Planned Activity description – The activity will implement an integrated Virtual Research Environment (DOWNSTREAM VRE) dedicated to the use of OGS and RI data on climate, carbon, and environment response nexus to provide services for the visualization, analysis, and sharing of the data provided by the different RIs.
  Particular emphasis will be given to integrating data streams originated by OGS participation in marine infrastructures in a data set accessible through a common access point of experimental observations referring to the Adriatic Sea and of products derived from their integration/elaboration; marine observations and in the deep sea. There will be a focus on the available information useful to derive a budget of the carbon cycle, or some of its components. As a test, the activity will point to a specific area, if enough information is available, to provide a first-order quantitative assessment of carbon cycling and/or highlight critical gaps.
  The rock/sediment core data analyses derived from scientific drilling both onshore and offshore will be grouped in sub-categories: Litho-stratigraphy, paleomagnetism, downhole logging, structural geology, basement geochemistry, micro-probe analyses, isotope geochemistry, and site-survey data. The DOWNSTREAM VRE of this data category will be designed to be in synergy with PANGEA, the most widely used data repository in Earth Science in Europe. Geophysical data from passive and active experiments and different frequencies will be shared through the DOWNSTREAM VRE. There will be a focus on possible effects of climate change on pilot test sites. Taking advantage of a landslides inventory and data available, considering different models for the expected climate changes in the region (and the consequent modification of the identified proxies), scenarios will be carried out to estimate their downstream impact on the landslide susceptibility, accounting for uncertainties.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Work Package N° WP1

Work Package Leader - 'Gelsomina Pappalardo, Research Director CNR'

1) Is the Work Package in compliance with the planned schedule for the achievement of the intermediate objectives, including any submitted changes?

yes, there are no reported delays in achieving the intermediate objectives

Please provide a detailed description of the ongoing critical issues, indicating their nature and possible solutions to ensure the success of the project within the planned timeframe:

Activity N° WP1.1

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IMAA,

- Planned Activity description – This activity will ensure that the contractual aspects within the Consortium are carried out in a timely manner, and fulfilment of the beneficiaries' contractual obligations. This activity is in charge of the entire management structure according to quality criteria and in compliance with regulatory obligations, which also guarantees an appropriate accounting codification, which allows subjecting to inspections and controls, the conservation of documents, compliance with information and communication obligations as well an easy sharing of the information necessary for monitoring, from the start of the project until the conclusion of the operations.
  It will implement appropriate quality control tools to monitor the work progress including deliverables and intermediate objectives, prepare and coordinate the periodic project reports (both technical and financial) with the partners, and ensure timely delivery to the MUR. It will moderate potential internal conflicts, propose resolutions and corrective actions, including regular cross-consortium strategic assessment of the capital investments and human resources. It will be responsible for the financial and administrative management and consistency of overall the resources used, and manage the distribution of the financial contribution between the contractors and activities in accordance with the contract.
  This activity will be in charge of the day-to-day execution of the management tasks for the entire Consortium and proper communication with MUR.
  Project meetings will be organized along the entire project. A kick-off meeting and yearly official project meetings plus two CC meeting per year, bimonthly EB and FOB meetings, and two RIB meetings per year, and at least three ESAC meetings will be organized in order to review the work progress, measure the project results against the set objectives, foster constructive work, and promote the long-term sustainability after the end of the project. ,

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP1.2

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IMAA,

- Planned Activity description – The coordination office will be responsible for implementing and managing the centrally managed project web portal. The web portal will be the central platform for information exchange with partners, the national and international science community, end users, stakeholders (including regional ones), private sector, and the general public. It will be linked to the ITINERIS HUB, developed in WP2. It will publish and advertise opportunities for access (WP2) and training activities (WP3) offered within the project, and provide access to the Project Data Centre (WP2). It will report on ongoing activities and inform on up-coming events, disseminate project results, publications, and provide documentation material.
  An internal pass-word projected intranet website will be created to host project internal information relevant for efficient project operation: deliverables, dissemination material, official documents, workshop material, reports.
  Internal project communication will be supported through adequate information tools with project partners, e.g., specific mailing lists, and new communication tools.
  A complete external communication plan, including press releases, brochures, presentation of opportunities in national and international conferences, social media and other new communication tools, will be developed at the beginning of the project and applied during the course of the project.
  This activity will ensure to comply with the obligations regarding communication and information provided for by art. 34 of Regulation (EU) 2021/241 providing adequate dissemination and promotion of the project, including online, both web and social, in line with the provisions of the PNRR Communication Strategy and indicating in the project documentation that the project is part of the PNRR, with explicit reference to funding from the European Union and the Next Generation EU initiative (eg using the phrase "funded from the European Union - Next Generation EU").
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- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Work Package N° WP2

Work Package Leader - 'Carmela Cornacchia, senior technologist CNR-IMAA'

1) Is the Work Package in compliance with the planned schedule for the achievement of the intermediate objectives, including any submitted changes?

yes, there are no reported delays in achieving the intermediate objectives

Please provide a detailed description of the ongoing critical issues, indicating their nature and possible solutions to ensure the success of the project within the planned timeframe:

Activity N° WP2.2

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IMAA,

- Planned Activity description – The objective of this activity is to design and develop a digital HUB to facilitate the integration of the environmental RIs and to increase the visibility and societal impact of the national network.
  The ITINERIS HUB is an online portal that will provide a valuable unified entry and gateway allowing users to access the collection of knowledge, services, data, analytic tools and compute platforms provided by the different RIs.
  A Catalogue of data and services will be designed and developed as the common, comprehensive and discoverable online registry of the services offered by the RIs' facilities and the research data and digital products stored in the multiple data centres of the sub-domains/RIs. Specific work will be carried out to: define the set of information that shall be provided to publish and give visibility to the RIs' services and data in the Catalogue; define the mechanisms, validation criteria and schedule for successful onboarding into the Catalogue; consolidate the specifications and design for the development of the presentation and data access layers of the Catalogue.
  As concerns data, the Catalogue will contain metadata that describes the research, providing available direct access to the underlying data collections or specific data portals where research data and products could actually be retrieved.
  An Access Platform will be designed, developed and integrated in the HUB as the single and coherent access channel that allow a centralised, harmonised and lean management of the physical and remote access process to the services set in the master plan (task 2.1): from the collection of access requests; to management, coordination and capture of reviews; to collection and reporting of access metrics and feedback from the users; etc.
  Authentication and authorisation and security services will be provided through the HUB to enable user specific and login protected content.,

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP2.3

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IRETLE,

- Planned Activity description – The aim of this activity is to identify the FAIR-enabling best practises to be adopted and implemented by participating RIs in order to prepare the necessary steps required for the exposition of their data and related services under the catalogue of the ITINERIS HUB. To this aim, a FAIR Implementation Working Group (FIWG) will be created, early in the project, consisting of representatives from established RIs and specific personnel hired by the project.
  In view of the widespread maturity of some RIs (e.g. ACTRIS, ICOS, LifeWatch), this activity is designed to finalise the implementation plans of the mature RIs to a prototype level and to provide the opportunity to the other RIs, of the same subdomain, to progress in a common direction using shared solutions. Well advanced flagship RIs with a high level of maturity will lead the development and implementation of interoperable services at subdomain level and provide support and guidance to the less mature and upcoming RIs. This activity will also establish the technical preconditions for the implementation of a virtual, federated machine-to-machine interface and a catalogue for ingestion of metadata that will give access to fair resources (data, services and other research outputs) provided at RIs, subdomains and across subdomains level. The technical preconditions will be set up by exploiting the machine-actionable FAIR Implementation Profiles (FIPs) that will be created or updated for established RIs. FIPs consist in a list of declared technology choices made by a community of practice for each of the FAIR Principles (e.g., PID, metadata schema, policy, communication protocol, structured vocabularies, etc.) and can be reused by other communities. After a detailed analysis of existing FAIR-enabling resources, an agreed decision will be made by the ITINERIS community in terms of FAIR implementation choices to be adopted at HUB level.
  ,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP2.4

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IRETLE,

- Planned Activity description – The aim of the activity is to translate into practice the elusive principle of data interoperability using FAIR terminology and the transition from ambiguous labels to describe data semantics to unambiguous and persistently identified terms. An innovative terminology-based service, ITINERIS TERMINOLOGY, will be developed to enhance the data interoperability of national environmental RIs. The activity will consist in 3 actions aiming to design, develop and apply the new service:
  - Definition of the ITINERIS TERMINOLOGY service foundations by identifying the relevant terminologies (i.e., controlled vocabularies, thesauri and ontologies) and terminology services used by ITINERIS partners, assessing their FAIRness level and building FAIR terminologies. A Terminology Interoperability Framework (TIF) will be also specified to harmonize the programmatic persistent access to terminologies served by selected terminology services. Moreover, the TIF will include a Common Semantic Model for the harmonization of exchanged information about terms for both humans and machines.
  - Design and implementation of the ITINERIS TERMINOLOGY service by identifying and implementing the appropriate technological solutions so that ITINERIS TERMINOLOGY can more easily harvest terminologies and their descriptions. This action will also implement any necessary internal indexing or caching mechanisms required to support search, discovery and mediation without usurping the established role of existing providers, as well as support any clients or other applications deployed to integrate ITINERIS TERMINOLOGY into (inter)disciplinary data infrastructures.
  - User-focused ITINERIS TERMINOLOGY service application by integrating the service into the catalogue of ITINERIS HUB and into two (inter)disciplinary data infrastructures to provide (meta)data enriched with semantic annotations. This action will demonstrate how the annotations may improve research data interoperability, discovery and exploitation. ,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP2.1

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IMAA,

- Planned Activity description – Activity 2.1 will design main components and features of a National Access Framework to coordinate access services to participating RIs. The Framework will build on a solid basis of knowledge both on the users (research needs and current access experience) and the providers (available resources and current access practices) of the different RIs. A Reference User Group (RUG) will be established to ensure that user communities have a say in all project developments. With the help of the Committee, a thorough user need analysis will enable innovation of services, processes and interactions taking the user perspective, also providing valuable input to RIs to meet user expectations. An inventory of the current facilities, carried out considering previous user surveys and studies, will complement the analysis. Main results of past studies will be discussed with the RUG, then adapted, supplemented, and updated. This combined effort will enable development of: a) an integrated user strategy, providing for user engagement and awareness of opportunities/value received from access; b) a master plan to manage a regular national access programme tailored to user needs.
  The Master plan will describe:
  - access policies and efficient processes (feedback mechanisms, etc.)
  - need for tools to collect and inform on the available services (input to Catalogue in Act. 2.2)

  and online applications to enable efficient and harmonized management of the entire access process (input to platform in Act. 2.2)
  The Master plan will propose monitoring and impact indicators to measure success of the national access programme. Access management workflows and tools will be tested with pilots in WPs 3-8. Results will be used to develop structured recommendations for the establishment of the National Access Programme of the ENV RIs Network and its long-term sustainability through different sources of funding and including a recommended pricing scheme with user fees based on different user types.,

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Work Package N° WP3

Work Package Leader - 'Alberto Basset, full professor Università degli Studi del Salento, Associate CNR'

1) Is the Work Package in compliance with the planned schedule for the achievement of the intermediate objectives, including any submitted changes?

yes, although with some changes that have already been communicated and which, however, do not affect the success of the project

Please provide a detailed description of the ongoing critical issues, indicating their nature and possible solutions to ensure the success of the project within the planned timeframe:

Activity N° WP3.2

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IMAA,
- Planned Activity description – The activity ensures the co-organization and management of the training courses and event planned in the WP4 and WP7 according to the ITINERIS Training plan and in collaboration with the training team of the ITINERIS Training Centre established in the activity 3.1. To this aim, two RTDs are hired by CNR-IMAA Potenza supporting the coordinators of the WP4 (Atmospheric domain) and WP7 (Solid Earth domain) for all issues related to the training activities. ,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP3.5

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IGG,
- Planned Activity description – The activity ensures the co-organization and management of the training courses and event planned in the WP 8 according to the ITINERIS Training plan and in collaboration with the training team of the ITINERIS Training Centre established in the activity 3.1. To this aim, one RTD is hired by CNR-IGG Pisa supporting the coordinators of the WP 8 (Virtual Research Environments and Cross-disciplinary Activities) for all issues related to the training activities. ,

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP3.1

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IRETLE,
- Planned Activity description – The activity ensures: a) the coordination and co-organization of all training programmes planned in the activities 3.6 - 3.8 within and across both WPs and involved RIs; b) the development and implementation of the Training Catalogue and Platforms; and, c) the long-term sustainability and the development of the Training Business Plan. To ensure the coordination and co-organization two Committees will be established: a coordination committee, chaired by the WP leader and constituted by a delegate from all other WPs, and a management committee constituted by the RTDs hired for the management and operation of the training programme. As regards the activities: point (a) includes the training programme for RIs employees, both researchers and technicians (activity 3.6), for RIs users (activity 3.6), for PhD students as next generation employee and users of the Environmental RIs (activity 3.7) for the domain specific 2nd level Master applicants (activity 3.7), for training RIs employees on science communication and stakeholder engagement (activity 3.8), addressing a target model user community constituted of primary to high school students. Point (b) includes the activity for the development of the ITINERIS Training Centre platform and related Catalogue of all training resources already realized by the involved RIs and those which will be realized in the month 30 of the project duration; point (c) includes the realization of a long-term training business and sustainability plan, in the first half of the ITINERIS operational period, and the implementation of the plan in the second half.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP3.8

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IRETLE,
- Planned Activity description – The activity develops: i. all training objects required in the activities 3.6 and 3.7; and, ii. the training objectives and a Semantic Training Platform for training RIs' employees, research fellows and research collaborators on scientific communication and users' engagement in environmental and sustainability sciences, targeting students at every type and level of school as a model target community of users. As regards point (i), the activity takes care of collecting and exposing on the Training Catalogue the tutorials realized by the RIs to train users on their most relevant facilities; the activity is also aimed at coordinating the realization of the tutorial, and/or of other types of training materials, for the facilities implemented within ITINERIS. QC and QA of all digital training object produced is planned through validation hands-on activities with both the scientific and technological staff of the RIs and with the RIs users. As regards point (ii), the activity involves:
  a) a learning by doing approach, with advanced intensive courses on science communication to the RIs staff and then advanced intensive courses held by RIs staff to school teachers. Domain-specific courses (one per domain) and two cross domain courses are organized in the first project year for the RIs employees and two series of intensive courses, as winter and summer schools are organised in the second year by the RIs employees for the school teachers. b) the development of a Semantic Training Platform, dedicated to the knowledge transfer and engagement, which incorporates the mining and re-use of educational e-training / e-learning courses produced by the RIs and the development of dedicated products. The digital training object and all other materials produced for the training events, are then made permanently accessible through the ITINERIS Training Platform.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP3.3

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IRETRM,
- Planned Activity description – The activity ensures the co-organization and management of the training courses and event planned in the WP2 and 6 according to the ITINERIS Training plan and in collaboration with the training team of the ITINERIS Training Centre established in the activity 3.1. To this aim, three RTD are hired by CNR-IRET Montelibretti supporting the training coordination of the WP2, for the FAIRness issues and for all issues related to the design, realization and testing of prototypes of the e-services and workflows available to researcher in the VREs and the training coordination of the WP6 (Terrestrial Biosphere).,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP3.6

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IRETRM,

- Planned Activity description – Training current RIs staff and user communities - The objective ensures the organization and the delivery of: a) advanced training, as training courses and hands-on stages, addressing the scientific and technical staff of the involved RIs; b) advanced training, as training courses and hands-on stages and as tutorials and other e-training/e-learning materials dealing with specific research facilities accessible at one or more ITINERIS RIs, addressing key user target groups of the RIs, including researchers and employees of public and private organization involved in environmental conservation, sustainable management and restoration. c) advanced training, as summer/winter schools and hands-on practical sessions on developing and using e-services, workflows, VLabs and VREnvironments, including all FAIRness components of digital objects, addressing technical staff of the involved RIs and selected user categories. Courses are organized in thematic categories addressing RIs' scientific and technical staff and selected user categories of the different domains included in ITINERIS. The training plan is scheduled with two to three intensive courses/hands-on session per domain and 1 to 2 trans-domain courses, addressing cross-cutting scientific, methodological and technological issues, per year. Every course has a scientific coordinator proposed by the involved RIs and the RTD unit of personnel assigned to the specific domain works as training manager for the course. The training materials produced for the training events, both courses and hands-on session are then made permanently accessible through the ITINERIS Training Platform. Tutorials and other digital training objects required for the advanced training of RIs users are developed in the activities 3.8 and made available to the users before the start of their hands-on sessions. The recruitment of the personnel involved in the organization and delivery of all courses is done in activities 3.1, 3.2, 3.3,3.4,3.5.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP3.7

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IRETRM,

- Planned Activity description – The activity focuses on training new generation of environmental scientist, who can take advantages of the research facilities developed by the Italian nodes of the Environmental European Research Infrastructures and ensure continuity in the scientific and technological excellence of these RIs staff. To this aim the activity organizes thematic PhD curricula, or analogous PhD programnme sections, of advanced training on key open challenges of the ITINERIS thematic domains in five Italian Universities, geographically distributed across Italy. At least two cycles of every curriculum are funded with three fellowships per cycle, with a co-funding of one PhD fellowship of the second cycle by the hosting University; the RIs can eventually contribute to the co-funding or by funding directly one or more fellowships. The budget of the fellowships covers the increase for one year research stage in the National and/or European RIs Nodes or in other outstanding International Research Centers. As regards the training programme of the PhD students, two intensive courses of 4CFU per year and PhD programme are organized in the context of the ITINERIS project, in addition to the official training programmes of every hosting University, with the participation of all PhD students enrolled in the ITINERIS activities on the vertical WPs. Moreover, two one-week trans-disciplinary field camps are organized per year on unifying environmental science theories and methodologies. The training materials produced for the PhD training courses and field camps are then made permanently accessible through the ITINERIS Training Platform.
  Tutorials and other digital training objects required for the advanced training of the PhD students are developed in the activities 3.8 and made available to the users before the start of their hands-on sessions. A training line through strongly focused 2nd level Master courses is also activated with the availability Master registration fellowships.
  ,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP3.4

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNRISMARVE,

- Planned Activity description – The activity ensures the co-organization and management of the training courses and event planned in the WP 5 according to the ITINERIS Training plan and in collaboration with the training team of the ITINERIS Training Centre established in the activity 3.1. To this aim, one RTD is hired by CNR-ISMAR Venezia supporting the coordinators of the WP 5 (Marine domain) for all issues related to the training activities. ,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Work Package N° WP6

Work Package Leader - 'Dario Papale Associate Professor University Tuscia /associated CNR-IRET'

1) Is the Work Package in compliance with the planned schedule for the achievement of the intermediate objectives, including any submitted changes?

yes, there are no reported delays in achieving the intermediate objectives

Please provide a detailed description of the ongoing critical issues, indicating their nature and possible solutions to ensure the success of the project within the planned timeframe:

Activity N° WP6.12

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IBBA ,

- Planned Activity description – Biotechnology is considered a key enabling technology in the development of a low-impact circular economy, where the integration of biological and industrial process will allow a sustainable exploitation of renewable resources, thus safeguarding the environment. This requires the development of large-scale processes that must be able to deliver the desired goods in a robust and economically sustainable way. The development of such processes requires different skills and coordinated efforts in order to achieve the desired goals within a reasonable span of time. This activity will be focussed on the potentiation of a research infrastructure dedicated to the development of pipelines for the production of enzymes and other bioproducts through sustainable industrial processes. This is normally achieved by a trial and error process which may involve a long series of steps, including the identification of bioparts, their functional and structural characterization, metabolic engineering, choice of expression/production system, and process scale-up. While all these activities are time-consuming and labour-intensive, digitalization of individual steps or parts of the pipeline has an enormous potential to optimize and accelerate bioprocess development. The present activity will generate an integrated infrastructure where automation, miniaturization and data science will be thoroughly exploited to develop new paradigms in industrial biotechnology. This will require the use of state-of-the-art equipment able to generate high quality data which can be fed into innovative software and workflows in order to accelerate bioprocess development. The activity will sustain the potentiation and digitalization of dedicated platforms for biomolecule/microorganism discovery, characterization, and engineering, which will be fully integrated in the IBISBA European infrastructure, thus providing translational R&D services to a large community of industrial biotechnology stakeholders.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP6.5

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IBBRBA,

- Planned Activity description – This activity is aimed to provide biodiversity (meta)data linked to Natural Science Collections (NSC by focusing on the extended digital specimen, a virtual representation of the physical specimen stored in a collection, identified by MIDS (Minimal Information Digital Specimen) and fully linked to related information (e.g.. images and videos, codification of functional traits, DNA and protein sequences, environmental parameters, etc.). In relation to the objective 3 (Functional Biodiversity Responses), the main outcome of the activity will be the implementation of a national network of biological research collections, including all the existing in vivo and ex-situ collections of biological organisms (animals, plants, fungi, algae, archaea, bacteria, viruses, etc.) which have been created and maintained through past and current research projects. The full digitization of the research collections currently offline will be achieved along with the reorganization, standardization and harmonization of the data and metadata currently available in the main online collections. All the taxonomic, genetic, geographical, ecological, physiological information for each specimen will be organized in an easily searchable platform supported by web-GIS functionalities. Reference to genetic/genomic data for each specimen will allow for the identification of the most interesting material for further genetic/genomic analysis. The availability of such huge amount of information on plant, animal, and microbial genetic resources will pave the way for the dissection of the morpho-physiological and molecular mechanisms of adaptation to climate change. The realization of a bioinformatic toolbox will allow the full integration and analysis of functional biodiversity stored in NSC.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP6.11

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IBBRNA,

- Planned Activity description – The combination of digital and biological transformation may significantly change the design and handling of manufacturing processes and their products. In the data-rich era, predictive design and rapid evaluation are at the core of any bioprocess implementation. For example, environmental metagenomic is greatly improving our understanding of the evolution and ecology of microbial systems in various environments and the large amount of data produced constitutes a huge reservoir of information that can be exploited to discover new enzymes with specific functions. However, all these data are often embedded in scientific publications, making them difficult to analyze. Furthermore, many efforts have been made in recent years to identify and characterize novel putative enzymes of potential biotechnological interest for bioprocess development starting from available metagenomic datasets. Therefore, the harmonization and FAIRization of these data will allow to create data repositories to be used to implement the databases for AI-driven 3D protein structure prediction system and, in the meantime, to predict the 3D structure and the functional assignment of the putative proteins identified in metagenomic datasets. Starting from these considerations, this activity will allow the implementation of strong and interoperable modular services for the discovery, characterization, and engineering of novel enzymes to be exploited for the sustainable use of natural resources.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP6.19

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IBBRNA,

- Planned Activity description – Climate change, environmental pollution, and the consequent loss of biodiversity have pushed Europe to move the production system towards a bio-based circular economy. Bioeconomy is the production of renewable biological resources and the conversion of these resources from agricultural, aquatic, and forestry sources and waste streams into value-added products, such as food, feed, bio-based products, and bioenergy to ensure sustainable growth. Setting-up a final process generally takes 5-10 years. This is often due to the lack of a coordinated action in the development of the bioprocess. Instead, it is important to develop new tools and methodologies to underpin the production of modular and interoperable services that are interlinked in workflows. The development of bioprocesses exploiting data digitalization will build up a repository to be used to create digital twins for bioprocess control, development, and implementation following a Design Built-Test Learn (DBTL) cycle. In this activity a complete bioprocess for the bioconversion and valorization of a natural resource (e.g. lignocellulosic biomass) will be digitalized to create a data repository of the whole steps of the bioprocess performed by the different services of the IBISBA-IT RI. To identify novel enzymes to be used for the bioconversion of selected biomasses, microbial biodiversity also of extreme environments will be analysed (by metagenomic approaches, enrichments, etc.) and the most promising candidate enzymes will be produced, biochemically characterized and engineered. The enzymes will be used to set up bioconversion tests and the processes will be monitored by means of suitable biosensors and -omics analysis. All the data obtained will be used to create data repositories to model the steps of the process and will be exploited to build a digital twin of the bioprocesses. Finally, the data available to all partners could be used to assess the environmental impact and sustainability of bioprocesses.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP6.8

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IBE,

- Planned Activity description – The eLTER network is monitoring terrestrial and freshwater ecosystems with different approaches and techniques, due to the different ecosystem types and to the bottom-up development of sites. The eLTER empowering activity in ITINERIS will target harmonization of the collection of data of Essential Biodiversity and Climate Variables (EBVs and ECVs) at a number of selected terrestrial (forests, coastal and mid and high elevation ecosystems) and freshwater (lakes) sites. Indeed, ecosystem monitoring programs need a large transformation and adaptation to face challenges such as climate change impacts and biodiversity crisis and their interaction with both historical and emerging stressors, in a context of increased land and water demand and new- or increased-uses.
  The activity at the OU IBE Sesto Fiorentino (FI) will develop the common database and shared data handling and elaboration system for the entire eLTER network, while it will improve and extend the monitoring capacity at sites in the northern part of Italy in order to: i) upgrade observatories via harmonized data collection with common sensors and ad-hoc campaigns: ii) integrate new indicators and tools for soil, water, climate, biodiversity and ecological variables. The UO will have a specific focus on terrestrial ecosystems indicators such us tree growth, phenology, soil parameters and ecosystem fluxes. Data collection and remote transmission will be secured by infrastructural improvement (data and remote connection, line power installation). The data will feed a common, cross-RI database to establish a national system for monitoring ecosystem status and changes.
  ,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP6.20

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IBE,

- Planned Activity description – Remote Sensing (RS) can monitor and improve the knowledge on Essential Biodiversity Variables (EBVs) and Essential Climate Variables (ECVs). The purpose of the activity will be: i) provide a data knowledge platform to calibrate and validate remote sensing observations through establishing a cross-RIs (eLTER, ICOS, ANAEE) validation network and ii) contribute to the measurement of climate and biodiversity variables sensu Copernicus. The network and the resulting products will help in making national scale biodiversity and climate monitoring more robust and will contribute to streamline future development in case remote measurements are not consistent with ground monitoring. The activity consists of a cross-RI service based on multi-platforms biosphere remote sensing with cutting edge techniques (radiation, temperature, hyperspectral, Lidar) that will deliver datasets of physical and biological variables (sensu Copernicus) as basis for RI-specific and cross RIs higher level data products. The activity includes: 1) setup in different terrestrial and aquatic sites of upgraded systems for measuring surface reflectance/irradiance in the full VIS-NIR-SWIR spectral domain (400-2500 nm) by means of fixed sensors and unmanned aerial platforms (UAV) 2) setup of data processing pipelines for the fixed systems and the UAVs and different remote sensing data streams (Copernicus, PRISMA) 3) setup of a cal-val surface ground truthing facility to calibrate and validate the data products and the data processing pipelines; 4) sampling of cross-RI ecosystem sites delivering ground-truth data to the ITINERIS data hub under FAIR compliance. The activity will start with sensors installation, UAV platforms and data processing pipelines upgrade, verification and validation and will follow with delivering data services to ecosystem RIs (eLTER, ICOS, ANAEE). The service will be established and accessible in the future through the ITINERIS hub as on-demand request.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP6.15

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IGG,

- Planned Activity description – The impact of human activities has reached a level that could lead to abrupt and, possibly, irreversible environmental changes that would significantly affect human well-being. The way out of such dangers requires a jump in our technology, that should become sustainable and able to work with nature instead of against it. In this framework, the technological approach relying on Nature-Based Solutions (NBS) recognizes the complexity of socio-ecological systems and the fact that they are variable in time and space, allowing for self-reorganization and temporal dynamics of the approaches and of the associated resistance and resilience capacities. In this context, NBS have recently been proposed by practitioners (in particular the International Union for Nature Conservation, IUCN) and quickly thereafter by the European Commission as a relevant avenue for the sustainable use of nature in solving societal challenges.
  This activity evolves in synergy with the European Partnership on Biodiversity (BIODIVERSA+), and in particular with its Work Package devoted to NBS, and will generate a database of a number of the currently-implemented NBS approaches adopted in Italy, which will be available for consultation and use with the goal of facilitating uptake of existing NBS and implementation of new ones.
  Parallel to the general NBS database, this activity will focus on a specific aspect of NBS, namely NBS devoted to reducing the effects of coastal erosion and droughts, including water management NBS and solutions devoted to reduce biodiversity loss. The effectiveness of such solutions will be tested by repeated remote sensing imagery of the environmental conditions, using both satellite (Sentinel) data and UAV (drone) measurements of the landscape and vegetation conditions., establishing All data and results will be inserted in a special section of the general NBS database.
  ,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP6.9

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IPSPNA,

- Planned Activity description – Strengthening digital technologies for plant phenomics and precision agriculture platforms in southern regions to improve adaptation and resilience of the agricultural systems to the effects of abiotic and biotic stresses, and to optimize the use of natural and biological resources. The aim is to expand the capacity of two major southern high-throughput phenotyping platforms to acquire and make available in near real time non-invasive quantification of plant structure and function and interactions with environments, providing highest accuracy measurements. This will allow precision crop testing in different climates in real agronomic conditions, with state-of-the-art, digital phenotyping equipment, improving statistical significance for genotype screening. To this end, controlled-environment phenotyping infrastructures will be strengthened with 1) sensors combining 3D vision with multispectral imaging, to capture high quality precise digital parameters in real time and 2) walk-in phytotron accommodating a XYZ robot bringing multi-sensor platform towards the plants at defined intervals to acquire digital data. Whereas the field phenotyping infrastructure will be implemented with gantry crane based robotic high-throughput platform, that moves autonomously along steel rails while continuously imaging, with a diverse array of cameras and sensors, the plants below it. Plants will grow in a system of individual pots placed on scales where irrigation is automated with high accuracy and reliability and loss of weight of every pot is automatically recorded with high precision allowing to compute transpiration dynamics and water use efficiency for every single plant. These controlled-environment and field phenotyping infrastructures will be complemented by state-of-the-art metabolomics and volatilomics equipment to create high quality, unique platforms for selecting crop genotypes for adaptation and mitigation of climate change.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP6.10

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IPSPFI,

- Planned Activity description – Strengthening digital technologies for plant phenomics and precision agriculture/forestry platforms to improve adaptation and resilience of agricultural and forestry systems in response to of climate change and of extreme climatic events, and to develop services and technological tools
  for the sustainable use, valorization and optimization of water, soil, and biodiversity resources. The aim of this activity is to strengthen the capacity of at minimum three major northern high-throughput phenotyping platforms, by acquiring novel digital non-destructive technologies to develop improved germplasm with tolerance to abiotic and biotic stresses. To this end, controlled-environment phenotyping infrastructures will be strengthened with 1) sensors combining 3D vision with multispectral imaging, to capture high quality precise digital parameters in real time; 2) walk-in phytotron accommodating a XYZ robot bringing multi-sensor platform towards the plants at defined intervals to acquire digital data; 3) integrated robotic system for root phenotyping; 4) system of individual pots placed on scales to be used in greenhouse, where irrigation is automated with high accuracy and reliability and loss of weight of every pot is automatically recorded with high precision, allowing to compute transpiration dynamics and water use efficiency for every single plant; 5) microArray technology for the phenotyping of microorganisms. These controlled-environment infrastructures will be complemented by state-of-the-art equipment to measure photosynthetic carbon fixation, metabolomics and volatilomics, as well as with a high resolution digital confocal microscope providing imaging precision for subcellular structures and dynamic processes. The availability of these emerging technologies will be of great benefit to measure the spatio-temporal behavior of numerous plant traits through automated processes in order to turn this information into actionable knowledge.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP6.18

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IPSPFI,

- Planned Activity description – Formation of a digital ecosystem in the agriculture and forestry sectors to develop services and technological tools for the sustainable use, valorisation and optimization of agriculture and forestry resources to reduce water consumption and increase biodiversity toward a green transition. Plant phenotyping is a smart ecosystem, that encompass multiple location growth conditions and computer-vision-assisted technologies applied at complementary scales and levels of plant biological organization (from molecular to ecosystem level), that require expertise in different domains and a competence to achieve practical applications allowing the identification of superior traits/genotypes. High-throughput phenotyping turns data mining activity into enhanced knowledge on complex genotype x environment x management interactions. This high-resolution spatial and temporal data-driven approach to crop and forestry management has the potential to optimize the use and management of resources, water included, while increasing the productivity across diverse environments. To this end, to transform data availability into usable and useful products, a centralized access to data will be created to integrate compatible, consistent information systems (findable, accessible, interoperable and reusable datasets - FAIR standard), as well as to apply new advanced data-fusion and data-harmonization approaches and advances in machine learning for big data analytics. Furthermore, to stimulate the development of new digital tools and create the space for real interaction between digital technologies and users, artificial intelligence will be applied to improve high-throughput data collection, produce personalized data and supply data-driven decision support systems as well as data organization and storage to be interpreted in a biological context and used for meta-analyses.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP6.3

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IRETFI,

- Planned Activity description – This activity will support the automatization and digitalization of the existing open-air terrestrial platforms of Italy, in order to move forward from standalone experimental manipulative platforms to part of a national network of RIs, improve FAIR access to their data and services, and provide data tested against model predictions trained with independent observational data from other RIs. Such an upgrade will support a full integration and harmonization of existing and new data coming from manipulative experiments across terrestrial ecosystems in Italy and will support research activities and training as well as the experimental activities and scaling-up of the National Centers (e.g., Agritech, Biodiversity), which need sophisticated experimental designs, long-term data/measurements, high geographic distribution/resolution and state of the art instrumentation. The ANAEE platforms provide data useful to validate and interpret the field observations carried out by RIs such as eLTER, ICOS, LIFEWATCH, and develop risk-assessment or process-based models that can be then applied to field sites. The activity contributes to the objective of harmonizing and integrating the data collected by this WP RIs and creates services for contrasting the effects of climate change drivers (i.e. elevated nitrogen, CO2 and ozone) on Italian agriculture and ecosystems. During the first year, the new personnel will be hired and the digitalization of the three ANAEE platforms will be discussed; acquisition and installation of the scientific instrumentation and technological equipment at each site/platform will be completed in the second year; the third year will be spent for implementing the platform set up, full operation and transfer of data,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP6.13

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IRETLE,

- Planned Activity description – The activity is aimed at strengthening the LIFEWATCH Italy research infrastructure with two actions: 1) reinforcing and updating the Virtual Research Environments of the Infrastructure and progressing the alignment with the LIFEWATCH ERIC VRE compositional structure; and, 2) reinforcing the commitment of the international scientific community in LIFEWATCH by pilot actions of opening data production facilities to remote users; proposed facilities included in this action are an advanced aquarium system for ecological experiments on freshwater and transitional water populations/communities, extensible to the marine ones, and a top level inverted confocal system. As regards action (1) i.e., the new VRE developments, key fundamental requirements are: a) a user-friendly interface accessible through web technologies; b) possible use of existing and validated webservices and modelling software by the user; c) interaction with the software interface of all platforms, catalogues and other services already in the LIFEWATCH Italy webportal; d) user interaction with the VRE user-experience based up to an advanced system where the skilled user will be able by using an orchestrator, to generate its own scientific workflows connecting different digital objects, from data to advanced semantic services and modelling tools. As regards action (2) it will deal with a substantial extension of use of facilities already available at the URT IRET Lecce in collaboration with the University of Salento. The aquarium system, including six racks of up to 18 aquaria each, will be completely updated allowing remote access to users enabled to remotely modify and adapt to field conditions water salinity, temperature and flow rate, if needed, in the aquaria and to control main physico-chemical water parameters. The confocal system will be updated for remote access, equipped with more advanced image-analysis system and integrated with the LIFEWATCH PYTHO-VRE eservices.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP6.17

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IRETLE,

- Planned Activity description – The activity is aimed at: 1) organize catalogue and make findable and accessible existing data resources on the tropho-energetics and space use behavior traits of aquatic organisms; 2) integrate existing data with new intensive laboratory and field data production by extending and updating the facilities already available at the URT IRET Lecce in collaboration with the University of Salento realizing an experimental data production centre on tropho-energetics and space use behavior of aquatic organisms; 3) open the access of the facilities to the staff on the ITINERIS RIs and to external researcher group. The structured data resources include individual body size, standard metabolic rates, trophic niche breadth, patch use, giving up time and giving up density, home range, connected with main abiotic parameters, including water temperature, for their application to advanced case uses. The experimental data production centre, which already equipped with 2 series of thermostatic rooms for experimental studies on functional biodiversity responses to climate change, makes available to the access the updated facilities for the data production on the following traits: a) individual level metabolic rates of aquatic organisms, including primary producers through high precision Strathkelvin systems for respiration rate assessment; b) individual space use behavior (i.e., patch selection, use, giving-up and density, homerange size) both in the lab, extending and updating an innovative Noldus system and in the field, at the LTER site of the Aquatina lagoon, with individual tracking methodologies in connection with the European Fish Tracking Network; c) individual trophic niche within food web networks using stable isotope and NGS methodologies. The implementation of an intranet connectivity of all equipment with the LIFEWATCH-Italy National Hub of Biodiversity and Ecosystem Research Data ensure real time data storage.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP6.16

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IRETRM,

- Planned Activity description – We propose a new set of field observations to produce basic data and databases to develop multidisciplinary and standardized protocols for the evaluation of NBS effectiveness and scaling up in accordance to IUCN framework, in order to stimulate and enable users to implement NBS. Deposition of pollutants and carbon sequestration will be measured in at least five (urban/periurban) flux measurement sites. At least two existing urban sites (Florence, Naples) will be strengthened and added to the Italian network. In these sites and additional three ICOS periurban sites we will instal specific sensors for measuring air pollution (3 x NOx fast analyzers, 2 x ozone analyzers, 3 x particle counters). Non ICOS sites will be strengthened also with relevant investments in the infrastructures (data transmission systems and power supply to the remote sites) so that they can all be able to deliver high quality data in real time, in particular concentration and fluxes of carbon and pollutants.
  Together with fluxes measured at the stations, for studying both above-ground and below-ground processes to get an insight on the knowledge of the pollutant dynamics in the plant-soil-biome system for bio/phytoremediation purposes, existing research facilities will be upgraded (e.g. greenhouses and climate growth chambers) into Ecotrons with plant and rhyzo-soil sensors and high throughput multispectral imaging devices. Thanks to advanced measurement at the sites and process studies supported by Ecotron implementation, a NBS catalogue for Italian regions will be drafted.
  ,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP6.1

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IRETRM,

- Planned Activity description – The OU is responsible for the coordination of the WP and a coordination center will be organized with staff that will ensure a strong interlink among RIs and continuous exchange. This will include the strengthening of the data processing capacities of the ICOS ETC hosted in Italy through investments in the data storage and computing power without creating a new center but investing in existing HPC Hubs. In this way the ICOS ETC will be able to process flux data for all the RIs participating to the project. An improvement in the data collection and sharing by the ICOS sites will be reached; in fact, part of the ICOS flux sites is not equipped with a reliable system for data transmission, the 5 ICOS Associated sites are not sharing data continuously but only yearly and not following the strict ICOS protocols and large part of the ICOS sites is currently poorly connected to a reliable power supply, with possible frequent power shortages which generate large gaps. Gaps are also due to the use of loggers without the technology for the data transmission or not supporting the new standards and due to instruments not fully updated. All the ICOS sites will be equipped to send data in Near Real Time to the central Hub and receive centralized processing. The OU will purchase and install a set of core sensors and loggers at all the ICOS sites. Sites will be strengthened also with relevant investments in the infrastructures to ensure in all cases a robust data transmission system and a robust power supply system (grid power, solar panels, or power generators). Finally, a new demonstration and test tower will be built to support the training activities and to compare methods and instruments, open also to private SME. Such an effort would guarantee that all the ICOS sites will transmit ICOS compliant and highly standardized data in real time, in continuous, minimizing risks of gaps and ensuring near real time data processing (daily) done following the international ICOS protocols.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP6.7

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IRSA,

- Planned Activity description – The eLTER network is monitoring freshwater and terrestrial ecosystems with different approaches and techniques, due to the different ecosystem types and to the bottom-up development of sites. The eLTER empowering activity in ITINERIS will target harmonization of the collection of data of Essential Biodiversity and Climate Variables (EBVs and ECVs) at a number of selected freshwater (lakes) and terrestrial (forests, coastal and mid and high elevation ecosystems) sites. Indeed, ecosystem monitoring programs need a large transformation and adaptation to face challenges such as climate change impacts and biodiversity crisis and their interaction with both historical and emerging stressors, in a context of increased land and water demand and new- or increased-uses.
  The activity at the OU IRSA Taranto will improve and extend the monitoring capacity at sites in the southern part of Italy in order to: i) upgrade observatories via harmonized data collection with common sensors and ad-hoc campaigns: ii) integrate new indicators and tools for soil, water, climate, biodiversity and ecological variables. The UO will have a specific focus on freshwater ecosystems indicators such us lake functioning and long-term variations in aquatic responses, limnological and paleolimnological approaches. Data collection and remote transmission will be secured by infrastructural improvement (data and remote connection, line power installation). The data will feed a common, cross-RI database to establish a national system for monitoring ecosystem status and changes.
  ,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP6.6

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNRISMARVE,

- Planned Activity description – This activity will provide biodiversity (meta)data linked to Natural Science Collections (NSC). The core is the extended digital specimen, a virtual representation of the physical specimen stored in a collection, identified by MIDS (Minimal Information Digital Specimen) and additional information (e.g. images and videos, codification of functional traits, DNA and protein sequences, environmental parameters). The following aspects will be taken into account.
  1) Italian aquatic environments as hotspots of biodiversity and introduced alien species, important for ecological studies aiming to understand the long-term effects of environmental and/or climate change. Collections including alien species are: a) aquatic herbaria. Acquisition and digitization of exiccata and label data mobilization might be used to assess changes in biogeographic distributions comparing either modern and historical herbaria or herbaria of other institutions available online; b) collections generated by Long Term Monitoring (LTM). Data on alien (invasive) species produced by LTM, focused on general aspect of biodiversity, could be used to develop specific LTM plans of invasive species.
  2) Collections from community ecology studies, as they provide data as potential benchmarks for models of community change over time. Selected taxa e.g. endemic, rare or otherwise relevant species, will be scrutinized in more detail.
  3) Among the phenotypic responses visible in collections stored from long term monitoring and sampling, body size would be the easiest to measure and store in digitized form as metadata associated with each specimen. Expectations are that within a species, body size may either diminish or increase depending on the interactions of body size and global change on the eco-evolutionary responses of the organisms. At the community level, local extinctions due to global change may differentially affect species with larger or smaller body size, shifting the community-level average body size.,

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP6.2

- Implementing Entity, Acronym and Operational Unit Name -UNIFI - Università degli Studi di Firenze, UNIFIDAGRI,

- Planned Activity description – The cropping systems experiments at plot and field level carried out at the various CIRCULAR sites make available an enormous amount of environmental, agronomic and cultivation data, which, however, has never been harmonised and, above all, made available through a database that can be easily and freely consulted by the entire scientific community. The objective of this activity is to make available, through the digital platforms that are made available and that will be enhanced by the DMC-CREA, both the data collected experimentally, and the modelling studies carried out on them. At the same time, an enhancement in terms of monitoring of the experimental tests is also foreseen through the acquisition of instrumentation capable of allowing continuous measurements of water, nutrient and GHGs flows and the development of new modelling tools. Finally, the acquisition of proximal and remote sensing data will allow to optimising the treatment management of the experimental sites. This activity may be enriched and complemented by interaction with ANAEE OUs (e.g. Aerolab) or other RIs (e.g. ICOS, EMPHASIS).,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP6.4

- Implementing Entity, Acronym and Operational Unit Name -UNIFI - Università degli Studi di Firenze, UNIFI–SMA ,

- Planned Activity description – This activity will provide biodiversity (meta)data linked to Italian natural history collections (NHCs). The core of the action is the focus on the extended digital specimen, a virtual representation of the physical specimen stored in a collection, identified by MIDS (Minimal Information Digital Specimen) and additional related information. Digitization of NHCs, both as imaging/modelling (2D/3D twins of physical vouchers) and databasing (basic data and metadata), is a priority action to assess biodiversity dynamics over the widermost range of spatial and temporal variation possible. The primary way to make a change in the strategic forecasting of natural resources management, is to allow the sharing of as many collection data as possible, instead of getting deep and detailed information from selected taxonomic or functional groups. Based on the landscape analysis of Italian NHCs contents performed by ANMS, 1% of the specimen collected in Italy and stored in Italian museums can be completely digitised from each taxonomic group, from microorganisms to upper plants and vertebrates. For those which are easier for imaging than databasing (herbarium specimen, pinned insects), a massive image acquisition could be extended to further 4-5%, providing effort to forthcoming joint research or citizen-science project devoted to data extraction from the imaged labels. The activity will be equally distributed along the project timelife, with a focus on those major reference collections that will allow the minimum costs in terms of logistic solutions. At the end of this action, this will allow to mobilise new data from as many as 90.000 labels (minimum), and images from 300.000 specimens, through a job equally distributed along the 24-months 'operative-phase' span. In addition, all the existing databased/imaged records within the Collection Management System of the museum concerned will be mapped in order to accomplish the technical readiness level needed to join DiSSCo,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP6.14

- Implementing Entity, Acronym and Operational Unit Name -INFN - Istituto Nazionale di Fisica Nucleare, INFN - BA,

- Planned Activity description – The activity has to specific aims: 1) Implement and extending a VRE supporting the activities of LIFEWATCH community in line with the requirements of the European community and with the overall aim of the project. The VRE will help the end users to both implement an easy and transparent data access and management, with deep optimization in terms of managing data locality, heterogeneity of the data and the management of the meta data. Part of this work will be carried on by internal INFN personnel and partially will be executed by external procurement to leverage on very diverse know-how needed in order to build a complex, flexible and very high-level VRE platform as needed by LIFEWATCH community; 2) Improve and refurbishment of the hardware infrastructure that LIFEWATCH-ITA community is already using and was build thanks to the LIFEWATCHPLUS PON project. This will be needed to support new requirements emerging by the project and will have the aim to cope with the new data that will become available during the running of the project, and that are already being collected from the Italian and European LIFEWATCH community.,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Work Package N° WP7

Work Package Leader - 'Giuliana Rossi - researcher - OGS'

1) Is the Work Package in compliance with the planned schedule for the achievement of the intermediate objectives, including any submitted changes?

yes, there are no reported delays in achieving the intermediate objectives

Please provide a detailed description of the ongoing critical issues, indicating their nature and possible solutions to ensure the success of the project within the planned timeframe:

Activity N° WP7.4

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IMAA,

- Planned Activity description – The proposed activities will contribute to provide scientific information and open data on the environment to the scientific community, the public and decision-makers according to the Digital Earth concept (Objectives 1 and 2). The first activity consists in establishing a service aimed at integrating the data from a variety of geophysical sensors by enhancing: i) the time-lapse Electrical Resistivity Tomography (4D-ERT) system for deep geophysical explorations (Objective 3); ii) the geophysical facilities for near-surface investigations (Objective 4); iii) the aerial payload infrastructure with sensors operating in short-wave infrared (SWIR) spectral range for land surface monitoring (Objective 5), and in keeping the data set updated.
  The second activity aims at innovatively using the ERT method as an advanced observing system, able to describe the spatio-temporal changes of the resistivity patterns within the depth range 0-10 km. The planned upgrading will be carried out by using machine learning technologies for geophysical data processing and analysis.
  The last activity aims at making the digital geophysical infrastructures more suitable for the investigations in urban areas, paying particular attention to the analysis of near-surface-soil-infrastructure dynamical interactions. The acquisition of a DAS interrogator will enable a continuous digital data acquisition from a 4 km long fiber-optic cable already installed in the industrial area of the Pilot set site of Tito. This will offer to the scientific community unique opportunities for testing and for methodology development, in a controlled environment. This site, in fact, will be opened to the scientific community for testing the performance of the DAS technology applied in near-surface geophysical investigations.
  The TIR airborne payload will be expanded with SWIR sensors. The data collected by each experiment will be integrated in the project platform and made available to the scientific community.,

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP7.5

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IREA,

- Planned Activity description – The activity will combine an airborne X/L Band Synthetic Aperture Radar (SAR) and in-situ geophysical technologies, using both the electromagnetic and electric sensing principles, for imaging and monitoring of the Soil-Subsoil System (SSS) (Obj. 4 and 5).
  Airborne SAR systems guarantee a high operational flexibility by reaching inaccessible areas and keeping short the revisiting time. A X/L Band SAR will be acquired and related data acquisition and processing will be set-up through novel data processing strategies. Mounted on-board an aircraft, it will include: 1) a compact, multi-capability radar system available in different configurations (X/L-band SAR system); 2) the GNSS/IMU system, providing both real-time position and attitude information to the radar 3) raw data storing for a subsequent post-processing on ground. The processing segment will involve computing resources to obtain SAR derived products (reflectivity, coherence, polarimetric information, deformation, topographic map). International standards will be exploited to collect, harmonise and integrate data and images. The interpretability of the generated SAR products will be improved by metadata definition, according to the international standards. The second main technological asset consists of a suite of mobile (also by exploiting drones) and fixed in-situ sensors, consisting of magnetometers, gradiometer, multi-antenna ground penetrating radar and optical backscatter reflectometer for high resolution imaging and monitoring of the shallower layers of the subsoil including the groundwater. The effectiveness of the in-situ sensors will gain of the expertise of IREA researchers in setting-up state of art processing methodologies for 2D and 3D imaging. The integration of airborne and in-situ sensors will allow a multi-scale and multi-resolution non-invasive monitoring of the dynamic processes affecting the SSS. The raw data and the derived products will be made available through the VREs. ,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP7.1

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNRISMARBO,

- Planned Activity description – 1) Improve access of Italian scientists to the ECORD infrastructure with an increased participation in proposal writing, drilling expeditions, sample/data requests, and training schools, along with a strengthened representative and participation in the scientific advisory structure, and training schools. Priority will be given to Early Career Scientists and Ph.D. students. The access will follow well-tested principles of proportionality for participation and scientific merit. In collaboration with the Department of Earth System Science and Environmental Technologies of CNR (DSSTTA).
  2) In the framework of ECORD -ICDP, generate a thematic digital archive of data archived for scientific drilling activities. The activity, in synergy with WP8, will include the finding, mapping digital archiving, accessing and sharing within the VRE of scientific drilling data and samples originated by Italian scientists. In the future, the facilities will also provide ECORD-ICDP with access to analytical facilities on cores and samples from drilling expeditions on the following thematic areas:
  A. Integrated Laboratory of Microanalysis (LAMAI) for optical and electron microscopy (SEM), electron microprobe for qualitative and quantitative morphological and in situ chemical microanalyses of solid material. In collaboration with the CNR-IGAG-Sapienza;
  B. Geochemistry and isotopic and elemental characterization (minor and trace elements, C, H, N elemental analysis), stable isotopes, radiogenic isotopes, dating. In collaboration with CNR-IGG;
  C. Archiving of ECORD site-survey data such as sediment/rock cores, vintage seismic data and integration and harmonization of multi-beam echo-sounder data (bathymetry) generated by the Italian scientific community. Based at CNR-ISMAR-Bologna.
  3) In synergy with 7.2 and 7.3, all participating institutes will implement activities of dissemination and outreach addressing research originated from scientific drilling towards students, educators, and citizens,

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP7.6

- Implementing Entity, Acronym and Operational Unit Name -UNIFI - Università degli Studi di Firenze, UNIFI-CPC ,

- Planned Activity description – This activity aims at developing an integrated platform to distribute, according to FAIR principles, data for the observation and the forecasting of ground deformations (landslides and subsidence), including the output from advanced monitoring platforms and hazard forecasting models in a multi-scale perspective.
  At the regional scale, the platform will share the output of statistical rainfall threshold models to provide landslide forecasts. An existing prototype will be transferred to the new FAIR platform, integrating data with those derived from other IRs. Moreover, the platform will host landslide and subsidence susceptibility maps, which are static elements expressing the spatial probability of occurrence of such processes. ATLaS has already developed machine learning techniques to enable this and the envisaged activity will consist in sharing the existing maps, integrating them with other data coming from other activities to perform a recursive validation and developing updated and improved versions of the maps, to be made available on the platform.
  - At the local scale, a platform for the visualisation and analysis of displacement time series of slope instabilities from different monitoring systems will be developed. This platform will enable a user-friendly interface to rapidly view data through a synoptic display of several series and, most notably, will include noise filters and models for the prediction of the time of failure of the monitored landslides. The main novelty of this platform is to enable real-time forecasts and to apply a probabilistic approach, in order to create a cloud of predictions that will allow decision-makers to take action with an increased confidence. The multi-sensor instrumentation already available at ATLaS will be integrated with devices and software specifically acquired for the project. This platform will grant the total control of data from acquisition to processing and sharing.,

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP7.2

- Implementing Entity, Acronym and Operational Unit Name -INGV - Istituto Nazionale di Geofisica e Vulcanologia , INGV-BO,

- Planned Activity description – 1) Facilitate the access of Italian scientists to the ICDP infrastructure with an increased participation in proposal writing, drilling expeditions, sample/data requests, and participation in the scientific advisory structure, and training schools. Priority will be given to Early Career Scientists and Ph.D. students. The access will take place according to well-tested principles of proportionality with respect to participation and scientific merit.
  2) In strict synergy with activities 7.1 and 7.3, INGV will implement activities of dissemination and outreach addressing research originated from scientific drilling towards students, school teachers, and citizens.,

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP7.7

- Implementing Entity, Acronym and Operational Unit Name -OGS - Istituto Nazionale di Oceanografia e di Geofisica Sperimentale , OGS_CRS,

- Planned Activity description – Over the past decade, SMINO grew both in the number of digital sensors used to record low and high-frequency ground motions and extension and spatial coverage. The increasing amount of information to be stored and distributed places increasing stress on the infrastructure. There is also a gap in the northern Adriatic Sea, limiting the quality and quantity of data and information of the area.
  For the modernization and completion of SMINO, we foresee two lines: 1) the completion of digital sensors and 2) the improvement of data communication and distribution to the international scientific community (Objective 2).
  1) In cooperation with the Friuli Venezia Giulia Region and its in-house company Insiel S.p.A., the use of the about 1675 km of optical fibers to obtain continuous and very dense monitoring of low and high-frequency soil movements. DAS technology allows high spatial and temporal resolution measurements even within urban areas, precluded to standard geophysical sensors. New DAS interrogators will be acquired for the continuous monitoring of ground movements in the piedmont area.
  We propose to install one underwater multi-parameter monitoring station in the northern Adriatic Sea (OBS -Ocean Bottom Seismographs-, gas meters, bio-chemical-physical water parameters) to cover the gap in real-time monitoring, being also an important link with WP5 and WP4. The project offers the opportunity to test/develop forefront instruments and methodologies at ideal different scales LABS. Synergy with the coordination of other complementary projects operating in hazard is considered of great importance, in particular for a harmonization of the produced complementary data sets.
  2) To cope with the amount of data (Petabytes) going on, we will shift to CLOUD resources and computing. We plan to modernise the network management infrastructures, to have a continuous flow of key information for defining shaking, deformation, and hazard maps, even during the critical post-disaster phases,

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP7.8

- Implementing Entity, Acronym and Operational Unit Name -OGS - Istituto Nazionale di Oceanografia e di Geofisica Sperimentale , OGS_GEO,

- Planned Activity description – Geophysics provides information on both shallow and deeper Earth structure and on the physical characteristics of the subsurface.The activity considers the collection and distribution of geophysical data as cross-cutting activity that supports the different Research Infrastructures of the Geosphere. Our approach aims at facilitating next generation and cutting-edge geophysical surveys in new application fields, to favour wider multidisciplinary collaborations both within the scientific community and with existing and new industrial partners.
  The activity is focused on: 1) the improvement of the digital geophysical data collection by innovative acquisition systems; 2) the generation of a new geophysical FAIR dataset to integrate the other existing databases.
  The acquisition of the cutting-edge seismic recording systems (nodes/wired remote units and DAS) fills a gap in the information presently given by actual geophysical infrastructures.
  The data sets collected from past and new experiments will be quality controlled, processed and post-processed and then made accessible to the public, the scientific community, local authorities, and industry.
  The large amount and wide spectrum of different data types that will be collected will entail the development of a new data management system that will require dedicated storage and computing facilities.To allow data to be Findable Accessible Interoperable and Reusable (FAIR), metadata will need to be produced and linked to data, populating a database that will be queried by a web-based system that will allow discovery, and interoperability with other international data sharing initiatives. In this perspective, metadata will need to follow international standards and be semantically enabled, while data formats will need to be compliant to standards used within the largest communities of researchers. All data will be identified through Digital Object Identifiers (DOI) to make possible the link from within scientific publications,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP7.9

- Implementing Entity, Acronym and Operational Unit Name -OGS - Istituto Nazionale di Oceanografia e di Geofisica Sperimentale , OGS_GEO,

- Planned Activity description – OGS owns a Seneca aircraft capable of acquiring remote sensing data, including LIDAR data that enable high-resolution digital elevation model (DEM) production for environmental applications. The platform is part of the EUFAR fleet. While remote sensing helps delineate surface structures, here we propose to develop an enhanced, better integrated and more widely accessible airborne platform for subsurface geosphere research, by including new payloads, namely aeromagnetic, and aerogravity
  We anticipate that this activity will help transform current national capabilities in airborne-related geosphere research and applications, by enabling next generation studies from shallow to deeper crustal levels to be launched. Modern aerogeophysical observations are still relatively sparse in Italy, despite their well-known utility worldwide to characterise both the structure and composition of different subsurface geological environs. We will acquire high-resolution digital aeromagnetic data sensors that are particularly useful for 3D imaging of buried basement fault systems, even in urban settings, and for defining the subsurface extent of intrusive and volcanic rocks. Fixed wing capabilities will be enhanced with the acquisition of two ultra-high resolution magnetic drones for follow up imaging of geological structures, including seismogenic faults monitored by our seismological network capabilities.
  We also propose to acquire a digital drone for georadar investigations to delineate shallow level (10s of m depth) geology.
  Finally, new capabilities in deeper geosphere imaging in particular over sedimentary basin environs will be enabled by acquiring and integrating a strap-down gravity system that will enable new aerogravity data collection in Italy, which is still largely devoid of this type of geophysical dataset .,
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP7.3

- Implementing Entity, Acronym and Operational Unit Name -OGS - Istituto Nazionale di Oceanografia e di Geofisica Sperimentale , OGS_GEO,

- Planned Activity description – 1) To implement and add to the existing scientific drilling infrastructure the presently missing borehole geophysics component. Existing data from downhole measurements, providing petrophysical characterization of sediment and rocks, will be collected and formatted for sharing within the Virtual Research Environment. Furthermore, the implementation of an improved access to the infrastructure through the provision of borehole geophysics services will be carried out.
  2) In synergy with the University of Pavia, finding, mapping digital archiving, accessing and sharing of petrographic, petrological and geochemical data extracted from igneous, metamorphic and mantle rocks collected by Italian scientists in IODP and ICDP frameworks. Access to analytical facilities on rock samples collected in future ECORD and ICDP drilling expeditions will also be provided.
  3) In synergy with the University of Milan, map, collect, validate and archive in a prototype data base of the Virtual Research Environment sediment samples from DSDP, ODP, IODP, drilling expeditions and all research by-products such as processed data series and publications. The archive will comprise digital and physical data storage allowing Open and Trans National Access following the FAIR principles.
  5) In synergy with the University of Florence collect, map and generate a thematic digital archive of structural data from cores, logging images and discrete samples, including: i) description and distribution of geometrical features; ii) analyses of stress in-situ and paleostress; iii) the drilling parameters and the laboratory experiments performed;
  4) In synergy with activities 7.1, and 7.2, promote and implement dissemination and outreach, of the research originated from scientific drilling towards students, school teachers, and citizens. All activities will be implemented in strict collaboration with WP8,

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Work Package N° WP5

Work Package Leader - 'Rosalia Santoleri, Research Director CNR-ISMAR'

1) Is the Work Package in compliance with the planned schedule for the achievement of the intermediate objectives, including any submitted changes?

yes, there are no reported delays in achieving the intermediate objectives

Please provide a detailed description of the ongoing critical issues, indicating their nature and possible solutions to ensure the success of the project within the planned timeframe:

Activity N° WP5.13

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IRSA,

- Planned Activity description – This task aims to expand the capacity of the different RIs insisting in the Ionian and Tyrrhenian Seas (e.g., eLTER, JERICO) to collect and deliver biological and ecological data in eulerian platforms, in order to fill crucial gaps in the Essential Variables observation framework (Bio-Eco EOVs and EBVs). A proper integration between oceanographic and biological/ecological research and monitoring is essential to broaden the spectrum of observing actions, holding the ecological connectivity concept as one of the main driving forces of marine ecosystems' functioning. Thus, both the understanding of the marine ecosystems and the assessment of their state and changes over time and space could be effectively enhanced.
  Particular attention will be devoted to the implementation of the observing capacity of:
  phytoplankton abundance, distribution and diversity: innovative instrumentation will allow to acquire near-real time data with an unprecedented time resolution (1 h) and to facilitate the broad taxonomic classification.
  macrofauna distribution, abundance and diversity: innovative instrumentation will allow us to map and monitor, e.g., fish and gelatinous macroplankton with RT imaging and an Automatic Identification System (AIS).
  The collection of supporting variables (e.g., temperature, salinity, oxygen, nutrients) and sub-variables (e.g., chlorophyll) will be also enhanced. Attention will be also dedicated to the analysis of organic and emerging pollutants in marine environment.
  The timeline will be as follow:
  A5.13.1. gap analysis and consolidation of the observational needs (1-6 month);
  A5.13.2. acquisition and deployment plan of the new instruments and sensors (7-18 month)
  A5.13.3. analysis of the main results from the enhanced observing systems (19-30 month).
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- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.14

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-ISP-ME,

- Planned Activity description – This Activity aims to recover and fill the gaps in EOVs, biological and habitat observations at Italian key sites in the Svalbard Islands (Kongsfjorden/Krossfjorden area; offshore Sptitsbergen), including coastal and off-shore permanent observatory platforms (n. 3 moorings, surface buoy, shore station), for a more comprehensive vision of the current and future Arctic ecosystem, key components of the global climate system. The UO will work to reinforce the data flow in polar regions, their disposability/usability by ITINERIS.
  Digital technologies will help to have a continuous understanding of the pressures on the natural environment and biodiversity. The use and integration of both advanced acquisition systems and automatic sensors will be adopted to improve real time and near real time data. This approach will include the exploitation of in situ multi-omics technologies for the characterization and quantification of pools of biological molecules that translate into the biodiversity, function, and dynamics of biological communities.
  This activity will be carried out with other RIs involved to realize the IOOS and the coverage and capability of abiotic and biotic observations (from microbes to marine mammals) actually jeopardized.
  Such improvement will allow to obtain a picture at ecosystem level, integrating near real time biological and ecosystem variables with EOVs, including automatic procedure for data validation and will permit FAIR data compliance. NADC and IADC polar data platforms will allow to bridge the polar data environment and IOOS.
  Tools for outreach, education and capacity building actions will be activated to increase public awareness about specific challenges of polar regions as well as to build new generations of polar researchers.
  The main activities are:
  A5.14.1. Gaps analyses in biological EOVs (1-6 month)
  A5.14.2. Acquisition of the new instruments/sensors, deployment and integration with IOOS (1-24 month)
  A5.14.3. Dissemination (1-30 month),

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.6

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNR-IAS,

- Planned Activity description – The activity aims at expanding the horizontal and vertical spatial coverage of EOVs and ECVs near real-time observations in two key areas of the Italian seas, the Ligurian sea and the coastal area of the Sicily channel. This challenge will be accomplished through two actions:
  A5.6.1. The first action aims at reducing the existing gap of measurements of EOVs and ECVs in near real-time from instruments moored in deep waters. To fill such a gap, the activity will empower the capacity of the Western Mediterranean research facility of EMSO of collecting near real-time physical data from the deep ocean. The implementation will consist of the implementation of data link from deployed deep instruments using fixed and mobile transponders and of improving the data transfer by installing a ground station ashore. (1-6 month)
  A5.6.2. The second action will expand the spatial coverage of bioacoustic and physical real-time observing of coastal marine ecosystems in Western Sicily acquiring two autonomous and land-synchronized buoys. The capabilities to perform automatic analysis of biodiversity and of the physical observation dataset will be improved as well. Furthermore, new acquired data will be harmonized and made available for data sharing through a web portal. (1-30 month)
  Both activities will also upgrade and make local data storage and processing capability of both infrastructure at the state-of-the-art also including the development of new synthesis products about the marine ecosystem for the IOOS National marine data centre.
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- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.1

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNRISMARVE,

- Planned Activity description – This activity aims at coordinating the effort to harmonize facilities, data and products provided by the different RIs and to build and test the Italian integrated Ocean Observing System (IOOS) able to ensure continuity of data and services and to respond to user requirements. IOOS will be implemented as an integrated system of systems with a single data interface to deliver smart observations, monitoring and modelling platforms, with harmonised working practices at Italian level. IOOS will proactively link together existing and planned observing systems, promoting the use of common technical standards with the goal to have coherent data sets compliant with FAIR principles. WP5 data flux will be then exposed through IOOS portal as a unique access point developed in Activities 5.2, 5.3 and 5.4 and interface with ITINERIS portal (WP2).
  The activity will be developed as following:
  - Coordination of the IOOS design and implementation interfacing with all the UOs involved in WP5 (1-30 month);
  - Overview and gap analysis of the national marine facilities and equipment with established access procedures (1-10 month);
  - design of the IOOS with creation and implementation of harmonic procedures for data production and management (1-12 month);
  - supplement and upgrading of the national equipment portfolio with new generation products for real time data transmission (6-30 month);
  - Monitor all WP5 activities and report to project coordinator WP1 (1-30 month);

  In addition, this activity will contribute to harmonization of the data and services provided by DANUBIUS, and by JERICO, ICOS components managed by CNR-ISMAR-Venezia. To ensure the full connectivity of the observing systems and empower the data acquisition and transfer with novel digital solutions, a dedicated action is planned to support the energy supply to sea facilities (fixed platforms), equipping them with instrumentation suited for better data acquisition and transfer.
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- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.17

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNRISMARVE,

- Planned Activity description – The Activity 5.17 aims at increasing the provision of modelled data filling recognized gaps in coastal environments and transitional zones, with a specific focus on the physical component. Outputs would support both process studies of the research community (dynamics in transitional environments, riverine influence, sediment transport), with high resolution modelled fields for the North Adriatic region, and needs of other stakeholders for operative products, connected to extreme events (e.g. storm surge). The activity will involve DANUBIUS for modelling, integrating the data contribution from all relevant environmental RIs (e.g. JERICO, ICOS, eLTER). Novel, more accurate model products integrated with Earth Observation (EO) data, would enhance the offer of European operative and other initiatives (e.g. Copernicus);
  The activity will develop as follows:
  A5.17.1. a review of the Italian offer in terms of modelled products on coastal and transitional environments will be provided, drafting a gap analysis. During the first year of activity new instrument installations and upgraded digital connections will start (1-12 month).
  A5.17.2. an identified set of EO data will be considered to improve modelling implementations, providing demonstrators' exercises in the North Adriatic region (e.g. use of data from all available RIs and from novel stations, what concerns water level, waves, temperature and salinity). Use of additional information from all RIs on sediments load, dispersion, marine litter tracking will be used for demonstrators' activities. A preliminary comparison of state of the art and new prototyping products will be provided evaluating the developed modelling products (6 – 24 month)
  A5.17.3. a defined framework to adapt the procedure to guarantee FAIR data release connected to the demonstrators' exercises will be tested and data will be made available on the Italian data centre (1-30 month).
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- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.19

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNRISMARVE,

- Planned Activity description – The aim of this activity is to build prototypes of integrated data products to provide information on selected processes, which may affect ecosystem structure and functioning (e.g. trophic state changes, biodiversity alteration); data products will be based on harmonized and validated datasets of parameters, coming from the various RIs.
  This approach aims to integrate different conceptual schemes of variables such as the Ecosystem Integrity (EI) and the Essential Variables frameworks, also to support and inform the main EU policies and strategies that deal with coastal and marine management.
  This activity will deliver:
  Data products based on merged selected oceanographic and biological/ecological parameters will be used to evaluate the Good Environmental Status (GEnS) as defined in the Marine Strategy Framework Directive on the basis of specific descriptors (e.g., eutrophication, hydrographical conditions);
  Data products based on merged selected oceanographic and biological/ecological parameters will be used to evaluate the Good Ecological Status (GEcS) as defined in the Water Framework Directive, in selected areas, where different RIs insist, providing an array of indicators based on the quality elements;
  Data products based on merged selected oceanographic and biological/ecological parameters will be used to evaluate the EI, as defined by Muller (2005), in selected areas, where different RIs insist, providing an array of EI indicators.
  The action is structured as follows:
  A5.19.1. analysis of the available parameters and of the requirements to deliver data products for the assessment of GenS, GeCs and EI (1-12 month);
  A5.19.2. Reinforcement and implementation of data products based on new acquired parameters for the assessment of GenS, GeCs and EI (12-24 month);
  A5.19.3. Development and realisation of demonstration exercises provided to the data centre for different stakeholders (12-30 month)
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- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.2

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNRISMARNA,

- Planned Activity description – Within the COI framework for the national marine data center, a main action to increase the storage and computing power to set up a national facility able to host ITINERIS data and services is foreseen. This facility will be part of the distributed IOOS data center, with shared activities and storage among other national poles and a marine hub to be set up in Naples and managed by COI National Ocean Data Committee and interfaced with ITINERIS central HUB.
  The planned activities are:
  A5.2.1. a planning phase in collaboration with WP5.3 and WP5.4 to identify data management needs, by defining requirements, structure, data flows and standards for the distributed and federated system; the IOOS data center governance will be drafted identifying roles and responsibilities for data management (1-6 month);
  A5.2.2. based on the community requirements and WP2 specification, the marine national facility will be built, as novel and complementary facility, to organize the national effort, improve connectivity and storage capabilities (1-30 month);
  A5.2.3. the marine data centre will be developed based on data themes, with data catalogues and datasets from all participating RIs. Data formats, vocabularies and services will be established in collaboration with WP5.3 and 5.4. Metadata of facilities and data will be collected from all the marine RIs, information will populate metadata and data catalogues developed by WP5.3 in compliance to FAIR principles and procedure from WP2 (1-30 month).
  A5.2.4. This marine central facility will integrate extra-RIs specific data, selected on the basis of the readiness and complementarity to existing RIs, made available to the central HUB, and will store all the RI CNR data. (16-30 month)
  A5.2.5. To ensure the full connectivity of the observing systems, empower the data acquisition and transfer with novel digital solutions, a dedicated action is planned to extend the JERICO observations toward the Southern area of the Italian seas (1-28 month).,

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.16

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNRISMARNA,

- Planned Activity description – This activity will enhance the capacity of the RV Falkor in terms of underway and/or continuous acquisition systems, as well as connectivity and real time data transmissions of data. Automation of underway observations is cost-effective for obtaining high-quality data at high spatial-temporal resolution. An expanding role for automated underway observations is envisioned by GOOS and will allow to compete at a high level with other main oceanographic institutions, in terms of automatic high-quality data acquisition and provision concerning carbon cycle, water cycle, warming climate, satellite data cal/val activities, model validation, ecosystem changes, habitat mapping. The activity will be structured as follows:
  A5.16.1. the details of the specific automatic devices will be set, and the tender will be issued (1-2 month)
  A5.16.2. complete the purchases of most of them and to install a state-of-the-art Ferrybox, i.e. an autonomous analytical system for measuring temperature, salinity, dissolved oxygen, fluorescence, total alkalinity and carbon dioxide in oceanic surface water, to be used underway and fully automatically. The other devices will also be purchased. Subsequently, the devices will be installed and will be ready to be used operationally (3-10 month)
  A5.16.3. a web-based access point will be developed that allows to visualise underway data, ship track and live maps, webcams and to make virtual tours of the vessel, enabling training and ocean literacy activities. A relocatable Remotely Operated Vehicle (ROV, light work class) will complement the activity, from which images can be livestreamed for interactive research and education (e.g. interactive lessons with students). (7-12 month)
  A5.16.4. the RV will be used and will test the transmission of underway data and other automatically collected data (10-30 month).
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- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.21

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNRISMARNA,

- Planned Activity description – The activity will be focused on the development and application of data-driven models for the reconstruction of the ocean state at mesoscale-resolving spatial resolution. The models will use innovative techniques (including deep learning algorithms/artificial intelligence) to combine observations collected by different sensors (including data provided by EU Copernicus services) aiming to provide improved descriptions of regional/basin scale 2D/3D (4D) distribution of selected EOV/ECV (e.g., temperature, salinity, ocean currents, chlorophyll a).
  The activity will exploit information coming from the RI participating in the project and also serve as a demonstrator of the usefulness and potential of the new data streams.
  The activity will include different steps:
  A5.21.1. Set up of the computing resources and interfaces to the IOOS Marine Data Centre and relevant external data sources (1-12 month).
  A5.21.2. Development of data-driven models based on existing observations. The models will be targeting mesoscale-resolving/improved coastal reconstructions of sea surface salinity and surface currents, as well as 3D projection of surface data at depths (including temperature, salinity and chlorophyll profiles). (6-24 month)
  A5.21.3. Test of data-driven methods and assessment based on new data streams. Depending on the prototype model considered, the new data streams will be initially used for models' validation, also eventually carried out within specific experiments, and integrated as additional input data sources at a later stage (25-30 month).
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- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.9

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNRISMARSP,

- Planned Activity description – The focus of Activity 5.9 is to increase the national monitoring level of the complex interplays between biogeochemical and physical processes taking place in the coastal environment. The proposed multiplatform approach will leverage on the coastal data measured in key areas by different RIs (JERICO, eLTER) using cameras and sensors mounted both on mobile (gliders and drifters) and fixed platforms (moorings). Mobile platforms help fill the gaps in EOV observations as they: a) sample different spatial scales, from the basin scale to the submesoscale; b) perform high-frequency and continuous observations; c) operate under bad-weather conditions, which may be the most interesting conditions for the ecosystem responses. The exploration of the complex interplays between biogeochemical and physical processes will also be based on other platforms measuring biological and physical variables (e.g., satellites, HF radars) in coastal environments. The acquired new biological data will also be used to calibrate and validate other extra-RI products funded by other EU initiatives (e.g., COPERNICUS with its satellite products).
  The Activity is organized as follows:
  A5.9.1. the calls for tenders for the acquisition of the mobile platforms (gliders and drifters) will start and the FAIR procedures will be established for the final data delivery. At the end of the year a gap analysis of biological observations in the Italian coastal environments will be provided (1-12 month);
  A5.9.2. the calls for tenders will be over and all new mobile platforms will be acquired within the first half of the second year (13-18 month);
  A5.9.3. deployment plans of all new mobile platforms to fill the gaps in specific key areas will be casted (7-24 month);
  A5.9.4. M30: new biological EOVs will be delivered ensuring FAIRness. Results of the multiplatform effort in coastal environments will be listed in a final report highlighting the relationships between biogeochemical and physical processes (7-30 month),

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.12

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNRISMARBO,

- Planned Activity description – This task aims to expand the capacity of the different RIs insisting in the Northern Adriatic Sea (eLTER, DANUBIUS, JERICO) to collect and deliver biological and ecological data in eulerian platforms, in order to fill crucial gaps in the Essential Variables observation framework (Bio-Eco EOVs, EBVs and ECVs). A proper integration between oceanographic and biological/ecological research and monitoring is essential to broaden the spectrum of observing actions, holding the ecological connectivity concept as one of the main driving forces of marine ecosystems' functioning. Thus, both the understanding of the marine ecosystems and the assessment of their state and changes over time and space could be effectively enhanced.
  Particular attention will be devoted to the implementation of the observing capacity of:
  - phytoplankton abundance, distribution and diversity: innovative instrumentation will allow to acquire near-real time data with an unprecedented time resolution (1 h) and to facilitate the broad taxonomic classification.
  - zooplankton abundance, distribution and diversity: the acquired instrumentation will allow automate imaging collection and facilitate the broad taxonomic classification.
  - macrofauna distribution, abundance and diversity: innovative instrumentation will allow us to map and monitor, e.g., fish and gelatinous macroplankton with RT imaging and an Automatic Identification System (AIS).
  The collection of supporting variables (e.g., temperature, salinity, oxygen, nutrients) and sub-variables (e.g. chlorophyll) will be also enhanced.
  The timeline will be as follow:
  A5.12.1. gap analysis and consolidation of the observational needs (1-6 month);
  A5.12.2. acquisition and deployment plan of the new instruments and sensors (7-18 month)
  A5.12.3. analysis of the main results from the enhanced observing systems (19-30 month).
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- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.10

- Implementing Entity, Acronym and Operational Unit Name -Consiglio Nazionale delle Ricerche, CNRISMARRM,

- Planned Activity description – Activity 5.10 will empower the NRT stream of observations for marine biota and biogeochemistry in the upper 2000m of regional open seas, develop synergies with complementary observations at the surface in close coastal environments and with satellite measurements operationally available from EU Copernicus services. Because marine biodiversity and related ecosystem functions occur over a continuum of spatial and temporal scales, a fit-for-purpose sampling is mandatory. The necessary observational breakthrough can only be achieved through deployment of Biogeochemical (BGC)-Argo profiling floats. These autonomous robots are the most flexible and cost-effective platforms to measure a wide range of EOVs and EBVs. They allow for adaptive sampling (i.e., both vertical and temporal resolutions) to track changes in the processes and their scales of occurrence in NRT thanks to the iridium antenna for a two-way communication then transmits via satellite the acquired data to land. Here, cutting-edge multi-sensor/multi-process Argo robots will fill the gap of biological and biogeochemical observations in the Italian open seas (Euro-Argo) over a continuum of spatial-temporal scales, also thanks to synergies with cameras for marine fauna and biogeochemical and Lagrangian drifters measuring biology at the surface at high frequency (JERICO), and satellite data. The activity is scheduled as:
  A5.10.1. Consolidation of observational needs: EOVs, EBVs and sensors in critically undersampled seas. Besides CTD and oxygen, floats will host optical sensors (chlorophyll, scattering, radiometry) and imaging cameras to better observe marine fauna (1–4 month).
  A5.10.2. Several BGC-Argo floats will be prepared, tested and deployed from vessels. Quality-control procedures will be implemented and/or developed for NRT distribution, also for biogeochemical drifters (5-30 month).
  A5.10.3. Synergies between BGC-Argo, drifters, cameras and satellite optical measurements will be developed (15-30 month),

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.5

- Implementing Entity, Acronym and Operational Unit Name -INGV - Istituto Nazionale di Geofisica e Vulcanologia , INGV-WIS,

- Planned Activity description – The activity shall enhance the capability data transfer in real time of the Western Ionian Sea EMSO node (WIS), a seafloor multi-sensor platform operating at 2000 m of water depth, extending the range of the observables and the depth range of measurements (i.e., water-column observation), providing hosting service to other disciplines (i.e., marine biology) and access (physical and virtual) to unprecedented deep-sea experiments. The contribution of this activity is detailed through the following actions:
  The network connectivity for real-time (RT) data transfer shall be improved through the deployment of a new submarine (e.o) cable connecting WIS to the shore station. The sea cable-termination will be capable of accommodating additional observation systems and equipment. A dedicated power and management system shall allow the access to the underwater facility and to distribute data in RT. This action will extend the operation of the facility for the next 20 years.
  A5.5.1. The mooring operating in the WIS facility will be upgraded with inductive cable and acoustic modems that will allow RT transfer of water column data to the shore station. (1-21 month).
  A5.5.2. The existing INGV data center of Portopalo will be upgraded for computing and massive storage to improve the data access and to contribute to geophysical, acoustic and environmental subset of marine data to the national marine data center. (1-30 month).
  A5.5.3. A Distributed Acoustic Sensor (DAS) system will be installed and operated to exploit the potential of the optical fibers of the cable for additional measurements (i.e., acoustic pressure) simultaneously all along the fiber length. Accordingly, the local computing and storage capacity will be also updated in order to handle a massive data flow. (1-30 month)
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- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.4

- Implementing Entity, Acronym and Operational Unit Name -INGV - Istituto Nazionale di Geofisica e Vulcanologia , INGV-BO,

- Planned Activity description –
  A5.4.1. Activity 5.4 will participate in the definition of a Data Management Plan (DMP) to describe how the data produced by RIs within the WP5 will be managed coherently, specifically data from INGV and EMSO in collaboration with UOs of CNR and OGS. The DMP covers the complete data life cycle, and describes the typology of data that will be harmonized and integrated during the project, the standards used, how the data will be preserved and shared from the marine infrastructure (1-24 month).
  A5.4.2. Activity 5.4 will participate in the design of the national integrated data portal to easy sharing INGV marine data. The access to open data will be guaranteed through ERDDAP, a data server that gives a simple, consistent way to download subsets of scientific datasets in common file formats and allows to produce graphs and maps. The ERDDAP data server will plug into the harmonized data and metadata repository and will expose the data. (1-30 month).
  A5.4.3. Activity 5.4 will also implement a prototype web application (geoportal) for visualization of data products, such as validated data time series of selected EOVs (physical and biogeochemical) from fixed stations (coastal, open ocean, bottom) based on SOURCE open code (Oliveri, and Simoncelli https://doi.org/10.5281/zenodo.5106546,Oliveri et al. 2022, https://doi.org/10.3389/fmars.2021.750387) and the corresponding synthetic time series extracted from open access model data. Derived quantities, such as averages at different time frequencies (daily, monthly, yearly), trends and model skill scores, will be also provided in order to allow a live characterization of the mooring site and a continuous monitoring of the marine environment. (1-30 month).
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- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.8

- Implementing Entity, Acronym and Operational Unit Name -ISPRA – Istituto Superiore per la Protezione e la Ricerca Ambientale, ISPRA,

- Planned Activity description – Monitoring data collected by the RI will be integrated and harmonized to be used on Geodatabase and GIS platforms. Standards already available (e.g. SeaDataNet, WMO) will be used and other formats will be proposed and implemented. ISPRA itself will provide monitoring data collected by its own present and future infrastructures, taking into account ongoing investments foreseen by other components of Italian Recovery and Resilience Plan (e.g. national wave network, national tide network, offshore buoys, 2 new research vessels). These infrastructures are part of GeoSciences. Such integration will also fully involve the Italian Information System – SIC which collects Italian Monitoring Programme for MSFD. Validation procedures will consolidate monitoring data according to planned quality assurance processes. Validated data will be integrated with re-analysis modelling products. Process of integration, harmonization, validation has the objective to provide data sets to support the following issues:
  - Assessment of GEnS for MSFD, characterization of pelagic and benthic habitats for the identification of new marine protected areas for the implementation of EU Biodiversity Strategy 2030
  - Identification of suitable areas for the implementation of renewable energy plants
  - Environmental Impact, Strategic Assessment procedures for coastal and marine infrastructures and for programmes and plans as MSP.

  The Activity is organized as follows:

  A5.8.1. data standards and validation criteria defined, calls for tenders for the acquisition of hardware and software platforms issued and awarded and employment recruitment procedures concluded (1-12 month);

  A5.8.2. data standards and validation procedures implemented, hardware and software platforms implemented, data collection flow implemented and data sets acquired and validated on hardware and software platforms (13-24 month);

  A5.8.3. production of data sets (monitoring and modelling) for specific environmental issues (13-30 month).,

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.7

- Implementing Entity, Acronym and Operational Unit Name -INFN - Istituto Nazionale di Fisica Nucleare, INFN - LNS,

- Planned Activity description – INFN-LNS contributes to WP5-O1 through a multi-task activity aimed at significant expansion of connectivity of scientific equipment in deep sea. The activity will focus on:
  A5.7.1. Upgrade of INFN-LNS shore labs to host new cabled observatories (1-30 month)
  A5.7.2. Design, production, integration and test of a new deep-sea Junction Box (JB) (1-30 month)
  The upgrade will include the civil works (building, power and data plants refurbishment) to adapt the shore laboratories owned by INFN-LNS to host the augmented power and data transfer systems from/to deep-sea. Reliability and redundancy criteria will be adopted to satisfy the scientific needs of connectivity and availability to the deep-sea assets.
  This activity also coordinates the production, integration and tests of a new JB to be installed at the 3500m deep LNS infrastructure of Capo Passero, already equipped with electro-optical cables.
  The JB will distribute and feed power supply to several subsea observatories and provide optical link for communication and data control/transfer between the observatories and the data acquisition systems hosted on shore. Qualified scientific payload can be also permanently fixed on JB, thanks to additional dedicated custom ports.
  The JB must be equipped with high-reliability mechanical, electrical and optical components satisfying MIL, oil&gas and space standards. A fully intrinsic design redundancy must be applied to guarantee no maintenance. Robust design specification, procurement through well-qualified companies, and extensive tests (environmental and functional tests) are key elements for the project planning and success. INFN has already designed and successfully operates a prototype JB at 3500 m, capable of interfacing about 10 observatories.
  An electro-optical interlink cable will be also purchased to connect the JB to the main electro-optical cable.
  INFN will also made available to the IOOS-NODC acoustic data from LNS and EMSO, and CTD, SV, CM data from EMSO/KM3NeT.
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- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.3

- Implementing Entity, Acronym and Operational Unit Name -OGS - Istituto Nazionale di Oceanografia e di Geofisica Sperimentale , OGS_OCE,

- Planned Activity description – The activities will focus on:
  A5.5.1. Improving the observational network in the northern Adriatic by increasing the surface currents measurements and coverage map, the acquisitions at observational sites of physical and biogeochemical variables with new buoys, profiling systems and sensors (JERICO), integrating pCO2, pH and optical measurements (ICOS), measuring flows at the lagoon inlets (Grado and Marano, DANUBIUS). The acquired data will be transmitted and interpolated through models (JERICO and DANUBIUS). The products will be visualised in a Geoportal of the North Adriatic Observational System. (1-30 month)
  A5.5.2. Improving the observational capacity of the southern Adriatic site by implementation and enhancement of a more stable and continuous real-time data transmission of physical and biochemical variables by means of acoustic data links coupled to sensors. Through this activity and the harmonisation with Argo float and glider data, it is expected to increase the Italian capacity of deep and open ocean observations. (EMSO, LNS, ICOS, Euro-Argo). (1-30 month)
  A5.5.3. Improving the high-frequency radar network in the Sicilian Channel by increasing surface current and wave measurements as well as data coverage. The data will increase the availability of oceanographic data for monitoring the area and feed into the Italian decision support system for risk management (JERICO). (1-30 month)
  A5.5.4. The UO will contribute to the Italian National Ocean Data Center (IOOS-NODC), by providing its experience as Italian reference within the IOC/IODE network of UNESCO Data Centers. The UO will follow the outcomes of the COI, the procedure from WP2, the SeaDataNet/EMODnet standards and will operate in interaction with WP5.2. The UO will develop metadata and data catalogues for data from marine RIs and the ITINERIS marine data Store. and will share the metadata guidelines. Attention will be dedicated to the Quality Control, in particular to the CO2 system data (1-30 month),

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.11

- Implementing Entity, Acronym and Operational Unit Name -OGS - Istituto Nazionale di Oceanografia e di Geofisica Sperimentale , OGS_OCE,

- Planned Activity description – The activities include:
  A5.11.1. The expansion of observational capabilities through the use of Lagrangian ARGO profilers will be carried out after a detailed analysis of key regions in our open seas. Floats equipped with new generation biogeochemical sensors and deep floats augmented with oxygen sensors will be deployed to improve the knowledge of the biological component. This will improve the observational capabilities, fill the gaps and a better interconnection with other infrastructures (like EMSO, ICOS,...) (1-30 month)
  A5.11.2. The creation of an incubator for Glider-Italy aims to test the development of a relocatable observing system, able to provide data in areas of interest not covered by other measurement systems. These piloted instruments profile from the surface to a depth of 1000m, in any weather condition for periods of months. Providing physical and biogeochemical parameters, they represent an important step towards a better space-time resolution of processes otherwise hardly studied (1-30 month)
  A5.11.3. The deployment of new sensors at the southern Adriatic Regional site is intended to integrate the observational capacity of biogeochemical and biological parameters (partial CO2, ocean sound and Photosynthetically Active Radiation - PAR) at the ecosystem level and fill the gaps in EOV measurements, especially at the bottom and surface level. The development and installation of a land-station will enhance the communication and the real-time data transfer of open ocean observations using satellite data transmission (ICOS, EMSO) (1-30 month)
  A5.11.4. The installation of instrumentation and sensors for the acquisition of biogeochemical parameters (pCO2, Oxygen, Nutrients,...) in the Northern Adriatic Sea to enhance the observational capabilities of existing sites, the installation of new sites instrumented will allow to extend the area monitored at the ecosystem level and fill the gaps in EOV measurements (JERICO, ICOS, DANUBIUS) (1-30 month)
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- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.18

- Implementing Entity, Acronym and Operational Unit Name -OGS - Istituto Nazionale di Oceanografia e di Geofisica Sperimentale , OGS_OCE,

- Planned Activity description – The UO OGS_OCE will focus on the development and application of ecosystem models for the northern Adriatic and the Northern Adriatic lagoons. As for the lagoons model, a better description of ecosystem dynamics will be reached by improving and applying the integrated SHYFEM-BFM system, obtained by coupling the transport model SHYFEM and the biogeochemical model BFM, by: i) Improving the parameterization of the plankton dynamic, related nutrient uptake and oxygen production, also capitalizing on the availability of data and information coming from the many RI participating to the project (e.g. DANUBIUS, eLTER, LIFEWATCH) and on new data streams implemented in the project; ii) Improving the definition of the inputs at the rivers-lagoon interface and of the exchanges at the lagoon inlets, thanks to new observing infrastructures deployed RI participating to the project (DANUBIUS, JERICO, LIFEWATCH, ICOS); iii) Improving the parallelization of the coupled code, so to have the possibility to run a significant number of test; iv) Analysis of biogeochemical dynamics within the lagoon and comparison with the available high frequency observations, sensitivity analysis and improvement of biogeochemical parameterization; v) Scenario analysis.
  As for the Northern Adriatic coastal area, we plan to apply the SHYFEM-BFM model used also for the lagoon, possibly in a configuration in which the lagoon is explicitly considered in the model domain, as well as to pursue the improvement and application of the already existing OGS North Adriatic operation system (medeaf.inogs.it/adriatic), built by capitalizing on our Copernicus experience built on the coupled MITGCM-BFM system. We plan to improve the existing framework by:
  A5.18.1. Integration of NRT-operational river runoff data (DANUBIUS) (1-15 month);
  A5.18.2. Integration of observation on exchanges at the lagoon inlets (DANUBIUS) (6-24 month);
  A5.18.3. Data assimilation of some of the available information (JERICO) (15-30 month).,

- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.20

- Implementing Entity, Acronym and Operational Unit Name -OGS - Istituto Nazionale di Oceanografia e di Geofisica Sperimentale , OGS_OCE,

- Planned Activity description – This activity will demonstrate advantages arising from the cross-infrastructure data integration (both eulerian and lagrangian) designing a prototype that will provide an overview (spatial and temporal) of all available observed variables and will return integrated and multidisciplinary information for enhancing the knowledge of the open sea.
  The implementation of this activity will be carried out through the following key steps:
  A5.20.1. Performing a survey able to return an overall distribution (spatial and temporal) of multidisciplinary data related to open sea RIs (Euro-Argo, EMSO, ICOS, EUROFLEETS, LNS). The survey is crucial to identify the best geographical area in which, taking into account the readiness of RIs, a demonstrator prototype can be developed. Further, it will highlight the need for a common future strategy to implement the efficiency and coverage of RIs (1-18 month);
  A5.20.2. Identification of the contribution of each RI, sharing and integration of specific datasets according to interoperable criteria, useful for the creation of multidisciplinary products (10-26 month);
  A5.20.3. Definition of basic requirements and design of a prototype for the integration of cross-infrastructural data. Actual implementation and demonstration (20-30 month).
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- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

Activity N° WP5.15

- Implementing Entity, Acronym and Operational Unit Name -OGS - Istituto Nazionale di Oceanografia e di Geofisica Sperimentale , OGS_CGN,

- Planned Activity description – Main target of the project is to increase the digital automation of the vessel. A modern automation and control system is a fully integrated system covering many aspects of the ship operation that includes the propulsion plant, the auxiliary engines, auxiliary machinery operation, cargo operation, navigation and administration of maintenance. In addition to all these aspects, in a research vessel the complexity augments due to the fact that onboard operates many different systems related to the scientific equipment onboard; for example, piston corers, oceanographic winches, seismic equipment, sonars, environmental sensors, CTD's, etc. Purpose of this task is to improve and extend the digital integration especially to the scientific equipment the automation and the e data harvesting in such a way that the information coming from all the equipment onboard will be fully stored onboard, and for part of it (part of the scientific data) transmitted to a "ground segment" in near real time. This leads to a possible duplication of part of the monitoring system located onboard the vessels in a remote location (office). A mandatory way through is the strengthening the communication capability of the vessel: Presently Laura Bassi mount two VSat antennas one in C and one in Ku band. The idea is to duplicate these assets to guarantee a constant data connection. Once data have been sent to the ground segment, the next step will be to implement a "remote control room" (a sort of virtual vessel) where data are collected and displayed and analysed. This virtual control room will be used for scientific research purposes and also for crew / student training. Data will be processed to comply with the FAIR principle. The data room implemented in will be also tool for harvesting data when the ship sails along the transits explicating the paradigm of underway data. (1-30 months),
- Has the activity changed significantly with respect to the planned technical-scientific content and/or the planned expenditure schedule?

no, it is in line with what it has been planned

Provide a detailed justification, indicating possible solutions:

SECTION 3 - INTERMEDIATE OBJECTIVES PROGRESS

Information relating to the progress of the individual Intermediate Objectives, submission of the expected Deliverables and updates on the indicators. If a Work Package does not proceed as expected, the difficulties that have emerged and the corrective actions must be highlighted.

Work Package N° WP4

Work Package Leader - 'Lucia Mona - Senior Researcher - CNR-IMAA'

INTERMEDIATE OBJECTIVES OF WORK PACKAGE, SCHEDULED TO BE ACHIEVED IN THE CURRENT BIMESTER

In the current bimester, the following Intermediate Work Package Objectives are expected to be achieved:

IO code	IO title
1931	**IO4.6**

Find below the detail of each Intermediate Objective relating to the Work Package of reference.

Intermediate Objective N° 1931

- Intermediate Objective title - IO4.6 ,
- Intermediate Objective description – IO4.6 – (B12) Reports on first operation at sites & reports about some Pilot services for OBJ2 and OBJ3: reports on the operation status for some activities provided (D4.2.3 D4.3.2 D4.4.3 D4.5.2 D4.8.2 D4.9.3). IO12 is a key milestone for the release of the products related to OBJ2 (D4.12.2 and D4.13.2) and for product definition related to OBJ3 (D4.14.2). Progress meeting for checking the status operation and data collection, and for the link with WP2 and WP8.,

- Planned objective indicators -Some objective, quantitative and measurable indicators are set as performance indicators to monitor the progresses of WP4 towards the achievement of its objectives. The performance indicators are set so that they will provide quantitative indication of the progresses with respect to the plans.
  In harmonization with other WPs, a first group of performance indicators monitor the execution of procedures propaedeutical to the objective achievement, i.e., the descriptions and acquisition of the assets (technological equipment mainly hardware and software) and the fixed term personnel (to be hired specifically for the project) which the funding is requested for. Intermediate values are set as target value for each performance indicator in correspondence with the WP4 milestones along with a final target foreseen at the end of the project.
  Performance indicators from 4.1 – 4.3 are administrative indicators while PI 4.4 is related to the technical/scientific advancements so can be intended as result indicators, which allow to measure of technical/scientific performance on the project progress and the effectiveness of the intervention carried out.
  In the following, there is the list of the indicators for WP4 with a brief description and objective and quantitative means of verification to measure it and the timing for the measurement of such indicators referred to the Intermediate Objectives of WP4 are listed in the following points [in brackets the value of the indicator in correspondence with the milestones IOs, and the target value at the end of the project]:
  PI 4.1 – Percentage of started purchase procedures [5%, 10%, 30%, 50%,70%,90%, 100%, 100%]
  method for measurement: decision to contract signed
  PI 4.2 - No. personnel selection procedures initiated [20, 25, 25, 25, 25, 25, 25, 25]
  method for measurement: call for selection published
  PI 4.3 - Percentage of granted contracts [0%, 5%, 10%, 30%, 60%, 80%, 90%, 100%]
  method for measurement: contracts signed
  PI 4.4 - No. deliverables released [4, 6, 11, 20, 27, 36, 45, 51]
  method for measurement: deliverables available through project platform
  Measuring progress against performance and result indicators will take place at the timing set by the milestones IOs, for implementation indicators for the ongoing monitoring (PI4.1 – PI4.4). Indicator measurement will pave the way to the overall performance assessment as well as to the introduction of corrective measures in case of significant deviations.
  Specific indicators are set up as impact indicators for assessing the effectiveness of the overall activities of WP4 in terms of potential impacts even in the long-term.
  PI 4.4 No. of new instruments up and running
  method for measurement: announcement of the start of the measurement for instrument or set of instruments on ITINERIS website and on social media [Target value at the end of the project 50 (estimated as 5 per each OU on average)]
  PI 4.5 No. of atmospheric datasets provided within ITINERIS
  method for measurement: number of atmospheric datasets available through ITINERIS resources [Target value at the end of the project 60 (estimated as 5 per each OU on average + 10

for the Pilot services activities ACT4.11-4.16)]
PI 4.6 No. of scientific publications using atmospheric data and tools produced within ITINERIS method for measurement: number of papers and conference abstracts with ITINERIS acknowledgements/references [Target value at the end of the project 30 (estimated as roughly 2 contributions as paper or abstract per each activity].
The measuring of impact indicators for the ex-post evaluation (PI 4.4 – PI 4.5) will take place annually.

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List of the Operational Units involved for the intermediate objective of reference

CNR-IMAA

CNR-ISACBO

CNR-ISACLT

CNR-ISACLE

CNR-ISP-BO

CNRISMARRM

UNIVE-DAIS

INFN - GE

INFN - FI

Has the intermediate objective been achieved as planned?

no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;

Are the indicators for assessing the achievement of the intermediate objective still the same?

Yes

Indication of the planned indicators:

PI 4.1 - 90% of purchasing procedures started [current status: 73% achieved]
PI 4.2 - 25 personnel selection procedures started [current status: 25 procedures started]
PI 4.3 - 80% of granted contract [current status: 58%]
PI 4.4 - 36 deliverables released [current status: 31 deliverables released]

Are the uploaded Deliverables compliant or equivalent as to demonstrating the achievement of the Intermediate Objective?

Yes

Work Package N° WP8

Work Package Leader - 'Antonello Provenzale - Institute Director CNR-IGG'

INTERMEDIATE OBJECTIVES OF WORK PACKAGE, SCHEDULED TO BE ACHIEVED IN THE CURRENT BIMESTER

In the current bimester, the following Intermediate Work Package Objectives are expected to be achieved:

IO code	IO title
1866	**IO8.8**

Find below the detail of each Intermediate Objective relating to the Work Package of reference.

Intermediate Objective N° 1866

- Intermediate Objective title - IO8.8,
- Intermediate Objective description – IO8.8 (B12): (a) All tender procedures are completed and the instrumentation is available, (b) implementation of all planned laboratory and field facilities, (c) advancement workshop with all hired personnel and permanent researchers involved in WP8, to verify the progress of the different WP Activities, (d) advancement reports for each WP Activity, (d) operational version of the CZ VRE service (D8.12), (e) operational version of the CLIMA VRE (D8.13), (f) operational implementation of the EV VRE including the selected EBVs and ECVs (D8.14).,

- Planned objective indicators -Performance indicators are designed to monitor WP8 progress, as for all other project WPs. These indicators provide a quantitative measure on what is achieved in the course of the project.

  The list of WP8 indicators includes a brief description, quantitative means of verification and the timing for the evaluation of the indicators, in agreement with the Intermediate Objectives of WP8 listed below [in brackets, the IO verification and its timing in bimesters].

  Performance indicators PI 8.1 – 8.5 are identified from the specifics of the proposed activities, i.e., from the descriptions of the proposed assets (technological equipment) and hired personnel. Intermediate values should follow the WP8 Intermediate Objectives, along with the final target at the end of the project.

  Performance indicators PI 8.1, PI 8.2, and PI 8.3 are mainly administrative indicators, whereas PI 8.4 and PI 8.5 are related to the technical/scientific advancement, and they can be interpreted as result indicators, allowing to measure of technical/scientific performance and the effectiveness of the intervention.

  PI 8.1 - Number of purchase procedures (including tenders) initiated [IO3-B3, IO5-B5]
  method of measurement: decision to sign a purchase contract

  PI 8.2 – Number of purchase procedures (including tenders) concluded and payed [IO1-B3, IO2-B5, IO3-B6, IO4-B7, IO5-B8, IO6-B9, IO7-B10]
  Method for measurement: contracts signed

  PI 8.3 - Number of hiring positions started [IO3-B6]
  Method for measurement: call for personnel selection published

  PI 8.4 - Number of deliverables released [IO1-B3, IO2-B5, IO3-B6, IO4-B7, IO5-B8, IO6-B9, IO7-B10, IO8-B12, IO9-B13, IO10-B14]
  Method for measurement: deliverables available on the project platform

  PI 8.5 – Number of operational VRE services [IO8-B12, IO10-B14]
  Method for measurement: operational VRE services reachable from the project platform

  Performance indicators PI 8.6 – 8.8 provide information on the effectiveness of the intervention in terms of its long-term impact and have been identified to facilitate ex-post assessment of the results. Impact indicators are constructed and quantified from the specificities of WP8 activities and the impact that WP8 aims to provide in the long term. Benchmark values drawn from national and international best practices are set for each indicator and are estimated considering 10 years of activity.

PI 8.6 - Number of remote/physical access requests to the measurement field and laboratory facilities [at least 20/yr in the ten-year period]
Method for measurement: remote/physical infrastructure access requests received

PI 8.7 - Number of user requests for virtual access to VRE services [at least 100/yr in the ten-year period]
Method for measurement: number of virtual access requests

PI 8.8 - Number of annual FAIR resources shared [a total of at least 8 resources/yr in the ten-year period]
Method for measurement: number of shared FAIR resources

For the implementation indicators PI 8.1 – PI 8.5, progress will be estimated at the timing set by the IOs. Indicator measurement will allow overall WP8 performance assessment and facilitate the introduction of corrective measures in case of significant deviations from the planned activities.

Impact indicators for ex-post evaluation (PI 8.6 – PI 8.8) will be estimated annually.

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List of the Operational Units involved for the intermediate objective of reference

CNR-IMAA

CNR-IBE

CNR-IGG

CNR-IRETFI

CNR-IRETLE

CNR-IRETRM

CNRISMARSP

OGS_OCE

Has the intermediate objective been achieved as planned?

yes

Are the indicators for assessing the achievement of the intermediate objective still the same?

Yes

Indication of the planned indicators:

PI 8.1 - Number of purchase procedures (including tenders) initiated - Method of measurement: decision to sign a purchase contract. EXPECTED: 43 REALIZED: 42
PI 8.2 – Number of purchase procedures (including tenders) concluded and payed - Method for measurement: contracts signed. EXPECTED : 21 REALIZED : 20.
PI 8.3 - Number of hiring positions started [18] - Method for measurement: call for personnel selection published. EXPECTED: 18, REALIZED : 18.
PI 8.4 - Number of deliverables released- Method for measurement: deliverables available on the project platform. EXPECTED : 14 REALIZED: 14
PI 8.5 – Number of operational VRE services. EXPECTED: 3 REALIZED: 3

Are the uploaded Deliverables compliant or equivalent as to demonstrating the achievement of the Intermediate Objective?

Yes

Work Package N° WP1

Work Package Leader - 'Gelsomina Pappalardo, Research Director CNR'

INTERMEDIATE OBJECTIVES OF WORK PACKAGE, SCHEDULED TO BE ACHIEVED IN THE CURRENT BIMESTER

In the current bimester, the following Intermediate Work Package Objectives are expected to be achieved:

IO code	IO title
1848	**IO1.12**

Find below the detail of each Intermediate Objective relating to the Work Package of reference.

Intermediate Objective N° 1848

- Intermediate Objective title - IO1.12,

- Intermediate Objective description – IO 1.12 (B12): a) Twelfth technical progress report; b) twelfth financial report; c) second update HR management plan; d) twelfth EB meeting; e) twelfth FOB meeting; f) fourth CC meeting.,

- Planned objective indicators -Performance indicators are set to monitor the WP1 progress as for all the project WPs. They will provide indications on what has been achieved with respect to what was planned in an objective, quantitative and measurable way.
  There are a first set of performance indicators constructed and quantified starting from the specifications of the proposed activities, i.e. from the descriptions of the assets (technological equipment mainly hardware and software) and the fixed term personnel (to be hired specifically for the project) which the funding is requested for. Intermediate values are set as target value for each performance indicator in correspondence with the WP1 Intermediate Objectives along with a final target foreseen at the end of the project.
  Performance Indicators (PI) from 1.1 – 2.3 are more administrative indicators while PI 2.4 is related to the technical/scientific advancements so can be intended as result indicators, which allow to measure of technical/scientific performance on the project progress and the effectiveness of the intervention carried out.
  Here in the following, there is the list of the indicators for WP1 with a brief description and an objective and quantitative means of verification to measure it and the timing for the measurement of such indicators referred to the Intermediate Objectives of WP1 listed in the following point [in brackets the value of the indicator in correspondence of the milestones IOs, and the target value at the end of the project (reported as last value)]:
  PI 1.1 - No. of purchase procedures initiated [3, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4]
  method for measurement: decision to contract signed
  PI 1.2 - No. of selection procedures initiated [6, 7, 8, 9, 9, 9, 9, 9, 9, 9, 9, 9, 9, 9]
  method for measurement: call for selection published
  PI 1.3 - No. of contracts granted [5, 4, 1, 2, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 15]
  method for measurement: contracts signed
  PI 1.4 - No. of deliverables released [3, 2, 3, 2, 2, 2, 2, 3, 2, 2, 2, 2, 2, 3, 4, 36]
  method for measurement: deliverables available through project web portal
  The indicator PI 1.5 allows to assess the effectiveness of the intervention in terms of its impact and have been identified to make the ex-post assessment of the expected results. Impact indicators are constructed and quantified from the peculiarity of WP1 activities (coordination and management of the entire project) and the impact that WP1 aims to produce in the long term. Benchmark values drawn from national and international best practices, are set for each indicator, and are estimated considering 10 years of operativity.
  PI 1.5 - No. of annual monitoring reports after the end of the project including impact indicators from all the other WPs [10]
  method for measurement: reports available on the project web portal
  Measuring progress against indicators will take place at the timing set by the milestones IOs, for performance indicators for the ongoing monitoring (PI1.1 – PI1.4). Indicator measurement will pave the way to the overall performance assessment as well as to the introduction of corrective measures in case of significant deviations. The measuring of impact indicators for the ex post evaluation (PI1.5) will take place annually.
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List of the Operational Units involved for the intermediate objective of reference

CNR-IMAA

Has the intermediate objective been achieved as planned?

yes

Are the indicators for assessing the achievement of the intermediate objective still the same?

Yes

Indication of the planned indicators:

PI 1.1 - No. of purchase procedures initiated [4] method for measurement: decision to contract signed –planned 4
PI 1.2 - No. of selection procedures initiated [9] method for measurement: call for selection published – planned 9
PI 1.3 - No. of contracts granted [12] method for measurement: contracts signed – planned 13
PI 1.4 - No. of deliverables released [27] method for measurement: deliverables available through project web portal – planned 27

Are the uploaded Deliverables compliant or equivalent as to demonstrating the achievement of the Intermediate Objective?

Yes

Work Package N° WP2

Work Package Leader - 'Carmela Cornacchia, senior technologist CNR-IMAA'

INTERMEDIATE OBJECTIVES OF WORK PACKAGE, SCHEDULED TO BE ACHIEVED IN THE CURRENT BIMESTER

In the current bimester, the following Intermediate Work Package Objectives are expected to be achieved:

IO code	IO title
1867	**IO2.4**

Find below the detail of each Intermediate Objective relating to the Work Package of reference.

Intermediate Objective N° 1867

- Intermediate Objective title - IO2.4,
- Intermediate Objective description – Intermediate Objective: WP2 - IO4 - Bimester 12
  Description:
  (a) Workshops/meetings (at least 2/months) with the hired personnel and RIs representatives involved in WP2, to ensure the internal and external coordination, and monitoring the progress of the activities;
  (b) First release of the Access Platform and related pilot testing;
  (c) First release of the Catalogue of data and services;
  (d) Release of the deliverables: D2.5 – first release; D2.6 – first release; D2.14 – final release.
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- Planned objective indicators -Performance indicators are set to monitor the WP2 progress as for all the projects WPs. They will provide indications on what has been achieved with respect to what was planned in an objective, quantitative and measurable way.
  There is a first set of performance indicators constructed and quantified starting from the specifications of the proposed activities, i.e. from the descriptions of the assets (technological equipment mainly hardware and software) and the fixed term personnel (to be hired specifically for the project) which the funding is requested for. Intermediate values are set as target value for each performance indicator in correspondence with the WP2 milestones along with a final target foreseen at the end of the project.
  Performance indicators from 2.1 to 2.3 are more administrative indicators while 2.4 is related to the technical/scientific advancements so can be intended as result indicator, which allows to measure the technical/scientific performance on the project progress and the effectiveness of the intervention carried out.
  Here in the following, there is the list of the indicators for WP2 with a brief description and an objective and quantitative means of verification to measure it and the timing for the measurement of such indicators referred to the Intermediate Objectives of WP2 listed in the following point [in brackets the value of the indicator in correspondence of the milestones IOs, and the target value at the end of the project è [WP2 - IO1 - Bimester 3; WP2 – IO2 - Bimester 6; WP2 – IO3 - Bimester 10; WP2 – IO4 - Bimester 12; WP2 – IO5 - end of the project]:
  · PI 2.1 - No. of purchase procedures initiated [3, 1, 1, 0, 0]
  method for measurement: decision to contract signed
  · PI 2.2 - No. of selection procedures initiated [13, 0, 0, 0, 0]
  method for measurement: call for selection published
  · PI 2.3 - No. of contracts granted [0, 3, 0, 1, 1]
  method for measurement: contracts signed
  · PI2.4 - No. of deliverables released [2, 6, 2, 1, 4]
  method for measurement: deliverables available through project platform.
  The indicators from PI2.5 – 2.8 allow to assess the effectiveness of the intervention in terms of its impact and have been identified to make the ex-post assessment of the expected results. Impact indicators are constructed and quantified from the peculiarity of WP2 activities and the impact that WP2 aims to produce in the long term. Benchmark values drawn from national and international best practices, are set for each indicator, and are estimated considering 10 years of operation.
  · PI2.5 - No. of remote/physical access requests [6000]
  method for measurement: requested received
  · PI2.6 - No. of user requests for virtual access [>3000/month]
  method for measurement: n. of access to ITINERIS HUB
  · PI2.7 - No. of FAIR resources shared [>1000/year]
  method for measurement: number of FAIR resources
  · PI2.8 - No. of views of FAIR resources [>30000/year]
  method for measurement: number of views

Measuring progress against indicators will take place at the timing set by the milestones IOs, for implementation indicators for the ongoing monitoring (PI2.1 – PI2.4). Indicator measurement will pave the way to the overall performance assessment as well as to the introduction of corrective measures in case of significant deviations.
The measuring of impact indicators for the ex post evaluation (PI2.5 – PI2.8) will take place annually.
,

List of the Operational Units involved for the intermediate objective of reference

CNR-IMAA

CNR-IRETLE

Has the intermediate objective been achieved as planned?

no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;

Are the indicators for assessing the achievement of the intermediate objective still the same?

Yes

Indication of the planned indicators:

PI 2.1 - No. of purchase procedures initiated [4]: planned 4
PI 2.2 - No. of selection procedures initiated [15]: planned 15
PI 2.3 - No. of contracts granted [15]: planned 14
PI2.4 - No. of deliverables released [7]: planned 7

Are the uploaded Deliverables compliant or equivalent as to demonstrating the achievement of the Intermediate Objective?

Yes

Work Package N° WP3

Work Package Leader - 'Alberto Basset, full professor Università degli Studi del Salento, Associate CNR'

INTERMEDIATE OBJECTIVES OF WORK PACKAGE, SCHEDULED TO BE ACHIEVED IN THE CURRENT BIMESTER

In the current bimester, the following Intermediate Work Package Objectives are expected to be achieved:

IO code	IO title
1887	**IO3.8**

Find below the detail of each Intermediate Objective relating to the Work Package of reference.

Intermediate Objective N° 1887

- Intermediate Objective title - IO3.8,
- Intermediate Objective description – IO.8 – (B12): (a) 100% of the second-year advanced courses in the actions 3.6 and 3.7 given; (b) Final release of the training resources made available by the Environmental RIs on the ITINERIS FAIR Training Catalogue; (c) WP meeting; (d) D3.10, D3.11, D3.12, D3.13, D3.14, D3.15.,

- Planned objective indicators -Performance indicators are set to monitor the WP3 progress throughout the project duration and in the following five years of full operation of the ITINERIS Training Platform.
  There are a first set of performance indicators is constructed and quantified starting from the specifications of the proposed activities, i.e. from the descriptions of the assets and services (e.g. software, agreements with the Universities) of the activities (e.g., number of courses delivered, fellowships assigned, …..) and the fixed term personnel (to be hired specifically for the project) which the funding is requested for. Intermediate values are set as target value for each performance indicator in correspondence with the WP3 milestones along with a final target foreseen at the end of the project.
  Performance indicators from 3.1 – 3.4 are more administrative indicators while PI 3.5 – 3.7 are more result indicators, which allow to measure of technical/scientific and activity performance on the project progress and the effectiveness of the intervention carried out.
  The list of these indicators with a brief description, an objective and quantitative means of verification and measurement and the timing for the measurement of such indicators [in brackets the value of the indicator in correspondence of the milestones IOs, and the target value at the end of the project] is reported below:
  PI 3.1 - No. of purchase/protocols of agreement procedures initiated [5,2,5,0,0,0,0,0,0,0,12]
  method for measurement: decision to contract/agreement signed
  PI 3.2 - No. of RTD hired [8,8,9,9,10,10,10,10,10,10,10]
  method for measurement: contracts signed
  PI 3.3 - No. of PhD selection procedures initiated [15,0,0,0,0,15,0,0,0,0,0,0]
  method for measurement: call for selection published
  PI3.4 - No. of courses delivered [20, 20,20,20, 20, 20,20,20,20, 20,100]
  method for measurement: course materials and training object available through the project Training Platform
  PI3.5 - No. of fellowships assigned [15,0,0,0,15,0,0,0,0,0,30]
  method for measurement: fellows pages available through the project Training Platform
  PI3.6 - No. of deliverables released [0,1,5,1,1,1,1,5,1,1,19]
  method for measurement: deliverables available through project platform
  The indicators from PI3.8 – 3.9 allow to assess the effectiveness of the intervention in terms of its impact and have been identified to make the ex-post assessment of the expected results. Impact indicators are constructed and quantified from the peculiarity of WP3 activities and the impact that WP3 aims to produce in the long term. Benchmark values drawn from national and international best practices, are set for each indicator, and are estimated considering 10 years of operativity.
  PI3.7 - No. of digital training objects (training courses, tutorials, …)accessible through the project Training Platform [>500]
  method for measurement: digital training objects accessible through the project Training Platform
  PI3.8 - No. of users of the digital training objects [>1000]

method for measurement: yearly visits/downloads of digital training objects from the ITINERIS Training Platform
PI3.9 - No. of annual Training resources shared with the European components of the RIs [>100]
method for measurement: n° of uploads of Training resources by European components of the RIs / n° of Training resources delivered in kind to the ERICs
Measuring progress against indicators will take place at the timing set by the milestones IOs, for implementation indicators for the ongoing monitoring (PI3.1 – PI3.6). Indicator measurement will pave the way to the introduction of corrective measures in case of significant deviations. The measuring of impact indicators for the ex post evaluation (PI3.7 – PI3.9) will take place annually
,

List of the Operational Units involved for the intermediate objective of reference

CNR-IMAA

CNR-IGG

CNR-IRETLE

CNR-IRETRM

CNRISMARVE

Has the intermediate objective been achieved as planned?

no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;

Are the indicators for assessing the achievement of the intermediate objective still the same?

Yes

Indication of the planned indicators:

PI 3.1 - No. of purchase/protocols of agreement procedures-initiated [10] method for measurement: decision to contract/agreement signed – planned 12
PI 3.2 - No. of RTD hired [9] method for measurement: contracts signed – planned 9
PI 3.3 - No. of PhD selection procedures initiated [21] method for measurement: call for selection published – planned 30
PI3.4 - No. of courses delivered [1] method for measurement: course materials and training object available through the project Training Platform – planned 20
PI3.5 - No. of fellowships assigned [20] method for measurement: fellows pages available through the project Training Platform – planned 30
PI3.6 - No. of deliverables released [9] method for measurement: deliverables available through project platform – planned 15

Are the uploaded Deliverables compliant or equivalent as to demonstrating the achievement of the Intermediate Objective?

Yes

UPDATE ON INTERMEDIATE WORK PACKAGE OBJECTIVES, WHOSE ACHIEVEMENT WAS EXPECTED IN THE PREVIOUS BIMESTERS

Intermediate objectives not achieved in the previous bimesters:

IO code	IO title	Reference bimester
1880	**IO3.3**	**6**
1885	**IO3.6**	**9**
1884	**IO3.5**	**8**
1878	**IO3.2**	**4**
1886	**IO3.7**	**10**

Find below the detail of each Intermediate Objective relating to the Work Package of reference.

Intermediate Objective N° IO3.3

- Intermediate Objective title - IO3.3,
- Intermediate Objective description – IO 3 - (B6): (a) 100% of the first-year advanced courses in the actions 3.6 and 3.7 given; (b) D3.2, D3.3, D3.4, D3.5, D3.6, D3.7; (c) WP meeting.,

- Planned objective indicators -Performance indicators are set to monitor the WP3 progress throughout the project duration and in the following five years of full operation of the ITINERIS Training Platform.
  There are a first set of performance indicators is constructed and quantified starting from the specifications of the proposed activities, i.e. from the descriptions of the assets and services (e.g. software, agreements with the Universities) of the activities (e.g., number of courses delivered, fellowships assigned, …..) and the fixed term personnel (to be hired specifically for the project) which the funding is requested for. Intermediate values are set as target value for each performance indicator in correspondence with the WP3 milestones along with a final target foreseen at the end of the project.
  Performance indicators from 3.1 – 3.4 are more administrative indicators while PI 3.5 – 3.7 are more result indicators, which allow to measure of technical/scientific and activity performance on the project progress and the effectiveness of the intervention carried out.
  The list of these indicators with a brief description, an objective and quantitative means of verification and measurement and the timing for the measurement of such indicators [in brackets the value of the indicator in correspondence of the milestones IOs, and the target value at the end of the project] is reported below:
  PI 3.1 - No. of purchase/protocols of agreement procedures initiated [5,2,5,0,0,0,0,0,0,0,12]
  method for measurement: decision to contract/agreement signed
  PI 3.2 - No. of RTD hired [8,8,9,9,10,10,10,10,10,10,10]
  method for measurement: contracts signed
  PI 3.3 - No. of PhD selection procedures initiated [15,0,0,0,0,15,0,0,0,0,0,0]
  method for measurement: call for selection published
  PI3.4 - No. of courses delivered [20, 20,20,20, 20, 20,20,20,20, 20,100]
  method for measurement: course materials and training object available through the project Training Platform
  PI3.5 - No. of fellowships assigned [15,0,0,0,15,0,0,0,0,0,30]
  method for measurement: fellows pages available through the project Training Platform
  PI3.6 - No. of deliverables released [0,1,5,1,1,1,1,5,1,1,19]
  method for measurement: deliverables available through project platform
  The indicators from PI3.8 – 3.9 allow to assess the effectiveness of the intervention in terms of its impact and have been identified to make the ex-post assessment of the expected results. Impact indicators are constructed and quantified from the peculiarity of WP3 activities and the impact that WP3 aims to produce in the long term. Benchmark values drawn from national and international best practices, are set for each indicator, and are estimated considering 10 years of operativity.
  PI3.7 - No. of digital training objects (training courses, tutorials, …)accessible through the project Training Platform [>500]
  method for measurement: digital training objects accessible through the project Training Platform
  PI3.8 - No. of users of the digital training objects [>1000]

method for measurement: yearly visits/downloads of digital training objects from the ITINERIS Training Platform
PI3.9 - No. of annual Training resources shared with the European components of the RIs [>100]
method for measurement: n° of uploads of Training resources by European components of the RIs / n° of Training resources delivered in kind to the ERICs
Measuring progress against indicators will take place at the timing set by the milestones IOs, for implementation indicators for the ongoing monitoring (PI3.1 – PI3.6). Indicator measurement will pave the way to the introduction of corrective measures in case of significant deviations. The measuring of impact indicators for the ex post evaluation (PI3.7 – PI3.9) will take place annually
,

List of the Operational Units involved for the intermediate objective of reference

CNR-IMAA

CNR-IGG

CNR-IRETLE

CNR-IRETRM

CNRISMARVE

Has the intermediate objective been achieved as planned?

no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;

Are the indicators for assessing the achievement of the intermediate objective still the same?

Yes

Indication of the planned indicators:

PI 3.1 - No. of purchase/protocols of agreement procedures initiated [9] method for measurement: decision to contract/agreement signed - planned 12
PI 3.2 - No. of RTD hired [9] method for measurement: contracts signed - planned 9
PI 3.3 - No. of PhD selection procedures initiated [21] method for measurement: call for selection published - planned 15
PI3.4 - No. of courses delivered [0] method for measurement: course materials and training object available through the project Training Platform - planned 20
PI3.5 - No. of fellowships assigned [20] method for measurement: fellows pages available through the project Training Platform - planned 15
PI3.6 - No. of deliverables released [8] method for measurement: deliverables available through project platform - planned 8

Are the uploaded Deliverables compliant or equivalent as to demonstrating the achievement of the Intermediate Objective?

Yes

Find below the detail of each Intermediate Objective relating to the Work Package of reference.

Intermediate Objective N° IO3.6

- Intermediate Objective title - IO3.6,
- Intermediate Objective description – IO.6 - (B9): (a) 50% of the second-year advanced courses in the actions 3.6 and 3.7 given; (b) WP meeting.,

- Planned objective indicators -Performance indicators are set to monitor the WP3 progress throughout the project duration and in the following five years of full operation of the ITINERIS Training Platform.
  There are a first set of performance indicators is constructed and quantified starting from the specifications of the proposed activities, i.e. from the descriptions of the assets and services (e.g. software, agreements with the Universities) of the activities (e.g., number of courses delivered, fellowships assigned, …..) and the fixed term personnel (to be hired specifically for the project) which the funding is requested for. Intermediate values are set as target value for each performance indicator in correspondence with the WP3 milestones along with a final target foreseen at the end of the project.
  Performance indicators from 3.1 – 3.4 are more administrative indicators while PI 3.5 – 3.7 are more result indicators, which allow to measure of technical/scientific and activity performance on the project progress and the effectiveness of the intervention carried out.
  The list of these indicators with a brief description, an objective and quantitative means of verification and measurement and the timing for the measurement of such indicators [in brackets the value of the indicator in correspondence of the milestones IOs, and the target value at the end of the project] is reported below:
  PI 3.1 - No. of purchase/protocols of agreement procedures initiated [5,2,5,0,0,0,0,0,0,0,12]
  method for measurement: decision to contract/agreement signed
  PI 3.2 - No. of RTD hired [8,8,9,9,10,10,10,10,10,10,10]
  method for measurement: contracts signed
  PI 3.3 - No. of PhD selection procedures initiated [15,0,0,0,0,15,0,0,0,0,0,0]
  method for measurement: call for selection published
  PI3.4 - No. of courses delivered [20, 20,20,20, 20, 20,20,20,20, 20,100]
  method for measurement: course materials and training object available through the project Training Platform
  PI3.5 - No. of fellowships assigned [15,0,0,0,15,0,0,0,0,0,30]
  method for measurement: fellows pages available through the project Training Platform
  PI3.6 - No. of deliverables released [0,1,5,1,1,1,1,5,1,1,19]
  method for measurement: deliverables available through project platform
  The indicators from PI3.8 – 3.9 allow to assess the effectiveness of the intervention in terms of its impact and have been identified to make the ex-post assessment of the expected results. Impact indicators are constructed and quantified from the peculiarity of WP3 activities and the impact that WP3 aims to produce in the long term. Benchmark values drawn from national and international best practices, are set for each indicator, and are estimated considering 10 years of operativity.
  PI3.7 - No. of digital training objects (training courses, tutorials, …)accessible through the project Training Platform [>500]
  method for measurement: digital training objects accessible through the project Training Platform
  PI3.8 - No. of users of the digital training objects [>1000]

method for measurement: yearly visits/downloads of digital training objects from the ITINERIS Training Platform
PI3.9 - No. of annual Training resources shared with the European components of the RIs [>100]
method for measurement: n° of uploads of Training resources by European components of the RIs / n° of Training resources delivered in kind to the ERICs
Measuring progress against indicators will take place at the timing set by the milestones IOs, for implementation indicators for the ongoing monitoring (PI3.1 – PI3.6). Indicator measurement will pave the way to the introduction of corrective measures in case of significant deviations. The measuring of impact indicators for the ex post evaluation (PI3.7 – PI3.9) will take place annually
,

List of the Operational Units involved for the intermediate objective of reference

CNR-IMAA

CNR-IGG

CNR-IRETLE

CNR-IRETRM

CNRISMARVE

Has the intermediate objective been achieved as planned?

no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;

Are the indicators for assessing the achievement of the intermediate objective still the same?

Yes

Indication of the planned indicators:

PI 3.1 - No. of purchase/protocols of agreement procedures initiated [9] method for measurement: decision to contract/agreement signed – planned 12
PI 3.2 - No. of RTD hired [9] method for measurement: contracts signed – planned 9
PI 3.3 - No. of PhD selection procedures initiated [21] method for measurement: call for selection published – planned 30
PI3.4 - No. of courses delivered [0] method for measurement: course materials and training object available through the project Training Platform – planned 20
PI3.5 - No. of fellowships assigned [20] method for measurement: fellows pages available through the project Training Platform – planned 30
PI3.6 - No. of deliverables released [9] method for measurement: deliverables available through project platform – planned 9

Are the uploaded Deliverables compliant or equivalent as to demonstrating the achievement of the Intermediate Objective?

Yes

Find below the detail of each Intermediate Objective relating to the Work Package of reference.

Intermediate Objective N° IO3.5

- Intermediate Objective title - IO3.5,
- Intermediate Objective description – IO3.5 - (B8): (a) 50% of the digital training objects for the needs of the actions 3.6 and 3.7 realized; (b) WP meeting.,

- Planned objective indicators -Performance indicators are set to monitor the WP3 progress throughout the project duration and in the following five years of full operation of the ITINERIS Training Platform.
  There are a first set of performance indicators is constructed and quantified starting from the specifications of the proposed activities, i.e. from the descriptions of the assets and services (e.g. software, agreements with the Universities) of the activities (e.g., number of courses delivered, fellowships assigned, …..) and the fixed term personnel (to be hired specifically for the project) which the funding is requested for. Intermediate values are set as target value for each performance indicator in correspondence with the WP3 milestones along with a final target foreseen at the end of the project.
  Performance indicators from 3.1 – 3.4 are more administrative indicators while PI 3.5 – 3.7 are more result indicators, which allow to measure of technical/scientific and activity performance on the project progress and the effectiveness of the intervention carried out.
  The list of these indicators with a brief description, an objective and quantitative means of verification and measurement and the timing for the measurement of such indicators [in brackets the value of the indicator in correspondence of the milestones IOs, and the target value at the end of the project] is reported below:
  PI 3.1 - No. of purchase/protocols of agreement procedures initiated [5,2,5,0,0,0,0,0,0,0,12]
  method for measurement: decision to contract/agreement signed
  PI 3.2 - No. of RTD hired [8,8,9,9,10,10,10,10,10,10,10]
  method for measurement: contracts signed
  PI 3.3 - No. of PhD selection procedures initiated [15,0,0,0,0,15,0,0,0,0,0,0]
  method for measurement: call for selection published
  PI3.4 - No. of courses delivered [20, 20,20,20, 20, 20,20,20,20, 20,100]
  method for measurement: course materials and training object available through the project Training Platform
  PI3.5 - No. of fellowships assigned [15,0,0,0,15,0,0,0,0,0,30]
  method for measurement: fellows pages available through the project Training Platform
  PI3.6 - No. of deliverables released [0,1,5,1,1,1,1,5,1,1,19]
  method for measurement: deliverables available through project platform
  The indicators from PI3.8 – 3.9 allow to assess the effectiveness of the intervention in terms of its impact and have been identified to make the ex-post assessment of the expected results. Impact indicators are constructed and quantified from the peculiarity of WP3 activities and the impact that WP3 aims to produce in the long term. Benchmark values drawn from national and international best practices, are set for each indicator, and are estimated considering 10 years of operativity.
  PI3.7 - No. of digital training objects (training courses, tutorials, …)accessible through the project Training Platform [>500]
  method for measurement: digital training objects accessible through the project Training Platform
  PI3.8 - No. of users of the digital training objects [>1000]

method for measurement: yearly visits/downloads of digital training objects from the ITINERIS Training Platform
PI3.9 - No. of annual Training resources shared with the European components of the RIs [>100] method for measurement: n° of uploads of Training resources by European components of the RIs / n° of Training resources delivered in kind to the ERICs
Measuring progress against indicators will take place at the timing set by the milestones IOs, for implementation indicators for the ongoing monitoring (PI3.1 – PI3.6). Indicator measurement will pave the way to the introduction of corrective measures in case of significant deviations. The measuring of impact indicators for the ex post evaluation (PI3.7 – PI3.9) will take place annually
,

List of the Operational Units involved for the intermediate objective of reference

CNR-IMAA

CNR-IGG

CNR-IRETLE

CNR-IRETRM

CNRISMARVE

Has the intermediate objective been achieved as planned?

no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;

Are the indicators for assessing the achievement of the intermediate objective still the same?

Yes

Indication of the planned indicators:

PI 3.1 - No. of purchase/protocols of agreement procedures initiated [9] method for measurement: decision to contract/agreement signed – planned 12
PI 3.2 - No. of RTD hired [9] method for measurement: contracts signed – planned 9
PI 3.3 - No. of PhD selection procedures initiated [21] method for measurement: call for selection published – planned 30
PI3.4 - No. of courses delivered [0] method for measurement: course materials and training object available through the project Training Platform – planned 20
PI3.5 - No. of fellowships assigned [20] method for measurement: fellows pages available through the project Training Platform – planned 30
PI3.6 - No. of deliverables released [9] method for measurement: deliverables available through project platform – planned 9

Are the uploaded Deliverables compliant or equivalent as to demonstrating the achievement of the Intermediate Objective?

Yes

Find below the detail of each Intermediate Objective relating to the Work Package of reference.

Intermediate Objective N° IO3.2

- Intermediate Objective title - IO3.2,
- Intermediate Objective description – IO 3.2 - (B4): (a) All procedures for the realization of both Training Platforms and digital training objects (activity 3.1 and 3.8) assigned; (b) 50% of the first-year advanced courses in the actions 3.6 and 3.7 given; (c) WP meeting; (d) D3.1.,

- Planned objective indicators -Performance indicators are set to monitor the WP3 progress throughout the project duration and in the following five years of full operation of the ITINERIS Training Platform.
  There are a first set of performance indicators is constructed and quantified starting from the specifications of the proposed activities, i.e. from the descriptions of the assets and services (e.g. software, agreements with the Universities) of the activities (e.g., number of courses delivered, fellowships assigned, …..) and the fixed term personnel (to be hired specifically for the project) which the funding is requested for. Intermediate values are set as target value for each performance indicator in correspondence with the WP3 milestones along with a final target foreseen at the end of the project.
  Performance indicators from 3.1 – 3.4 are more administrative indicators while PI 3.5 – 3.7 are more result indicators, which allow to measure of technical/scientific and activity performance on the project progress and the effectiveness of the intervention carried out.
  The list of these indicators with a brief description, an objective and quantitative means of verification and measurement and the timing for the measurement of such indicators [in brackets the value of the indicator in correspondence of the milestones IOs, and the target value at the end of the project] is reported below:
  PI 3.1 - No. of purchase/protocols of agreement procedures initiated [5,2,5,0,0,0,0,0,0,0,12]
  method for measurement: decision to contract/agreement signed
  PI 3.2 - No. of RTD hired [8,8,9,9,10,10,10,10,10,10,10]
  method for measurement: contracts signed
  PI 3.3 - No. of PhD selection procedures initiated [15,0,0,0,0,15,0,0,0,0,0,0]
  method for measurement: call for selection published
  PI3.4 - No. of courses delivered [20, 20,20,20, 20, 20,20,20,20, 20,100]
  method for measurement: course materials and training object available through the project Training Platform
  PI3.5 - No. of fellowships assigned [15,0,0,0,15,0,0,0,0,0,30]
  method for measurement: fellows pages available through the project Training Platform
  PI3.6 - No. of deliverables released [0,1,5,1,1,1,1,5,1,1,19]
  method for measurement: deliverables available through project platform
  The indicators from PI3.8 – 3.9 allow to assess the effectiveness of the intervention in terms of its impact and have been identified to make the ex-post assessment of the expected results. Impact indicators are constructed and quantified from the peculiarity of WP3 activities and the impact that WP3 aims to produce in the long term. Benchmark values drawn from national and international best practices, are set for each indicator, and are estimated considering 10 years of operativity.
  PI3.7 - No. of digital training objects (training courses, tutorials, …)accessible through the project Training Platform [>500]
  method for measurement: digital training objects accessible through the project Training Platform
  PI3.8 - No. of users of the digital training objects [>1000]

method for measurement: yearly visits/downloads of digital training objects from the ITINERIS Training Platform
PI3.9 - No. of annual Training resources shared with the European components of the RIs [>100]
method for measurement: n° of uploads of Training resources by European components of the RIs / n° of Training resources delivered in kind to the ERICs
Measuring progress against indicators will take place at the timing set by the milestones IOs, for implementation indicators for the ongoing monitoring (PI3.1 – PI3.6). Indicator measurement will pave the way to the introduction of corrective measures in case of significant deviations. The measuring of impact indicators for the ex post evaluation (PI3.7 – PI3.9) will take place annually
,

List of the Operational Units involved for the intermediate objective of reference

CNR-IMAA

CNR-IGG

CNR-IRETLE

CNR-IRETRM

CNRISMARVE

Has the intermediate objective been achieved as planned?

no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;

Are the indicators for assessing the achievement of the intermediate objective still the same?

Yes

Indication of the planned indicators:

PI 3.1 - No. of purchase/protocols of agreement procedures initiated [9] method for measurement: decision to contract/agreement signed - planned 7
PI 3.2 - No. of RTD hired [9] method for measurement: contracts signed - planned 8
PI 3.3 - No. of PhD selection procedures initiated [21] method for measurement: call for selection published - planned 15
PI3.4 - No. of courses delivered [0] method for measurement: course materials and training object available through the project Training Platform - planned 20
PI3.5 - No. of fellowships assigned [20] method for measurement: fellows pages available through the project Training Platform - planned 15
PI3.6 - No. of deliverables released [1] method for measurement: deliverables available through project platform - planned 1

Are the uploaded Deliverables compliant or equivalent as to demonstrating the achievement of the Intermediate Objective?

Yes

Find below the detail of each Intermediate Objective relating to the Work Package of reference.

Intermediate Objective N° IO3.7

- Intermediate Objective title - IO3.7,
- Intermediate Objective description – IO.7 - (B 10): (a) ITINERIS Semantic Training Platform on Environmental Sciences published in the ITINERIS Training Platform; (b) D3.9; (c) WP meeting.,

- Planned objective indicators -Performance indicators are set to monitor the WP3 progress throughout the project duration and in the following five years of full operation of the ITINERIS Training Platform.
  There are a first set of performance indicators is constructed and quantified starting from the specifications of the proposed activities, i.e. from the descriptions of the assets and services (e.g. software, agreements with the Universities) of the activities (e.g., number of courses delivered, fellowships assigned, …..) and the fixed term personnel (to be hired specifically for the project) which the funding is requested for. Intermediate values are set as target value for each performance indicator in correspondence with the WP3 milestones along with a final target foreseen at the end of the project.
  Performance indicators from 3.1 – 3.4 are more administrative indicators while PI 3.5 – 3.7 are more result indicators, which allow to measure of technical/scientific and activity performance on the project progress and the effectiveness of the intervention carried out.
  The list of these indicators with a brief description, an objective and quantitative means of verification and measurement and the timing for the measurement of such indicators [in brackets the value of the indicator in correspondence of the milestones IOs, and the target value at the end of the project] is reported below:
  PI 3.1 - No. of purchase/protocols of agreement procedures initiated [5,2,5,0,0,0,0,0,0,0,12]
  method for measurement: decision to contract/agreement signed
  PI 3.2 - No. of RTD hired [8,8,9,9,10,10,10,10,10,10,10]
  method for measurement: contracts signed
  PI 3.3 - No. of PhD selection procedures initiated [15,0,0,0,0,15,0,0,0,0,0,0]
  method for measurement: call for selection published
  PI3.4 - No. of courses delivered [20, 20,20,20, 20, 20,20,20,20, 20,100]
  method for measurement: course materials and training object available through the project Training Platform
  PI3.5 - No. of fellowships assigned [15,0,0,0,15,0,0,0,0,0,30]
  method for measurement: fellows pages available through the project Training Platform
  PI3.6 - No. of deliverables released [0,1,5,1,1,1,1,5,1,1,19]
  method for measurement: deliverables available through project platform
  The indicators from PI3.8 – 3.9 allow to assess the effectiveness of the intervention in terms of its impact and have been identified to make the ex-post assessment of the expected results. Impact indicators are constructed and quantified from the peculiarity of WP3 activities and the impact that WP3 aims to produce in the long term. Benchmark values drawn from national and international best practices, are set for each indicator, and are estimated considering 10 years of operativity.
  PI3.7 - No. of digital training objects (training courses, tutorials, …)accessible through the project Training Platform [>500]
  method for measurement: digital training objects accessible through the project Training Platform
  PI3.8 - No. of users of the digital training objects [>1000]

method for measurement: yearly visits/downloads of digital training objects from the ITINERIS Training Platform
PI3.9 - No. of annual Training resources shared with the European components of the RIs [>100]
method for measurement: n° of uploads of Training resources by European components of the RIs / n° of Training resources delivered in kind to the ERICs
Measuring progress against indicators will take place at the timing set by the milestones IOs, for implementation indicators for the ongoing monitoring (PI3.1 – PI3.6). Indicator measurement will pave the way to the introduction of corrective measures in case of significant deviations. The measuring of impact indicators for the ex post evaluation (PI3.7 – PI3.9) will take place annually
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List of the Operational Units involved for the intermediate objective of reference

CNR-IMAA

CNR-IGG

CNR-IRETLE

CNR-IRETRM

CNRISMARVE

Has the intermediate objective been achieved as planned?

no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;

Are the indicators for assessing the achievement of the intermediate objective still the same?

Yes

Indication of the planned indicators:

PI 3.1 - No. of purchase/protocols of agreement procedures initiated [9] method for measurement: decision to contract/agreement signed – planned 12
PI 3.2 - No. of RTD hired [9] method for measurement: contracts signed – planned 9
PI 3.3 - No. of PhD selection procedures initiated [21] method for measurement: call for selection published – planned 30
PI3.4 - No. of courses delivered [0] method for measurement: course materials and training object available through the project Training Platform – planned 20
PI3.5 - No. of fellowships assigned [20] method for measurement: fellows pages available through the project Training Platform – planned 30
PI3.6 - No. of deliverables released [9] method for measurement: deliverables available through project platform – planned 9

Are the uploaded Deliverables compliant or equivalent as to demonstrating the achievement of the Intermediate Objective?

Yes

Work Package N° WP6

Work Package Leader - 'Dario Papale Associate Professor University Tuscia /associated CNR-IRET'

INTERMEDIATE OBJECTIVES OF WORK PACKAGE, SCHEDULED TO BE ACHIEVED IN THE CURRENT BIMESTER

In the current bimester, the following Intermediate Work Package Objectives are expected to be achieved:

IO code	IO title
1895	**IO6.5**

Find below the detail of each Intermediate Objective relating to the Work Package of reference.

Intermediate Objective N° 1895

- Intermediate Objective title - IO6.5,
- Intermediate Objective description – IO6.5-(B12): (a) Progress meeting to discuss the project status and last possible actions; (b) Release of deliverables D6.4, D6.5, D6.6, D6.7 and D6.8. (c) sensors and equipment purchase completed; (d) test installation and demonstration of sensors and equipment bought in the previous bimesters;,

- Planned objective indicators -The first two Performance Indicators are designed to track and ensure the use of resources as planned in the project proposal and in relation to the different activities. In particular the percentage of purchase hiring procedures. For each indicator is reported the Intermediate Objective of reference and the technical criteria for evaluation:
  WP6-PI1 – Percentage of purchase procedures initiated (with reference to the budget) – link: WP6-IO1; WP6-IO2; WP6-IO3; WP6-IO4; WP6-IO5; WP6-IO6.
  Verification method: percentage of the total budget used in tenders
  Indicators and timing: [B6: 35%; B9: 67%; B11: 76%; B12 87%; B13: 100%]

  WP6-PI2 – Percentage of hiring procedures initiated (with reference to the budget) – link: WP6-IO1; WP6-IO2.
  Verification method: percentage of the total budget used in hiring procedures
  Indicators and timing: [B2: 41%; B6: 100%]

  Two additional Performance Indicators are instead designed to track the activities of the project as proposed in the activities and the achievement of the results and impact. For each indicator is reported the Intermediate Objective of reference and the technical criteria for evaluation:

  WP6-PI3 – Number of Deliverables completed and reported – link: WP6-IO2; WP6-IO4; WP6-IO5; WP6-IO6; WP6-IO7.
  Verification method: total number of deliverables released
  Indicators and timing: [B6: 1; B11: 3; B12 8; B13: 16; B14: 24]

  WP6-PI4 – Number of scientific publications using ITINERIS Terrestrial Biosphere data or services – link: all the IOs.
  Verification method: number of articles with ITINERIS in the acknowledgment and based on WP6 data and services
  Indicators and timing: [B15: 50]

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List of the Operational Units involved for the intermediate objective of reference

CNR-IBBA

CNR-IBBRBA

CNR-IBBRNA

CNR-IBE

CNR-IGG

CNR-IPSPNA

CNR-IPSPFI

CNR-IRETFI

CNR-IRETLE

CNR-IRETRM

CNR-IRSA

CNRISMARVE

UNIFIDAGRI

UNIFI–SMA

INFN - BA

Has the intermediate objective been achieved as planned?

no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;

Are the indicators for assessing the achievement of the intermediate objective still the same?

Yes

Indication of the planned indicators:

PI1 – Percentage of purchase procedures initiated (with reference to the budget) – Verification method: percentage of the total budget used in tenders Indicators and timing (76%) : planned 76% - Target: 87% of the budget used in tenders.
PI2 – values not expected for this bimester
PI3 – realized 3; planned 8
PI4 – values not expected for this bimester.

Are the uploaded Deliverables compliant or equivalent as to demonstrating the achievement of the Intermediate Objective?

Yes

UPDATE ON INTERMEDIATE WORK PACKAGE OBJECTIVES, WHOSE ACHIEVEMENT WAS EXPECTED IN THE PREVIOUS BIMESTERS

Intermediate objectives not achieved in the previous bimesters:

IO code	IO title	Reference bimester
1894	**IO6.4**	**11**

Find below the detail of each Intermediate Objective relating to the Work Package of reference.

Intermediate Objective N° IO6.4

- Intermediate Objective title - IO6.4,
- Intermediate Objective description – IO6.4 - (B11): (a) Release of deliverables D6.2 and D6.3; (b) Third draft version of the planned deliverables; (c) update of D6.1 with new activities; (d) test installation and demonstration of sensors and equipment bought in the previous bimesters; (e) WP progress meeting.,

- Planned objective indicators -The first two Performance Indicators are designed to track and ensure the use of resources as planned in the project proposal and in relation to the different activities. In particular the percentage of purchase hiring procedures. For each indicator is reported the Intermediate Objective of reference and the technical criteria for evaluation:
  WP6-PI1 – Percentage of purchase procedures initiated (with reference to the budget) – link: WP6-IO1; WP6-IO2; WP6-IO3; WP6-IO4; WP6-IO5; WP6-IO6.
  Verification method: percentage of the total budget used in tenders
  Indicators and timing: [B6: 35%; B9: 67%; B11: 76%; B12 87%; B13: 100%]

  WP6-PI2 – Percentage of hiring procedures initiated (with reference to the budget) – link: WP6-IO1; WP6-IO2.
  Verification method: percentage of the total budget used in hiring procedures
  Indicators and timing: [B2: 41%; B6: 100%]

  Two additional Performance Indicators are instead designed to track the activities of the project as proposed in the activities and the achievement of the results and impact. For each indicator is reported the Intermediate Objective of reference and the technical criteria for evaluation:

  WP6-PI3 – Number of Deliverables completed and reported – link: WP6-IO2; WP6-IO4; WP6-IO5; WP6-IO6; WP6-IO7.
  Verification method: total number of deliverables released
  Indicators and timing: [B6: 1; B11: 3; B12 8; B13: 16; B14: 24]

  WP6-PI4 – Number of scientific publications using ITINERIS Terrestrial Biosphere data or services – link: all the IOs.
  Verification method: number of articles with ITINERIS in the acknowledgment and based on WP6 data and services
  Indicators and timing: [B15: 50]

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List of the Operational Units involved for the intermediate objective of reference

CNR-IBBA

CNR-IBBRBA

CNR-IBBRNA

CNR-IBE

CNR-IGG

CNR-IPSPNA

CNR-IPSPFI

CNR-IRETFI

CNR-IRETLE

CNR-IRETRM

CNR-IRSA

CNRISMARVE

UNIFIDAGRI

UNIFI–SMA

INFN - BA

Has the intermediate objective been achieved as planned?

yes

Are the indicators for assessing the achievement of the intermediate objective still the same?

Yes

Indication of the planned indicators:

PI1 – Percentage of purchase procedures initiated (with reference to the budget) – Verification method: percentage of the total budget used in tenders Indicators and timing (76%) : planned 76% *PI2 – values not expected for this bimester* *PI3 – realized 3; planned 3* *PI4 – values not expected for this bimester.*

Are the uploaded Deliverables compliant or equivalent as to demonstrating the achievement of the Intermediate Objective?

Yes

Work Package N° WP7

Work Package Leader - 'Giuliana Rossi - researcher - OGS'

INTERMEDIATE OBJECTIVES OF WORK PACKAGE, SCHEDULED TO BE ACHIEVED IN THE CURRENT BIMESTER

In the current bimester, the following Intermediate Work Package Objectives are expected to be achieved:

IO code	IO title
1877	**IO7.5**

Find below the detail of each Intermediate Objective relating to the Work Package of reference.

Intermediate Objective N° 1877

- Intermediate Objective title - IO7.5,
- Intermediate Objective description – IO7.5-(B12): (a) First experimental data with the new instruments; (b) Progress meeting to discuss the project status and last possible actions; (c) Release of the D7.3; D7.6; D7.8; D7.9.,

- Planned objective indicators -Performance indicators are set to monitor the WP7 progress as for all the project WPs. They will provide indications on what has been achieved with respect to what was planned in an objective, quantitative and measurable way.
  There is a first set of performance indicators constructed and quantified starting from the specifications of the proposed activities, i.e., from the descriptions of the assets (technological equipment, mainly hardware and software) and the fixed term personnel (to be hired specifically for the project), for which the funding is requested. Intermediate values are set as target values for each performance indicator in correspondence with the WP7 IOs and a final target foreseen at the end of the project.
  Performance indicators from 7.1 – 7.3 are more administrative indicators, while PI 7.4 is related to the technical/scientific advancements intended as result indicators, which allow measuring technical/scientific performance on the project progress and the effectiveness of the intervention.
  In the following, the list of the indicators for WP7, with a brief description, an objective and quantitative means of verification to measure it and the timing for the measurement, referred to the Intermediate Objectives of WP7, [in brackets the value of the indicator in correspondence of the IOs, and the target value at the end of the project]:
  PI 7.1 - Percentage of purchase procedures initiated [62%, 80%, 90%, 100%, 100%, 100%, 100%, 100%
  method for measurement: decision to contract signed
  PI 7.2 - Percentage of selection procedures initiated [22%, 100%, 100%, 100%, 100%, 100%, 100%, 100%
  method for measurement: call for selection published
  PI 7.3 - Percentage of contracts granted [53%, 94%, 100%, 100%, 100%, 100%, 100%, 100%]
  method for measurement: contracts signed
  PI 7.4 - No. of deliverables released [0, 0, 1, 1, 4, 0, 3, 0]
  method for measurement: deliverables available through project platform

  The indicators from PI7.5 – 7.9 allow us to assess the effectiveness of the intervention in terms of its impact. These have been identified to make an ex-post assessment of expected results in the following ten years. Impact indicators are constructed and quantified from WP7 activities' peculiarity and the impact that WP7 aims to produce in the long term. Benchmark values drawn from national and international best practices are set for each indicator and are estimated considering ten years of operativity.

  A5.21.1. PI7.5 - No. of remote/physical access requests [750]
  method for measurement: requested received
  PI7.6 - No. of user requests for virtual access [1500]
  method for measurement: number of applications for access users, or number of unique users/visits/logins, distinguishing between different kinds of service (data, services, VRE)
  PI7.7 - No. of papers using the data and citing the RI [240]
  method for measurement: number of papers citing the RIs and the data (through DOI) (search

acknowledgment in Scopus and own collection of non-indexed products).
PI7.8 - No. of projects using the RI and the derived data [60]
method for measurement: number of projects using the RI and the derived data.
PI7.9 - No. of Italian researchers involved in the activities of ECORD and ICDP programs [30].
Method for measurement: number of researchers involved (compared to the year 2021 used as a reference baseline ECORD-ICDP as international infrastructure keeps track of all accesses sorted by countries).
Measuring progress against indicators will take place at the timing set by the milestones IOs, for implementation indicators for the ongoing monitoring (PI7.1 – PI7.4). Indicator measurement will pave the way to the overall performance assessment as well as to the introduction of corrective measures in case of significant deviations.
The measuring of impact indicators for the ex post evaluation (PI7.5 – PI7.9) will take place annually.

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List of the Operational Units involved for the intermediate objective of reference

CNR-IMAA

CNR-IREA

CNRISMARBO

UNIFI-CPC

INGV-BO

OGS_CRS

OGS_GEO

Has the intermediate objective been achieved as planned?

yes

Are the indicators for assessing the achievement of the intermediate objective still the same?

Yes

Indication of the planned indicators:

PI 7.1 - Percentage of purchase procedures initiated [96%] - planned 100%
PI 7.2 - Percentage of selection procedures initiated [100%] - planned 100%
PI 7.3 - Percentage of contracts granted [88%] - planned 100%
PI 7.4 - No. of deliverables released [5] - planned 6

Are the uploaded Deliverables compliant or equivalent as to demonstrating the achievement of the Intermediate Objective?

Yes

UPDATE ON INTERMEDIATE WORK PACKAGE OBJECTIVES, WHOSE ACHIEVEMENT WAS EXPECTED IN THE PREVIOUS BIMESTERS

Intermediate objectives not achieved in the previous bimesters:

IO code	IO title	Reference bimester
1875	**IO7.4**	**11**

Find below the detail of each Intermediate Objective relating to the Work Package of reference.

Intermediate Objective N° IO7.4

- Intermediate Objective title - IO7.4,
- Intermediate Objective description – IO7.4-(B11): (a)Standardization of the metadata and data format on the repositories; (b) tenders, sensors and equipment purchase completed; (c) completion of the installation of sensors and equipment for field and laboratory facilities; (e) Release of deliverables D7.2; (f) WP progress meeting.,

- Planned objective indicators -Performance indicators are set to monitor the WP7 progress as for all the project WPs. They will provide indications on what has been achieved with respect to what was planned in an objective, quantitative and measurable way.
  There is a first set of performance indicators constructed and quantified starting from the specifications of the proposed activities, i.e., from the descriptions of the assets (technological equipment, mainly hardware and software) and the fixed term personnel (to be hired specifically for the project), for which the funding is requested. Intermediate values are set as target values for each performance indicator in correspondence with the WP7 IOs and a final target foreseen at the end of the project.
  Performance indicators from 7.1 – 7.3 are more administrative indicators, while PI 7.4 is related to the technical/scientific advancements intended as result indicators, which allow measuring technical/scientific performance on the project progress and the effectiveness of the intervention.
  In the following, the list of the indicators for WP7, with a brief description, an objective and quantitative means of verification to measure it and the timing for the measurement, referred to the Intermediate Objectives of WP7, [in brackets the value of the indicator in correspondence of the IOs, and the target value at the end of the project]:
  PI 7.1 - Percentage of purchase procedures initiated [62%, 80%, 90%, 100%, 100%, 100%, 100%, 100%
  method for measurement: decision to contract signed
  PI 7.2 - Percentage of selection procedures initiated [22%, 100%, 100%, 100%, 100%, 100%, 100%, 100%
  method for measurement: call for selection published
  PI 7.3 - Percentage of contracts granted [53%, 94%, 100%, 100%, 100%, 100%, 100%, 100%]
  method for measurement: contracts signed
  PI 7.4 - No. of deliverables released [0, 0, 1, 1, 4, 0, 3, 0]
  method for measurement: deliverables available through project platform

  The indicators from PI7.5 – 7.9 allow us to assess the effectiveness of the intervention in terms of its impact. These have been identified to make an ex-post assessment of expected results in the following ten years. Impact indicators are constructed and quantified from WP7 activities' peculiarity and the impact that WP7 aims to produce in the long term. Benchmark values drawn from national and international best practices are set for each indicator and are estimated considering ten years of operativity.

  A5.21.1. PI7.5 - No. of remote/physical access requests [750]
  method for measurement: requested received
  PI7.6 - No. of user requests for virtual access [1500]
  method for measurement: number of applications for access users, or number of unique users/visits/logins, distinguishing between different kinds of service (data, services, VRE)
  PI7.7 - No. of papers using the data and citing the RI [240]
  method for measurement: number of papers citing the RIs and the data (through DOI) (search

acknowledgment in Scopus and own collection of non-indexed products).
PI7.8 - No. of projects using the RI and the derived data [60]
method for measurement: number of projects using the RI and the derived data.
PI7.9 - No. of Italian researchers involved in the activities of ECORD and ICDP programs [30].
Method for measurement: number of researchers involved (compared to the year 2021 used as a reference baseline ECORD-ICDP as international infrastructure keeps track of all accesses sorted by countries).
Measuring progress against indicators will take place at the timing set by the milestones IOs, for implementation indicators for the ongoing monitoring (PI7.1 – PI7.4). Indicator measurement will pave the way to the overall performance assessment as well as to the introduction of corrective measures in case of significant deviations.
The measuring of impact indicators for the ex post evaluation (PI7.5 – PI7.9) will take place annually.

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List of the Operational Units involved for the intermediate objective of reference

CNR-IMAA

CNR-IREA

CNRISMARBO

UNIFI-CPC

INGV-BO

OGS_CRS

OGS_GEO

Has the intermediate objective been achieved as planned?

no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;

Are the indicators for assessing the achievement of the intermediate objective still the same?

Yes

Indication of the planned indicators:

PI 7.1 - Percentage of purchase procedures initiated [87%] *PI 7.2 - Percentage of selection procedures initiated [96%]* *PI 7.3 - Percentage of contracts granted [64%]* *PI 7.4 - No. of deliverables released [1]*

Are the uploaded Deliverables compliant or equivalent as to demonstrating the achievement of the Intermediate Objective?

Yes

Work Package N° WP5

Work Package Leader - 'Rosalia Santoleri, Research Director CNR-ISMAR'

INTERMEDIATE OBJECTIVES OF WORK PACKAGE, SCHEDULED TO BE ACHIEVED IN THE CURRENT BIMESTER

In the current bimester, the following Intermediate Work Package Objectives are expected to be achieved:

IO code	IO title
1909	**IO5.7**

Find below the detail of each Intermediate Objective relating to the Work Package of reference.

Intermediate Objective N° 1909

- Intermediate Objective title - IO5.7,
- Intermediate Objective description – IO5.7 – (B12) Implementation of the data center features (CNR-ISMAR-Napoli, OGS_OCE, INGV-BO, INFN-LNS); WP progress meeting.,

- Planned objective indicators -Performance indicators are set to monitor the WP5 progress for all activities. They will provide indications on what has been achieved with respect to what was planned in an objective, quantitative and measurable way.
  There is a first set of performance indicators constructed and quantified starting from the specifications of the proposed activities, i.e. from the descriptions of the assets (technological equipment mainly hardware and software) and the fixed term personnel (to be hired specifically for the project) which the funding is requested for. Intermediate values are set as target value for each performance indicator in correspondence with the WP5 Intermediate Objectives along with a final target foreseen at the end of the project.
  Performance Indicators (PI) from 5.1 – 5.3 are more administrative indicators while PI 5.4 is related to the technical/scientific advancements so can be intended as result indicators, which allow to measure of technical/scientific performance on the project progress and the effectiveness of the intervention carried out.
  Here in the following, there is the list of the indicators for WP5 with a brief description and an objective and quantitative means of verification to measure. The timing for the measurement of such indicators are inserted taking into account the Intermediate Objectives of WP5 scheduling listed in the following point [in brackets the value of the indicator in correspondence of the milestones IOs (1,3,4,5,7,9,12,14,15), and the target value at the end of the project (reported in bold)]:

  PI 5.1 - No. of purchase procedures initiated [10, 0, 30, 10, 10, 0, 0, 0, 0, 0, 0, 60]
  method for measurement: decision to contract signed
  PI 5.2 - No. of selection procedures initiated [25, 0, 24, 0, 0, 0, 0, 0, 0, 0, 0, 49]
  method for measurement: call for selection published
  PI 5.3 - No. of contracts granted [0, 0, 24, 20, 20, 30, 10, 10, 0, 0, 0, 0, 114]
  method for measurement: contracts signed
  PI 5.4 - No. of deliverables released [0, 0, 3, 2, 1, 3, 0, 0, 2, 0, 0, 6, 0, 14, 1, 32]
  method for measurement: deliverables available through project web portal
  PI 5.5 No of EOV, EBVs and ECV available in the marine integrated data center node [0, 0, 0, 0, 0, 25, 13, 38]
  The indicator PI 5.5 allows to assess the effectiveness of the intervention in terms of its impact and have been identified to make the ex-post assessment of the expected results. Impact indicators are constructed and quantified from the peculiarity of WP5 activities and the impact that WP5 aims to produce in the long term. Benchmark values drawn from national and international best practices, are set for each indicator, and are estimated considering 10 years of operativity.

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List of the Operational Units involved for the intermediate objective of reference

CNR-IRSA

CNR-ISP-ME

CNR-IAS

CNRISMARVE

CNRISMARNA

CNRISMARSP

CNRISMARBO

CNRISMARRM

INGV-WIS

INGV-BO

ISPRA

INFN - LNS

OGS_OCE

OGS_CGN

Has the intermediate objective been achieved as planned?

no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;

Are the indicators for assessing the achievement of the intermediate objective still the same?

Yes

Indication of the planned indicators:

PI 5.1 - No. of purchase procedures initiated [118] method for measurement: decision to contract signed – planned 60
PI 5.2 - No. of selection procedures initiated [49] method for measurement: call for selection published – planned 49
PI 5.3 - No. of contracts granted [140] method for measurement: contracts signed – planned 104
PI 5.4 - No. of deliverables released [13] method for measurement: deliverables available through project web portal – planned 16
PI 5.5 - No of EOV, EBVs and ECV available in the marine integrated data center node [0] - planned 38

Are the uploaded Deliverables compliant or equivalent as to demonstrating the achievement of the Intermediate Objective?

Yes

UPDATE ON INTERMEDIATE WORK PACKAGE OBJECTIVES, WHOSE ACHIEVEMENT WAS EXPECTED IN THE PREVIOUS BIMESTERS

Intermediate objectives not achieved in the previous bimesters:

IO code	IO title	Reference bimester
1907	**IO5.6**	**9**

Find below the detail of each Intermediate Objective relating to the Work Package of reference.

Intermediate Objective N° IO5.6

- Intermediate Objective title - IO5.6,
- Intermediate Objective description – IO5.6 – (B9): (a) Progresses toward the advanced data products; (b) Progress meeting to discuss the WP status, (c) update implementation plan and last possible actions; (c) progress of the PhD fellowship. ,

- Planned objective indicators -Performance indicators are set to monitor the WP5 progress for all activities. They will provide indications on what has been achieved with respect to what was planned in an objective, quantitative and measurable way.
  There is a first set of performance indicators constructed and quantified starting from the specifications of the proposed activities, i.e. from the descriptions of the assets (technological equipment mainly hardware and software) and the fixed term personnel (to be hired specifically for the project) which the funding is requested for. Intermediate values are set as target value for each performance indicator in correspondence with the WP5 Intermediate Objectives along with a final target foreseen at the end of the project.
  Performance Indicators (PI) from 5.1 – 5.3 are more administrative indicators while PI 5.4 is related to the technical/scientific advancements so can be intended as result indicators, which allow to measure of technical/scientific performance on the project progress and the effectiveness of the intervention carried out.
  Here in the following, there is the list of the indicators for WP5 with a brief description and an objective and quantitative means of verification to measure. The timing for the measurement of such indicators are inserted taking into account the Intermediate Objectives of WP5 scheduling listed in the following point [in brackets the value of the indicator in correspondence of the milestones IOs (1,3,4,5,7,9,12,14,15), and the target value at the end of the project (reported in bold)]:

  PI 5.1 - No. of purchase procedures initiated [10, 0, 30, 10, 10, 0, 0, 0, 0, 0, 0, 60]
  method for measurement: decision to contract signed
  PI 5.2 - No. of selection procedures initiated [25, 0, 24, 0, 0, 0, 0, 0, 0, 0, 0, 49]
  method for measurement: call for selection published
  PI 5.3 - No. of contracts granted [0, 0, 24, 20, 20, 30, 10, 10, 0, 0, 0, 0, 114]
  method for measurement: contracts signed
  PI 5.4 - No. of deliverables released [0, 0, 3, 2, 1, 3, 0, 0, 2, 0, 0, 6, 0, 14, 1, 32]
  method for measurement: deliverables available through project web portal
  PI 5.5 No of EOV, EBVs and ECV available in the marine integrated data center node [0, 0, 0, 0, 0, 25, 13, 38]
  The indicator PI 5.5 allows to assess the effectiveness of the intervention in terms of its impact and have been identified to make the ex-post assessment of the expected results. Impact indicators are constructed and quantified from the peculiarity of WP5 activities and the impact that WP5 aims to produce in the long term. Benchmark values drawn from national and international best practices, are set for each indicator, and are estimated considering 10 years of operativity.

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List of the Operational Units involved for the intermediate objective of reference

CNR-IRSA

CNR-ISP-ME

CNR-IAS

CNRISMARVE

CNRISMARNA

CNRISMARSP

CNRISMARBO

CNRISMARRM

INGV-WIS

INGV-BO

ISPRA

INFN - LNS

OGS_OCE

OGS_CGN

Has the intermediate objective been achieved as planned?

no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;

Are the indicators for assessing the achievement of the intermediate objective still the same?

Yes

Indication of the planned indicators:

PI 5.1 -No. of purchase procedures initiated [93] method for measurement: decision to contract signed – planned 60 *PI 5.2 - No. of selection procedures initiated [42] method for measurement: call for selection published – planned 49* *PI 5.3 - No. of contracts granted [113] method for measurement: contracts signed – planned 94* *PI 5.4 - No. of deliverables released [10] method for measurement: deliverables available through project web portal – planned 9* *PI 5.5 No of EOV, EBVs and ECV available in the marine integrated data center node [0] - planned 25*

Are the uploaded Deliverables compliant or equivalent as to demonstrating the achievement of the Intermediate Objective?

Yes

Summary of the Intermediate Objectives envisaged up to this Report's bimester of reference and state of achievement

WP	IO code	IO title	Reference bimester	State (achieved / to be achieved)
WP4	1931	IO4.6	12	no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;
WP8	1866	IO8.8	12	yes
WP1	1848	IO1.12	12	yes
WP2	1867	IO2.4	12	no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;
WP3	1880	IO3.3	6	no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;
WP3	1885	IO3.6	9	no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;
WP3	1884	IO3.5	8	no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;

WP3	1878	IO3.2	4	no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;
WP3	1886	IO3.7	10	no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;
WP3	1887	IO3.8	12	no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;
WP6	1895	IO6.5	12	no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;
WP6	1894	IO6.4	11	yes
WP7	1875	IO7.4	11	no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;
WP7	1877	IO7.5	12	yes
WP5	1907	IO5.6	9	no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;

WP5	1909	IO5.7	12	no, but it will be achieved in the following bimesters, without creating critical issues to the overall timing of the project;

SECTION 4 – FORECAST ANALYSIS AND FINAL COMMENTS

Forecast analysis of the evolution of the project and final comments

1) Forecast analysis

In the next months the project will be dedicated to the completion of the purchasing plan. Most of the purchasing procedures have been already started and awarded, and will be concluded in the next months. Specific attention is being paid to verifying adherence to the DNSH regulation during the execution phase, ensuring that no significant harm is caused to the environment and that all six environmental objectives are respected.
Furthermore, continuous procedural monitoring is in place to verify budget commitment status and allocation consistency with planned activities. No critical underspending situations are foreseen at this stage.
Delays caused by the complexity of certain administrative procedures will result in subsequent delays in the availability and operation of the required instrumentation.
Continuous coordination is ongoing with partners and the Operational Units (OUs) responsible for the project activities to identify potential risks or critical issues that may affect the achievement of objectives. This proactive engagement allows for early identification and implementation of mitigation strategies or corrective actions, ensuring that technical-scientific activities progress as planned, all the expected objectives are achieved and all activities are completed.

In particular, having started the first training courses, in the coming months the implementation of the revised training plan is expected to progress, with an increase in both the number of courses delivered and the personnel involved in these activities.

It is anticipated that in the next bimester, a project variation request will be formalized. This request will primarily address the urgent need for fixed-term personnel contract renewals, necessitated by the six-month project extension to ensure the continuity of critical research activities and the timely completion of the project. It will also facilitate the strategic reallocation of other funds to optimize and maximize the return on investment made in scientific instrumentation and technological equipment, thereby significantly accelerating project impact and and progress.

With regard to the next Intermediate Objectives IO3.9, IO6.6, IO7.6, and IO8.9. slight delays are foreseen. In most of the cases it is mainly due to the aforementioned need to complete the installation and testing phases before proceeding with data acquisition from the new instrumentation/sensors. This will allow the deliverables to be finalised with an extended analytical scope, ensuring higher quality results. Importantly, these delays do not have a significant impact on the specific objectives of the respective Work Packages or on the general objectives of the project.
Specific updates will be provided during the evaluation of each Intermediate Objective, covering those scheduled for the upcoming bimester as well as any previously expected objectives that have not yet been completed and will therefore be re-evaluated.

2) Final comments

In the twelth bimester the project has not undergone any changes to its scope or declared objectives.
The project activities continued in all the WPs.

Among the relevant activities of this bimester, it is noted that the first training course of WP3 was held in Rome on October 23rd. Specifically, this course "Access to Research Infrastructures: process and modalities" provided participants with a comprehensive understanding of the principles of access management.
The Deliverables D3.10 "Report Training Executive Working Plan" has been released during this period, providing a precise schedule of the courses.
The fellows' pages of the 20 PhD students, for the XXXVIII and XXXIX PhD cycle with fellowship financed in ITINERIS, are available on the training platform.

As regards the planned Intermediate Objectives envisaged up to this bimester:

- *IO1.12 from WP1, IO7.5 from WP7, IO 8.8 from WP8 were completed and all the expected activities were carried out as described in the plans.*
- *IO6.4 (B11) from WP6, previously postponed, can be now considered completed following the release of third draft versions of all the Deliverables.*
- *IO2.4 (B12) is postponed pending the completion of activities related to the first release of the Data and Services Catalogue of the ITINERIS HUB.*
- *IOs in WP3 are postponed due to the new plan of training courses. They will be progressively achieved as folows: IO3.2 in B14, IO3.3 in B15, IO3.5 in B15, IO3.6 in B16, IO3.7 in B16 and IO3.8 in B18.*
- *IO 4.6 (B12) is postponed pending the release some of the planned deliverables that will be completed in the next months due to the aforementioned delay in the instrument purchase procedures.*
- *IO5.6 (B9) and IO5.7 (B12) are postponed because the marine integrated data center node is still in the implementation phase. therefore the related deliverable has is not yet released and the objective indicator measuring integration of EOV, EBVs and ECV dataset available marine integrated data center has not been reached.*
- *IO6.5 (B12) is postponed to await the release of third draft versions of all the Deliverables. expected in this bimester the release of deliverables D6.4, D6.5 and D6.6. Completion is expected by B17. However, the project activities and objectives remain unchanged and are still fully achievable.*
- *IO 7.4 (B11) is postponed to await the release of the deliverable D7.2 whose implementation is in progress with the digital thematic archive to be implemented selected. Completion is expected by B17.*

It has been confirmed that all other planned activities and deliverables in the aforementioned Intermediate Objectives have been completed as scheduled, and the postponement of IOs have no significant impact on the technical implementation or the overall project schedule. Moreover, the 6-month extension of the project duration allows for sufficient time to complete all activities as originally planned.

As regards the performance indicators set in correspondence of the IOs to monitor the WP progresses, those related to the selection procedures can be considered completed, being all the researchers/technologists/technicians employed at the partners' OUs. Specifically, 187 individuals have been recruited to date, with 5 contracts finalized during the two-month period. It is also noted that 9 personnel have resigned to date, one of which during the current two-month period.

In terms of budget, significant progress has been achieved across all relevant work packages (WPs), with purchasing procedures for goods/services/works published during the two-month period totaling approximately 7,3 M€. Additionally, procedures valued at approximately 5,2 M€ were awarded and procedures worth approximately 6.3 M€ were contracted, particularly in the cost category "Scientific instrumentation and technological equipment, software license and patents.
Further details are provided in the attached IO reports.

SECTION 5 - LIST OF DELIVERABLES SUBMITTED IN THE PERIOD

- *D1.1.12 - twelfth Technical Progress Report including description of the performed activities, released deliverables, IO achieved, and risks analysis*
- *D1.2.12 - twelfth Financial Report including financial reporting for each WP/activity and for each partner, analysis of critical financial- administrative aspects and proposed solutions to solve possible deviation from the original plan in the reference period*
- *D4.4.3 Report on the operation in the laboratory and in the field of the acquired instruments at ISAC CNR Lecce and calibration comparison with reference method*
- *D4.5.2 Definition of the customizations necessary for the instrumentation and the aircraft to make the instrumentation airborne.*
- *D4.8.2 Report on improved analytical performances at LABEC for laboratory and real-time in situ aerosol analysis*
- *D4.9.3 Testing report of the new plants for technical gases distribution at INFN Genova*
- *D5.14 Report on the implementation on new prototyping model products in the North Adriatic; and on new integrated data products for Good Environmental Status, Good Ecological Status, and Ecosystem Integrity assessment*
- *D5.15 Report on the progress on the modeling system set up and improvement on the implementation of the data assimilation modules*
- *D5.16 Report on results of the survey on the distribution of the multidisciplinary data and on the catalogue of data selected to implement the prototype*
- *D5.17 Data-driven reconstruction of the ocean state – Algorithm Theoretical Background Document(ATBD)*
- *D7.3 Implementation of an ICT facility for geophysical and airborne data archiving and sharing*
- *D7.6 INTEGRATED DATA PORTAL FOR SMINO DATA ARCHIVING AND SHARING*
- *D7.8 Implementation of new geophysical data management system with dedicated storage and computing facilities*
- *D7.9 DEVELOPMENT OF AN AEROGEOPHYSICAL INFRASTRUCTURE*
- *D8.12 OPERATIONAL VERSION OF THE CZ VRE SERVICE AND THE ASSOCIATED USER GUIDE*
- *D8.13 Operational version of the CLIMA VRE and user guide of the Virtual Research Environment dedicated to climate indicators*
- *D 8.14 Operational implementation of the EV VRE including the selected EBVs and ECVs*

- **SECTION 6 – REPORT ON THE IOs ACHIEVED IN THE PERIOD**
  - **Report on the Intermediate Objective IO 1.12**

The following activities were performed during the twelfth bimester:

During the September-October period, the increasing complexity of project activities particularly financial, procedural, and physic, made it essential to strengthen internal communication flows among all project partners. These activities were coordinated by WP1, which ensured the effective management of information exchange through the systematic and structured use of the project's document management platform, SharePoint. SharePoint served as the main tool for sharing information and facilitating collaboration among the various Work Packages and Operating Units involved in the project. Through this platform, technical and administrative documents, updates on the progress of activities and milestones, as well as materials needed for monitoring and official reporting to MUR, were shared efficiently. The constant use of SharePoint allowed for coherent and up-to-date information flow, improving the traceability of partner contributions and the management of cross-cutting activities. This was particularly critical during a period of intense operations and the need for continuous alignment across the various project components.
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As regards the EB meetings, in the previous period July–August 2024, the EB of ITINERIS intensified exchanges and meeting to ensure alignment of the activities across Work Packages and to prepare for the Annual Meeting. In particular, besides the 12th Executive Board (EB12) meeting, several preparatory meetings were held starting from January 2024, with a strong focus on reviewing the preparing the work progress and finalizing the contents and structure of the Annual Meeting.

The 13th Executive Board meeting (EB13) was convened at the end of August, slightly in advance of this reporting period to ensure the participation of all WP leaders, considering their limited availability in B13 due to overlapping commitments of national and international conferences and other institutional obligations.

Overall, these meetings strengthened the internal coordination and helped maintain the momentum of the project.

All aspects of the project, including scientific, technical, administrative, and financial matters were managed. Ensured day-to-day operations run smoothly and comply with relevant regulations.

Maintained consistent communication with project partners and the Ministry of University and Research (MUR). This included regular updates, addressing inquiries, and coordinating
collection of relevant information from partners. In particular, participation was ensured in a coordination meeting held on October 17th, 2024 between the Ministry and the scientific, administrative, and infrastructure managers of all the projects funded under the PNRR "Research Infrastructures" Call.

To ensure the project's governance structure and comprehensive operational robustness of the entire project, WP1 is also managing crucial relationships and working in close collaboration with the relevant central departments at the central offices of the lead implementing entity, the National Research Council (CNR).

Coordination activities included support to Invitalia, to verify the formal and administrative compliance of reimbursement requests and facilitate overall control and audit processes to guarantee proper fund management.

Facilitated information sharing and ensured transparency for monitoring purposes. Implemented and ran the tools in the project information management system (SharePoint) to monitor project progress, deliverables, and intermediate objectives.

The coordination office carried out and coordinated the daily communication tasks, guaranteeing the operational foundation, and all disseminating project results, notifying and tracking communication actions, and key events in which they participated to showcase the project;

Internal communication was primarily conducted through the project's information management system (SharePoint).

The planned activity of updating the HR Management Plan was carried out, resulting in the second update of the document. This update ensures that personnel management remains aligned with the status of selection procedures and the specific allocation to project activities.

Twelfth FOB meeting: Unless group meetings are needed, it was decided to continue communications through emails or individual meetings, to better address the different and specific issues and provide individual support and details on the preparation of the technical report and reimbursement requests;

The fourth Coordination Committee meeting was not held during this bimester, as the annual meeting had already taken place in the previous bimester. That meeting also enabled alignment with the representatives of the CC.

As regards the objective indicators:
All expected deliverables have been releases, including technical report D1.1.12 and financial report D1.2.12. As previously explained, at the time of preparation of the proposal, these reports were thought of as the results of the management and coordination activities necessary to report technical and financial progresses. The same content has been requested by the MUR to be reported directly on the GEA platform. Therefore, these deliverables are released when the reporting activities are performed and submitted on the GEA platform.

Procedures for the selection of fixed-term personnel:
Procedures for the selection of fixed-term personnel were completed already in previous bimesters, resulting in a total of 8 contracts signed.
The procedure "Call 400.1" remains and no more selections/appointments will be made due to a lack of available candidates.

Purchasing procedures:
One last procedure to acquire ICT hardware and peripherals for the CNR-IMAA OU has been started, with decision to contract expected in the next period.

- **Report on the Intermediate Objective IO 6.4**

The Intermediate objective has the aim to evaluate the actual implementation of the new measurements and services, track the status of the deliverables and ensure that the procurement procedures are all in line with the timeline needed to provide the data to the project. More specifically the objectives are:

(a) Release of deliverables D6.2 and D6.3. The IO has been reached and the deliverables released.

(b) The second and the third version of the deliverables are all released.

(c) update of D6.1 with new activities. The IO has been achieved and a new version of the D6.01 with the updates in particular on the sensors hub and measurements campaigns ongoing has been released.

(d) test installation and demonstration of sensors and equipment bought in the previous bimesters. The installation and tests of sensors continued and increased during the bimester and will continue also next bimesters, also thanks to the vegetation growing season. All the details of the installations and tests can be found in the specific OUs reports.

(e) WP progress meeting. A meeting of the WP6 in presence has been organized the half day before the ITINERIS annual meeting on July 9th. The Minute of the meeting has been released.

- **Report on the Intermediate Objective IO 7.5**

The following activities have been performed during the bimester:

(a) First experimental data with the new instruments: most of the sensors and equipment for field and laboratory facilities were acquired, and installation is ongoing. For most of the activities, the infrastructure staff trained on the use of the acquired instrumentation and carried out some experimental acquisition campaigns (7.4 and 7.5 joint activity); in the case of the experiment to be held in the Carnic piedmont area, on the monitoring of a landslide data will be inserted into the virtual platforms that are being created (7.6 and 7.7 joint activities in collaboration with WP8). Activities 7.7 and 7.8 performed the various joint tests and verification procedures on the fiber cables and iDAS interrogator systems at the OGS test laboratory PITOP, located in Piana di Toppo (PN) (16-20 September 2024). As regards ECORD activities, testified by increasing papers number (7.1), the archiving of the various cores and borehole data started in all the involved units (7.3), preparing the same for the archiving with the m-DIS database. Moreover, collective activity has implied meetings to prepare for the m-DIS training course within WP3 tasks, scheduled for 4-7 February 2025 at the University of Pavia.

(b) Progress meeting to discuss the project status and last possible actions: we continued the periodic exchange of documents to monitor the progress of the various activities, identify bottlenecks, and find remediation solutions through advancement reports for each WP Activity used to calculate the relative Indicators, whereas the mail exchange allowed to discuss the project status and plan the possible actions, in terms of courses and joint activities. A procedure for the hiring of personnel was completed at the end of the bimester (activity 7.7), whereas a contract was signed (Activity 7.5).

(c) Release of the D7.3; D7.6; D7.8; D7.9.

-Deliverable 7.3 (B12, Activities 4-5) Implementation of an ICT facility for geophysical and airborne data archiving and sharing:

This deliverable aims to illustrate the ICT facility designed to store and share data acquired from geophysical and airborne technologies and the results of processing these data. The ICT facility is expected to have a positive impact on the collaboration among researchers, practitioners, and end-users, fostering interdisciplinary projects. The ICT facility has been designed to be a valuable tool assuring rapid access to existing data and improving knowledge about the territory, which

is flexible enough to accommodate future data growth and technological advancements, with the final goal encouraging innovation opportunities. The ICT facility is implemented to be compliant with the ITINERIS HUB of the Work Package (WP) 2, fulfilling meticulous technical specifications and standards to ensure optimal performance and interoperability, enabling data reuse and collaboration, by FAIR and Open Data principles adoptions.

-Deliverable 7.6 (B12, Activity 7.7): Integrated data portal for SMINO data archiving and sharing:

The new portal represents the access point to SMINO information and data. The goal is to enable easy access to the various networks constituting SMINO, both seismological and geodetic, and to the various data and services through the appropriate links. It also constitutes the link to the other platforms developed within the PNRR project MEET, bound to EPOS-Italia Research infrastructure and their services.

-Deliverable 7.8 (B12, Activity 7.8): Implementation of new geophysical data management system with dedicated storage and computing facilities:

Deliverable 7.8 reports on the SNAP web-based data system able to handle geophysical data and in particular Exploration Seismics in the context of the Itineris Project. Seismic data Network Access Point (SNAP) is the data web portal and framework that allows access to all geophysical data acquired by OGS. Within SNAP, metadata is used both for data usage, meaning processing, integration, or interpretation and for data discovery. SNAP embeds GeoNetwork to offer interoperability services such as harvesting to other data-sharing initiatives. Given the potential of GeoNetwork and the importance of managing the data according to the FAIR Principles (Findability, Accessibility, Interoperability, and Reusability), SNAP uses GeoNetwork to generate metadata to complement the metadata already present within SNAP.

-Deliverable 7.9 (B12, Activity 7.9): Development of aerogeophysical infrastructure:

The deliverable describes the ongoing implementation of a new Italian Aerogeophysical Research Infrastructure launched by the National Institute of Oceanography and Applied Geophysics –OGS and specifically by its Geophysics Section. This activity is a new Italian contribution to the European Facility for Airborne Research (EUFAR), an established collaborative network dedicated to advancing interdisciplinary airborne research in environmental science.

- **Report on the Intermediate Objective IO 8.8**

The following activities have been performed during the bimester:

The IO8.8 (B12) is:

Release of D8.12 (B12, Activity 8.1, CNR-IGG) Operational version of the CZ VRE service and the associated user guide.

Release of D8.13 (B12, Activity 8.7, CNR-ISMAR-Lerici) Operational version of the CLIMA VRE and user guide of the Virtual Research Environment dedicated to climate indicators.

Release of D8.14 (B12, Activity 8.4, CNR-IBE) Operational implementation of the EV VRE including the selected EBVs and ECVs, and the associated user guide.

The IO8.8 was fully reached and the three deliverables were completed and made available as planned.

(b) The Deliverable on the available information on downstream environmental and climate change effects (D8.9) was completed and released.

DETAILED DESCRIPTION OF THE KPI FOR IO 8.8

PI 8.1 - Number of purchase procedures (including tenders) initiated - Method of measurement: decision to sign a purchase contract. TOTAL EXPECTED: 43 REALIZED AT B12: 42

There still are delays in the tender of T8.4 owing to delays in the definition of the technical characteristics of the instrumentation.

PI 8.2 – Number of purchase procedures (including tenders) concluded and payed - Method for measurement: contracts signed. EXPECTED AT B12: 21 REALIZED AT B12: 20. The smaller number of contracts is due to delays in providing the instrumentation and/or tenders that had to be re-issued.

There is one remaining purchase procedure which is delayed owing to the need for re-issuing the tender. It is expected to be completed in B13.

PI 8.3 - Number of hiring positions started [18] - Method for measurement: call for personnel selection published. EXPECTED: 18 by B6, REALIZED in B12: 18.

All personnel selections were concluded by B9. The objective indicator is fully reached.

PI 8.4 - Number of deliverables released - Method for measurement: deliverables available on the project platform. EXPECTED by B12: 14 REALIZED: 14

The Deliverables D8.12, D8.13 and D8.14 were completed and submitted to coordination. The indicator is fully reached.

PI 8.5 – Number of operational VRE services. EXPECTED by B12: 3 REALIZED: 3

Preliminary versions of the CZ VRE (T8.1), of the EV VRE (T8.4) and of the CLIMA VRE (T8.7) are now operational and fully described in the corresponding deliverables. The indicator is fully reached.