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ISTRUZIONE
RICERCA

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1. INTRODUCTION

Deliverable 3.13 has been developed within the framework of the ITINERIS project as part of Work Package (WP) 3, focusing on the activities organized during the **second year** of the project by all the Operative Units (OUs) involved in **Activity 3.7**. This deliverable, which falls under Intermediate Objective 3.8, was produced under the responsibility of the **CNR-IRET** (National Research Council, Research Institute on Terrestrial Ecosystems).

The main objective of Deliverable 3.13 is to provide a general overview of the training program designed by the WP3 OUs and implemented during the second year of the project . This report documents the operational implementation phase, the management of PhD students, and the concrete launch of the training activities. The number and titles of the courses detailed in this report reflect the status as of December 2024. The operational framework was led by the technologists assigned to the WP3 Training Centre, who provided comprehensive oversight of the course lifecycle. To ensure long-term accessibility and continuous updates, all training materials and activities are available on the dedicated ITINERIS training platform within the community.

The document is structured into four chapters, starting with Chapter 1, which introduces the purpose and the general context of the report. Chapter 2 contains the activities made for the XXXVIII and XXXIX PhD cycles supported by ITINERIS. In Chapter 3, the report presents the training programme developed during the second year and Chapter 4 provides a comprehensive list of acronyms used throughout the document.

2. ACTIVITIES FOR THE XXXVIII AND XXXIX PHD CYCLES SUPPORTED BY ITINERIS

This section details the progress of the 20 activated PhD fellowships, moving beyond the contracting phase described in the reports and deliverables related to the first year of project activities.

The distribution remains consolidated, with no retirement from positions reported during the second year, as follows:

PhD Cycle - XXXVIII (12 positions):

- University of Naples Federico II: 3 positions (Atmospheric Domain).
- University of Pisa: 3 positions (Solid Earth Domain).
- University of Salento: 3 positions (eScience Domain).
- University of Tuscia: 3 positions (Terrestrial Domain).

PhD Cycle - XXXIX (8 positions)

- University of Naples Parthenope: 2 positions (Marine Domain).
- University of Salento: 3 positions (eScience Domain).
- University of Tuscia: 3 positions (Terrestrial Domain).

Regarding individual career paths, PhD student Claudia Fiorella Huamani Cahuas, PhD Cycle XXXVIII - University of Tuscia, took maternity leave from March 16, 2024, to August 16, 2024, which required a subsequent rescheduling of her research activity timeline.

Bimonthly and Annual Reporting

The CNR-IRET Lecce Operational Unit has continued to implement the monitoring system for the PhD students' research activities based on:

- *Bimonthly Reports:* Every two months, each PhD student submits a brief account of the research activities carried out, participation in national and international congresses and conferences, attendance at training courses, and the publication of scientific articles.
- *Annual Reports:* At the end of each year, PhD students produce a summary report on the results achieved and their participation in courses.

Participation in the 2nd ITINERIS General Meeting

PhD students actively participated in the "*2nd General Meeting ITINERIS*" held in Rome on July 9-10, 2024. They presented their research progress through poster sessions and discussions with university and WP representatives. During the ad hoc WP3 session, they also interacted with various research infrastructure representatives and were introduced to the ITINERIS training platform, along with the specific training program dedicated to them and the infrastructure staff.

Participation in intensive courses and summer/winter schools

PhD students are actively engaged in the intensive training program, attending courses at their universities and enrolling in the summer and winter schools organized under Activity 3.7. The curriculum is designed to deliver a balance of domain-specific expertise and cross-disciplinary skills and is managed by the WP3 Training Centre. To optimize attendance, the program's scheduling is carefully coordinated to avoid conflicts with already programmed academic and research activities. Furthermore, to promote broad participation in these high-level trans-domain summer/winter schools, the project fully economically support all attendance costs for its doctoral students as presented in project proposal. For a detailed overview of the WP3 training programme, please refer to the comprehensive course list in the following Chapter.

3. TRAINING PROGRAMME DEVELOPED IN THE SECOND YEAR OF THE PROJECT

During the second year of the project, a significant operational milestone was achieved with the successful awarding of a tender dedicated to the management of logistical and administrative support for the ITINERIS training courses; this procurement specifically covers the requirements outlined in Activities 3.7 (CIG: B0C25D2FB0). The objective of this tender was to centralize logistical tasks (ranging from flight and hotel bookings to catering services and lecturer contract management), for the training courses provided in activity 3.6, 3.7 and 3.8 decreasing significantly mitigating the administrative burden on the OUs.

As regard the participation of Ph.D. students to the WP3 ITINERIS training courses, the primary objective of the training programme is to offer a high quality and specialized courses domain-specific for each university involved in WP3 as follow: University of Salento (FAIRness Domain), University of Naples Federico II (Atmospheric Domain), University of Tuscia (Terrestrial Biosphere Domain), University of Naples Parthenope (Marine Domain) and University of Pisa (Solid Earth Domain). Regarding the series of summer and winter schools (VREs and Cross-disciplinary Activities), six courses will be organized in Pisa and Lecce. In order to allow to all the ITINERIS PhD students to participate in these advanced trans-domain courses with all the expensive covered by Activity 3.7 WP3 founds.

One of the goals was also to maximize student participation in the offered courses to minimize overlaps between these courses and the program's scheduled teaching activities, particularly those defined under Activity 3.7. This strategic planning was implemented to ensure that PhD students can effectively balance their scientific research commitments, fieldwork, and participation in national and international conferences, thereby optimizing their overall educational path. For the third year, the completion of the remaining training courses and the organization of a summer/winter schools dedicated to the multidisciplinary integration of environmental data are planned. It should be noted that the number and titles of the courses indicated refer to the date of December 2024, and that both the courses and the materials are uploaded and permanently accessible thought the ITINERIS training platform.

The operational framework was driven by the assigned WP3 Training Centre technologists, who provided comprehensive oversight of the course lifecycle. This role involved a detailed preparatory phase, including identifying key themes of interest for the Research Infrastructures and partner institutes, selecting qualified instructors, and managing the temporal and spatial allocation of resources (course's location selection, hotel scouting, catering arrangements,..). The entire organization was executed in close synergy with Forma.Lab S.r.l., the service provider selected via the tender to handle the secretariat and logistical duties, with the CNR-IRET Lecce unit acting as the focal node for the Training Centre.

Regarding participation, the team managed the identification, recruitment, and communication flow with participants. As documented in the bi-monthly reports and intermediate project objectives, the participant pool is heterogeneous, comprising staff

from Research Infrastructures/Institutes and, in specific instances, PhD students from universities involved in WP3. The support provided to participants was holistic, here are listed some of the actions provided by the technologists:

- Pre-Course: communicational and logistical assistance, administration of entry-level knowledge tests (when needed), registration on the relative course area on the ITINERIS training platform;
- During Course: on-site reception, training guidance provided also by the selected classroom tutors from Forma.Lab S.r.l., provision of the assessment exam via the ITINERIS training platform;
- Post-Course: continued assistance up to the issuance of certificates signed by the WP3 Leader, Prof. Alberto Basset, support for reimbursement of expenses when incurred.

To ensure high quality standards, a rigorous feedback mechanism was implemented. At the end of each event, every participant completed a comprehensive survey via the ITINERIS training platform. The survey consists of 37 questions organized into four distinct sections: (1) Course Goals and Overall Evaluation, (2) Teaching Quality, (3) Teaching Materials and Resources, and (4) Organizational Aspects. It includes 24 multiple-choice questions (rated on a scale of 1 to 5) and 13 open-ended questions to capture qualitative feedback.

Be advised that the number, titles, and delivery methods and training modules of the courses are subject to evolution or changes relative to the submission date of this document. for the most up-to-date schedule and details, please refer directly to the ITINERIS training platform accessible via the ITINERIS Hub or at the following Link: https://training.itineris.cnr.it.

3.1 Training activities for eScience Domain (WP2)

The training program detailed in this paragraph comprises a multidisciplinary curriculum designed to equip the PhD students with advanced analytical tools and methodological expertise. The selection of intensive courses reflects a strategic integration of life sciences and computational technology. Key technical competencies are addressed through hands-on training with ICT (Information and Communication Technology) tools, in MATLAB, Geocomputation, and data harmonization based on FAIR principles. Furthermore, the program emphasizes the modernization of scientific workflows through Virtual Research Environments (VREs), ensuring data reproducibility and software quality.

TRAINING PROGRAMME

eScience

Course N.1

Title: Exploring the World of Metabolomics and Metagenomics

Description: This course employs a multi-scale approach to analyze biological systems from the molecular to the ecosystem level, integrating key 'omics' disciplines such as metabolomics, genomics, epigenomics, and proteomics. The curriculum consists of theoretical modules covering NMR analytical principles, metabolomic profiling strategies, and genomic applications for environmental conservation, followed by practical sessions on protein analysis. The training concludes with hands-on activities focused on the critical reading and discussion of scientific articles. This intensive three-day course is planned to be provided in person at the University of Salento.

Course N.2

Title: Introduction to MatLab

Description: The course is designed to provide hands-on experience in writing efficient, robust code and developing interactive user interfaces. The curriculum is divided into two main modules on MATLAB programming techniques and building interactive applications with particular focuses on data structuring, performance optimization and use built-in tools in managing code. This course is organized in an online asynchronous pre-lessons provided directly on the MATLAB platforms and three-day course held in person at the University of Salento and MathWorks® provides expert instructors to lead their hands-on training sessions.

Course N.3

Title: Data mining and machine learning

Description: This course provides a comprehensive introduction to the application of Artificial Intelligence (AI) in environmental research. It is designed to help early career scientist to improve the knowledge and the integration of AI with their specific research activities. The program combines theoretical lectures with hands-on activities, covering core AI principles, supervised and unsupervised methodologies, and practical applications

such as biodiversity monitoring, climate modelling, and remote sensing. Furthermore, the curriculum addresses critical ethical dimensions such as data bias, surveillance, and regulatory frameworks like the AI Act. This intensive course is planned to be provided in person at the University of Salento.

Course N.4

Title: Data harmonization and integration

Description: The course is designed for PhD students seeking a solid foundation in managing heterogeneous environmental datasets. The curriculum covers fundamental principles such as FAIR data practices, metadata standards, and semantic annotation, providing participants with the tools to resolve inconsistencies across diverse data sources. Through a combination of theoretical modules and practical hands-on projects using R and Python, students will learn to build interoperable data frameworks and conduct collaborative coding. The course concludes with a project validation process a part respect the final exam on the ITINERIS training platform. This five-day course is planned to be provided in person at the University of Salento.

Course N.5

Title: Geocomputation and geospatial modelling analysys (PhD)

Description: The training course is designed to introduce PhD students to advanced open-source geocomputation tools, specifically focusing on GDAL and Python within a Linux environment. The program aims to equip participants with the skills necessary to develop independent data processing routines and master geospatial data analysis. The curriculum covers a wide range of topics, including Linux proficiency, raster and vector data manipulation, and the use of scientific Python libraries for applications in fields such as forestry, climate modelling, and species distribution. The course structure combines online lectures, recorded for asynchronous viewing, with two days hands-on sessions and compulsory coding assignments to ensure practical problem-solving capabilities at the University of Salento.

Course N.6

Title: Developing research projects in Virtual Research Environments

Description: The course is specifically designed to train junior data scientists, PhD students, and postdocs in the technologies and practices required for modern research. Using a project-based teaching method and the LifeWatch 'Notebook-as-a-VRE' (NaaVRE) platform, the course covers essential topics such as cloud computing, scientific workflow management, containerization, and Research Software Quality (DevOps). Participants will gain hands-on experience in loading external data into Jupyter environments, scaling notebooks into cloud workflows, and developing small-scale research projects, ensuring the reproducibility and provenance of their scientific activities.

This three-day course is planned to be provided in person at the University of Salento. The identified lectures are Dr. Zhiming Zhao, Dr. Spiros Koulouzis and Dr. Gabriel Pelouze.

3.2 Training activities for Atmospheric Domain (WP4)

Within the activity 3.7 in the atmospheric domain, two training courses have been designed for the Ph.D. students at the University of Naples "Federico II". The aim of these courses is to give the students an holistic view of the relationship between human and the atmospheric domain. In this perspective the courses aim at providing the knowledge to understand the impact of anthropogenic activities and the science contribution to monitor and mitigate climate change effects. A detailed description is provided in the following section.

TRAINING PROGRAMME

Course N.1

Title: Can Science Save the Earth? (Optical advanced instruments for atmospheric monitoring design and operation)

Description: As science and supporting technologies collect more and better data about the world around us, the opportunities to study climatic forcings and to detect, monitor and address climate change effects are increasing. The course aims at illustrating the Earth's climate system discussing current methods exploited in atmospheric and environmental monitoring. Emphasis will be also given to the optical design of advanced instruments and the physical principles of their operational aspects with examples of applications and atmospheric parameters measured. The selected location is the Department of Physics "Ettore Pancini", University of Naples Federico II - Monte S. Angelo University Campus, Via Cintia, 80126 Naples, Italy in March 2025. The identified lecturers are Giorgio Alcide Di Sarra (ENEA), Guido Di Donfrancesco (ALA System); Xuan Wang (WHU).

Course N.2

Title: Anthropogenic activities and effects on the living environment and human health.

Description: The course aims to provide a detailed knowledge of the mechanisms of formation of pollutants by anthropogenic activities to correctly understand environmental problems and the relationship between anthropogenic activities and effects on the living environment and human health. The goal is to provide tools and methodologies for the correct implementation of environmental policies. The selected location is the Department of Physics "Ettore Pancini", University of Naples Federico II - Monte S. Angelo University Campus, Via Cintia, 80126 Naples, Italy.

3.3 Training activities for Marine Domain (WP5)

The training programmes of the WP5 was developed considering the pillars and concepts presented in the previous Deliverable (3.5). The first three courses were scheduled in February 2025 at University of Naples Parthenope, and we are pretty close to complete the definition of teachers, modules and contents.

TRAINING PROGRAMME

Course N.1

Title: Autonomous instruments in oceanography

Description: The technology of autonomous instruments has matured tremendously in the past few decades. Autonomous instruments are especially important in an environment as difficult to access as the ocean. For this reason, the course will be devoted to an overview of the main categories of autonomous instruments, so that students can realize the current possibilities currently offered in this field. Theoretical lectures will be coupled with data processing exercises. Students will become familiar with the most widely used autonomous oceanographic instruments to be able to use them and/or their data in their current and future research activities. The course il scheduled for February 2025 directly at the University of Naples Parthenope.

Course N.2

Title: Advanced data analysis and processing techniques

Description: First and second level academic training in applied sciences typically stops at standard statistical techniques of data processing. In this course we intend to provide students with advanced notions of processing, with reference to two very current topics: on the one hand, the vast amount of data available (we are currently in the era of big data), and on the other hand, the spread of artificial intelligence techniques, which may find very novel applications in reconstructing 3D and 4D features of the ocean. Practical exercises will be offered to students along with theoretical considerations. Students will become familiar with the most current techniques of advanced statistical treatment of data, with the issue of large data set processing, and with the now available artificial intelligence tools for processing oceanographic data. The course il scheduled for February 2025 directly at the University of Naples Parthenope.

Course N.3

Title: Oceanographic observational and modelling products available for marine research

Description: Many in situ and satellite oceanographic observations as well as ocean circulation model results are available nowadays. It is very important for future researchers to be able to navigate their way through this large supply, and the purpose of this course is to provide students with a detailed description of the available data. After an initial overview, portals and products specific to the needs of attendees will be explored in depth. It is expected that the course will enable them to orient themselves independently. Students will acquire the ability to use major portals for accessing oceanographic data and model outputs to be able to find information needed for their current and future research activities. The course il scheduled for February 2025 directly at the University of Naples Parthenope.

Course N.4

Title: Applications of dynamic systems theory in oceanography

Description: The course explores the integration of dynamic systems theory principles within the field of oceanography. Participants will delve into the interdisciplinary approach

of applying dynamical systems concepts to analyze and model complex oceanic phenomena, such as ocean circulation patterns, climate dynamics, and ecosystem behaviour. Through a combination of theoretical frameworks and practical case studies, learners will gain a deep understanding of how dynamic systems theory can elucidate the interconnected processes governing the behaviour of the ocean. From predicting events to understanding the impact of climate change on marine ecosystems, this course equips participants with the tools and knowledge to tackle pressing oceanographic challenges through a dynamic systems lens.

Course N.5

Title: Software for processing meteorological and oceanographic data

Description: The course provides a hands-on exploration of the tools and techniques used to analyse and interpret data in the fields of meteorology and oceanography. Participants will learn how to navigate and utilize specialized software packages tailored to the unique needs of processing atmospheric and oceanic data. Through practical exercises and real-world examples, learners will develop proficiency in tasks such as data preprocessing, visualization, statistical analysis, and modelling. Whether studying weather patterns, ocean currents, or climate trends, this course equips participants with the skills necessary to effectively harness the power of software tools for extracting valuable insights from meteorological and oceanographic datasets.

Course N.6

Title: Oceans and climate

Description: The course delves into the intricate relationship between ocean and the global climate system. Participants will explore the multifaceted interactions between oceanic processes and climate dynamics, gaining insights into how ocean influence climate patterns and vice versa. Through a combination of theoretical knowledge and empirical evidence, learners will examine key topics such as ocean-atmosphere interactions, ocean circulation patterns, and the role of oceans in regulating Earth's temperature and weather systems. Additionally, the course will address the impacts of climate change on oceans, including sea level rise, ocean acidification, and shifts in marine ecosystems. By understanding the complex interplay between oceans and climate, participants will gain a deeper appreciation of the profound influence that oceans have on shaping the planet's climate and the implications for future climate scenarios.

3.4 Training activities planned in Terrestrial Domain (WP6)

This paragraph outlines the intensive training activities planned in Terrestrial Domains, it is composed by six training courses, and it is designed to equip students of the University of Tuscia with fundamental skills in data analysis and scientific project management. From the fundamentals of high-performance computing and artificial intelligence to the processing of complex environmental data and the effective communication of results,

each course is a fundamental building block to address the challenges of modern research environment.

TRAINING PROGRAMME

Course N.1

Title: Introduction to High Performance and Data Intensive Computing

Description: The aim of the course is to supply the basic concepts of information science and technology necessary to understand and interact with modern computing architectures. The study of High Performance Computing (HPC) behind human interface will be supplemented with the theoretical models they refer to with a comprehensive coverage of hardware and software computing systems. Lab sessions and hands-on will further complete the training by providing practical knowledge in accessing, programming and deploy computational workflows in different scientific domains. The course is structured into sessions held on non-consecutive dates, ensuring participants have sufficient time to put the acquired skills into practice between lessons.

Course N.2

Title: Python for Data Sciences

Description: The aim of the course is to give an overview of different Python packages useful for Machine Learning (ML) to be used besides Pytorch and Tensorflow, two of the main ML frameworks. Tools with different scopes will be explored that can be divided in 3 different areas: data handling, parallelization, and visualization. The lessons will be performed with Jupyter Notebooks to let the participants have an hands-on approach on the concepts explained.

Course N.3

Title: Computer Vision and Machine Learning Techniques for Environment

Description: The course will introduce the different machine learning methods used in environmental applications (ANN, RF, Deep Learning), using examples of application. In the second part practical activities of machine learning applications to user specific cases will be implemented

Course N.4

Title: Eddy Covariance processing and data use

Description: The course will only shortly cover the practical aspects of the eddy covariance measurements collection and focus more on the data processing, uncertainty estimation and use in environmental application, with practical activities based on data and products collected by the FLUXNET network and ICOS.

The participants will know where to find eddy covariance measurements, how to correctly handle them, interpret and estimate the uncertainty and which are the possible data uses.

Course N.5

Title: Programming with R

Description: This introductory R programming course is designed for PhD students in environmental science fields. It covers the fundamental concepts of R, including data structures, basic syntax, and data manipulation techniques. The course also focuses on the application of R for environmental data analysis, including statistical modelling, data visualization, and working with large datasets. The goal is to equip students with the necessary skills to analyze and interpret scientific data effectively, supporting their research in environmental sciences.

Course N.6

Title: Build a project proposal

Description: The course will provide scientists with the correct tools to manage public communication with different types of interlocutors, covering all the aspects, from the level of details to the graphical tools and language. The course will also cover the preparation of a project proposal in competitive calls, covering in particular the structure, the key points to cover and text organisation.The participants will have the knowledge needed to improve their capacity to present their results in different contexts and to organise a project proposal. Possible speaker for the communication to the public.

3.5 Training activities for Solid Earth (WP7)

During the second year, the first training course for activities of Ph.D. students of the XXXVIII cycle working in the Solid Earth domain was held by the Department of Earth Sciences of the University of Pisa from December 9 to 12, 2024.

The remaining two training courses have been defined in collaboration with CNR-IMAA, CNR-IREA, OGS, and the University of Florence and are scheduled for January 2025

TRAINING PROGRAMME

Course N.1

Title: Advanced technologies for monitoring and prediction of ground instabilities

Overview: This course to Ph.D students explores landslide types, analyses triggering and runout mechanisms through modelling, and examines detection, monitoring and early warning systems for ground movement

Description: this course introduced to the different landslide types and to the main characterization and numerical modelling methods of the triggering and runout

mechanisms. Theoretical principles, data acquisition methodologies and application examples of the main surveying and monitoring technologies for ground displacements. Landslide Early Warning Systems on a local and regional scale, with particular reference to their temporal and spatial forecasting concerns

Training objectives: Learn the main survey and monitoring techniques to be employed for different ground deformation types, with special aim to the quick definition of risk scenarios in emergency situations and early warning systems.

The course was held at Department of Earth Sciences, University of Pisa, on December 09-12, and it involved 6 PhD students from the University of Pisa, University of Florence and University of Basilicata.

The course involved the expertise of University of Florence: Dr.Veronica Tofani, Dr. Giovanni Gigli, Dr. Pierluigi Confuorto, Dr. Tommaso Carlà, Dr.Matteo Del Soldato, Dr.Federico Raspini, Dr. Emanuele Intrieri, Dr. Samuele Segoni and Technologist Dr.Tommaso Beni.

The course consisted of 4 modules:

- Geohazards and hydrogeological risk; landslides
- Traditional and advanced systems for landslide surveying and monitoring
- Satellite radar interferometry
- Landslide forecasting and warning at slope scale using displacement monitoring

The four modules were covered over the four days of the course. A full day was dedicated to each module. The course presented case studies and demonstrated to the students the use of monitoring, instruments as Borehole Inclinometers, Borehole Extensometers, and Piezometers.

At the end of each day, each student was asked to take a test on the topic covered on the ITINERIS TRAINING PLATFORM. The course consisted of a total of 14 assessment questions across the modules. To pass, participants had to answer at least 9 of the 14 questions correctly. Each student received a Certificate of Achievement. On the last day of the course, students completed a course survey on: quality of teaching, teaching materials and resources, organizational aspects, perceived economic value, the additional course is very good (4.5/5). The assigned technologist provided comprehensive support for the course logistics and managed all organizational aspects.

Figure 3.1: images from the training course : Advanced technologies for monitoring and prediction of ground instabilities

Course N.2

Title: Geophysical methods in geoscience and near surface geophysics

Description: This course will learn the basic knowledge concerning the main geophysical methods used for near surface investigation and the physical principles which form the basis for each of these methods with some examples of applications. The course will consist of 6 modules and the registration process has been opened with a deadline of 9 December 2024.The course will take place at Department of Earth Sciences, University of Pisa on January 20 -23.

Course N.3

Title: Geophysics and natural risks: instruments and principles of data analysis

Description: This course will learn Learning the basic concepts about the use of airborne Synthetic aperture radar (SAR) systems and introduction to strategies for acquiring, processing and integrating data acquired by in situ geophysical instrumentations, with a special focus on ground penetrating radar (GPR), electrical resistivity, electromagnetic systems and passive seismic methods, and hydrogeophysical monitoring methodologies. The course will consist of 7 modules and the registration process has been opened with a deadline of 9 December 2024 and the course will take place from 27 to 30 January at the Department of Earth Sciences of the University of Pisa.

3.6 Training activities for Trans Domain (WP8)

This section outlines the training offer dedicated to all WP3 Ph.D. students. The program consist in six advanced courses structured as a multidisciplinary curriculum designed to provide the essential transversal and technical skills required for a successful research career. The program covers a wide range of topics, including safety in research environments, scientific communication, the use of advanced Virtual Research Environments (VRE), and main pills of FAIR principles. Full reimbursement of expenses is provided for all lecturers and Ph.D. candidates attending these advanced courses. The collection of participant data will be managed by the WP3 staff, who will then communicate the information to FormaLab S.R.L for booking and secretariat purpose.

TRAINING PROGRAMME

Course N.1

Title: Safety in lab and field work related to Ris - 1

Description: This course will provide to Ph.D students notions about safety in laboratories (use of instruments, apparatus and/or chemical, physical or biological agents) and in field environments where activities are carried out outside. Instructors, provided an understanding of the risks that can occur in the field. It will illustrate all the precautions necessary to avoid or, if necessary, manage risks in order to carry out work activities in personal and colleagues' safety.
The course will include a full day dedicated to an outdoor exercise simulating an emergency situation. The course will consist of 4 modules. The registration process has been opened with a deadline of 9 December 2024.The course will take place at Repubblica Marinara Hotel, Pisa on January 14 -17.

Course N.2

Title: How to present your activities and results – 1

Description: The main aim of the course is to provide Ph.D. and Post Doc students with a method to communicate and disseminate their research results. Examples of oral presentations and scientific papers in the field of Earth System Science will be presented and discussed with the students. Through practical exercises and group work, participants will develop the necessary skills to draft and deliver oral presentations and write scientific articles. A variety of tasks will be assigned during the classes, including drafting posters and oral presentations, giving talks, practicing scientific writing, and editing. The course is scheduled in March.

Course N.3

Title: Use open scientific infrastructure facilities and VRE - Basic

Description: Creating digital work environments that facilitate "Data -driven" research through analytical and application data streams, allowing the researchers to easily access different datasets, elaborate and use them through calculating and visualization tools is the idea behind the VREs supported by D4Sciences.

The training provides notions on the Digital Objects, the FAIR principles for research products and the scientific data repositories, the VRE usability (from data collection, to data analysis up to results publication), the practical sessions on data analyses, the Cloud Storage principles and it will address possible necessities of the ITINERIS VREs. The course is scheduled in April.

Course N.4

Title: Use open scientific infrastructure facilities and VRE - Advanced

Description: The course provides to Ph.D students *advanced* notions to create digital work environments and it provides notions on the VRE and its Spatial Data Infrastructure, execution of analytical integrated processes, implementation of algorithms/methods, use of codes in Python and R, description and practical test on the ITINERIS VREs. The course is scheduled in April.

Course N.5

Title: Safety in lab and field work related to RIs – 2

Description: This course will provide to Ph.D students notions about safety in laboratories (use of instruments, apparatus and/or chemical, physical or biological agents) and in field environments where activities are carried out outside. Instructors, provided an understanding of the risks that can occur in the field. It will illustrate all the precautions necessary to avoid or, if necessary, manage risks in order to carry out work activities in personal and colleagues' safety.
The course will include a full day dedicated to an outdoor exercise simulating an emergency situation.
The course provides to Ph.D students *advnced* notions to create digital work environments and it provides notions on the VRE and its Spatial Data Infrastructure, execution of analytical integrated processes, implementation of algorithms/methods, use of codes in Python and R, description and practical test on the ITINERIS VREs. The course is schedulated in May at the University of Salento (LE).

Course N.6

Title: How to present your activities and results – 2

Description: The main aim of the course is to provide Ph.D. and Post Doc students with a method to communicate and disseminate their research results. Examples of oral presentations and scientific papers in the field of Earth System Science will be presented and discussed with the students. Through practical exercises and group work, participants will develop the necessary skills to draft and deliver oral presentations and write scientific articles. A variety of tasks will be assigned during the classes, including drafting posters

and oral presentations, giving talks, practicing scientific writing, and editing. The course is schedulated in May at University of Pisa.

4. LIST OF ACRONYMS

AI: Artificial Intelligence

CIG: Tender Identification Code (Codice Identificativo Gara in italian)

FAIR: Findable, Accessible, Interoperable and Reusable

GPR: Ground Penetrating Radar

HPC: High Performance Computing

ICT: Information and Communication Technology

RI: Research Infrastructure

SAR: Synthetic Aperture Radar

VRE: Virtual Research Environment

WP: Work Package