



D 3.12 Report: Second activity report of Activity 3.6



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1. INTRODUCTION

The deliverable 3.12 was planned to be released within the framework of the ITINERIS project and it is part of the activities of the Work Package (WP)3 concerning the activities organized in the second year of the project by all the OUs involved in Activity 3.6.

This deliverable is included into the Intermediate Objective 3.8 and it is produced under the responsibility of the Operative Unit (OU) of the National Research Council, Research Institute on Terrestrial Ecosystems (CNR-IRET).

The main aim of the deliverable 3.12 is to provide a general overview of the training program designed by the Operative Units of WP3 and developed in the second year of the project as planned in Activity 3.6. The remaining courses are also detailed, featuring information updated through end 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.

The document is structured in 3 chapters, including this chapter. Chapter 2 of the report provides the details of the training courses already provided and those updated for the current period proposed by the OUs of the WPs involved in WP3 for Activity 3,6. Chapter 3 presents the list of acronyms used in the report.

2. 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 3.6 (CIG: B0C25D0E0A). The objective of this tender was to centralize logistical tasks (ranging from flight and hotel bookings to catering services and lecturer contract management), decreasing significantly mitigating the administrative burden on the OUs.

The training courses of Activity 3.6 focused on providing needs for Research Infrastructures (RI) staff with a program designed to offer thirty-six advanced courses organized following the thematic categories addressing RIs' scientific and technical staff and selected user categories of the different domains included in the project ITINERIS with all the training materials produced and courses made permanently accessible through 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>.

2.1 Training activities for Access Management and eScience (WP2)

The training program aims to provide essential skills for researchers and technical staff of research infrastructures within the digital and data-intensive research ecosystem.

The training activities for Access Management (WP2) were designed to equip RI staff involved in user support and service provision with a solid foundation in access management. These two courses have been thought to deliver essential concepts, practical applications, and key processes for ensuring effective and user-centered access to research infrastructures. The training aimed to provide participants the ability to manage access efficiently by covering fundamental activities and requirements while fostering user trust and engagement with the RI.

The eScience training program offers a series of six intensive and specialized courses designed to enhance participants' skills in the management, analysis, and application of scientific data, with a strong emphasis on Open Science practices and the FAIR Principles (Findable, Accessible, Interoperable, Reusable).

The first two courses are entirely focused on the knowledge and practical application of the FAIR Principles, aiming to train participants capable of evaluating and implementing FAIRification strategies within their own organizations.

The subsequent courses focus on advanced tools and methodologies for data analysis, including: utilizing ontologies and Knowledge Graphs to enhance the discoverability and interoperability of complex data; mastering Cloud technologies and Virtual Research Environments (VREs) for executing data-intensive research activities using Jupyter Notebooks; developing efficient workflows for geospatial analysis and modelling using open-source tools such as Linux, GDAL, and Python; and providing an interdisciplinary foundation for applying AI and Machine Learning (ML) techniques in the environmental field.

TRAINING PROGRAMME

Access and Management courses

Course N.1

Title: Access to Research Infrastructures: Process and Modalities-1

Description: This course provided a comprehensive understanding of access management principles. Participants learnt to navigate user applications, peer reviews, service provision,

and feedback collection. Case studies and hands-on exercises ensured participants can apply their knowledge effectively, enriching their skillset and user experience outcomes. This training course intended to provide RIs' staff involved in serving and supporting users with an adequate base of practical knowledge for access management. The course conveyed the essential concepts, practical applications, processes, main activities and requirements to successfully provide access that meets user needs and earns their trust and engagement in the RI. The course was delivered to professionalize RI personnel whether they were beginners or seeking to improve their operations. The training was delivered by two highly experienced experts in international research infrastructure access management: Dr. Rosa Maria Petracca Altieri, a research technologist at CNR, specialized in user access management for RIs, design and implementation of strategic frameworks for RI access and sustainability, and Dr. Sabine Philippin, a research manager at CNRS-LAMP, with extensive experience in European research infrastructures and involved in access policies, service provision, and long-term sustainability of RIs.

The course was structured around six key modules, covering a broad range of topics fundamental to RI access management:

- Introduction to Research Infrastructure Services
- Access Legal Framework (EU, national, and local regulations, access policies, governance)
- User Needs and Experience (user segmentation, feedback collection, user experience enhancement)
- Access to RI Services (definition of services, service catalogues, ITINERIS Catalogue of Services)
- Access Process (access lifecycle, workflows, evaluation, access management plans, ITINERIS Access Management Plan and Platform)
- Financial Framework for Access and Sustainability (cost estimation, funding strategies, pricing schemes, ITINERIS access programme sustainability)

Training objectives: The course aimed to provide participants with a robust understanding of the fundamental concepts and principles of access management. Participants adopted a user-centric approach developing practical skills to master essential processes, such as user application, peer review, service provision, and feedback collection. Insights into real-world scenarios and case studies allowed participants to explore practical applications. Hands-on exercises enabled RI personnel to gain the necessary skills to apply their knowledge effectively in their specific contexts, ensuring a satisfactory user experience.

The course was held at the Ateneo Garden Palace, Via dei Salentini 3, Rome, on October 23, 24, and 25. It involved 25 participants, including 2 WP3 technologists, from the following research infrastructures and institutes:

- | | |
|---------------|--------------|
| • ACTRIS | • EMPHASIS |
| • AnaEE | • EMSO-ERIC |
| • CeTrA | • Geoscience |
| • DANUBIUS-RI | • IBISBA |
| • DiSSCo | • ICOS |
| • ECORD | • JERICO-RI |
| • eLTER-RI | • LifeWatch |

- SIOS

The course consisted of 6 modules, with a total of 12 assessment questions across the modules on ITINERIS TRAINING PLATFORM. To pass, participants had to answer correctly at least 9 of the 12 questions. The assigned technologist provided comprehensive support for the course logistics and managed all organizational aspects.



Figure 2.1: images from the training course Access to Research Infrastructures: Process and Modalities –1

Course N.2

Title: Access to Research Infrastructures: Process and Modalities- 2

Description: This second edition of the compact training course “Access to Research Infrastructures: Process and Modalities “is intended to deepen the RIs’ staff base of practical knowledge for access management. The course conveys the essential concepts, practical applications, processes, main activities and requirements to successfully provide access that meets user needs and earns their trust and engagement in the RI. The course will enrich and professionalize RI personnel whether they are beginners or seeking to improve their operations.

Training objectives: The course aims to provide participants with a robust understanding of the fundamental concepts and principles of access management. Participants will learn to adopt a user-centric approach, developing practical skills to master essential processes, such as user application, peer review, service provision, and feedback collection. Focus on ITINERIS case studies and hands-on exercises will allow participants to explore practical applications related to service management (description, cataloguing, costing, Service Level Agreements).

The second edition of the course will be held in person and is scheduled to take place on March 18-20, 2025, at the CNR Research Area in Potenza, Contrada S. Loya, 85050 Tito Scalo (PZ), Italy. For this edition, three different teachers, Dr. Carmela Cornacchia (CNR-IMAA), Dr. Rosa Maria Petracca Altieri (CNR-IMAA) and Dr. Simone Gagliardi (CNR-IMAA), have been selected to lead the training sessions, ensuring a diverse and comprehensive learning experience.



Figure 2.2: Course flyer of the 2nd edition of the course “Access to Research Infrastructures: Process and Modalities – 2”

eScience courses

Course N.1

Title: FAIR Awareness

Description: The advanced course, delivered entirely online primarily by instructors from the GO FAIR Foundation, consisted of five distinct sessions. These sessions took place on November 27, 29, December 4, 5, and 11, 2024. The training methodology was comprehensive, involving reading materials, live lectures and discussions, hands-on exercises, and training videos. The core content provided participants with a rigorous understanding of the FAIR Principles (Findable, Accessible, Interoperable, Reusable) and practical ideas on how to plan their FAIR implementation strategy using the Three-Point-FAIRification Framework.

The course was structured into 5 modules as follows (one module per session): History and Origins of FAIR; The FAIR Principles; Good FAIR Practices; FAIR Data Stewardship; FAIR Assessment Tools.

Training objectives: Upon completion of the course, participants are expected to: Know the origins and history of FAIR and the problems the framework is designed to solve; Evaluate the costs and benefits of implementing FAIR data policies; Recognize successful implementation examples and differentiate them from "Fake FAIR" practices; Be knowledgeable about both qualitative and quantitative FAIR assessment tools; Understand how FAIR fits into broader data management and data stewardship workflows; Learn how to effectively prioritize FAIR implementations within project proposals and strategic roadmapping.

Over 30 participants attended the training; 25 of these participants successfully passed an additional examination at the end of this course and the “FAIR Assessment via FAIR Implementation Profiles”, allowing them to receive the FIP Implementer qualification issued by the GO FAIR Foundation. The following Research Infrastructures (RIs) were represented in the training course:

- ACTRIS
- AnaEE

- ATLAS
- CeTrA
- DANUBIUS RI
- DiSSCo
- eLTER RI
- EMPHASIS
- EMSO
- IBISBA
- ICOS
- IMAA
- IRET
- JERICO
- LifeWatch
- LNS
- OGS
- SIOS
- SMINO

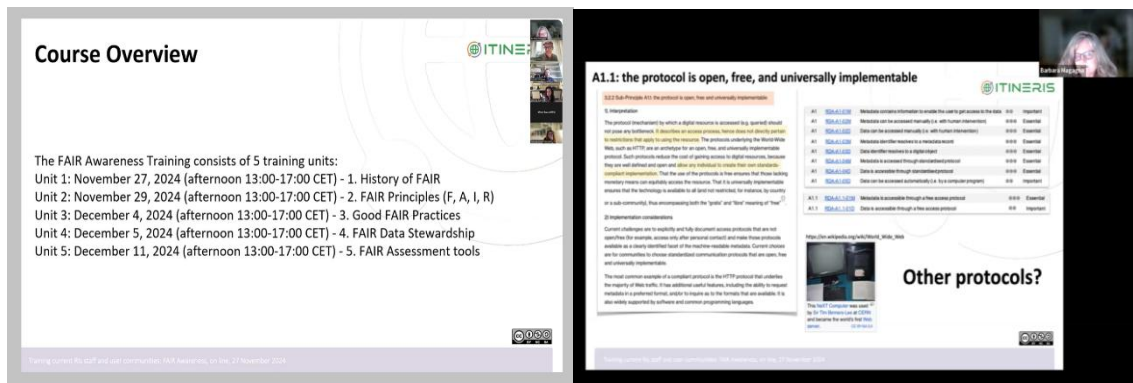


Figure 2.3: images from the training course FAIR Awareness

Course N.2

Title: FAIR Assessment via FAIR Implementation Profiles

Description: This follow-up course will improve the understanding gained in the previous course “FAIR Awareness”. The course focus is on how to conduct a rigorous FAIR assessment of a given resource, using FAIR Implementation Profiles (FIPs), part of the Three-Point-FAIRification Framework. This approach aims to help participants to better understand FAIR implementation solutions that drive convergence across communities.

The course will be provided online involving lectures and discussions, hands-on exercises, training videos, assistance time in workshops and a final exam for getting the qualification for a FIP facilitator during January and February 2025.

Training objectives: After completing of this course, participants can qualify as FIP implementers with the GO FAIR Foundation, giving them the confidence to raise FAIR awareness in their organizations and provide advise on how best to implement FAIR fit to purpose.

Course N.3

Title: Semantic tools and Datalabs: an Integrated approach to data analysis

Description: This course will provide researchers to master the intersection of semantic technologies and data analysis, anchored by the FAIR Principles (Findable, Accessible, Interoperable, Reusable). Participants will gain hands-on expertise in leveraging tools like ontologies, metadata standards, and knowledge graphs to dramatically enhance data discoverability and interoperability. Through practical, real-world sessions, the curriculum provides the skills needed to effectively manage, enrich, and analyze complex datasets in alignment with global Open Science and FAIR best practices. The course will be provided in June at the Ecotekne University Campus (Lecce).

Course N.4

Title: Open Science on Cloud using Jupyter Notebooks

Description: The course is a 24-hour short program focused on training scientific staff—such as those at RI data centers—to effectively utilize the technologies and methodologies required for performing research activities with Jupyter notebooks on the Cloud. Delivery will be structured around a project-based teaching model. For all practical exercises and final course projects, participants will rely on the LifeWatch Notebook-as-a-VRE (NaaVRE) environment.

Training Objectives: This course will provide a foundational understanding of the digital research ecosystem, covering core concepts like VREs, Scientific Workflows, and Cloud Computing. Participants will master the key techniques involved in data and computing-intensive research. Practical skills include loading external data into the Jupyter environment and developing robust, data-intensive applications while applying basic software quality control. Ultimately, attendees will be able to synthesize these skills to develop a small research project using integrated data management, cloud, and workflow technologies.

The course will be provided in June at the Ecotekne University Campus (Lecce) and online.

Course N.5

Title: Geocomputation and geospatial modelling analysis - RI

Description: This course will introduce students to a robust array of powerful, open-source geocomputation tools (specifically, GDAL and Python) within the Linux environment. The core objective is to rapidly upskill participants who may have little to no prior Linux programming experience. By the end of the training, attendees are expected to feel confident in their ability to understand and modify advanced open-source data processing routines. The goal is to equip researchers with powerful, transferable tools and to hone their capacity for effective independent study afterward. The acquired skills will be immensely beneficial, extending beyond GIS-related applications to general data processing and applied statistical computing across numerous fields. Ultimately, we aim to provide participants with a sound foundation for a successful career as a Geographic Data Scientist.

Training objectives: The primary objectives of this course are to equip researchers and technicians with the skills necessary to implement efficient geospatial data analysis and management workflows using open-source tools. This involves developing proficiency in Linux for effective file and system management, mastering open-source geoprocessing tools for the manipulation of both raster and vector data, and utilizing the Python programming language for robust data processing and workflow automation. Furthermore, they will explore and apply Python's scientific libraries to conduct sophisticated analysis on geospatial data.

The course will be provided in June at the Ecotekne University Campus (Lecce) and online.

Course N.6

Title: Artificial Intelligence applied to environmental monitoring

Description: This intensive course aims to provide participants with an interdisciplinary foundation in applying Artificial Intelligence (AI) and Machine Learning (ML) techniques to environmental sciences. The focus is to equip participants with the knowledge of fundamental AI/ML concepts and to utilize these technologies for critical environmental applications such as biodiversity monitoring, climate modelling, remote sensing and big data analysis.

Training objectives: The course aims to enable participants to understand and apply fundamental AI, ML, and Deep Learning concepts. A key objective is the practical application of AI tools in crucial environmental contexts, including biodiversity monitoring, climate modelling, remote sensing, and big data analysis for air, water, and soil quality. Finally, the program focuses on the critical skill of evaluating the ethical implications of AI deployment, with emphasis on issues such as privacy, data sovereignty, the impact of automation, and equitable decision-making in environmental contexts.

The course will be provided in June at the Ecotekne University Campus (Lecce).

2.2 Training activities for Atmospheric Domain (WP4)

The training courses related to the activity 3.6 for the atmospheric domain have been designed to guarantee a balanced and complete learning path encompassing in situ and remote sensing atmospheric data, together with a general perspective on human health and atmospheric data exploitation. A total number of six courses are foreseen:

- Two courses on atmospheric standardized observations, one for the in situ and one for the remote sensing parts.
- Two courses on the data acquisition, processing and submission, one for the in situ and one for the remote sensing parts.
- One course on the exploitation of atmospheric composition data from the ground-based, atmospheric models, and satellite perspective.
- One course on climate change, urban pollution and human health.

A detailed description of the six courses is provided in the following section.

TRAINING PROGRAMME

Course N.1

Title: ACTRIS Aerosol Remote Sensing Data Acquisition, Processing, and Submission

Description: The first training course related to the activity 3.6 for the atmospheric domain was mainly focused on the aerosol data management for the ACTRIS community. The course was also followed by researchers working on other atmospheric Research Infrastructures such as ICOS. The course provided information on modalities of data submission, processing and curation for the ACTRIS aerosol remote sensing component. The course was mainly addressed to people dealing with aerosol remote sensing observations, even outside ACTRIS.

Training objectives: This course objective was to provide the scientific and technical background needed to be part of the Aerosol Remote Sensing component of ACTRIS. This includes being able to deal with standard operative procedures to maintain high quality, accessible, well documented, and traceable Aerosol Remote Sensing data products, including digital tools for data submission, data processing, and quality control.



Figure 2.4: images from the training course ACTRIS Aerosol Remote Sensing Data Acquisition, Processing and Submission

The course was held at Institute of Methodologies for Environmental Analysis, Contrada S. Loja - Zona industriale C.P. 27 - 85050 Tito Scalco (PZ) on the 11th-12th-13th of November 2024. Thirteen students from the WP4 Operating Units, ICOS and ACTRIS National Facilities, were involved.

During the training the students had the chance to interact with six experts in atmospheric data acquisition, processing and submission: Giuseppe D'Amico (CNR-IMAA), Ina Mattis (DWD), Nikolaos Siomos (LMU), Pilar Gumà Claramunt (CNR-IMAA), Claudio Dema (CNR-IMAA), Lucia Mona (CNR-IMAA). The course was divided in two modules:

- Module 1: ACTRIS Aerosol Remote Sensing data standardisation and processing (11th-12th of November)
- Module 2: ACTRIS Aerosol Remote Sensing Data Center: submission and data curation (13th of November)

Table 2.1: agenda overview of the course.

11 November			12 November		
09:00 – 09:30	Arrival, registration, Coffee		09:00 – 10:00	• Depolarization calibration: instrumental correction	Nikolaos Siomos (LMU)
09:30 – 09:40	• Welcome and logistics	Gianluca Di Fiore (CNR-IMAA)	10:00 – 11:00	• Depolarization calibration: SCC implementation	Giuseppe D'Amico (CNR-IMAA)
09:40 – 10:00	• Aerosol Remote Sensing data standardization: ACTRIS approach	Giuseppe D'Amico (CNR-IMAA)	Coffee break		
10:00 – 11:30	• ACTRIS Aerosol Remote Sensing data processing: SCC overview	Giuseppe D'Amico (CNR-IMAA)	11:30 – 12:30	• Optical processing of lidar data	Ina Mattis (DWD)
11:30 – 12:30	• ACTRIS Aerosol Remote Sensing instrumental quality assurance	Nikolaos Siomos (LMU)	Lunch		
14:00 – 14:30	• Lidar data pre-processing	Giuseppe D'Amico (CNR-IMAA)	14:00 – 16:00	Hands on: optimized processing settings, submission depolarization calibration data	Giuseppe D'Amico (CNR-IMAA) Claudio Dema (CNR-IMAA) Ina Mattis (DWD) Pilar Gumà Claramunt (CNR-IMAA) Nikolaos Siomos (LMU)
14:30 – 15:30	• SCC web interface/API	Claudio Dema (CNR-IMAA)	Coffee break		
15:30 – 16:00	• Raw data conversion/submission tools	Pilar Gumà Claramunt (CNR-IMAA)	16:30 – 17:30	Hands on: optimized processing settings, submission depolarization calibration data	Giuseppe D'Amico (CNR-IMAA) Claudio Dema (CNR-IMAA)
Coffee break					
16:30 – 17:30	Hands on: setup of simple system, submission of raw data file, basic processing	Giuseppe D'Amico (CNR-IMAA) Claudio Dema (CNR-IMAA) Ina Mattis (DWD) Pilar Gumà Claramunt (CNR-IMAA)			
13 November					
09:00 – 09:20	• ACTRIS Aerosol Remote Sensing data processing: Future Developments	Giuseppe D'Amico (CNR-IMAA)			
09:20 – 10:30	• ACTRIS Aerosol Remote Sensing datacenter: ARES overview	Lucia Mona (CNR-IMAA)			
Coffee break					
11:00 – 11:30	• Automatic Quality control on ARES products	Pilar Gumà Claramunt (CNR-IMAA)			
11:30 – 12:00	• ARES submission data portal	Pilar Gumà Claramunt (CNR-IMAA)			
12:00 – 12:30	• ARES data portal/API	Claudio Dema (CNR-IMAA)			
Lunch					
14:00 – 14:30	• ARES data portal: new products	Lucia Mona (CNR-IMAA)			
14:30 – 16:00	Hands on: exploring and getting products from ARES data portal/API	Claudio Dema (CNR-IMAA) Pilar Gumà Claramunt (CNR-IMAA)			
Coffee break					
16:30 – 17:15	Hands on: exploring and getting products from ARES data portal/API	Claudio Dema (CNR-IMAA) Pilar Gumà Claramunt (CNR-IMAA)			
17:15 – 18:00	Visit to CIAO				

The two modules were designed to have three typologies of interaction: i) “frontal teaching” session, where the teachers were providing frontal lessons to the students via power point presentations; ii) “hands on” session, where students, assisted by the teachers, could interact with the tools used for aerosol remote sensing data processing and submission; iii) “modules’ final test” session, where students can test their knowledge on the topic learnt. All students successfully passed the exam. The students and the teachers also had the chance to visit the CNR-IMAA Atmospheric Observatory (CIAO) and get to know better the instruments used for collecting atmospheric data.

Course N.2

Title: Atmospheric Composition Data Exploitation

Description: The training course will provide an overview of available measurements from ground-based, airborne, satellite and model platforms of interest for the investigation of atmospheric composition. The course will also provide some examples of data accessing, handling and exploration tools and hands on exercises. TO better organize the teaching activities, the course will be divided in three topical modules: ground-based observations, atmospheric models, satellite observations. The modules will be divided in frontal teaching sessions and practical sessions. Students will have the chance to practice the different atmospheric perspective through three case studies: Canadian fire in 2023; Saharan dust events from 2024; North Stream methane leak during Ukrainian war.

Training objectives: The course aims to provide an overview of atmospheric composition data in terms of content and access possibilities. The training is addressed to researchers and technologists recently hired at the RIS as well as to PhD students and research fellows working at RIs and more in general in atmospheric field.

The course will be held on January 28-30, 2025 at the Institute of Methodologies for Environmental Analysis, Contrada S. Loja - Zona industriale C.P. 27 - 85050 Tito Scalo (PZ) with hybrid participation (max 15 students allowed in-person)

Course N.3

Title: Atmospheric standardized observations: Methods and maintenance in observatories – In-Situ

Description: The course is mainly addressed to people related to the in-situ atmospheric measurements at the National Facilities. It is open for any interested student from final year of Master to Postdoc level; but engineers and scientists from the ACTRIS and ICOS RIs are welcome. Lectures give an overview of the scientific topics and the methodologies, operative procedures recommended for in situ long term in situ measurements of trace gases, aerosol, clouds.

Training objectives: Give the main information on scientific questions and standard operative procedures to maintain high quality, accessible, well documented and traceable in situ (ACTRIS-ICOS) measurement data and data products, including digital tools for data quality control, analysis, visualisation, and research.

The course will be held on May 27-28, 2025 in Via Rocca, 2, 41029 Sestola MO + GAW/WMO Global station of Monte Cimone

Course N.4

Title: Atmospheric Data acquisition, processing, and submission. In-Situ.

Description: The course will provide information on modalities of data submission, processing and curation for the ACTRIS aerosol in situ component. The course is mainly addressed to people dealing with aerosol in situ observations, even outside ACTRIS. It is open for any interested student from final year of Master to Postdoc level; but engineers and scientists are welcome as well.

Training objectives: Provide the scientific and technical background needed to be part of the Aerosol in situ component of ACTRIS, define standard operative procedures to maintain high quality, accessible, well documented, and traceable aerosol in situ data products, including digital tools for data submission data processing, and quality control.

The course will be held in May 2025 in Via Rocca, 2, 41029 Sestola MO + GAW/WMO Global station of Monte Cimone

Course N.5

Title: Atmospheric Standardized observations: methods and maintenance in the labs – Remote Sensing

Description: This course is aimed at providing the knowledge to manage the laboratorial activities confidently and autonomously, for Remote Sensing Atmospheric Standardized Observation. Lectures give an overview of the techniques and methodologies, operative procedures recommended for Remote Sensing long-term measurements of aerosol. The training course is open to: students from final year of Master to Postdoc level; engineers, technologists and scientists.

Training objectives: It provides the main information on techniques and methodologies for atmospheric ground-based remote sensing observations, and standard operative procedures to autonomously maintain high quality, accessible, well documented, and traceable Remote Sensing measurement data and data product.

The course will be held in Contrada S. Loja - Zona industriale C.P. 27 - 85050 Tito Scalo (PZ)

Course N.6

Title: Climate change and urban pollution: challenges and objectives for the atmospheric research

Description: The course, that will be provided online, will give the students the knowledge to better understand the key elements to be considered when addressing climate change and urban pollution from an atmospheric research perspective. The training is addressed to researchers and technologists recently hired at the RIS as well as to PhD students and research fellows working at RIs and more in general in atmospheric field.

Training objectives: The current status of climate changes and urban pollution will be treated within the course. In particular, research needs for addressing climate change processes and uncertainties as well as links between air quality and human health will be discussed.

Modules (drat): i) Climate change scientific key questions: Aerosol & Clouds relevance-Extreme events (flooding, fires, heat waves); ii) Reducing impact of climate change effects using atmospheric knowledge (Solarenergy , water wasting, early warnings); iii) Urban pollution, open questions and link with Human health

2.3 Training activities for Marine Domain (WP5)

The training programmes of the WP5 was developed considering the pillars and concepts presented in the previous Deliverables. Two courses were delivered, while the others are still under development.

TRAINING PROGRAMME

Course N.1

Title: Introduction to Marine Research Infrastructures: managing complexity

Overview: This course introduces Marine Research Infrastructures, focusing on their operation and management. Participants will learn about their complexity, governance models, financial aspects, policy frameworks, and the scientific data process. Practical examples under ITINERIS will be explored, from sensor installation to data sharing and publication

Description: This course offers a comprehensive introduction to the marine research infrastructures highlighting their complexity in terms of operation and management. Participants will gain insights into the multifaceted aspects of research infrastructures, which represent a relatively recent reality within both the Italian and European contexts. The course provides practical examples of marine research infrastructures under ITINERIS, exploring governance models, financial considerations, policy frameworks, and the scientific data production process from sensor installation to data sharing and publication.

Training objectives: Besides the socio-economic relevance and the importance for advancing the S&T research, the trainees will get familiarity with the management and operation of different types of marine research infrastructures –including the different modes by which the researchers and general users can take advantage of the use of infrastructures.

The course was held at the INGV offices in Catania, from the 25th to the 28th of November 2024. It involved 31 participants, including 2 WP3, 4 WP5, 1 WP2 technologists, from the following research infrastructures and institutes:

- ACTRIS
- DANUBIUS-RI
- eLTER-RI
- EMSO-ERIC
- Euro Argo
- Eurofleets
- ICOS
- INFN-LNS
- JERICO-RI
- SIOS

The course consisted of 4 modules, 1 site visit (on the 27th of November students were brought to INFN-LNS facility in Porto Palo), and a final test carried out on ITINERIS TRAINING PLATFORM. To pass, participants had to answer correctly at least 11 of the 15 questions.

The assigned technologist provided comprehensive support for the course logistics and managed all organizational aspects.

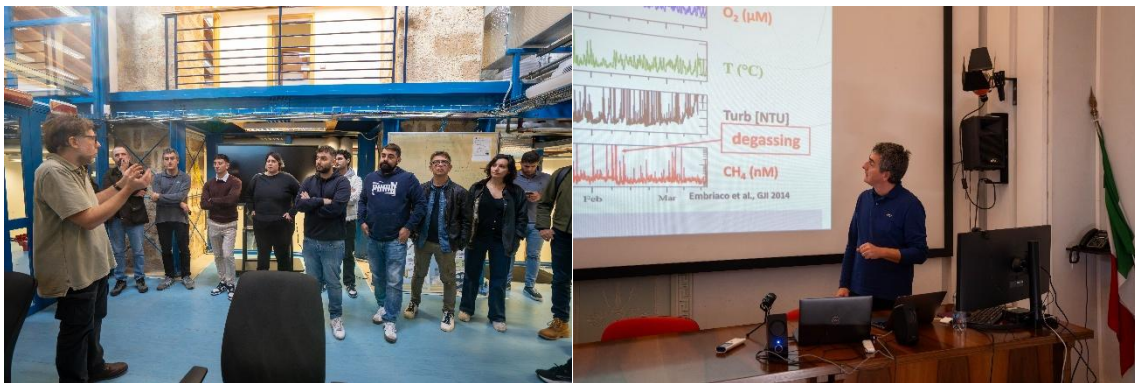


Figure 2.5: images from the training course Introduction to Marine Research Infrastructures: managing complexity

Course N.2

Title: Marine data management and data quality control

Description: This course aims to provide a comprehensive introduction to marine data management and validation, including the guiding principles of open science and the European data infrastructures that support it. This course has been developed by and for marine data managers and researchers responsible for the collection and good management

of marine data. It covers various general aspects related to marine data management and data life cycle, including metadata, quality control, data policy, data sharing and publication, data management plans. By the end of this course, participants will be able to undertake the core tasks required to process and curate marine data and advise researchers on the importance of metadata and responsible data sharing.

Training objectives: Participants will get with a solid understanding of the fundamental concepts, best practices and principles of data management and quality control. Insights from previous experiences and case studies will allow participants to deepen the knowledge on the national and EU landscape of marine data infrastructures. Practical exercises will enable RI staff to acquire the basic skills to be applied effectively in their specific context.

The course was held at the CNR-ISMAR offices in Venice, from the 9th to the 12th of December 2024. It involved 37 participants, including 2 WP3, 4 WP5, 1 WP2 technologists, from the following research infrastructures and institutes:

- ACTRIS
- DANUBIUS-RI
- DiSSCo
- eLTER-RI
- EMSO-ERIC
- Euro Argo
- Eurofleets
- ICOS
- INFN-LNS
- JERICO-RI
- SIOS

The course consisted of 7 modules and a final test carried out on ITINERIS TRAINING PLATFORM. To pass, participants had to answer correctly at least 12 of the 17 questions.



Figure 2.6: images from the training course Marine data management and data quality control

Course N.3

Title: Ship-based training initiatives in marine-related sciences

Description: The course aims to prepare technical-scientific personnel for effective research engagement in marine environments and it will be divided in two parts, the first

which aims to give preparatory information and the second which consists in the training activities on a research vessel. This remote preparatory course will be carried out remotely and provides essential theoretical knowledge and foundational skills required for ship-based training in marine-related sciences. Participants will gain an understanding of basic offshore safety, oceanographic instruments, and data processing techniques. This course is designed to prepare technical-scientific personnel for effective engagement in subsequent hands-on training aboard oceanographic vessels. Upon completion of the preparatory course, participants will be equipped with the foundational knowledge necessary to effectively participate in the on-board part, which provides comprehensive ship-based training in marine-related sciences, emphasising practical skills and theoretical knowledge essential for research activities aboard oceanographic vessels (i.e. BOSIET certificate). Participants will undergo a safety course and gain hands-on experience in operating oceanographic instruments, conducting field activities, and processing collected data.

Course N.4

Title: Title: Structure of the Marine Data Access at the European Level

Description: The course provides a comprehensive overview of the infrastructure and mechanisms facilitating access to marine data across Europe. Participants will delve into the intricate network of data repositories, platforms, and protocols established to collect, manage, and disseminate marine data. From oceanographic research to environmental monitoring and maritime activities, the course examines the crucial role of data accessibility in understanding and managing the marine environment. Through case studies and practical examples, learners will gain insights into the challenges and opportunities inherent in harmonizing marine data access on a continental scale, contributing to informed decision-making and sustainable marine resource management.

Course N.5

Title: Introduction to Marine Research Infrastructures: managing complexity - 2

Description: This course offers a comprehensive introduction to the management of complexity within marine research infrastructures. Participants will gain insights into the multifaceted aspects of research infrastructures and their management within both the Italian and European contexts. The course covers various types of marine research infrastructures under ITINERIS, exploring governance models, financial considerations, policy frameworks, and the scientific data production process from sensor installation to data sharing and publication.

Course N.6

Title: Marine data management and data quality control.

Description: The course will provide general information on data management and quality control of different marine data types and an overview of the main EU Blue Data Infrastructures, their tools and services. The FAIR data management principles will be used as guidelines to introduce interoperability solutions (metadata and standards) and discuss the data life cycle and how to develop data management plans (DMP). Technical aspects and specific tools (i.e. Ocean data View, ERDDAP) will be introduced together with practical examples and exercises. Data and data products publication (i.e. DOI) best practices will also be introduced

2.4 Training activities planned in Terrestrial Domain (WP6)

The training activity of WP6, described in the previous Deliverables, has successfully moved into the operational phase. The delivery of the first training course began on December 2024, delivered via an asynchronous online platform. Meanwhile, the logistical components for the subsequent five courses are currently going to be finalized to ensure learning experience.

TRAINING PROGRAMME

Course N.1

Title: “Datalogger programming and sensors connection – Basic course

Description: This course equips the participants with the fundamentals of environmental data logging, covering sensor connection, data collection setup, metadata management, and data retrieval. Dataloggers are widely used in environmental monitoring. The course provides the basic information needed to prepare a data logger, connect the different sensors and understand the possible options, setup the data collection scheme, list the metadata needed and collect and download data. The participants will have the needed knowledge to connect and collect data from a range of environmental sensors.

Training objectives: The course has been provided the basic information needed to prepare a data logger, connect the different sensors and understand the possible options, setup the data collection scheme, list the metadata needed and collect and download data. The participants had the needed knowledge to connect and collect data from a range of environmental sensors. The course program covered the following topics: connecting to a data logger, view pro, management tasks, device configuration, data tables, power system design, station setup examples, grounding the system, verification of measurements, troubleshooting of measurements, station maintenance.

The course, delivered online in an asynchronous format, commenced on 10 December 2024. It saw the participation of over 70 registrants from many Research Infrastructures, including:

- AnaEE
- EMPhASys
- eLTER,
- ICOS

All participants received instructions to access the online materials and the final exam.

Course N.2

Title: Use of Isotopes in environmental investigations

Description: The course will introduce the use of isotopes in the environmental applications in the different domains and then dedicate time (in parallel or sequential) to use in different components (atmosphere, vegetation, soil, water). It includes practical activities in the laboratory. Participants will have an overall idea of the possible isotope based methods and basics of data collection.

Course N.3

Title: Introduction in python programming

Description: The aim of the course is to supply the basic concept of programming for data manipulation and analysis. The course will start from zero knowledge and will introduce the basic concepts of Python. Examples and practical sessions will be based on solving typical problems with attention to general concepts of programming and data manipulation. By the end of the course, the participants will have a good understanding of the Python basics and will have acquired the skills to manipulate data files and tables, and to write/execute a Python code from Python notebooks.

Course N.4

Title: Introduction to High Performance and Data Intensive Computing - RIs

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 computing technology 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 organized in modules.

Course N.5

Title: Datalogger programming and sensors connection advanced

Description: Advanced Datalogger Programming Course is dedicated to graduates of the basic course, this program explores advanced techniques for complex data collection and management. The course, which includes many practical activities, aims to train independent operators capable of managing complex operational situations involving the use of multiple types of sensors.

Course N.6

Title: Eddy Covariance theory and practice: from sensor setup to preliminary data processing - RIs

Description: The course will provide the basics of the eddy covariance technique. Principles of atmospheric physics, sensor characteristics and setup, fluxes calculations and aspects to consider in the measurement. Participants will have the essential knowledge to design and implement an eddy covariance tower and calculate the fluxes. During the

course, various practical activities will be carried out relating to both the construction phase of the Eddy towers and the management and analysis of the data collected.

2.5 Training activities for Solid Earth (WP7)

During the second year, the WP7 training programme was defined to ensure a comprehensive learning path on geosphere and land surface sensing and monitoring technologies. A total of five courses are planned on geophysical data acquisition and archiving, new tools acquired with the ITINERIS project, technologies for detecting and monitoring ground displacements, and data mining with machine learning and deep learning. Several coordination meetings were organised with the WP7 leader, researchers and lecturers to define the details of the courses and their scheduling.

TRAINING PROGRAMME

Course N.1

Title: Advanced technologies for landslides

Description: This course will offer an introduction to landslide processes, exploring the most widely used data acquisition methodologies and their applications. Participants will learn about technologies for detecting and monitoring ground movements, as well as the key Early Warning Systems employed for landslide phenomena on both local and regional scales. The course will consist of 4 modules. The registration process has been opened with a deadline of 7 January 2025. The course will take place at Civil Protection Centre - University of Florence on January 27 -30.

Course N.2

Title: Digital collection and archiving of drilling data with mDIS

Description: This course provides a detailed description and application and customisation of the database software mDIS (mobile Drilling Information System) developed and used at GFZ Potsdam within the International Continental Scientific Drilling Program (ICDP) and adopted by the European Consortium for Research Ocean Drilling (ECORD). During the course the developers will collect the needs of the Italian ITINERIS scientific community for data collection and usage to create a requirement catalog for a ITI-NERIS-mDIS version. The course will consist of 3 modules and Hands-on session on m-DIS. The registration process has been opened with a deadline of 7 January 2025. The course will take place at Kosmos Natural History Museum, Pavia on 04 -07 February.

Course N.3

Title: Distributed Acoustic Sensing (DAS) for high resolution and high scale geophysical imaging

Description: This course provides an introduction to DAS technology and how it can improve geophysical inspections in different context such as: VSP, reflection/refraction

seismic, reservoir monitoring. Theoretical principles, data acquisition methodologies and application examples of the main surveying. Survey design approaches, processing techniques with hands-on practice, both on real datasets and actual field equipment. The course will consist of 5 modules. The course will take place at OGS, Trieste on 04 -07 February.

Course N.4

Title: Geophysical instruments and data processing

Description: The course is held at the pilot sites of the WP7 in Friuli Venezia Giulia and Basilicata regions. Introduction to the near-surface geophysics; Presentation of the geophysical-airborne approach for near-surface, land surface monitoring and natural risk mitigation; Description of the instrumentation; elements of data processing; field activities; demonstration of data analysis. The course will consist of 5 modules. The course will consist of 2 modules. The course will take place at CNR –IMAA Tito Scalo (PZ). The course will be activated in June, the exact starting date of the course has not yet been determined.

Course N.5

Title: Data mining and machine learning for Geophysics

Description: The course provides the basics of artificial intelligence and the paradigms of machine learning and deep learning. The lectures will be theoretical and practical, with thematic discussions and guided exercises. The course will consist of 4 modules. The course will take place at DIEM, University of Salerno (SA). The course will be activated in June, the exact starting date of the course has not yet been determined.

2.6 Training activities for Trans Domain (WP8)

During the second year, the training programme of WP8, with the support of lecturers and training companies, the training programmes were detailed. The training activities for future RI research staff are divided into three main subject areas: Safety with 2 courses, VRE with 2 courses and how to present one's activities and results with 2 courses, spread over two years. The training includes theoretical knowledge and practical sessions. The first course 'VRE operating mode – BASIC' has been activated on December 2024.

The other courses scheduled are described in the following two paragraphs.

TRAINING PROGRAMME

Course N.1

Title: VRE operating mode - BASIC

Description: This training introduced to digital assets, FAIR principles for research products and scientific data repositories, VRE usability (from data acquisition to data analysis to publishing results), data analysis hands-on, and cloud storage principles. 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 provided 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.

Training objectives: use of VRE from collection to data elaboration, use of data analysis tools, Cloud Storage and Computing, Research Publishing, address ITINERIS VREs necessities.

The course was held at the National Research Council, Pisa Research Area, Pisa, on December 09-12, and it involved 19 participants from the following research infrastructures and institutes:

- ACTRIS
- ATLAS
- CeTrA
- DiSSCo
- ECORD
- Elter
- EMSO-ERIC
- EuroArgo
- IBISBA
- LifeWatch
- SIOS
- SMINO

The course involved the expertise of CNR-ISTI (Dr. Massimiliano Assante, Dr. Luca Frosini, Dr. Lucio Lelii, Dr. Francesco Mangiacrapa, Dr. Alfredo Oliviero, Dr. Marco Procaccini, Dr. Gian Luca Vannini) and CNR-IGG (Dr. Eugenio Trumpy):

The course consisted of 4 modules covered over the four days of the course, a full day was dedicated to each module.

1. Introduction to ITINERIS Project, Digital Objects, FAIR principles for research products, Scientific Data Repository
2. D4 Science, VRE concepts and VRE Common Services to support the entire research cycle
3. Cloud computing, Data analysis tools (JupyterLab, CCP)
4. D4Sciences VREs case studies and ITINERIS VREs

During the course, the teachers propose "hands-on" sessions, which are appreciated by the participants. Hands-on sessions guide participants in storing scientific data in the cloud, analysing and processing that data, and publishing it in a metadata catalogue for immediate access.



Figure 2.7: images from the training course : VRE operating mode - BASIC

At the end of each day, each participant was asked to take a test on the topic covered on the ITINERIS TRAINING PLATFORM. The course consisted of a total of 8 assessment questions across the modules. To pass, participants had to answer at least 5 of the 8 questions correctly. Each participant received a Certificate of Achievement. On the last day of the course, participants 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).

Course N.2

Title: Safety in the field work related to RIs (towers climbing and hiking principles)

Description: the course is intended for IR personnel who for research activities work at height (tower climbing) and may have to manage emergency situations and first aid, related to extreme conditions (bleeding, hypothermia, anaphylactic reaction, altitude sickness). the training provides BLS certification; First Aid - and high quote- certification. The course will consist of 3 modules; the course will take place at Research Area of Pisa for hiking principles and at Ente Scuola Edile e CPT della Provincia di Pisa

The course will be activated in March, but the exact starting date of the course has not yet been determined.

Course N.3

Title: How to write a successful proposal

Description: The course will analyze the components of the preparation of a successful proposal, including the ability to carefully read and interpret the call text, the need for international collaborations and networking, and the role of clarity and conciseness.

The course will be activated in March, but the exact starting date of the course has not yet been determined.

Course N.4

Title: Use open scientific infrastructure facilities and VRE - Advanced

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 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, but the exact starting date of the course has not yet been determined.

Course N.5

Title: Safety in the field work related to RIs (fire risk and sea activities)

Description: the training provides notions of fire-fighting and Sea rescue. The course is aimed at IR personnel who for research activities work indoor and/or outdoor environments and may face emergency situations related to fire risk and rescue at sea. The course is divided into 2 modules each of which ends with a practical test and issuance of certification.

The course is scheduled in May, but the exact starting date of the course has not yet been determined.

3. LIST OF ACRONYMS

BLS: Basic Life Support

BOSIET: Basic Offshore Safety Induction & Emergency Training

CIG: Tender Identification Code

DAS: Distributed Acoustic Sensing

FAIR: Findable, Accessible, Interoperable and Reusable

FIP: FAIR Implementation Profile

OU: Operative Unit

RI: Research Infrastructure

VRE: Virtual Research Environment

VSP: Vertical Seismic Profile

WP: Work Package