MISSIONE 4
ISTRUZIONE
RICERCA

ITINERIS

D4.1.1: Atmosphere WP implementation plan [B2]

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Index

1. INTRODUCTION

This deliverable is prepared in the context of the ITINERIS project, within the Work Package 4, Atmosphere. The WP4 main objective is to integrate Research infrastructures working in the atmospheric domain through synergistic approaches and cross boundaries developments.

This deliverable reports the implementation plan of the whole WP activity. The report is based on the discussions and brainstorming among all the OUs participating in the workpackage, discussion started already during the ITINERIS proposal preparation and become more intense after its real start.

The aim of this document is to describe how the overall objective of the WP4-Atmosphere will be achieved and how the workpackage will be managed and activities monitored and carried out at WP level. Detailed description of implementation plan for each specific task of the WP-Atmosphere will be described in the correspondent dedicated deliverables.

The document is structured in 5 different sections. After this introduction, an overview of existing Italian RIs in the atmospheric domain before ITINERIS is reported in section 2. Section 3 reports the WP Atmosphere objectives and structure. The WP implementation plans are reported in section 4. Finally, Section 5 reports the implementation plan for the linkages between WP-Atmosphere and the other WPs for the achievement of the ITINERIS overall objectives.

2. ATMOSPHERIC RESEARCH INFRASTRUCTURES IN ITALY

ITINERIS aims to provide new data and products to address scientifically and societally relevant issues in the environmental domain. The main mean for achieving this ambitious goal is the cross-disciplinary research in environmental sciences, the re-use of existing data in a synergistic way and the development of new integrated data products, observations, and methodologies.

The project is structured around four WPs related to the four main environmental subdomains: atmosphere (WP4), marine domain (WP5), terrestrial biosphere (WP6) and geosphere (WP7). In each of these WPs, the participating RIs work together towards a harmonized development and ensure full interoperability, promoting inter-RI data use and, whenever possible, co-location and standardization of methods and tools.

As for what concerns the Atmospheric Domain, Italy participates in all main RIs of pan-European interest, and hosts other atmospheric-relevant national RIs, as reported in the PNIR 2021-2027. All these atmospheric RIs are part of ITINERIS and are reported in Fig. 1.

The Italian atmospheric-related RIs are ACTRIS and ICOS (both in the ESFRI Landmark), EUFAR and SIOS (EU Research infrastructures) and CeTra, an Italian Research Infrastructure dedicated to the trace/ultratrace chemical analysis of environmental matrices.

The heterogeneity and complementarity of these RIs and the need for harmonization require a coordinated action to integrate and interlink them, rather than independently enhancing individual RIs.

These Research Infrastructures have different levels of maturity, ranging from ESFRI Landmarks, which already deliver services and provide access to data and facilities at EU level, to new EU and national RIs, some of which at a rather initial stage.

Figure 1: atmospheric-related RIs in Italy, reported in the PNIR 2021-2027 and participating in ITINERIS.

In particular, WP4 will promote the establishment of a national integrated system for atmospheric observations, to address current national and international open issues on atmospheric processes, including pollution, and their impacts on several sectors, from climate change to human health, to agriculture and renewable energy production. This will be achieved through the development of common services with high level of competences and avoiding duplications. Thanks to SIOS, this system will have an extension outside Italy into the European Arctic. WP4 promotes internal exchange of expertise by facilitating transfer of best practices from the most mature RIs (ESFRI Landmarks) to the RIs under development, a process that will strengthen the landscape of national RIs operating in the environmental domain.

In the following, a short description of the atmospheric-related RIs, and of Italian role and competences is reported.

2.1 ICOS

ICOS is the Integrated Carbon Observation System Research Infrastructure (www.icos-cp.eu). ICOS provides standardised and open data from more than 140 measurement stations across 14 European countries. The stations observe greenhouse gas concentrations in the atmosphere as well as carbon fluxes between the atmosphere, the land surface, and the oceans. Thus, ICOS is rooted in three domains: Atmosphere, Ecosystem and Ocean.

The ICOS Atmosphere network includes stations in 14 European countries. Each of the current 36 labelled Atmosphere stations (other 10 stations are still in the labelling process) measures greenhouse gas mole fractions (such as carbon dioxide and methane) in the atmosphere, as well as other useful variables (N_2O, meteorological variables, $^{14}CO_2$ and other stable isotopes).

Atmospheric measurements are usually taken on top of tall towers, in mountainous terrain or in coastal environments. These stations are usually not influenced much by local phenomena but are rather exposed to atmospheric transport and processes covering larger areas. Thus, integral information on regional sources and sinks of greenhouse gases can be retrieved.

All ICOS Atmosphere stations are highly standardised, utilising similar equipment and methodologies. Standard operation procedures define for example the overall setup, calibration strategies, and the data transfer of the stations.

The data collected at the Atmosphere stations are automatically processed and quality controlled by the Atmosphere Thematic Centre, then checked by the station Principal Investigator, jointly reviewed by the MSA, and finally published via the ICOS Carbon Portal. The Central Analytical Laboratories provide calibration gases and analyse samples taken at the ICOS Atmosphere stations for additional quality control and to extend the set of observed parameters.

Italy currently lists 4 ICOS Atmospheric Stations (Fig. 2) from North to South: Plateau Rosa (mountain site), Mt Cimone (mountain site), Potenza (continental site) and Lampedusa (remote site). Additionally, Ispra-JRC continental site contributes to the observations over the Country. The ICOS atmospheric observational component has been recently highly enhanced and supported by the PRO-ICOS_MED (Potenziamento della Rete di Osservazione ICOS-Italia nel Mediterraneo) project funded by MIUR under PON "Ricerca e Innovazione 2014-2020, contract COD. PIR01_00019, CUP B85D18000340001. At the present, all the Italian sites by Potenza are already labelled and are providing observations to the ICOS Carbon Portal. The Potenza site recently applied for the first step of the labelling as Level 1 site, and the set-up of the instrumentation is currently in progress.

Figure 2: Italian ICOS atmospheric stations (February 2023).

Additionally, a national hub for supporting the ICOS atmospheric observations has been implemented through PRO-ICOS_MED in Lamezia Terme.

2.2 ACTRIS

Aerosol, Clouds and Trace Gases Research Infrastructure (ACTRIS) is the pan-European RI that produces high-quality data and information on short-lived atmospheric constituents and on the processes leading to the variability of these constituents in natural and controlled atmospheres (www.actris.eu).

ACTRIS enables free access to high-class long-term atmospheric data through a single-entry point. We offer access to our world-class facilities providing researchers, from academia as well as from the private sector, with the best research environments and expertise promoting cutting-edge science and international collaborations.

ACTRIS National Facilities (NFs) comprise Observational and Exploratory Platforms, both within Europe and at selected global sites.

ACTRIS NFs support long-term observations and research related to atmospheric aerosol, clouds, and reactive trace gases. They are committed to long-term operation. NFs follow specific technical requirements. Instrumentation follows the recommendations and is approved by the Topical Centres. Measurement methodologies and procedures are compliant with the standards of calibration, operation and quality assurance defined by the Topical Centres. Data are made available to users through the ACTRIS Data Centre.

ACTRIS NFs can also provide physical access to users if respective capacity and expertise is proven. ACTRIS NFs provide users with physical access to state-of-the-art, well-characterised and versatile facilities.

Italian Country has proposed (Fig. 3): 7 NFs as Observatory Platforms and 3 NFs as Exploratory Platforms. In particular, all 7 sites are proposed for aerosol remote sensing component, 5 for the aerosol in situ (Bologna/Mt. Cimone, Napoli, Potenza, Lecce, Lampedusa), 2 for clouds remote sensing (Potenza, Lampedusa), 1 for trace gases in situ (Lecce) and 1 for trace gases remote sensing (Potenza). Additionally, Ispra-JRC station contributes to the observations of aerosol in situ and remote sensing over the Country.

The 3 proposed Exploratory Platforms are: an atmospheric simulation chambers In Genova, and 2 mobile platforms for aerosol and cloud remote sensing observations (Potenza) and aerosol and trace gases in situ observations (Lecce).

Figure 3: Italian ACTRIS location of National Facilities (February 2023).

Italy plays a key role within ACTRIS, not only for its observational capability, but also participating in different central facilities:

- Head Office – CNR-IMAA runs the SAMU (Service Access Management Unit)
- Data Center – CNR-IMAA leads ARES (Aerosol REmote Sensing) Unit of the data center.

- Topical Center for the aerosol remote sensing – CNR-IMAA hosts part of CARS (Center for Aerosol Remote Sensing) for the High Power lidars.
- Topical Center for the Aerosol in Situ – INFN Firenze hosts the EMC2 (Elemental Mass Calibration Center)

ACTRIS observational component in Italy has been recently highly enhanced and supported by the project PER-ACTRIS-IT - Potenziamento della componente italiana della Infrastruttura di Ricerca Aerosol, Clouds and Trace Gases Research Infrastructure", COD. PIR01_00015, CUP B17E19000000007 - PON "Ricerca e Innovazione 2014-2020" Notice D.D. n. 424 del 28/02/2018.

2.3 EUFAR

EUFAR (European Facility for Airborne Research, https://www.eufar.net) facilitates and promotes transnational access to national research aircraft and instruments. From in situ measurement of atmospheric properties to remote sensing, the high manoeuvrability of instrumented aircraft allows researchers to pursue atmospheric and environmental phenomena, especially in remote locations, to follow their evolution and to explore their physics, chemistry, and biology from small spatial sales up to thousands of kilometres. Today, EUFAR Members operate 13 instrumented aircraft and 3 separate remote-sensing instruments, some of which can be deployed on different aircraft.

A EUFAR data archive with search facilities is hosted by CEDA (https://flight-finder.ceda.ac.uk), but efforts are needed to ensure the increasing availability of data from this archive in addition to its availability via other portals.

14 institutions are members of EUFAR, 3 of which are Italian: CNR-ISAC, OGS (National Institute of Oceanography and Applied Geophysics) and University 'G. d'Annunzio' of Chieti-Pescara. Additionally, 4 institutions are involved as associated partners.

2.4 SIOS

SIOS (Svalbard Integrated Artic Earth Observation System, https://sios-svalbard.org) supports long-term measurements in and around the archipelago of Svalbard addressing Earth System Science questions. The observing system and research facilities offered by SIOS are built on the extensive observation capacity and diverse world-class research infrastructure provided by many institutions already established in Svalbard. This includes a substantial capability for utilising remote sensing resources to complement ground-based observations.

The vision of SIOS is to be the leading long-term observing system in the Arctic to serve Earth system science and society. The mission coherent with this vision includes: development an efficient observing system; sharing technology, experience, and data; closing knowledge gaps; and decrease the environmental footprint of science.

The SIOS Implementation strategy is based on three main pillars: (i) integration and optimization of the observing system and scientific community; (ii) provide services to the member Institutions and users, in particular for data; (iii) communication.

Several tools and opportunities have been developed and implemented since 2018 to sustain vision, mission, and strategy above indicated. Details can be found on the SIOS website www.siso-svalbard.org.

Focusing on data services, SIOS offers a virtual data centre for unified access to relevant data describing Earth System Science in Svalbard. The SIOS Data Management System (SDMS) relies on the principles of distributed data management. Datasets, as well as their associated metadata, are managed by several physically distributed Data Centres. The SIOS Data Management Service aims to enable, through the distributed system, data submission, discovery, access, use and preservation of SIOS relevant data sets and metadata across these data centres. Services in development thanks to the common effort include a data central access portal, an observation facility catalogue, tools for data formatting and visualization, training material for data management.

CNR-ISP manages the observational site Dirigibile Italia in Ny-Ålesund (Figure 4). Moreover, contribute to SIOS SDMS with the Italian Arctic Data Centre (IADC).

Figure 4: SIOS observation facility map (February 2023).

Italian facility is highlighted by red pinpoint.

2.5 CETRA

CeTra (Centre for Trace Analysis, https://www.unive.it/pag/42456) is a joint infrastructure of Ca' Foscari University of Venice (Department of Environmental Sciences, Informatics and Statistics - DAIS - and Department of Molecular Sciences and Nanosystems – DSMN), and the Institute for Polar Sciences of the Italian National Research Council (ISP-CNR). CeTra is an international excellence centre for research, advanced training and services operating with universities, research institutions and companies interested in trace/ultra-trace analysis and chemical imaging in the field of environment. The research activity at CeTrA is grounded on almost three decades of experience on the local to trans-national study of the Atmosphere, with a special attention to coastal and transition environments, monitoring and regulation of ship traffic, and long-range atmospheric dynamics seen from the Eastern Alps and polar regions (Arctic, Antarctica). CeTrA develops advanced analytical methods and produces high-quality data for identification, quantitative determination and micro-to-nano scale imaging of trace and ultra-trace chemical species in environmental matrices. Innovative methods are applied to pilot studies concerning the physicochemical characterization of atmospheric aerosols, the dispersion/source appointment of emerging pollutants, the study of fire emissions and photochemical processes, amongst the others. The facility includes a wide range of cutting-edge analytical instrumentation and infrastructural resources, including two Clean Laboratories dedicated to the ultra-clean manipulation/preparation of samples for inorganic and organic analysis, respectively. In addition, CeTrA manages the high-altitude weather and climate observatory of Col Margherita (MRG), a unique background station south-facing the Eastern Alps, that is Regional Station of GAW-WMO.

3. WP4 OBJECTIVES

As reported above, the scenario of Italian atmospheric-related RIs is heterogenous in terms of maturity level, geographical distribution, observed atmospheric parameters and data access.

The main aim of this WP is to integrate Research infrastructures working in the atmospheric domain through synergistic approaches and cross boundaries developments. Linkages with extra-RI atmospheric data and services are also fostered and enhanced. This will allow the establishment of a national integrated system for the atmospheric observations to address the current national and international open topics on atmospheric characterization and impacts on several sectors from climate change to human health, from agriculture to renewable energy production.

Hot topics in the atmospheric domains will be addressed as Pilot services: their achievements will demonstrate the added value of such a synergistic approach, paving the way for further developments.

With this aim, some specific objectives have been identified and a WP organizational structure in terms of Operative Units and tasks has been established.

OBJ1 - Integration and harmonization within the Italian Network of Environment RIs

The integration and harmonization within ITINERIS aim to develop potentialities for a synergistic approach amongst the different RIs.
This will be done providing data which complement the different RIs and that will be harmonized in the ITINERIS data portal and made explorable and interactively used in the ITINERIS Virtual Research Environment. The synergies amongst RIs will be achieved by reciprocal support: portable and back up instruments will be available for the provision of data, functional to test cases under the Pilot activities. Some back-up instruments and main instruments components will be available for supporting data

provision at the RI observational sites distributed across the Country in case of dysfunctionality of the instruments. Among these, portable instruments will be available also as a tool for synergies among RIs and for application in specific locations as of interest for the purposes of Pilot activities (see below), and for potential interested users. Further complementing instruments will be deployed at observational sites for allowing the developments of synergistic approaches and advanced data products provision.
Data collection and provision will be strongly enhanced by reinforcing the data curation and connection of the Italian component of atmospheric RIs, including data acquired in polar regions. For the data not yet curated and maintained by the European Research infrastructures, data will be curated by correspondingly OUs in ITINERIS following recommendations and guidelines provided by WP2. Actions will be carried out to provide virtual access to the data through the ITINERIS entry point developed in WP2.

OBJ2 - Pilot service on Aerosol types and sources
The Pilot aims to provide information about the aerosol types and sources at atmospheric RI observational sites. The knowledge of the aerosol types and sources is an essential information for better understating the impacts of aerosols on climate, environmental and socio-economic sectors. Nowadays some techniques based on aerosol remote sensing allows to infer the aerosol types on the basis of multiwavelength aerosol optical properties. At the surface, detailed data about the chemical composition, ions content, and particle size determination can allow to extract information about the source of aerosols through specific methods. Both typing and source investigations, needs the support of a robust knowledge of the different aerosol type characteristics which can be only obtained through specific measurements performed in controlled environment. This Pilot aims to provide advanced and robust information on the aerosol types and sources based on the integration of all these components (remote sensing, near surface and chamber techniques) distributed over the ITINERIS sites. In particular, we aim to provide information about the soil/desert dust presence, an aerosol typing classification, the carbon content and the role of natural and anthropogenic combustion sources, the characteristics of marine aerosol, of secondary aerosol, and of bioaerosol (in particular pollens).

OBJ3 - Pilot service on Planetary Boundary Layer height and its impact on aerosol and trace gases concentration at ground
This pilot aims to provide a tool for the determination of atmospheric boundary layer height (ABLH), which governing the convective mechanisms in the lower layers of the atmosphere, has an impact on the wellbeing of citizens. In particular, the pilot aims to provide ABLH height with adequate spatial, temporal, and geographical resolution accompanied by the relative uncertainty, using novel ABLH determination approach based on AI techniques. This objective will be reached taking the most from the enhanced observational capability achieved at National level for OBJ1. Additionally, data related to greenhouse gases, reactive gases and atmospheric aerosol provided by the environmental RIs will be integrated to provide a suite of data products able to describe the impact of ABLH on aerosol and trace gases concentration near the surface. Finally, a scientific and technical assessment will be carried out to evaluate the optimal strategy for developing specific tools to connect dynamics of the atmosphere and air quality.

OBJ4 - Pilot service on impact of natural and anthropic fires on atmospheric composition

This pilot aims to provide a tool for the determination of the impact of natural and anthropic fires on atmospheric composition (aerosol and gases) and structure by combining observations carried out at ground-based sites of the RIs and making use of enhanced observational capability achieved at National level for OBJ1. Data related to greenhouse gases, reactive gases and atmospheric aerosol provided by the environmental RIs will be integrated to provide a suite of data products able to detect the occurrence of open fire plumes. The detection of the plumes will represent the basis for the assessment of the impact of open fire emissions to the variability of key-atmospheric trace gases and aerosols.

Data related to the different observation techniques carried out within the atmospheric environmental RIs will be synergistically used to identify the plumes and provide impact assessment of the emissions.

4. WP4 IMPLEMENTATION

All the RIs reported in Section 2 are represented in the WP4 through 1 or more **Operative Units** (OUs). Specifically, 10 OUs are part of the WP4-Atmosphere as reported in Fig.5 and Table 1.

Figure 5: Geographical distribution of Operative Units in the ITINERIS WP4.

Institution	***Location***	***RIs***
CNR-IMAA	Potenza	ACTRIS
CNR-ISAC	Bologna	ACTRIS EUFAR
CNR-ISAC	Lecce	ACTRIS
CNR-ISAC	Lamezia-Terme	
CNR-ISMAR	Roma	ACTRIS
CNR-ISP	Bologna	SIOS
INFN	Firenze	ACTRIS
INFN	Genova	ACTRIS
UniVe	Venezia	CeTrA Centre for Trace Analysis

Table 1: Operative Units in the ITINERIS WP4 and respective RIs.

As reported above, the WP4 Atmosphere aims to the integration of Research infrastructures working in the atmospheric domain, through synergistic approaches and cross boundaries developments. With this aim the 4 specific objectives reported in the previous section and 16 **Actions** were identified (see Annex 3).

Each one of the OUs involved in WP4 oversees its own action (namely those between 4.1-4.10) focused on the integration and harmonization objective, as OU contribution to this overall goal. Although such activities are individual and carried on under the responsibility of each OU, only the coordination of such actions and exchange of expertise among the OU possible in ITINERIS can really lead to the aimed integration and harmonization of a distributed data system.

Observational capability of the WP4 OUs, enhanced for achieving OBJ1, will be used for the purposes of OBJ2. Additionally, the following activities are specifically devoted to OBJ2 achievements: Act 4.11-*Aerosol typing*; Act 4.12 *Aerosol sources*; Act 4.13 *Aerosol characterization in controlled environment*.

Observational capability of the WP4 OUs, enhanced for achieving OBJ1, will be used for the purposes of OBJ3. Additionally, the following activities are specifically devoted to OBJ3 achievement: Act 4.14- *Impact of ABLH on aerosol and trace gases concentration at ground* and Act 4.15 *Atmospheric Boundary Layer Height*.

A specific activity is devoted to the OBJ4, the activity 4.16 *Emission from natural and anthropic fires*, however also the achievement related to OBJ2 will concur to the achievement of this objective being aerosol one component the forest fire emissions. Observational capability of the WP4 OUs, enhanced for achieving OBJ1, will be used for the purposes of OBJ4.

The ambitious goal of WP4 corresponds to a budget of about 28 M€ distributed over 10 OUs and 16 Activities. This requires an efficient management and high level of coordination among partners. Moreover, the interlinkages between Act. 1-10 concurring to OBJ1 and those related to OBJ2-3&4, call for a wide discussion involving all the OU participating to the WP4 for sharing implementation plans at single units looking for contribution to the OBJ2,3,& 4; identifying the methods and observations available over the Country for characterizing the aerosol typing, the ABLH and the forest fires emissions; avoiding useless duplications of instruments from one hand, and building on previous expertise on the other hand; identifying observational and methodological gaps for the achievement of specific WP4 objectives.

Because of all these reasons, it was established to plan a monthly **meeting** for the whole WP4-Atmosphere. This plan goes well beyond what established in the project, where typically 1 bi-monthly meeting was planned (reported in dark blue in Figure 6) and guarantees a better coordination in WP4.

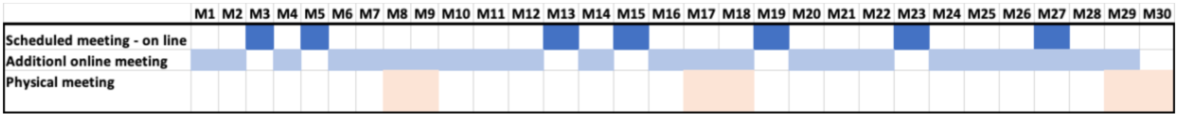

Figure 6: Plan of meetings of ITINERIS WP4.

It was agreed to have at least a short meeting every month, and every 2 months a longer meeting for a more detailed analysis of progresses and issues will be held. Among all these meetings, in-person meetings would be appropriate for enhancing networking and cooperation within the community. Potential period for the in-person meetings of WP4 are reported in Figure 6 as light pink. 3 in-person meetings could be planned: a meeting around month 8-9 could be important as community meeting, because at that time most of the WP4 personnel should be already hired, and activities would be speed up; month 17-18, i.e., the beginning of the second half of the project, is timely as progress meeting and detailed discussion on Pilot services developments. A final meeting (month 29-30) will allow to discuss the organization and implementation of the sustainability of atmospheric ITINERIS system and products. The in-person meetings, of course, will be co-located and co-organized with the general ITINERIS meetings whenever possible.

Additional remote meeting could be organized whenever necessary for specific needs, for example for organizing the 3 Pilots. This was the case for 2 additional meetings held in February as first discussion on Objective 2 & 4.

To achieve the integration and harmonization of Italian RIs working in atmospheric domain, the WP4 meeting (as well the specific Pilot meetings) are open also to staff working at the institution participating to Italian atmospheric-related RIs which are not partners of ITINERIS.

A first list of **WP4 participants** has been set up and used for sharing the information (Annex 1). This is just a first version of WP4 involved people, since it is expected to have 28 new persons specifically hired for WP4 purposes and 19 co-funded PhD grants.

Additional to mailing list, information and materials are shared among the group using a shared folder on-cloud. Specific folders have been created for the Meeting documents, the deliverables and for the 3 Pilots.

The identification of contact point for atmospheric domain for each OU (annex 2) as well as of each Task leader (Annex 3) is essential to guarantee a correct flow of information in such complex WP. This is particularly important for monitoring the achievement of the WP4 Intermediate Objectives (IOs) and the Tasks progresses and the timely provision of deliverables.

Because of the WP4 complexity and of the high number of involved OUs (and therefore of specific single-OU tasks), 49 **deliverables** are planned in WP4. Figure 7 shows the GANTT chart grouped by Objective (a, b, c, and d for OBJ1, 2, 3 & 4, respectively).
The different activities are organized in a coherent way across the OUs: for the enhancing and integration of the observation and data, implementation plans, and progress reports are planned even if with slightly different timing depending on specific needs. Deliverables related to Pilots are expected later in time, to allowe an initial discussion among all partners and specific plans for each pilot task. The development of pilot tasks typically foresees identification of observations and data products of interest, their implementation and finally description of achieved results. The implementation of integrated observations/methods will be tested and, in some case, achieved through specific measurements campaigns. Even if not yet planned into details, the first Pilot meetings clearly stated the need of intensive campaigns. These could be based on enhanced observational capability in one site (e.g., the OU leading the task), distributed campaigns for monitoring specific atmospheric conditions and/or campaign with mobile system in peculiar location. Details and timing will be further discussed in the next pilot meetings, but certainly at least 1 campaign for Pilot will be held.

OBJECTIVE1	UO	Task	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15
D4.1.1: Atmosphere WP implementation plan	CNR-IMAA	4.1		■													
D4.1.2: Implementation plan for the enhancement of CNR IMAA atmospheric observatory (CIAO) for the provision of RIs integrated and synergistic data products	CNR-IMAA	4.1		■													
D4.1.4: Report on the enhancement of CNR IMAA atmospheric observatory for the provision of RIs integrated and synergistic data products	CNR-IMAA	4.1														■	
D4.2.1: Implementation plan for the CNR ISAC Bologna integrated facility and harmonized with the network	CNR-ISAC -BO	4.2		■													
D4.2.2: Progress report on the acquisition of equipment that will be integrated in the facilities of CNR ISAC Bologna OU and harmonized with the network	CNR-ISAC -BO	4.2								■							
D4.2.3 Report on the operation in the laboratory and in the field of the acquired instruments at CNR ISAC Bologna and calibration/comparison with reference methods	CNR-ISAC-BO	4.2												■			
D4.2.4 Realization of the technological systems, installation, and operability of the instruments at CNR ISAC Bologna	CNR-ISAC-BO	4.2														■	
D4.3.1 Progress report on the acquisition of equipment that will be integrated in the facilities of the CNR ISAC Lamezia OU and harmonized with the network.	CNR-ISAC-LT	4.3								■							
D4.3.2 Report on the operation in the laboratory and in the field of the acquired instruments at the CNR ISAC Lamezia and calibration/comparison with reference methods.	CNR-ISAC-LT	4.3												■			
D4.3.3 Realization of the technological systems, installation, and operability of the instruments at the CNR ISAC Lamezia	CNR-ISAC-LT	4.3														■	
D4.4.1: Implementation plan for the CNR ISAC Lecce integrated facility and harmonized with the network	CNR-ISAC-LE	4.4		■													
D4.4.2: Progress report on the acquisition of equipment that will be integrated in the facilities of CNR ISAC Lecce OU and harmonized with the network	CNR-ISAC-LE	4.4								■							
D4.4.3 Report on the operation in the laboratory and in the field of the acquired instruments at CNR ISAC Lecce and calibration/comparison with reference methods	CNR-ISAC-LE	4.4												■			
D4.4.4 Realization of the technological systems, installation, and operability of the instruments at CNR ISAC Lecce	CNR-ISAC-LE	4.4														■	
D4.5.1 Report on the acquisition of aeroportable instrumentation for the optical and microphysical characterization of atmospheric particulate	CNR-ISAC-BO	4.5								■							
D4.5.2 Definition of the customizations necessary for the instrumentation and the aircraft to make the instrumentation airborne	CNR-ISAC-BO	4.5												■			
D4.5.3 Implementation of the customizations necessary for the instrumentation to make it airborne	CNR-ISAC-BO	4.5														■	
D4.6.1 Definition of the specific observational requirements and installation of an innovative Lidar	CNR-ISMAR	4.6						■									
D4.6.3 Production of Near Real Time atmospheric and marine geophysical variables for CNR-ISMAR Rome	CNR-ISMAR	4.6														■	
D4.7.1 Implementation plan of the integrated polar data repository	CNR-ISP	4.7						■									
D4.7.2 Report on high level science products based on polar data	CNR-ISP	4.7										■					
D4.7.3 Documentation of fully developed integrated polar data repository	CNR-ISP	4.7														■	
D4.8.1 Implementation plan for the operation of the 3 MV Tandetron accelerator at LABEC with the upgraded computer control systems (software and hardware)	INFN-FI	4.8						■									
D4.8.2 Report on improved analytical performances at LABEC for laboratory and real-time in-situ aerosol analysis	INFN-FI	4.8												■			
D4.8.3 Report on the aerosol analysis made at INFN Firenze	INFN-FI	4.8														■	
D4.9.1 Testing report of the updated version of the ChAMBRe DAQ and data A40storage system	INFN-GE	4.9								■							
D4.9.2 Testing report of the new equipment for off-line aerosol speciation at INFN Genova	INFN-GE	4.9										■					
D4.9.3 Testing report of the new plants for technical gases distribution at INFN Genova [B12]	INFN-GE	4.9												■			
D4.10.1 Implementation plan of an integrated and accessible digital platform architecture for CeTrA	UNIVE-DAIS	4.10			■												
D4.10.2 Documentation of the platform catalogue of services giving access to all modules of the CeTrA platform in its beta-version	UNIVE-DAIS	4.10										■					
D4.10.3 Report on CeTrA digital platform performances	UNIVE-DAIS	4.10														■	

Figure 7a: GANTT chart for Tasks related to objective 1.

OBJECTIVE2	UO	Task	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15
D4.11.1 Report on the organization of test cases for aerosol typing method improvements	CNR-IMAA	4.11			■												
D4.11.2 Documentation of desert dust product	CNR-IMAA	4.11								■							
D4.11.3 Documentation of aerosol typing products and tools	CNR-IMAA	4.11															■
D4.12.1 Development of semi-automatic method for identification and characterization of new particle formation events	CNR-ISAC-LE	4.12								■							
D4.12.2 Identification and characterization of aerosol sources based on offline integration of physical and chemical properties	CNR-ISAC-LE	4.12												■			
D4.12.3 Methodology for identification and characterization of natural and anthropogenic aerosol sources based on online measurements	CNR-ISAC-LE	4.12															■
D4.13.1 Release of a dataset on bioaerosol characterization	INFN-GE	4.13								■							
D4.13.2 Release of a dataset on aerosols compositional and optical characterization	INFN-GE	4.13												■			
D4.13.3 Release of a catalog of procedures for the characterization of the atmospheric aerosol properties by atmospheric simulation chamber	INFN-GE	4.13															■

Figure 7b: GANTT chart for Tasks related to objective 2- Aerosol typing.

OBJECTIVE3	UO	Task	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15
D4.14.1 Definition of the minimum requirements for a common, matched database of measured/derived variables for both atmospheric composition and atmospheric dynamics	CNR-ISAC -BO	4.14								■							
D4.14.2 Definition of indicators/metrics providing information on air quality in relation to the atmospheric stratification and dynamics	CNR-ISAC-BO	4.14												■			
D4.14.3 Documentation of developed data products capable of providing information on air quality in relation to the atmospheric stratification and dynamics	CNR-ISAC-BO	4.14															■
D4.15.1 Report on atmospheric boundary layer height measurement campaign	CNR-IMAA	4.15							■								
D4.15.2 Report on the optimization of morphological image processing approach algorithm for ABLH determination	CNR-IMAA	4.15										■					
D4.15.3 Report on optimization of morphological image processing approach algorithm results on lidars and ceilometers observations	CNR-IMAA	4.15															■

Figure 7c: GANTT chart for Tasks related to objective 3- Atmospheric Boundary Layer.

OBJECTIVE4	UO	Task	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15
D4.16.1 Survey on observational data available at the atmospheric environmental RIs as suitable/promising to trace open fire emission plumes	CNR-ISAC-LT	4.16						■									
D4.16.2 Report on optimal strategy for integrating the identified tracers	CNR-ISAC-LT	4.16										■					
D4.16.3 Report on natural and anthropic fires product: data acquisition procedures and documentation	CNR-ISAC-LT	4.16															■

Figure 7d: GANTT chart for Tasks related to objective 4- Forest fires emissions.

ANNEX 1 – CURRENT LIST OF WP4 PARTICIPANTS

Involved people and OUs			
Lucia Mona	CNR-IMAA	**Adelaide Dinoi**	CNR-ISAC Lecce
Serena Trippetta	CNR-IMAA	**Daniela Cesari**	CNR-ISAC Lecce
Aldo Amodeo	CNR-IMAA	**Davide Dionisi**	CNR-ISMAR Roma
Ermann Ripepi	CNR-IMAA	**Vito Vitale**	CNR-ISP Bologna
Nikolaos Papagiannopoulos	CNR-IMAA	**Mauro Mazzola**	CNR-ISP Bologna
Giuseppe D'Amico	CNR-IMAA	**Luisa Patrolecco**	CNR-ISP Bologna
Angela Marinoni	CNR-ISAC Bologna	**Massimo Chiari**	INFN Firenze
Paolo Cristofanelli	CNR-ISAC Bologna	**Giulia Calzolai**	INFN Firenze
Francesco Cairo	CNR-ISAC Bologna	**Fabio Giardi**	INFN Firenze
Francesca Barnaba	CNR-ISAC Bologna	**Paolo Prati**	INFN Genova
Elisa Castelli	CNR-ISAC Bologna	**Dario Massabò**	INFN Genova
Roberta Claudia Calidonna	CNR-ISAC Lamezia	**Marco Roman**	UNIVE DAIS
Teresa Lo Feudo	CNR-ISAC Lamezia	**Daniele Zannoni**	UNIVE DAIS
Daniele Contini	CNR-ISAC Lecce	**Mara Bortolini**	UNIVE DAIS
People at associated institutions			
Giandomenico Pace	ENEA	**Vincenzo Rizi**	UNILA
Alcide Di Sarra	ENEA	**Marco Iarlori**	UNILA
Salvatore Amoruso	UNINA	**Lucio Calcagnile**	UNI Salento
Andrea D'Anna	UNINA	**Daniela Meloni**	ENEA
Antonella Boselli	CNR-IMAA & UNINA		

ANNEX 2 –OU ATMOSPHERIC CONTACTS

OU	*Contact Person*
CNR-IMAA	Lucia Mona
CNR-ISAC BO	Angela Marinoni
CNR-ISAC-LT	Claudia Calidonna
CNR-ISAC-LE	Daniele Contini
CNR-ISAC-BO	Francesco Cairo
CNR-ISMAR-RO	Davide Dionisi
CNR-ISP-BO	Vito Vitale
INFN-FI	Massimo Chiari
INFN-GE	Paolo Prati
UNIVE-DAIS	Marco Roman

ANNEX 3 – TASK LEADERS

Task	*Title*	*Task Leader*	*Institution*
4.1	CNR IMAA activities for integration and harmonization with the Italian Network of Environment RIs	Serena Trippetta	CNR-IMAA
4.2	CNR ISAC BO activities for integration and harmonization within ITINERIS	Angela Marinoni	CNR-ISAC BO
4.3	CNR ISAC LT activities for integration and harmonization within ITINERIS	Claudia Calidonna	CNR-ISAC-LT
4.4	CNR ISAC LE activities for integration and harmonization within ITINERIS	Daniele Contini	CNR-ISAC-LE
4.5	Activity to strengthen the national participation to EUFAR consortium for airborne research	Francesco Cairo	CNR-ISAC-BO
4.6	CNR-ISMAR-Roma activity for integration and harmonization within ITINERIS	Davide Dionisi	CNR-ISMAR-RO
4.7	Consolidate and expand Italian polar repositories, integrating with ITINERIS	Vito Vitale	CNR-ISP-BO
4.8	INFN Firenze activities for integration and harmonization with the Italian Network of Environment RIs	Massimo Chiari	INFN-FI
4.9	INFN Genova activities for integration and harmonization with the Italian Network of Environment RIs	Paolo Prati	INFN-GE
4.10	CeTrA activities for integration and harmonization with the Italian Network of Environment RIs	Marco Roman	UNIVE-DAIS
4.11	Aerosol typing	Nikolaos Papagiannopoulos	CNR-IMAA
4.12	Aerosol source identification	Daniele Contini	CNR-ISAC-LE
4.13	Aerosol characterization in controlled environment	Paolo Prati	INFN-GE
4.14	Impact of atmospheric boundary layer height on aerosol and trace gases concentration at the ground	Angela Marinoni	CNR-ISAC-BO
4.15	Atmospheric boundary layer height (ABLH)	Giuseppe D’Amico	CNR-IMAA
4.16	Emission from natural and anthropic fires	Claudia Calidonna	CNR-ISAC-LT