



D4.3.3: Realization of the technological systems, installation, and operability of the instruments at the CNR ISAC Lamezia. [B16]



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1. INTRODUCTION

This deliverable is prepared in the context of the ITINERIS project, within Work Package 4 that deals with the integration of Research Infrastructures (RI) working in the atmospheric domain through synergistic approaches and cross-boundary developments.

This deliverable reports the progress in the acquisition of equipment for the WP4.3 activities for integration and harmonization of CNR ISAC Lamezia Terme with the Italian Network of Environment RIs at the 16th Bimester.

The primary objective of Section 4.3 is to enhance the observational capacity of the Lamezia Terme facility. This reinforcement will act mainly in the context of the ICOS RI as Lamezia Terme hosts a HUB for the ICOS Italian nodes of the Atmospheric Italian community. These instrumental improvements of the Lamezia Terme ICOS Italian Hub, will consolidate the Italian contribution to the ICOS RI.

Concerning ICOS RI, we will ensure a long-term commitment of GHG observations by implementing new greenhouse gas (GHG) instrumentation. In particular, we enhanced the observational capacities of CO₂, CH₄, and C isotopes through the use of a C13 analyzer, a C14 sampler, and improvements in 222Rn measurement. Furthermore, the long-term commitment will also rely on: i) a reorganization of the Lamezia Terme ICOS hub logistics and related services, also considering the new location of the internal laboratories in a Lamezia Terme downtown ii) setup of an external area for hosting future campaigns for open-fire tracer detection, and some logistic arrangements for the summer mountain campaign.

The reinforcement of the observational capabilities of the Lamezia Terme site is mainly linked to the scientific activities of RIs integration and pilot forest fire implementation.

At Lamezia Terme observatory are present both ICOS and ACTRIS compliant instrumentation since 2014. The development of new tools is foreseen on some previous databases collected through existing observation capability, and publication in the context of activities carried out at Lamezia Terme research unit. The integration will be possible with the new equipment purchasing activity

The document is structured in four different sections. Annexes and references are reported at the end of the document.

2. CNR ISAC LAMEZIA TERME ATMOSPHERIC OBSERVATORIES AND ROLE IN ATMOSPHERIC RIS

The Lamezia Terme observatory (LMT) and ICOS Italian Atmospheric HUB is an integrated site that is a semi-rural coastal observatory in Southern Italy's "toe" in the center of the Mediterranean area. The Lamezia Terme site includes the CNR observatory of Lamezia Terme (6 m a.s.l. 600 m. from the coastline), the Regional GAW-WMO station in Italy, and the ICOS Italian Atmospheric HUB developed under the project PRO- ICOS-MED to serve the Italian Atmospheric ICOS stations: Monte Cimone, CNR-ISAC, Potenza, CNR-IMAA and Lampedusa, ENEA. At LMT Regional GAW-WMO station, GHG, reactive gases, and observations of pollution have been performed in the last 10 years.

Since 2012, the CNR-ISAC Lamezia Unit has been involved in Italian and European projects for the use of integrated atmospheric observations (meteo parameters, gases and aerosols), useful for the study of renewable energy resources, coastal erosion, hydrological effect, and forest fire. This integration can contribute to a reliable and sustainable operational service in support to air quality

policies, climate change, and its impacts. The institute also has decadal experience on the synergic use of remote sensing and in situ measurements of aerosol, gases, and clouds.

Furthermore, a mobile laboratory for ICOS network is available at LMT ISAC unit to characterize GHG and Radon, equipped also with autosampling flasks and a ceilometer for PBL height detection at possible different locations. The mobile laboratory observational capabilities are also planned to be used in several field campaigns across the country, addressing gases, reactive gases, and integrating aerosol-related problems.

The list of current available instruments is included in the ANNEX 1

3. IDENTIFIED GAPS AND NEEDS FOR INTEGRATION

The main needs for the LMT observatory maintenance and reinforcement are linked both to human capital and technical infrastructure.

Human capital

Human resources are one of the key factors for the long-term sustainability of the RIs. A lot of effort was targeted at selecting suitable personnel, training them, and preparing them for infrastructure maintenance and research activities.

Technical infrastructure

The sustainability of the observations is linked to a good state and continuous maintenance of instrumentation and technical installations in both fixed and mobile observatories. In particular, there is a need to implement the observatory with electrical and network connections, UPS, gas inlet compliant with the recent standard operating procedures defined in the RI network.

The implementation plan and integrated measures were conceived considering gaps and needs for the integration.

The first gap was identified in the measures of CO₂ and CH₄ integration, considering the isotopes of C₁₃ and C₁₄, respectively, using a sampler/analyser to obtain a comprehensive measurement of carbon atmospheric circulation, including that linked to open fires. This will support the understanding of the nature of the fossil or biomass of a burning carbon source. Together with the measurement of C₁₄, C₁₃ isotope sampler/analyser, and an instrument for ²²²Rn measurements will improve the capability of understanding the combustion products nature and the understanding of their combination. To integrate greenhouse gases and gaseous pollutant concentration, some particulate matter concentration analyzer and sampler are planned to be added together with some components for the improvement of the quality of the measurements, such as dryers or deep freezer refrigerators.

Additionally, a reorganization of the logistics of ICOS hub located at the OU and related services was planned. Furthermore, an external area will be set up with electric power and internet connection, ready to host campaigns for open fire tracer detection.

Furthermore, to guarantee an optimal instrumentation hosting, assuring power, connection, and environmental condition preservation, a local data center preservation system has been planned. This data center will be connected to the institute's infrastructure.

Other actions foresee the implementation of: i) hardware and software systems needed to store, integrate, and harmonize natural and anthropic fires collected data; ii) instruments for the collection of open fires tracers' data, like an automatic ionic chromatograph, CO₂ analyzer, and aethalometer.

3.1 LIST OF INSTRUMENTS/GOODS ACQUIRED WITHIN ITINERIS:

AE43 (aethalometer)
Picarro G5310 (N₂O, CO, H₂O),
NO_x analyser
ICOS Dryer,
¹⁴C ICOS sampler,
Rn222 sampler equipped with dryers
Hardware and software platform for integration
Data Storage
CH₂O analyzer
Automatic ionic chromatograph

4. EQUIPMENT PROCEDURES

The Operative Unit of Lamezia Terme organized the purchase procedures at ISAC level, together with Lecce and Bologna Units. For Lamezia Terme the following procedures were planned: 1 EU tender procedures, 1 derogation purchase for uniqueness, 11 under threshold procedures on the Italian market for public administration.

The following table (Table 1) reports the instrument description, the typology of purchasing procedure, the type of procedure according ISAC organization among the OU, the involved WP4 task, and the status of the procedure.

Table 1 – Status of integration equipment and works purchasing procedures

INSTRUMENT DESCRIPTION	PROCEDURE	Internal Organization	Activity	Status
AE33 (aethalometer for black carbon concentration, BB fraction)	EU tender	EU-1-ISAC L1	4.16	Waiting for instrument verification
Analizzatore 13C (CRDS for 13C in CO ₂ and CH ₄)	EU tender – uniqueness	EU 3 ISAC	4.3	Purchased and operative
ICOS Dryer	RDO-MEPA		4.3	Purchased and operative
Refrigeratory	RDO-MEPA		4.3	Purchased and operative
RN222 integration (flux chambers and integrated dryer)	RDO-MEPA		4.3	Purchased and operative

C14 analyser	RDO-MEPA		4.3	Waiting for instrument delivery
Hardware and software platform	RDO-MEPA		4.16	On signing contract
CH2O ¹ analyzer	RDO-MEPA		4.16	Purchased and operative
NOx analyser	RDO-MEPA		4.3	Waiting for instrument delivery
Data Storage	RDO-MEPA		4.3	On signing contract
Automatic ionic chromatograph	RDO-MEPA		4.16	Purchased and operative
Structural adaptation of Pilot experimental area (structural and building works)	RDO-MEPA		4.16	Waiting for permission-renewing hosting ISAC-CNR Observatory Lamezia Terme
Civil infrastructures and related systems for HUB integration (structural and building works)	RDO-MEPA		4.3	Waiting for contract signing with Lamezia Terme Municipality

Despite the initial purchasing time schedule, all the acquisition procedures were delayed due to the new procurement code introduction in July 2023, which implied significant changes in the purchasing procedures at the national level, thus forcing CNR to deliberate new internal purchasing procedure rules.

Furthermore, in January 2024, there was the adoption of a digitalized MEPA platform as a purchasing framework. The spin-up of this process was not fully prepared and taught to the administration, and this furtherly slowed down the procedures' calendar.

In October 2024, the observatory was hit by a severe flood episode, and many of the existing instruments were destroyed. All the activities were delayed due to infrastructural reconstruction and the planning of a resilient solution for the observatory instruments' safety. The OU is now designing and starting an acquisition of a solution to lift the existing external shelter for instrument recovery and adapting the technological infrastructure. All instrument purchases are going to be signed and delivered by August 2025. We are going to restart the process for technological infrastructure adaptation works before August and close the contract for procedures in which the good providers were already been identified.

¹ In correction of COH2.

ANNEX 1 – CNR-ISAC LT AVAILABLE INSTRUMENTS

Lamezia Terme Observatory and ICOS Italian HUB

MAAP Thermo 5022 : aerosol absorption coefficients, Black carbon, scattering corrected

Nephelometer, TSI 6735: Aerosol light scattering coefficients.

SMPS Tropos: Aerosol size-distribution (range: 10 - 800 nm) CPC-TSI 3772: Fine particles
Number concentration

Aerodynamic Particle Sizer, TSI 3321: Aerosol size-distribution (range: 0.5 - 30 μm)

Picarro G2401 (CO_2 , CH_4 , CO , H_2O),

Los Gatos G5310 (N_2O , CO , H_2O),

Thermo 49i (O_3),

ICOS Flask Sampler

Ceilometer Luft CHM15K,

Radon analyser MIAM,

Diluitore Thermo 146i