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RICERCA

D4.2.1: Implementation plan for the enhancement of CNR ISAC Bologna Integrated facility and harmonized with the network [B2]

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1. INTRODUCTION

This deliverable is prepared in the context of the ITINERIS project, within the Work Package 4 that deals with the integration of Research infrastructures working in the atmospheric domain through synergistic approaches and cross boundaries developments.

This deliverable reports the implementation plan of the WP4.2 activities for integration and harmonization of CNR ISAC Bologna with the Italian Network of Environment RIs. The main aim of 4.2 is the instrumental strengthening of the observational capacity of the Po Valley Observatories and of mobile exploratory platforms, in order to reinforce the Italian contribution to the following Research Infrastructures: ACTRIS, EUFAR, ICOS. In particular, concerning ACTRIS RI, we'll extend the observations to the cloud in-situ and reactive gases remote sensing component and will extend the observational capabilities of mobile platforms. For what concerns ICOS RI, we will assure a long-term commitment of GHG observations in the northern Italy by implementing new greenhouse gas (GHG) instrumentations. Moreover, we will extend the observational capacities to CO_2 and CH_4 isotopologues as well as to column-averaged abundances of the main GHGs.

The aim of the Deliverable is mainly linked to the scientific activities allowing to study the impact of the atmospheric boundary layer height on aerosol and trace gases concentration in the lowermost levels. The in-situ observation concerns both station near sea level and high-altitude site.

One of the main scientific goals is to couple and derive a dependence among pollutants concentration in the main urban areas, related to AQ issues, and the ABL height. The development of new tools is foreseen on some previous database related to ACTRIS and RI-URBANS sites (Mialno, CMN-PV, …) and can applied to the long term continuous data set in the frame of ACTRIS RI. The tool can also become a prediction tool, in the context of 100% digital outcome of the ITINERIS project.

With the acquisition of the FTIR NDACC-TCCON compliant instrument, we will fill the gap of lacking GHG measurements in the Po Valley. These kinds of observations are missing, more generically, in a vast area covering the Central and Northern part of the Italian peninsula. The instrument will record direct solar spectra in the near-infrared spectral region and allow the retrieval of accurate and precise column-averaged abundance of the most important atmospheric GHGs

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

2. CNR ISAC ATMOSPHERIC OBSERVATORIES AND ROLE IN ATMOSPHERIC RIS

The "Monte Cimone with Po Valley facilities" observation node (CMN-PV) is an integrated site that provides a three-dimensional observation of one of the most critical hot spots in Europe for climate and air quality. The CMN-PV Node includes the CNR observatory of Monte Cimone (2165 m s.l.m.), the only global GAW-WMO station in Italy, the urban site of Bologna located within the CNR campus, and the rural site of San Pietro Capofiume. At these observatories, observations of polluting and climate-altering atmospheric compounds are performed since 20 years, also in collaboration with other Italian and international Institutions.

Since 2006, the CNR-ISAC Bologna Unit has been involved in European projects for the integration of atmospheric observations (aerosols, gases and clouds) into networks distributed throughout Europe. This integration contributes to a reliable and sustainable operational service in support of air quality policies, long-range transport of pollutants and climate change. The institute also has a decadal experience on the synergic use of remote sensing and in situ measurements of aerosol, gases and clouds. Moreover, the CNR-ISAC Bologna Unit is in charge for the operations of the ICOS atmospheric class-2 site CMN-IT. Within the European ICOS atmospheric network, this site represents a valuable location to monitor the net carbon fluxes occurring within the PBL of the northern Italy.

Within EU projects, in particular ACTRIS-2 and ATMO-ACCESS, the CMN-PV station has been selected among the bases that provide transnational access, offering high technical and scientific skills and advanced instrumentation, using "state-of-the-art" instruments for field campaigns and instrumental prototypes testing.

Moreover, a mobile laboratory (AEROLAB, an exploratory platform of ACTRIS) is available at ISAC Institute to characterize the aerosol optical, physical and properties in different locations in order to integrate the permanent observatories time series. Its observational capabilities were used in several field campaigns across the country addressing aerosol related problems,

The list of current available instruments is included in the

Table ***2:*** *Procedures for structural and building works. The start and end are given in terms of bimesters starting from the beginning of the project. Analysis of the market are still going on and there is the possibility to further optimize the internal organization of the EU tenders, unicity, and Mepa RdO.*

ANNEX 1.

3. IDENTIFIED GAPS AND NEEDS FOR INTEGRATION

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

-Human capital

The human resources are in fact the key factor for the long term sustainability of the RIs. A lot of efforts is actually dedicated to the selection of suitable personnel; we wish a possible integration with permanent position of a non negligible fraction of the enrolled personnel.

- Technical infrastructure

The sustainability of the observations is linked to a good state and continuous maintenance of instrumentation and technical installations (electricity, net, …) at the observatories (fixed and mobile). There is the need to implement the observatories, with electrical and network connections, UPS, gas inlet and aerosol inlet compliant with the recent standard operating procedures defined in the ACTRIS network.

In order to achieve the main scientific goals of ITINERIS project, it is crucial to strengthen the observational capacity of the ISAC-BO observatories, in term of data continuity and new variables to be measured. For these reasons, the OU ISAC-Bologna planned to purchase some instruments as back up in case of failure of the existing instrumental assets, such as aethalometers, nephelometer, SMPS, CRDS, …. Moreover, in order to achieve a deeper characterization and comprehension of processes affecting the air mass ageing we considered the need of new observation devoted to observe the aerosol, trace gases and cloud with both in-situ and remote sensing. In particular, the unit of Bologna envisages the extension of observation capacity to cloud in-situ component, with a fog monitor, Ice Nuclei analyzer and a cloud sampler. An SP-2 will give additional information on the BC mixing state and ageing processes affecting the air masses reaching Monte Cimone. Moreover a deep implementation of Aerolab mobile platform will extended to the remote sensing component, in order to observe the atmospheric profiling over different environments on the Italian territory and apply the tools under development in the frame of 4.14 activity (impact of PBL on the in situ concentrations) in different areas over Italy.

List of instruments/goods to be acquired within ITINERIS:

The Portable Ice Nucleation Experiment (PINE)

Fog monitor, LWC, Reff, DROPLET SIZE DISTRIBUTION

SP-2 D (Refractory BC, mixing state)

Cloud sampler

AE33 (aethalometer for black carbon concentration, BB fraction)

CASS (Total Carbon Content ("TC"), the Elemental Carbon content (EC), the Organic Carbon content (OC) and the Black Carbon content (BC) of suspended aerosol particles in near-Real Time)

SMPS (arosol size distribution 10-800 nm)

2 x Aurora 3000 (aerosol scattering and back scattering coefficient)

2 x CPC 3750 (aerosol number concentration)

Ceilometer

Solar Lunar sunphotometer

Lidar Raymetrics

Doppler Cloud radar

UPS

2 analyzers G2401 (Cavity Ring Down Spectrometers CO, CO_2, CH_4, H_2O)+1 analyzer G2201-I (CRDS for ^{13}C in CO_2 and CH_4)

Aethalometer A33 Magee

Nephelometer Aurora 3000

Airborne isokinetic Aerosol inlet Brechtel 1200

Aerosol sampler

Meteorological probes

Data storage

Data analyses platforms

4. PROCEDURES FOR THE PERSONNEL

Four positions for personnel with the profile of Technologist have been published in the Italian "Gazzetta Ufficiale" and ad hoc CNR website. The calls have been published on December 27th 2022 with a deadline on January 26th 2023. An average of 12 applications for each call have been recorded. Evaluation committees have been nominated and selections are ongoing following the CNR rules.

The Technologists will work in strict collaboration with the four position of researcher (III level) that were foreseen in the activity 4.14. These positions have also been published on December 27th 2022 with a deadline on January 26th 2023. Evaluation committee has been nominated and selection is ongoing following the CNR rules.

5. EQUIPMENT PROCEDURES

The Operative Unit of Bologna organized the purchase procedures at ISAC level, together with Lecce and Lamezia Terme Units. We planned 3 EU tender procedures, 11 derogation

purchases for uniqueness, 18 procedures under threshold on the Italian market for public administration.

The following table (Table 1) reports the organization into EU procedures, RdO, Unicity, classified by main CPV, and timing details. The 4.2.1 procedures refer to Bologna Unit and as such only these are reported in the table. The table also reports, for completeness, which is the ISAC unit handling the procedure if different from ISAC-BO.

The Table 2 reports the implementation plan of the procedures for the expense typology “d”, related to infrastructure and construction works classified by main CPV, and timing details

INSTRUMENT DESCRIPTION	CPV code	ISAC UNIT	PROCEDURE	Internal Organization for EU-Tenders	Activity	Start of procedure	End of procedure
The Portable Ice Nucleation Experiment (PINE)	38340000-0	BOLOGNA	Unicity		4.2	B3	B12
Fog monitor, LWC, Reff, DROPLET SIZE DISTRIBUTION	38340000-0	BOLOGNA	Unicity		4.2	B7	B14
SP-2 D (Refractory BC, mixing state)	38340000-0	BOLOGNA	Unicity		4.14	B3	B12
Cloud sampler	38340000-0	BOLOGNA	Mepa RdO		4.2	B6	B12
AE33 (aethalometer for black carbon concentration, BB fraction)	38340000-0	BOLOGNA	EU tender	EU-1-ISAC L1	4.2	B3	B9
CASS (Total Carbon Content ("TC"), the Elemental Carbon content (EC), the Organic Carbon content (OC) and the Black Carbon content (BC) of suspended aerosol particles in near-Real Time)	38340000-0	BOLOGNA	EU tender	EU-1-ISAC L1	4.2	B3	B9
SMPS (arosol size distribution 10-800 nm)	38340000-0	BOLOGNA	EU tender	EU-1-ISAC L4	4.2	B3	B9
2 x Aurora 3000 (aerosol scattering and back scattering coefficient)	38340000-0	BOLOGNA	EU tender	EU-2-ISAC L1	4.2	B5	B11
2 CPC 3750 (aerosol number concentration)	38340000-0	BOLOGNA	EU tender	EU-1-ISAC L2	4.2	B3	B9
Ceilometer	38340000-0	BOLOGNA	EU tender	EU-1-ISAC L5	4.14	B3	B9
Solar Lunar sunphotometer	38340000-0	BOLOGNA	EU tender	EU-1-ISAC L6	4.14	B3	B9
Lidar Raymetrics	38340000-0	BOLOGNA	EU tender	EU-1-ISAC L7	4.14	B3	B9
Doppler Cloud radar	38340000-0	BOLOGNA	EU tender	EU-3-ISAC L4	4.14	B7	B14

Gruppi di continuità UPS	31680000-6	BOLOGNA	Mepa RdO		4.2	B3	B6
2 analizzatori G2401 (CRDS CO, Co2, CH4)+1 analizzatore 13C (CRDS for 13C in CO2 and CH4)	38432100-3	BOLOGNA	Unicity		4.14	B4	B11
FTIR for GHG and RGs	38432100-3	BOLOGNA	Unicity		4.14	B4	B12
Aerosol sampler	38340000-0	BOLOGNA	Mepa RdO		4.2	B3	B6
Meteorological probes	38340000-0	BOLOGNA	Mepa RdO		4-2	B8	B11
storage dati osservatori	30230000-0	BOLOGNA	Mepa RdO		4.2	B3	B7
piattaforme per analisi dati	30230000-0	BOLOGNA	Mepa RdO		4.2	B3	B7
Webcam per visualizzazione interna esterna	30230000-0	BOLOGNA	Mepa RdO		4.2	B9	B13
Upgrade stazione mobile per acquisizione dati, condizionamento e rilevazione meteorologica	38340000-0	BOLOGNA	Mepa RdO		4.2	B3	B5

Table 1: Procedures for acquisition of equipment. The start and end are given in terms of bimesters starting from the beginning of the project. Analysis of the market are still going on and there is the possibility to further optimize the internal organization of the EU tenders, unicity, and Mepa RdO.

RI	ISAC unit	DESCRIPTION	Activity	CPV (5)	START of pcedure	END of procedur e	Internal Organization for EU-Tenders
ICOS	Bologna	container/shelter ICOS	4.14	45214630-5	B3	B12	Mepa RdO
ICOS	Bologna	Structural implementation FTIR Observatory	4.14	45200000-9	B3	B11	Mepa RdO
ACTRIS	Bologna	aerosol inlet	4.2	30230000-0	B3	B9	Mepa RdO
ACTRIS	Bologna	gas inlet	4.2	30230000-0	B3	B9	Mepa RdO
ACTRIS	Bologna	container/shelter ACTRIS	4.2	45200000-9	B9	B15	Mepa RdO
ACTRIS/ICOS	Bologna	Improvement of Observatories infrastructure	4.2	45200000-9	B6	B13	Mepa RdO

Table 2: Procedures for structural and building works. The start and end are given in terms of bimesters starting from the beginning of the project. Analysis of the market are still going on and there is the possibility to further optimize the internal organization of the EU tenders, unicity, and Mepa RdO.

ANNEX 1 – CNR-ISAC BO AVAILABLE INSTRUMENTS

Monte Cimone

Aethalometer Magee AE33: aerosol absorption coefficients, Black carbon, Brown Carbon, multiwavelenght

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

Nephelometer, TSI 6735: Aerosol light scattering coefficients, 3 w

SMPS Tropos: Aerosol size-distribution (range: 10 - 800 nm)

CPC-TSI 3772: Fine particles Number concentration

Optical Particle Counter, GRIMM 1108: Aerosol size-distribution (range: 0.3 - 30 µm), PM10, PM2.5

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

CCN-200, Droplet Measurement Technique: CCN concentration at 6 super saturation degree

NAIS (Neutral cluster and Air Ion Spectrometer): size distribution of neutral particles and +/- ions (range 0.8-40 nm)

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

Picarro G5310 (N_2O, CO, H_2O),

Thermo 49i (O_3),

Thermo 42i-TL (NO, NO_2),

Teledyne T200UP (NO, NO_2),

Thermo 43i-TLE (SO_2).

ICOS Flask Sampler,

Celiometer Luft CHM15K,

^{14}C ICOS sampler,

Calibratore Thermo 49i-PS,

Diluitore Thermo 146i

Bologna

Thermo 49i (O_3),

Teledyne T200UP (NO, NO_2),

DOAS "TROPOGAS" ,

Calibratore Thermo 49i-PS,

Diluitore Thermo 146i

San Pietro Capofiume

DOAS “SkySpec-2D-210”

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

LiDAR

SMPS, custom built

Aerolab

Aethalometer Magee AE33: aerosol absorption coefficients, Black carbon

Nephelometer, Ecotech Aurora 3000: Aerosol light scattering coefficients

SMPS Tropos: Aerosol size-distribution (range: 8 - 800 nm)

Optical Particle Counter, GRIMM 11R: Aerosol size-distribution (range: 0.3 - 30 µm), PM10, PM2.5

Aerodynamic Particle Sizer, TSI 3321: Aerosol size-distribution (range: 0.3 - 30 µm)

CPC-TSI 3772: Fine particles Number concentration