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D4.16.1: Survey on observational data available at the atmospheric environmental RIs as suitable/promising to trace open fire emission plumes

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Comments	

Index

LIST OF TABLES AND FIGURES

INTRODUCTION

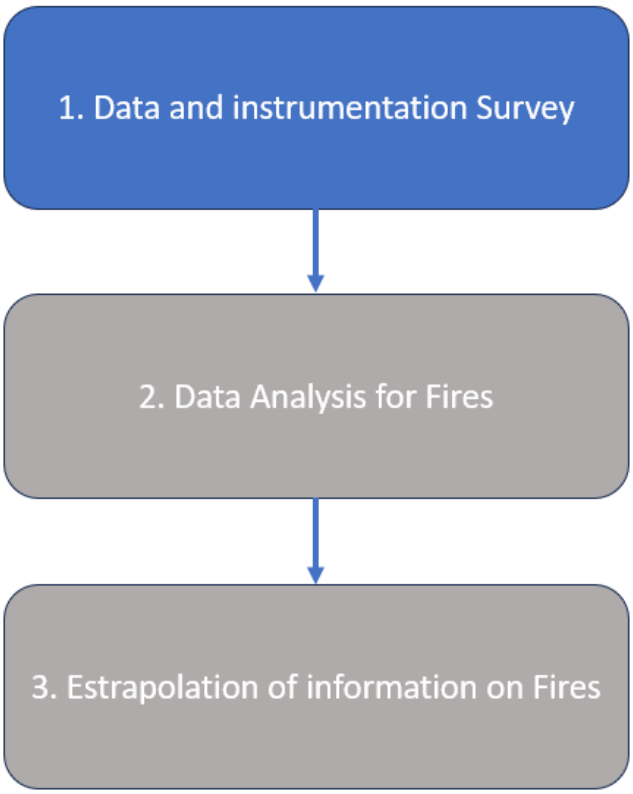
- This document sets the preconditions for this Activity (Act. 4.16) considering an inventory of the measurements instrumentation, sites, available dataset and other related information.
- Then, the document introduces to the next activities to be followed and can act as Roadmap for this Activity. Forest Fires is of particular interest for ITINERIS (WP4 – Atmosphere) as the knowledge of their emissions, more general open fires, can help to better understand how they impact on climate change.
- Extreme wildfires are increasing, also due to a more frequency of drought period and heat waves during summer season and, last years their occurrence attracted the attention [UNEP 2022]. According the Lancet that annual exposure to wildfire smoke results in more than 30,000 deaths across the 43 countries included in the study. The year 2021 was registered the record of CO2 emissions for Boreal fires. Boreal fires typically accounting for 10% of global fire carbon dioxide emissions, contributed 23% (0.48 billion metric tons of carbon) in 2021, by far the highest fraction since 2000. 2021 was an abnormal year because North American and Eurasian boreal forests synchronously experienced their greatest water deficit [Zeng 2023].
- Open fire emissions involve significant production of CO2, as the most diffused GHG, reactive gases and aerosol at different size (µm-to –nm). A comprehensive set-up of measurements, ranging from GHG to aerosol with measurement in situ and profiles including meteorological observation, allows to collect a large amount of useful information to detect and study open fire emissions at local medium and long range distance [Lo Feudo 2015], [Parise 2023].
- In the following, we focus on inventory of instruments available in ITINERIS community and discuss the instruments, geographical distribution, and available dataset useful for open fire emission studies. Considering the goal of ITINERIS project of integrating information from different European Research Infrastructures (ICOS; ACTRIS etc...), here is a first assessment of running atmospheric programmes useful for the ITINERIS purpose.
- A sketch of the planned measures in ITINERIS is given, Finally, a tentative plan for the next steps with clear guidelines is presented.

MATERIALS AND METHODS

The activity, till now, consisted into a phase of recognition of the instrumentation availability at different observational sites, managed by participant to WP4 and added valuable sites such as Lampedusa managed by ENEA, that decided to join the Pilot Open Fires.

This is the first phase, and the preliminary one, necessary to reach the goal in a more correct and profitable way. Only through knowledge of the available data we can identify the most correct analysis methodology, and therefore identify the

information to extrapolate for a comprehensive analysis of fire emissions in the atmosphere.



Planned steps for Pilot Open fire implementation

Considering the goal of integrating several measured data, we proceeded to collection of any useful information regarding the instrumentation available in any OU.
An expression of interest on Open Fires Pilot was launched to all WP4 PI and consequently was required the filling out a form with the possibility of updating later with new running measurement program and data.

The requested form was designed to collect information regarding instrumentation, available dataset and other information useful for the next phase of data analysis:

- Type of analyser, sampler, profiler, meteo-station, etc.);
- Instrument model and type of collected data (concentration, distribution, profile, in situ measure, etc.);
- Lat, Lon, asl;
- Period of running measurement program:
- Sampling time interval.

The form allows to collect organizational information:

- OU organization: PI, involved researchers, instrument manager;
- Location of instrumentation: fixed or mobile for specific campaign;
- Availability for intensive campaign for summer period (detecting open fire emissions) or intercomparison

THE JOINING OBSERVATORIES

In the Table 1 the WP4 OU participant to Open Fire Pilot are present. The joining OU includes sites spread out over the Italian territory.

Table 1 OU/sites joining to Pilot Open Fires

UO	*Short name*	*Lat*	*Lon*	*Asl (m. slm)*
CNR – ISAC Lamezia Terme	LMT	38,86°	16,23°	4,5
CNR – ISAC Lecce	ECO	40,33°	18,12°	36,0
CNR – ISAC Bologna	CMN	44,23°	10,70°	2165,0
CNR – IMAA Tito Scalo	POT	40,6°	15,72°	760,0
ENEA - Lampedusa	LMP	35,51°	12,63°	12,6
UniVE – CNR ISP - Venezia	MRG	46,37°	11,79°	2543,0
UniNA - Napoli	UNA	40,83°	14,18°	14,18

As depicted in the Figure 1 5 sites are distributed in southern regions and two on the northern part of Italy to higher quotes a.s.l (up 2543 m.) respectively CMN e MRG. LMP and LMT are coastal ones far from the city centre, two internal at different a.s.l.. And two of them are big urban centres (Naples and Lecce) less than 50 a.s.l.

Figure 1 OU Open Fire Pilot participant

TYPES OF MEASUREMENT AND TIME SERIES INTERVAL

The different types of measures in the different observatory are the following:

- Greenhouse Gases (GHG);
- Reactive Gases (RG);
- Meteorological data (M);
- Aerosol (concentration and distribution);
- Lidar Profiles;
- Solar Radiation
- Radon sampler;

In the Table 1 for each observatory the different kind of measurement data is represented in green, to better determine the specific running program.

Table 2: The aerosol types considered for the tree-like automatic aerosol typing.

Site	*GHG*	*Reactive Gas*	*Meteo*	*Aerosol*	*Profiles*	*Radiation*	*Radon*
LMT							
ECO							
POT							
LMP							
MRG							
UNA							
CMN							

GREEN HOUSE GASES

For the GHG Picarro G2401 is the standard instrument, the OU running this measurement program are depicted in the Figure 2.

Figure 2 OU running GHG program measurement

The temporal coverage of GHG observation for each site is depicted in Figure 3:

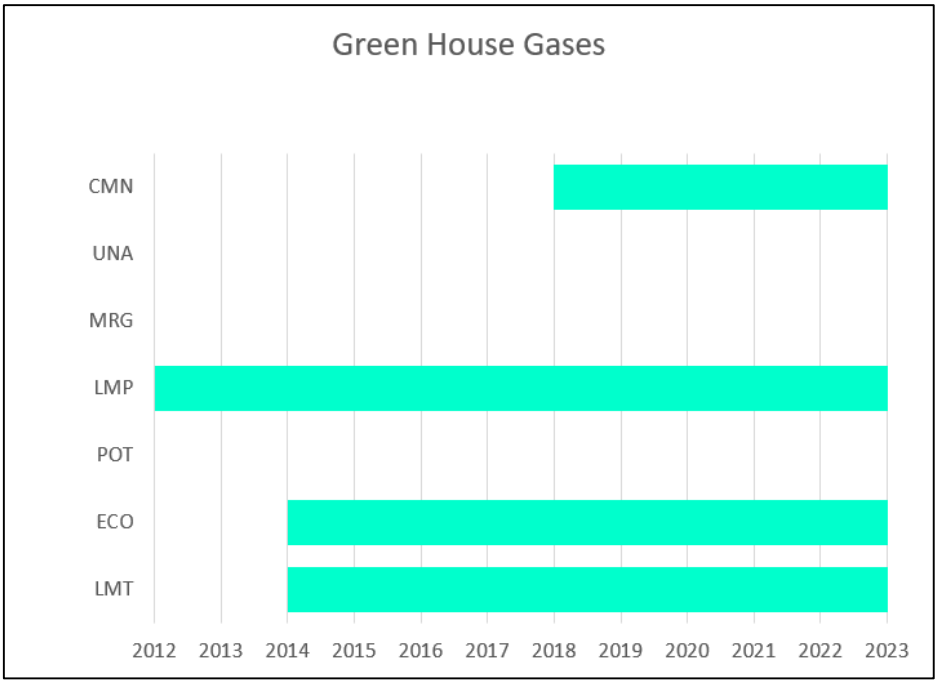


Figure 3 OU running GHG program measurement dataset temporal coverage

REACTIVE GASES

Reactive gases (RG) measures cover all sites but not NAP. Thermo Tei42i analyses NO, NO2 and NOX, and Tei49i analyses O_3, the OU running this measurement program are depicted in the Figure 4.

Figure 4 OU running RG program measurement

The temporal coverage of RG observation for each site is depicted in Figure 5

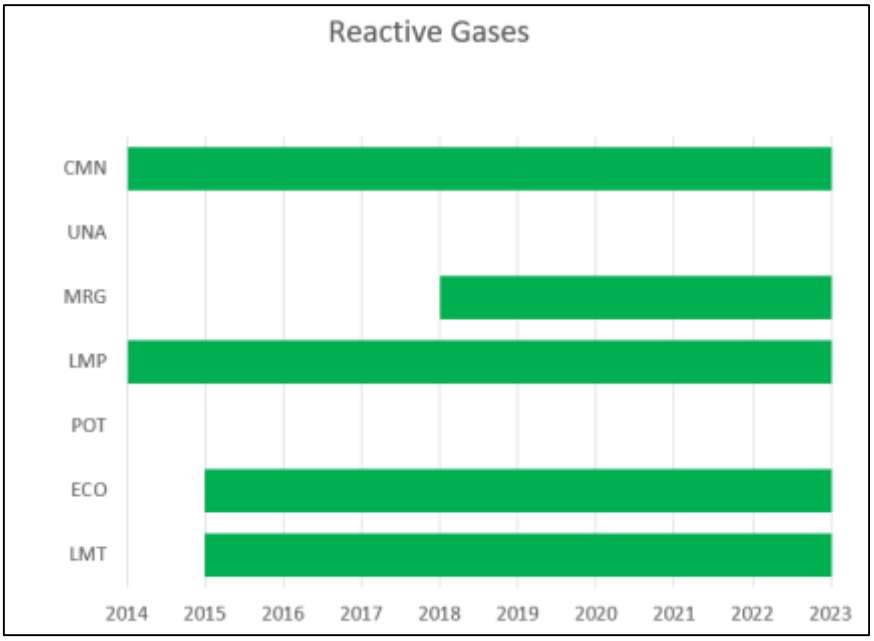


Figure 5 OU running RG program measurement dataset temporal coverage

METEOCLIMATE DATA

Meteo data are collected in all sites but NAP. Waisala WTX520 o WTX530 data are registered in CMN, ECO, LMT. While MRG and LMP collect data through assembled single sensors of different brands. The OU running this measurement program are depicted in the Figure 6.

Figure 6 OU running METEO program measurement

The temporal coverage of METEO observation for each site is depicted in Figure 6

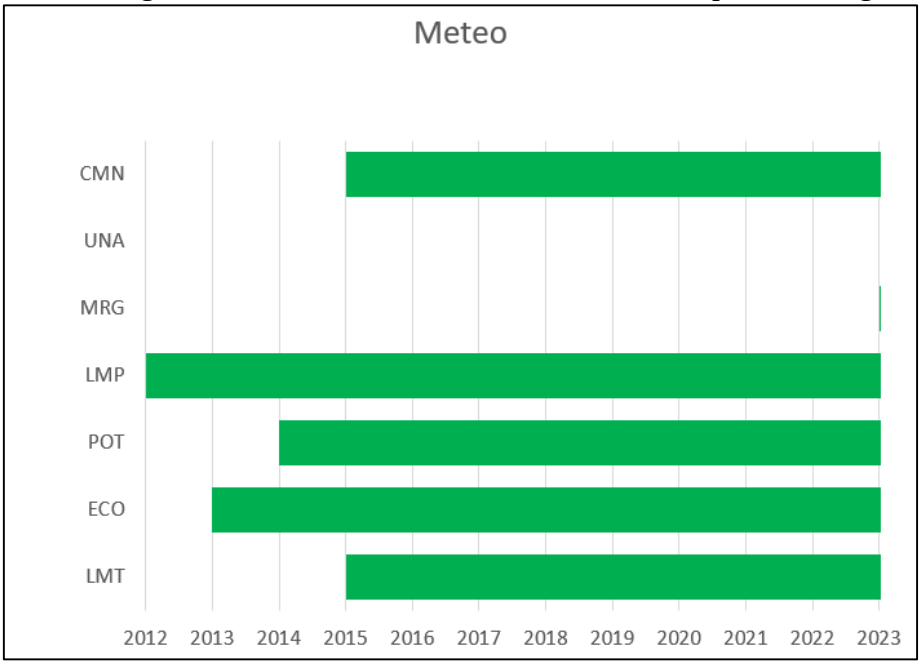


Figure 7 OU running METEO program measurement dataset temporal coverage

AEROSOL DATA

Concentration, distribution, number, optical properties of aerosol are collected in the most part of the sites. Different information is available as are different instrumentations and models, only standards are available for ACTRIS RI.
The OU running this measurement program are depicted in the Figure 8.

Figure 8 OU running AEROSOL program measurement

The temporal coverage of METEO observation for each site is depicted in Figure 9

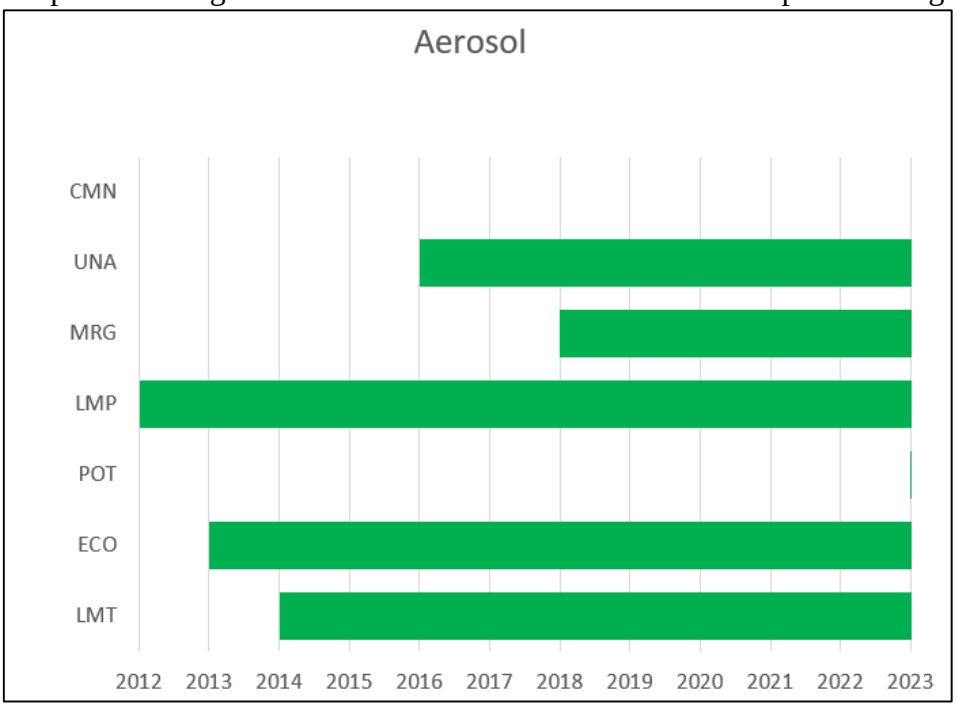


Figure 9 OU running AEROSOL program measurement dataset temporal coverage

LIDAR PROFILES

Lidar Profiles are collected only in three sites, the instrumentation is variable, but only different for those site with EARLINET running program. Data set are heterogeneous for this parameter.

Figure 10 OU running PROFILES program measurement

The temporal coverage of PROFILES observation for each site is depicted in Figure 11 OU running PROFILES program measurement dataset temporal coverage

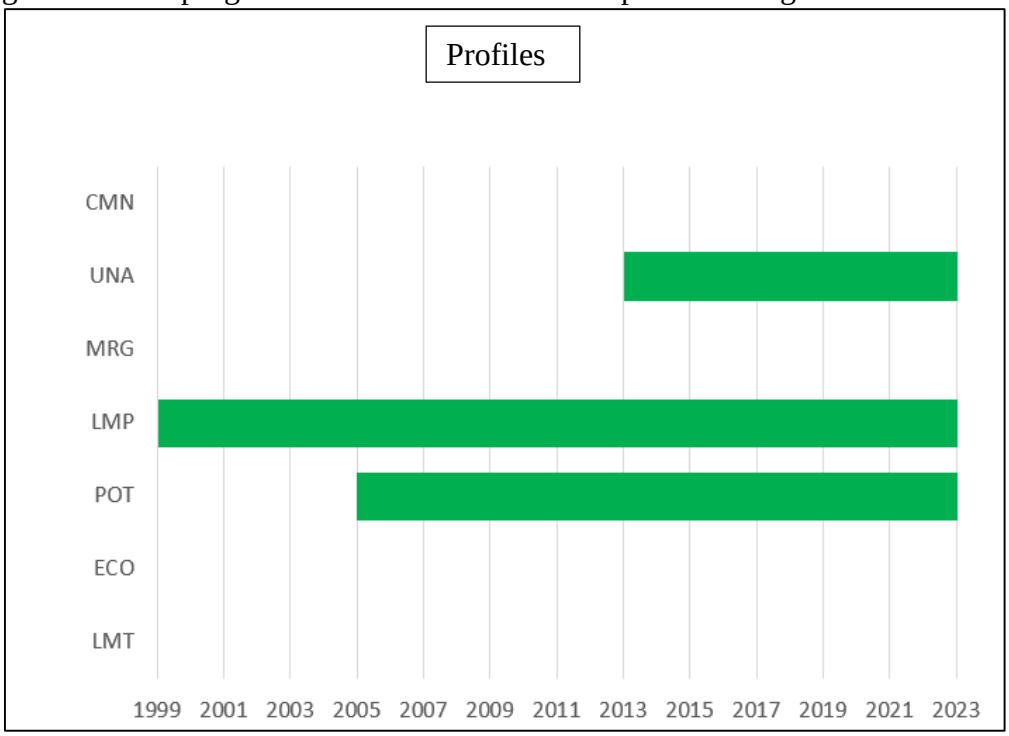


Figure 11 OU running PROFILES program measurement dataset temporal coverage

OTHER PARAMETERS

In some sites other running measure are present such as:
- **Solar Radiation** (LMP)- "Kipp&Zonen CGR4" (available dataset (2004 – actual) and "Licor Li190R – dataset (2002 – actual)
- ***RadonRN 222 concentration*** (POT***)*** "Radon Mapper MI.AM", just running.

FURTHER CONSIDERATION

In the frame of ITINERIS other equipment will be acquired, potentially useful to this pilot in terms of on line analysis or sampling or for further analysis off-line.
This inventory will be update in the view of the new measurement program by using the new equipment and other OU will be able to join to the actual work group.
Last consideration is regarding mobile labs, organised with internal equipment, can play an important role in enriching observational available sites with their positioning in other strategic places.

TEST CASES AND IMPLEMENTATION

- The plan is to use the historical data set.
- The focus is:

  - on any joining OU with the possibility to register open fire episodes in each site representative of different conditions, and detecting past event occurrence;

  - organising summer campaign, in the frame of ITINERIS, at LMT as Calabrian region is usually affected by a huge amount of Open Fire during this period and hosting here different complementary instrumentation to enrich specific dataset, or same instruments for intercomparison.

- Characterization of any site of background values of any species dataset.

- We will investigate possible synergies with other Objectives/Actions such as aerosol typing.

REFERENCES

[UNEP 2022] United Nations Environment Programme (2022). Spreading like Wildfire – The Rising Threat of Extraordinary Landscape Fires. *A UNEP Rapid Response Assessment. Nairobi.*

[Zeng 2023] Zheng Philippe Ciais Frederic Chevallier Hui Yang Josep G. Canadell Yang Chen Ivar R. van der Velde Ilse Aben Emilio Chuvieco Steven J. Davis Merritt Deeter Chaopeng Hong Yawen Kong Haiyan Li Hui Li Xin Lin Kebin He Qiang Zhang ***Record-high CO2 emissions from boreal fires in 2021****, Science. 2 Mar 2023 Vol 379, Issue 6635 pp. 912-917 DOI: 10.1126/science.ade0805*

[Lo Feudo 2015] Teresa Lo Feudo, Daniel Gulli, Rosamaria Calaudi, Elenio Avolio, Claudia Roberta Calidonna, ***Impact of agriculture biomass burning and preliminary results, on coastal site Lamezia Terme, integrating data of different instruments.*** *XXXVIII Meeting of the Italian Section of the Combustion Institute, September 2015, Lecce, Italy.*

[Parise 2023] Domenico Parise, Luana Malacaria, Salvatore Sinopoli, Claudia Roberta Calidonna, Daniel Gullì, Ivano Ammoscato, Elenio Avolio, Mariafrancesca De Pino, Paolo Cristofanelli and Teresa Lo Feudo, ***Climate change and forest fires of summer seasons (2017-2021) in the central Mediterranean region: a pre-liminary analysis****, V Euro-Mediterranean Conference for Environmental Integration, 2-5 October 2023, Rende, Italy (Proceedings Elsevier in Press)*

ANNEX

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D4.16.1: Annex 1 - Survey list of the data available at the Institutes

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Greenhouse Gases Summary

Insitute	Parameter	Active	Instrument / Model / Product	Site	PI (First Name - Second Name)
ISAC - LAMEZIA TERME	CO2	yes	Picarro G2410	LMT	Claudia Roberta Calidonna & Teresa Lo Feudo
ISAC - LAMEZIA TERME	CO	yes	Picarro G2410	LMT	
ISAC - LAMEZIA TERME	CH4	yes	Picarro G2410	LMT	
ISAC - LECCE	CO2	no	Picarro G2410	ECO	Daniele Contini
ISAC - LECCE	CO	no	Picarro G2410	ECO	
ISAC - LECCE	CH4	no	Picarro G2410	ECO	
IMAA - Tito	Mole Fraction of CO_2, CH_4, CO e H_2O	No	Picarro G2401 Gas Concentration Analyzer	POT	Lucia Mona
IMAA - Tito	Mole Fraction of N_2O e CO	No	N_2O/CO Analyzer LGR (Series N2OCM-913	POT	
IMAA - Tito	CO_2, CH_4, N_2O, SF_6, CO, H_2, ^{13}C e ^{18}O nella CO_2	No	ICOS 24-Port Flask-Sampler + ICOS Air Dryer Systems (developed by “Max Plank Institute” - MPI)	POT	
IMAA - Tito	$^{14}CO_2$ concentration	No	$^{14}CO_2$ sampler (developed by "Università di Heidelberg" – Germany)	POT	
ENEA - Lampedusa	CO2	yes	Picarro G2401	LMP	Tatiana Di Iorio
ENEA - Lampedusa	CO	yes	Picarro G2401	LMP	
ENEA - Lampedusa	CH4	yes	Picarro G2401	LMP	
ENEA - Lampedusa	13CO2	yes	Picarro G2201i	LMP	
ENEA - Lampedusa	13CH4	yes	Picarro G2201i	LMP	
ISAC - Monte Cimone	CO2	yes	Picarro G2410	CMN	Paolo Cristofanelli
ISAC - Monte Cimone	CO	yes	Picarro G2410	CMN	
ISAC - Monte Cimone	CH4	yes	Picarro G2410	CMN	

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Reactive Gases Summary

Institute	Parameter	Active	Instrument / Model / Product	Site	PI (First Name - Second Name)
ISAC - LAMEZIA TERME	NO	yes	thermo tei42i	LMT	Claudia Roberta Calidonna & Teresa Lo Feudo
ISAC - LAMEZIA TERME	NO2	yes	thermo tei42i	LMT	
ISAC - LAMEZIA TERME	NOx	yes	thermo tei42i	LMT	
ISAC - LAMEZIA TERME	O3	yes	thermo tei49i	LMT	
ISAC - LECCE	NO-NO2-NOx	yes	thermo tei42i	ECO	Daniele Contini
ISAC - LECCE	O3	yes	thermo tei49i	ECO	
ISAC - LECCE	SO2	yes	thermo tei43i	ECO	
ISAC - LECCE	NO-NO2-NOx-NH3-NT	yes	thermo tei17i	ECO	
ISAC - LECCE	N2O	yes	thermo tei46i	ECO	
IMAA - Tito	O3, HCl, HF, ClONO2, HNO3, N2O, CH4, CO, C2H6, and HCN	No	FTIR	POT	to be decided
ENEA - Lampedusa	O3	yes	thermo 49i	LMP	Paolo Cristofanelli
DAIS - UNIVE	NOx	no	Horiba, TBI	MRG	-
DAIS - UNIVE	O3	no	Horiba, TBI	MRG	
CNR-ISP/CNR-ISAC	O3	no	Thermo 49i-PS	MRG	
CNR-ISP	O3	no	LCS, Alphasense	MRG	-
ISAC - Monte Cimone	NO	yes	thermo tei42i	CMN	Paolo Cristofanelli
ISAC - Monte Cimone	NO2	yes	thermo tei42i	CMN	
ISAC - Monte Cimone	NOx	yes	thermo tei42i	CMN	
ISAC - Monte Cimone	O3	yes	thermo tei49i	CMN	

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Meteo Data Summary

Institute	Parameter	Active	Instrument / Model / Product	Site	PI (First Name - Second Name)
ISAC - LAMEZIA TERME	Temp	yes	VAISALA WTX 530	LMT	Claudia Roberta Calidonna & Teresa Lo Feudo
ISAC - LAMEZIA TERME	P	yes	VAISALA WTX 530	LMT	
ISAC - LAMEZIA TERME	UR	yes	VAISALA WTX 530	LMT	
ISAC - LAMEZIA TERME	Rain	yes	VAISALA WTX 530	LMT	
ISAC - LAMEZIA TERME	WSP	yes	VAISALA WTX 530	LMT	
ISAC - LAMEZIA TERME	WDir	yes	VAISALA WTX 530	LMT	
ISAC - LECCE	Temp	yes	VAISALA WXT 5200	ECO	Daniele Contini
ISAC - LECCE	P	yes	VAISALA WXT 5200	ECO	
ISAC - LECCE	UR	yes	VAISALA WXT 5200	ECO	
ISAC - LECCE	Rain	yes	VAISALA WXT 5200	ECO	
ISAC - LECCE	WSP	yes	VAISALA WXT 5200	ECO	
ISAC - LECCE	WDir	yes	VAISALA WXT 5200	ECO	
ISAC - LECCE	solar radiation	yes	CNR4 Radiometer KIPP & ZONEN	ECO	
IMAA - Tito	Temp	yes	VAISALA WTX 530	POT	Marco Rosoldi
IMAA - Tito	P	yes	VAISALA WTX 530	POT	
IMAA - Tito	UR	yes	VAISALA WTX 530	POT	
IMAA - Tito	Rain	yes	VAISALA WTX 530	POT	
IMAA - Tito	WSP	yes	VAISALA WTX 530	POT	
IMAA - Tito	WDir	yes	VAISALA WTX 530	POT	
IMAA - Tito	Profiles	yes	VAISALA RS92 & RS41	POT	
ENEA - LAMPEDUSA	Temp	yes	VAISALA HMP155E	LMP	Lorenzo De Silvestri
ENEA - LAMPEDUSA	P	yes	VAISALA PTB210	LMP	
ENEA - LAMPEDUSA	UR	yes	VAISALA HMP155E	LMP	
ENEA - LAMPEDUSA	WDir	yes	WMT702	LMP	
ENEA - LAMPEDUSA	WSP	yes	WMT702	LMP	
ENEA - LAMPEDUSA	Rain	yes	OTT Pluvio2	LMP	Claudio Scarchilli
CNR-ISP	Temp	yes	Campbell CS2615	MRG	-
CNR-ISP	Surf Temp	yes	Apogee SI-111	MRG	-
CNR-ISP	P	yes	Vaisala PTB110	MRG	-
CNR-ISP	UR	yes	Campbell CS2615	MRG	-
CNR-ISP	Rain/Snow	yes	Campbell model 52202	MRG	-
CNR-ISP	Solar radiation	yes	Hukseflux NR01 4-comp. net rad.	MRG	-
CNR-ISP	WSP	yes	Young 05108-45	MRG	-
CNR-ISP	WDir	yes	Young 05108-45	MRG	-
ISAC - Monte Cimone	Temp	yes	VAISALA WTX 530	CMN	Paolo Cristofanelli
ISAC - Monte Cimone	P	yes	VAISALA WTX 530	CMN	
ISAC - Monte Cimone	UR	yes	VAISALA WTX 530	CMN	
ISAC - Monte Cimone	Rain	yes	VAISALA WTX 530	CMN	
ISAC - Monte Cimone	WSP	yes	VAISALA WTX 530	CMN	
ISAC - Monte Cimone	WDir	yes	VAISALA WTX 530	CMN	

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Aerosol Data (page 1)

INSTITUTE	Parameter	Active	Instrument / Model / Product	Site	PI (First Name - Second Name)
ISAC - LAMEZIA TERME	PM mass (PM10-PM2.5)	yes	SWAM5a Dual Ch	LMT	Claudia Roberta Calidonna & Teresa Lo Feudo
ISAC - LAMEZIA TERME	number concentration(0.28-10µm)	yes	OPC FAI	LMT	
ISAC - LAMEZIA TERME	size distribution (8-800nm)	yes	MPSS TROPOS	LMT	
ISAC - LAMEZIA TERME	Black Carbon	yes	MAAP Thermo 5012	LMT	
ISAC - LAMEZIA TERME	Scatttering coefficient	yes	Nephel. Aurora3000	LMT	
ISAC - LECCE	PM mass (PM10-PM2.5)	yes	SWAM5a Dual Ch.	ECO	Daniele Contini
ISAC - LECCE	number concentration(0.28-10µm)	yes	OPC FAI	ECO	
ISAC - LECCE	size distribution (8-800nm)	yes	MPSS TROPOS	ECO	
ISAC - LECCE	size distribution (500 - 20000nm)	yes	TSI APS	ECO	
ISAC - LECCE	number concentration (0.25 - 10µm)	yes	Grimm OPC	ECO	
ISAC - LECCE	Black Carbon	yes	MAAP Thermo 5012	ECO	
ISAC - LECCE	Scattering coefficient	yes	Nephelometer TSI	ECO	
ISAC - LECCE	Scattering coefficient	yes	Nephel. Aurora3000	ECO	
ISAC - LECCE	Black carbon	yes	Magee AE33	ECO	
ISAC - LECCE	Total carbon	yes	Magee TCA08	ECO	
ISAC - LECCE	OC and EC offline	yes	Sunset lab analyser	ECO	
IMAA/UNINA-NAPOLI	Aerosol Columnar	yes	CE-318 Sun-sky-lunar Photometer	NAP	Antonella Boselli & Salvatore Amoruso
IMAA/UNINA-NAPOLI	PM	yes	OPC GRIMM EDM164	NAP	
DAIS - UNIVE	PTS, PM10, PM2,5, PM1	yes	GRIMM EDM264	MRG	-
CNR-ISP	PM10	yes	TCR Tecora Skypost	MRG	-
ENEA - LAMPEDUSA	spectral AOD	no	MFRSR	LMP	Alcide di Sarra
ENEA - LAMPEDUSA	spectral AOD	yes	Cimel CE318TP AERONET	LMP	Daniela Meloni
ENEA - LAMPEDUSA	PM 10	yes	Dadolab sampler	LMP	Silvia Becagli (Univ. Firenze)
ENEA - LAMPEDUSA	aerosol size distribution, refractive index, phase function, SSA	yes	Cimel CE318TP AERONET	LMP	Daniela Meloni

Aerosol Data (page 2)

INSTITUTE	Parameter	Active	Instrument / Model / Product	Site	PI (First Name - Second Name)
IMAA - Tito	absorption coefficient and Black Carbon concentration (ng/m^3)	Yes	Aethalometer (A33-Dual spot, Magee Scientific)	POT	Lucia Mona
IMAA - Tito	total scattering σ_{sp} and the backscattering σ_{bsp} coefficients	No	Integrating Nephelometer (Aurora 3000-Ecotech)	POT	
IMAA - Tito	size distribution and concentration - size range 10nm-800nm	No	SMPS (3938-TSI)	POT	
IMAA - Tito	size distribution and concentration - size range 0.8µm-10µm	Yes	APS (3321-TSI)	POT	
IMAA - Tito	concentration of particles with dimensions > 10nm	No	CPC (3750-TSI)	POT	
IMAA - Tito	Ambient monitoring of NO_3, SO_4, NH_4, Cl and Organic mass loadings	Yes	ToF-ACSM (Aerodyne Research)	POT	
IMAA - Tito	PM_{10}-$PM_{2.5}$-PM_1 concentration (µg/m^3)	No	Pmx sampler (SWAM 5a-Dual Channel Monitors, FAI Instruments	POT	
IMAA - Tito	multi-elemental analysis	No	Agilent 5800 ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometer	POT	
IMAA - Tito	Organic carbon (OC), elemental carbon (EC, also termed Black Carbon [BC]), and temperature-separated carbon fractions on aerosol filter deposits	No	EC/OC DRI 2015 Series 2 – Aerosol Magee Scientific	POT	

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Profiles					
Institute	**Parameter**	**Active**	**Instrument / Model / Product**	**Site**	**PI (First Name - Second Name)**
IMAA - Tito	aerosol backscatter @355, 532 , aerosol extinction @355, 532 nm	NO	PEARL	POT	Aldo Amodeo
IMAA - Tito	aerosol backscatter @355, 532, 1064nm , aerosol extinction @355, 532 nm, aerosol depolarization @532 nm	yes	MUSA	POT	Aldo Amodeo
IMAA - Tito	aerosol backscatter @355, 532, 1064nm , aerosol extinction @355, 532 nm, aerosol depolarization @355, 532, 1064 nm	yes	POLPO	POT	Aldo Amodeo
IMAA - Tito	aerosol backscatter, extinciton and lidar ratio @355 nm	yes	Raymetrics 3LR111	POT	Aldo Amodeo
IMAA - Tito	aerosol backscatter @355, 532, 1064nm , aerosol extinction @355, 532 nm, aerosol depolarization @355, 532, 1064 nm	No	Mobile Multiwavelength lidar	POT	Aldo Amodeo
IMAA - Tito	aerosol backscatter @355, 532nm , aerosol extinction @355 nm, Vapor d'acqua, aerosol depolarization @355, 532 nm	No	SMALL COMPACT TRANSPORTABLE LIDAR	POT	Aldo Amodeo
IMAA - Tito	aerosol optical depth @ 340, 380, 440, 500, 675, 870, 937, 1020, 1640 nm	YES	CIMEL triple mode	POT	LUCIA MONA
ENEA - LAMPEDUSA	aerosol, clouds	yes	Luft CHM 15K	LMP	Tatiana Di Iorio
ENEA - LAMPEDUSA	aerosol, clouds	yes	High power lidar	LMP	Tatiana Di Iorio
IMAA/UNINA-NAPOLI	Aerosol	yes	Lidar	NAP	Salvatore Amoruso

Radiation Data					
Institute	**Parameter**	**Active**	**Instrument / Model / Product**	**Site**	**PI**
ENEA - LAMPEDUSA	downward SW	yes	Kipp&Zonen CMP21/CMP22	LMP	Daniela Meloni
ENEA - LAMPEDUSA	downward LW	yes	Kipp&Zonen CGR4	LMP	
ENEA - LAMPEDUSA	downward PAR	yes	Licor Li190R	LMP	

Radon Data					
Institute	**Parameter**	**Active**	**Instrument / Model / Product**	**Site**	**PI**
IMAA - Tito	^{222}Rn concentration	No	Radon Mapper mi.am	POT	Lucia Mona

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