A NEW ICOS CLASS 1 STATION AT CNR-IMAA: STARTING A NEW INFRASTRUCTURE IN THE HEARTH OF MEDITERRANEAN BASIN

E. LAPENNA, I. ZACCARDO, A. BUONO, F. CARDELLICCHIO, T. LAURITA, S. TRIPPETTA, D. AMODIO, C. COLANGELO, A. GIUNTA, A. MAUCERI, E. RIPEPI, L. MONA

National Research Council - Institute of Methodologies for Environmental Analysis (CNR-IMAA)

emilio.lapenna@cnr.it

ICOS Atmosphere Thematic Centre

Consiglio Nazionale delle Ricerche

IMAA ISTITUTO DI METODOLOGIE PER L'ANALISI AMBIENTALE

ITINERIS

SCAN ME

OVERVIEW

At the Institute of Methodologies for Environmental Analysis of the National Research Council (CNR-IMAA) we have completed step 1 of the labelling for the new ICOS-compliant atmosphere Class 1 Continental POT station and we are setting up the station to start step 2. The ICOS station consists of a 100 m tower with three sampling levels (100, 50, and 10 m, each one with its own meteorological station) and a ceilometer at the basement. The atmosphere POT station has been labelled as Class 1 because the maximum number of parameters required by ICOS will be measured (including CO_2, CO, CH_4, N_2O, H_2O). The annexed shelter, in fact, is equipped with the continuous analyzers (PICARRO G2401, LGR, ^{222}Rn analyzer) and the gas samplers (automatic flask sampler, Heidelberg CO_2 sampler for radiocarbon analysis)[1]. Furthermore, CNR-IMAA runs CIAO (CNR IMAA Atmospheric Observatory), one of the largest ground-based remote-sensing station in the Mediterranean Basin and in Europe. The complexity of the observatory allows ICOS measurements to be integrated with aerosol lidar profiling, cloud remote sensing, aerosol in- situ and radiosounding observations made at CIAO.

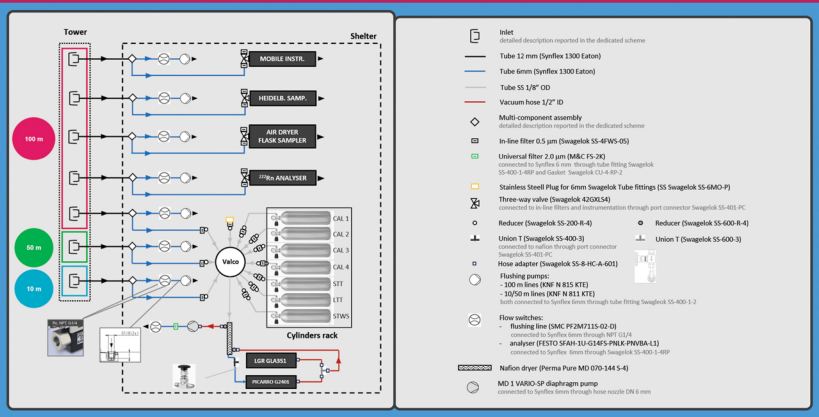
CIAO Observatory

https://ciao.imaa.cnr.it/

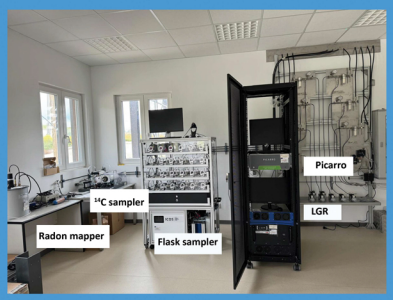
STATION GEOGRAPHICAL DESCRIPTION

Our station will provide important measures within ICOS since in the Mediterranean basin there is only one Class 1 station. Our site is located in Tito (Southern Italy, 40.60° N, 15.72° E, 760 m asl), close to Potenza City (~7 km), in a plain surrounded by low mountains (below 1100 m asl), less than 150 km from the West, South and East coasts. It is characterized by a typical mountain weather strongly influenced by Mediterranean atmospheric circulation, resulting in generally dry, hot summers and cold winter.

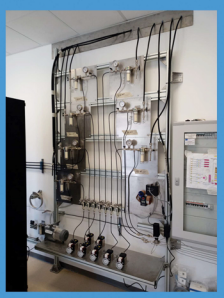
ICOS POT site



Tower scheme



Overview of the Instrumentation



View of the sampling lines

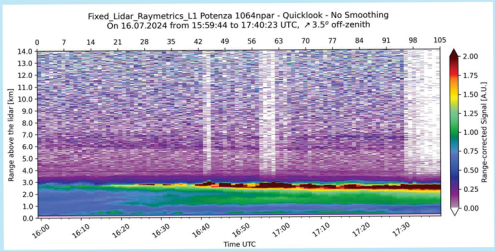
SYNERGIES WITH ACTRIS

The ICOS tower is located 1,2 km far away from ACTRIS instrumentation. This gives the opportunity to study and characterize atmosphere content and properties with an holistic approach, performing a synergistic investigation on GHGs and atmospheric aerosol. Integrated approaches with remote sensing and in-situ observations allow us to combine GHG observations and aerosol characterization in terms of vertical profiles of aerosol physical and optical properties, and aerosol concentration, size dimension and chemical composition at ground level. This information is essential for investigating long range transportation, mixing processes, potential effects on ecosystems and public health. As further tool toward a more advanced integration, we plan to deploy ACTRIS-like instruments (namely APS, nephelometer and aethalometer) at the base of the ICOS tower collecting air samples with such instruments at the three altitude levels (10, 50, and 100 m). [2]

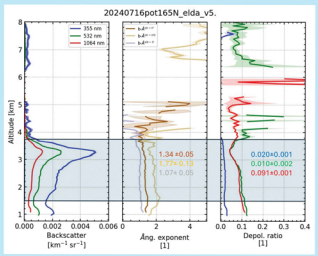
One of the first topic of interest for the ICOS-ACTRIS integration is certainly a more robust detection and quantification of wildfires emissions. CO_2 and CO concentration, aerosol concentration, dimension and chemical composition, and in particular black carbon content provided by Aethalometer, can be key parameters in this sense. Coupling such information with aerosol vertical profiles and associated aerosol typing will provide a better insight of plume distribution and evolution.[2],[3]

Below lidar and aethalometer observations related to a local fire occurred on July 16, 2024 at about 2 km away from CNR-IMAA are reported: an aerosol layer appeared around 16:00 UTC from the ground up to 2-3 km asl and at 18:00 UTC a sudden decrease in the angstrom exponent was observed to the ground indicating the increase of the detected particles at the ground (fresh fires implies larger particle then typical ones). No ICOS CO_2 and CO measurements were available for integrating also such measurements on our analysis, but this kind of cases (unluckily often occurring in southern Italy) is clearly relevant for integrated ACTRIS-ICOS studies.

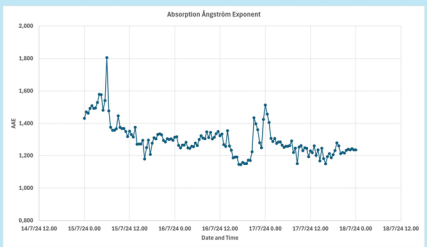
Wildfire event (16:00-18 UTC , 16th July 2024, Pantano lake, Basilicata, Italy)



Quicklook lidar (from 16:00 to 18:00 UTC)



Backscatter signal ($km^{-1}sr^{-1}$) (left panel), Angstrom exponent (central panel) depolarization ratio trends vs altitude (km) (right panel)



Angstrom absorption exponent trend

FUTURE PERSPECTIVES ...

This ongoing setup will allow studying the horizontal variability by comparing aerosol in situ measurements below the tower and 1,2 km away at ACTRIS site, and vertically by sampling at various heights of the tower. In this way, the ICOS gases measurements and all the ACTRIS observations integrated studies can be carried out taking into account such variability. Finally, we are also adding a PICARRO G2201 for the measurements of isotopic mixtures of carbon in CO_2 and CH_4: this could allow to disentangle the anthropogenic pollution sources and study their evolution with time.

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