"With the contribution of the Life Programme of the European Union"

Climatology at Urban scale: analysis and monitoring activities at the Meteorological Observatory "Valerio" of Pesaro Municipality

III CAPACITY BUILDING SESSION

Pesaro, - 15th December 2016

Life SEC Adapt Project
LIFE14 CCA/IT/000316

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Biometeorology Institute CNR

Coordinated by Svim

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The current studies on population dynamics indicate that in a few decades most of the human population will live in the cities.
In addition to the problem of abandonment of country land, the next challenges for our politicians will address all issues related to health, pollution, energy, mobility and quality of life in new "megacities"

London: 7'500'000 abitanti

Mexico City: 20'000'000 abitanti in 1500 km^2

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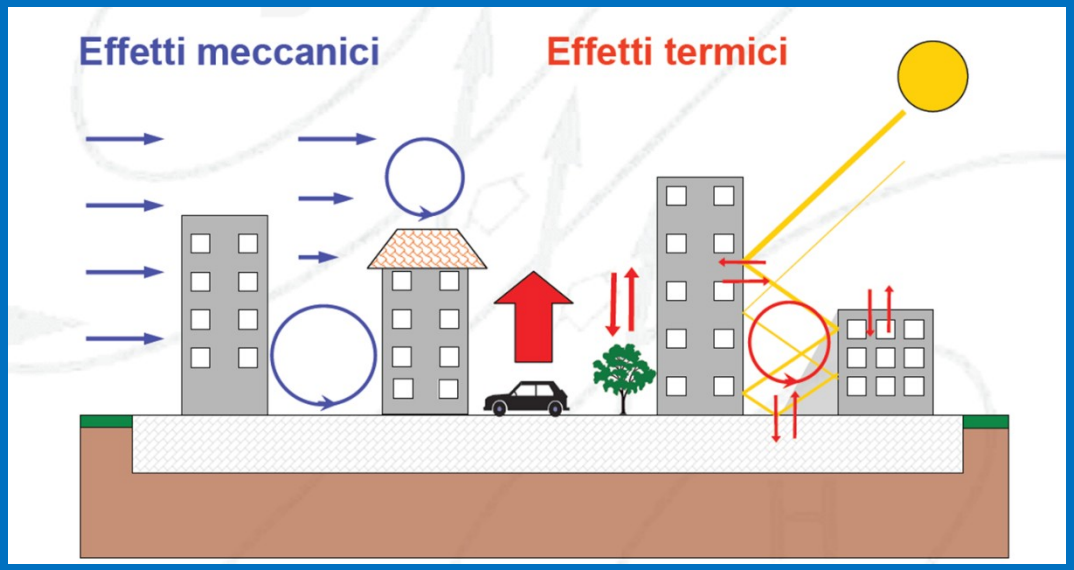
The urban environment differs from rural environment by climatic point of view: the differences are due to urban development. Urbanization infact changes the form of the landscape, and also produces changes in the area's energy processes.



Constructions (buildings, road pavements etc.) modify:

- energy balance
- soil evaporation
- wind direction and speed
- optical properties of the surfaces
- air and soil temperature
- Rainfall

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Urban climate vs rural areas climate

Mean annual temperature : higher
T max: higher
T min: higher
Freezing days: less
Relative humidity: lower
Rainfall amount: higher
Snowy days: less
Wind Gusts: higher
Wind speed: slower
Cloud cover: higher

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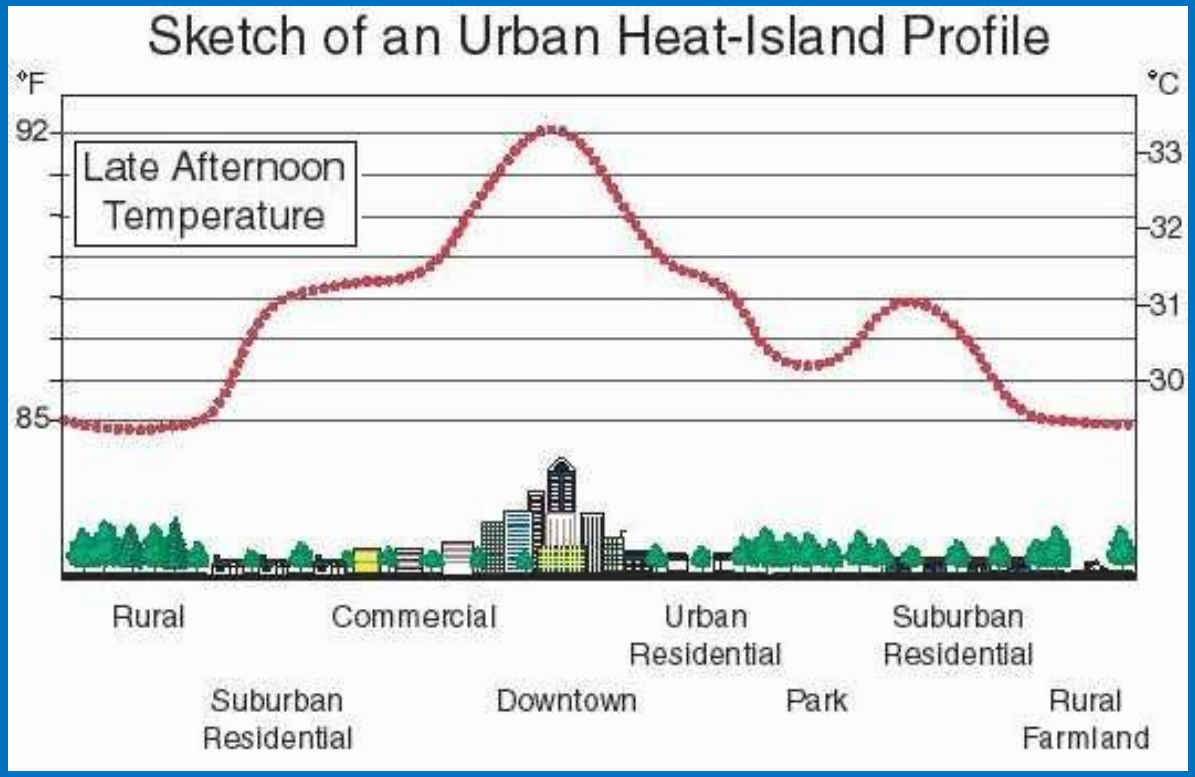
Urban heat island



Due these difference, the city centre are warmer than surrounding areas

Londra: ΔT = 10° C
Helsinki: ΔT = 8° C
Monaco: ΔT = 7° C
Vienna: ΔT = 6° C
Parma: ΔT = 3° C

Fonte: WMO / OMS

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Two primary processes influence the formation of this "heat island."

1) During summer, urban pavement and asphalt absorb, store, and reradiate more solar energy per unit area than the vegetation and soil in rural areas. Furthermore, less of this energy can be used for evaporation in urban areas, which usually exhibit greater precipitation runoff from streets and buildings. At night, radiative losses from urban building and street materials keep the city's air warmer than in rural areas.

2) During winter the urban atmosphere is warmed slightly, but significantly, by energy from fuel combustion from: home heating, power generation, industry, and transportation. Another contribution to worm urban atmosphere came from pollutants coverage and water vapour that absorbs part of thermal radiation emitted by the Earth's surface.

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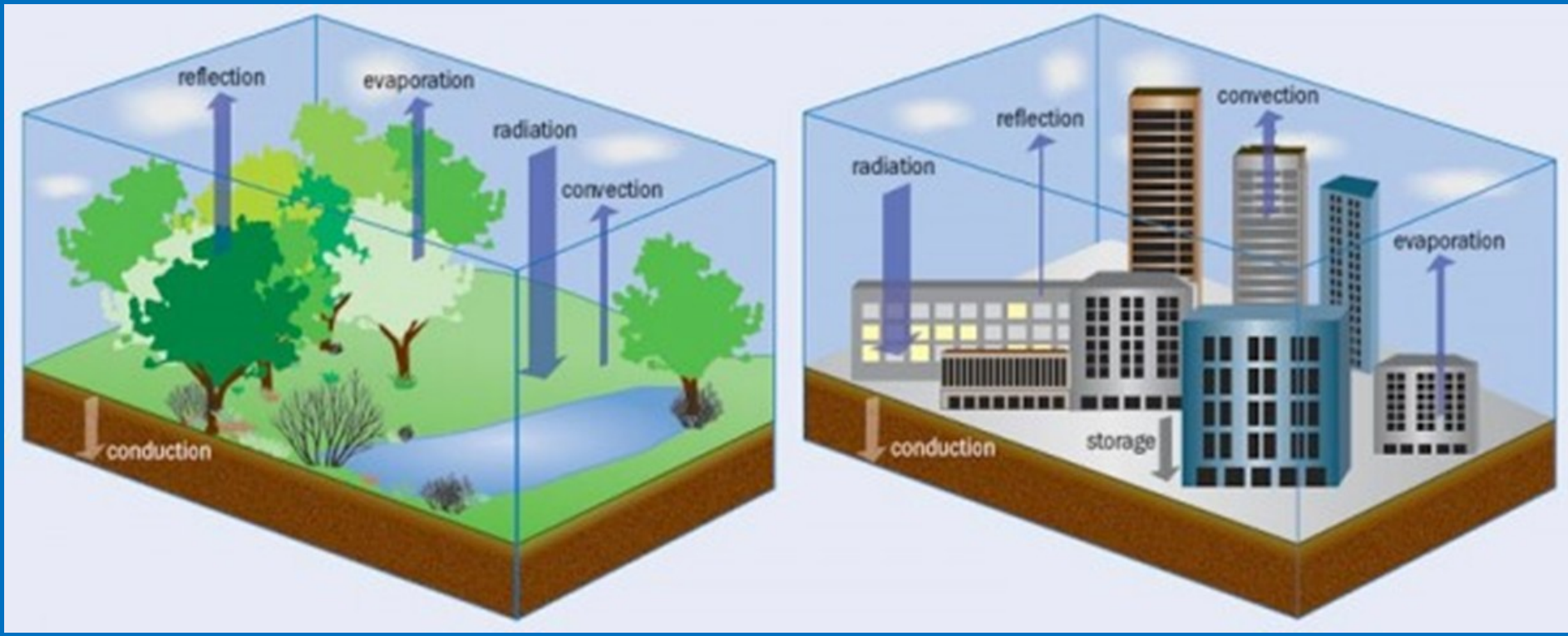

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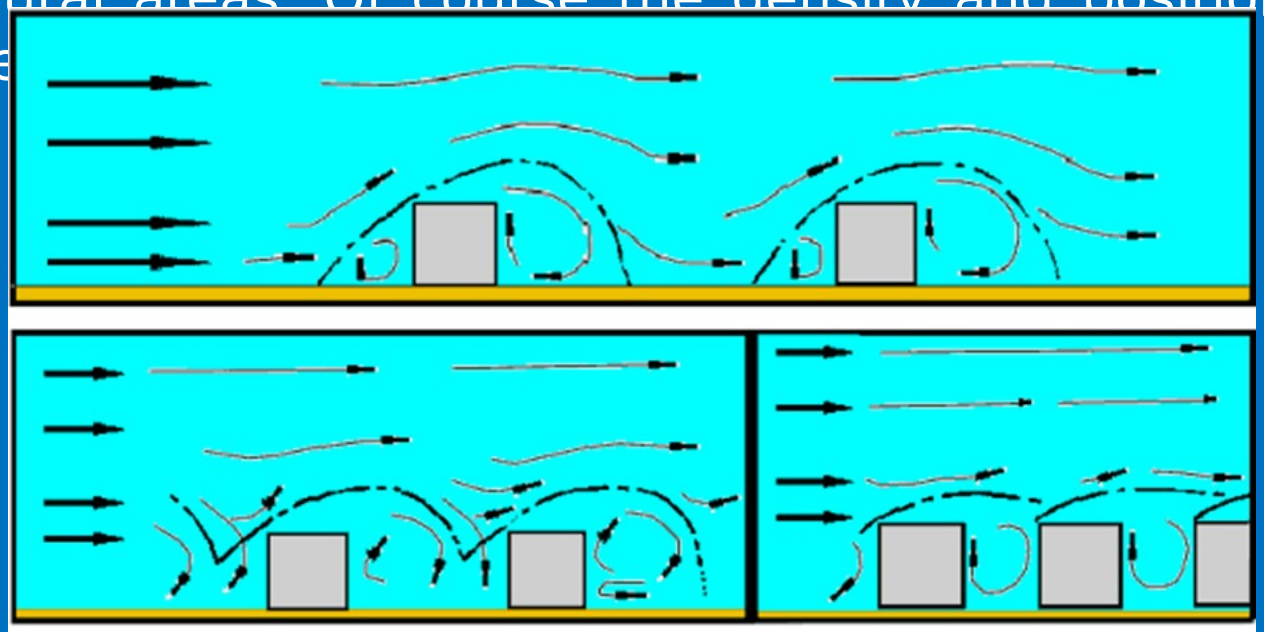
The wind flow through a city is characterized by mean speeds that are 20 to 30% lower than the wind blowing in the surrounding country. This difference is the result of the increased frictional drag caused by urban structure (buildings), which is rougher than rural areas. Of course the density and position of buildings are ve



Urban Wind Flow Patterns With Various Simple Building Shapes and Spacings

URBAN CLIMATE LABORATORY

The collaboration between CNR Ibimet and Osservatorio Valerio, but also with Osservatorio Ximeniano in Florence, Collegio Romano in Rome, Osservatorio S. Marcellino in Naples and Fondazione Osservatorio Meteo Duomo in Milan, placed the base to create the Urban Climate Laboratory.
The ancient meteorological observatories listed above, with more then 100 year of story and data collected, sited in the center of the most important cities of Italy, are the best place where to investigate all the meteorological phenomena at urban scale.

There are others similar infrastructure in Europe like Kings College in London and the Royal Netherlands Meteorological Institute (KNMI) in Amsterdam.

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Osservatorio Ximeniano

Collegio Romano

Osservatorio Valerio

Osservatorio S. Marcellino

Osservatorio Milano Duomo

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The knowledge of the climatic characteristics of a city is essential as a management tool of the city itself.

The collaboration between CNR Ibimet and Osservatorio Valerio was born in order to improve the knowledge of Pesaro’s environment, through innovative measuring instruments of chemical and physical parameters of the atmosphere, and to provide useful knowledge for public administrators to improve the “CITIZENS LIFE QUALITY” .

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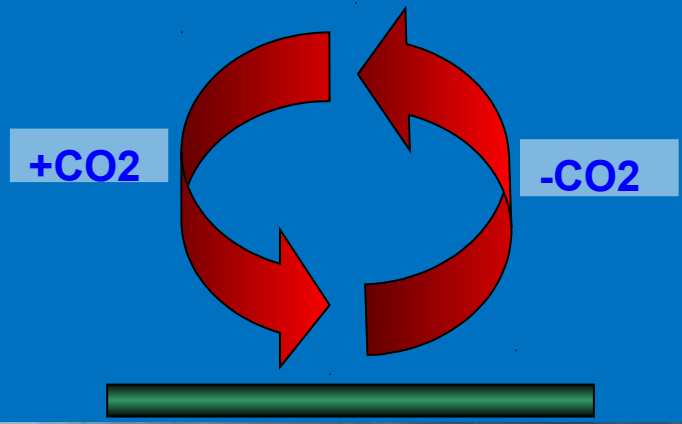
EDDY COVARIANCE TECHNIQUE

1. WIND AND TURBULENCE
2. GAS CONCENTRATION

GAS FLUX



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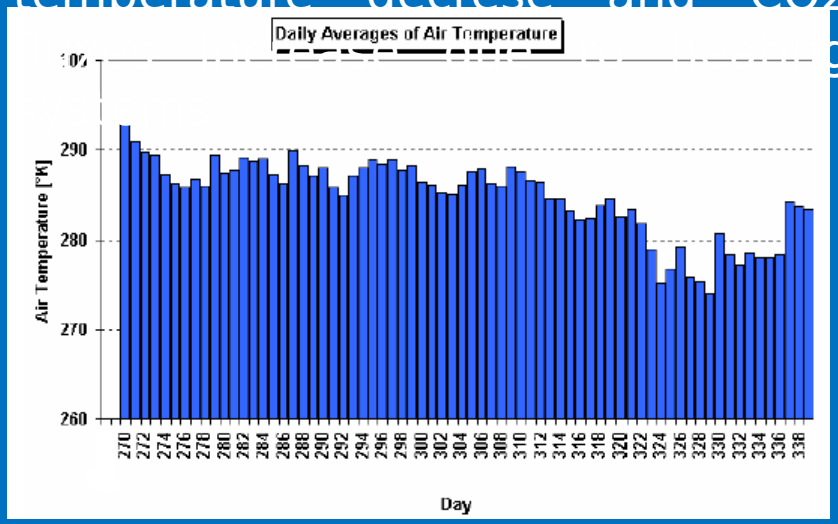
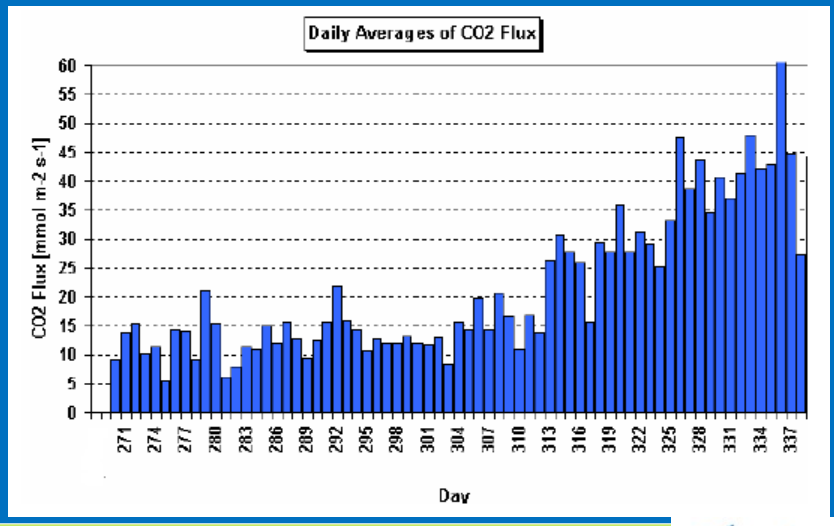
The Eddy-covariance sensor tower installed at Osservatorio Valerio in Pesaro

Annual measurement of CO2 emissions:

temperature decrese and CO2 [illegible]g





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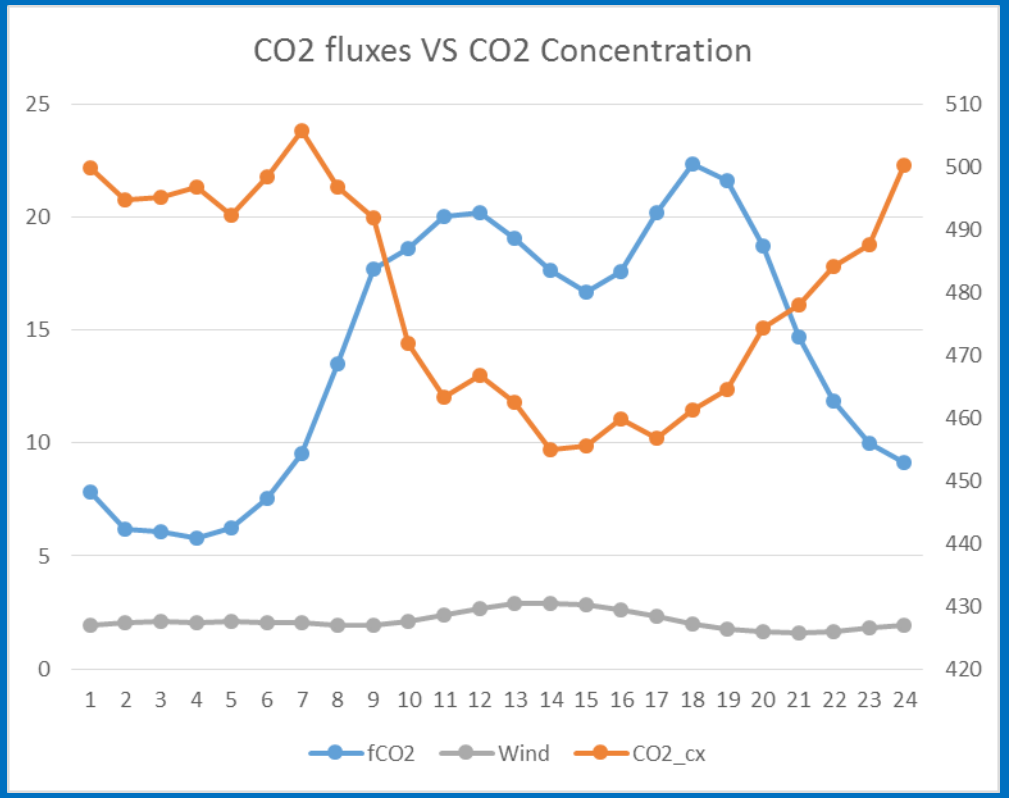
«URBAN METABOLISM»



An example of data analysis in Pesaro, during the 24 hour of a working day, while CO2 concentration (CO2_cx) decrease during day (VEGETATION SINK) the CO2 emission (fCO2) increase due to human activity, in particular, is very relevant the peak in the morning caused by car traffic from home to working place and another peak in the evening caused by traffic flow from working place to home.

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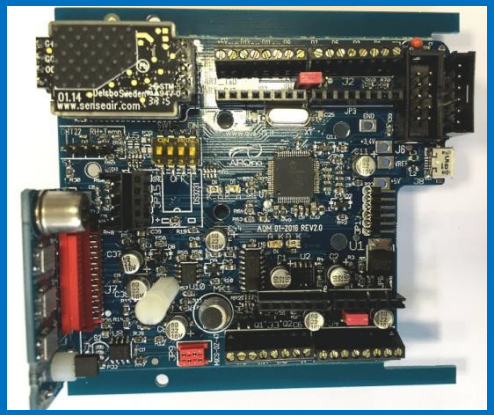
COMPONENTS OF THE INTEGRATED MONITORING PLATFORM:

AIRQINO - THE AIR QUALITY UNIT

The "AirQino" air quality monitoring unit is based on the Arduino open-source electronic board, equipped with a set of low-cost and high-resolution sensors
The board integrates a microprocessor that acquires all readings from the installed sensors. Through a GPRS modem AirQino transmits geolocated data to a server connected to the applications and webserver, allowing real-time observations on a The device Is compliant with

Parameter	Unit	Range
Temperature	°C	-40 – 80
Relative Humidity	%	0 – 100
Noise	dB	0 – 100
road pavement quality	g	-5 – 5
CO_2	ppm	0 – 2000
O_3	ppb	0 – 400
NO_2	ppm	0.05 – 5
CO	ppm	1 – 30
PM 2,5 – PM10	mg/mq	0 – 1000
COV	ppm	1 – 1000



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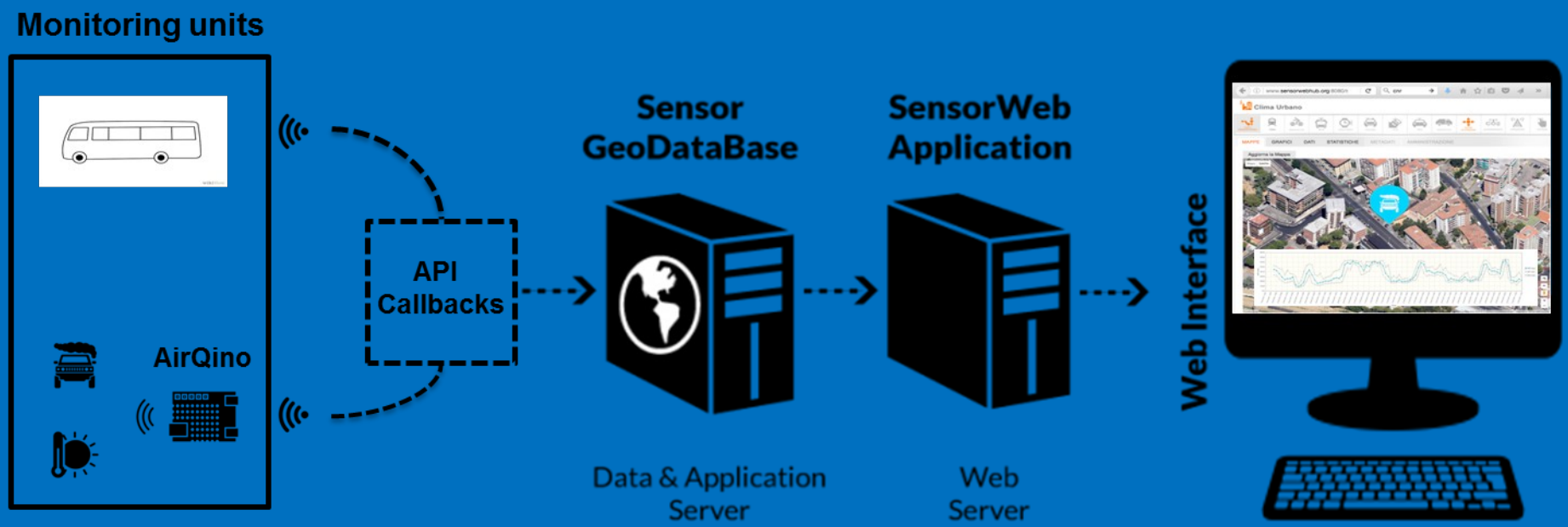
COMPONENTS OF THE INTEGRATED MONITORING PLATFORM: THE SPATIAL DATA INFRASTRUCTURE



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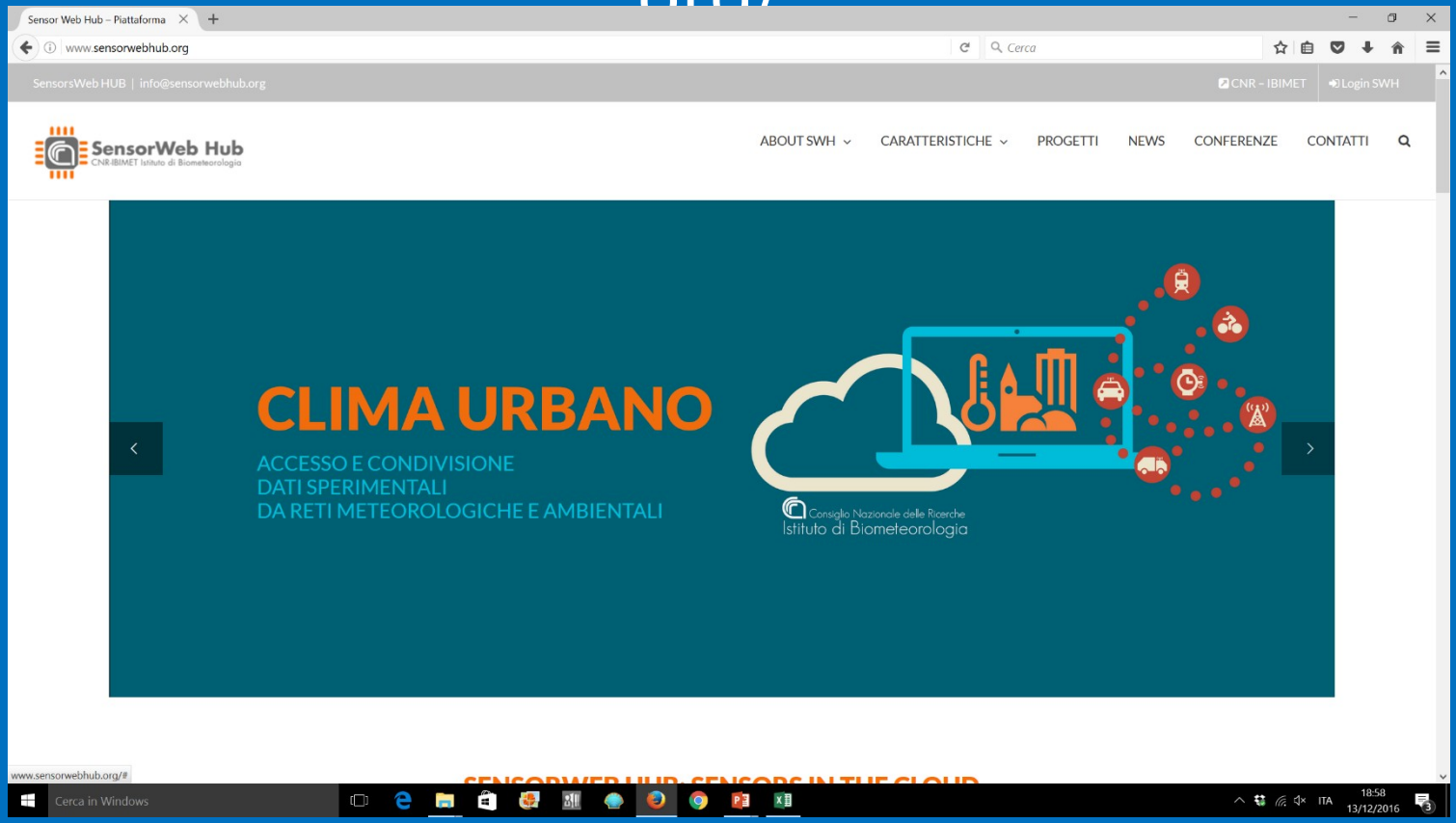
http://www.sensorwebhub.org/



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http://www.s...minio=urban

www.sensorwebhub.org:8080/swb2-2/?user=guest&password=guest&dominio=urban

MAPPE | GRAFICI | DATI | STATISTICHE | METADATI | AMMINISTRAZIONE

Benvenuto
guest

1 2 3 4 5 6 7 8 9 10

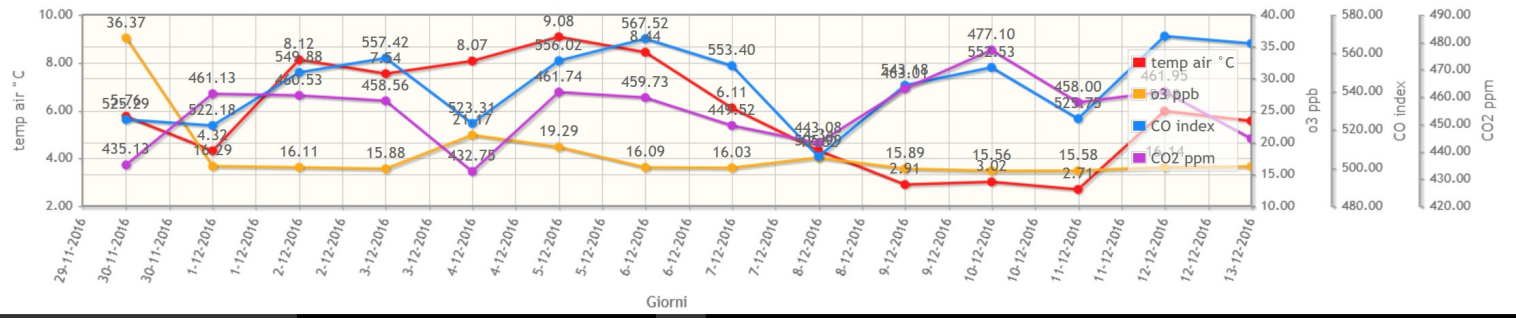
Seleziona la stazione	Status
Sensore di Test 3	ATTIVO
ARIABUS PESARO	ATTIVO
Stazione Mobile Test SIM 1	ATTIVO
Stazione Mobile Test SIM 2	ATTIVO
Bike 1 - Siracusa	ATTIVO

1 2 3 4 5 6 7 8 9 10

Da:
01/12/16
A:
13/12/16

Visualizza

Grafici giornalieri



Cerca in Windows

ITA 19:02 13/12/2016

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AeroLab Ibimet – The fleet

CNR-IBIMET-001

CNR-IBIMET-002 (Efesto)

- **Manual flight (pilot only)**
- **Semi-automatic flight (pilot + automatic waypoints routing)**

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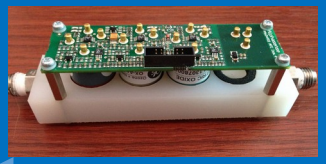
New activities: *Atmospheric composi*

(CO_2, H_2S, O_3 et al)



In-situ (CO_2, H_2S, CH_4)

wind

In-situ (CO_2, H_2S, CH_4)

camino

In-situ (CO_2, H_2S, CH_4)

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thank you!!!!!!!

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