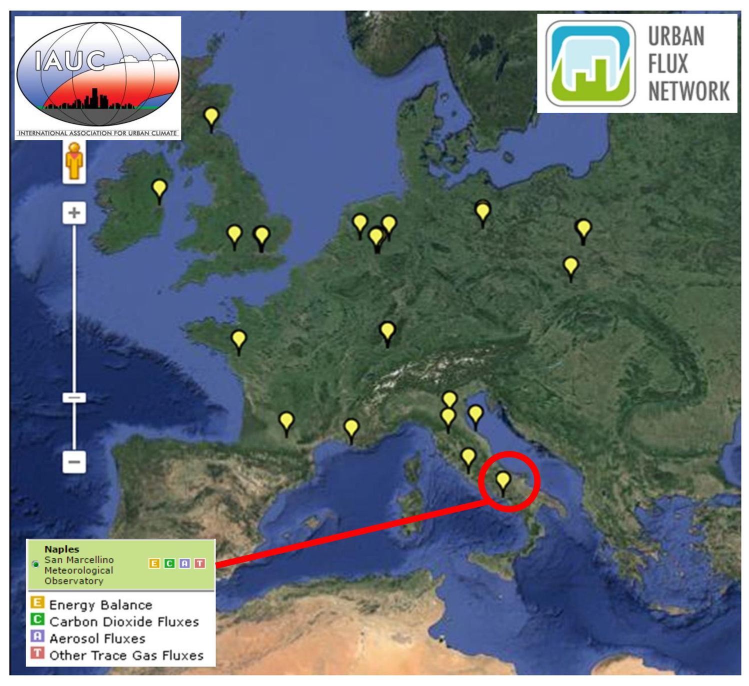
Greenhouse gas emissions from urban area of Naples (IT)

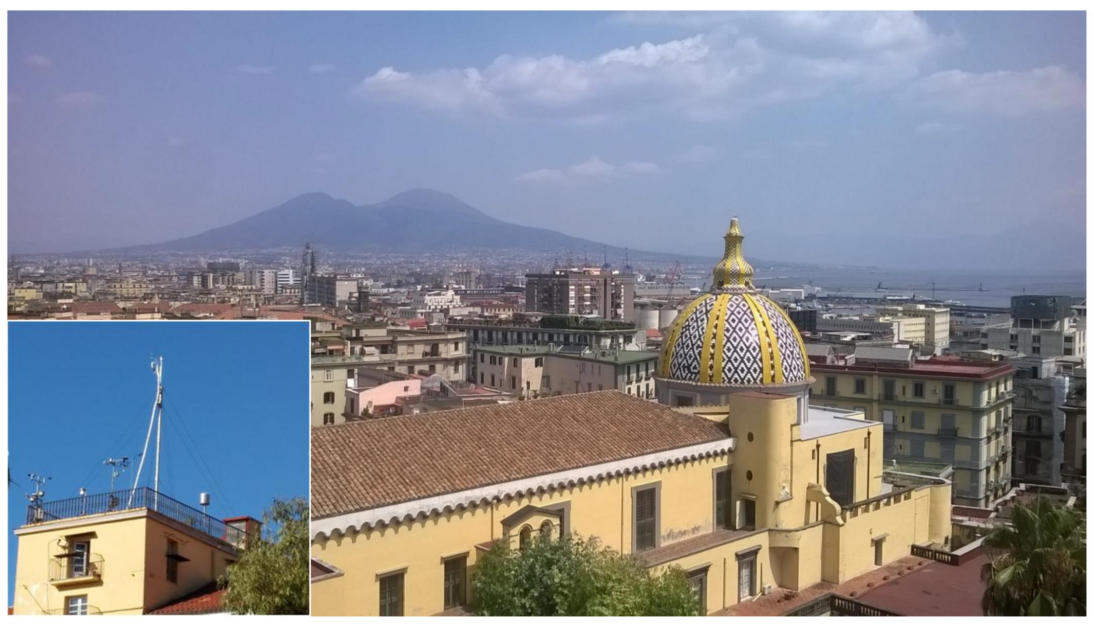
D. Piscitelli[1], D. Famulari[1], A. Esposito[1], P. Di Tommasi[1], G. Agrillo[1], A. Manco[1], M. Tosca[1], B. Gioli[2], V. Magliulo[1], A. Mazzarella[3], R. Viola[3], N. Scafetta[3], A. Riccio[4], A. Zaldei[2], P. Toscano[2]

(1) National Research Council, CNR-ISAFOM, Napoli, IT , daniela.piscitelli@isafom.cnr.it, (2) National Research Council, CNR-IBIMET, Firenze, IT, (3) Meteorological Observatory, Department of Science of the Earth, Environment and Resources, University of Naples "Federico II", Naples, IT, (4) Department of Applied Science, University of Naples "Parthenope", Napoli, IT

The super-site of Largo San Marcellino

A super-site for the measurement of atmospheric pollutants from urban sources has been established at the Meteorological Observatory of Largo San Marcellino in historical city centre of Naples (Campania, Southern Italy), where the complex layout of the coast and surrounding mountains favours the development of combined sea breeze upslope winds and the evolution of return flows with several layers of pollutants and subsidence. A super-site is part of the Urban Flux Network of *IAUC*. The metropolitan area of Naples, with a population of circa 4 million (around 1 million within the city), has one of the highest population densities in Europe (over 8000 inhabitants per km^2) and is heavily built up.





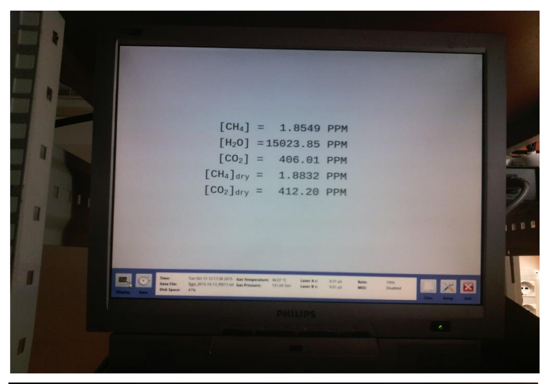
Above a view from the terrace where the instrumentation is setup. Below the rack with the analyzers.

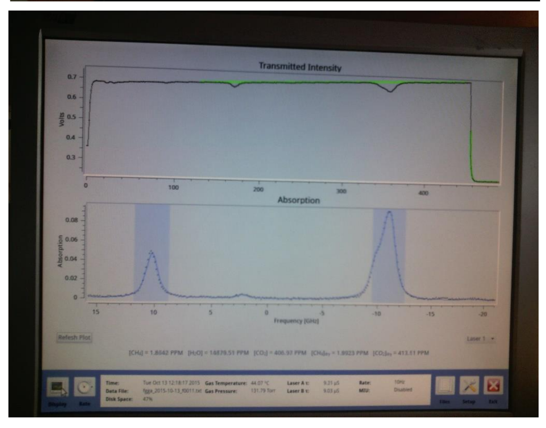
The eddy covariance tower

An eddy covariance tower has been installed on the rooftop of the Meteorological Observatory of Largo San Marcellino

A fast response ultrasonic anemometer (Gill WindMaster) located on a terrace, 35m height above the irregular street level, resulting in an overall measuring height of 45 m.

Mixing ratios of CO_2, CH_4 and H_2O are measured by a fast response (10 Hz) IR spectrometer (Los Gatos Research Eddy Covariance Package, see pictures on the right). Automatically reports CH_4 and CO_2 on a dry (and wet) mole fraction basis.

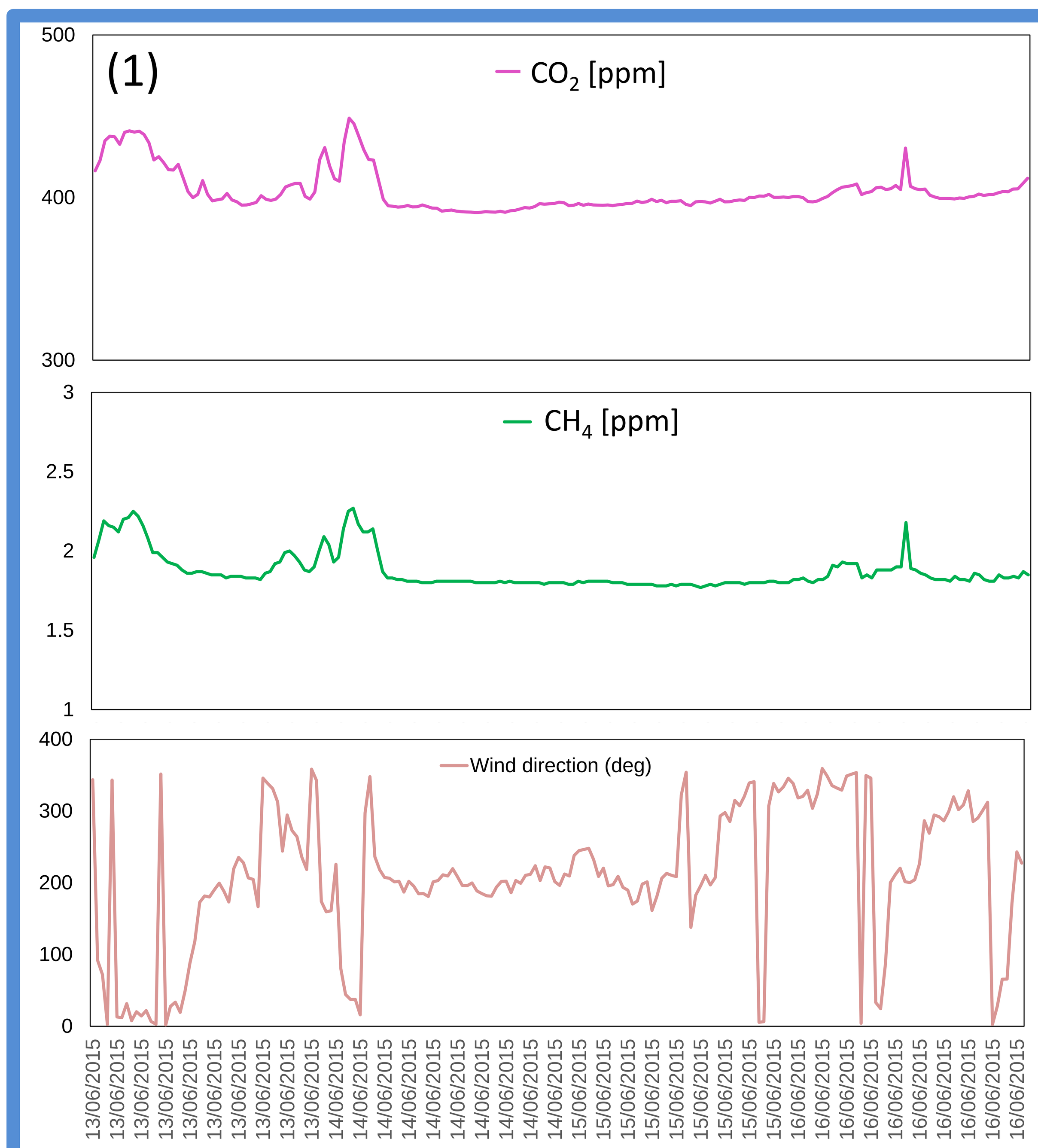




O_3 mixing ratios are measured by a fast analyser (10Hz, FOS Sextant), and referred to concentrations measured by a slower analyser (2B-Technologies, 205).

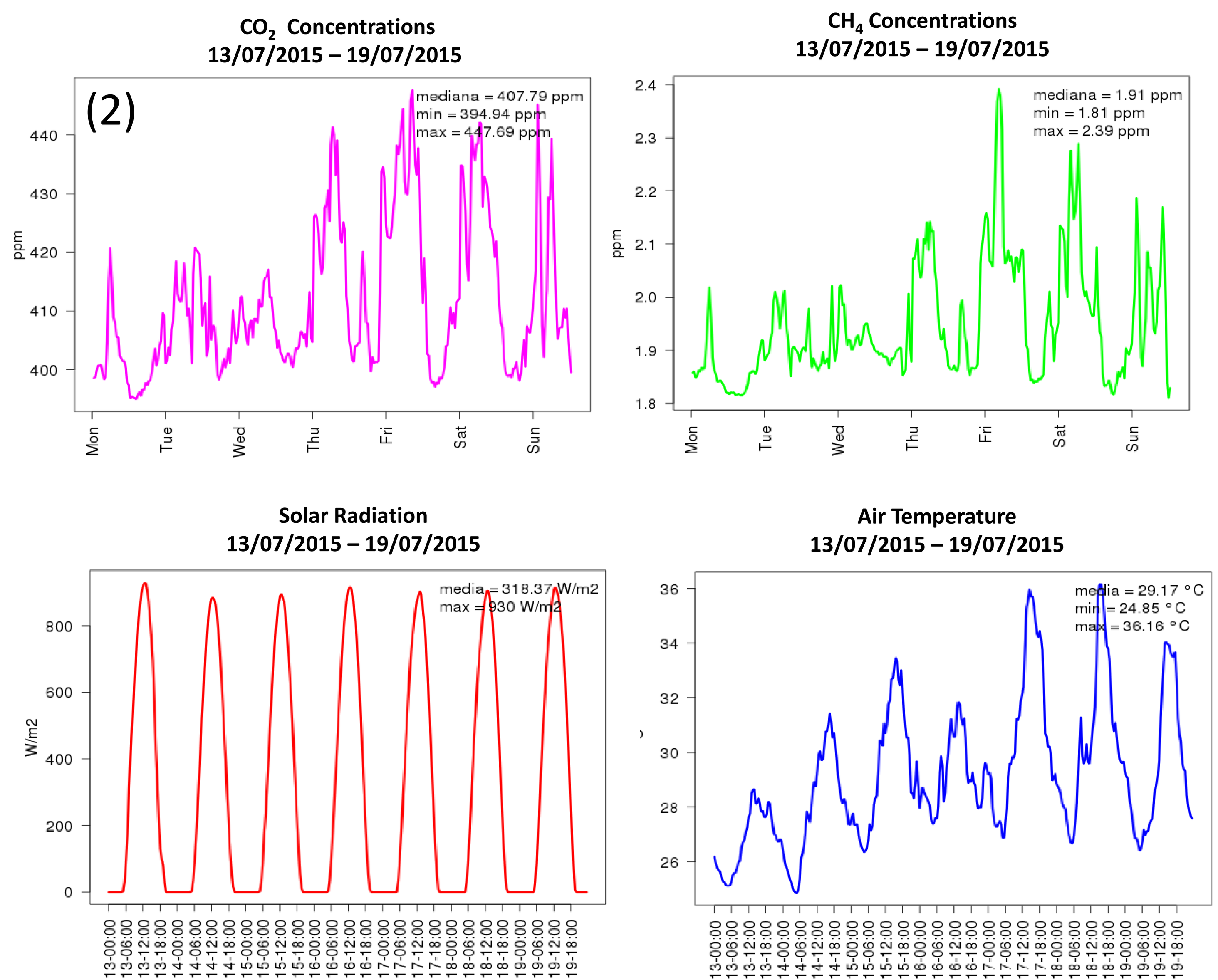
NOx are quantified (1 Hz) using a chemiluminescence analyser (Eco Physics, CLD 88p with photolytic converter (PLC 860).

Size segregated aerosol are measured by gravimetric method (hourly/daily) by a SWAM 5A Dual Channel (PM10 and PM2.5, FAI Instruments) and a faster Optical Particle Counter (4 Hz, FAI Instruments) measures 22 classes of particles diameter. All analysers outputs are synchronised with the sonic anemometer at 10 Hz on a CR3000 datalogger (Campbell Scientific).



In figures (1) we observe a GHG concentration decrease over four days due to a change of wind regime in a typical summer period: a change in relative humidity corresponding to a changed wind direction.

Examples of greenhouse gases concentrations in the city

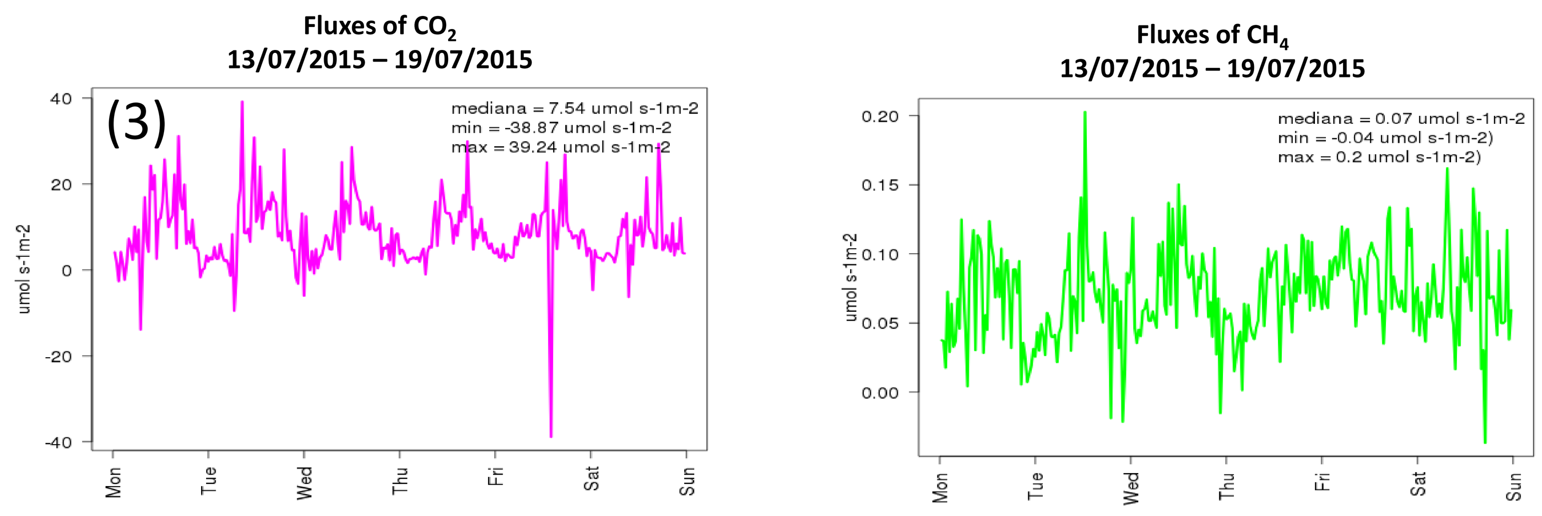


In figures (2) we report an example week from July 2015 with high levels of CO_2 and CH_4, corresponding to high pressure conditions during the hottest time of the year.

During the whole year, the results show that the mean urban levels of CO_2 are between 395-520 ppm; whereas the mean levels of CH_4 span between 1.8-2.5 ppm.

Examples of fluxes of carbon dioxide and methane

In figure (3) typical fluxes of GHG recorded at San Marcellino are shown for a week in July 2015. In this period, the median values of the fluxes were: 7.54 µmol/m^{2}s for carbon dioxide and 0.07 µmol/m^{2}s for methane.
The eddy fluxes were calculated by EddyPro.



Consiglio Nazionale delle Ricerche

Università degli Studi di Napoli Federico II

investiamo nel vostro futuro

AriaSaNa
www.ariasana.org
Osservatorio Regionale della Qualità dell'Aria