

Fluxes of urban pollution from the city of Naples (IT)

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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, situated in the historical city centre of Naples (Southern Italy). Largo San Marcellino is part of the Urban Flux Network of IAUC, featuring 65 Supersites worldwide, 32 of which are active. 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 km²) and is heavily built up. Situated near Mount Vesuvius, facing the Tirreanean Sea, with a complex layout of the coasts and surrounding mountains which favour the development of combined sea breeze upslope winds and the evolution of return flows with several layers of pollutants and subsidence.



View of the city of Naples in windy conditions (L) and still conditions (R).



A view from the terrace where the instrumentation is setup. Bottom-left: the EC tower seen from an adjacent rooftop.

The eddy covariance tower

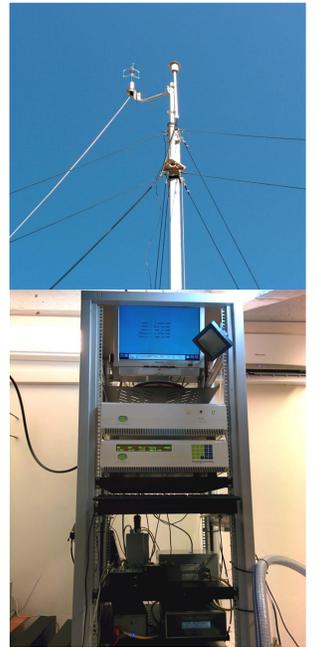
A fast response ultrasonic anemometer (Gill WindMaster) located on a terrace, 35m height above the irregular street level, resulting in an overall measuring height of 45 m.

Mixing ratios of CO₂, CH₄ and H₂O are measured by a fast response (10 Hz) IR spectrometer (Los Gatos Research).

O₃ mixing ratios are measured by a fast analyser (10Hz, FOS Sextant), and referred to concentrations measured by a slower analyser (2B-Technologies, 205).

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

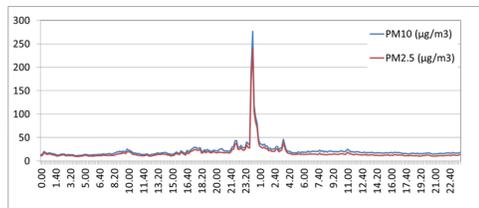
Size segregated aerosol are measured by gravimetric method (hourly/daily) by a SWAM 5A Dual Channel (PM10 and PM2.5, FAI Instruments) and a faster Optical Particle Counter (4 Hz, FAI Instruments) measures 22 classes of particles diameter. All analysers outputs are synchronised with the sonic anemometer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



Examples levels of pollutants in the city

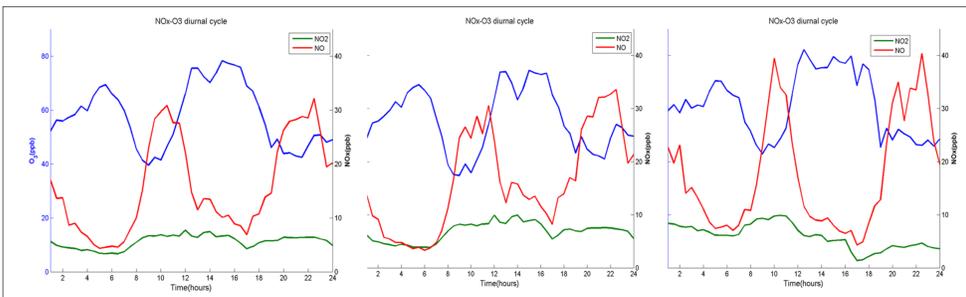
An example during a *winter* month (Dec14 - Jan15)

Snapshot of the particulate matter levels of the Fireworks display of New Year's Eve in Naples.

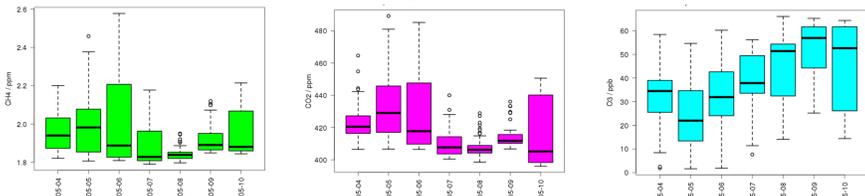


NO and NO₂ show the same daily pattern, suggesting common sources; NO_x and O₃ show anti-correlation. There were no particular differences between weekdays and weekends (Christmas period). Mean NO₂/NO_x = 0.28 ; mean NO/NO_x = 0.72

O ₃	NO ₂	NO	PM _{2.5}	PM ₁₀	CO ₂	CH ₄
2 - 62	5- 29	0.5 - 84	12 - 47	18 - 55	420-520	1.85-2.48
ppb	ppb	ppb	µg/m ³	µg/m ³	ppm	ppm



Example during a *late spring* week



Examples of fluxes of pollutants

Eddy fluxes were calculated by EddyPro.

Fluxes of PM are reported in counts, whereas for gaseous species we report the fluxes of mixing ratios. The PM is referred to the winter period, and the gases to the late spring.

