UNIVERSITA' DEL SALENTO
MASTER IN METEOROLOGIA E OCEANOGRAFIA FISICA
UNIVERSITA' PARTHENOPE

Air quality in the city of Lecce (Southern Italy): a preliminary assessment of COVID-19 lockdown impact

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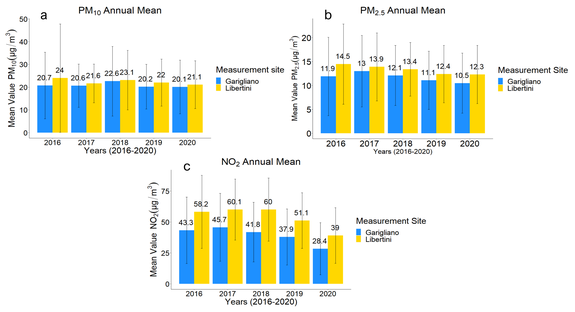
Introduction and study area

COVID-19 has effect not only on the people's health and the economy, but also on the environment. Many studies showed how in some cases air-quality improved, while in others it got worse. This study is devoted to the study of **COVID-19 lockdown impact in the city of Lecce**, using Arpa Puglia meteorological and pollution datasets from three measurement sites: "**piazza Libertini**" and "**Via Garigliano**" for pollution and "**Via Miglietta**" for meteorological data. Both pollution sites are subject to **vehicular traffic**.

Map of Italy showing the Apulia region and satellite images (from Google Earth) showing the position of the city of Lecce and of the stations considered in this paper.

Mean Annual Values

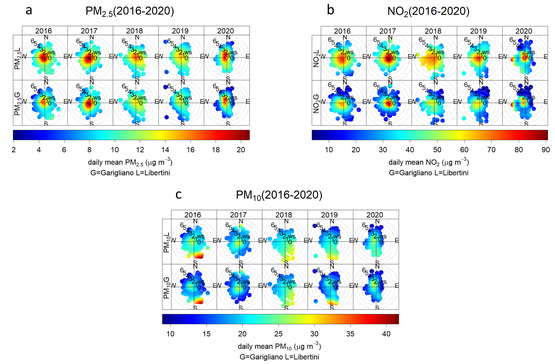
- **As for PM Mean values are below the annual limit** of 50μg/m^3 and 25μg/m^3 for PM_{10} (a) and $PM_{2.5}$ (b) and they were in general lower in the last two years
- **NO_2** (c) annual mean **exceeded legislative limit** (40μg/m^3) **every year**, **except in 2020**.



Bar plots showing annual means of a) PM_{10}, b) $PM_{2.5}$ and c) NO_2 in piazza Libertini (gold) and via Garigliano (light blue)

Identification of pollution source

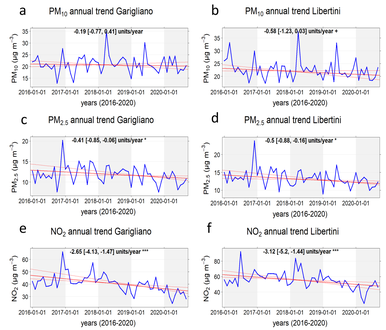
- Polar plots have been employed to detect **potential pollution sources** building bins in which root-square mean concentration is calculated.
- Peaks in **PM 10** (c) indicate that it has main **advection input.**
- Peaks in **$PM_{2.5}$** and **NO_2** (a, b) mean that they have main **local input** (vehicular traffic).



PM_{10} (c), $PM_{2.5}$ (a) and NO_2 (b) **polar plots** for each measurement site.

Temporal trends (2016-2020)

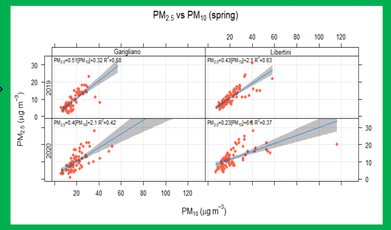
- **Decreasing values for $PM_{2.5}$ and NO_2 are confirmed by annual trends.**
- A decrease of $PM_{2.5}$ in the last five years is evident (c,d) and it is estimated to be 0.4μg/m^3 per year for via Garigliano and 0.5μg/m^3 per year for piazza Libertini.
- For NO_2, the decrease is -2.65μg/m^3 per year for via Garigliano and -3.12μg/m^3 per year for piazza Libertini (e,f). **Nothing can be said about PM_{10}** (a,b).



Annual **trends** for PM_{10}, $PM_{2.5}$ and NO_2 for both measurement sites. Trends for $PM_{2.5}$ and NO_2 are **statistically relevant** (p-value < 0.05).

Effect of COVID-19 lockdown on PM in 2020 spring

decrease of $PM_{2.5}/PM_{10}$ ratio up to 0.2 units for piazza Libertini and 0.1 units for via Garigliano in the 2020 spring.

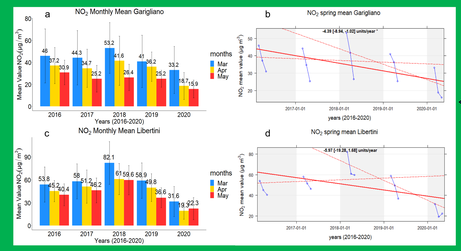


Scatterplots between PM_{10} and $PM_{2.5}$ spring values in 2019 and 2020 for via Garigliano (left) and for piazza Libertini (right).

PM spring percentage decrease in 2020 (compared to 2016-2019 average)

PM decrease	$PM_{2.5}$	PM_{10}
Piazza Libertini	-7%	-4%
Via Garigliano	-13%	-9%

Effect of COVID-19 lockdown on NO_2 in 2020 spring



Bar plots with NO_2 monthly (March, April and May) values for a) via Garigliano and c) piazza Libertini. b) Same as a), but showing TheilSen's estimation trends.

NO_2 decreased by more than 50% in 2020 spring respect to 2016-2019 average.

NO_2 monthly percentage **decrease** in 2020 (compared to 2016-2019 average)

NO_2 decrease	March	April	May
Piazza Libertini	-50%	-63%	-66%
Via Garigliano	-28%	-50%	-55%