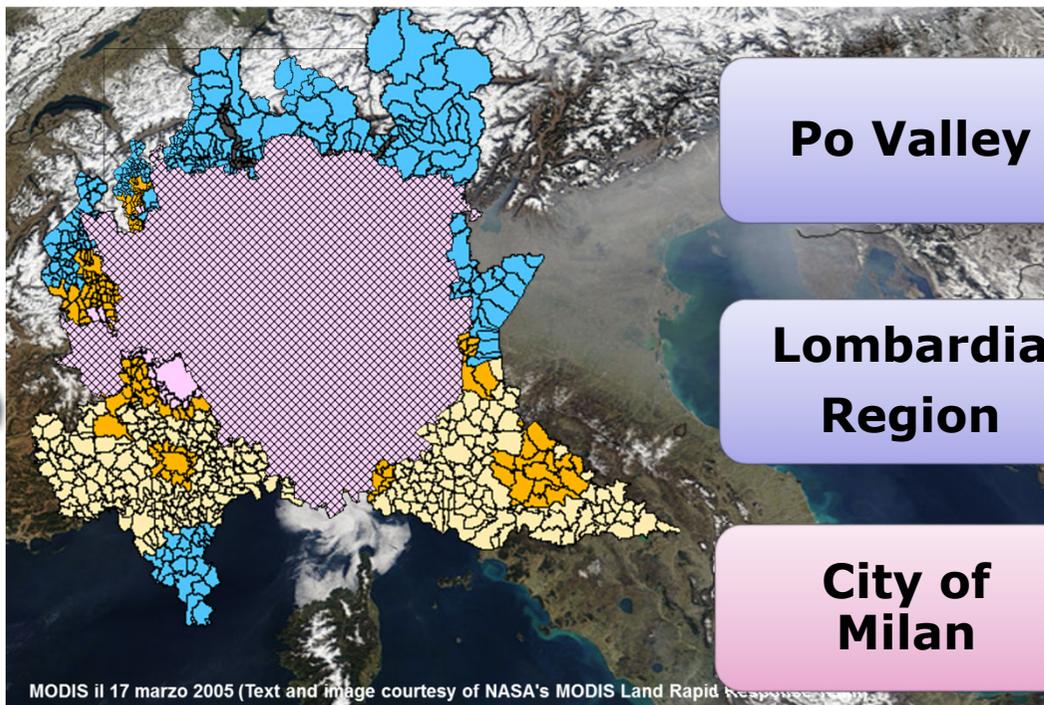


Impact and Implications of the COVID-19 Pandemic on air quality in Lombardy, Italy

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Alessandro Marongiu, Giuseppe Fossati, Elisabetta Angelino
ARPA LOMBARDIA

2020 Beijing International Forum for Metropolitan
Clean Air and Climate Actions
September 8th, 2020

Milan, Lombardia, Po Valley: where and how many



Po Valley

- **Inhabitants: 24 milion**
- **Population density: 264 inab/km²**

Lombardia Region

- **Inhabitants: 10 milion**
- **Population density: 419 inab/km²**

City of Milan

- **Inhabitants: 1,3 milion**
- **Population density: 7.272 inab/km²**

- Po Valley: closed by mountains exceeding 2500 m a.s.l. on three sides (highest peaks exceeding 4000 m a.s.l.)
- Meteorological conditions often adverse to air pollution dispersion

The «COVID-19 lockdown» in Lombardia and in Italy

22 February -
7 March 2020

- Quarantine in small areas (red zones - 50.000 people):
 - Ban of leaving houses except for supplying food and medicines
- Closing of schools in Lombardia
- Progressive closing of schools in Po Valley
- Progressive reduction of unnecessary travel and meeting in Po Valley

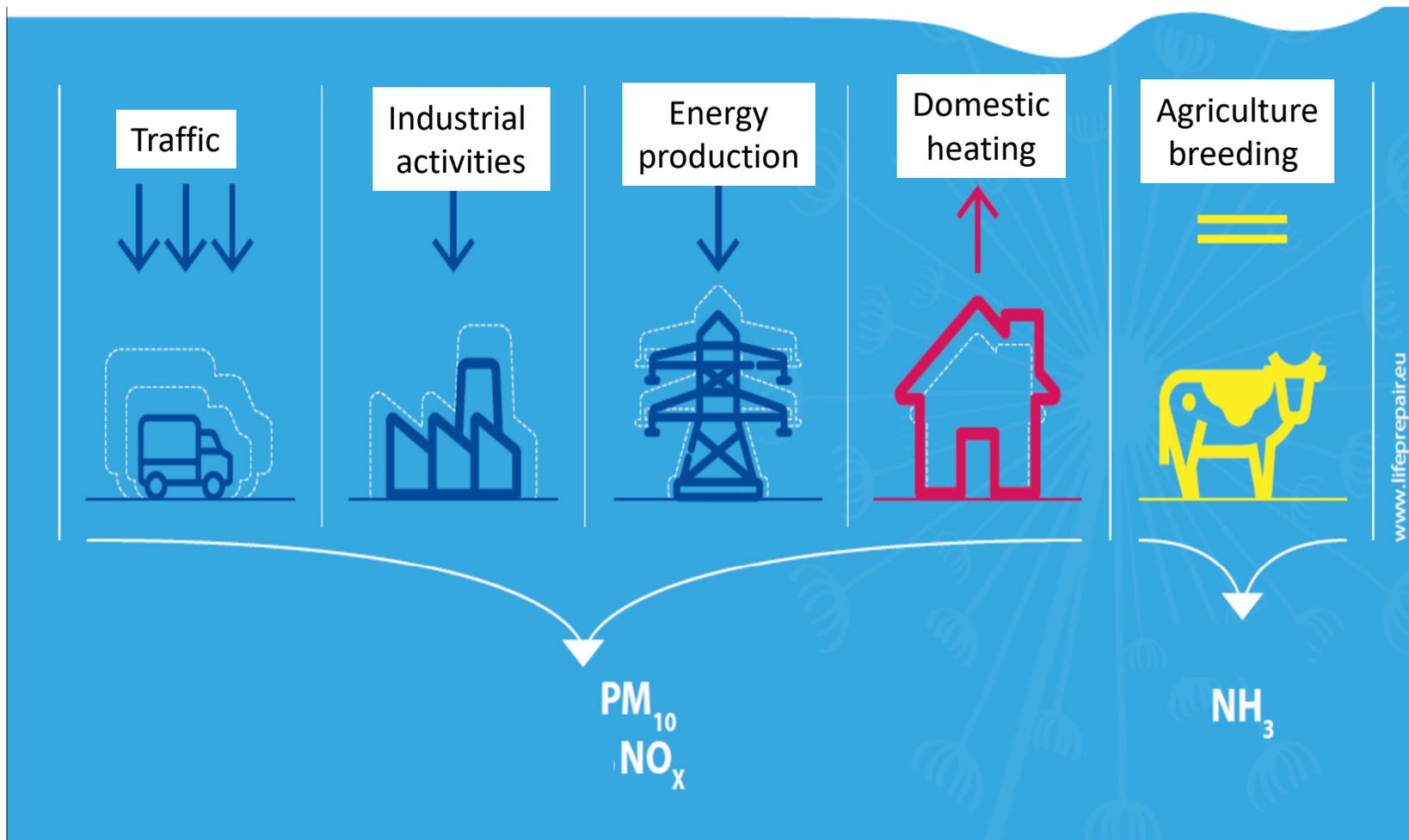
8 March –
21 March 2020

- Quarantine of the whole Northern Italy (16 M people)
- Restricting travel from, to or within the affected areas, banning funerals and cultural events, and requiring people to keep at least one meter of distance from one another in public locations
- Commercial and retail businesses except those providing essential services closed down
- Progressive extension of measures to the whole Italy

22 March –
3 May 2020

- Shutting down all not-necessary businesses and industries

The effects of «lockdown» - pressure factors



The effects of «lockdown» - pressure factors – Traffic

Traffic on road decreased significantly, both in urban areas and on highways:

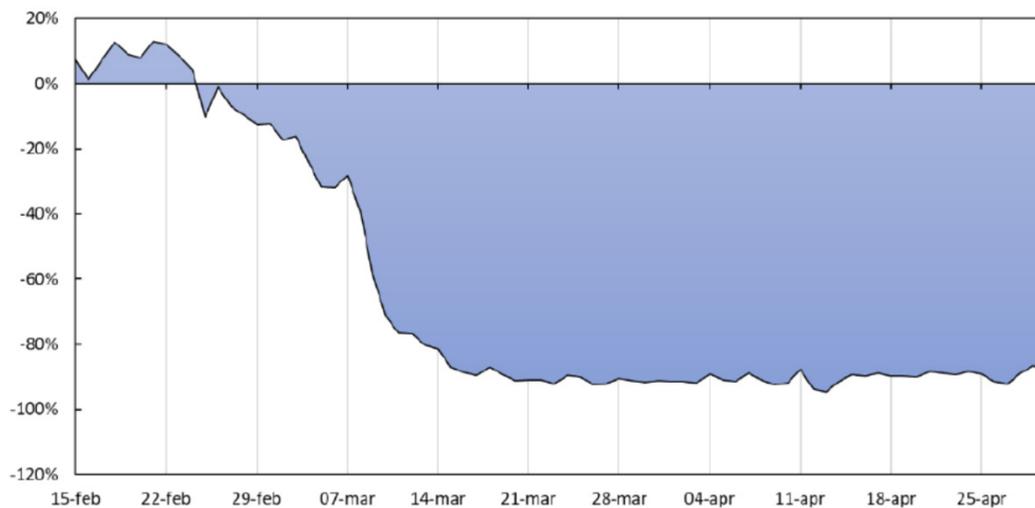
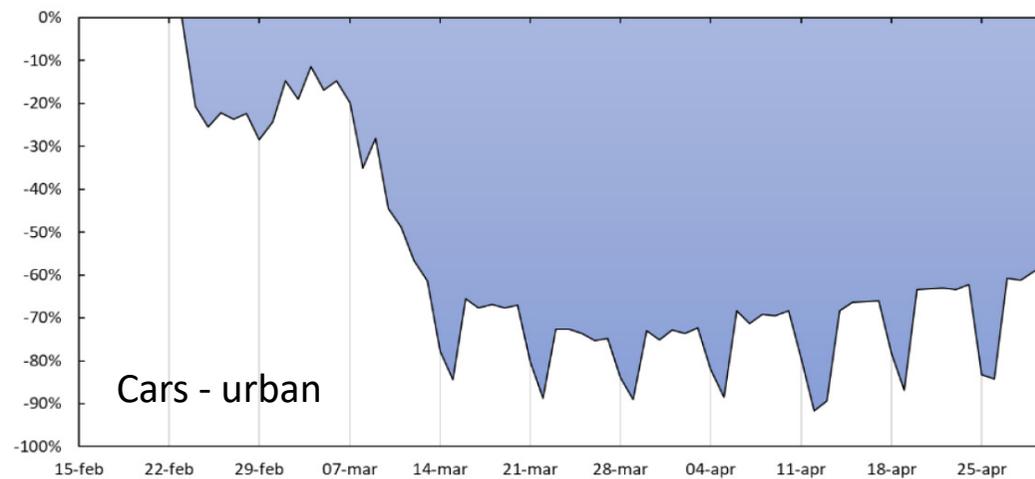
minus 80% – 90% cars

minus 70% - 80% light duty vehicles

minus 50% - 60% heavy duty vehicles

Air traffic decreased of more than 90%

https://www.arpalombardia.it/sites/DocumentCenter/Documents/Aria%20-%20Relazioni%20approfondimento/report%20stima%20emissioni%20COVID%2019%20lombardia_aprile20.pdf



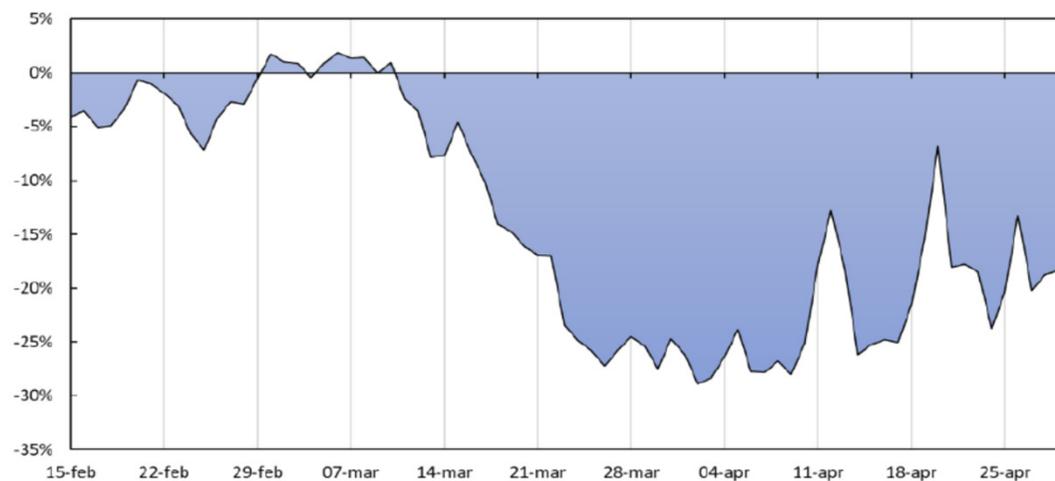
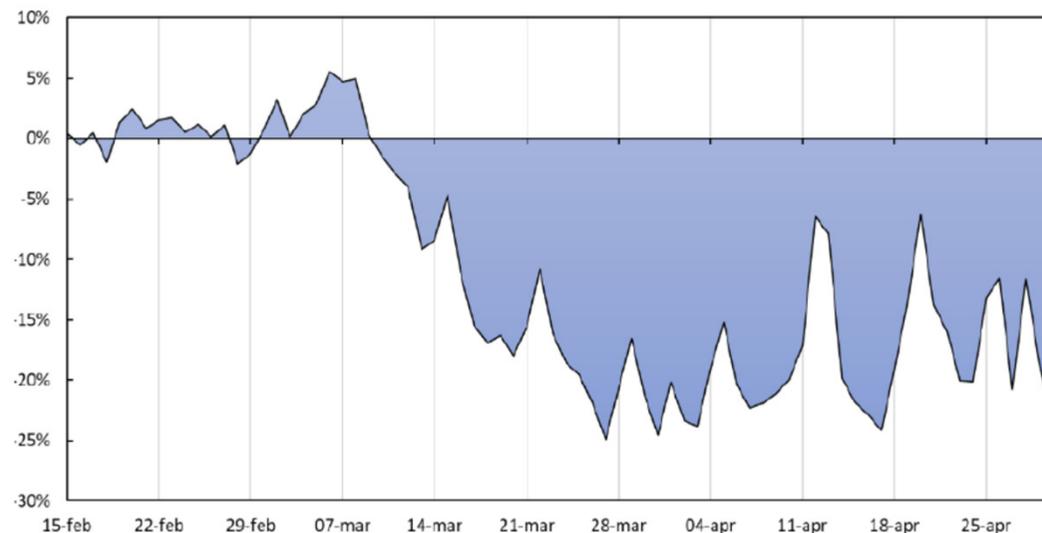
The effects of «lockdown» - pressure factors – industry

Energy load decreased
of 20% – 30%

(source: Terna <https://www.terna.it/it/sistema-elettrico/transparency-report/total-load>)

Natural gas used in industry decreased
of 20 – 30%

https://www.arpalombardia.it/sites/DocumentCenter/Documents/Aria%20-%20Relazioni%20approfondimento/report%20stima%20emissioni%20COVID%2019%20lombardia_aprile20.pdf

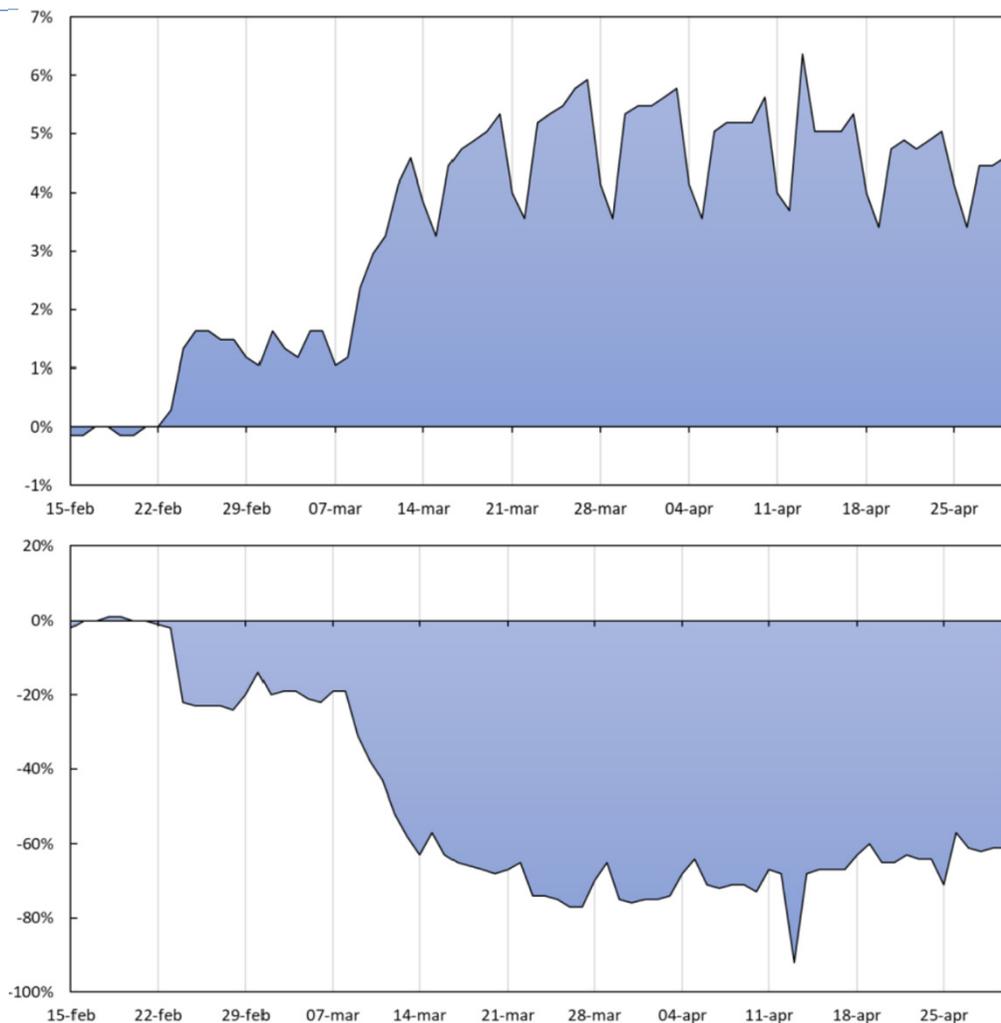


The effects of «lockdown» - pressure factors – domestic heating

Domestic heating of private houses increased of 3 – 6%

Heating of buildings for commercial and services sectors decreased of 70% – 80%

https://www.arpalombardia.it/sites/DocumentCenter/Documents/Aria%20-%20Relazioni%20approfondimento/report%20stima%20emissioni%20COVID%2019%20lombardia_aprile20.pdf



The effects of «lockdown» - agriculture

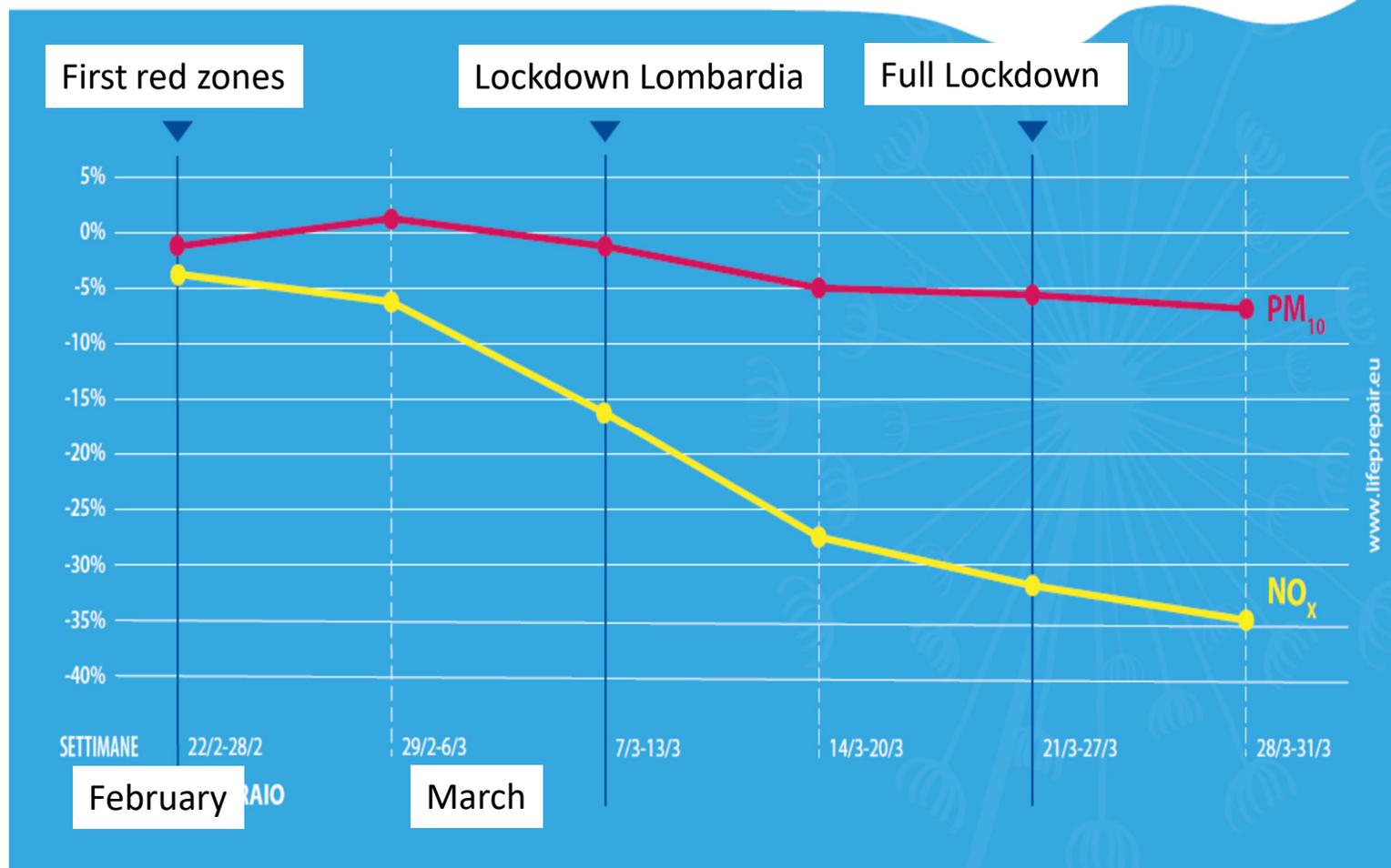
The activities in agriculture and breeding sectors
remained substantially unchanged

The effects of «lockdown» - emissions

On the base of:

- the emission inventory
- the trend of activities

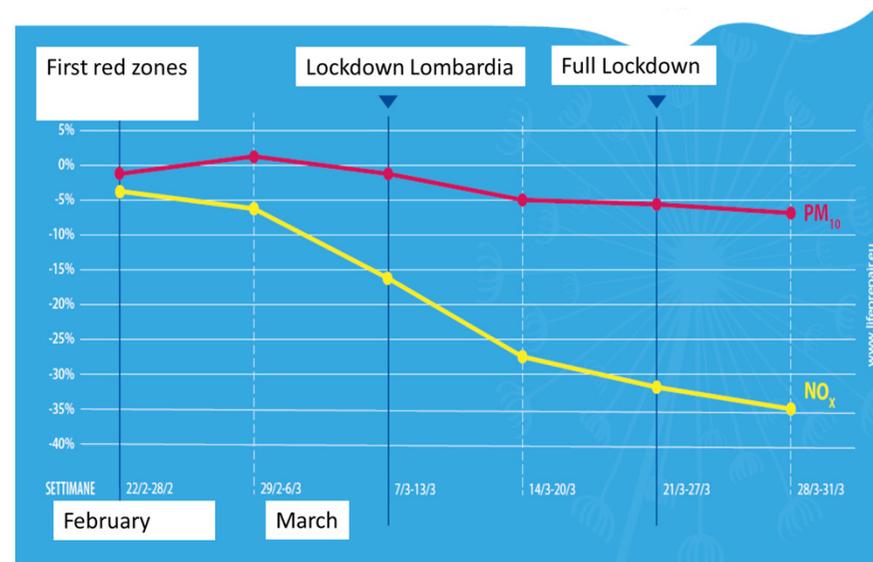
during the lockdown we calculated the variation in emissions



The effects of «lockdown» - emissions

The reduction of emissions in the strickter lockdown phase was estimated in:

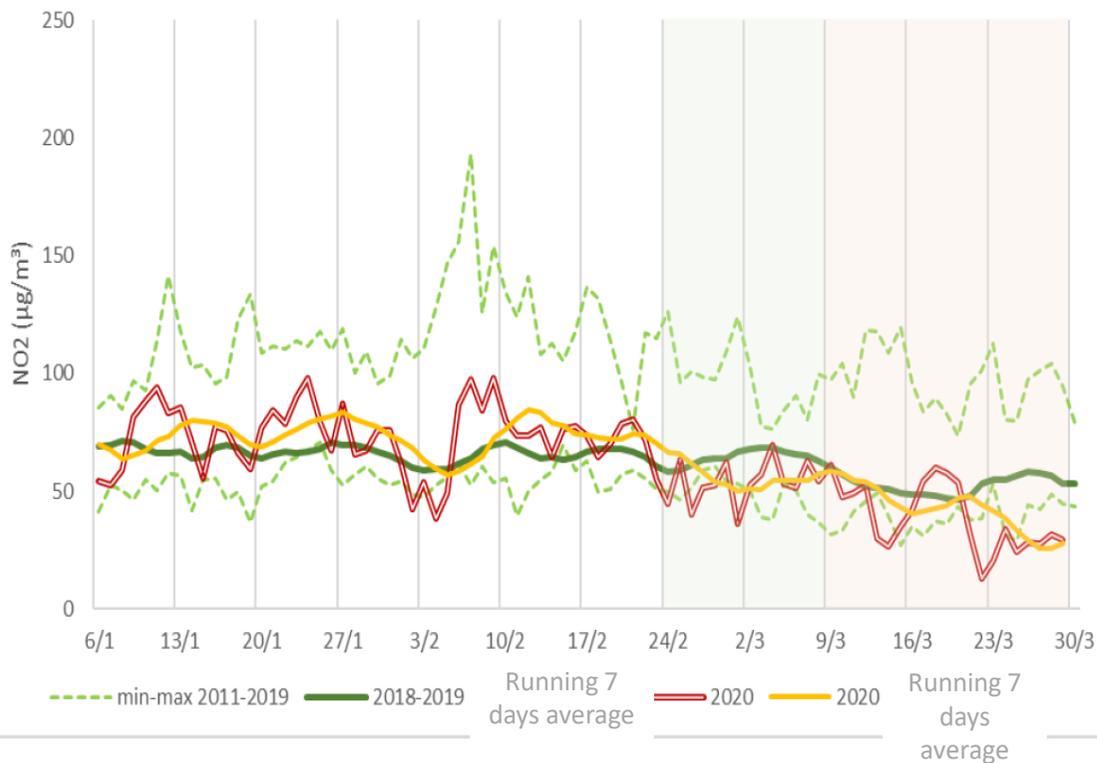
- Around 30 – 40% for NO_x (with a significant contribution from traffic, considering the reduction in flows of about 80% for light vehicles and 50-60% of heavy trade)
- Around 7 - 14% for primary PM₁₀ and VOC (reduction from traffic and industry partially balanced by increased heating emissions)
- ammonia emissions are not substantially reduced (considering that agricultural and livestock activities, did not change significantly during the lockdown the change around 1% due to the reduction in traffic)



What happened to air quality? The case of NO2

We performed different types of analysis on the base of the data of air quality network

Milano (average 3 stations: Marche Liguria Senato – Daily average NO2

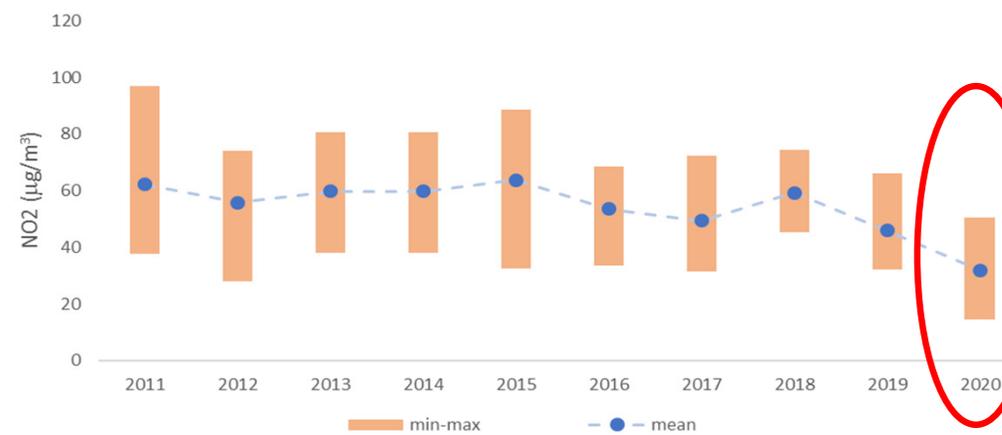


Guido Lanzani 8°, September 2020

Milano NO2
March



Milano NO2
April

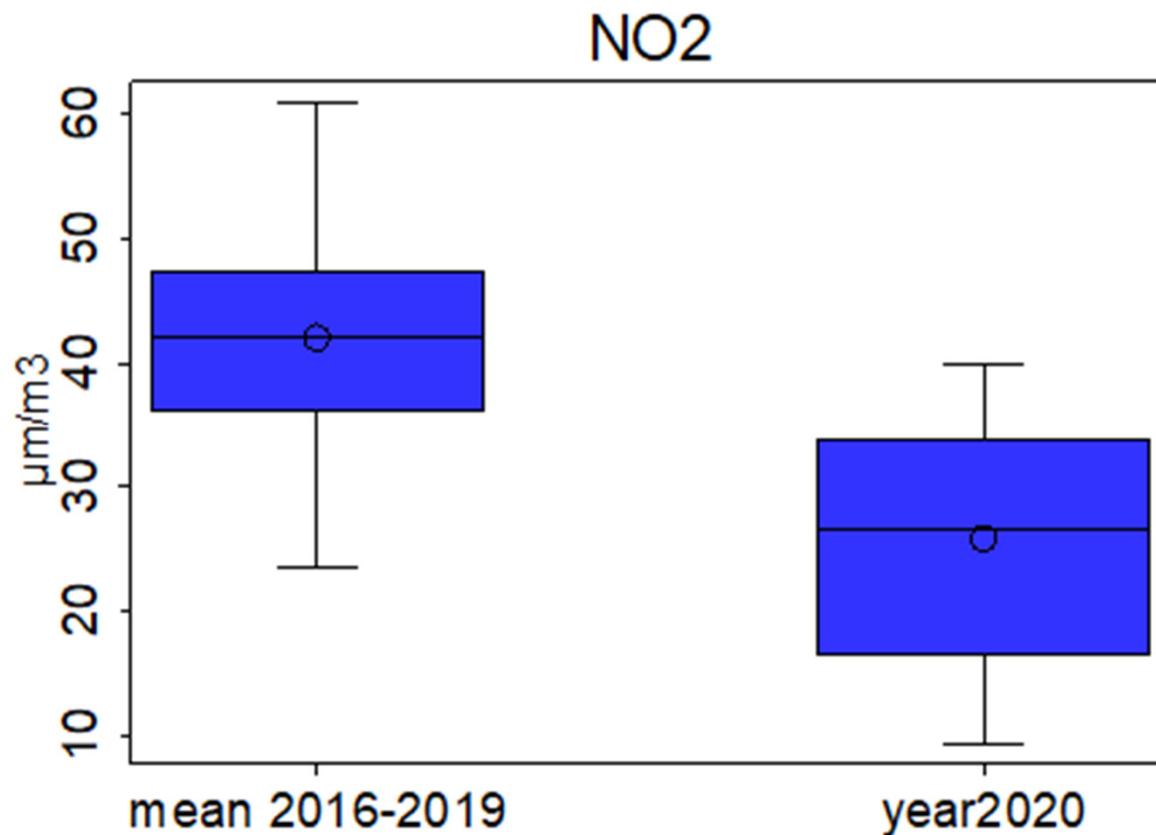


What happened to air quality? The case of NO2

Also in the whole Po Valley, NO and NO2 decreased to the lowest values of the period

- NO – 58%,
- NO2 – 38%

in traffic stations
 compared to the mean in
 the period 2016 - 2019



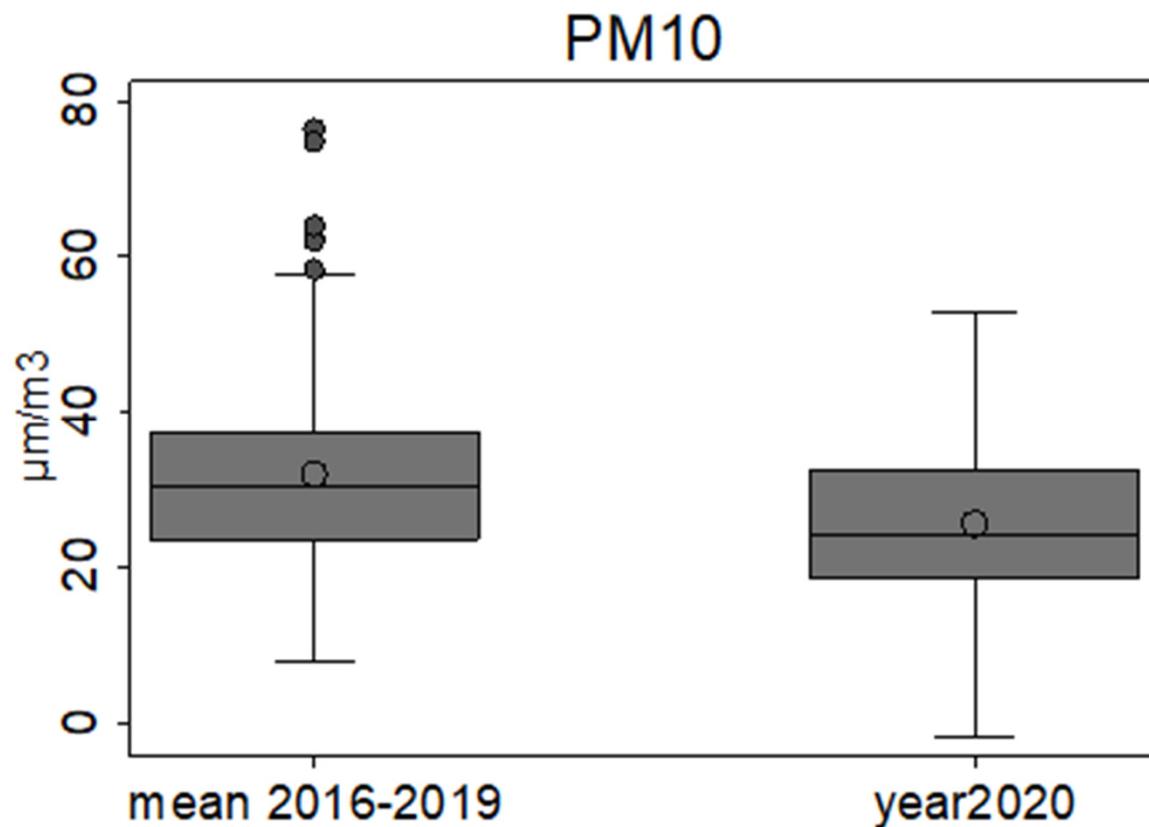
source:



What happened to air quality? The case of PM10

The trend for PM10 is less evident.

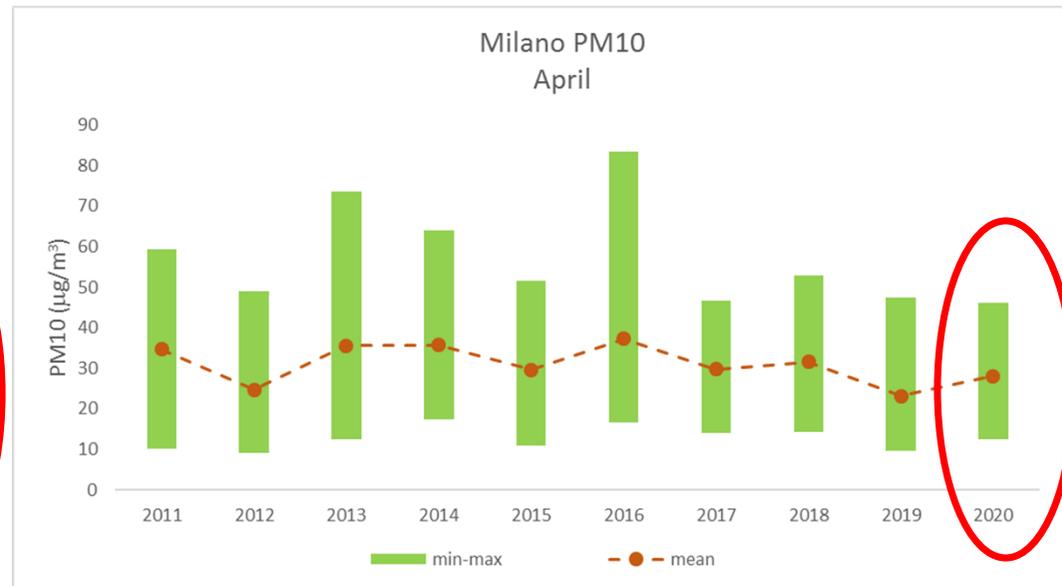
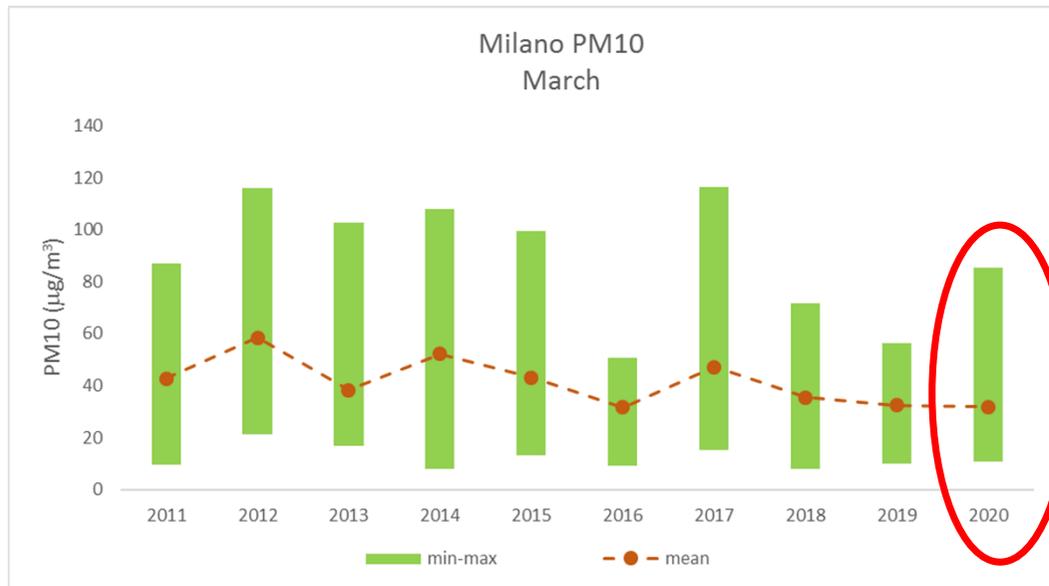
On average, in Po Valley, during lockdown it decreased from 19% in traffic stations and of 15% in background stations



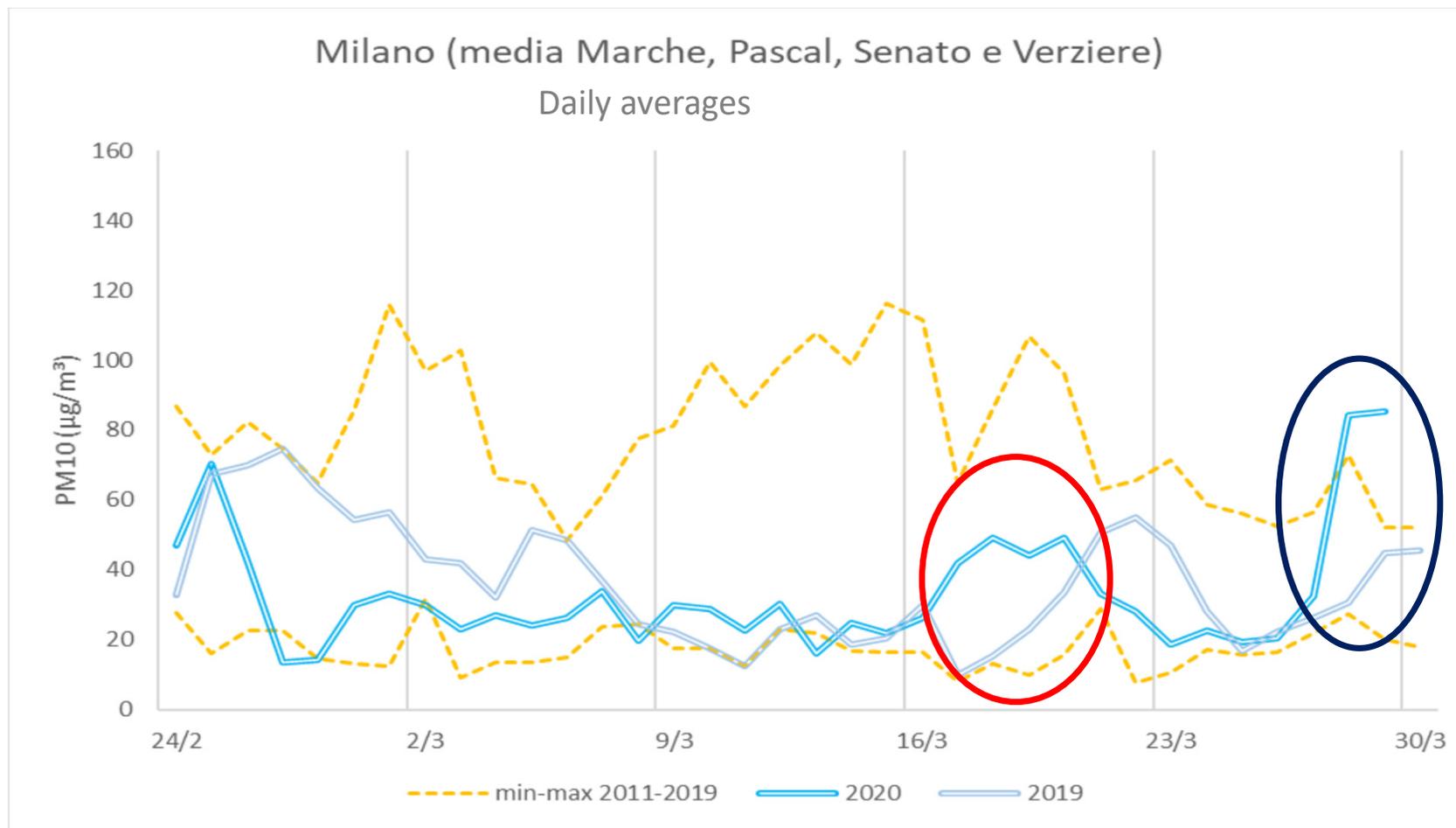
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What happened to air quality? The case of PM10 in Milan

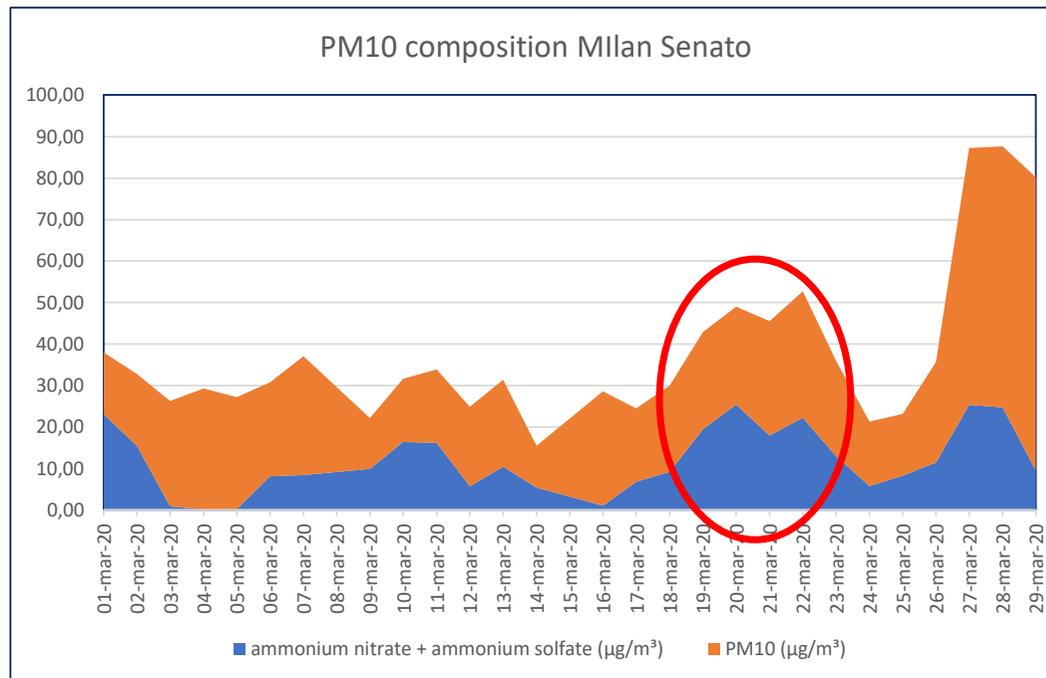
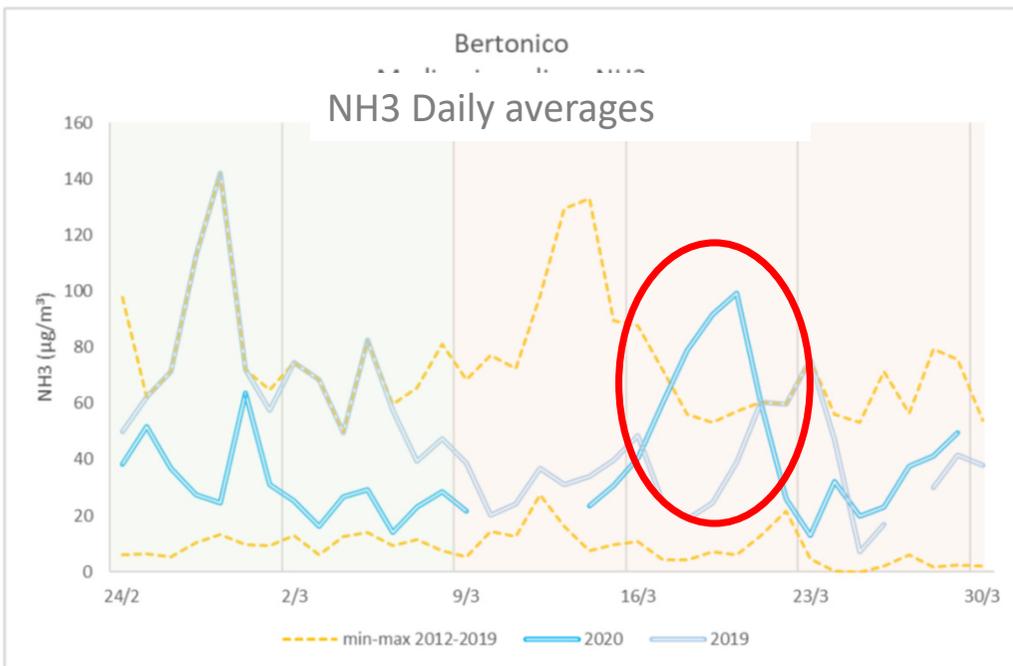
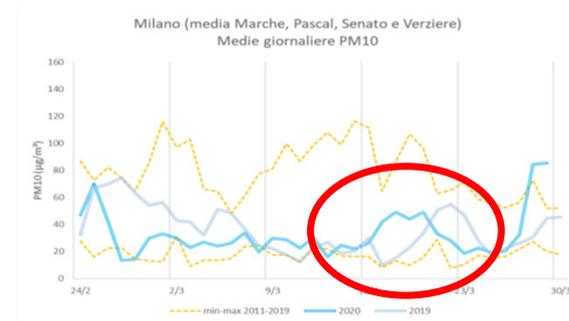


What happened to air quality? The case of PM10 in Milan

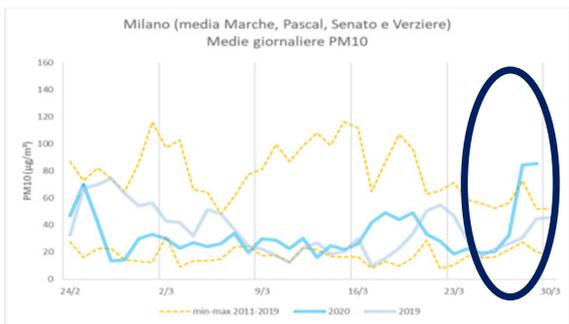


What happened to air quality? The case of PM10 in Milan

From 17° to 22° of March: secondary PM10 formation



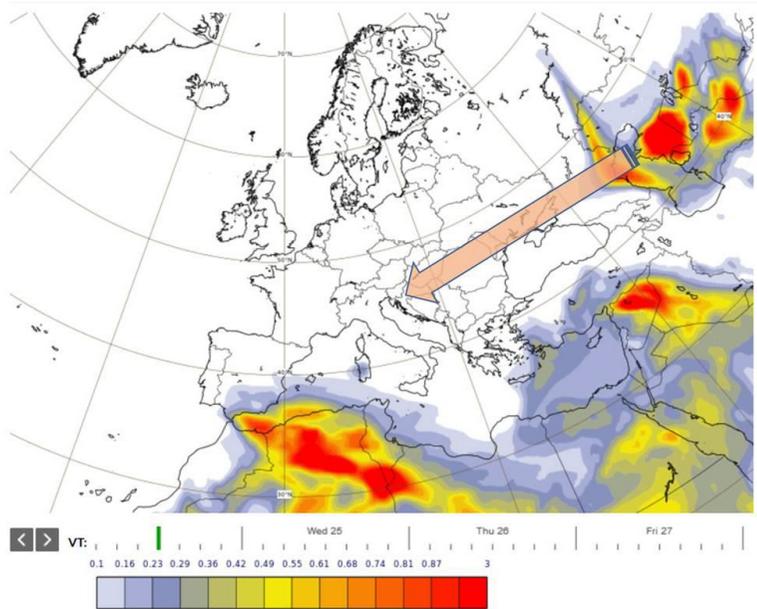
What happened to air quality? The case of PM10 in Milan



From 28° to 29° of March: transport of dust from desert

Dust aerosol optical depth at 550 nm (provided by CAMS, the Copernicus Atmosphere Monitoring Service)

Tuesday 24 Mar, 00 UTC T+12 Valid: Tuesday 24 Mar, 12 UTC



Conclusions

- The lockdown due to COVID-19 pandemic led to a reduction in some pressure factors:
Traffic decreased significantly, industry reduced activities of 1/3rd. Domestic heating increased (slightly) and agriculture remained substantially unchanged
- So, emissions of NO_x and other pollutants more directly linked to traffic decreased in a remarkable way. Emissions of other pollutants had had a less pronounced trend (for the period)
- Consequently, NO₂ concentrations decreased in an evident way. PM₁₀, both for the probable increase in primary emissions from wood combustion in domestic heating and for its partially secondary nature, showed a less clear trend
- The unwanted experiment during lockdown has once again confirmed that to improve air quality it is necessary to act not only sectorially but on all the sources, in particular for the secondary pollution.



Thank you for your attention